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TRADE POLICIES, HOUSEHOLD WELFARE AND POVERTY ALLEVIATION

CASE STUDIES FROM THE VIRTUAL INSTITUTE ACADEMIC NETWORK

UNITED NATIONS

Trade policies, household welfare and poverty alleviation:

Case studies from the Virtual Institute academic network

UNITED NATIONS

NEW YORK AND GENEVA, 2014

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The UNCTAD Virtual Institute is a capacity-building and networking programme that aims to strengthen teaching and research of international trade and development issues at academic institutions in developing countries and countries with economies in transition, and to foster links between research and policymaking.

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UNCTAD/GDS/2014/3

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Preface

In 2000, the world's leaders set an ambitious agenda of Millennium Development Goals (MDGs) committing their nations to a new global partnership to reduce extreme poverty, and setting out a series of time-bound targets for 2015. Many countries have been struggling to achieve these goals under circumstances that have deteriorated as a result of the global economic crisis. The target of halving extreme poverty between 1990 and 2015 is likely to be achieved thanks to the considerable fall in the poverty rate in Asian countries with large populations, such as China and India, but progress has been much slower in other regions, particularly in sub-Saharan Africa. Progress in achieving full and productive employment and decent work for all has been even less satisfactory as the recent deterioration of the labour market has resulted in a decline in employment, pushing more workers into vulnerable employment and poverty.

International trade can support the achievement of the MDGs in developing countries and play a positive role in pro-poor growth and sustainable development. It can create employment, enhance access to technology and knowledge, raise productivity, increase the variety and quality of goods available to consumers, stimulate capital inflows, increase foreign exchange earnings, and generate resources for sustainable development and poverty reduction. However, this positive relationship is not automatic and does not necessarily take place in all countries and contexts. Both national policies and international action need to be adopted and implemented to maximize the positive impact of trade on poverty. The design of effective national policies, as well as the formulation of negotiating positions for international fora dealing with trade issues, must be grounded in a thorough analysis of data, trends and experiences, and based on a careful assessment of the possible effects of various policy options and negotiation outcomes. In this respect, academic institutions and researchers are key to generating the analysis needed to inform policymaking.

To leverage researcher-policymaker cooperation that can help countries design pro-poor trade policies, the UNCTAD Virtual Institute (Vi) launched a three-year (2012–2014) trade and poverty project aiming to strengthen the capacity of researchers in developing and transition countries. Advisory support to the project was provided by two experienced trade and poverty researchers, Alessandro Nicita from the UNCTAD Division on International Trade in Goods and Services and Commodities, and Amelia Santos-Paulino from the Division for Africa and Least Developed Countries. The objective of the project was twofold: first, to equip participating researchers with knowledge of the trade and poverty conundrum and the empirical tools needed to assess the impact of trade and trade-related policies on poverty and income distribution; and second, to encourage these researchers to undertake policy-oriented studies on trade and poverty.

The first project objective was achieved by training researchers through an online course on trade and poverty analysis authored by Guido Porto (National University of La Plata, Argentina) and Nicolas Depetris Chauvin (African Center for Economic Transformation, Ghana, and University of Buenos Aires, Argentina), in collaboration with David Jaume (National University of La Plata). The course, developed by Vi webmaster Susana Olivares with assistance from Micaela Mumenthaler and Franziska Pfeifer, took place from 10 September to 30 November 2012. It was tutored by Nicolas Depetris Chauvin and Vi economist Cristian Ugarte, with technical support from Susana Olivares, and graduated 77 researchers, including 29 women, from 45 developing and transition countries.

To further the second objective of the project – to encourage and facilitate policy-oriented research – the online course analysed policy-relevant research papers, offered specific presentations and an online forum to discuss policy questions related to trade and poverty, and challenged participants to draft an essay proposing a research idea on a trade and poverty issue of relevance to national policymaking as part of the final course assignment. The top graduates of the course were invited to develop their essays into full proposals for research projects to be conducted in cooperation with national policymakers. The 14 researchers whose proposals were selected for Vi support in March 2013 were paired with international expert "mentors" who assisted them in the completion of their studies. These experts included UNCTAD's Alessandro Nicita and Marco Fugazza (Division on International Trade in Goods and Services and Commodities), Amelia Santos-Paulino and Rashmi Banga (Division for Africa and Least Developed Countries), Piergiuseppe Fortunato (Division on Globalization and Development Strategies) and Claudia Trentini (Division on Investment and Enterprise). Other participating experts were Marion Jansen of the World Trade Organization's Economic Research and Statistics Division, and online course co-author Nicolas Depetris Chauvin. The Vi team provided comments and suggestions on the direction and content of the studies and supported the authors during the drafting process.

The researchers benefited from a combination of online and face-to-face mentoring, the latter provided during a workshop in Geneva in June 2013. In addition to offering expert advice, the workshop included a session on writing policy briefs and communicating with policymakers in order to help researchers establish effective links with policymakers. The experience of participating researchers confirmed that the interaction with policymakers was useful in identifying important topics for policy analysis, developing a better understanding of the researched sectors and related government policies, gaining access to relevant data, and understanding the constraints policymakers may face in implementing the researchers' recommendations.

This book is a collection of country case studies emanating from the Virtual Institute's trade and poverty project. The studies were drafted by researchers from universities, think tanks, and government ministries in Argentina, China, Costa Rica, the former Yugoslav Republic of Macedonia, Nigeria, Peru, the Philippines, and Viet Nam. The studies were peer-reviewed by Nina Pavcnik from Dartmouth College, Petia Topalova from the John F. Kennedy School of Public Policy at Harvard University, Isidro Soloaga from the Universidad Iberoamericana Ciudad de México, and Marcelo Olarreaga from the University of Geneva. Vi economist David Zavaleta contributed to the final stages of the preparation of the book. Nina Pavcnik served as the editor and offered additional technical comments on all the studies. The book was copy-edited by David Einhorn and Martha Bonilla; Eveliina Kauppinen and Mireille Velazquez assisted in formatting the text. Design and layout were created by Hadrien Gliozzo, with photos contributed by Irene Becker, Leniners, Lars Lundqvist, Jasna Susha and Julien Yamba, and advice on the cover by Andrés Carnevali. The publication process was managed by Nora Circosta.

I would in particular like to extend special thanks to Cristian Ugarte, who managed the entire project and was the driving force behind its successful completion.

Finally, our gratitude goes to the United Nations Department of Economic and Social Affairs and the Government of Finland, whose trust and financial contributions allowed us to make this project a reality, and to all the national policymakers who supported our researchers.

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Introduction

Trade policies, household welfare and poverty alleviation – An overview

*Nina Pavcnik**

1 Introduction

During the past three decades, low- and middle-income countries have become increasingly integrated into the global economy. Exports of low-income countries grew from 26 to 55 per cent of their gross domestic product (GDP) between 1994 and 2008 (Hanson, 2012). Exports of middle-income countries increased from 25 to 55 per cent of their GDP during the same period. Hanson (2012) attributes the heightened global engagement to declines in trade costs through large-scale trade liberalizations in developing countries and the removal of barriers to low-skilled goods such as apparel and textiles in developed country markets. Greater international fragmentation of production and increased demand for commodities, fueled by growth in India and China, have also contributed to this trend.

This globalization of less-developed countries has sparked a debate in academic and policy circles about the relationship between international trade and poverty. Global poverty has declined: the share of people living on less than a dollar per day dropped from 52 per cent in 1981 to 22 per cent in 2008 (Chen and Ravallion, 2012). But to what extent is this decline related to growth in international trade? How do the poor fare as low-income countries embrace more liberalized trade policies and expose domestic markets to increased import competition? Do the poor benefit as low-income countries gain access to high-income export markets? Several recent surveys and studies address these questions and discuss the channels through which international trade might affect poverty (Goldberg and Pavcnik, 2004; Winters *et al.*, 2004; Harrison, 2007; Pavcnik, 2008).

* The author would like to thank Carla Larin from Dartmouth College for her excellent research assistance.

Increased participation in global markets also exposes the poor in less-developed countries to terms-of-trade shocks. Fluctuations in global food prices might play a particularly important role because of the significance of food staples in consumption and the prevalence of employment in agriculture among the poor in less-developed economies. As a result, trends in global food prices have received substantial attention from domestic and international policymakers. Until recently, much of this attention has focused on the role of agricultural subsidies in high-income countries in depressing world prices of agricultural commodities. During the 2006–2008 food crisis, the focus shifted to concern about large increases in the prices of key food staples. Ivanic and Martin (2008) suggested that these price hikes contributed to an increase in global poverty. Many governments resorted to trade policy measures to reduce the impact of these global food price shocks on domestic consumers and poverty (Rocha *et al.*, 2012; Aksoy and Hoekman, 2010). However, higher prices of agricultural commodities do not necessarily harm the poor (Aksoy and Hoekman, 2010) because the effects of food price increases on poverty are country- and commodity-specific and depend on initial conditions. The relationship between international trade, agriculture and commodity prices, and poverty thus continues to be a topic of great policy interest.

The studies collected in this volume examine the welfare and poverty consequences of changes in global commodity prices and trade policies in selected countries. The goal of this overview is to place these studies in the context of existing literature on international trade and poverty.

Table 1 lists the countries covered in the studies and compares their level of economic development, poverty, and prevalence of agricultural employment. The case studies focus on lower-middle-income and middle-income countries, with GDP per capita ranging from USD 2,388 in Nigeria to about USD 12,000 in Argentina in 2010 purchasing power parity (PPP) terms. The countries vary in their prevalence of poverty, with the share of the population that lives on less than a dollar per day ranging from less than 1 per cent in the former Yugoslav Republic of Macedonia and Argentina to 16 to 18 per cent in countries such as China, the Philippines, and Viet Nam and 68 per cent in Nigeria. The studies also encompass countries that differ in their exposure to global agricultural markets through production and employment. Less than 1 per cent of individuals are employed in agriculture in Argentina, compared to 45 per cent in Nigeria and almost 50 per cent in Viet Nam.

The studies address the relationship between globalization and poverty in the context of two broad themes. One set of studies examines the welfare consequences of the recent increases in global food prices. The other set of studies examines the welfare effects of trade policy and exchange rate changes. Table 1 lists the price change and/or specific policies and commodities that are the focus of each country's case study.

The research uses a common methodology based on household-level surveys, originally developed by Deaton (1989), to examine the welfare consequences of international trade. The focus is on the short-term effect of price changes through household consumption, production and wage earnings, which in turn affect household welfare and poverty. While the studies could in principle examine the role of all three components, data constraints at times confine the analysis to a subset of the channels. The channels considered in each country are also specified in Table 1.

The studies yield insights about the relationship between trade policy, changes in commodity prices, and poverty. Most importantly, they provide additional support for the conclusion by Aksoy and Hoekman (2010) that it is not possible to generalize about how higher food prices affect the poor. The consequences of commodity price changes for poverty through the channels examined in this volume are country-specific. Net effects on the poor for each country case study are summarized in Table 1. They depend on the impact of the trade policy change on domestic prices, the exposure of the poor households to price fluctuations as producers and consumers of the good, the exposure of these households to price shocks through wage earnings, and the magnitude of the price changes.

For example, while the rural poor tend to be harmed by increases in the price of rice in the Philippines, they benefit from an increased price of maize in the former Yugoslav Republic of Macedonia. This difference stems from the fact that the rural poor in the Philippines tend to be net consumers of rice, while the rural poor in the former Yugoslav Republic of Macedonia are net producers of the commodity that experienced a large price increase. The case of the former Yugoslav Republic of Macedonia further illustrates that the effects on poverty might depend on the commodity under consideration.

Table 1 Country case study summaries

Country	GDP per capita[1]	Poverty rate[2]	Employment in agriculture[3]	Price or policy change	Commodity	Channels	Net effect on the poor
Philippines	3,910	18.4[4]	33	Price increase	Rice	Consumption, production	Negative
Former Yugoslav Republic of Macedonia	11,367	0.6	19[5]	Price increase, subsidy	Wheat, maize, rice	Consumption, production, wage earnings	Commodity-specific
Argentina	12,016[6]	0.9	1	Export restrictions (price increase)	Wheat, wheat-based products	Consumption	Neutral/ positive
China	7,503	16.3	37	Exchange rate appreciation	All commodities	Consumption	Positive
Costa Rica	11,504	3.1[7]	15	Lower tariffs (price decrease)	Rice	Consumption	Positive
Peru	9,355	4.9	26	Lower tariffs (on corn) (price decrease)	Corn, chicken	Consumption	Positive
Nigeria	2,388	68	45[8]	Lower tariffs (price decrease)	Agriculture, manufacturing	Consumption, production, wage earnings	Positive
Viet Nam	3,334	16.9[9]	48[10]	Large-Scale Field Model (price increase)	Rice	Consumption, production, wage earnings	Positive (negative for the poorest)

Source: World Bank World Development Indicators.

[1] *PPP terms in 2010 USD.*

[2] *Poverty headcount ratio at USD 1.25 a day (PPP) as a percentage of the population at 2010 international prices.*

[3] *Per cent of total employment in 2010.*

[4] *Data only available at 2009 prices.*

[5] *Data only available for 2011.*

[6] *Data only available for 2006.*

[7] *Data only available at 2009 prices.*

[8] *Data only available for 2004.*

[9] *Data only available at 2008 prices.*

[10] *Data only available for 2011.*

The studies also provide institutional details about the organization of the supply chain through which commodities are delivered from producers to consumers. Several studies highlight that it is crucial to consider how price changes are passed through in this supply chain. For example, studies on Viet Nam and Argentina suggest that the main beneficiaries of higher prices might be the middlemen and intermediaries. Likewise, studies on Costa Rica and Peru suggest that the welfare gains of consumers from reductions in import tariffs on a good might be reduced when wholesale importers do not fully pass on cost savings to consumers of final goods. Further exploration of the organization of the supply chain can therefore be a fruitful topic for future research.

Section 2 of this overview reviews the channels through which international trade might affect poverty and discusses the empirical evidence on the importance of these channels in practice. Section 3 discusses the mechanisms through which international trade affects poverty in the studies compiled in this volume and overviews the common methodology. Section 4 summarizes the findings of the studies that focus on the welfare consequences of recent increases in global food prices. Section 5 reviews the studies that examine the welfare effects of trade policy and exchange rate changes. Section 6 puts forth conclusions.

2 International trade and poverty – An overview

This section reviews the channels through which international trade might affect poverty and discusses the empirical evidence on the importance of these channels in practice.

2.1 International trade and poverty: Economic growth

Economists agree that economic growth is potentially the most important channel to reduce poverty and that international trade might play an important role in this process. This argument requires one to first examine the relationship between international trade and economic growth, and then consider how trade-induced economic growth might affect poverty.

Theoretically, the relationship between international trade and growth is ambiguous, especially for lower-income countries that might not have comparative advantage in sectors that generate dynamic gains from trade (Rodriguez and Rodrik, 2001). International trade raises average incomes through static gains from trade due to specialization according to comparative advantage and economies of scale, among other factors. However, if specialization according to comparative advantage contracts sectors that are engines of growth, it could outweigh the benefits of static gains from trade and reduce growth in less-developed countries. Several empirical studies (most notably Frankel and Romer, 1999) find that countries that trade more tend to have higher incomes, but a robust relationship between international trade and growth across countries has been elusive (see Rodriguez and Rodrik, 2001, for a critique). That being said, it is difficult to point to countries that were able to grow over long periods of time without opening up to trade (Irwin, 2004). So the lack of robust evidence certainly does not imply that international isolation leads to growth. One major challenge in this literature is determining the causality of whether countries that trade more (or observe an increase in international trade) subsequently experience higher growth, or whether high-growth countries simply engage more in international trade.

Several recent studies have made advances in addressing the causality problem and confirm a positive link between international trade and growth. For example, Feyrer (2009) found that declines in trade associated with the closure of the Suez Canal were associated with reductions in income in countries that rely heavily on the canal for transportation. Estevadeordal and Taylor (2013) compared changes in growth rates in less-developed countries that participated in the Uruguay Round of the World Trade Organization (WTO) negotiations with changes in growth rates among non-participants. They found that declines in import tariffs increased GDP growth among the countries that liberalized their trade. Increased growth rates stemmed mainly from declines in tariffs on capital goods and imported intermediate inputs rather than reductions in tariffs on consumer goods. This highlights the importance of gains from trade that operate through increased efficiency and innovation in the production process. The importance of imported inputs and technology for efficiency and innovation in less-developed countries is corroborated by microeconomic firm-level evidence (Amiti and Koenings, 2007; Topalova and Khandelwal, 2011; Goldberg *et al.*, 2010). While this more recent evidence suggests a robust and more nuanced positive relationship between international trade and economic growth, the academic debate on the topic continues.

In order to consider how international trade affects poverty via growth, one needs to examine how trade-induced economic growth affects poverty – a link which is very difficult to establish. Widely cited works by Dollar and Kraay (2002, 2004) suggest that trade – via growth – is good for the poor by showing that countries with increased participation in international trade experience greater declines in poverty. However, these findings have been heavily debated (Ravallion, 2001; Deaton, 2005). Trade-induced economic growth could help the poor (for example, by increasing their earning opportunities through the creation of employment for less-educated individuals), but it could also circumvent the poor (Ravallion, 2001).

2.2 International trade and poverty: Relative prices, wages, and employment

Most studies that examine the relationship between international trade and poverty look at the direct effect on poverty that might operate through changes in relative prices, wages and employment. A survey by Goldberg and Pavcnik (2004) discussed trade-related mechanisms that could affect poverty through earnings of less-educated workers, industry wage premiums, occupational wage premiums, and effects on worker employment and/or unemployment. They suggested that the effects of international trade on poverty are country-specific. The effects depend on the exposure of the poor to international trade through employment opportunities and the above-mentioned sources of income, the impact of trade on these sources of income, and the nature of the trade policy change in the country in question.

Several recent studies have directly examined the effect of trade liberalization on poverty.[1] Goldberg and Pavcnik (2007) found no relationship between international trade and poverty in urban Colombia. Poverty among urban households in Colombia was relatively low, with less than 3 per cent of households living below the dollar-a-day poverty line during the time frame under study. The urban poor tended to live in households with an unemployed household head, so the main mechanism through which international trade could affect poverty was through its effects on unemployment. The study did not find any evidence that declines in import tariffs in Colombia were associated with increased unemployment. As a result, it is not surprising that the study also did not find any evidence that import tariff declines affected urban poverty.

Several studies have found a statistically significant impact of international trade on poverty in countries with relatively high poverty rates at the onset of trade policy reforms. In these cases, the effects of trade reform on poverty depend in part on the nature of trade liberalization and the ease of worker mobility. For example, India experienced large declines in poverty during the 1990s. Topalova (2007, 2010) found that poverty declined less in Indian districts that were more exposed to import tariff declines, especially

[1] Several of these studies were published in Harrison (2007), a volume on globalization and poverty.

in areas located in states with stringent labour laws. Indian workers in industries with larger tariff cuts experienced declines in relative wages, so the study conjectured that limited mobility of individuals living in these districts precluded them from moving to the areas with new employment opportunities. Kovak (2011) also documented declines in regional wages and evidence of limited regional labour mobility in the aftermath of trade liberalization in Brazil. As in the case of India, the Brazilian reform consisted of lowered import barriers to trade. McCaig (2011), on the other hand, found that poverty dropped more in Vietnamese provinces that were better positioned to benefit from increased export opportunities after Viet Nam signed the bilateral trade agreement with the United States. Workers in provinces that were more exposed to export opportunities, especially workers with less education, experienced increases in wages in response to declines in tariffs on Vietnamese exports in the United States, which translated into lower poverty.

Overall, these studies highlight that the effects of international trade on poverty depend on the nature of the trade reform, the effects of international trade on sources of income/employment, and the importance of these channels for the households at the bottom of the income distribution in the country in question.

2.3 International trade and poverty: Relative prices, and net consumption and production

The studies reviewed in Section 2.2 examine the link between international trade and poverty that operates through the response of wages and employment opportunities of individuals to trade-induced changes in relative prices of goods. Trade-induced changes in relative prices of goods might also affect poverty through exposure of households as consumers and producers of goods (see surveys by Goldberg and Pavcnik, 2004, and Harrison, 2007). Most individuals in low-income countries do not work for wages and are instead self-employed in a household business or farm. However, these households might be exposed to trade-induced price fluctuations as producers of commodities experiencing price changes. Likewise, households in low-income countries are affected by price fluctuations as consumers. Fluctuations in the prices of food staples might be particularly important because poor households in these economies often spend 60 to 80 per cent of their household budget on staples.

The literature that examines the above-mentioned effects of trade policy on poverty through net consumption and production builds on the methodology of Deaton (1989) and focuses on the first-order effects of price changes on the welfare of households, holding the consumption and production bundles of households fixed.

Overall, the literature concludes that the effects of trade liberalization on poverty operating through these channels are case-specific. They depend on the nature of the trade policy change, exposure of the poor to trade-induced price fluctuations as consumers, producers and wage earners, sensitivity of wages to price changes, and the magnitude of the price changes.

Potentially the most influential among these studies are Porto (2006) and Nicita (2009). Porto (2006) examined the effect of the Common Market of the South (MERCOSUR) on urban Argentine households through consumption and earnings channels. The study found that import tariff reductions induced by MERCOSUR benefited poor households in Argentina. Tariffs declined relatively more on skilled-labour-intensive goods than unskilled-labour-intensive goods, leading to increased relative prices of unskilled-labour-intensive goods. As predicted by the Hecksher-Ohlin model, this translated into increased wages of unskilled workers and declines in earnings of skilled workers. Because most workers from poor households in urban Argentina tend to be less educated, the earnings in poor households increased. At the same time, poor households experienced a decline in welfare through the consumption channel because they tend to consume relatively more of the goods whose price increased (such as unskilled-labour-intensive goods). However, the welfare gains through earnings exceeded the welfare losses through consumption, leading to overall welfare gains for the poor.

Nicita (2009) studied the effect of Mexico's trade liberalizations during the 1980s and 1990s on Mexican households through consumption, production and wage earnings channels. Import tariff reductions lowered the prices of agricultural and manufacturing goods, and these lower prices benefited households through the consumption channel at all income levels. However, welfare gains were smaller for the poor because they relied more heavily on self-produced consumption. Lower prices of agricultural goods negatively affected poor households through the production channel, and the poor were also not well positioned to gain through the wage earnings channel. The trade reform was associated with a slight increase in the wages of educated workers that mainly benefited higher-income households composed of individuals with many years of completed schooling. Overall, the study found that the welfare gains through consumption outweighed the welfare losses through production for the poor. It also concluded that the trade reform was more beneficial for households living closer to the United States border and in urban areas.

The above studies focus on first-order effects of price changes on the welfare of households, holding the consumption and production bundles of households fixed. Households might respond to price changes by altering consumption and production. A related study that examines the importance of international trade for the welfare of poor households is Brambilla *et al.* (2012), who examined the effect of anti-dumping duties on catfish imposed by the United States on Vietnamese households. The study found that higher import tariffs lower production and investment, and reduce the income of Vietnamese households that rely on catfish as their source of livelihood. The study illustrates that the usual methodology that focuses on first-order short-term effects of price changes through consumption and production might potentially ignore welfare consequences associated with longer-term responses to price shocks that operate through changes in household consumption, production and investment decisions (Porto, 2010).

3 Overview of studies in this volume

The studies in this volume focus on the relationship between international trade and poverty that operates through channels discussed in Section 2.3. While the studies cover a variety of topics, they all examine short-term first-order effects of price changes on household welfare that operate through household consumption and production.

The welfare analysis uses a common methodology that is based on cross-sectional household-level data that contain information about household income (and its sources) and household expenditures allocated to different consumption items. The data are representative of households along the entire distribution of income, allowing for direct examination of the welfare consequences of price fluctuations for poor households. As in Deaton (1989), household budget shares of a commodity measure a household's exposure to price changes through the consumption channel. Likewise, the household income share stemming from production of a commodity measures a household's exposure to price changes through the production channel. A household's exposure to price changes through labour earnings – the wage channel – depends on the share of these earnings in household income and the elasticity of wages with respect to a price change.

The studies use either information on actual price changes or a price change predicted by a policy adjustment, such as a change in an import tariff or exchange rate appreciation. The framework can be used to simulate the effect of price changes on household welfare, taking into account differences in households' exposure to price changes through these three channels. While all studies could in principle examine the role of all channels, data constraints at times confine the analysis to the first-order welfare effects of price changes operating through consumption.

The studies apply this framework to address two broad topics. One set of studies examines the welfare consequences of the increases in global commodity prices during the 2008–2010 food crisis. These studies focus on the Philippines, the former Yugoslav Republic of Macedonia and Argentina. Section 4 summarizes their findings. The other set of studies – on China, Costa Rica, Peru, Nigeria and Viet Nam – examines the welfare effects of trade policy and exchange rate policy, and is reviewed in Section 5.[2]

4 The effects of global food price increases

Several studies explore the short-term welfare implications for the poor of price increases during the 2006–2008 food crisis. This discussion is related to the discourse on the consequences of agricultural subsidies in rich countries for the terms of trade of low-income countries. These subsidies lower world prices of commodities, generating terms-of-trade losses for countries that are net exporters of these commodities, while benefiting countries that are net importers of the goods.

Research suggests that the poorest countries are often net importers of commodities which are subject to agricultural subsidies (Panagariya, 2006; Valdes and McCalla, 1999; McMillan *et al.*, 2007). They might therefore be adversely affected by the elimination of these subsidies. The main beneficiaries of the elimination of agricultural subsidies are expected to be large net exporters of agricultural goods such as Brazil (Panagariya, 2006; Valdes and McCalla, 1999), that is, lower-middle-income and middle-income countries. This literature highlights that the overall effect of recent price hikes on countries depends on whether a country is a net producer or a net consumer of the good. In aggregate, the surges in prices benefit countries that are net exporters of the food staple experiencing the price increase, while harming countries that are net importers of the good.

It is important to emphasize that in a country that might largely benefit from a price increase, poverty can increase or decrease. Within countries, price hikes generate winners and losers. A price increase of a good raises

[2] The description of each study in Sections 4 and 5 draws on facts and policy descriptions from the respective studies, unless otherwise noted. Please refer to the individual studies for original references.

the welfare of households that are net producers of the good, and reduces the welfare of households that are net consumers of the good. The consequences of price hikes for poverty depend crucially on whether the households at the bottom of the income distribution are net consumers or net producers of the good (Aksoy and Hoekman, 2010).

4.1 Effects on importing countries

The above discussion suggests that recent increases in global food prices might reduce aggregate welfare in countries that are net consumers of the good that experiences a price increase. This does not imply, however, that the poor in import-competing countries are necessarily worse off. The consequences of the price increases for the welfare of the poor in import-competing countries are country- and commodity-specific. The studies on the Philippines and the former Yugoslav Republic of Macedonia included in this volume highlight these nuances and illustrate the importance of using micro-survey data to better understand the relationship between global increases in food prices and poverty.

The Philippines: Rice

The study on the Philippines examines the impact of the 2008 rice crisis on household welfare in the country. During the crisis, world rice prices more than doubled. As one of the largest importers of rice in the world, the Philippines suffered a terms-of-trade loss and a potentially sizable aggregate welfare decline.

The study examines the effects of price increases on poverty through household consumption and production. Because a typical Filipino household is a net consumer of rice, the study finds that more households are negatively affected by the increase in rice prices. Rice accounts for about 13 per cent of household spending (a third of spending on food) in a typical Filipino household. Consistent with Engel's Law, the poorest households in the Philippines spend between 20 to 25 per cent of their budget on rice, with the share declining to less than 5 per cent among the relatively richer households. Consequently, the uptick in domestic rice prices had a particularly large negative effect on the welfare of the poorest households because they were the most exposed to rice price hikes through consumption.

The price shock lowered the welfare of poor households in rural and urban areas, but the price increase is predicted to have had a more detrimental effect on the urban poor. The finding of negative welfare effects on the rural poor might be surprising at first because rice cultivation is concentrated in rural areas, with 22 per cent of the rural population growing rice. However, rice cultivation is not an important income source for the poorest rural households.

The study also considers gender differences by comparing the income and expenditure patterns of female- and male-headed households. While the patterns of expenditure are similar for both types of households, differences are found in the composition of income: rice production is relatively more important in male-headed households, probably because female-headed households derive income from other non-rice production-related activities. As a result, female-headed households are more vulnerable to price hikes.

Overall, the study illustrates that households adversely affected by the rice crisis outnumber households that were better off, with the poor bearing disproportionate welfare losses. The main beneficiaries of the rice price increases were richer agricultural households, which tend to be net producers of rice.

The study highlights the effects of rice price increases on household welfare through the household level of rice consumption and production, but not through household wage earnings. This channel might play the largest role in regions where rice cultivation is concentrated if rice price increases are large enough to increase local demand for agricultural labour and thus local wages.

The former Yugoslav Republic of Macedonia: Wheat, maize and rice

Similar to the Philippines, the former Yugoslav Republic of Macedonia experienced a negative terms-of-trade shock during the recent food crisis. The country is a net importer of wheat, maize and rice, the three crops that experienced a large price increase between 2006 and 2012. However, GDP per capita in the country is substantially higher than in the Philippines, so a typical Macedonian household is substantially less exposed to these price shocks through consumption and production than a typical household in the Philippines.

Rice consumption and production play a small role in the lives of average Macedonian households, accounting for less than 1 per cent of household expenditure and less than half a per cent of income. Even among rural households, expenditure on rice accounts for less than 1 per cent of the household budget and about 1 per cent of household income.

An average Macedonian household is more exposed to fluctuations in prices of wheat and maize, spending about 2 per cent of household expenditure on wheat and maize and receiving 5 per cent of income from the two commodities. Wheat and maize play a substantially larger role in the lives of rural households, contributing to about 20 per cent of household income and 4 per cent of household expenditure. The two commodities account for a small share of average urban household expenditure (0.8 per cent) and income (0 per cent).

The study highlights differences in the short-term effects of increased global prices on households through consumption, production, and wage earnings. Price increases of all three commodities reduced the welfare of urban households that are net consumers of these commodities. The poorest urban households, especially female-headed ones, experienced the largest decline in welfare.

Price increases in wheat and maize were beneficial for rural households along the entire income distribution, with the poorest households benefiting the most from price hikes. However, conditional on per capita expenditure, male-headed households benefited substantially more than female-headed ones. The cultivation of wheat and maize occurs mainly in male-headed households, and this accounts for the observed differences in welfare changes by gender. The poorest female-headed rural households do not engage significantly in cultivation and are most negatively affected by price increases.

Rice accounts for a substantially smaller share of the household budget, so the effects of rice price increases were small in magnitude. Rice price increases benefited mainly male-headed rural households in the middle and upper level of income distribution, as these households are more likely to cultivate rice. Poor, female-headed rural households were particularly adversely affected.

The study also evaluates the effectiveness of a production subsidy implemented by the government of the former Yugoslav Republic of Macedonia in 2006 to encourage production of wheat and maize and improve the livelihoods of the rural poor. The results suggest that the subsidy did not reverse the trend of declining domestic production of cereals. Neither was it an effective tool for combating poverty, in part because poor rural female-headed households and poor urban households tend to be net consumers rather than producers of the subsidized crops. The study proposes an alternative scheme for subsidy disbursement that better targets the poorest sub-groups and aims to encourage production among female-headed households and poor urban households. While the alternative subsidy scheme might better target the poor than the original one, a policy tool that more directly addresses poverty alleviation, such as direct cash transfers to the poor or other forms of a social safety net aimed at the poor, might be even more effective. Overall, the study is a clear illustration of the usefulness of micro-level surveys in assessing the short-term first-order effect of price changes induced by government policy.

4.2 Export restrictions in response to the food crisis

The 2006–2008 food crisis deteriorated the terms of trade of importers such as the Philippines and the former Yugoslav Republic of Macedonia, while improving the terms of trade of exporting countries. Exporting countries experience a net benefit from the price hikes. However, the price shocks can also increase poverty in these countries by disproportionately harming the households at the bottom of the income distribution if these households are net consumers of the good. Faced with these concerns, many exporting countries responded to the food crisis by restricting exports of key food staples through the imposition of export quotas and by raising export taxes. Rocha *et al.* (2012) reported 85 new export restrictions between 2008 and 2010, the majority of them imposed on wheat, maize and rice, which are all staples that account for a large share of the household budget in low- and middle-income countries.

In theory, export restrictions such as export taxes and quotas lower domestic prices of staples. Faced with an increased cost of exporting, domestic firms divert export sales to domestic markets, hereby increasing the supply and consequently lowering internal prices. This benefits domestic consumers (who can now consume more of the good and at lower prices) at the expense of domestic producers (who now produce less and sell at lower prices).

Export restrictions do not constitute first-best economic policies for poverty reduction during times of price hikes. In addition, these measures only alleviate the increases in poverty during times of price hikes if the poor are actually net consumers of the good in question. This is more likely to hold for urban households, but it is less clear for rural households.

Argentina: Export restrictions, subsidies and international wheat prices

The study on Argentina contributes to the understanding of these issues by focusing on the potential effects of quantitative restrictions imposed on wheat exports in 2006 on the welfare of urban households in Argentina. Argentina is a net exporter of wheat, with exports accounting for over 60 per cent of production and over 7 per cent of the country's total exports during the period under study. Argentina introduced export duties on wheat in 2002, followed by quantitative export restrictions on wheat in 2006. Domestic price ceilings and subsidies for millers and wheat producers were also put in place in 2007.

As a result, millers were to purchase wheat from producers at a low "internal supply price". The government then paid the mills a subsidy in case they bought wheat domestically at a higher price than the internal supply price, and provided producers a subsidy compensating them in case the price in the international market, adjusted by export duties, exceeded that in the domestic market. These policies were implemented to curb domestic inflation in cereals and wheat-based products (such as bread and pasta) during the period of high global prices and to ensure sufficient domestic provision of wheat.

Export restrictions benefited Argentine consumers of wheat, including producers and consumers of wheat-based products, at the expense of Argentine wheat producers. While the subsidies might have in part compensated Argentine wheat producers, they required government funding. How effective were these policies in curbing inflation and protecting the poor from high food prices?

The author examines the consequences of these policies for the welfare of Argentine urban households through household consumption of wheat-based products. A typical Argentine household spends about 6 per cent of its budget on wheat-based products such as bread and pasta, but export restrictions were associated with negligible welfare gains for urban consumers. Wheat-based products account for a substantially higher budget share among poor households (about 11 per cent) than among households in the top 5th quintile of the income distribution (about 3 per cent). Although declines in prices of wheat-based goods benefited the poorest households the most, the magnitude of these effects also turns out to be quite limited.

Negligible welfare effects are attributed to the minimal influence that high international wheat prices have on prices of wheat-based products. Wheat accounts for about 10 per cent of the cost of producing wheat-based products, with inputs such as labour, utilities and rent playing a substantially more important role. According to the study, the price of wheat-based products would only increase 1 per cent more in the absence of export quotas.

The study also examines the interaction of export restrictions with domestic policy measures. When combined with ceiling prices and subsidies to the milling industry, welfare effects on households are larger, although they continue to be small in magnitude. These results are indicative of the failure of the policies to achieve welfare goals, and might help direct the design and implementation of future policies.

The study highlights the importance of examining the organization of the entire supply chain. The author argues that the likely main beneficiaries of the policy were millers and exporters because they usually hold export licences. The establishments that received export licences were able to purchase wheat at low prices controlled by price ceilings, and then export it at high international prices. The author suggests that export restrictions actually reduced competition among the millers and exporters, thus strengthening their monopoly position over wheat producers and further reducing the price of wheat received by the farmers.

The effectiveness of export restrictions in insulating domestic consumers from price increases and reducing poverty could diminish further once global externalities of a trade policy change are taken into account. When several large exporters simultaneously impose export restrictions, this limits the world supply and leads to the escalation of international prices. Recent research by Anderson *et al.* (2013) pointed out that, once the effects of export restrictions on world prices are considered, the declines in global poverty attributed to these restrictions are substantially reduced.

5 Effects of appreciation and trade policy

Governments can also influence the domestic prices of goods through exchange rate policy and trade policy. A set of studies in this volume examines the short-term consequences of such policies on household welfare.

China: Effects of exchange rate appreciation

In July 2005, China ceased to fix its exchange rate against the United States dollar and began to appreciate the renminbi, which led to a 30 per cent appreciation of the Chinese currency against the dollar.

The study on China examines the impact of the appreciation on changes in welfare of Chinese households through consumption. It first determines the effect of the renminbi appreciation on domestic prices, and then analyses the subsequent effect of these price changes on household welfare through consumption. The analysis focuses on rural China, where most poor households are located. According to the study, in 2007, 14 per cent of rural households and less than half a per cent of urban households in China lived on less than a dollar per day.

Appreciation in the nominal exchange rate of renminbi could exert downward pressure on prices of domestic substitute products in China by lowering prices of competing imported goods and by reducing the demand for Chinese export goods abroad. The estimates confirm that the appreciation lowered consumer prices of goods in China, with the exception of medical care and durable goods. The authors attribute the lack of decline in prices in these two areas to imperfect substitutability of domestic and foreign medicines (most Chinese consumers tend to consume domestically produced medicines) and to the fierce competition within China among domestic producers of durable goods, which translates into the prices of these products rarely being affected by the currency appreciation. Food products and housing experienced the largest drop in prices, in part due to reduced prices of fuel. Because purchased food products account for the largest share of the household budget (on average between 19 to 33 per cent in various regions), the appreciation generated significant welfare gains for all households by reducing their consumption expenditure.

However, poor households benefited less from appreciation than richer households. The lower benefits of the poor in rural areas stem from a heavy reliance on self-produced consumption (which is not affected by appreciation) and a subsequently lower share of purchased food. Among the items affected by appreciation, poorer households consume less of the goods that experienced greater price declines. The authors also show that appreciation generated larger gains for households living in provinces with more developed market institutions, because appreciation pass-through to domestic prices is higher (and thus prices lower) in these regions. Inland provinces in Western China tend to have less developed markets, so the poor households in these provinces benefited the least from appreciation. Conditional on income, households in coastal areas are better positioned to gain than households in inland provinces.

The study focuses on the impact of the appreciation on household welfare through short-term first-order price effects on household consumption, and illustrates that this channel benefits poor households less than richer ones. With the reduced demand for Chinese exports, it is plausible that households employed in the export sector would experience decreased earnings. The export sector employs a large proportion of less-educated workers, who tend to be from poorer households. Thus, one needs to be cautious about making conclusions with regard to the total effect of the appreciation on household welfare.

Costa Rica: Import tariffs and quotas on rice

The domestic rice market in Costa Rica is protected by several domestic and border policies, ranging from import tariffs and quotas to the fixing of domestic prices. These policies, which apply to paddy and milled rice, have neither increased productivity of rice farmers nor improved conditions for small farmers. However, they have substantially raised the prices paid by Costa Rican consumers, at times to levels double the prices prevailing on international markets.

In 2004, Costa Rica signed the Dominican Republic-Central America-United States Free Trade Agreement (CAFTA-DR). As part of this agreement, which entered in force in 2009, it agreed to gradually phase out import quotas on rice imports and provide unlimited duty-free access to rice imports from the United States by 2025. Costa Rican imports on average cover 35 per cent of its demand, with the United States accounting for over 80 per cent of imports (Central America, Argentina and Uruguay provide the rest). Consequently, this agreement might have an important effect on the Costa Rican rice market, especially since the non-preferential tariff on rice imported from the United States is 36 per cent. This study provides an *ex-ante* analysis of the welfare effects of the elimination of rice import tariffs and the relaxation of import quotas on Costa Rican consumers.

Research suggests that existing policies have mainly benefited vertically integrated large farmers and millers, who often hold quota licences and are able to purchase paddy rice cheaply on the world market, earning high profits as they process it and sell it domestically. By reducing the cost of rice imports (and increasing their supply), the elimination of import tariffs is expected to reduce the domestic price of rice, leading to welfare gains for rice consumers. A typical Costa Rican household is a net consumer of rice, with 8 per cent of the food budget spent on rice.

The study finds that poor households in Costa Rica would benefit most from a reduction in the price of rice following implementation of the CAFTA-DR. This is expected, given that households in the bottom quintile of the income distribution spend on average 5 per cent of their overall budget on rice. Middle-income households would also benefit from a reduction in rice prices, while welfare gains for the richest households would be negligible due to lower expenditure on rice.

Poor urban households are expected to benefit the most from a price decrease because they tend to consume more rice than rural households with the same income. The study also suggests greater benefits for larger households and for households with less-educated household heads, owing again to the larger share of rice in these households' expenditure.

The study highlights the potential gains to Costa Rican rice consumers of the trade policy change through first-order effects on consumption. The analysis assumes that importers of rice will pass lower prices of imported rice on to consumers once the tariffs are eliminated. In addition, the study implicitly assumes that domestic policies will not interfere with the predicted declines in the consumer price of rice. To the extent that larger importers (mainly millers) have market power and the government keeps in place domestic measures that benefit producers and millers at the expense of consumers, the realized welfare gains of Costa Rican consumers might be smaller.

Peru: Elimination of the import tariff on yellow corn

Peru is a net importer of yellow corn, which also is the third most important agricultural crop in the country and the main input for the broiler industry. Taken together, the production of yellow corn and chicken meat accounted for 23 per cent of agricultural GDP in 2012.

The Peruvian government introduced trade measures aimed at reducing the effective import tariff applied to yellow corn. Between 2000 and 2011, the tariff declined from 33.3 per cent to zero. This study examines the short-term effects of tariff elimination on the welfare of Peruvian households through the consumption of chicken. It focuses on households in coastal Peru, the region where most imported yellow corn is consumed and where about 90 per cent of the broiler industry is located.

A decline in the import tariff on yellow corn lowers the domestic price of corn, which, while reducing domestic production (and lowering the welfare of domestic producers), is expected to increase consumption and benefit consumers of yellow corn. Chicken meat farmers, the main consumers of yellow corn, are expected to benefit from these price reductions. According to the study, yellow corn accounts for 45 per cent of their production costs. To the extent that declines in production costs are passed on to final consumers, consumers of chicken meat would also benefit from tariff elimination.

In coastal regions of Peru, expenditure on chicken meat accounts on average for about 4 per cent of total household expenditure and approximately

15 per cent of food expenditure. Net consumption of chicken is lowest among the extremely poor and increases as income rises, subsequently declining for the wealthiest households. Despite very low consumption among the poorest households, the corn tariff nonetheless benefits poor households more than richer ones. Urban households account for 86 per cent of the coastal population and the study finds slightly higher welfare gains in urban than in rural areas because of higher chicken consumption among urban households.

The study raises the issue of the extent to which the tariff-induced declines in the cost of production in the broiler industry are passed on to consumers through lower prices of chicken meat. While the elimination of the import tariff on corn benefits final consumers of chicken meat, the magnitude of the effect is predicted to be small. Limited gains to consumers of chicken meat might be related to the vertical integration between corn wholesalers and the broiler industry.

In Peru, the main importers or wholesale buyers of corn are also the largest producers of chicken meat. To the extent that they have some market power (or variable markups), they may not pass much of the cost savings on corn prices through to lower prices of chicken, thereby limiting the potential gains of import tariff liberalization for final consumers. Limited short-term gains for consumers are consistent with recent studies that highlight low pass-through of cost savings induced by tariff reductions on imported inputs to consumer prices (De Loecker *et al.*, 2012).

Nigeria: Effects of the Common External Tariff

As a member of the Economic Community of West African States (ECOWAS), Nigeria adopted the ECOWAS Common External Tariff (CET) in 2005. This study examines the potential effects of adoption of the CET on the welfare of Nigerian households.

The implementation of the ECOWAS CET committed Nigeria to lower the maximum tariffs imposed on imports from non-member countries. The study reports that average import tariffs on agricultural goods declined from 32 to 15 per cent and the average import tariffs on manufactured goods declined from 25 to 11 per cent between 2000 and 2010. Imports from ECOWAS members account for less than 5 per cent of Nigerian imports. Given that Nigeria mainly imports goods from non-ECOWAS trade partners, the implementation of the CET could in principle have important consequences for the welfare of Nigerian households.

The study examines the effects of import tariff reductions through the ECOWAS CET on household welfare through the consumption, production and wage earnings channels. It focuses on several agricultural product groups, such as rice and fruits, and on processed manufactured goods, such as oil and bread. Jointly, these goods account for about 30 per cent of the household budget of a typical Nigerian household.

Declines in import tariffs are associated with lower domestic prices of agricultural goods. Declines in prices increase the welfare of households at all income levels through the consumption channel. Welfare gains are larger for poor households because they spend a larger portion of their budget on agricultural goods. However, poor households also experience reductions in welfare as producers of agricultural goods. Overall, the consumption channel plays a more important role and the CET is predicted to increase the welfare of poor Nigerian households, as well as households at other levels of income.

With regard to the wage earning channel, the study finds that the lower domestic prices are not associated with changes in the country's wages.

While the study provides interesting insights on the effects of the CET on household welfare in Nigeria, two issues might affect its findings. Data availability and quality are potentially a concern, affecting the estimates of the relationship between import tariffs and domestic prices of manufactured goods. In addition, internal unrest affected Nigeria's international trade and thus potentially the results of the analysis.

Viet Nam: Upgrading the rice export value chain

The opening of Viet Nam to export markets lifted many households out of poverty (McCaig, 2011), but policymakers continue to focus their attention on sharing the benefits of exporting more widely with farmers. Viet Nam currently ranks as the largest world exporter of rice; however, farmers appear to gain less from exporting than other actors in the value chain (Tran *et al.*, 2013). The vast majority of farmers sell rice to exporting firms through a complex chain of collectors and millers. Farmers' ability to bargain for higher prices is hampered by the market power of intermediaries, outstanding loans after harvest, and the inability to store rice. Less than 5 per cent of rice sales occur directly between farmers and exporters, in part because transportation and coordination costs make it unprofitable for large-scale exporters to directly interact with small-scale farmers.

The study evaluates the potential effects on the welfare of Vietnamese rice farmers of a pilot project that upgrades the rice export value chain. The project, the Large-Scale Field Model (LSFM), aims to increase the farm gate price of rice by reducing the role of intermediaries and linking farmers directly with exporters, so that benefits of exporting could be shared more with farmers. The project also aims to consolidate land across farmers to reduce the cost of production through economies of scale. In addition, it includes several measures that aim to improve farmers' access to higher-quality inputs to subsequently increase rice yields.

The effectiveness of the project is evaluated among farmers in the Mekong River Delta, Viet Nam's key rice-exporting region. The analysis, which simulates the effects of the project on farmers' welfare through consumption, production and wage earnings, suggests that on average it benefits the farmers. However, the poorest farmers tend to be net consumers of rice, so in the long-term when there is an additional increase in the price of paddy, they are not as well positioned to benefit from an upgraded export supply chain as are wealthier households that are net producers of rice. Households with a larger farm size are the main beneficiaries, owing to economies of scale. Overall, although the poorest farmers might not always benefit from the project, the total effect of the upgraded export supply chain is estimated to reduce poverty in the Mekong River Delta.

With regard to the extent that productivity improvements and cost reduction would be passed on to lower prices, the study may overstate the gains from the project. The literature suggests that the pass-through of cost reduction to prices is incomplete (De Loecker *et al.*, 2012). Therefore, reduction in costs may not be completely reflected in the price decrease.

This study illustrates the importance of focusing on the entire supply chain through which exports reach product markets. The short- and long-term effects of the policy are evaluated under the assumption that the project will successfully implement structural changes that lead to better farm gate prices and cost reductions for farmers, including elimination of intermediaries, land consolidation across farmers, and new infrastructure such as storage. Most of the large exporters of rice are state-owned enterprises, which, according to the study, lack incentives to invest in improvements in the distribution chain. The study illustrates the possibility of upgrades in the supply chain to benefit the farmers, but questions of implementation remain a topic for future discussion.

6 Concluding remarks

The relationship between globalization and poverty continues to garner attention in research and policy circles. The studies in this volume contribute towards a better understanding of this issue by using household-level surveys to analyse the effects of global price shocks and trade policy changes on the poor.

The studies yield several insights about the relationship between changes in commodity prices and poverty. Most importantly, they provide additional support for the conclusion by Aksoy and Hoekman (2010) that it is not possible to generalize about how higher food prices affect the poor. The effects of commodity price changes on poverty through the channels examined in this volume are case-specific. They depend on the exposure of the poor households to price fluctuations as producers and consumers of the good, the exposure of these households to price shocks through wage earnings, and the magnitude of the price changes.

All of the studies evaluate the welfare effects of policy changes, holding the household consumption share, production share, and earning share constant. As such, this welfare analysis might be particularly useful for *ex-ante* evaluation of a price or policy change and more likely to be representative of short-term household welfare responses to price fluctuations. More broadly, such *ex-ante* studies can provide a useful policy tool that can be implemented with existing household-level surveys to better understand the potential short-term effects of policy changes on the distribution of income (as is done in the study on Costa Rica, for example, which examines the potential effects of CAFTA-DR prior to its full implementation).

The studies in this volume also raise additional questions. First, several of them suggest that the transmission of policy changes to prices faced by consumers (or producers) depends on the market structure in the commodity markets, the local supply chain, the distance from the border, and the development of market institutions, among other factors. The studies on Viet Nam and Argentina, for example, suggest that poor farmers (or poor consumers) might not always necessarily be the main beneficiaries of policies implemented to reduce poverty. The middlemen or intermediaries are at times better positioned to benefit from price changes. In order to better understand the impact on poverty, future studies need to further explore the institutional details that affect the transmission of prices through the supply chain.

Second, while all the studies could in principle examine the role of all three channels (consumption, production and wage earnings), data constraints at times confine the analysis to the first-order welfare effects of price changes operating through consumption. As a result, one needs to be cautious when analysing policy implications based on a subset of potential channels through which changes in prices affect welfare in the short run.

In practice, households might respond to a price change by adjusting their consumption and production of a commodity (Porto, 2010; Brambilla *et al.*, 2012). Price changes and trade policy might also affect the incentive of firms to improve and invest in the productivity of production processes. These channels through which international trade might also affect poverty are not captured in the current studies. Such longer-term assessment therefore remains a fruitful topic for future research.

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Philippines

Distributional impact of the 2008 rice crisis in the Philippines

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Abstract

The rice crisis of 2008 posed tremendous challenges to Philippine policy-makers. They had to grapple with ensuring an adequate supply of rice by importing rice in times of rising international prices. At the same time, they had to maintain domestic rice prices relatively stable. This study examines the distributional impact of the 2008 rice crisis in the Philippines at the household level. Using non-parametric regressions, it maps the relative vulnerability of various household groups across per capita expenditure according to the gender of the household head, income decile, geographical region, agricultural household indicator, and whether the household is urban or rural. Using the actual change in domestic rice prices at the farm gate and retail levels, the study then examines the changes in household welfare for various household groups. The analysis shows that the most severely affected household groups include poor, urban, female-headed, and non-agricultural households. This finding could be instrumental in helping the government target beneficiaries with poverty-alleviating response programmes under similar circumstances in the future.

* The authors would like to thank Segfredo Serrano from the Department of Agriculture of the Philippines, as well as Maria Araceli Albarece and Jerome D. Bunyi from the Permanent Mission of the Philippines to the World Trade Organization for their comments on the study.

1 Introduction

The year 2007 marked the beginning of the crises of the 3 F's: food, fuel, and finance. These disturbances were largely unanticipated and had serious effects across many nations. South-East Asia, which had endured a debilitating financial crisis in 1998, emerged largely unscathed from the 2007 crisis, but it did suffer from the effects of the food crisis, particularly in the rice sector.

As in other Asian countries, rice is the most politically sensitive issue in the Philippines in terms of food prices. The dramatic spike in international prices of rice that started in 2007 and peaked in 2008, and its consequent effect on domestic prices, became a major concern for Philippine policymakers for a number of reasons.

First, rice is the staple food for the majority of Filipinos. It accounts for more than a third of the average calorie intake of the population. In addition, rice is a major food expense, accounting for 13.1 per cent of total household spending and a third of total food consumption.

Second, the rice production industry is a significant economic sector in the country. As of 2007, around 11.5 million farmers and family members – representing approximately 22 per cent of the rural population – depended on growing rice for their livelihood. In 2010, the rice sector accounted for 15.5 per cent of the country's value added in agriculture and 3.5 per cent of the gross domestic product (GDP) (NSCB, 2013).

Third, changes in rice prices affect general inflation, as rice accounts for 9.4 per cent of the consumer price index.

The rice crisis presented tremendous challenges to Philippine policymakers. Since rice plays a central part in the political economy, stabilizing rice prices ranks as one of the government's highest policy objectives. Perennial shortfalls in domestic rice production are addressed by having recourse to imports year after year. Although many programmes aimed at improving agricultural productivity, the Philippines by and large continues to be a rice importer. For this reason, access to the world rice market is an important consideration for the government. Thus, when the world rice markets started to tighten in the lead-up to 2008, policymakers felt the need to step up imports in order to secure the rice supply. Some observers (Dawe and Slayton, 2010) claim that the timing and volume of the purchases, particularly when carried out against the backdrop of increased imports by other countries, further tightened the world rice supply and exacerbated the price hike in the international market.

In light of these developments, the trade-off faced by Philippine policymakers was not easy. First, there were cost considerations associated with importing rice. As the world rice supply was tightening, international prices were likewise increasing, and this would, through the pass-through mechanism, stimulate local price increases. On the other hand, a decision not to import would increase the probability of a rice shortage in the domestic market. If and when a rice shortage were to occur, rice prices would definitely spike and political turmoil would likely result, a highly undesirable scenario.

Policymakers opted to import in 2008. By their action, they revealed their preference for avoiding a rice shortage in the domestic market. However, this had a cost – price hikes. While it may not be entirely clear to what extent Philippine imports may have contributed to the rise in world prices, the world rice market indeed felt pressure, considering that the Philippines was the world's biggest importer at that time.[1] World rice prices rose from a monthly average of USD 360 per metric ton in January 2008 to USD 770 per metric ton in May 2008. Between March and September 2008, local retail prices jumped by close to 40 per cent.

The uptick in domestic rice prices had profound consequences in terms of poverty, as the poor invariably bear the brunt of food crises. Since as much as 40 per cent of incomes of the poor are spent on staples, a large price increase leaves a deep dent in their purchasing power (Dawe and Slayton, 2010). For households in the lowest income levels in the Philippines, for instance, rice accounts for 60 to 65 per cent of calorie intake. Because crises are by nature unexpected, there is little scope for the poor to substitute other staples for rice. Therefore, there are concerns that food crises may plunge more people into poverty, in addition to exacerbating the hunger and malnutrition of those who are already poor (Heady and Fan, 2008).

2 Research objectives

This study examines the effects of the rice crisis on public welfare. Such effects animate much of the political economy of stabilizing prices. In particular, the study investigates the distributional impact of the 2008 rice crisis in the Philippines on real incomes at the household level. There is

[1] According to the International Rice Research Institute (IRRI, 2013), the Philippines and Nigeria were the world's largest importers of rice in 2008. Each country accounted for 26.2 per cent of total world rice imports. For the IRRI World Rice Statistics, see *http://ricestat.irri.org:8080/wrs2/entrypoint.htm.*

much ambiguity about this issue because increases in rice prices have different welfare effects on households depending on whether the increases affect net producers or net consumers of rice. This study uses the net benefit ratio introduced by Deaton (1989) to analyse the relative vulnerability of different household groups to increases in rice prices. The specification of the household groups includes gender, urbanity, and agricultural traits.

The distributional effect has been a topic of interest among observers. For instance, Reyes *et al.* (2009), using non-parametric estimations of data from the 2006 Family Income and Expenditure Survey (FIES) in the Philippines, found that the impact of rice price increases varied across different household groups (income levels, sector of employment, level of urbanity, and geographical location). In a related work, Balisacan *et al.* (2010) asserted that, because the bottom two deciles of the Philippine population were net rice consumers, they were hurt more by the rice crisis than were those who were relatively better off.

This study closely follows Reyes *et al.* (2009), but differs in the specification of the rice crisis period – from March to September 2008 when domestic prices of rice rose by an average of more than 30 per cent per month – as well as in the choice of household groups.[2]

The study also looks into the gender dimension of poverty during the rice crisis. Many studies have delved into the disadvantages faced by women in many aspects of well-being, including education, health, and survival (World Bank, 2001; Klasen and Wink, 2003). From their findings arose the concept of the "feminization of income poverty", which means that poverty is more frequent in female-headed households than in male-headed households (Chant, 2008). Along this line, the current study examines the extent to which female-headed households were vulnerable to the rice crisis compared to male-headed households.

During the crisis period, domestic price increases of rice differed markedly at the retail and farm gate levels. This had consequences for the magnitude of welfare changes accruing to either net consumers or net producers

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[2] The study by Reyes *et al.* (2009) covers the period 2006–2008. Consequently, their magnitude of rice price increases at the retail and farm gate levels differs from the present study. They employed the 2006 FIES, while this study uses the 2009 FIES. This study uses the specification of the household groups from Reyes *et al.* (2009) but includes the gender of the household head as an additional household group characteristic. Moreover, the specification of the net benefit ratio in this study differs from that of Reyes *et al.*, who had access to figures on actual quantities of rice consumed and produced by households.

of rice at the household level. This study conducts a simulation to quantify the change in welfare measured by compensating variation, and taking into account the differential between retail and farm gate prices. The welfare analysis is disaggregated by gender of the household head, level of urbanity (urban and rural), agricultural household indicator (agricultural and non-agricultural activity), income decile, and geographic region.

How can the knowledge of households that were most or least affected by crisis-induced price hikes be useful for policy purposes? A study of the distributional effects of the 2008 rice crisis could help policymakers identify the type of households and the geographic locations most affected by the crisis. This could lead to better targeting policies towards those segments of the population that are most in need of assistance, and could improve the effectiveness of such assistance. It could also help determine the welfare or social costs of the government's decision to massively import rice during 2007 and 2008, a decision which sparked increases in rice prices.

For example, in order to mitigate the negative effects of the increase in rice prices, the government turned to the distribution of rice at subsidized prices through the National Food Authority (NFA). Apparently, the extent of NFA operations was quite limited due to constraints in the volume and distribution of subsidized rice. Knowing which segments of the population are the most vulnerable could help ensure that subsidized rice supplies be allocated more effectively in the future. In addition, examining the impact of the rice crisis at the household level could help create a profile of the households that suffered the most, and thus help direct remedial programmes and other poverty-alleviating measures towards these households in the future.

The following section offers a brief description of the 2007–2008 international rice crisis. The study then goes on to outline the methodology and summary statistics, report the empirical results and their interpretation, and provide conclusions and examine policy implications.

3 International rice crisis

The price spike during the 2007–2008 food crisis was the largest price shock since the world food crisis in 1973–1975 (Timmer and Dawe, 2010). Although the food crisis affected a number of commodities, including wheat and maize, the sharpest increase in prices occurred in the rice market. Dawe and Slayton (2010) reported that in a span of six months from

October 2007 to April 2008, the world price of rice tripled, from USD 335 to over USD 1,000 per metric ton, a world record high in nominal terms.[3]

It is important to frame the world rice crisis against the backdrop of market conditions in 2007–2008. During this period, the total production of milled rice in the world amounted to 432.6 million metric tons. However, as Briones (2012b) indicated, world trade in rice is quite meagre, as only 7 per cent of total production (about 30 million metric tons) is traded in international markets. In comparison, 11 per cent of total wheat and 18 per cent of total corn production is traded internationally. Given the thinness of world volumes, surges in import volumes or sudden contractions of export supply can potentially cause swings in rice prices.

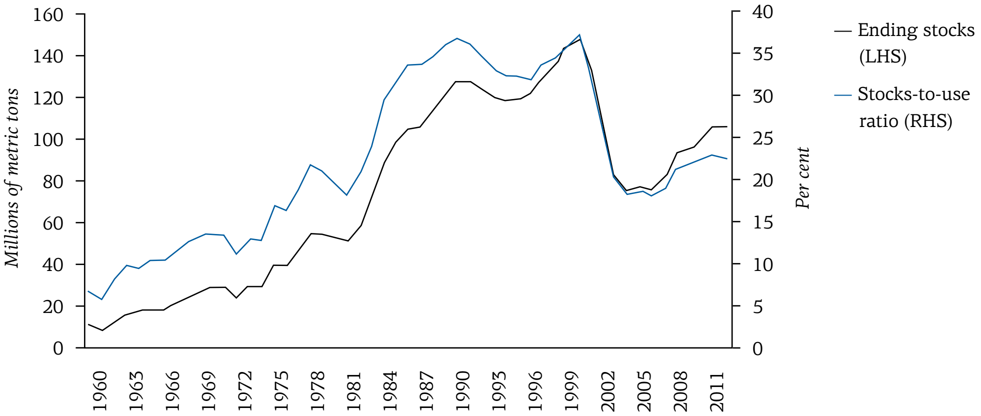
Volatility in prices can be avoided if there are enough rice stocks to cushion the impact of a supply or demand shock. But was the size of rice stocks in 2007–2008 sufficient to act as an effective buffer? Figure 1 shows the level of rice stocks in the world market from 1960 to 2008 in terms of ending stocks and the stocks-to-use ratio.[4] As can be seen, both measures were at record lows during 2007–2008. This suggests that the world rice market is quite vulnerable to price shocks in the face of sharp changes in trade volumes.

Although a number of possible causes have been put forward to explain the 2007–2008 rice crisis, it is generally held that the cause was fundamentally different from that of the food crisis of 1972–1973, which was largely rooted in a weather phenomenon ("El Niño") that severely affected food production (Timmer and Dawe, 2010).

[3] This refers to the price of the rice variety Thai 100% B.

[4] Ending stocks give the total amount of rice the world has in stock at the end of the marketing year, i.e. the amount of rice in the world less the total amount of rice consumed. The stocks-to-use ratio gives the ending stocks as a percentage of the total stocks of rice consumed by all countries. The two measures reflect the effects of both supply and demand factors during the year and are useful indicators of price movements. In general, a lower ending stock (or stocks-to-use ratio) results in higher prices, and vice versa.

Figure 1 World rice market – Ending stocks and stocks-to-use ratio, 1960–2012



Source: Authors' estimations, based on USDA (2013).
Note: LHS stands for left-hand scale, RHS for right-hand scale.

No supply shock of such proportions took place in 2007–2008. Rather than a natural disaster, the world market was hit by artificial scarcity (Timmer, 2010) caused by a confluence of low global rice stocks, hoarding of rice supplies by consumers, farmers, and traders, and *ad hoc* responses of governments to fears of impending rice shortages. When traditional rice-exporting countries like India and Vietnam instituted export bans, a spirit of uncertainty pervaded the international rice markets. Importers, on the other hand, jostled to stabilize their own markets as international rice supplies rapidly thinned. Sarris (2010) stated that when market agents realize that buffers in global markets are too low to assure adequate supply flows, they start to behave atomistically to ensure the supply flow in their own domestic markets. This “herd” behaviour creates panic buying and hoarding, even when the underlying conditions do not justify it, and thus leads to price spikes. Such surge in prices was graphically manifested in the global rice crisis of 2007–2008.

Dawe and Slayton (2010) commented that the 2007–2008 rice crisis was not a failure of the free market to deliver optimal outcomes, but rather that government decisions were instrumental in fanning the crisis. Because the international rice market is thin, and governments play a large role in international trade, the market is particularly vulnerable to such panics and uncertainty.

4 Methodology and summary statistics

The methodology of this study closely follows the study by Deaton (1989) on the distributional consequences of rice price changes in Thailand following adjustments to an export tax. During the 2008 rice crisis, rice prices in the Philippines rose significantly. Given the standard framework, the welfare implications of the price change depend on whether the household is a net producer or a net consumer of rice.

The empirical methods used in this study allow for assessing distributional effects by identifying which households are affected by a shock in the price of rice. This assessment involves three steps. First, we provide a descriptive analysis of household characteristics through expenditure distributions of households across different groups: the total sample, female- and male-headed households, urban and rural households, and agricultural and non-agricultural households. This allows for assessing the well-being of various groups of households.

Second, we use non-parametric regressions to evaluate the relationship between per capita expenditure of households and the level of rice consumption and production. The objective is to evaluate how a change in the price of rice affects households, based on whether the households are net producers or net consumers of rice.

Third, we simulate the effects of the rice crisis on household welfare. While it is important to analyse the different channels through which households are affected, this study focuses on the price effects of the rice crisis. In particular, for each household, we estimate the compensating variation, which is the additional amount of money the household needs to remain at the same welfare level as before the crisis. The estimation incorporates the average price of rice before and after the 2008 crisis, and the difference in the rate of increase of the price of rice at the farm gate and retail levels. In addition, a non-parametric regression is used to examine the welfare effects of price changes triggered by the rice crisis on households with different levels of per capita expenditure.

Following the standard methodology for the analysis of the distributional impact of price changes, this study uses household data from the FIES,[5] which is a nationwide survey of households undertaken every three years by the National Statistics Office. The aim of the survey is to gather data on family income and expenditure that are representative of the country and its administrative regions. Information gathered in this survey is used by the national authorities to construct the consumer price index and to assess human development, poverty, and standards of living, among others.

This study uses the 2009 FIES, since it is closer to the crisis year than the 2006 FIES. The 2009 FIES included the country's 17 administrative regions as its sampling domain and made use of an area sample design. The regions were stratified into non-overlapping subgroups called "strata",[6] with primary sampling units defined as a barangay[7] or a combination of barangays consisting of at least 500 households.

Table 1 shows the distribution of the households surveyed in 2009, disaggregated by gender of the household head, urbanity, agricultural household indicator, and administrative region. A total of 38,400 households were surveyed in the 2009 FIES. Note that a larger percentage of the sample is male-headed, rural, and non-agricultural.

Table 1 Structure of the sample

Household group	Number of observations	Share in the sample (per cent)
All households	38,400	100.00
Gender of household head		
Male	30,585	79.65
Female	7,815	20.35
Urbanity		
Urban	17,335	45.14
Rural	21,065	54.86
Agricultural household indicator		
Agricultural	9,944	25.90
Non-agricultural	28,456	74.10

[5] More details on the FIES are available at: *http://www.census.gov.ph/article/technical-notes-family-income-and-expenditure-survey-fies.*

[6] The fact that 452 strata only contain a single sampling unit may lead to missing standard errors in the estimations.

[7] A barangay is the smallest administrative unit in the Philippines. It corresponds roughly to a village or a district.

Household group	Number of observations	Share in the sample (per cent)
Region		
National Capital Region	4,285	11.16
Cordillera Administrative Region	1,581	4.12
I Ilocos Region	2,277	5.93
II Cagayan Valley	1,901	4.95
III Central Luzon	3,028	7.89
IV-A CALABARZON	3,661	9.53
IV-B MIMAROPA	1,667	4.34
V Bicol Region	2,212	5.76
VI Western Visayas	2,592	6.75
VII Central Visayas	2,526	6.58
VIII Eastern Visayas	2,012	5.24
IX Zamboanga Peninsula	1,655	4.31
X Northern Mindanao	1,768	4.60
XI Davao Region	2,151	5.60
XII SOCCSKSARGEN	1,928	5.02
XIII Caraga	1,568	4.08
Autonomous Region of Muslim Mindanao	1,588	4.14

Source: Authors' calculations, based on the 2009 FIES.
Note: Estimated number of households in the Philippines = 18,452,000; number of strata = 939; number of primary sampling units = 2,822. CALABARZON stands for Calamba, Laguna, Batangas, Rizal, and Quezon. MIMAROPA stands for Mindoro Occidental, Mindoro Oriental, Marinduque, Romblon, and Palawan. SOCCSKSARGEN stands for South Cotabato, Cotabato, Sultan Kudarat, Sarangani, and General Santos City.

Table 2 presents summary statistics for the main variables of interest using the entire sample.[8] The second column shows per capita expenditure of households, which is the variable used in this study as a measure for household well-being. To estimate per capita expenditure for each household, total expenditure is divided by the total number of members in the household. As shown in the table, a typical Filipino household has an annual per capita expenditure of Philippine pesos (PHP) 44,038.96, or USD 924.47.[9]

The last three columns of Table 2 show the rice consumption and income patterns of households. The share of rice expenditure (i.e. the budget share of rice) is calculated as the ratio of rice expenditure to the total expenditure of the household. While we can directly compute the budget share of

[8] See Annex 1 for the summary of key statistics across household groups.

[9] According to the Central Bank of the Philippines in 2013, the average exchange rate in 2009 was PHP 47.637 to USD 1.

rice from the 2009 FIES dataset, we cannot do the same for the rice income share because of the absence of data on income from rice production at the household level. As a proxy for income from rice, we use the household income from crop production net of the expenses from crop farming. To adjust for regional differences in the prevalence of rice production, we adjust the data by imputing a factor that is the share of rice in the total value of crop production per region. To illustrate, we define rice income using the following equation:

$$\textit{rice income} = k * \textit{net income from crop production} \tag{1}$$

where k is the ratio of rice production and total crop production in the region.[10] On average, a household spends 13.1 per cent of its budget on rice and earns 3.59 per cent of its total income from rice farming. One limitation of this method of constructing rice income is that it assumes the existence of a representative farmer.

Finally, the net income share of rice is calculated per household by taking the difference between its share of rice income and its share of rice expenditure. The average net income share of rice is –9.52 per cent, which means that a typical Filipino household is a net consumer of rice.

Table 2 Summary of key statistics

	Per capita expenditure (PHP)	Budget share of rice (per cent)	Income share of rice (per cent)	Net income share of rice (per cent)
25th percentile	17,895.60	5.98	0.00	–15.13
Mean	44,038.96	13.10	3.59	–9.52
75th percentile	50,701.67	18.21	1.83	–4.18
Standard deviation	53,086.21	9.29	8.24	10.77

Source: Authors' calculations, based on the 2009 FIES.
Note: Estimated number of households in the Philippines = 18,452,000; number of strata = 939; number of primary sampling units = 2,822.

[10] Data on the level of rice production per region were obtained from the Bureau of Agricultural Statistics (2013).

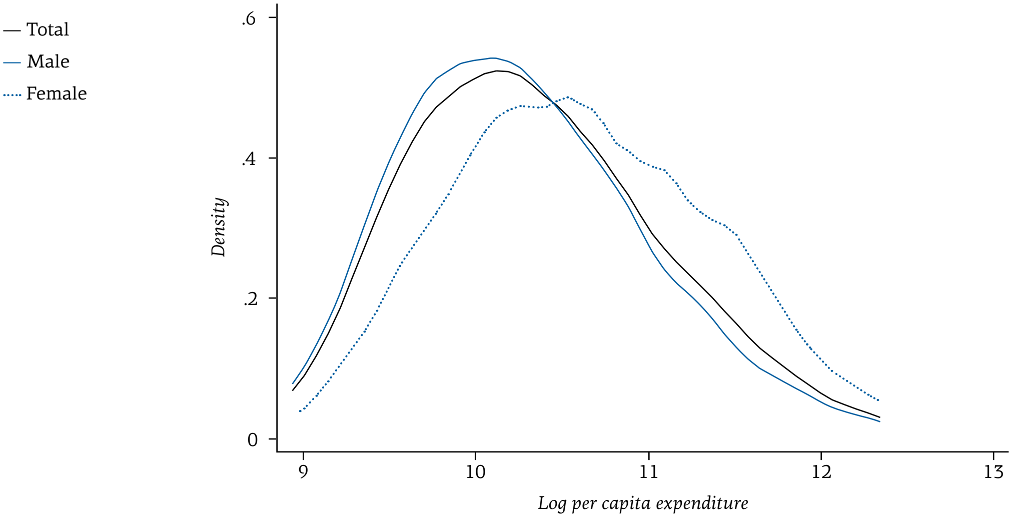
5 Empirical results

5.1 Kernel density estimations of expenditure

This section presents kernel density estimations of the log of per capita expenditure by household type in order to assess the living standards of households in terms of expenditure.[11] The analysis uses the log of per capita expenditure as a variable for household welfare.

Figure 2 shows that the log of per capita expenditure seems normally distributed at the national level and across the gender of the household head. The density of female-headed households is shifted to the right relative to the density of male-headed households. This suggests that female-headed households are, on average, richer than male-headed households.

Figure 2 Expenditure distribution by gender of household head



Source: Authors' estimations, based on the 2009 FIES.

[11] Annex 2 presents the expenditure distributions across regions.

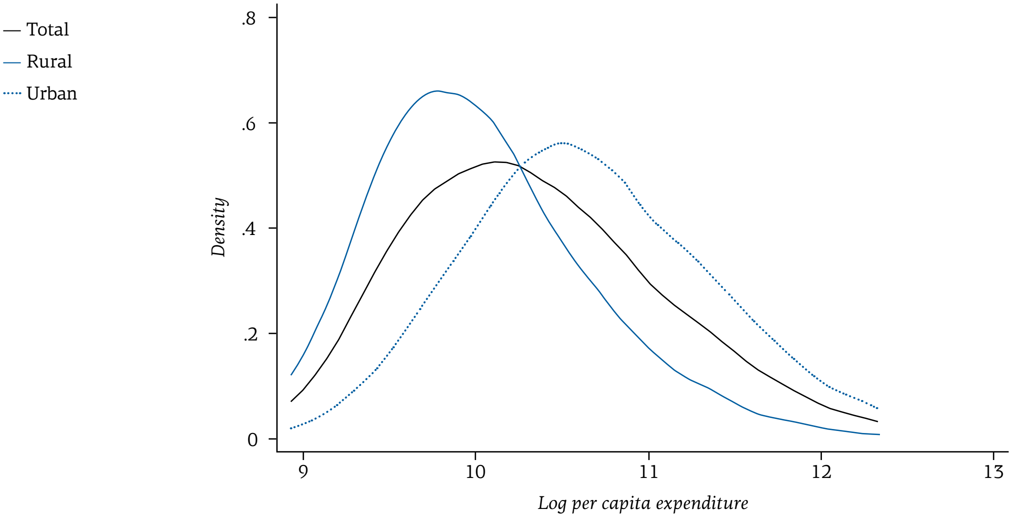
It is important to see this result in the context of the relationship between gender and poverty. The literature review by Lampietti and Salker (2000) reveals that there is a significant variation in the nature and extent of gender inequality across countries, thus making it impossible to generalize the welfare disparities between women and men. Marcoux (1998), Chant (1997), and Rosenhouse (1994) stress that evidence on the poverty status of female-headed households in comparison to male-headed households is ambiguous. Moreover, they argue that the evidence surrounding the incidence of poverty in female-headed households is country-specific and case-specific. In Viet Nam and Thailand, for example, Klasen *et al.* (2011) find that female-headed families are better off than male-headed families in terms of current consumption, while UNCTAD (2011) reports that this is not the case in Cape Verde.

The poverty status of female households in the Philippines clearly differs from that of Cape Verde, as shown by several studies. Schelzig (2005) finds that both the incidence and the severity of poverty among female-headed families in the Philippines are lower. Balatibat and Nierras (2005) find that female-headed families are not poorer than male-headed households. According to UNESCAP (2010), poverty among female-headed households was consistently 14 to 15 percentage points lower than that of the male-headed households during the period from 1985 to 1994. Bernardino (2011) corroborates these findings by asserting that 42 per cent of female-headed households in the Philippines belong to the richest 30 per cent of the income distribution, while only one-fifth belong to the poorest 20 per cent.

Chant (2006) conducted one-on-one interviews and focus groups with 223 respondents from low-income groups in three countries – the Gambia, Costa Rica, and the Philippines – between 2003 and 2005. The finding was that poverty is more likely to afflict male-headed households than female-headed households in the case of the Gambia and the Philippines. Intal (1994) attributes this to higher educational attainment, smaller family size, and female-biased employment demand in the formal sector, particularly in the export sector. The findings with regard to the differences in distribution of per capita expenditure for male- and female-headed households in 2009 in the current study are therefore consistent with the literature.

Figure 3 presents the expenditure distribution of households by level of urbanity. It shows that the distribution of urban households relative to that of rural households is shifted to the right. This means that, on average, urban households are richer than rural households. It is not difficult to imagine why this is so, since there are more opportunities to earn a living in urban areas. Also, the distribution for rural households is right skewed, indicating that a large portion of rural households are poor.

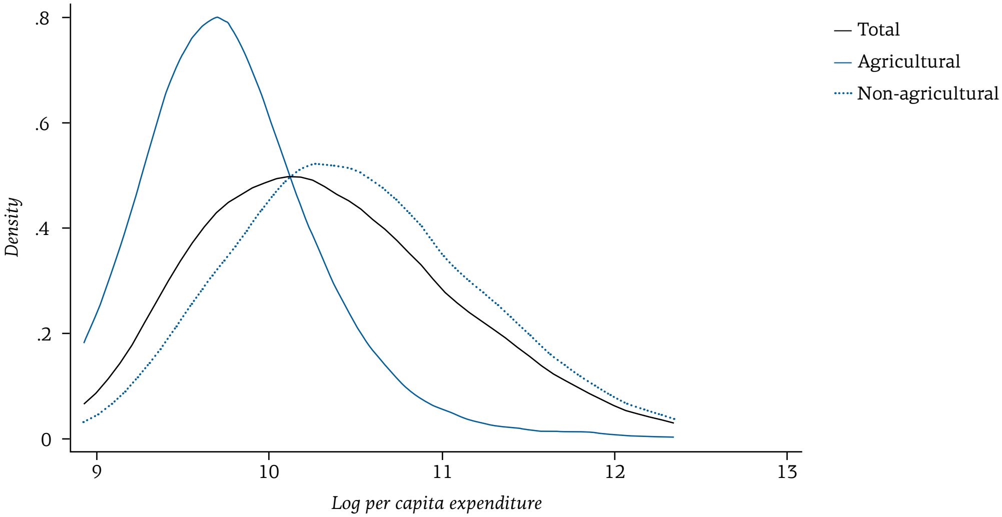
Figure 3 Expenditure distribution by level of urbanity



Source: Authors' estimations, based on the 2009 FIES.

Finally, Figure 4 presents the expenditure distribution of agricultural and non-agricultural households. On average, non-agricultural households are relatively richer than agricultural households, as evidenced by the plot lines in the figure. Moreover, the right skewedness of the distribution of agricultural households suggests that the majority of agricultural households have low levels of expenditure.

Figure 4 Expenditure distribution by agricultural household indicator



Source: Authors' estimations, based on the 2009 FIES.

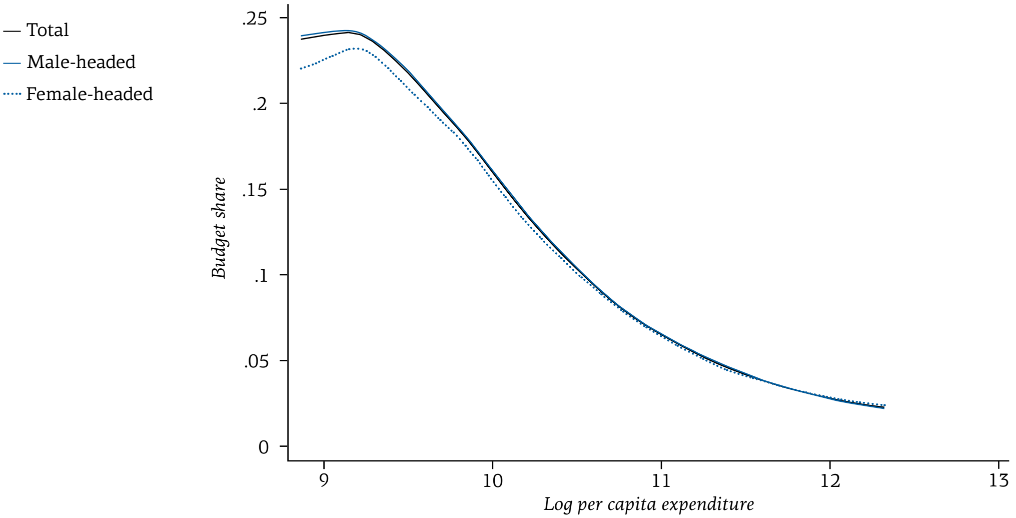
5.2 Non-parametric regressions

This section presents non-parametric regressions on the log of per capita expenditure of the following: (a) the share of rice in total expenditure, (b) the share of rice in total income, and (c) the net share of rice in total income. These regressions will help explain the distributional effects of shocks in the price of rice while taking into account the disparities in living standards based on the gender of the household head, the level of urbanity, and the agricultural/non-agricultural household indicator.

Figure 5 presents the result for the share of rice in total expenditure. The share of rice in total expenditure at the left tail of the distribution is almost 25 per cent and decreases significantly as one moves from poorer to relatively better-off households. This behaviour is expected and consistent with Engel's Law, as it implies that the budget shares of relatively more expensive food items and other non-food items increase with the level of expenditure. Also, the budget share of rice is slightly lower for female-headed households, but the difference vanishes for richer households.

Reyes *et al.* (2009) show that the share of rice in total expenditure decreases as income increases. Their findings show that there are more net rice consumers (84.7 per cent of households) than there are net producers (12.8 per cent) in the Philippines, thus indicating that there are more households that will be negatively affected by the increase in rice prices.[12] They obtain the same results when the data are disaggregated by urbanity, income decile, and region.[13]

Figure 5 Budget share of rice and per capita expenditure by gender of household head



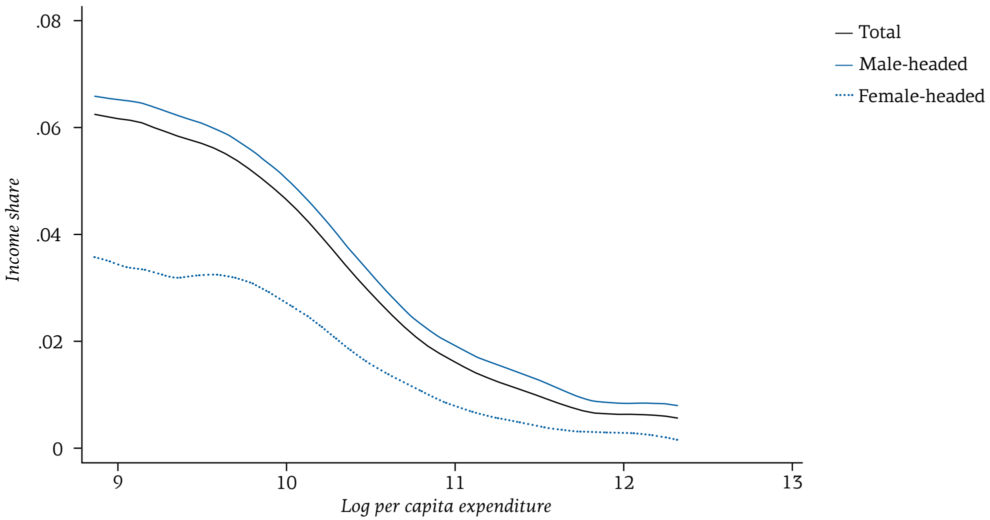
Source: Authors' estimations, based on the 2009 FIES.

In terms of rice production of households, the share of rice in total income declines with the level of well-being, as evidenced in Figure 6. However, on average, rice income is much lower in female-headed households than in male-headed households. This suggests that female-headed households may have other sources of income aside from rice production. Note that the gender-related difference is most pronounced for poor households and becomes smaller as expenditure increases.

[12] In contrast to our constructed indicator for the income share of rice, Reyes *et al.* (2009) used the actual rice income from the 2006 FIES. However, this variable is not readily available to the public in the 2009 FIES..

[13] Annex 3 presents the non-parametric regressions on the log of per capita expenditure of the share of rice in total expenditure and the share of rice in total income by level of urbanity and agricultural household indicator.

Figure 6 Income share of rice and per capita expenditure by gender of household head

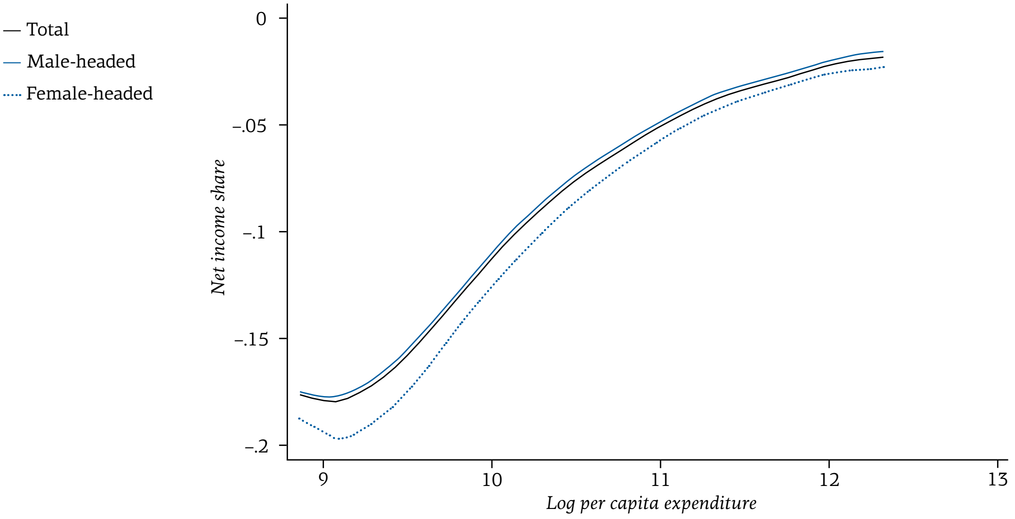


Source: Authors' estimations, based on the 2009 FIES.

In order to see the short-term impact of a rice price shock on households with different expenditure levels, we estimate a non-parametric regression of the net income share of rice, which is the equivalent of the net benefit ratio (NBR) of Deaton (1989). Furthermore, to see the difference in consumption and production patterns across household types, we present the regressions separately by gender of the household head, level of urbanity, and agricultural household indicator.

The result by gender of the household head is presented in Figure 7. On average, the net income share of rice stands at –9.52 per cent, indicating that Filipino households are mostly net rice consumers. On average, the net share of rice in total income for both male- and female-headed households is negative across all levels of per capita expenditure. For households at the lower tail of the income distribution, net rice income is approximately –20 per cent and becomes less negative as one moves from poorer to richer households. This suggests that an increase in the price of rice is highly regressive; that is, an increase in the price of rice would hurt the poor more. Moreover, we can see that at each level of per capita expenditure, female-headed households have a slightly lower (i.e. more negative) net income share of rice compared to male-headed households.

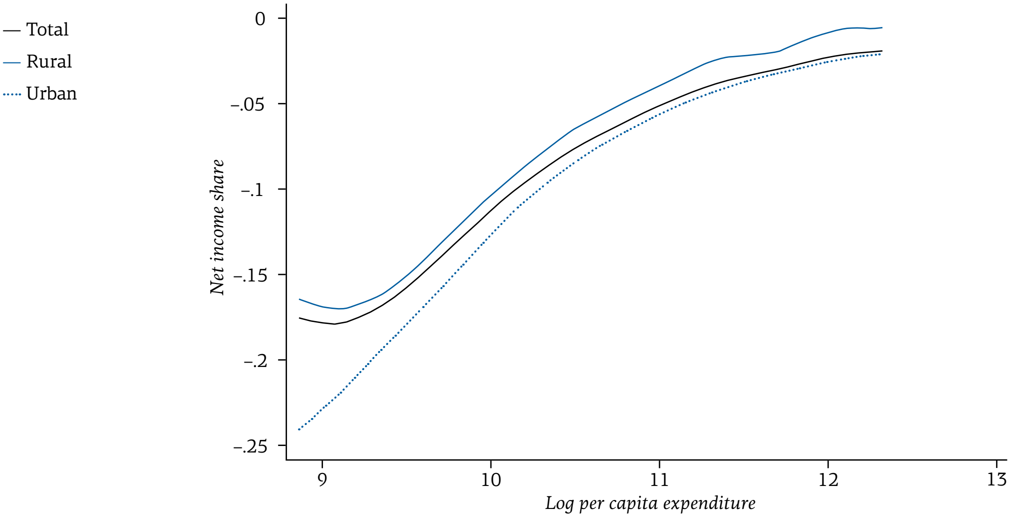
Figure 7 Net income share of rice and per capita expenditure by gender of household head



Source: Authors' estimations, based on the 2009 FIES.

Figure 8 shows that the regressive pattern holds at the urban and rural levels. Also, the net share of rice in total income is lower for poorer urban households, which means that an increase in the price of rice would have a more negative impact on them.

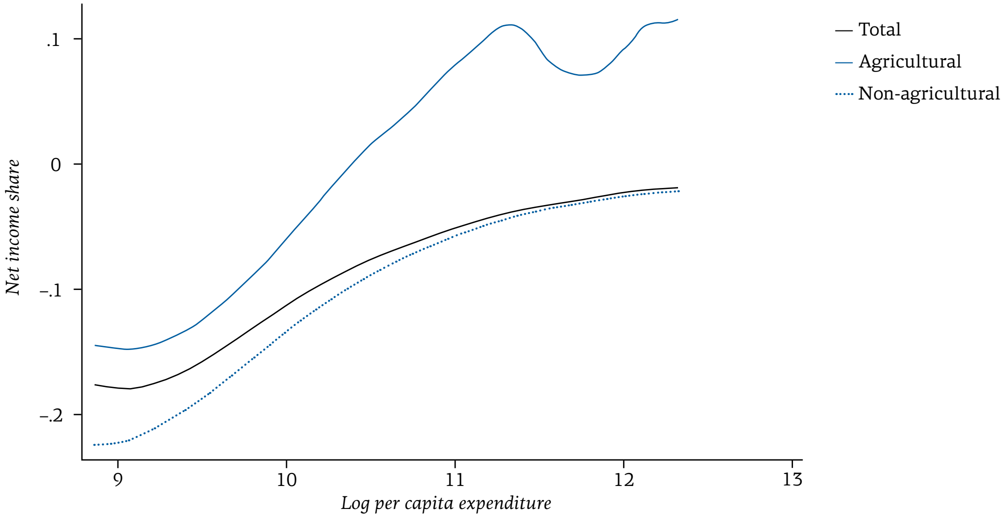
Figure 8 Net income share of rice and per capita expenditure by level of urbanity



Source: Authors' estimations, based on the 2009 FIES.

The regression for non-agricultural households in Figure 9 is similar to that for urban households, but slightly more negative. Interestingly, while the net income shares of agricultural households at lower levels of per capita expenditure are negative, those at higher levels of per capita expenditure are positive. This means that poorer agricultural households are more likely to be net consumers of rice and thus would be worse off if the price of rice were to increase. Conversely, richer agricultural households tend to be net producers of rice and thus would be better off if the price of rice were to increase.

Figure 9 Net income share of rice and per capita expenditure by agricultural household indicator



Source: Authors' estimations, based on the 2009 FIES.

These findings for the agricultural and non-agricultural cases are consistent with Fujii (2013), who finds that agricultural households are less vulnerable than non-agricultural households. In general, poorer households are more vulnerable than wealthier ones to food inflation.

6 Simulations

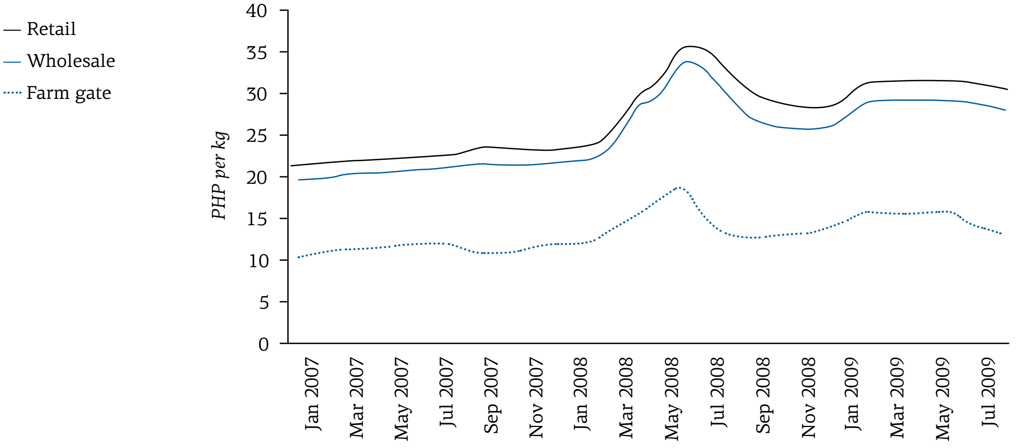
The non-parametric regression results presented above are useful for describing the profile of households that are likely to be vulnerable to shocks in rice prices. However, they do not allow for seeing the extent of the impact of the 2008 rice crisis on household welfare. That is, the previous regressions do not account for the actual price increase and the imperfect transmission of the price increase during that rice crisis episode.

6.1 Imperfect transmission of prices during the 2008 rice crisis

Figure 10 presents the trend in domestic rice prices in PHP from 2007 to 2009.[14] The trends are broadly similar at the wholesale, retail, and farm gate levels, but farm gate prices are significantly lower than the other two, which are similar to each other.

Following Balisacan *et al.* (2010), we divide the period considered into three phases: pre-crisis (January 2007 to February 2008), crisis (March 2008 to September 2008), and post-crisis (October 2008 to August 2009). In the pre-crisis phase, the prices averaged PHP 22.54 per kilogram (kg) at the retail level, PHP 20.82 per kg at the wholesale level, and PHP 11.32 per kg at the farm gate level. During the crisis, average retail prices of rice rose by 39.77 per cent (to PHP 31.50 per kg), wholesale prices increased by 40.47 per cent (to PHP 29.25 per kg), and farm gate prices by 34.12 per cent (to PHP 15.18 per kg). At the peak in June 2008, retail prices were higher by 51.78 per cent, wholesale prices by 54.97 per cent and farm gate prices by 59.05 per cent than the prices in February 2008.[15] Prices started to decline in July and stabilized in October 2008. Note that the prices in the post-crisis phase were higher relative to those in the pre-crisis phase.

Figure 10 Monthly trends in retail, wholesale and farm gate rice prices, January 2007 – August 2009 (PHP per kg)



Source: Authors' estimations, based on data from the Bureau of Agricultural Statistics (2013).
Note: Wholesale and retail prices – regular milled rice; farm gate price – palay (paddy) other variety, dry (converted to 14 per cent moisture content).

In analysing the distributional impact of the actual price shock of 2008, we incorporate the imperfect transmission of price from the pre-crisis phase (January 2007 to February 2008) to the crisis phase (March 2008 to September 2008).

Let the rate of increase of rice prices at the retail level be x and the rate of increase at the farm gate level be y. Suppose that in a certain geographical region, the former exceeds the latter, that is, $x > y$. Because the difference in the price increase rates is already known *ex post*, one can establish that the magnitude of y is a fraction of x, say, $y = ax$ where a is a constant. In the next subsection, we will include this constant a as a scale effect when we compute the net difference between the share of rice in the food budget and in total household income.

Table 3 shows the average rate of change in national and regional farm gate and retail prices during the pre-crisis and crisis phases. In the far right column, which gives the ratio of the average rates of change in farm gate and retail prices, one sees that the ratio is below 1 at the national level. This means that the retail price transmission to farm gate prices was imperfect. In particular, retail prices increased more rapidly than farm gate prices during the rice crisis. Across regions, the transmission varied. For instance, similar to that of the national level, the Caraga, Central Visayas, and Northern Mindanao regions had ratios below 1. However, for the Autonomous Region of Muslim Mindanao, the Cordillera Administrative Region, and Eastern Visayas, the ratio was above 1, which means that in those regions, the increase in farm gate prices was greater than the increase in retail prices.

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[14] Data on rice prices were collected from the Bureau of Agricultural Statistics, which distinguishes three types of rice prices: farm gate, wholesale, and retail. Such data series are available from 1990 to 2012. For the trends at the wholesale and retail levels, we use monthly wholesale and retail prices of regular milled rice, while for the trends at the farm gate level we use the farm gate prices of palay (paddy, other variety, dry).

[15] The rice prices at the retail, wholesale, and farm gate levels are nominal. To lend perspective, in June 2008, retail prices were higher by 51.78 per cent compared to February 2008 prices. For the same period, the increase in the consumer price index was 5.15 per cent.

Table 3 Average rate of change of national and regional farm gate and retail prices during the 2008 rice crisis

Region	Change in farm gate price (per cent), *y*	Change in retail price (per cent), *x*	*a* = *y*/*x*
All regions	34.12	39.77	0.8580
National Capital Region	..	44.95	1[§]
Cordillera Administrative Region	47.16	43.58	1.0821
I Ilocos Region	37.77	45.72	0.8261
II Cagayan Valley	37.64	42.81	0.8793
III Central Luzon	36.39	42.71	0.8520
IV–A CALABARZON	36.91	42.70	0.8642
IV–B MIMAROPA	32.62	37.67	0.8660
V Bicol Region	33.43	39.66	0.8431
VI Western Visayas	27.69	33.48	0.8271
VII Central Visayas	28.14	41.68	0.6751
VIII Eastern Visayas	40.17	39.17	1.0257
IX Zamboanga Peninsula	31.16	40.57	0.7681
X Northern Mindanao	30.78	41.32	0.7448
XI Davao Region	33.62	39.84	0.8438
XII SOCCSKSARGEN	25.49	33.71	0.7562
XIII Caraga	24.86	39.93	0.6227
Autonomous Region of Muslim Mindanao	37.89	33.98	1.1152

Source: Authors' calculations, based on the average farm gate prices of palay (paddy, other variety, dry) and average retail prices of rice (regular milled rice) from the Bureau of Agricultural Statistics (2013).
Note: Prices changes refer to the growth rate of prices between the pre-crisis phase (January 2007 to February 2008) and the crisis phase (March 2008 to September 2008).
Two dots (..) indicate that data are not available.
[§] Data on farm gate prices for the National Capital Region are not available as the volume of rice production in this region is negligible. We therefore assume that at any point in time there is no disparity between the retail and farm gate prices in the National Capital Region.

6.2 Welfare effects of the 2008 rice crisis

To quantify the effect of the 2008 rice crisis, we use a benefits/costs variable, *BC*, defined by the equation:

$$BC = (\, as - s^{*}\,)\, d\ln(p) \qquad (2)$$

where s is the share of rice farming in total income, s^{*} is the share of rice in total expenditure, p is the retail price of rice, $d\ln(p)$ is the percentage change in the retail price of rice and a is the ratio of the average rates of change in farm gate and retail prices, as defined in the previous subsection. Because, for the majority of the regions, the growth rate of retail prices is higher compared to farm gate prices, the benefits/costs variable may be smaller than it would be if prices accruing to producers and consumers had similar growth rates. Interestingly, since the differential growth rates of farm gate and retail prices vary across regions, benefits/costs ratios vary across regions as well.

Hence, similar to the NBR used by Deaton (1989), the benefits/costs variable quantifies the variations in rice consumption and production patterns across households. In addition, the measure takes into account different levels of heterogeneity – that is, the difference in the rates of increase of prices across provinces, and the difference at the farm gate *vis-à-vis* the retail level. Similarly, Reyes *et al.* (2009) introduced an innovation in computing the NBR by using different magnitudes for the increase in retail prices and the increase in farm gate prices. They were able to calculate and compare the NBRs before and after the price increases because they had data on actual quantities of rice produced and consumed by the households. Unfortunately, this study could not use the same methodology because data in the 2009 FIES on quantities of rice produced and consumed are not available for public access.

Table 4 presents the estimations of the benefits/costs variable for various types of households. On average, households in the Philippines were negatively affected by the rice crisis, as indicated by a negative benefits/costs variable. Household groups with more negative average benefits/costs included male-headed, rural, non-agricultural, and lower-decile households. Finally, as reflected in the standard deviations in the far right column of Table 4, the spread of the distribution of the benefits/costs variable is greater for male-headed, rural, agricultural, and lower-decile households.[16]

[16] Annex 4 presents histograms of benefits/costs for various groups of households.

Table 4 Welfare effects of the 2008 rice crisis on various groups of households

Household group	25th percentile	Mean	75th percentile	Standard deviation
All households	–0.0614	–0.0400	–0.0183	0.0406
Gender of HH head				
Male	–0.0634	–0.0407	–0.0189	0.0422
Female	–0.0532	–0.0372	–0.0166	0.0338
Urbanity				
Urban	–0.0494	–0.0358	–0.0182	0.0294
Rural	–0.0734	–0.0441	–0.0185	0.0490
Agricultural HH indicator				
Agricultural	–0.0786	–0.0360	0.0035	0.0625
Non-agricultural	–0.0572	–0.0411	–0.0201	0.0313
National income decile				
1	–0.0883	–0.0545	–0.0189	0.0524
2	–0.0880	–0.0571	–0.0288	0.0485
3	–0.0831	–0.0549	–0.0318	0.0456
4	–0.0748	–0.0498	–0.0300	0.0433
5	–0.0677	–0.0465	–0.0298	0.0390
6	–0.0574	–0.0399	–0.0263	0.0353
7	–0.0482	–0.0329	–0.0229	0.0322
8	–0.0398	–0.0280	–0.0190	0.0265
9	–0.0321	–0.0221	–0.0150	0.0232
10	–0.0207	–0.0140	–0.0090	0.0186
Region				
National Capital Region	–0.0331	–0.0249	–0.0139	0.0149
Cordillera Administrative Region	–0.0484	–0.0241	–0.0101	0.0495
I Ilocos Region	–0.0727	–0.0455	–0.0219	0.0437
II Cagayan Valley	–0.0560	–0.0128	0.0269	0.0614
III Central Luzon	–0.0531	–0.0294	–0.0186	0.0475
IV–A CALABARZON	–0.0521	–0.0389	–0.0205	0.0261
IV–B MIMAROPA	–0.0731	–0.0443	–0.0188	0.0457
V Bicol Region	–0.0729	–0.0486	–0.0222	0.0394
VI Western Visayas	–0.0706	–0.0479	–0.0243	0.0357
VII Central Visayas	–0.0667	–0.0462	–0.0194	0.0438
VIII Eastern Visayas	–0.0851	–0.0544	–0.0238	0.0466
IX Zamboanga Peninsula	–0.0746	–0.0442	–0.0122	0.0501

Household group	25th percentile	Mean	75th percentile	Standard deviation
X Northern Mindanao	–0.0778	–0.0526	–0.0231	0.0415
XI Davao Region	-0.0662	-0.0475	-0.0248	0.0331
XII SOCCSKSARGEN	-0.0684	-0.0457	-0.0224	0.0352
XIII Caraga	-0.0950	-0.0697	-0.0412	0.0414
Autonomous Region of Muslim Mindanao	-0.0546	-0.0317	-0.0041	0.0389

Source: Authors' calculations, based on the 2009 FIES and Bureau of Agricultural Statistics (2013).
Note: HH stands for household.

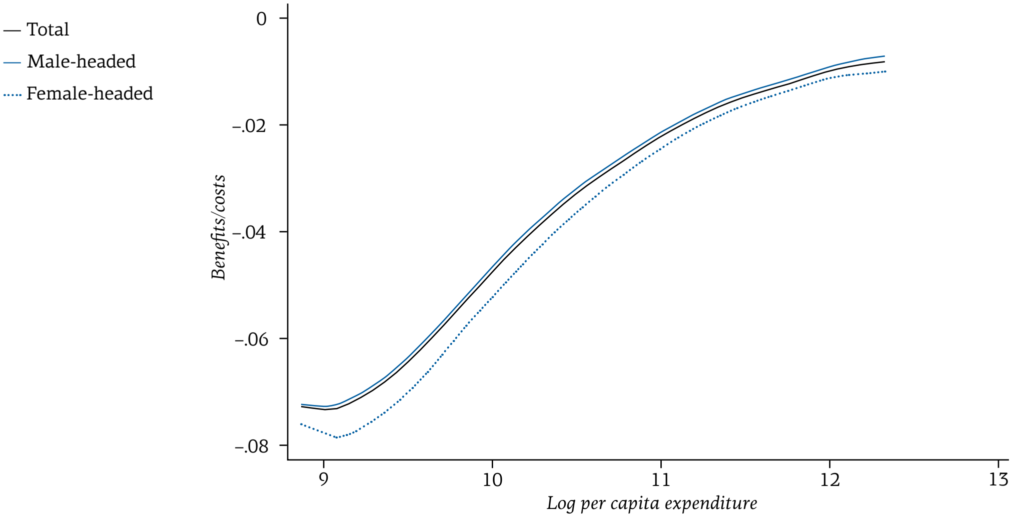
However, the differences across groups in this table only reflect the effects of the price changes owing to differences in per capita expenditure across groups, differences in rice production and consumption patterns, and in price increases across regions. Therefore, we cannot use this table to compare welfare effects across groups of households, such as between male- and female-headed households, at the same level of per capita expenditure. In the following section, the distributional analysis takes into account the well-being of the household – a factor that could determine whether a household would gain or lose from the rice price shock.

6.3 Benefits/costs and levels of household expenditure

It is also important to look at the distribution of the benefits/costs in different categories as measured by per capita expenditure. This yields results that are comparable to the regressions of the net income share of rice in Section 5.

Figure 11 shows the non-parametric regression results by gender of the household head. As expected, the benefits/costs variable is negative throughout the distribution and becomes less negative with higher expenditure levels. This means that higher prices due to the 2008 rice crisis hurt the poor the most. Moreover, the benefits/costs for female-headed households are lower than the benefits/costs for male-headed households. The effect of the 2008 rice crisis therefore seems to have been more detrimental to the female-headed households. The reason for this result is that female-headed households are more likely the net consumers of rice at all levels of per capita expenditure, as seen in Figure 7.

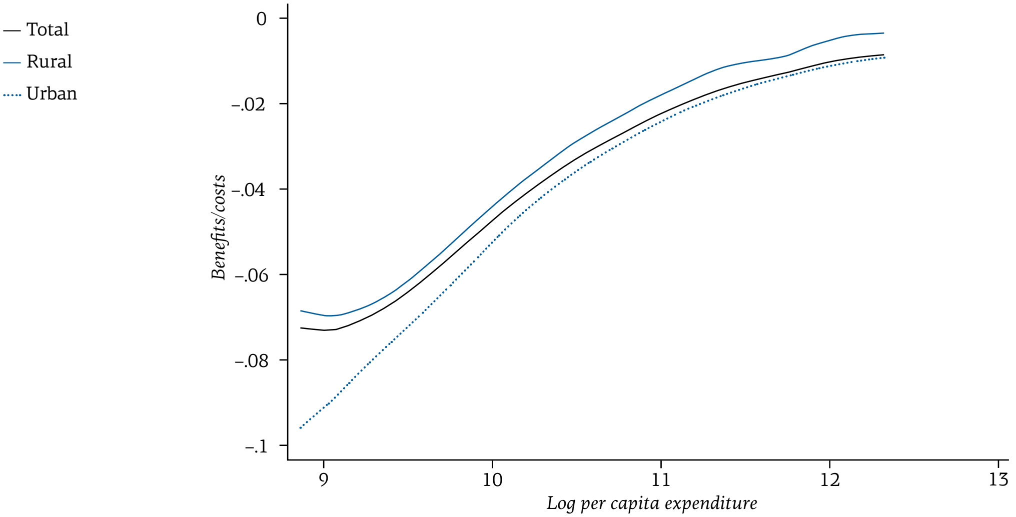
Figure 11 Benefits/costs and per capita expenditure by gender of household head



Source: Authors' estimations, based on the 2009 FIES and Bureau of Agricultural Statistics (2013).

As seen in Figure 12, the regressions estimated for urban and rural households likewise display a regressive trend. Urban households, on average, have a more negative benefits/costs variable across the spectrum. This suggests that urban households were worse off relative to the rural households.

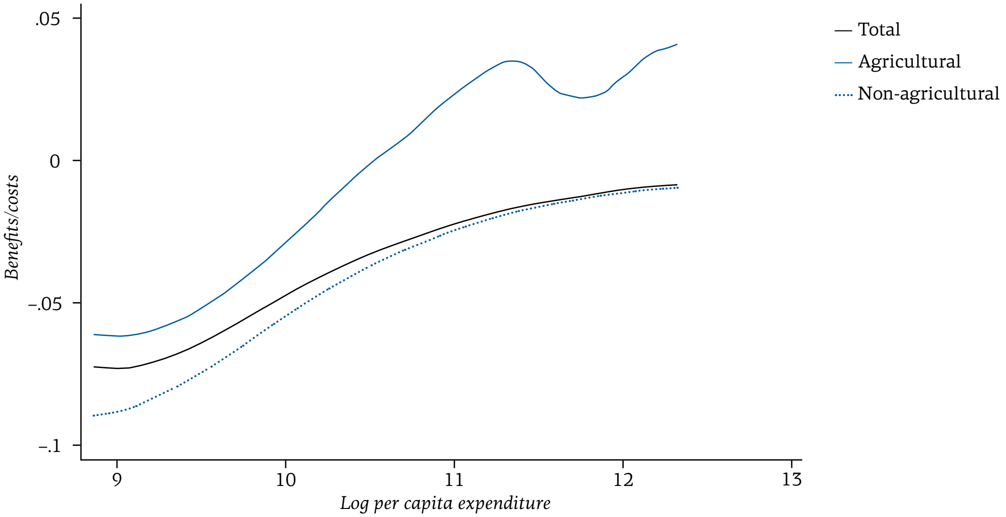
Figure 12 Benefits/costs and per capita expenditure by level of urbanity



Source: Authors' estimations, based on the 2009 FIES and Bureau of Agricultural Statistics (2013).

Finally, Figure 13 shows that across levels of expenditure, non-agricultural households have a lower benefits/costs variable, suggesting that they were more adversely affected than agricultural households. In addition, note that in the regression for agricultural households, households at the right tail of the distribution have a positive benefits/costs variable. This means that richer agricultural households gained from the rice crisis, as they are more likely the net producers of rice.

Figure 13 Benefits/costs and per capita expenditure by agricultural household indicator



Source: Authors' estimations, based on the 2009 FIES and Bureau of Agricultural Statistics (2013).

6.4 Who are the gainers and losers from the 2008 rice crisis?

Following Reyes *et al.* (2009), we use the plus or minus sign of the household benefits/costs variable, *BC*, to assess how the welfare of households has changed due to the 2008 rice crisis. If *BC* > 0, the household is defined as better off from the increase in the rice price and thus is a "gainer" in the rice crisis. Conversely, if *BC* < 0, the household is defined as worse off from the increase in the rice price and thus is a "loser" in the rice crisis. Note that the identification of gainers and losers does not take into account the magnitude of the gain or loss, but just the sign.

Table 5 presents the breakdown of the population in each sub-group into unaffected, gainers, and losers. Among households in the Philippines, 91 per cent were losers in the rice crisis while only 8.4 per cent were gainers and 0.6 per cent were unaffected. Regardless of the type of household, those who were adversely affected by the rice crisis clearly outnumbered those who were better off. This result is consistent with the result of Reyes *et al.* (2009), who, based on the change in the NBR due to rice price changes, found that 85.5 per cent of households in the Philippines were negatively affected while only 12.1 per cent benefited during the crisis.

The far right column of Table 5 shows the proportions of households defined as losers in the rice crisis. As shown, female-headed, rural, non-agricultural, and higher-income households tend to have higher shares of losers relative to their counterparts. These results seem contradictory to the results in Table 4. Accordingly, based on the average values of benefits/costs, the better-off groups include female-headed, urban, and higher-income households. However, the distribution of benefits/costs in Annex 4 shows that losers in the female-headed, urban, and higher-income groups, although higher in terms of share, tend to have higher (i.e. less negative) values of benefits/costs variable relative to the losers in the male-headed, rural, and lower-income groups. One can also note from the standard deviation of the benefits/costs in Table 4 that the spread of the distribution of the variable for households in the lower-income brackets is wider, thus making it possible to have a higher share of households that end up as gainers from the price change (see Figure A4.4 in Annex 4).

Note also that the proportions of gainers among rural households (14.34 per cent) and agricultural households (26.59 per cent) were considerable. Moreover, there were a number of gainers in the lower-income deciles and in regions such as the Cagayan Valley, Autonomous Region of Muslim Mindanao, Cordillera Administrative Region, and the Zamboanga Peninsula. This suggests that there are a number of net sellers of rice in these groups.

Table 5 Proportion of unaffected, gainers and losers in the 2008 rice crisis by various groups of households (per cent)

Household group	Unaffected	Gainers	Losers
All households	0.6	8.4	91.0
Gender of household head			
Male	0.52	9.55	89.93
Female	0.86	4.13	95.01
Urbanity			
Urban	0.58	2.42	97.00
Rural	0.61	14.34	85.05

Household group	Unaffected	Gainers	Losers
Agricultural household indicator			
Agricultural	0.39	26.59	73.02
Non-agricultural	0.65	3.08	96.27
National income decile			
1	2.34	15.31	82.35
2	0.76	12.38	86.86
3	0.43	10.36	89.21
4	0.54	10.08	89.38
5	0.31	7.46	92.23
6	0.24	6.82	92.93
7	0.06	6.86	93.08
8	0.66	5.27	94.07
9	0.29	5.03	94.68
10	0.29	4.46	95.26
Region			
National Capital Region	0.83	0.10	99.07
Cordillera Administrative Region	0.06	18.68	81.26
I Ilocos Region	0.09	11.91	88.00
II Cagayan Valley	0.42	33.71	65.88
III Central Luzon	0.48	11.24	88.27
IV-A CALABARZON	0.35	1.56	98.09
IV-B MIMAROPA	0.17	12.92	86.90
V Bicol Region	0.27	8.07	91.66
VI Western Visayas	0.47	6.21	93.32
VII Central Visayas	1.57	9.68	88.75
VIII Eastern Visayas	0.22	8.82	90.96
IX Zamboanga Peninsula	1.74	16.76	81.50
X Northern Mindanao	1.18	7.84	90.98
XI Davao Region	0.84	5.23	93.93
XII SOCCSKSARGEN	0.35	7.00	92.65
XIII Caraga	0.25	3.06	96.69
Autonomous Region of Muslim Mindanao	0	22.24	77.76

Source: Authors' calculations, based on the 2009 FIES and Bureau of Agricultural Statistics (2013).
Note: In each row, the values sum to 100.

Table 6 presents, within each category, the breakdown of gainers, losers and unaffected into sub-groups. Most of the losers are located in urban and non-agricultural areas, while the gainers are in rural and agricultural areas. These results are not surprising, as most households in urban and non-agricultural areas tend to be net consumers of rice and those in rural and agricultural areas tend to be net producers of rice. Reyes *et al.* (2009) also reported a larger proportion of losers in urban areas.

The sub-set of gainers (third column in Table 6) shows that the proportion of households belonging to the lower-income deciles is higher, as they are likely to be net producers of rice.[17] Such results are comparable to the findings of Reyes *et al.* (2009).

Looking at regional patterns, most of the losers live in the National Capital Region, the regional grouping of Calamba, Laguna, Batangas, Rizal, and Quezon (CALABARZON), and Central Luzon. This finding is similar to that of Reyes *et al.* (2009). Most of the gainers live in Central Luzon, Cagayan Valley, Central Visayas, and the Autonomous Region of Muslim Mindanao. In contrast, Reyes *et al.* (2009) found that most of the gainers were situated in Central Luzon, Ilocos, Western Visayas, and the Cagayan Valley.

Table 6 Distribution of unaffected, gainers and losers in the 2008 rice crisis by various groups of households (per cent)

Household group	**Unaffected**	**Gainers**	**Losers**
Gender of household head			
Male	69.29	89.60	77.90
Female	30.71	10.40	22.10
Urbanity			
Urban	48.42	14.38	53.12
Rural	51.58	85.62	46.88
Agricultural household indicator			
Agricultural	14.80	71.64	18.17
Non-agricultural	85.20	28.36	81.83
National income decile			
1	39.54	18.22	9.05
2	12.85	14.73	9.54

[17] Balicasan *et al.* (2010) maintain that, because the poor generally devote higher shares of expenditure to cereals (mainly rice), they tend to be hit harder by a rice crisis. Their finding, however, is not strictly comparable with Table 6 because they did not include rice income in their framework.

Household group	Unaffected	Gainers	Losers
3	7.24	12.33	9.80
4	9.08	12.00	9.82
5	5.27	8.88	10.14
6	4.11	8.12	10.21
7	1.01	8.17	10.23
8	11.17	6.28	10.34
9	4.89	5.98	10.40
10	4.83	5.30	10.47
Region			
National Capital Region	18.71	0.16	14.52
Cordillera Administrative Region	0.17	3.88	1.56
I Ilocos Region	0.81	7.72	5.27
II Cagayan Valley	2.48	14.19	2.56
III Central Luzon	8.98	14.70	10.66
IV-A CALABARZON	7.59	2.42	14.05
IV-B MIMAROPA	0.93	4.92	3.05
V Bicol Region	2.64	5.57	5.84
VI Western Visayas	6.25	5.82	8.07
VII Central Visayas	19.74	8.58	7.26
VIII Eastern Visayas	1.73	4.92	4.68
IX Zamboanga Peninsula	10.53	7.16	3.21
X Northern Mindanao	9.04	4.24	4.55
XI Davao Region	6.78	2.98	4.94
XII SOCCSKSARGEN	2.55	3.61	4.42
XIII Caraga	1.07	0.93	2.71
Autonomous Region of Muslim Mindanao	0.00	8.20	2.65

Source: Authors' calculations, based on the 2009 FIES and Bureau of Agricultural Statistics (2013).
Note: Within each household category, the values in each column sum to 100.

7 Conclusions and policy implications

What was the distributional impact of the 2008 rice crisis in the Philippines? Following the methodology of Deaton (1989), this study mapped out the vulnerability of various household groups to rice price shocks through non-parametric regressions of the net rice share on per capital expenditure for different household groups.

At the national level, the measures of the net income share of rice for both male- and female-headed households are negative across all levels of per capita expenditure. The findings also show that for low-income households, net rice income is approximately –20 per cent and becomes less negative as one moves from poorer to richer households. This suggests that an increase in the price of rice is highly regressive – that is, it hurts the poor more, a finding consistent with Reyes *et al.* (2009) and Fujii (2013). In addition, female-headed households have a slightly lower net income share of rice, suggesting that they are more vulnerable compared to male-headed households.

For urban households, the net income share of rice is lower than that for rural households. Furthermore, it is much lower for poorer segments of urban households. This implies that a price shock has a more detrimental effect on the poor in urban areas.

For households in the agricultural sector, the outcome is mixed – poorer agricultural households are net consumers of rice while richer ones are net producers. Hence, price increases hurt poor agricultural households but benefit agricultural households with higher income. On the other hand, as households in the non-agricultural sector are generally net consumers of rice, they are more vulnerable to price shocks compared to households in the agricultural sector.

We carried out simulations on the benefits/costs variable (an indicator for the change in the NBR), given actual price changes at the farm gate and retail levels for each household during the 2008 rice crisis. The gainers and losers from the rice crisis could be identified by the sign of the benefits/costs variable (gainers for positive change, losers for negative change). We found that, on average, over 90 per cent of the households in the survey suffered a loss of welfare. The few that gained from the price shock were found mostly in the rural and agricultural sectors.

Although the overwhelming majority at each income decile experienced a loss in welfare, there were relatively more gainers among those in the lower-income deciles than in the higher-income deciles. An explanation is that those belonging to the higher-income deciles are net consumers of rice. Similarly, the majority of the households in all regions suffered a loss in welfare, while the regions with a substantial number of gainers were the Cagayan Valley, Autonomous Region of Muslim Mindanao, Cordillera Administrative Region, and the Zamboanga Peninsula.

The non-parametric regression of the benefits/costs variable on the log of per capita expenditure provided several results. First, conditional on the level of per capita expenditure, female-headed households are more vulnerable to changes in rice prices. This means that female-headed households suffered a greater loss of welfare from the crisis.[18]

Second, conditional on the level of per capita expenditure, the benefits/costs for urban households are lower than for rural households. Such results are not surprising given that urban households are more likely to be net consumers of rice than rural households.[19]

Third, conditional on the level of per capita expenditure, agricultural households suffered less than non-agricultural households. It is quite obvious that the rice producers would be in the agricultural sector and that the urban poor, with very little potential for gains from rice production, would be hit harder.

In the analysis of the impact on households by national income decile, we see that the decreases in the benefits/costs are greater for the lower-income deciles. The dispersions are also greater at the lower-income levels than the higher-income ones. Again, one implication is that the poorest of the poor suffer the brunt of the rice crisis.

The profile of gainers and losers is not entirely unexpected, as most households in urban and non-agricultural areas tend to be net consumers of rice, and those in rural and agricultural areas tend to be net producers. Thus, for targeting transfers, Philippine policymakers should be guided by the

[18] There appears to be some tension between the absolute values of benefits/costs (Table 4, columns 2–4) and the non-parametric regression results of the net income share of rice and the log of per capita expenditure (Figures 7–9) with regard to identifying the most affected household groups. Considering the relative vulnerability of male- and female-headed households, we can say that, on average, male-headed households experienced a deeper welfare loss (negative benefits/costs) than female-headed ones. However, the benefits/costs variable for male-headed households has a greater dispersion, i.e. a higher standard deviation (Table 4, column 5, and Figure A4.1). In addition, controlling for per capita expenditure, female-headed households are found to have systematically lower benefits/costs (Figure 11).

[19] Given the average benefits/costs (Table 4, columns 2–4), rural households appear to suffer a greater loss in welfare than urban households. In addition, the standard deviation of the benefits/costs distribution for rural households is greater, but higher extreme values are found for urban households (Table 4, column 5; Figure A4.2). This implies that some urban households enjoyed particularly high benefits from the price increase, which pushed up the average. However, the proportion of losers in the rural sector is smaller than that in the urban sector (Table 5).

absolute magnitudes of the benefits and costs and by their distribution on the log of per capita expenditure.

By and large, the entire country suffered through the 2008 rice crisis, although a minority actually gained. As a short-term measure to help vulnerable households, Balicasan *et al.* (2010) advocate the expansion of conditional cash transfers, complemented with a targeted rice subsidy programme in depressed areas. These safety nets would help avoid hunger and poverty.

Indeed, policymakers are confronted with the challenge of designing an appropriate poverty-alleviating response in the event that a rice crisis occurs again. While it is desirable that all affected households have access to assistance programmes such as subsidized rice or conditional cash transfers, the government's resource constraints dictate that there ought to be strategic targeting of beneficiaries. Those that suffer most from the crisis ought to be prioritized by assistance programmes.

However, the effectiveness of assistance programmes is often compromised by leakage. Because of poor targeting of the beneficiaries, less-needy households may benefit from government assistance at the expense of more needy ones. Reyes *et al.* (2009) cite leakage as a reason why cheap subsidized rice from the National Food Authority does not always reach the poor. In addition, the lack of capacity of local governments to accurately identify households for conditional cash transfers limits the effectiveness of the safety net programme of the Department of Social Work and Development.

Hopefully, the findings of this study will help target government relief and safety net programmes in the event of future rice crises. Information about vulnerable household groups from the experience of the 2008 rice crisis in the Philippines may help in the identification of those segments of the population that deserve a higher priority in assistance.

Admittedly, even if this study can help improve the targeting mechanism of households that need assistance during food crises, the inadequacy of the available resources relative to the needs may compromise the effectiveness of such a mechanism. Given the extent of poverty in the Philippines, and the very limited participation of the NFA at present in the market in terms of procurement and buffer stocks, there seems to be very little scope for assistance. Thus, in addition to better targeting, there is a case for considering the expansion of the government budget directed to helping the poor cope with rice crises.

Balisacan *et al.* (2010) observe that the past implementation of the NFA's rice subsidy programme was not cost-effective. Thus, concomitant with expanded budgets for this programme, there is a need for better governance of the NFA.

Social safety net and rice subsidy programmes are only short-term measures, and policymakers also need to look at longer-term solutions. It should be borne in mind that policy options have accompanying costs. Having an idea of the welfare costs resulting from a crisis could help evaluate such policy options. Our findings about the impact of the 2008 rice crisis indicate that around 90 per cent of households experienced a reduction of welfare to varying degrees. Back-of-the-envelope estimations show that the government needs PHP 803 million worth of measures, such as cash handouts, to bring the welfare of households back to the pre-crisis level.[20] In absolute terms, the cost to society is very high. Thus, investing in crafting longer-term policy measures to prevent the crisis from recurring is worthwhile.

As a perennial task, policymakers should not abandon initiatives to solve the problem at its core – that is, to improve rice productivity. In fact, because of the structural problems in the rice sector, Balisacan *et al.* (2010) contend that a rice crisis in the Philippines would have occurred even in the absence of the global price shock. The factors that they cite are similar to those that afflict agriculture and the rural economy in the Philippines in general. One main constraint to Philippine agriculture is the productivity slowdown resulting from the lack of investment in the sector and in support services. Particularly lacking are investments in infrastructure, research, and institutions. In addition, assistance to farmers in terms of extension services is rather weak. Mismatches of the choice of rice variety with the soil type occur as well. Hence, when the global rice crisis broke, the Philippine domestic rice market, laden with problems of its own, was caught unprepared and adversely affected.

Is it a question of introducing new programmes and projects? Indeed, there are already existing programmes to improve rice productivity and enhance food security. For instance, the Agriculture and Fisheries Modernization Act contains provisions that rationalize production zones and their associated products. There is a need to streamline current programmes, strengthen their disciplines, and implement them effectively.

[20] To estimate this value, we compute the amount of cash each household must receive so that it would have zero benefits/costs.

The Philippine government has gone farther than simply improving NFA operations. In fact, it has embarked on a rice self-sufficiency strategy under the Food Staples Sufficiency Programme that envisioned a no-import target for 2013.[21] Since the crisis, the government has raised the NFA buying price of paddy to higher than pre-crisis levels. As a consequence of the supply response, the NFA has had to raise its procurement levels.

Some observers (Briones, 2012a) raise the point that self-sufficiency should be qualified by the "affordability" criterion. Others contend that there should be a distinction between food self-sufficiency and food self-reliance. Food self-sufficiency is associated with meeting food needs from local sources and minimizing dependence on trade. Food self-reliance, on the other hand, implies assuring food adequacy from both local and foreign sources.

The concept of food self-reliance is thus consistent with continued engagement of the country in international trade. Actually, the World Trade Organization's Agreement on Agriculture provides policy options for a country to support domestic production as part of the food security strategy, provided that certain conditions are met. Furthermore, Dawe and Slayton (2010) caution against blaming the free trade mechanism as the culprit behind the rice crisis. Both Clarete (2012) and Briones (2012a) reiterate that protectionist measures against rice imports may not be the optimal policy. Cooperation in assuring adequate levels of the world rice supply would be a promising way to build confidence. In this context, Sarris (2010) suggests the use of long-term supply contracts on rice between countries.

In the end, policymakers have to find a balance between producer and consumer interests in rice policy. Given the enormity of the social and financial cost of another rice crisis, Philippine policymakers should direct their efforts towards improving rice productivity. Because instituting reforms takes time, they should also make every effort to enhance international cooperation to stabilize the supply of internationally traded rice. These are, by no means, easy tasks.

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[21] The government, through the NFA, imported 236,000 metric tons as of November 2013. Meanwhile, as the NFA distributed free rice in relief operations in some localities hardest hit by the Typhoon Yolanda, the buffer stock has dipped below the desired level. There are reports that the government may import rice again to replenish the rice inventory (Despuez, 2013).

Annexes

Annex 1 Summary of key statistics across groups of households

Table A1.1 presents the means of the key statistics for different groups of households.[22] In terms of per capita expenditure, female-headed, urban, and non-agricultural households are substantially richer than male-headed, rural, and non-agricultural households, respectively.

In terms of rice consumption patterns, male-headed, rural, and agricultural households have higher shares of rice expenditure relative to their counterparts.

The rice production patterns vary across groups of households. Male-headed, rural, and agricultural households derive higher shares of their income from rice farming than their counterparts.

Finally, we take a look at the net share of rice in the total income of households. Note that all mean values in this panel are negative, implying that, on average, households, regardless of type, are net consumers of rice. This suggests that they would be negatively affected by an increase in the price of rice. The more vulnerable groups include male-headed, rural and non-agricultrual households.

Table A1.1 Summary of key statistics for different groups of households

		Gender of HH head		Urbanity		Agricultural HH indicator	
		Male	Female	Urban	Rural	Non-agricultural	Agricultural
Per capita expenditure (PHP)	25th percentile	17,001.33	23,111.00	25,860.78	14,415.75	21,985.27	12,430.86
	Mean	40,210.56	58,293.46	59,129.08	29,046.06	50,647.97	21,459.63
	75th percentile	46,279.00	71,283.00	69,935.00	33,151.33	59,143.67	23,711.67
	Standard deviation	47,506.82	68,191.72	66,212.59	28,482.30	56,826.59	27,468.82
Budget share of rice (per cent)	25th percentile	6.50	4.52	4.59	9.33	5.39	12.67
	Mean	13.77	10.62	9.53	16.66	11.14	19.80
	75th percentile	19.09	14.53	12.59	22.73	15.14	26.58
	Standard deviation	9.45	8.21	6.97	9.93	7.84	10.67

[22] For the definitions of the key variables, refer to Section 4.

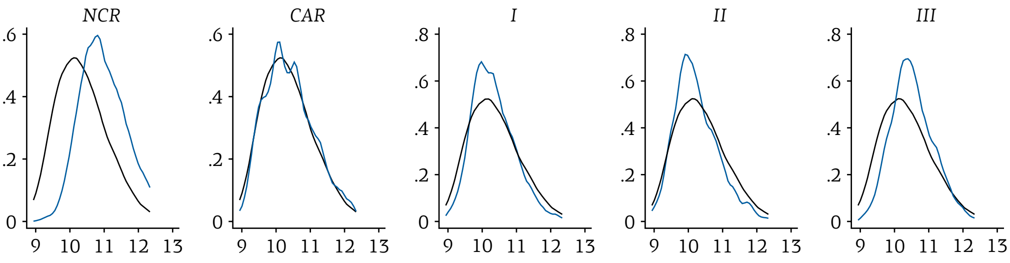
		Gender of HH head		Urbanity		Agricultural HH indicator	
		Male	Female	Urban	Rural	Non-agricultural	Agricultural
Income share of rice (per cent)	25th percentile	0.00	0.00	0.00	0.00	0.00	0.00
	Mean	4.10	1.66	0.97	6.19	1.18	11.81
	75th percentile	3.49	0.00	0.00	9.33	0.00	20.12
	Standard deviation	8.74	5.66	4.70	10.00	3.70	12.88
Net income share of rice (per cent)	25th percentile	–15.68	–13.01	–11.89	–18.29	–13.96	–19.59
	Mean	–9.67	–8.96	–8.56	–10.47	–9.97	–7.99
	75th percentile	–4.31	–3.87	–4.22	–4.05	–4.70	2.70
	Standard deviation	11.22	8.87	7.60	13.12	8.09	16.89

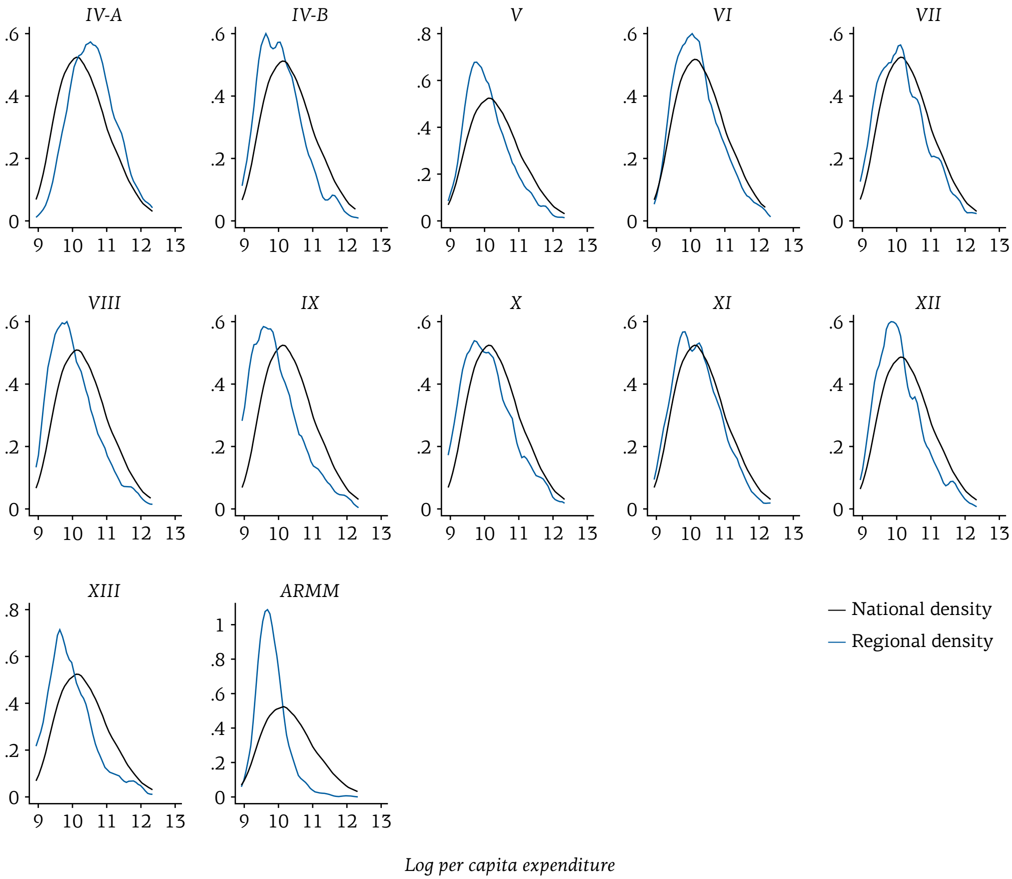
Source: Authors' calculations, based on the 2009 FIES.
Note: Estimated number of households in the Philippines = 18,452,000; number of observations = 38,400; number of strata = 939; number of primary sampling units = 2,822.

Annex 2 Kernel density estimations of expenditure by region

Figure A2.1 shows the distribution of expenditure across regions. Note that the following regions have distributions that are biased to the right: National Capital Region, Region III – Central Luzon, and Region IV-A – CALABARZON. This means that households located in these regions are better off relative to an average Filipino household. The regions with distributions that are biased to the left are Region II – Cagayan Valley, Region IV-B – MIMAROPA, Region V – Bicol, Region VI – Western Visayas, Region VII – Central Visayas, Region VIII – Eastern Visayas, Region IX – Zamboanga Peninsula, Region X – Northern Mindanao, Region XI - Davao, Region XII – SOCCSKSARGEN, Region XIII – Caraga, and the Autonomous Region of Muslim Mindanao. These regions have households that are relatively poorer compared to an average Filipino household.

Figure A2.1 Expenditure distributions by region





Source: Authors' estimations, based on the 2009 FIES.
Note: NCR stands for National Capital Region. CAR stands for Cordillera Administrative Region. ARMM stands for Autonomous Region of Muslim Mindanao.

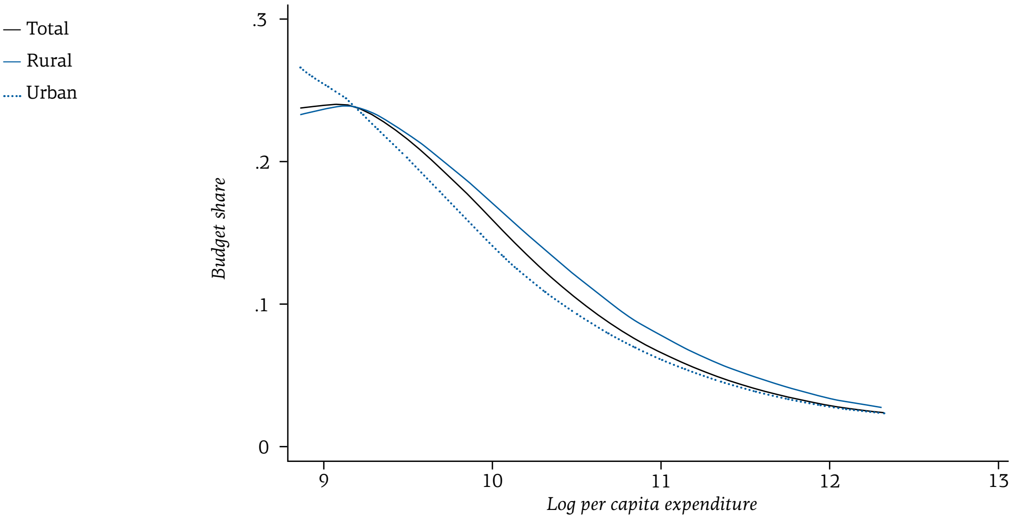
Annex 3 Non-parametric regression results across groups of households

For various types of households, we present non-parametric regressions on the log of per capita expenditure of (a) the share of rice consumption in total expenditure, and (b) the share of rice production in total income.

Share of rice consumption in total expenditure

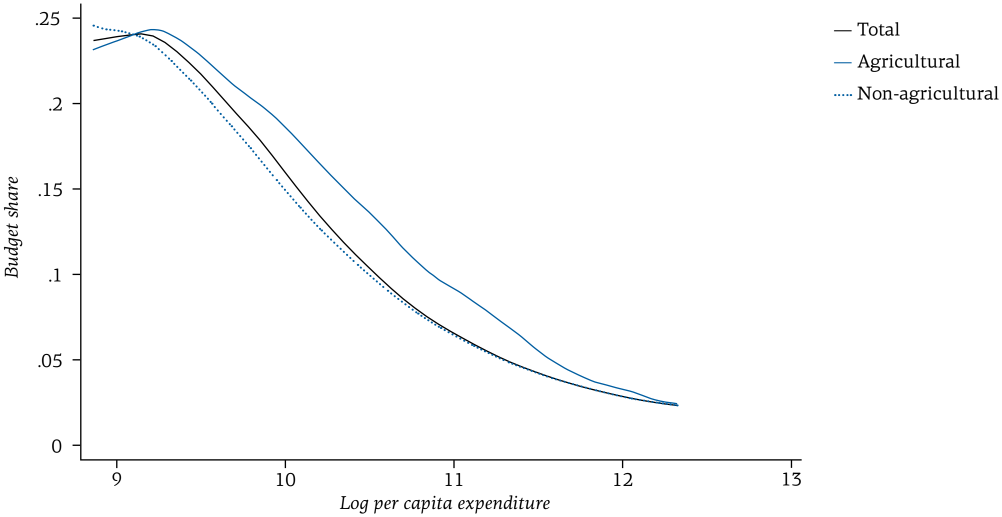
The rice expenditure pattern can vary across household types. Figures A3.1 and A3.2 show the results for urban/rural households and non-agricultural/agricultural households. Urban households have a declining rice budget share across the spectrum. However, for rural and agricultural households, there is a slight hump for households with lower levels of expenditure. Rural or agricultural households at very low levels of expenditure are likely to increase the share of rice in their budget when their incomes rise. Since rice is a basic food item in a food basket of a typical household, it is reasonable to expect that the poorest rural or agricultural households would put a premium on rice over other expenditure items. However, with a significant increase in income, they would start spending more on other non-rice items. In the plot line for rural and agricultural households in Figure A3.1, this insight is reflected in the downward portion of the hill.

Figure A3.1 Budget share of rice and per capita expenditure by level of urbanity



Source: Authors' estimations, based on the 2009 FIES.

Figure A3.2 Budget share of rice and per capita expenditure by agricultural household indicator

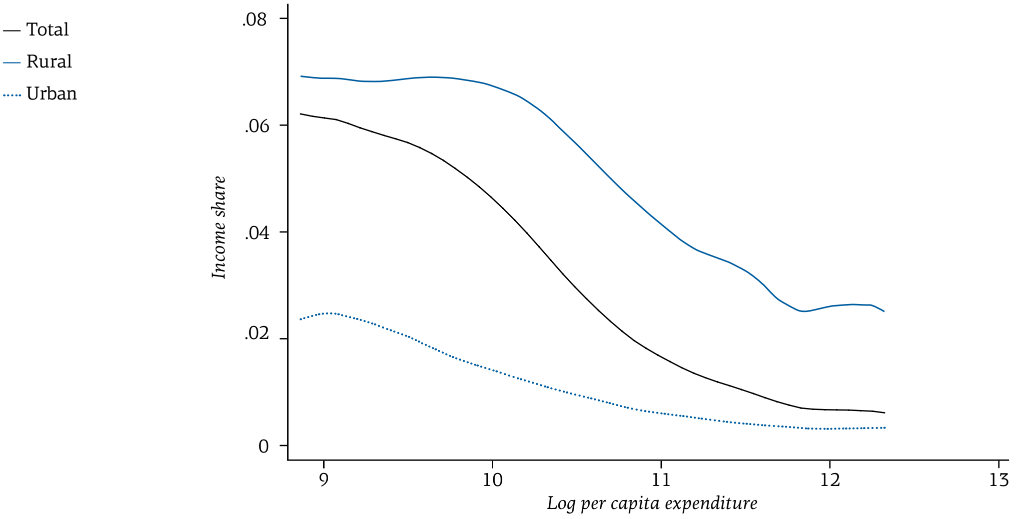


Source: Authors' estimations, based on the 2009 FIES.

Share of rice production in total income

The rice production pattern can also vary across types of households. For instance, Figure A3.3 shows that, in general, rural households have a higher income share of rice. This suggests that relative to urban households, rural households earn more of their income from rice production. For urban households, the share of rice in income is small, and as households become better off, it gets even smaller. In contrast, for rural households at low levels of expenditure, the share of rice in income tends to be relatively constant up to a given level of expenditure, and then it falls considerably.

Figure A3.3 Income share of rice and per capita expenditure by level of urbanity

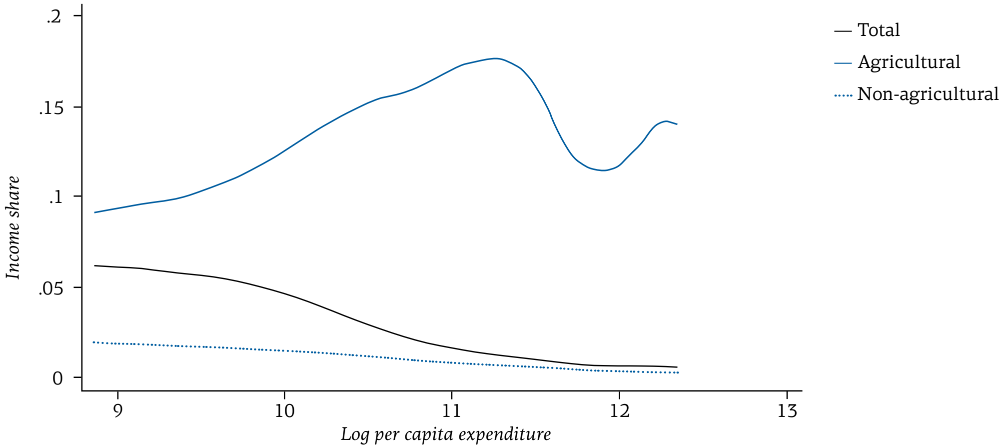


Source: Authors' estimations, based on the 2009 FIES.

The regression for non-agricultural households in Figure A3.4 indicates a small income share of rice and displays an almost flat trend. We can, however, see a much more interesting result when we look at the result for agricultural households. Unsurprisingly, across all levels of expenditure, the rice income share is higher in agricultural households than in non-agricultural households. While all of the regressions of rice income shares presented so far show a downward trend, the result for agricultural households shows an irregular pattern: as the level of expenditure increases, the share of rice in the income of agricultural households rises, declines, and then rises again.

[23] For the definition of the benefits/costs variable, refer to Section 6.2.

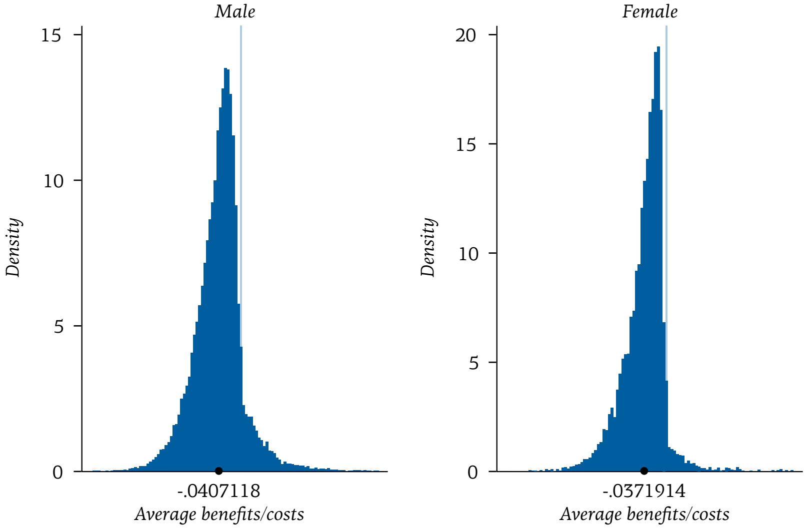
Figure A3.4 Income share of rice and per capita expenditure by agricultural household indicator



Source: Authors' estimations, based on the 2009 FIES.

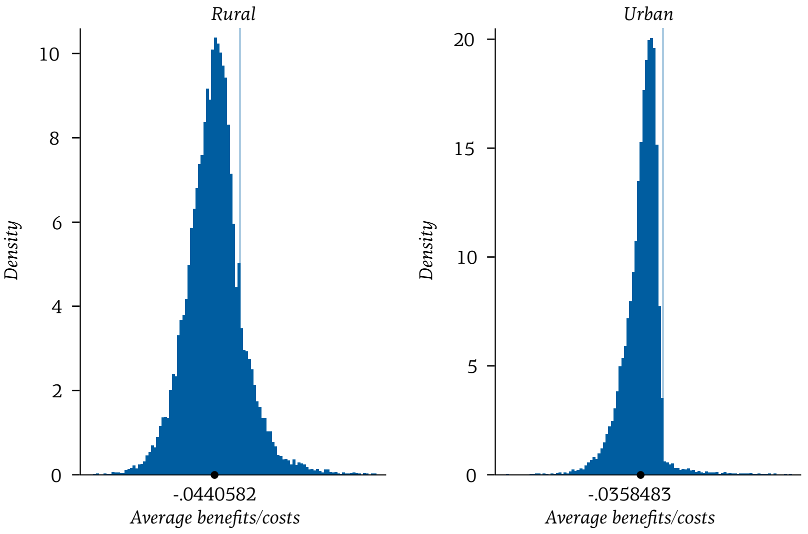
Annex 4 Histograms of the benefits/costs variable for various groups of households[23]

Figure A4.1 Histograms of the benefits/costs variable by gender of household head



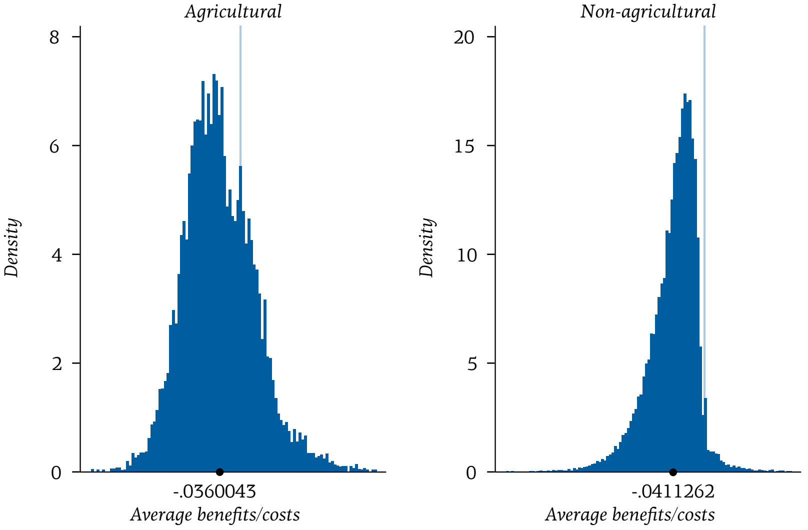
Source: Authors' estimations, based on the 2009 FIES.
Note: The vertical lines represent x = 0.

Figure A4.2 Histograms of the benefits/costs variable by level of urbanity



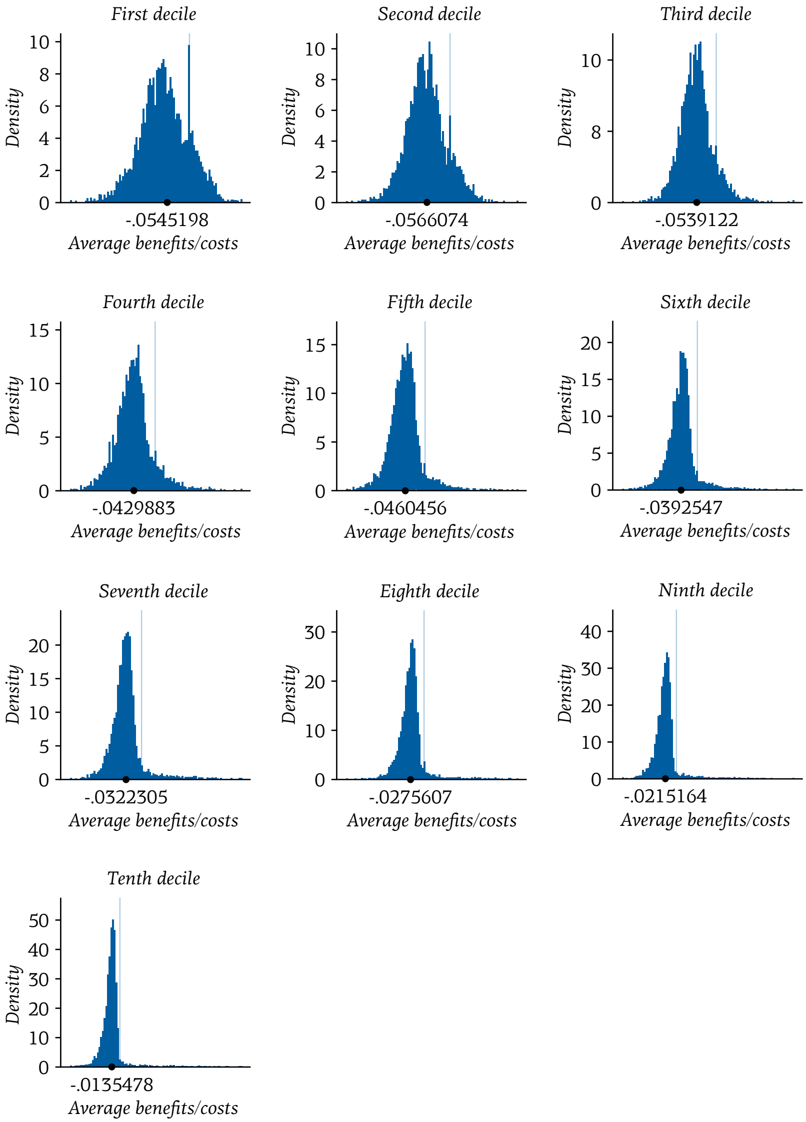
Source: Authors' estimations, based on the 2009 FIES.

Figure A4.3 Histograms of the benefits/costs variable by agricultural household indicator



Source: Authors' estimations, based on the 2009 FIES.

Figure A4.4 Histograms of the benefits/costs variable by national income decile



Source: Authors' estimations, based on the 2009 FIES.

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Former Yugoslav Republic of Macedonia

Increasing the welfare effect of the agricultural subsidy programme for food crop production in the former Yugoslav Republic of Macedonia

Marjan Petreski *

Abstract

The objective of this study is to analyse the welfare implications of increasing prices of wheat, maize and rice, and agricultural subsidies on household welfare in the former Yugoslav Republic of Macedonia. Based on this analysis, we propose a redesign of the subsidy programme for these crops, which might help to improve the welfare of households. The results suggest that the effects of increased commodity prices and the current subsidy programme were positive only for male-headed rural households. The newly proposed disbursement scheme for government subsidies is therefore based on targeting female-headed rural households for both wheat and rice, all poor urban households for wheat, and male-headed rural households for rice. Results of the simulation with regard to wheat-maize production suggest that targeting poor urban households could result in a significant welfare effect ranging up to 30–40 per cent of the income of this group of households, assuming it is accompanied by a usufruct of state-owned land and start-off grants for initial investment. Targeting poor female-headed rural households may increase the impact of the scheme from almost zero to about two-thirds of the income of poor male-headed rural households. The effect on the welfare of poor rural rice producers may also be large – up to 20 per cent of household income – taking into account that a considerable effort is however needed to start off rice production.

* The author would like to thank Nikica Mojsoska Blazevski, Adviser to the Ministry of Labour and Social Policy, Margarita Deleva from the Ministry of Agriculture, and Biljana Trajkovska from the Ministry of Labour and Social Policy of the former Yugoslav Republic of Macedonia for their support in the preparation of this study.

1 Introduction

Food crop commodities – namely wheat, maize and rice – are important in the former Yugoslav Republic of Macedonia: 24.5 per cent of households farm one or more of these crops, and more than 50 per cent of rural households spend more than 10 per cent of their budget on them. The overall poverty rate, based on the relative poverty line,[1] was estimated at 27.1 per cent in 2011 – up from 25 per cent in 2006 – while rural poverty was at 37.6 per cent in 2011. Given that more than a fourth of the population lives below the poverty line, it is not a coincidence that a large portion of poor household income is spent on food crop commodities and the derived products.

Prices of food crop commodities have been rising since 2006: in October 2012, they were 46.5 per cent higher than the average level in 2006. The increase has been widespread, but the aforementioned commodities – wheat (118 per cent), maize (165 per cent), and rice (76 per cent) – have experienced price increases larger than other commodities over the same period. However, the production of food commodities has been declining since the 1990s when the planning system was abandoned; at present, it is on average 60 per cent of the production in 1991, though the level varies across the different crops. The increase in prices has been insufficient to increase the production.

Commodity price developments may have large impacts on real incomes of poor households in developing countries. However, little information is available on actual impacts on the poor, despite some concerns expressed in the literature (e.g. FAO, 2011; World Bank, 2008). The overall impact of commodity price increases on the welfare of the poor depends on whether the gains to poor producers outweigh the adverse impacts on poor consumers, on the pattern and response of household income, and on the policy responses. It has been widely claimed that the effects are quite diverse and country-specific (Hertel and Winters, 2006).

Agricultural subsidies have been among government policy programmes generally pursued in times of commodity price increases (Wodon and Zaman, 2010). The right-oriented government of the former Yugoslav Republic of Macedonia, which took office in late 2006, undertook an ambitious agenda for subsidizing agriculture with budget funds that reached 4.5 per cent of total government expenditure in 2011 from virtually zero in 2006. Despite ambiguously communicated, it seems that an overarching

[1] The relative poverty line is 60 per cent of the median equivalent income.

objective of the programme was to increase production and improve the living conditions of those who are predominantly living or temporarily migrating to rural areas. The programme was designed so that any production would be subsidized with specifically determined lump sums, to support current producers as well as steer former producers to resume crop production. The food crop commodities mentioned above have been subsidized as follows: EUR 150 per cultivated hectare (ha) up to 10 ha of cultivated land; EUR 90 per ha for 10–50 ha; EUR 45 per ha for 50–100 ha; and EUR 15 per ha for more than 100 ha. No special conditions regarding the type of household producing staple foods applied to benefit from the programme.

However, the effects of the agricultural subsidy programme have been, to a large extent, unsatisfactory. Despite an increase in government subsidies, the production of all food crop commodities – except for rice – has further declined, while household welfare – judging by the increase in poverty – has not improved.

Two related policy questions therefore arise. First, what are the likely effects of the observed change in the level of food crop prices on household welfare in the former Yugoslav Republic of Macedonia? Second, what are the likely effects of the government subsidy programme on household welfare, and could another subsidy disbursement scheme strengthen the impact on the welfare of households? This study provides an analytical background for discussion of these questions.

Ideally, our analysis would use household surveys undertaken before and after the price increases and the introduction of the government subsidy programme. This would allow a precise analysis of the effects of the price change and the subsidy on the welfare of households and on farm supply behaviour. However, such data do not exist – or at least not entirely. Instead we therefore use the 2011 Household Budget Survey (HBS), which however does not provide any information on subsidies. Hence, we apply the rules for subsidy disbursement specified above to evaluate their effect. Based on the findings, we propose another scheme for disbursement (for the three crops analysed here) that aims to improve the welfare of households in the former Yugoslav Republic of Macedonia. Therefore, the focus of the study is on the welfare implications of the price increases and government subsidies. We first evaluate how household welfare was affected by the increasing prices of the most important crops, and second, how it was affected by the subsidies which the government introduced for crop farming. Subsequently, we present a new agricultural subsidy programme for food crops redesigned into a tool to alleviate (rural) poverty in the country.

No in-depth analysis has been undertaken thus far to help understand the consumption and income patterns of households in the former Yugoslav Republic of Macedonia and their decisions with regard to cultivating crop commodities. In particular, the effect of government subsidies remains fully unexamined. Many economists and former policymakers in the former Yugoslav Republic of Macedonia argue that the design of the government agricultural subsidy programme is arbitrary and uninformed, and hence does not act as a mechanism for maximizing the poverty-reduction effect. The design of the programme thus continues to be a topic of heated public debate.

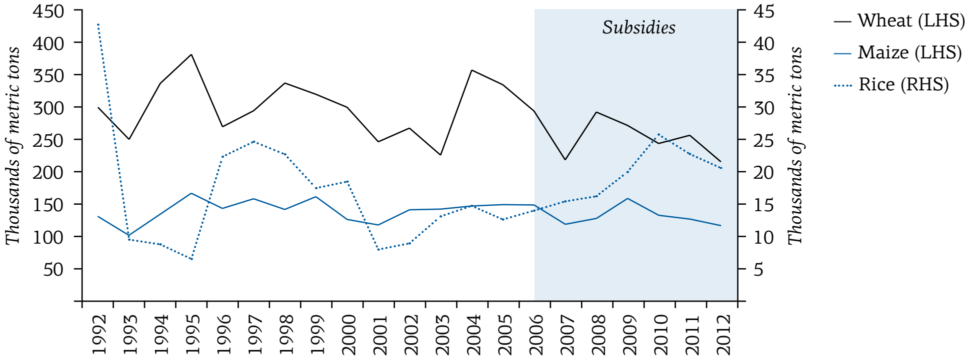
The study is organized as follows: Section 2 presents the HBS data and explains how they meet the particular needs of the analysis. It also explores some of the distinguishing features of household income that anticipate the more sophisticated estimation results that follow. Section 3 gives a brief overview of the relevant literature and sets this study's place in the literature. Section 4 outlines the analytical framework, which is the one applied in Deaton (1989a, 1989b). Section 5 charts the distributional results of a change in crop prices and the introduction of government subsidies, and proposes a new disbursement scheme that improves the impact on welfare. The conclusions are presented in Section 6.

2 Stylized facts

2.1 Macroeconomic aspects

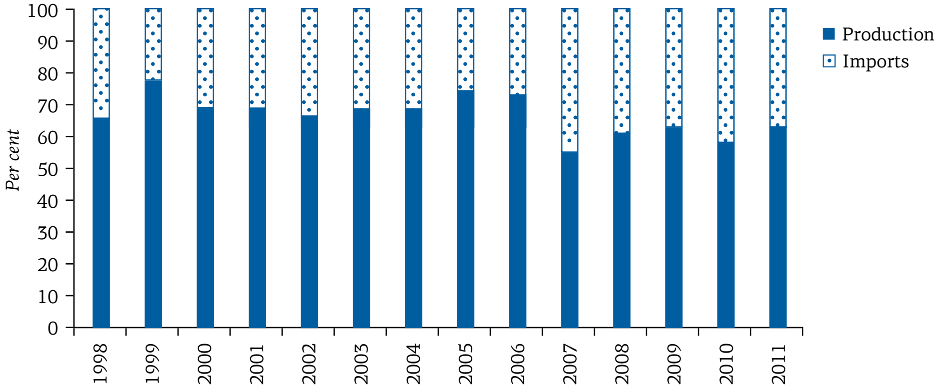
Despite being a poor republic in the former Yugoslavia, the former Yugoslav Republic of Macedonia had a larger production of food crops in 1992 than nowadays. Figure 1 shows the production patterns of the three food crops analysed here, namely wheat, maize and rice. The general non-increasing trend of production is evident for all three crops, with largely emphasized volatility. The introduction of government subsidies in 2007 did not change these patterns – at least not as expected: only rice production increased, but as a continuation of an increasing trend that had begun earlier, while the production of the other two crops stagnated or declined. In addition, as Figure 2 suggests, the share of imported cereals in total consumption increased.

Figure 1 Production of food crop commodities, 1992–2010 (thousands of metric tons)



Source: Author's calculations, based on FAO statistics and State Statistical Office.
Note: LHS stands for left-hand scale, RHS for right-hand scale.

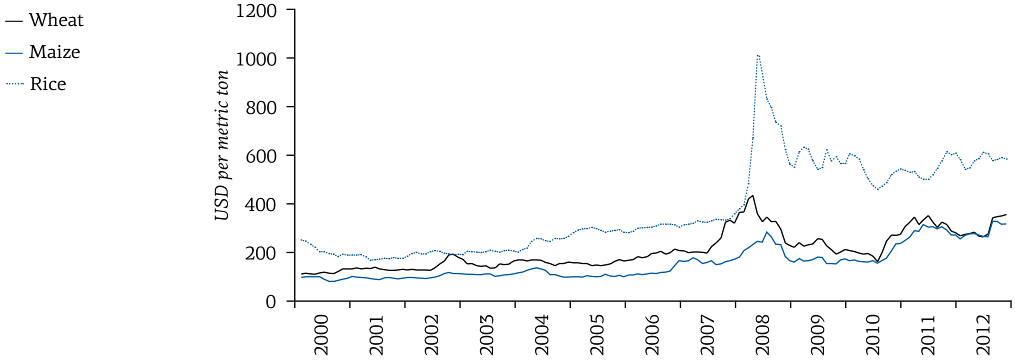
Figure 2 Production versus import of cereals, 1998–2012 (per cent)



Source: Author's calculations, based on FAO statistics and National Bank of the Republic of Macedonia.

Figure 3 presents the price changes that accompanied these production patterns. At the same time that the government subsidy programme was introduced, food commodities marked the largest price increase in years, mainly due to weather-related shortages occurring in different countries worldwide. The increase in prices was widespread, but the food crops analysed here experienced the largest price increases between 2006 and 2012 at the international stage: wheat (118 per cent), maize (165 per cent), and rice (76 per cent).

Figure 3 Prices of food commodities, 2000–2012 (USD per metric ton)



Source: Author's calculations, based on IMF statistics.

2.2 Microeconomic patterns of demand and supply

We use data from the 2011 HBS[2] to describe the patterns of demand and supply of wheat, maize and rice, with respect to urban/rural households and gender of the household head. Table 1 shows the number of surveyed households and their distribution over the country. A total of 3,566 surveyed households are analysed; these households are distributed over two geographical sections and by gender of household head. Although the share of urban households may be overrepresented, due to a lower expense in surveying urban households, in this study we will use the weights obtained alongside the dataset to correct for this issue.

Table 1 Structure of the survey

		Geographical distribution		
		Urban	**Rural**	**Total**
Gender of head of household	**Male**	2,092	817	2,909
	Female	553	104	657
	Total	2,645	921	3,566

Source: 2011 HBS.

[2] Ideally, we would have preferred to start with the 2006 HBS (the survey before the price hike), but data on the income and expenditure of cereals (wheat and maize) and rice were largely missing because surveyed households at that time were answering the survey on a voluntary basis only. However, the 2011 HBS served the purpose well, because, as observed in Figure 1, no large changes in the produced quantities occurred between 2006 and 2011.

Table 2 presents sample means for the main variables of interest. Throughout this study, we will be using total household income per capita as a preferred measure of household living standards. Judging by this criterion, and ignoring any price differences, households in urban areas have a higher living standard than those in rural areas, and female-headed households are wealthier than male-headed households. While the first regularity is expected, the second regularity may be surprising, but still logical for the former Yugoslav Republic of Macedonia – at least partially. Namely, in a predominantly still patriarchic-minded society, a female-headed household signifies that a male head has passed away or migrated; in the former case, this reduces the household size (as well as total income); in the latter case, with the reduction of its size, the household is likely to receive remittances, which elevate its per capita income.[3] It could be observed that the average household size is lower for female-headed households, whereas the difference in household size between urban and rural households is likely insignificant. Finally, the average age of the head of household is quite high, due to households often consisting of grandparents, parents and children, with a grandparent reported as head of household.

Table 2 Summary statistics

		All HH	Geographical distribution		Gender of head of household	
			Urban	Rural	Male	Female
HH characteristics	HH size	3.8	3.7	4.1	4.0	2.8
	Age of HH head	55.7	55.4	56.9	53.9	62.6
	Income per capita	6,125	6,928	3,744	5,778	7,470
Annual production (kg per HH)	Wheat/maize	886.1	0.3	3,511.7	955.7	616.9
	Rice	37.7	0	149.5	45.5	10.8
Annual expenditure (kg per HH)	Wheat/maize	293.7	136.5	759.7	304.7	251.1
	Rice	27.3	27.7	26.0	27.3	27.0
Annual self-consumption (kg per HH)	Wheat/maize	14.8	0	58.8	15.9	10.8
	Rice	0.2	0	0.7	0.2	0.02
Income share (per cent)	Wheat/maize	5.2	0	20.7	5.6	3.8
	Rice	0.3	0	1.2	0.3	0.3

[3] Remittances are an important source of income in the former Yugoslav Republic of Macedonia, amounting to more than 4 per cent of GDP per year. About one-fourth of the households are remittance receivers.

		All HH	Geographical distribution		Gender of head of household	
			Urban	Rural	Male	Female
Expenditure share (per cent)	Wheat/maize	1.7	0.8	4.3	1.7	1.8
	Rice	0.6	0.6	0.6	0.6	0.7
Self-consumption share (per cent)	Wheat/maize	0.1	0	0.4	0.1	0.1
	Rice	0	0	0	0	0

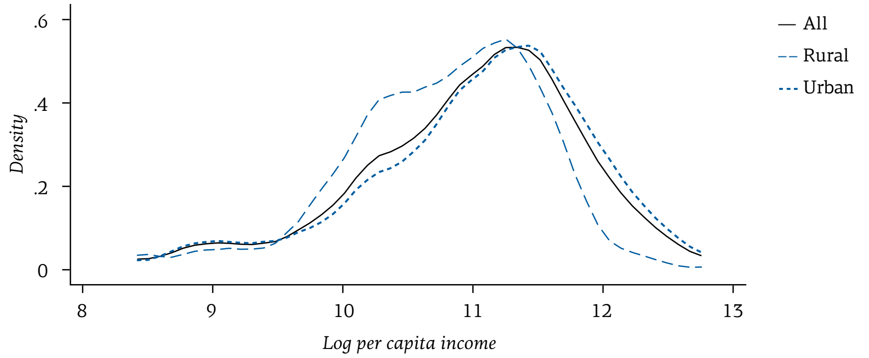
Source: Author's calculations, based on the 2011 HBS.
Note: HH stands for household, kg for kilogram; income per capita is measured in Macedonian denar (MKD).

The fourth and fifth columns of Table 2 show the geographical and gender distribution of crop quantities, and income and expenditure shares. At the outset, it is estimated that in the former Yugoslav Republic of Macedonia, about 90,000 households cultivate wheat and maize, and about 10,000 to 11,000 cultivate rice. Expectedly, urban households do not produce these crops (or they do so in a negligible amount); hence we will focus on rural households. Wheat and maize appear to be an important source of income for rural households – a rural household produces on average 3.5 metric tons of wheat and maize per year and earns about 21 per cent of its income from cultivation. About one-fifth of that amount is the average expenditure on wheat and maize per rural household, which is five times more than for urban households. Note that under expenditure on wheat and maize, we count both grains and bread produced, given an aggregation of household expenditures in the household survey. The figures nevertheless seem plausible because the share of bread in the consumption basket of rural households is higher due to rural households being poorer than urban households and to their continued tradition to bake bread domestically. Female-headed households produce one-third less wheat and maize than male-headed households, which underscores the role played by males in cultivating this crop (including the necessity to handle large machinery).

The importance of rice in both income and consumption of households in the former Yugoslav Republic of Macedonia is significantly lower than for wheat and maize. Rice is also almost exclusively produced in rural households: male-headed households are larger producers in absolute terms, but rice production has equal importance, in relative terms, for both male- and female-headed households. Likewise, both types of households are not different in their consumption of rice.

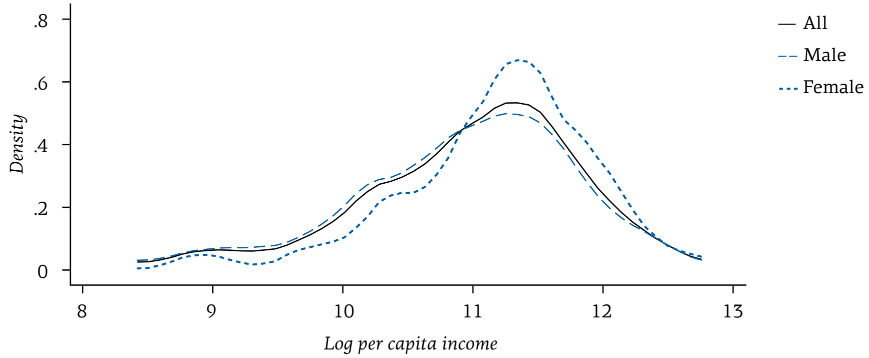
Nevertheless, the averages presented in Table 2 are likely insufficient to consider the distributional effects of potential price changes on the crops considered here. There are rich and poor households in both rural and urban regions and across male- and female-headed households. Production and consumption patterns are far from being independent of household resources. If it is true that wealthier households are those that produce crops for sale, while poor households hardly satisfy their own needs, then the direct effects of higher prices, while being potentially beneficial for the entire sector (especially the rural one), might as well worsen the income of poor households. Figures 4 and 5 show the estimates of the distribution of living standards across households by both geographical section and gender. The kernel-smoothing graphs illustrate the estimated density functions of the logarithm of household per capita income.[4]

Figure 4 Per capita income distribution by geographical section



Source: Author's estimations, based on the 2011 HBS.

Figure 5 Per capita income distribution by gender of household head



Source: Author's estimations, based on the 2011 HBS.

[4] We use the logarithm of the income per capita, as it is usually strongly positively skewed.

The figures show a difference between the wealth of urban and rural households, in favour of the former; although the difference may seem small, it is still important given the logarithmic scale. However, rural households in the middle of the distribution are wealthier than their urban counterparts and then extend into a long upper tail, suggesting that there are very rich households even within the rural sector. Conversely, the contingent of wealthy urban households is quite pronounced. Figure 5 suggests that female-headed households are more "equal" in terms of income than male-headed households. Male-headed households are more likely to be observed in both the poor and the rich tails of the income distribution.

Considering (a) the importance of wheat and maize for households in the former Yugoslav Republic of Macedonia, (b) the price spike since 2006, (c) the implementation of government subsidies, and (d) the diversity of households in terms of wealth, the discussion above highlights the importance of evaluating the effects of increasing prices and agricultural subsidies on the welfare of households. This will be the aim of our analysis.

3 Literature review

Recent spikes in global food prices have sparked a new strand of literature to investigate their effects on poverty. For instance, using household level information for selected low-income countries, Ivanic and Martin (2008) find that the share of the population living below the poverty line has increased as a result of higher food prices in eight of the nine countries included in their study. Similarly, de Hoyos and Medvedev (2011) provide a formal assessment of the implications of higher prices for global poverty using a representative sample of 63 to 93 per cent of the population of the developing world. Their study finds an increase in extreme poverty[5] headcount at the global level of 1.7 percentage points, albeit ranging from negligible in Eastern Europe to considerably large in sub-Saharan Africa. A similar magnitude of poverty increase due to price hikes is found by Wodon *et al.* (2008) in sub-Saharan Africa.

An also recent study by Aksoy and Isik-Dikmelik (2008) however challenges the idea that higher food prices unambiguously deteriorate the income of the poor. Using household survey data from nine low-income countries, the study finds that net sellers are disproportionately represented among

[5] Extreme poverty refers to a condition that is characterized by severe deprivation of basic human needs, including food, safe drinking water, sanitation facilities, health, shelter, education and information. It depends not only on income but also on access to services.

the poor, hence an increase in food prices could transfer income from richer to poorer households. However, many other studies (e.g. Poulton *et al.*, 2006; Christiaensen and Demery, 2007) argue that the rural poor are more frequently net buyers and thus a price increase exerts a negative impact on them. Consequently, although studies tend to find that higher food prices have a negative impact on the poor, the relationship is neither unique nor universal, but depends on the specific context (Hertel and Winters, 2006). Earlier studies (e.g. Deaton, 1989a; Ravallion, 1990; Ravallion and van de Walle, 1991; Friedman and Levinsohn, 2002), other than offering contribution to the methodological approach to this issue, examine similar issues and provide specific policy recommendations for specific countries.

In contrast to this discussion, the effect of agricultural subsidies – as a potentially countervailing programme to rising food prices[6] – on household welfare and poverty remains largely unexamined. Only Wodon and Zaman (2010) discuss agricultural subsidies as a policy to counter the effects of rising food prices, but no estimates have been provided in this context. The present study therefore builds on these grounds. It will estimate the welfare effect of changes in crop prices and propose a redesign of government subsidies to improve their effect on alleviating poverty in the former Yugoslav Republic of Macedonia.

4 Methodology and data

4.1 Methodology

The analysis of the distributional impact of price increases follows a methodology outlined by Singh *et al.* (1986) and Deaton (1989a, 1997), and subsequently widely applied (Barrett and Dorosh, 1996; Budd, 1993; Ivanic and Martin, 2008; Wodon *et al.*, 2008; Klytchnikova and Diop, 2010). The argument made is that the non-parametric techniques in Deaton's methodology do not impose any structure on the data and hence make full use of the information available. Deaton's framework can be summarized as follows. The change in welfare following a change in prices for a household is:

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[6] We should note here that for a country that imports food and is a price taker on world markets, such as the former Yugoslav Republic of Macedonia, a consumption subsidy would countervail increasing food prices by lowering the domestic price of consumed food. However, a production subsidy – the one analysed here – would further increase domestic food prices. Therefore, interpretation of our findings should be made with caution from this viewpoint.

$$\Delta w_{ij} = \sum_{j=1}^{n} \Delta p_j \left[(prod_{ij} - cons_{ij}) + \eta_j L_i \right] \tag{1}$$

where Δw_{ij} is the welfare effect expressed in percentage terms of the initial consumption level of household i for good j, Δp_j is the percentage change in prices for each good considered (category by category), $prod_{ij}$ is the income share coming from production of good j (household sales of item j divided by total income), $cons_{ij}$ is the expenditure share of good j (household consumption of item j divided by total consumption), η_j is the wage rate elasticity with respect to changes in prices of good j, and L_i is the labour share in household income.

Our analysis proceeds as follows. We use non-parametric techniques to estimate the production, consumption and labour income effects of the observed price changes over 2006–2012. We disentangle the effects on households by geographical distribution and gender to be able to judge which target group, which part of the income distribution and which specific food crop commodity may benefit the most from agricultural subsidies.

Once we identify these groups, we conduct a simulation of the effect of subsidies using equation (1). Based on the findings, we propose a scheme for disbursement of the proposed amount of agricultural subsidies for 2012, i.e. we direct the funds to specific groups of households instead of them being disbursed linearly to everyone. We then evaluate the welfare effects of this alternative subsidy scheme.

To undertake the analysis, we need information on household production, consumption and sales of the above agricultural products. For conducting the proposed research, the Household Budget Survey of the former Yugoslav Republic of Macedonia in 2011 is used. In addition to the usual demographic and labour market data, the HBS contains data on production and consumption of the above-mentioned food crops. A disadvantage, however, is that the HBS reports those parameters for wheat and maize grains together. With rice, this gives two categories of food commodities to be analysed in this study.

4.2 Simulation

The HBS does not contain data for subsidies. We therefore analyse the impact of the existing scheme by applying the prevailing rules for subsidy disbursement. To evaluate the current scheme, which is based on lump sums per cultivated hectare and not per produced kilogram, we need to assume a certain production of the food crop per hectare. For this, we will use the average kilogram per hectare ratio for cereals of 3,373 metric tons per hectare in the former Yugoslav Republic of Macedonia obtained from the Ministry of Agriculture, Forestry and Water Management. We will then base the simulation on the transformation of kilograms into hectares.

Table 3 Conversion rates for crop subsidies, averages for 2006–2009

Subsidy rules per hectare	Subsidy rules per kilogram
EUR 150 per ha up to 10 ha	4.45 cents per kg up to 10 ha
EUR 90 per ha for 10–50 ha	2.67 cents per kg for 10–50 ha
EUR 45 per ha for 50–100 ha	1.33 cents per kg for 50–100 ha
EUR 15 per ha for above 100 ha	0.44 cents per kg for above 100 ha

Source: Author's calculations, based on Ministry of Agriculture, Forestry and Water Management.
Note: The conversion follows these steps: First, we observe kilograms produced by a household; second, we use the conversion of 3,373 metric tons per hectare to find the plot size that a household owns; and third, based on this information, we compute the subsidy a household receives.

The simulation should make some assumptions with respect to the change in production due to subsidies. However, we should be cautious in this regard, as the stylized facts of Section 2 suggest that despite both price increases and government subsidies, crop production in the former Yugoslav Republic of Macedonia stagnated or continued to fall. As further support to this claim, Table 4 presents simple tests for structural breaks in the annual time series (1992–2012) for the nationwide quantity produced of wheat, maize and rice. If the subsidy had a bearing on production, one would expect to detect a structural shift after the implementation of the subsidy programme. The figures shown are the t-statistics for the significance of the potential shift in production when subsidies were introduced.[7] The test does not claim that the potential shift has happened due to the introduction of subsidies only, but simply tests whether a shift has occurred. We consider three different years to capture lagged effects of the 2006 subsidy programme on production. Results suggest that a structural shift in the production cannot be claimed, as all t-statistics are within the "insignificance" range of between –1.96 and 1.96 for the 5 per cent significance level.

[7] In essence, we regress the production on a constant term and a dummy variable for a shift in any of the three years (2006, 2007 and 2008).

Table 4 Testing for structural breaks in production around the introduction of subsidies

	t-statistics		
	Wheat	Maize	Rice
2006	–0.6958	–0.0343	0.1502
2007	–1.3325	–1.4196	0.1532
2008	1.3015	0.4073	0.0855

Source: Author's estimations, based on FAO statistics.

Table 5 investigates the issue further. It portrays a simple regression of total cereal production on subsidies to check the magnitude with which they potentially affect production. The regression also includes prices, as these are expected to drag production up, and the log of income, so as to capture any general economic trends that may affect production (such as the ongoing crisis). We use annual time-series data over 2003–2012 collected from FAO statistics, the Ministry of Agriculture, Forestry and Water Management, and the State Statistical Office. We present results from an ordinary least squares (OLS) estimator, as well as from a generalized method of moments (GMM) estimator, which take into account potential endogeneity of variables (for instance, subsidies may lead to increased production, but more production will trigger a larger amount of subsidies to be paid out). However, all coefficients are insignificant, suggesting that in the case of the former Yugoslav Republic of Macedonia, subsidies (not increasing prices) are not correlated with increased production, which is fully in line with what we observe in Figure 1.

Table 5 Reaction of production to subsidies

	OLS	GMM§
Log of income	1.18	1.34
Log of subsidies	–0.24	–0.24
Prices	–0.24	–0.53
Constant	0.59	–

Source: Author's estimations.
Note: None of the estimated parameters are found to be significant at the 10 per cent level.
§ means that two lags of the independent variables are used as instruments.

For the analysis, we also need data on wages and total income of households. The HBS provides data on all sources of income in households, so the share of labour income in the total income is readily available. The price pass-through and the wage-price elasticity with respect to prices are obtained as follows.

4.3 Price pass-through

In the analysis we need some guidance on calculating the magnitude of the pass-through of international to domestic prices. This is essential in the analysis as the Ministry of Agriculture, Forestry and Water Management exerts limited control over price changes through mediating negotiations between purchasers and producers, so that excessive movements of prices in either direction are somehow smoothed.[8] To support this, we run a regression of the domestic price index of cereals on the international price index for each quarter in 2005–2011 (Table 6). Data are obtained from the Ministry of Agriculture, Forestry and Water Management and FAO statistics. The result is a pass-through estimate of 0.42, which supports our claim regarding the variance smoothing likely exerted by the Ministry of Agriculture, Forestry and Water Management. Hence, we rely on this figure in the further analysis.

Table 6 Reaction of domestic to international prices

	Dependent variable: Domestic prices
	OLS
International prices	0.42***
R-square	0.81

Source: Author's estimations.
*Note: *, ** and *** denote statistical significance at the 10, 5 and 1 per cent level, respectively. Both series have been de-seasoned and de-trended. These procedures boil down to regressing the variable on a constant, a trend and seasonal dummies. The residual of such regression is the de-trended/de-seasoned variable. As the procedure includes a constant, the constant does not appear in this model. Estimates are robust to arbitrary heteroskedasticity and autocorrelation.*

4.4 Wage-price elasticity

We estimate the wage-price elasticity (η in equation (1)) from aggregate wages and economy-wide price time-series index (consumer price index, CPI) obtained from the State Statistical Office of the former Yugoslav Republic of Macedonia (both expressed as indices). The latter is available on a quarterly basis for 1997–2012, which gives sufficient observations for a credible econometric analysis.[9]

[8] For example, the process of negotiations in 2013 is explained here: *http://republika.mk/?p=93101* (in Macedonian).

[9] Although estimates for the two goods instead of the entire consumption basket may be desirable and may give the analysis further credibility, the relevant series for the former Yugoslav Republic of Macedonia were available to the author only at the annual level for 2006–2012, which is insufficient for a credible estimation of the elasticities.

Table 7 presents the results: OLS results in column (1), and GMM results in column (2). Note that because both wages and prices contained a trend, we work with the de-trended series. The trend may be the result of a third variable, the most prominent being economic growth. The risk of a bias arising from the omission of an important variable in the model is thus reduced. The OLS estimate suggests that a 1 percentage point increase in prices results in a 0.64 percentage point increase in wages.

Table 7 Wage-price elasticity

	(1) OLS	(2) GMM
Prices	0.641***	0.626**
Observations	64	60
R-square	0.105	0.069
Underidentification test (p-value)	-	0.0000
H_0: The model is underidentified		
Weak identification test (Kleibergen-Paap rk Wald F statistic) H_0: The model is weakly identified	-	40.18***
Hansen J test (p-value) H_0: Instruments are valid	-	0.2452

Source: Author's estimations.
*Note: *, ** and *** denote statistical significance at the 10.5 and 1 per cent level. Series have been de-seasoned and de-trended. These procedures boil down to regressing the variable on a constant, a trend and seasonal dummies. The residual of such regression is the de-trended/de-seasoned variable. As the procedure includes a constant, the constant does not appear in this model. Estimates are robust to arbitrary heteroskedasticity and autocorrelation of order one. The GMM estimation uses a set of lagged prices (four periods) to correct for potential endogeneity.*

However, one may argue that these results may still suffer endogeneity bias stemming from simultaneity.[10] In other words, the coefficient on prices may reflect the positive effect that increasing prices exert on wages, but also the rising pressure on prices, which may be exerted by rising wages. Hence, we need an instrumental-variable (IV) estimator to tackle all potential sources of endogeneity. Column (2) reflects the model with a GMM estimator (see e.g. Baltagi, 2008); the model is well specified according to the respective tests. The coefficient on prices, though, does not differentiate more than the OLS estimate: a 1 percentage point increase in prices results in an increase in wages of 0.626 percentage point, on average and other things being equal. The finding is sensible and in line with the findings and discussion in Jovanovic and Petreski (2012) for price-wage elasticities in transition economies. Therefore, in the analysis, we use this estimated wage-price elasticity.

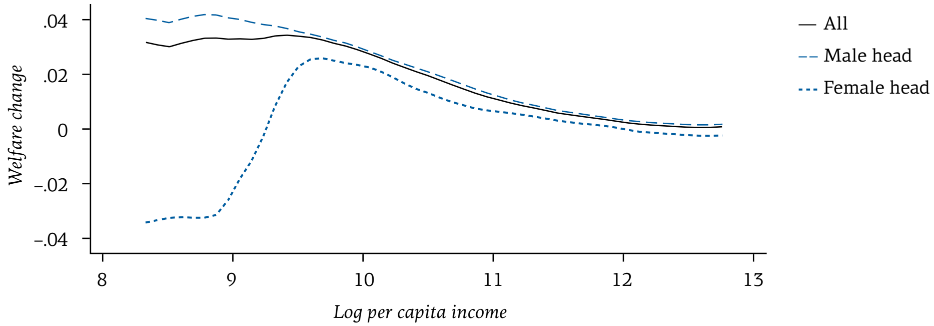
5 Findings and discussion

This section presents the results of the analysis. Results are analysed and discussed in the following order: First, we present the welfare effects of the rising prices of wheat, maize and rice; second, we show the welfare effects of government subsidies for these crops; and third, we describe the welfare results of a new proposed scheme for subsidy disbursement, which potentially increases the overall welfare and shields the vulnerable groups of households. Note that the sections visualize only the overall result decomposed into rural/urban and male-/female-headed households; the particular components of the welfare function are shown in Annexes 1 and 2.

5.1 Welfare effects of rising prices

The welfare change in terms of share of household income due to the observed price change of wheat and maize between 2006 and 2011 at each point of the income distribution is estimated and plotted in Figures 6, 7 and 8 – the first refers to all households, and the next two refer to urban and rural households, respectively. Note that the respective price changes over this period for wheat-maize and rice are 102.5 per cent and 81.8 per cent, not considering the international-domestic price pass-through. The price change results in a positive welfare change for all households over the income distribution. However, when disaggregated according to gender, results suggest that male-headed households are better off and poor female-headed households are worse off.

Figure 6 Welfare change for all households due to increasing prices – Wheat and maize

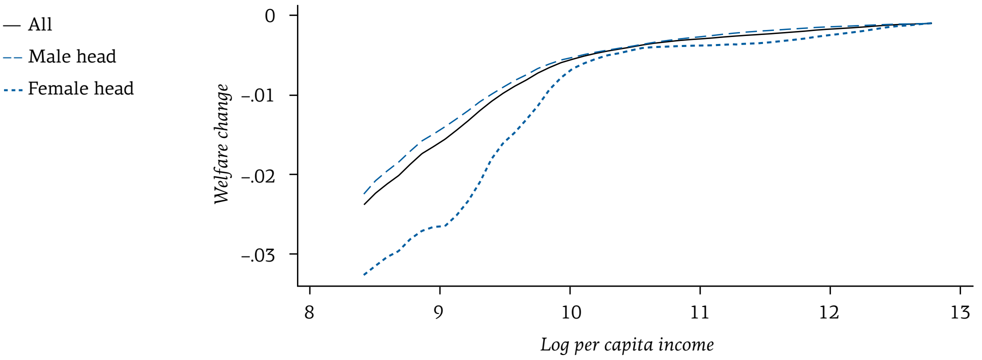


Source: Author's estimations, based on the 2011 HBS.

10 Endogeneity bias may arise because of an omitted variable, measurement error and simultaneity. See further explanations in Wooldridge (2002). OLS estimates in this study have the omitted variable bias to an extent reduced by using de-trended series. However, the overall endogeneity may be addressed only by an IV estimator as is GMM.

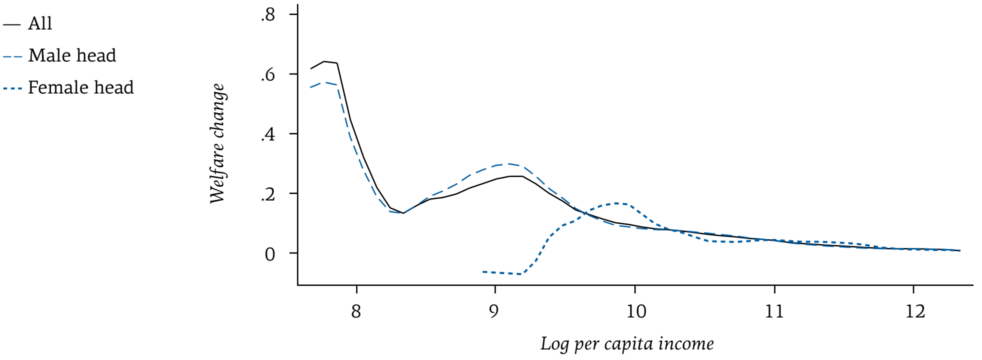
However, a more detailed look is worth considering. The disaggregation between urban and rural households is essential, because as we have seen in Section 2, urban households in the former Yugoslav Republic of Macedonia do not produce wheat and maize or do so negligibly. The result is expectedly an overall negative welfare effect of increasing prices on those households – the effect being more pronounced on female-headed urban households (Figure 7). In contrast, the overall welfare effect on rural households is positive (Figure 8) – the effect being negative only on female-headed rural households in the negligible fourth percentile of the income distribution.

Figure 7 Welfare change for urban households due to increasing prices – Wheat and maize



Source: Author's estimations, based on the 2011 HBS.

Figure 8 Welfare change for rural households due to increasing prices – Wheat and maize



Source: Author's estimations, based on the 2011 HBS.

A closer look at the drivers of these results in Annex 1 suggests the usual Engel's Law, or its wheat-maize equivalent – that, on average, the share of budget spent on wheat and maize declines as the living standard rises. It is also clear that female-headed households spend more on wheat-maize in the left part of the income distribution. However, while urban households have virtually no income from wheat-maize (no production), rural households earn part of their income from this type of agricultural production, the share being larger for the poorer male-headed households. Female-headed poor households, interestingly, have a low income share from wheat-maize, which is likely due to the task of cultivating wheat and maize being perceived as a male job (due to the difficulty of cultivation and the necessity to handle large machinery). This fact then drives the negative welfare effect of the price change on poor female-headed rural households. It is worth mentioning that the labour income share in total budget increases with the level of income of the household but it occurs at a faster pace for urban households.

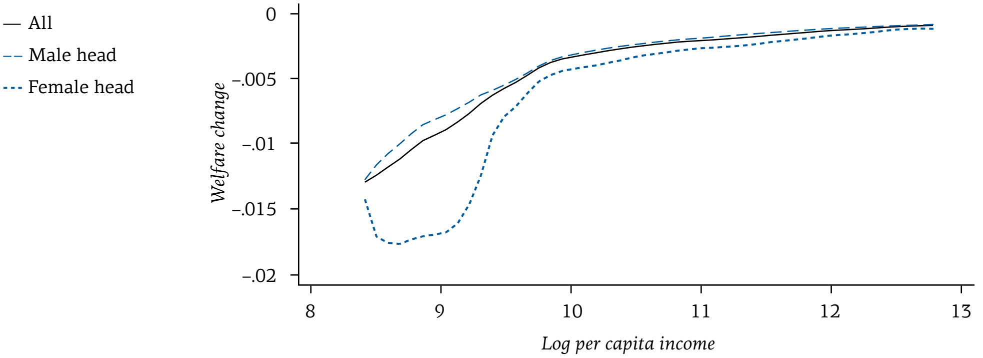
The welfare change in terms of share of household income due to the observed price change of rice between 2006 and 2011 at each point of the income distribution is estimated and plotted in Figures 9, 10 and 11 – the first refers to all households, and the next two refer to urban and rural households, respectively. The price change results in a negative welfare effect on all female-headed households over the income distribution and on poor male-headed households.

Figure 9 Welfare change for all households due to increasing prices – Rice

Source: Author's estimations, based on the 2011 HBS.

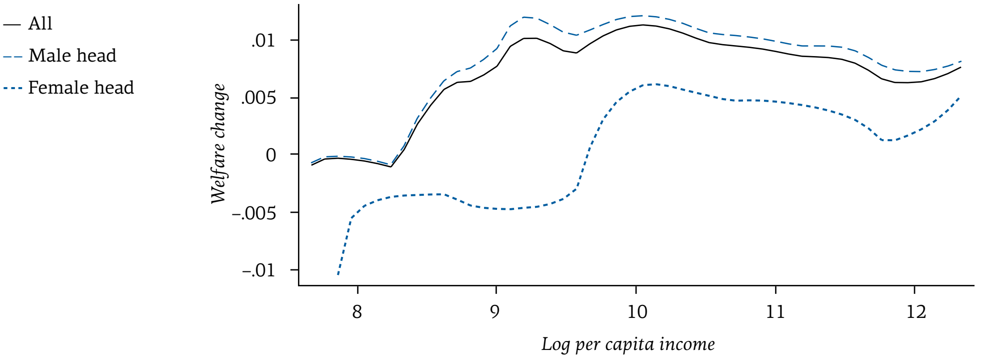
A more detailed look suggests that urban households are negatively affected by the price increase along the entire income distribution. This is expected, given that they do not produce rice, or do so negligibly. The result for rural households is mixed. Overall, only the poorest male-headed households are slightly negatively affected and a small part of female-headed households (only about 6 per cent) on the left of the income distribution also shows a negative welfare change.

Figure 10 Welfare change for urban households due to increasing prices – Rice



Source: Author's estimations, based on the 2011 HBS.

Figure 11 Welfare change for rural households due to increasing prices – Rice



Source: Author's estimations, based on the 2011 HBS.

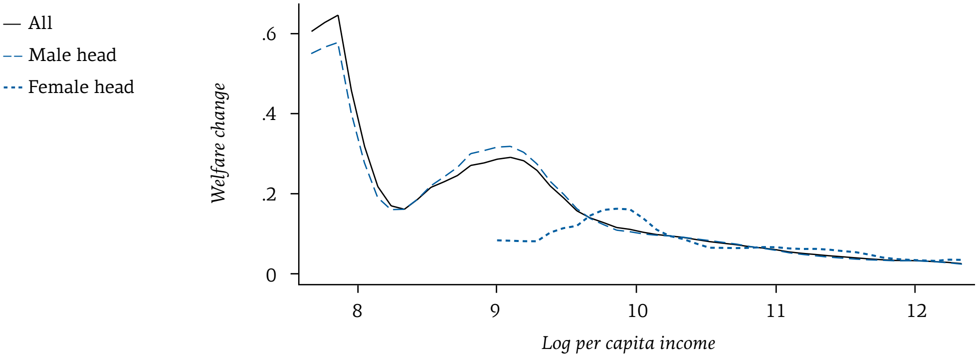
The drivers of those results may be seen in Annex 2. Again, we observe Engel's Law – rice consumption share declines as the living standard increases – and the decline is expectedly steeper for the female-headed urban households. Surprisingly, the rice consumption share is pronounced only for middle-income female-headed rural households and not for the poorest ones, which may suggest that the latter still compensate the need for rice consumption with some other cheaper crop. This group of households also does not cultivate rice; the cultivation is mostly spread over the left of the middle of the income distribution for female-headed rural households, but also for male-headed rural households. However, given the dominance of the labour income share, the welfare effect is positive on both urban and rural households in 2006 and 2011, with the exception of the poorest female-headed households. Hence, the finding with regard to the poorest female-headed households drives the negative welfare effect on these households when prices of rice increase.

5.2 Welfare effects of the introduction of government subsidies

Figures 12 and 13 estimate the welfare change due to government subsidies for the food crops discussed here. The conversion rates presented in Table 3 are used to disburse subsidies in the current scheme. The welfare function is then re-estimated by considering the income from subsidies within the production income. Note that because currently only rural households have an agricultural production, these households are the target of the current agricultural subsidy programme. Hence, the graphs present the results only for the rural households. Also note that this simulation implicitly assumes that the subsidy is completely passed-through to recipient prices and it does not affect market prices. The effect of the agricultural subsidy programme on wheat and maize may be considered important, because it reaches up to 60 per cent of total income for the poor male-headed rural households (although they account for only about 2 per cent of all households). The share then falls to 20–30 per cent for male-headed households up to about the fifth percentile of the income distribution and subsides to zero afterwards. However, given that female-headed rural households were found not to be largely engaged in wheat-maize production (Section 5.1), the effect of the government subsidy is small (about 10 per cent) for the lowest percentiles: it rises to 15–18 per cent for the first decile and then subsides to zero.

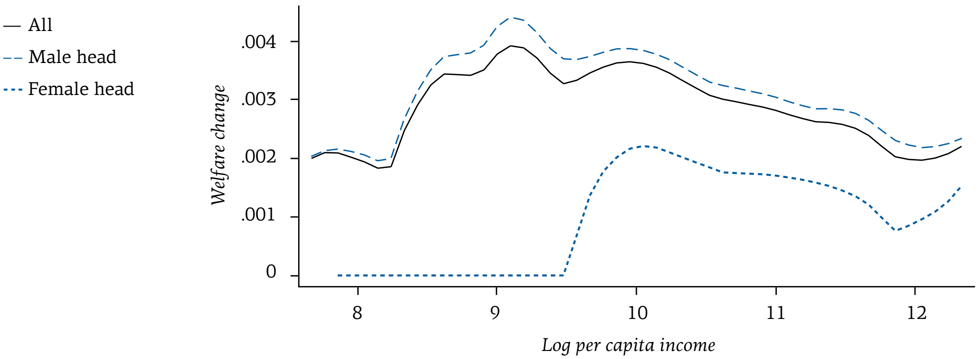
Figure 13 presents the welfare result of a government subsidy for rice and portrays a different picture. Given the smaller production of rice, the effect of the government subsidy is also small or negligible. This is mainly because both the poorest male- and female-headed rural households were found to be larger consumers than producers of rice, possibly suggesting that the subsidy is perceived as insufficient to cover the effort needed for the cultivation of rice.

Figure 12 Welfare change for rural households due to subsidies – Wheat and maize



Source: Author's estimations, based on the 2011 HBS.

Figure 13 Welfare change for rural households due to subsidies – Rice

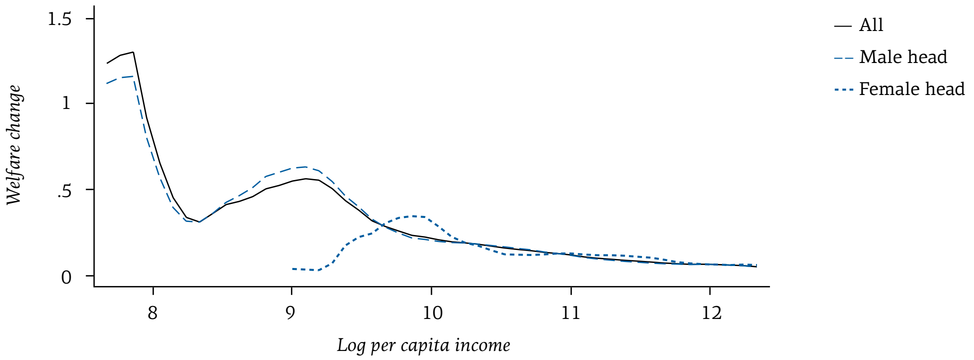


Source: Author's estimations, based on the 2011 HBS.
Note: There are very few observations in the zero-affected area.

Figures 14 and 15 combine the price and subsidy effect on the welfare of rural households. Apparently, both effects are positive for the male-headed rural households that produce wheat and maize (Figure 14). In fact, for the poorest households, the welfare more than doubles, whereas for those on the left of the income distribution – i.e. 15 per cent to 20 per cent of all male-headed households – it ranges from 30 per cent to 60 per cent of the initial income, which is also a significant positive change. However, female-headed rural households show a different effect: for those in the first decile, the effect is somewhat positive, but not as much as for the male-headed households. Note that because urban households do not produce wheat, the urban equivalent of Figure 14 is Figure 7.

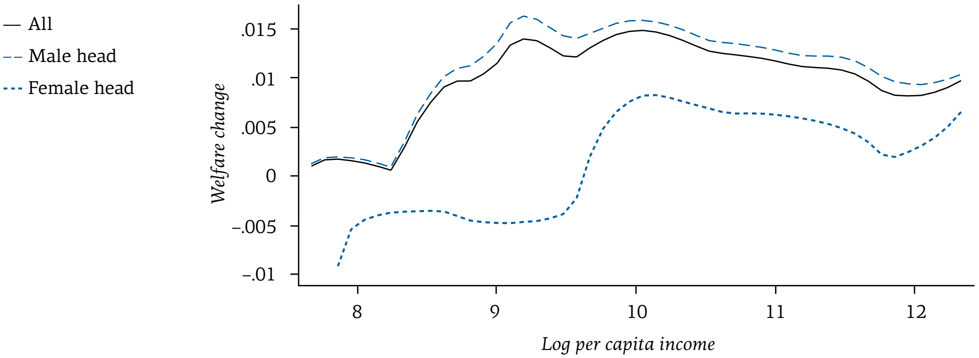
Figure 15 shows a positive welfare change due to increasing prices and government subsidies for male rice producers, and a negative welfare change for female rice producers (for about 10 per cent of total female rice producers), because increasing prices dominate and rice subsidies are rather small for the overall welfare effect to be significant. Note that because urban households do not produce rice either, the urban equivalent of Figure 15 is Figure 11.

Figure 14 Welfare change for rural households due to subsidies and prices – Wheat and maize



Source: Author's calculations, based on the 2011 HBS.

Figure 15 Welfare change for rural households due to subsidies and prices – Rice



Source: Author's calculations, based on the 2011 HBS.

Finally, Table 8 gives the share of the estimated amounts of wheat and rice subsidies in 2012 and compares them with the actual amounts. However, we are not able to make a comparison with the actual amounts for individual crops, as these figures are not available separately, but only as a cumulative amount for the entire plant-type production. Results of the simulation seem plausible: the government spends nearly one-third of the plant-type subsidies for the production of wheat and maize, while the amount disbursed for rice production is negligible, namely 1.2 per cent.

Table 8 Actual versus simulated subsidies

	Actual subsidies for all plant-type production	**Estimated subsidies for wheat-maize production**	**Estimated subsidies for rice production**
Subsidies (EUR)	56,800,000	16,926,400	681,600
Share in all plant-type production subsidies (per cent)	-	29.8	1.2

Source: Author's calculations and Ministry of Agriculture, Forestry and Water Management.

5.3 New scheme for subsidy disbursement

The above analysis offers several lines of thought with regard to a possible modification of the current scheme of agricultural subsidies for wheat-maize and rice, in particular:

- The poorest female-headed rural households should be targeted more intensively to encourage them to produce wheat and maize, especially because of the large effect that production may have on the welfare of this group along income distribution.

- All rice producers should be targeted with possibly larger subsidies per cultivated hectare and with a more intensive targeting of the poorest households.

- Poorest urban households (largely defined as those in the first two quintiles of the income distribution) should also be a target of the programme for wheat and maize (rice production being rather specific due to the difficulty of the production process and the climatic conditions it requires). The programme should target in particular the female-headed households, given the possibility to accompany it by a usufruct of state-owned land[11] and one-off subsidies for purchase of the minimum equipment for agricultural production. These instruments may attract urban dwellers, and particularly former rural-urban migrants, to get them involved in agricultural production.

Given these findings, we propose the following new scheme for subsidy disbursement, presented in Table 9.

Table 9 New proposed scheme for subsidy disbursement

Wheat/Maize	Rice
All households – Reduction of the subsidy to EUR 110 per ha	*All households* – Increase of the subsidy to EUR 250 per ha
Female-headed rural households with per capita income of less than EUR 220 – Increase of the subsidy to EUR 185 per ha	*Female-headed rural households with per capita income of less than EUR 360* – Increase of the subsidy to EUR 375 per ha
All urban households with per capita income of less than EUR 360 – Subsidy of EUR 100 per ha – State-owned land up to 1.15 ha at usufruct – Initial lump sums for investment into minimal machinery for agricultural production	*Male-headed rural households with per capita income of less than EUR 80* – Increase of the subsidy to EUR 375 per ha

Source: Author.

[11] According to the official numbers from the Ministry of Agriculture, Forestry and Water Management, about 48 per cent of the entire land in the former Yugoslav Republic of Macedonia is agricultural land (about one million ha). The state owns about 20 per cent – i.e. about 200,000 ha – of the arable land.

We will now present the welfare effects of the new scheme. Table 10 suggests that these effects have been drawn on the assumption that the government does not wish to change the overall amount devoted to subsidizing wheat-maize production, whereas that of rice production is assumed to double. The doubling, though, is mainly driven by the increased subsidy per cultivated hectare and only negligibly by the increased production, as this was something we could only assume with great caution. Note that increasing the subsidy for wheat-maize may require huge efforts by the government, whereas increasing the rice subsidy is a fairly small endeavour with potentially large welfare effects, especially on poor female-headed households, as we will see next. However, increasing the rice subsidy may trigger a problem – male-headed households may start to declare themselves as female-headed households to be eligible for the higher subsidy. While the government should find a mechanism to prevent such situations, this analysis assumes that it does not occur at all.

Table 10 Actual versus simulated subsidies after modification

	Actual subsidies for all plant-type production	**Estimated subsidies for wheat-maize production**	**Estimated subsidies for rice production**
Subsidies (EUR)	56,800,000	17,539,465	1,502,835
Share in all plant-type production subsidies (per cent)	–	30.8	2.6

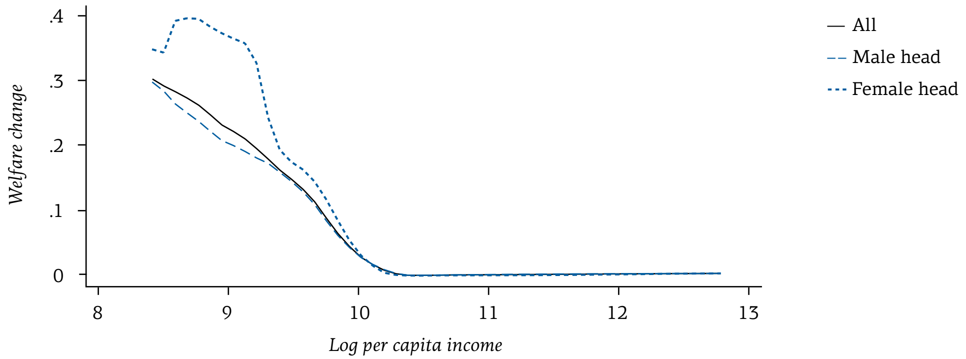
Sources: Author's calculations and Ministry of Agriculture, Forestry and Water Management.

Figures 16 and 17 present the results of the new subsidy scheme for wheat and maize for urban and rural households, respectively. Apparently, the new scheme produces a sizeable effect on the targeted urban households (Figure 16), as they are already poor and even a small "intervention" by the government would turn the welfare effect from significantly negative to significantly positive. However, although a large effort will be needed for an urban household to decide to engage in agricultural production, the graph shows that the benefits may be considerable and would unquestionably rescue these households from falling into destitute poverty, as their share of income from wages is already low. Note that poor urban households are most likely situated in smaller towns, where the connection with villages is still lively; this suggests that engaging in agriculture may still be a viable option for them. Agricultural experts suggest that while the initial one-off grant or subsidized loan of about EUR 3,000 may serve for the required initial investment, the harvest, which requires large machinery, may need to be outsourced. Such a grant scheme to be offered by the government is comparable with the current scheme for support of single-employee start-ups, and may be considered together.

Targeted female-headed rural households (Figure 17) may also reap large benefits but only if they decide for a larger-scale production. Namely, the graph assumes that these households would expand wheat-maize sown land from the present low amounts to at least an average of about 1.15 cultivated hectares. If this is the case, the poorest female-headed rural households may increase the welfare effect of the scheme from virtually zero to about two-thirds of the income of their male counterparts. However, this assumption is rather strong, given our findings that subsidies do not increase production, and should therefore be approached with considerable caution.

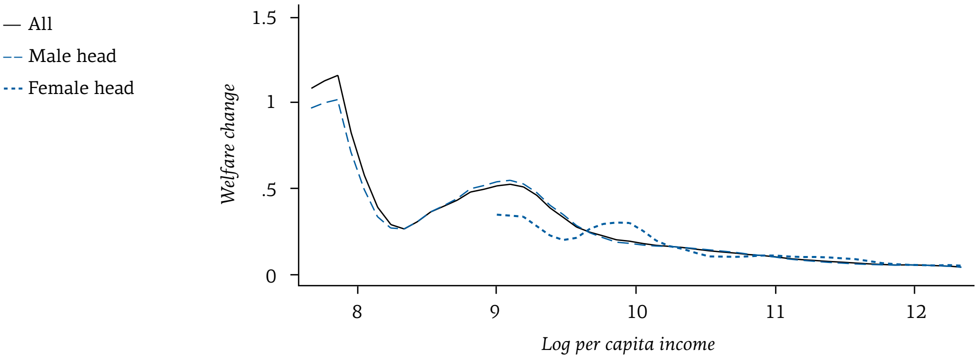
Although the current scheme does not likely have an effect on production, the new scheme we propose may start influencing production due to the provision of larger subsidies for specific households. In addition, one should bear in mind that the results are also conditional on resolving two important issues: (a) declaring the household as female-headed when it is actually male-headed to qualify for a higher subsidy; and (b) traditionally lower participation of women in production activities.

Figure 16 Welfare change for urban households after scheme modification – Wheat and maize



Source: Author's estimations.

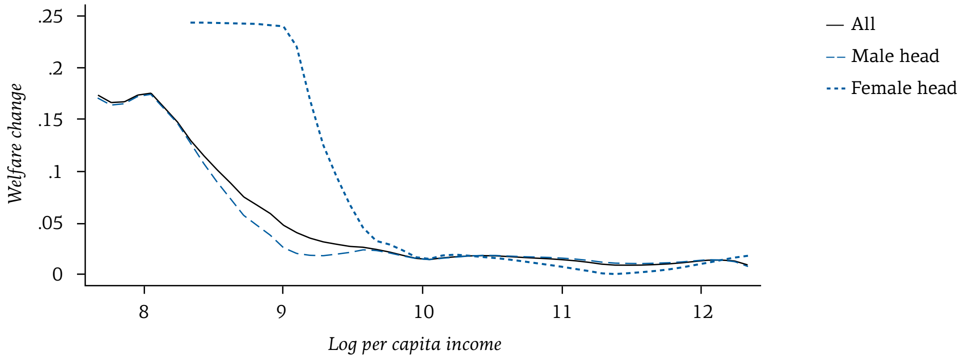
Figure 17 Welfare change for rural households after scheme modification – Wheat and maize



Source: Author's estimations.

Figure 18 presents the results of the new subsidy scheme for rice for rural households only. There are two important caveats with regard to the cultivation of rice and subsequently to the proposed scheme. First, although urban households were found to be negatively affected by the rice price increase, it is unlikely that they can be steered to produce rice even if offered free-of-charge state-owned land or additional subsidies for initial investment in machinery. This is due to the specificity of rice production. Second, the proposed scheme targets all rural households (producers and non-producers). This seems ambitious because rice production requires specific climate for production (specific regions of the country), in addition to the particularities of the production process (for instance, planting rice under water). From that viewpoint, the results presented in Figure 18 seem to overestimate the welfare impact of the new subsidy scheme. Unfortunately, we do not have the regional information in the survey that would allow us to target the regions known for rice production only. Still, the information obtained in Figure 18 is valuable, as it suggests that the effects of a well-targeted subsidy programme for rice may be sizeable, assuming that the considerably larger subsidy per hectare offered will motivate poor households that otherwise cultivate smaller plots of land to increase production. For the poor female-headed rural households, the overall welfare effect turns from slightly negative to significantly positive, and with a considerable share of rice income in overall income, due to the low initial income level.

Figure 18 Welfare change for rural households after scheme modification – Rice



Source: Author's estimations.

6 Conclusions and policy recommendations

The objective of this study was to analyse the welfare implications of rising prices of wheat, maize and rice and those of agricultural subsidies on household welfare in the former Yugoslav Republic of Macedonia. We used the 2011 Household Budget Survey data and non-parametric techniques to estimate these effects on household welfare along the segments of the income distribution.

Results suggest that increasing prices of wheat, maize and rice exerted positive welfare effects on male-headed rural households only, whereas the effects on female-headed rural households and all urban households were generally negative, largely due to the different production patterns. The welfare effect of the government subsidy programme for wheat and maize production was positive for all rural households: fairly large for male-headed households and small for female-headed rural households. The effect on rice production was zero or negligible, largely due to the small subsidy amount versus the large effort needed for the cultivation of rice. Overall, both price and subsidy effects were found positive only for the male-headed rural households.

Based on these findings, we evaluated a new disbursement scheme for government subsidies targeting female-headed rural households for both crops (wheat-maize and rice); all poor urban households for wheat; and male-headed rural households for rice. For the poor urban households, we also proposed the possibility of a usufruct of state-owned land and initial subsidy for investment in machinery; for the poor rural rice producers, we proposed an effort to steer non-producers to become engaged in production where possible, along with a larger subsidy per cultivated hectare. However, the simulation setup is largely based on re-distributional effects and only modestly on increased production effects, as we were unable to document that subsidies positively affected cereal production in the former Yugoslav Republic of Macedonia.

Results of the simulation suggest that targeting poor urban households for wheat-maize production could result in a significant welfare effect ranging up to 30–40 per cent of the initial income of this group of households. Targeting poor female-headed rural households may increase the impact of the scheme to about two-thirds of the income of poor male-headed rural households, preventing this vulnerable group from falling into destitute poverty. The effect on poor rural rice producers may also be large – up to 20 per cent of household income – taking into account that a considerable effort is however needed to start off rice production.

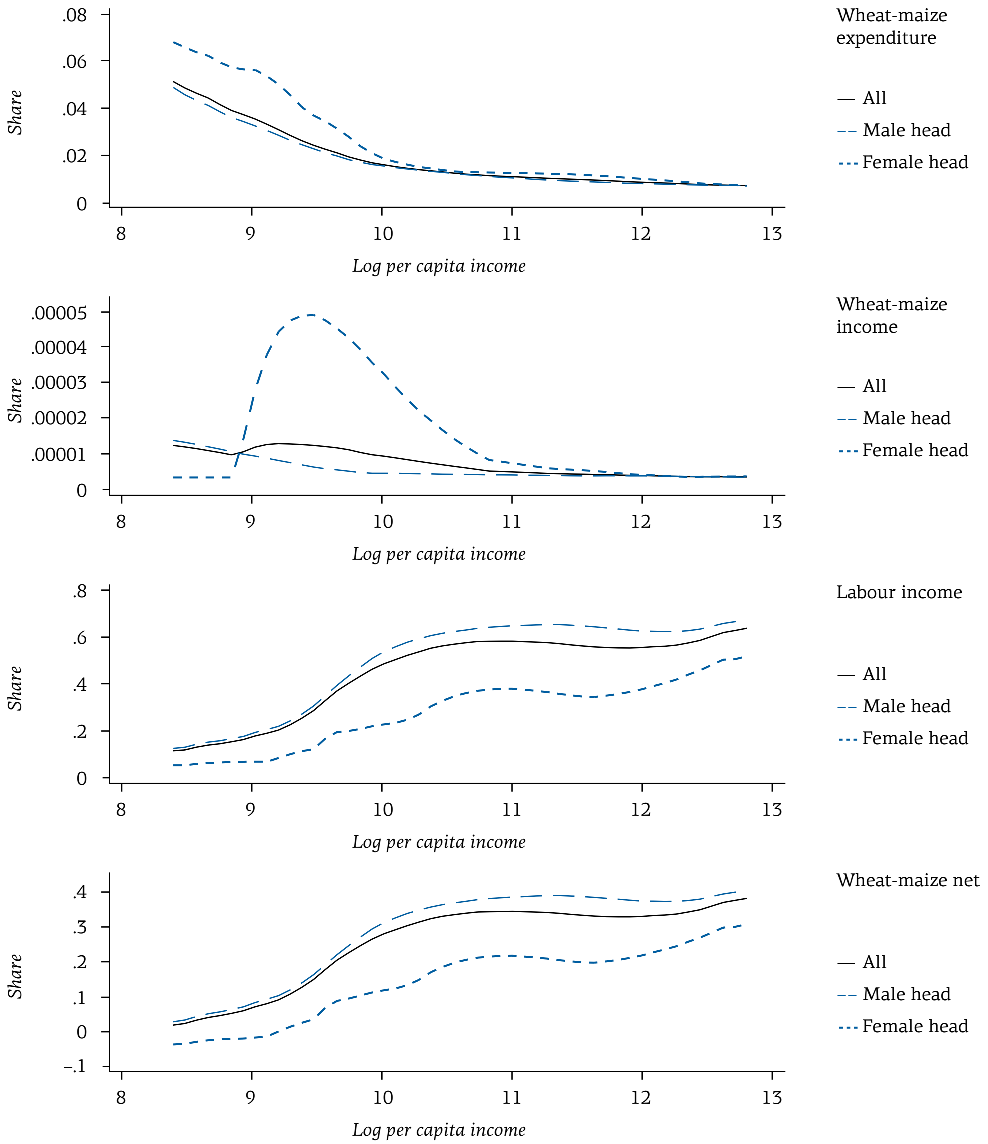
Hence, the policy recommendations stemming from this analysis dovetail to putting particular emphasis on poor female-headed rural households for both wheat-maize and rice production, increasing the subsidy for rice production due to its specificity and large effort needed, and offering the usufruct of state-owned land and start-off grants for poor urban households to encourage them to produce wheat and maize.

Although this analysis was motivated by the fact that the government uses subsidies to target the poor, it abstracts from discussing other more direct means to address poverty in the economy. Other policies would include social financial assistance schemes, in-work benefits, conditional cash transfers and the like. Even though the interplay of those policies with the agricultural subsidies programme may be interesting to analyse, it remains a topic for future research and discussion.

Annex

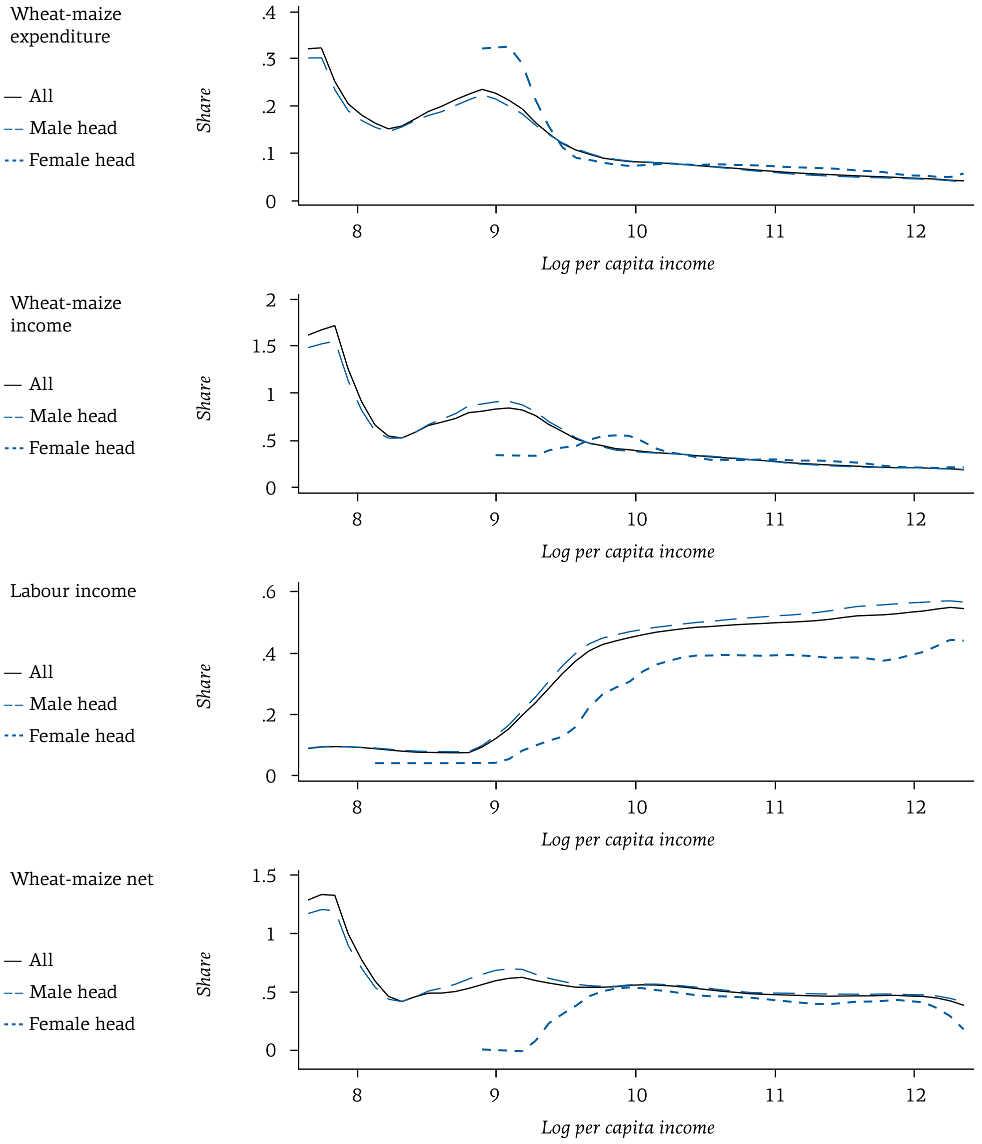
Annex 1: Detailed diagrams – Price change for wheat and maize

Figure A1.1 Components of the welfare function of urban households in 2006 – Wheat and maize



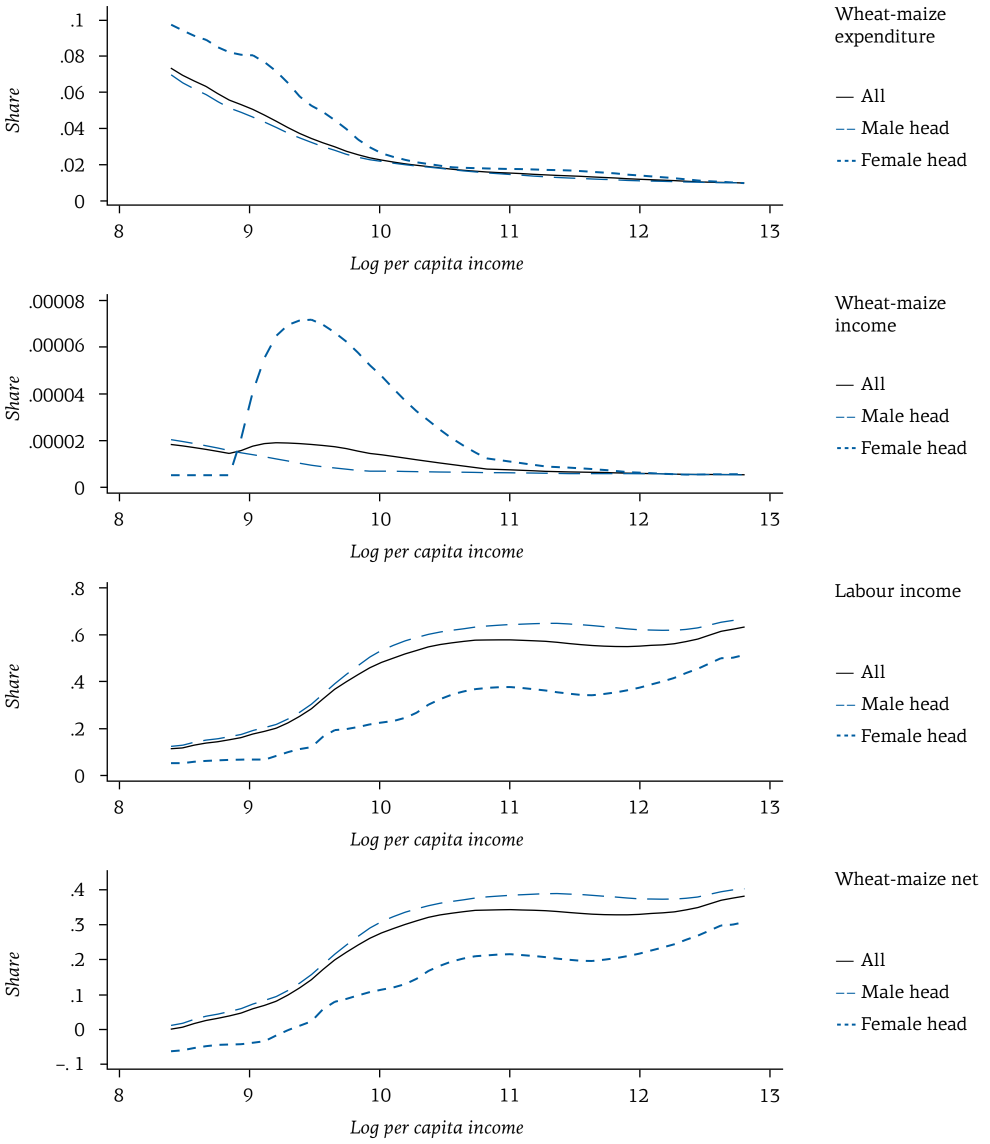
Source: Author's estimations, based on the 2011 HBS.

Figure A1.2 Components of the welfare function of rural households in 2006 – Wheat and maize



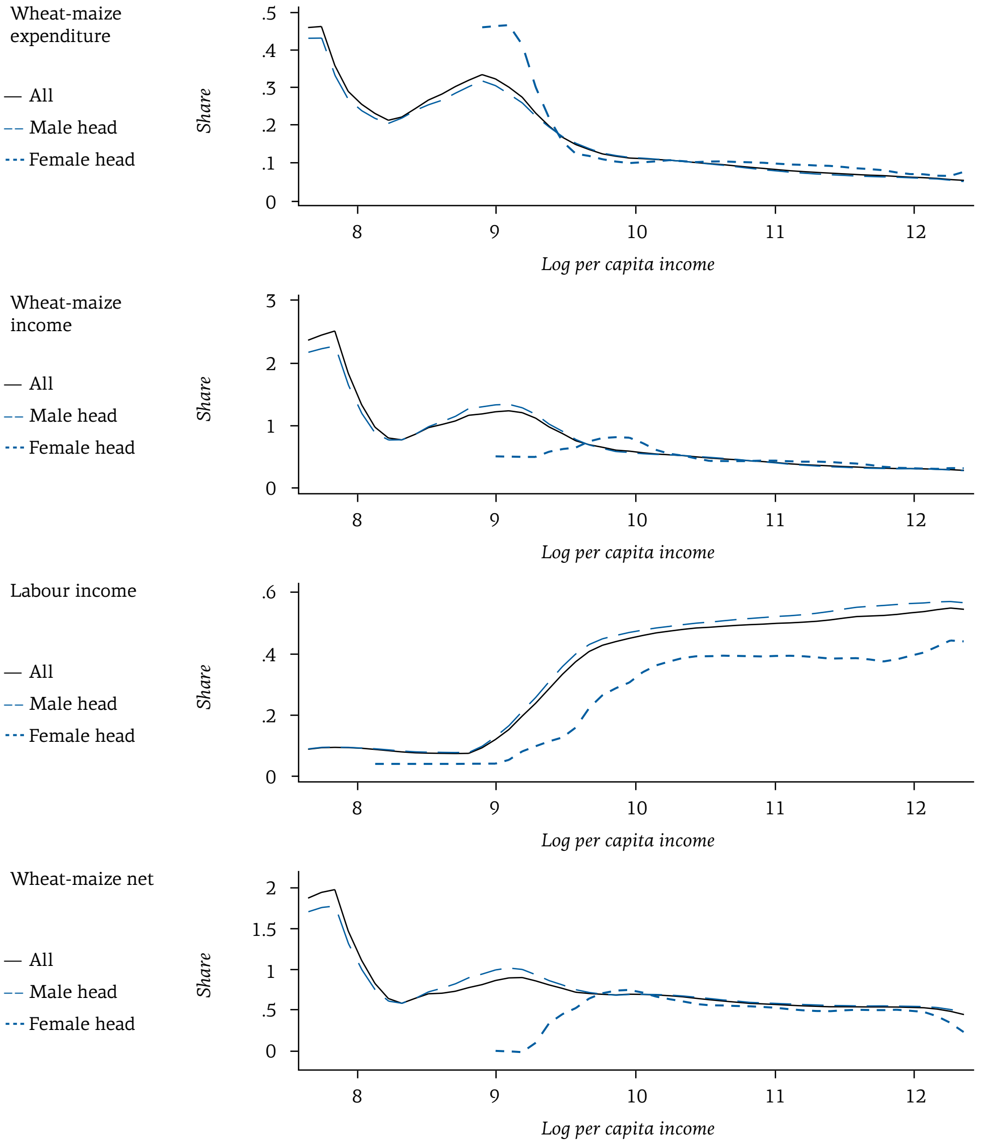
Source: Author's estimations, based on the 2011 HBS.

Figure A1.3 Components of the welfare function of urban households in 2012 – Wheat and maize



Source: Author's estimations, based on the 2011 HBS.

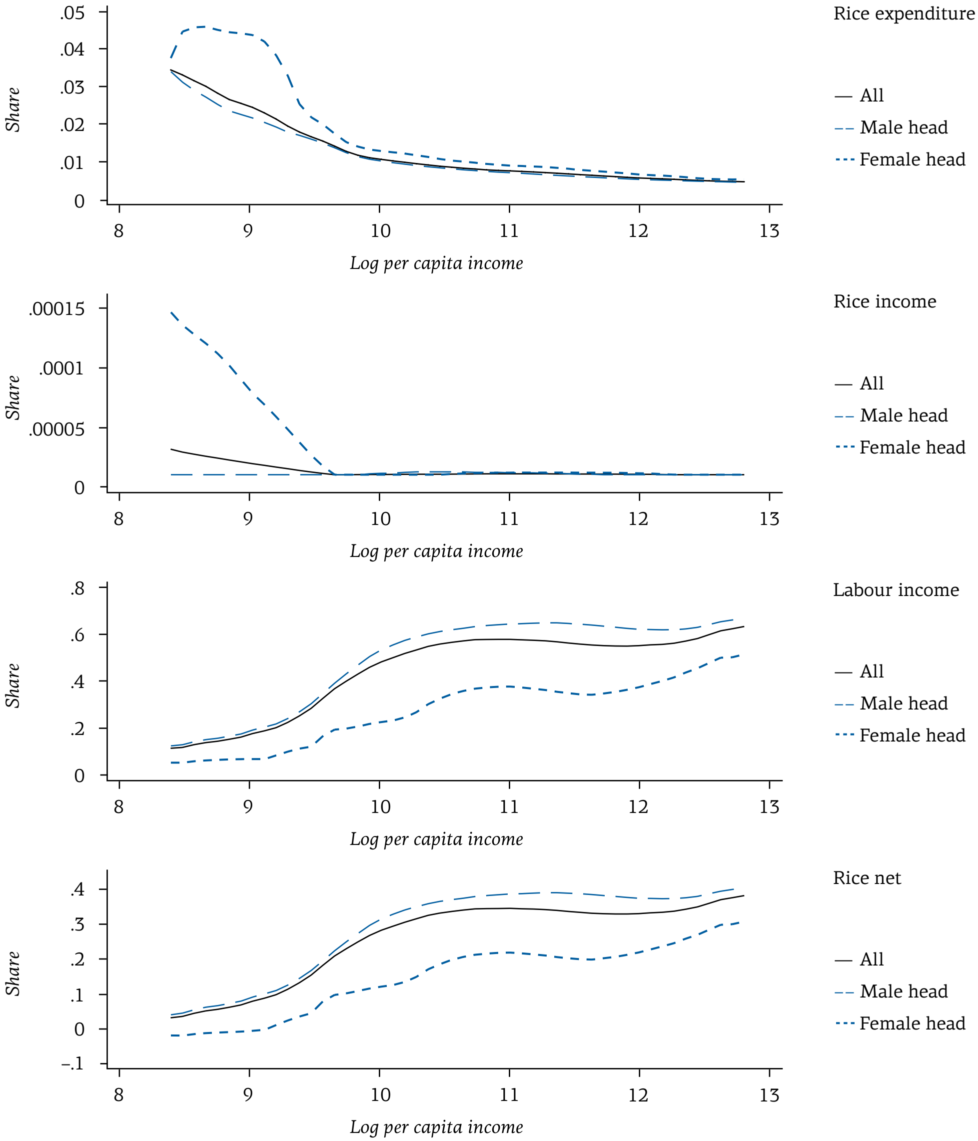
Figure A1.4 Components of the welfare function of rural households in 2012 – Wheat and maize



Source: Author's estimations, based on the 2011 HBS.

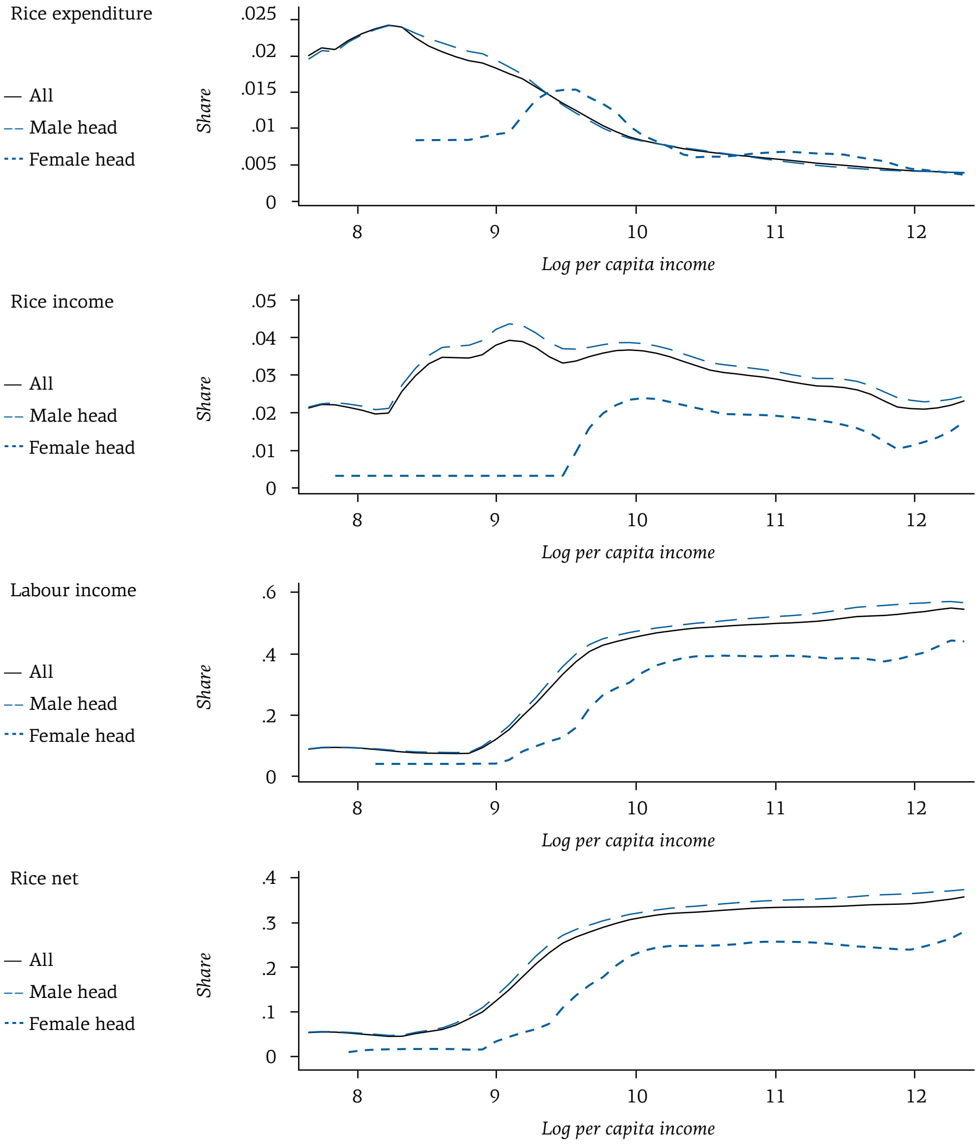
Annex 2: Detailed diagrams – Price change for rice

Figure A2.1 Components of the welfare function of urban households in 2006 – Rice



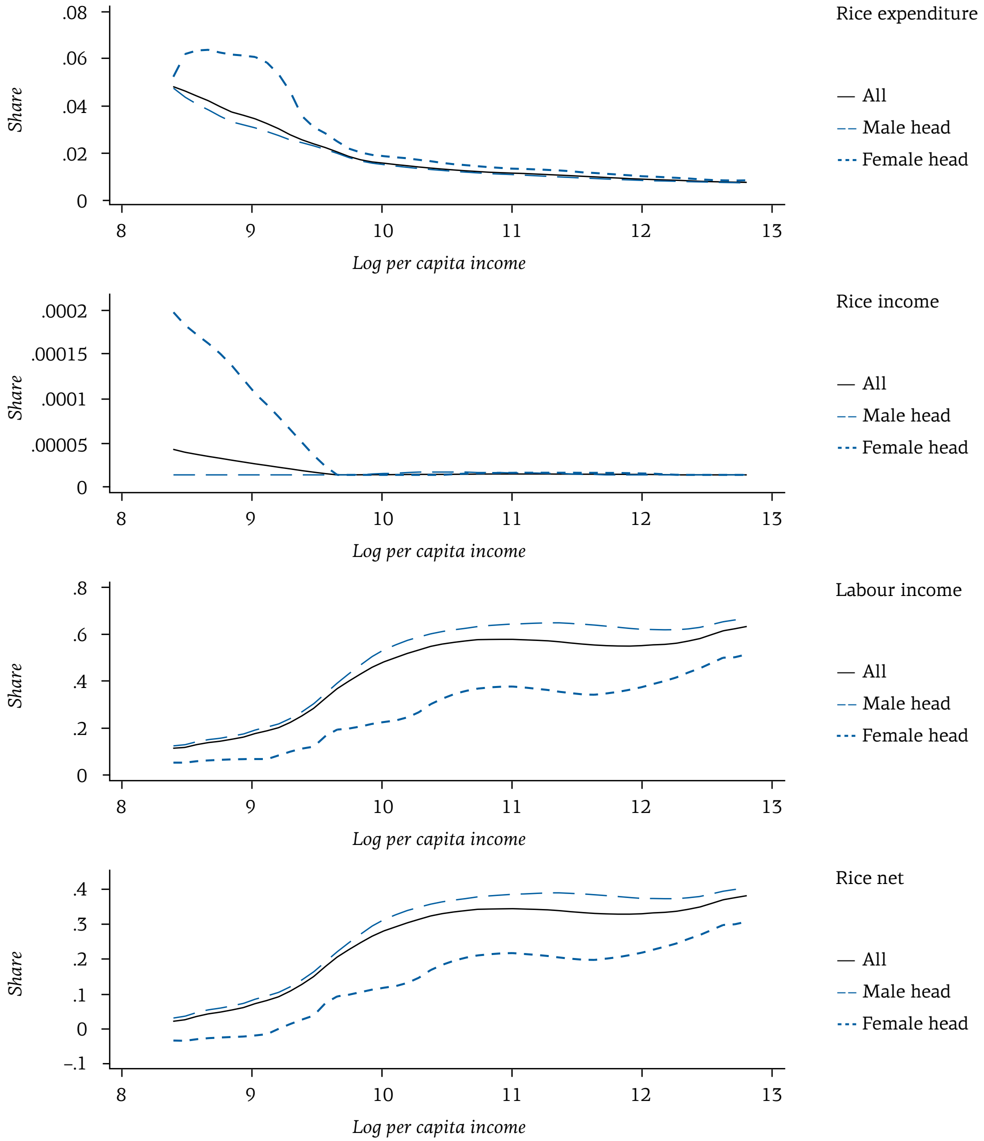
Source: Author's estimations, based on the 2011 HBS.

Figure A2.2 Components of the welfare function of rural households in 2006 – Rice



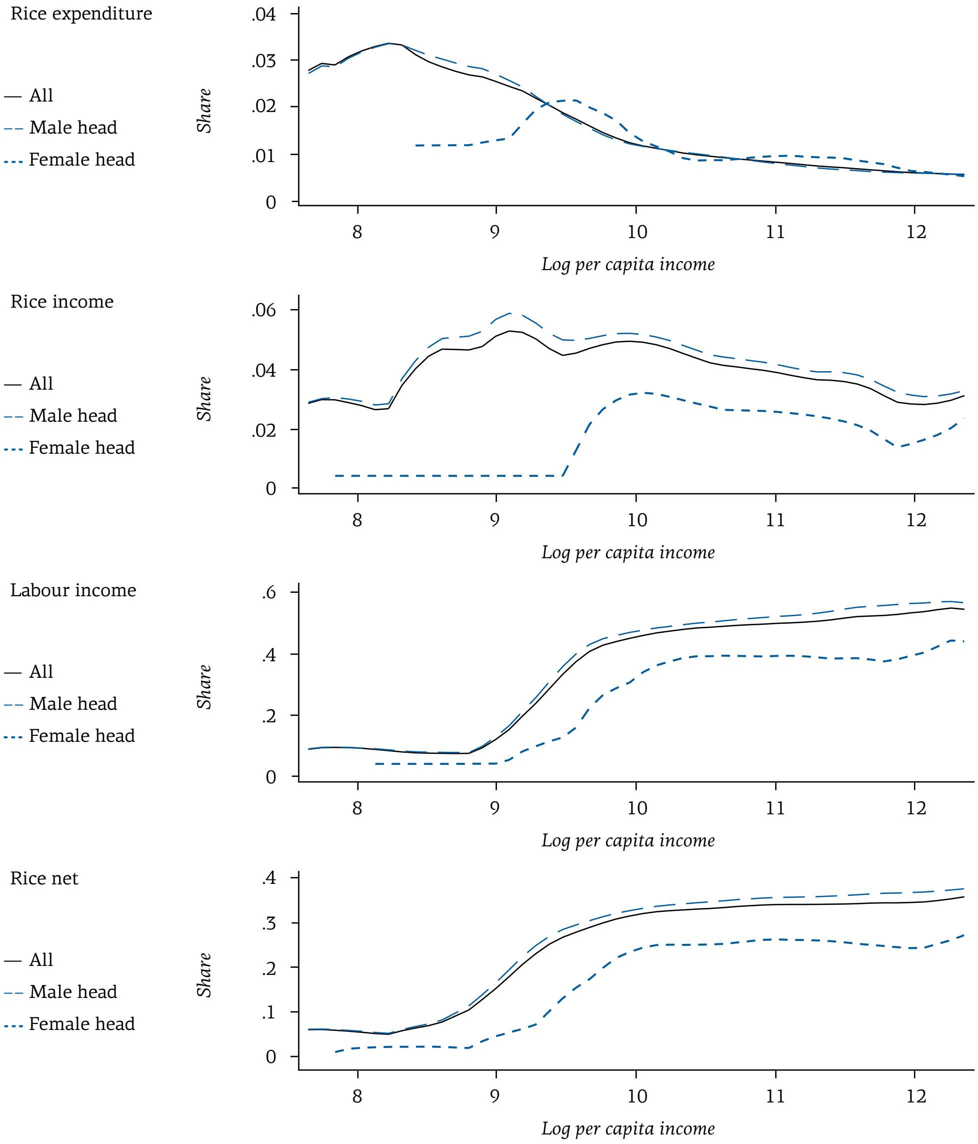
Source: Author's estimations, based on the 2011 HBS.

Figure A2.3 Components of the welfare function of urban households in 2012 – Rice



Source: Author's estimations, based on the 2011 HBS.

Figure A2.4 Components of the welfare function of rural households in 2012 – Rice



Source: Author's estimations, based on the 2011 HBS.

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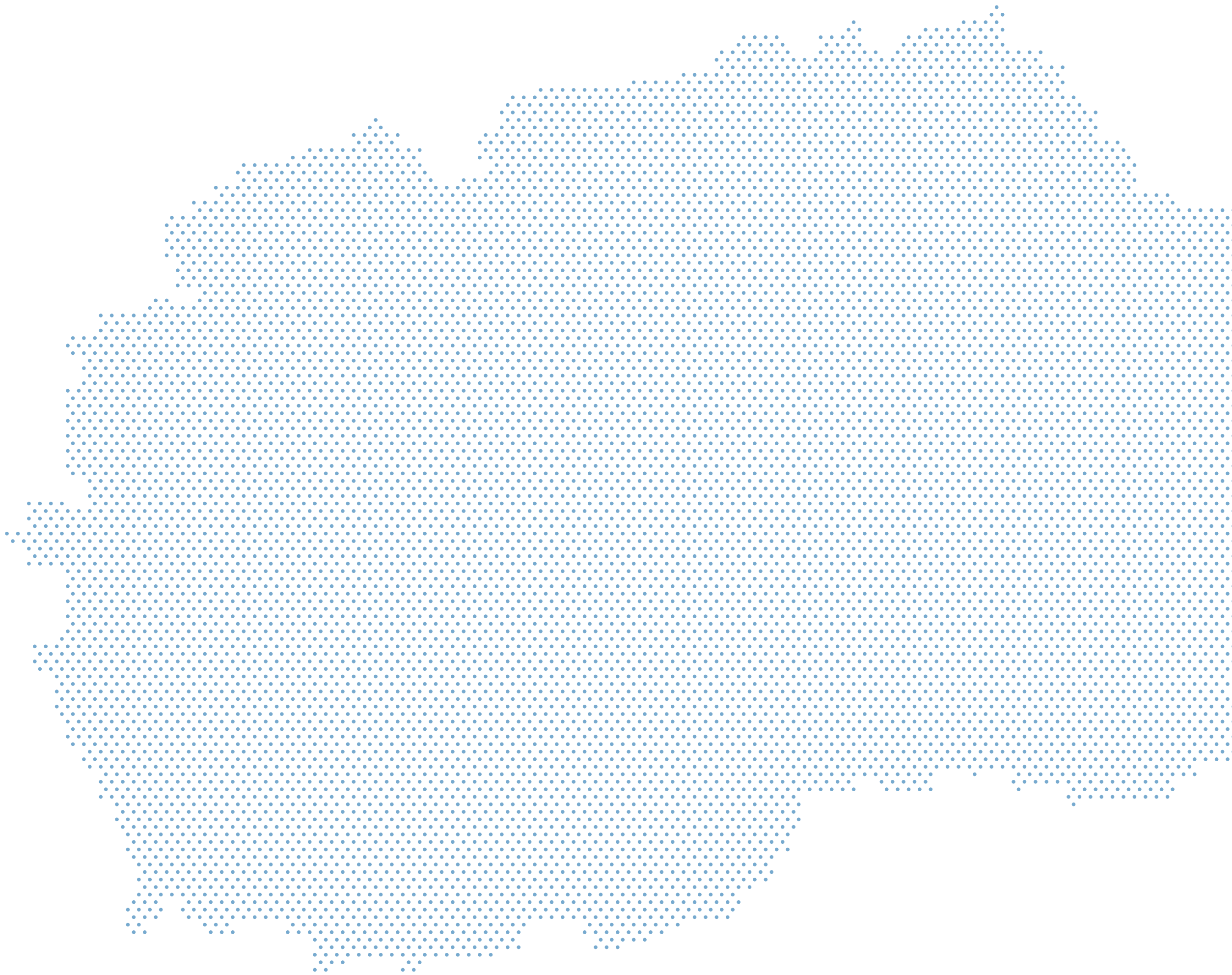

Argentina

Welfare impact of wheat export restrictions in Argentina: Non-parametric analysis on urban households

Paula Andrea Calvo *

Abstract

The Argentine wheat value chain was subject to considerable policy interventions during the last decade. The measures adopted by the government included export duties from 2002 onward, quantitative wheat export restrictions since 2006, and domestic price ceilings and subsidies introduced in 2007. These policy instruments aimed to limit the increase in domestic prices of cereals during a period of high international prices and to keep an adequate provision of grains in the domestic market. Export restrictions implicitly intended to avoid an increase in the prices of basic consumption goods derived from wheat. However, these non-tariff measures could also distort farmers' incentives to produce. Using non-parametric techniques, this study contributes to the policy discussion of the effects of non-tariff measures in the cereals market by evaluating the welfare impact of wheat export restrictions on Argentine urban households. Focusing on the effects of changes in prices of final consumption goods during 2006–2011, the study finds that prices of wheat derivatives would be only 1 per cent higher in the absence of quantitative restrictions, with negligible welfare effects on consumers. If both export restrictions and subsidies to millers were removed, prices would be 6.4 per cent higher. This would imply modest welfare losses ranging from zero to 1.5 per cent, mainly affecting the poorest households.

* The author would like to thank Raúl Auger from the National Senate of Argentina and Roberto Bisang from Universidad de Buenos Aires for their support in the preparation of this study.

1 Introduction

In 2006, the Argentine government initiated a succession of temporal export prohibitions and quotas on exports of wheat and corn, which were added to high export duties applied since 2002. These non-tariff measures (NTMs) became one of the most important trade policies of the incumbent government. Moreover, a broad set of complementary measures, including ceiling prices and subsidies, were put into practice, aiming to influence the price of cereals and their derivatives in the domestic market. The result was a complex system of interventions in the value chain of wheat, potentially distorting prices and incentives in different stages of production.[1]

These policy measures generated an intense debate between those in favour and those against them. Supporters argued that export restrictions limited the increase in domestic prices of grains by shielding domestic prices from high levels prevailing in international markets. According to the World Bank Commodities Price Data,[2] prices of agricultural commodities increased by 137 per cent in nominal terms between 2002 and 2012. Food prices increased more than did raw materials (152 per cent versus 116 per cent). In particular, nominal prices of wheat increased by 112 per cent during this period.[3]

Final products – such as bakery products and pasta – that use wheat as an input in production are an important component of the basic food basket of the typical Argentine household.[4] Consequently, the policies

[1] Many countries implemented policies to restrict food exports as a response to the price spikes of 2007–2008. This led to a further increase in commodity prices in international markets. As a result, export restrictions were placed on the agenda of multilateral negotiations in an attempt to address high and volatile food prices (Sharma, 2011).

[2] The Commodities Price Data (also known as "Pink Sheet") are a monthly collection of commodity prices and indices published by the World Bank. See *http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTDECPROSPECTS/0,,contentMDK:21574907~menuPK:7859231~pagePK:64165401~piPK:64165026~theSitePK:476883,00.html.*

[3] Key reasons behind the spike in commodity prices during the last decade have been extensively discussed in the literature. Possible explanations can be found in the growth of the world economy until 2008, followed by an increase in demand (especially in the People's Republic of China and India), the increasing role of commodities in financial portfolios, and depreciation of the dollar. Also, the higher use of food commodities in biodiesel industries and climatic factors could have contributed to the price boom (Gayá and Michalczewsky, 2011; Gilbert, 2010; Abbott *et al.*, 2011; Cooke and Robles, 2009; Mitchell, 2008). The increasing role of commodities in financial portfolios has made commodity prices more responsive to financial conditions. As suggested by UNCTAD (2012), financialization is the root cause of commodity price volatility. This would help explain the impressive growth in commodity prices until 2008, the collapse during the 2009 crisis and the subsequent recovery of prices.

explicitly aimed to limit price increases in a setting of high inflation rates in Argentina. Moreover, they aimed to keep an adequate supply of grains in the domestic market in a setting of growing international demand and weather-induced national shortages. Thus, although these measures could hurt producers, export restriction could benefit consumers.[5]

Opponents of these policies argued that grains only play a small role in price formation of final goods compared to other components such as wages, utilities, taxes, freights, etc. Controls on cereal prices would thus not be sufficient to limit inflation. Additionally, export restrictions could potentially affect producer incentives, thus reducing the supply of cereals in the domestic market. For example, restrictions on wheat exports could motivate producers to divert land to more profitable crops, such as barley or sorghum. By exporting these grains, producers could circumvent the restrictive policies imposed by the government and take advantage of the favourable external conditions. If that were the case, the potential positive effect of policies on consumers could become negligible, as a lower supply would have the opposite effect on domestic prices. The evidence suggests some trends in this direction. According to data from the Ministry of Agriculture, between 2006 and 2012, the wheat-sown area indeed decreased by 44.3 per cent. Also, in September 2013, domestic wheat prices were 50 per cent higher than international prices.[6]

This study aims to contribute to the current discussion on the impacts of interventions in the wheat market through the application of NTMs. Following Deaton (1989a, 1989b) and Benjamin and Deaton (1993), it uses non-parametric techniques to capture the effect of export restrictions on wheat on household welfare. The analysis focuses on welfare changes operating through changes in prices of final goods that use wheat as a production input and represent an important component of the basic consumption basket. Estimations of welfare gains or losses of the policies are based on a comparison of consumer welfare under the real scenario against several counterfactual scenarios. The analysis focuses on the "post-intervention" period 2006–2011 when NTMs were implemented. The "pre-intervention"

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[4] Derivatives of wheat have an important share in official consumer price index (CPI) calculations. For CPI 1999=100, the group Food and Beverages had a share of 31.28 per cent of CPI, whereas the subgroup Bread, Cereals and Pasta had a weight of 4.54 per cent. Currently, in CPI 2008=100, Food and Beverages have a share of 37.8 per cent and Bread, Cereals and Pasta have a weight of 7.14 per cent.

[5] See Ministry of Economy and Production, Resolution 9/2007.

[6] Data from the Buenos Aires Futures Exchange Market and the World Bank Commodities Price data indicate that the average price in the domestic market was USD 463 and the international price USD 307 per metric ton.

period 1994–2005 is used as a benchmark.[7] The construction of different frameworks will provide a baseline for policy evaluation.

The analysis aims to evaluate first-order effects on consumption of urban households in main Argentine cities, generated by export restrictions. In the case of Argentina, the budget share of food for the poorest households is large and about twice as high as for the richest households, confirming the predictions of Engel's Law. Therefore, any potential effect of the interventions in the wheat market is expected to have a larger impact on lower-income households. If export restrictions prevent the increase in prices of basic goods, interventions in this market could have a pro-poor bias. Unfortunately, the lack of data precludes the analysis of the effects of the policy on wheat producers. However, even if producer effects are not analysed, assessing the existence or not of a positive effect on the consumer side will be a good benchmark for evaluating the results of government policies in the wheat market.

A study of the impact of cereal export restrictions in Argentina is important for two additional reasons. First, cereals play a key role in the export basket. Between 1998 and 2011, primary products represented, on average, 21.5 per cent of total exports. Wheat and maize alone accounted for 7.5 per cent of total Argentine exports.[8] Second, if most of the production were oriented towards the domestic market, an analysis of export restrictions would not be so relevant. However, during 1998–2006, 66 per cent of the total wheat production in Argentina was sold in the international market, while the remaining 34 per cent was destined to the domestic market (IERAL, 2011).

Overall, the results obtained in this study have relevant policy implications and contribute to the current discussion regarding trade restrictions. So far, no other work in Argentina has attempted to evaluate the impact of the recent non-tariff measures and complementary measures in the cereals market on the welfare of households. The study finds that prices of wheat derivatives would be only 1 per cent higher in the absence of quantitative restrictions, with negligible welfare effects on consumers. If both export restrictions and subsidies to millers were removed, prices of final goods would be 6.4 per cent higher, with welfare effects ranging from zero to 1.5 per cent, mainly affecting the poorest households. These results are

[7] The post-intervention period excludes 2012 because of additional complications, such as exchange rate controls, which would make it even more difficult to isolate the impact of quantitative restrictions on exports.

[8] Author's calculations, based on data from UN COMTRADE.

indicative of the failure of the policies to achieve welfare goals, and might help direct the design and implementation of future policies.

The study is organized as follows. Section 2 describes in detail the broad set of policies implemented in the wheat market during the last years and discusses the role of wheat in the Argentine economy. Section 3 summarizes the literature associated with the use of non-parametric techniques to address welfare effects of commodity prices on poverty. Data and methodology are presented in Section 4. Section 5 discusses the main results, and Section 6 concludes.

2 Wheat: Value chain and intervention policies

This section describes the general situation and the policies implemented in Argentina's wheat market. It also briefly discusses the implications of the recent policy interventions for the value chain of wheat.

In 1999, Argentina entered a recession that triggered a decline of gross domestic product (GDP), investment and consumption in real terms. The situation worsened during 2001, culminating in one of the worst crises in Argentina's history. Between 1998 and 2002, GDP at constant prices fell by 18 per cent. In January 2002, the Convertibility Law was abolished, with a consequent nominal devaluation of the Argentine peso (ARS) by 140 per cent during the first quarter of 2002. Social indicators were also strongly affected by the crisis: in 2002, the poverty rate peaked at 23 per cent[9] while the unemployment rate rose to 21.5 per cent in the first half of that year. Favourable external conditions helped to overcome the crisis and drove the improved performance of the economy in the following years. The increase in commodity prices, coupled with real exchange rate depreciation, fostered agricultural exports. At the same time, the government had an urgent need to raise funds to address the widespread social crisis.[10] In February 2002, export duties on cereals, oil seeds and their derivatives were introduced – the first of a large set of policy measures applied to cereals and oil seeds during the last decade.

To better understand the impact of the measures that were implemented, it is important to understand the organization of the value chain of wheat. The chain consists of three stages: (a) primary production (sowing and

[9] This figure is based on World Bank data on a poverty headcount ratio of USD 2 a day, adjusted by purchasing power parity (PPP), at 2005 international prices.
[10] See Ministry of Economy, Resolution 11/2002.

harvesting of the grain); (b) first processing stage during which the milling industry transforms wheat into wheat flour as the main output; and (c) second processing stage during which the industry uses wheat outputs processed in the first stage as main inputs. The outputs of this third stage are mainly bakery products (especially bread), cookies, biscuits and pasta. The wheat value chain has been frequently targeted by government interventions, partly because of the importance of wheat-based products in Argentine household consumption, and partly because of the traditional competing role of the agricultural sector and the manufacturing industry in the design of Argentina's trade policy.[11]

During the 1980s, the cereals market was a target of several policies, such as high export duties and exchange rate control, which affected grain producer incentives due to domestic prices being well below international prices. During the 1990s, the wheat market was deregulated, reducing the gap between national and international prices of grain (Ghezán *et al.*, 2001). However, as discussed above, the government re-intervened in the wheat market in the early 2000s, affecting supply and prices in the domestic market.

The text that follows summarizes the most important policies implemented in the wheat value chain during the last decade.

Tariff measures

Export duties were first implemented in February 2002, at 10 per cent for wheat, 5 per cent for wheat flour and other mixes for bakery, and 5 per cent for bakery products, cookies and pasta.[12] The implementation of export duties was motivated by fiscal reasons, in an attempt to raise funds to finance the government budget. The rates were changed several times before reaching, in January 2009, their current values of 23 per cent for wheat, 13 per cent for wheat flour and 5 per cent for second processing stage products (IERAL, 2011; Peri, 2009).[13]

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[11] Brambilla *et al.* (2010) highlight the role of distributional conflict as a key determinant of trade policy in Argentina. In particular, there is a natural tension between the sector with a comparative advantage (agriculture), represented by landowners, and the industry, which is the domain of workers. In this scenario, a free trade policy, other things being equal, worsens the distribution of income in Argentina.

[12] See Ministry of Economy, Resolution 11/2002.

[13] In March 2008, Resolution 125 of the Ministry of Economy tied export duties of wheat, corn, soybean and sunflower to free on board (FOB) prices of grains and oil seeds to adjust rates automatically as international prices increased. This law was derogated in July 2008 after a conflict between the government and rural workers and organizations, which included lock-outs and suspension of grain commercialization for more than 120 days.

Non-tariff measures

These measures consist of quantitative restrictions (export quotas) on wheat exports. They were first implemented in May 2006, with temporary halts of grain export.[14] They were then strengthened in May 2008 through the Register of Export Operations (ROE) for agricultural products (called the "Green ROE"), a system of non-automatic export licences administered by the National Office of Control of Agricultural Trade (ONCCA).[15] The system of restrictions was based on the calculation of an exportable surplus, defined as a function of the total availability of grains and the needs of the domestic industry, adjusted by a factor meant to cover potential contingencies. If the exportable surplus were zero, exports would be prohibited.[16] Calculations of quotas and requirements of the domestic market were modified several times, creating uncertainty for producers and exporters and affecting their decision-making process. Each November, the ONCCA determined domestic market requirements and the amount that each firm could export, as a function of the firm's performance in the previous year. In addition, several complementary administrative procedures were introduced, potentially hindering commercialization. Among them was a reduction of the time period during which exporters could sell the product in the external market after receiving approval.[17] Also, exporters had to pay export duties in advance.[18]

Compensation regime for the wheat milling industry and producers

In 2007, export restrictions were complemented with a compensation scheme consisting of ceiling prices and subsidies for the wheat milling industry and producers. These measures intended to control prices of wheat derivatives in the domestic market. The compensation regime established an "internal supply price" that millers should pay in the domestic market, with the aim of controlling the price of bread and bakery products. In cases where the prices paid by millers in the domestic market exceeded the internal supply price, which was set at an artificially low level, the

[14] Quantitative export restrictions were imposed only on the export of grains and did not affect the export of wheat-based products (such as flour and cookies).

[15] ONCCA stands for *Oficina Nacional de Control Comercial Agropecuario.*

[16] See ONCCA, Resolution 543/2008.

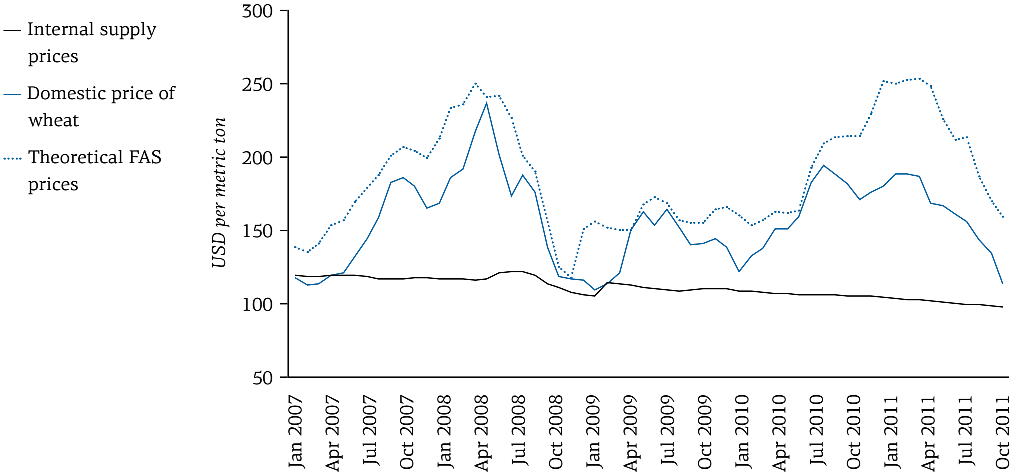
[17] These time periods, ranging from 45 days to one year, were also modified several times.

[18] See ONCCA, Resolutions 2846/2008, 2/2009 and 5556/2009; AFIP (*Administración Federal de Ingresos Públicos* – the Federal Administration of Public Revenue), Resolution 2636.

law provided a subsidy covering the price differential.[19] The policy also included a compensation scheme for grain producers to guarantee that they would benefit from the increase in prices in international markets. The amount of the subsidy was calculated as the difference between the theoretical free alongside ship (FAS)[20] price and the sales price in the domestic market. The subsidy to producers applied to 85 per cent of declared internal sales.[21]

Figure 1 illustrates the effects of the compensation scheme. The system generated a double price gap in the wheat market to be covered by subsidies. The lower gap in Figure 1 shows the difference between the domestic wheat price and the internal supply price, which was covered by subsidies to the milling industry. This gap was large during most of the analysed period, imposing a heavy burden on the government budget. The upper gap shows the difference between the theoretical FAS price and the domestic price of wheat. In theory, this difference should have been covered by subsidies to producers. In practice, however, subsidies to producers were mostly not paid or were disbursed with several months of delay. This upper gap represents a loss for producers who were not able to take advantage of favourable external conditions (even after adjusting prices by export duties).

Figure 1 Double price gap in the wheat market, 2007–2011 (USD per metric ton)



Source: Author's calculations, based on data from Rosario's Exchange Market, Buenos Aires Futures Exchange Market, Ministry of Agriculture, Ministry of Economy, and Central Bank of Argentina.
Note: Prices are expressed in nominal terms. Prices expressed in ARS are converted into USD using the monthly nominal exchange rate published by the Central Bank of Argentina.

Overall, the interventions in the wheat market consisted of an intricate set of rules that were not easy to implement. Constant modifications to these rules made it difficult for those involved to make decisions. The application of export restrictions widened the gap between domestic and international prices, favouring industrial producers at the detriment of agricultural producers. Additionally, the compensation regime represented a large financial burden for the government, as illustrated by the double gap in Figure 1. A study from the Center of Implementation of Public Policies for Equity and Growth estimated that between the second quarter of 2007 and the first quarter of 2010, subsidies to wheat millers and producers amounted to ARS 3.34 billion, i.e. approximately USD 1 billion (Dequino, 2010), which is equivalent to 15.5 per cent of Argentine exports of wheat between 2007 and 2010. Exporters were also affected by the measures, but those who managed to obtain licences derived large benefits from buying cereals at lower domestic prices and selling them at higher international prices. Consequently, these measures likely generated a large transfer of resources from producers and the government to millers and exporters. Moreover, export restrictions could have led to a loss of international buyers who may have found other suppliers, given the uncertainty related to the quantities and time periods for exports from Argentina.

Although the lack of data makes it difficult to undertake a detailed analysis of the effect of the above measures on producers, several trends provide indicative information on this issue. Figure 2 shows the evolution of the land allocated to wheat production for 1990–2013. During 2006–2012, this area shrank by 44 per cent. Although preliminary, official figures for the 2012–2013 season show a further reduction of the wheat-sown area of more than 30 per cent compared with the previous season. During the same season, production levels also dropped by 40 per cent, to an expected output close to 8.5 million metric tons.

Given that planting decisions reflect producer incentives, the decrease in land sown during the last years could be a potential response to the government's interventions in the wheat market. During the harvests of 2008–2009, 2009–2010 and 2012–2013, production levels were at their lowest in

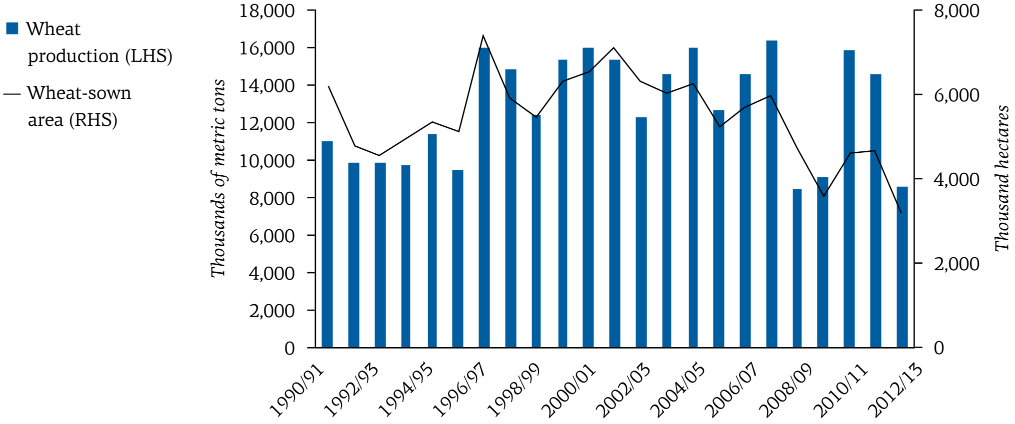
[19] The internal supply price was initially fixed at ARS 370 (USD 119) per metric ton in January 2007. In March 2009, it was increased to ARS 420 (then equivalent to USD 114). See Ministry of Economy and Production, Resolutions 9/2007 and 19/2007; Ministry of Economy and Public Finances, Resolution 83/2009; ONCCA, Resolutions 378/2007, 674/2007 and 2242/2009.

[20] The FAS price was published daily by the Ministry of Agriculture and was calculated as the FOB price minus export duties and other expenses associated with the exporting activity.

[21] See ONCCA, Resolution 11/2007.

the past two decades.[22] The drop in international prices as a consequence of the global crisis and adverse climatic factors (such as the 2008 droughts) may have contributed to these outstandingly low levels. However, the existence of NTMs that prevented producers from benefiting from international prices of wheat may have been an additional element of the bad performance of the wheat sector in Argentina. Reflecting the low production levels and the effects of the global crisis, the exports of wheat fell drastically in 2009 and stayed at low levels for two subsequent years.

Figure 2 Wheat production and sown area, 1990–2013



Source: Author's calculations, based on the Integrated System of Agricultural Information (Sistema Integrado de Información Agropecuaria) and Ministry of Agriculture, Livestock and Fisheries.
Note: LHS stands for left-hand scale, RHS for right-hand scale.

Most of the wheat exported by Argentina is sent abroad unprocessed (i.e. direct export of grains). For this reason, it is important to provide incentives to producers to process wheat domestically, promoting national value added and employment.[23] In this regard, export restrictions on wheat could foster further processing of the grain. To analyse these effects is beyond the scope of this study; however, some aggregate data suggest that the policies implemented might have benefited actors involved in the

[22] These production levels were comparable only with production levels reached during the 1980s when policies negatively affected agricultural activities through high export duties and exchange rate controls (Ghezán *et al.*, 2001).

[23] According to local estimates, the processing of wheat to flour generates an increase of 13 per cent in the FOB price for a metric ton of wheat compared with wheat that is exported unprocessed. When pasta and cookies are exported, this increase amounts to 154 and 578 per cent, respectively (IERAL, 2011).

processing stages of the wheat value chain by lowering the price of key inputs. In particular, between 2005 and 2011, the number of private firms in the milling industry increased by 15 per cent, and those producing bakery products and pasta by 26 and 29 per cent, respectively. These figures exceeded the growth in the overall number of firms in the economy (13 per cent) and in the food industry (15 per cent). Similar results were obtained in terms of employment, with an increase in the number of formal workers in the bakery and pasta industry of 45 and 33 per cent, respectively, exceeding that in the food industry (24 per cent) and the economy as a whole (34 per cent). These numbers could be indicative of the positive role of the implemented policies in promoting industrialization. However, this evidence is not conclusive as it could also have been driven by factors other than export restrictions on wheat. Unfortunately, the lack of data precludes a more comprehensive analysis of this issue.

3 Related literature

There is a large body of literature that studies the impact of the recent increase in commodity prices on welfare, especially on the poorest households. Estrades and Terra (2012) use a general equilibrium (GE) model to analyse the effect of the spike in commodity prices in 2006–2008 on Uruguay. They find that the increase in food prices affected the already poor population, making them even poorer. However, because Uruguay is an agriculture export-oriented country, the increase in commodity prices had an overall positive effect on the economy. Warr (2008) also uses a GE model to study the effect of higher food prices in Thailand. He finds that despite many poor farmers benefiting from the increase in staple prices, poverty has worsened. Ivanic and Martin (2008) find that short-term impacts of higher food prices on poverty differ strongly by country and commodity. However, they find that cases of poverty increase are more frequent than those of poverty reduction. Ivanic *et al.* (2012) find that the global increase in prices in 2010 generated an increase in poverty in both low- and middle-income countries. Valero-Gil and Valero (2008) study the effect on poverty from the increase in food prices in Mexico in 2006–2008. Using consumption data, they find an increase in poverty and extreme poverty rates. Yu *et al.* (2011) document the effects of trade policy changes on several importing and exporting countries, as a response to the pressures exerted by rising commodity prices in the domestic markets as a consequence of the worldwide increase in agricultural prices in 2007–2008. They find that trade policy measures were inefficient and worsened inflation. Also, net importing countries that did not adopt trade policies suffered welfare losses as a consequence of the policies implemented by their major trading partners.

Non-parametric techniques are also increasingly used in the literature on trade and poverty to evaluate household welfare effects and distributional consequences of price changes. Deaton (1989a) developed a theoretical approach for the use of household microdata to analyse the welfare impact of trade policies that generate price changes in developing countries. Using similar techniques, different case studies have been conducted. For example, Deaton (1989b) assessed the impact of changes in the price of rice on the welfare of households in Thailand. Benjamin and Deaton (1993) studied the welfare effect of the reduction of producer prices of cocoa and coffee in Côte d'Ivoire. Barrett and Dorosh (1996) evaluated the welfare impact of rice price changes on households in Madagascar.

This study differs from the above works in two aspects. First, the authors of the papers above take into account the role of households both as consumers and producers of commodities, because in developing countries most households are engaged in agricultural activities. A main limitation of the analysis in this study however is that, in spite of the importance of agricultural production in Argentina, data from rural areas are not available in household surveys. Due to this drawback, the analysis therefore focuses on urban households in Argentina's main cities, on the assumption that these households are not engaged in agricultural production. A second difference is related to the role of commodity prices in household welfare. Some food commodities, such as coffee and rice, have a direct impact on consumption, whereas wheat only has an indirect impact on consumption as an input in final goods (such as flour, bakery products and pasta). For this reason, it is necessary to estimate the pass-through from commodity prices to final goods prices, an approach that is not used in the papers reviewed above.

In this context, this study aims to contribute to the large body of literature that tries to assess the impact on households of the price spikes during 2006–2011. According to the review of recent literature, there is no previous work that has tried to evaluate the impact of commodity price increases in Argentina, and in particular, the effect of NTMs on welfare. The analysis uses non-parametric techniques to assess the welfare effect on households in Argentina resulting from the change in prices generated by the trade policies affecting the wheat market.

[24] ENGH stands for *Encuesta Nacional de Gasto de los Hogares.*

[25] INDEC stands for *Instituto Nacional de Estadísticas y Censos.*

[26] Questionnaires, databases and methodological information related to the ENGH are available at: *http://www.indec.gov.ar.*

4 Data and methodology

This section describes the data used in the study and the methodology employed.

4.1 Data

Microdata at the household level were taken from the National Survey of Household (ENGH).[24] This survey is conducted by the National Institute of Statistics and Census of Argentina (INDEC)[25] – the Argentine official statistical agency – in cooperation with provincial statistical agencies.[26] The ENGH provides detailed data on household expenditure and income, as well as other relevant demographic and socio-economic variables relating to the households and their members. The latest ENGH was carried out between October 2004 and December 2005. Data were collected during a "survey week", when ordinary expenses (such as food and beverages, transport expenditure, etc.) were self-registered by household members. For non-ordinary expenditure and income, data were obtained through direct interviews with household members. All variables related to expenditure and incomes were converted to monthly statistics and expressed in ARS.

The main advantage of this survey is that it includes disaggregated expenditure data (including quantities and prices) at the household level. This study uses in particular information obtained from households on wheat-based products (including bread, cereals and pasta). Although this group of products contains some goods that are not direct derivatives of wheat (such as rice and other cereals), the whole group is considered because price information is available only at this level of aggregation.

As already mentioned, the main drawback of the ENGH is the limited rural coverage[27] and the lack of disaggregated data on income sources in rural areas. For this reason, the scope of this study was reduced to first-order consumption effects on urban areas of the most important Argentine provinces (City of Buenos Aires, Buenos Aires Metropolitan Area, Santa Fe, Córdoba, and Mendoza). The importance of these provinces was established in terms of the total population.[28] [29]

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[27] Of the 29,111 households that reported expenses, only 7.45 per cent are from rural areas.

[28] Urban households located in main cities account for 39 per cent of the observations of the sample.

[29] Another possibility would have been to divide the country into geographic areas to study differences in the welfare effects on households between areas. This analysis is not included in the current work and will be left for future research.

Following Deaton (1989a, 1989b) and Benjamin and Deaton (1993), the logarithm of consumption expenditure per capita, m, will be used as a proxy for household welfare.[30] This variable was constructed with the following caveats. First, positive consumption expenditure rather than net expenditure was considered.[31] This means that household incomes from sales and non-consumption expenditure were excluded.[32] Second, per capita expenditure is based on equivalent adults estimations available from the ENGH.[33] In addition, shares of food and wheat-based product expenditure, $\frac{p_i q_i}{m}$, were calculated as a share of total consumption expenditure. Henceforth, p stands for prices, q for consumed amounts, m for nominal total consumption expenditure of the household and i for the different groups of products considered.

Table 1 shows summary statistics of household income per capita and expenditure per capita for different regions of the country in 2004–2005 (when the survey was conducted), and the share of total consumption allocated to food and wheat-based products. Urban households are richer than rural ones and spend a lower share of total expenses on food and wheat-based products. Households in the main cities have higher income and expenditure per capita than the national average and allocate a lower share of income to those goods. However, these differences do not seem large. When the City of Buenos Aires is excluded from the group of other main cities (last column), statistics for these cities are similar to national statistics. This fact unmasks large differences between the City of Buenos Aires and the remaining main cities. On average, households from the City of Buenos Aires have 2.2 times higher income and expenditure than households in other main cities, and they spend a lower share of total expenditure on covering basic needs.

[30] There are several reasons in favour of using consumption instead of income as a proxy for well-being. The main advantage is that, generally, self-reported expenditure presents less measurement bias than self-reported income (Cameron and Trivedi, 2005; Gasparini *et al.*, 2013). In addition, households tend to smooth consumption over time.

[31] Consumption expenditure is classified into nine different categories: Food and Beverages; Clothing and Footwear; Properties, Fuels and Utilities; Equipment and Maintenance of the Household; Health Expenditure; Transport and Communications; Recreation; Education; and Other Goods and Services.

Table 1 Summary statistics for different regions, 2004–2005

	Total country	Urban areas	Rural areas	Main cities	City of Buenos Aires	Other main cities
Expenditure per capita	587	603	364	706	1,254	577
Income per capita	660	672	492	757	1,373	623
Share of food in total expenditure	39.1	38.6	47.4	37.5	30.5	38.5
Share of wheat-based products in total expenditure	6.3	6.2	8.5	5.5	3.6	5.9
Share of bread in food expenditure	16.0	15.8	17.9	14.6	11.7	15.3
Average number of equivalent adults	2.73	2.71	3.09	2.6	2.08	2.72
Number of households in the sample	28,758	26,645	2,113	11,227	2,819	8,408

Source: Author's calculations, based on the 2004–2005 ENGH.
Note: Summary statistics are calculated at the household level. Expenditure per capita and income per capita are expressed in ARS. Shares are expressed in per cent.

[32] Non-consumption expenditure includes expenses such as taxes, transfers, donations and loss of money; asset accumulation such as estate purchases, machinery and equipment for economic activities, jewellery and artworks; and other uses of resources, such as purchases of bonds or other public securities, private purchases of stocks, foreign currency and loans to non-household members, among others.

[33] The number of equivalent adults is obtained using the criteria of nutritional requirements, according to the sex and age of the household member. A table of equivalences is included in the methodological report of the ENGH and the report describing the structure of the data, available at: *http://www.indec.mecon.ar/eah/engho200405_metodologico.pdf* and *http://www.indec.mecon.ar/eah/ENGHo200405_archivosdedatos.pdf.*

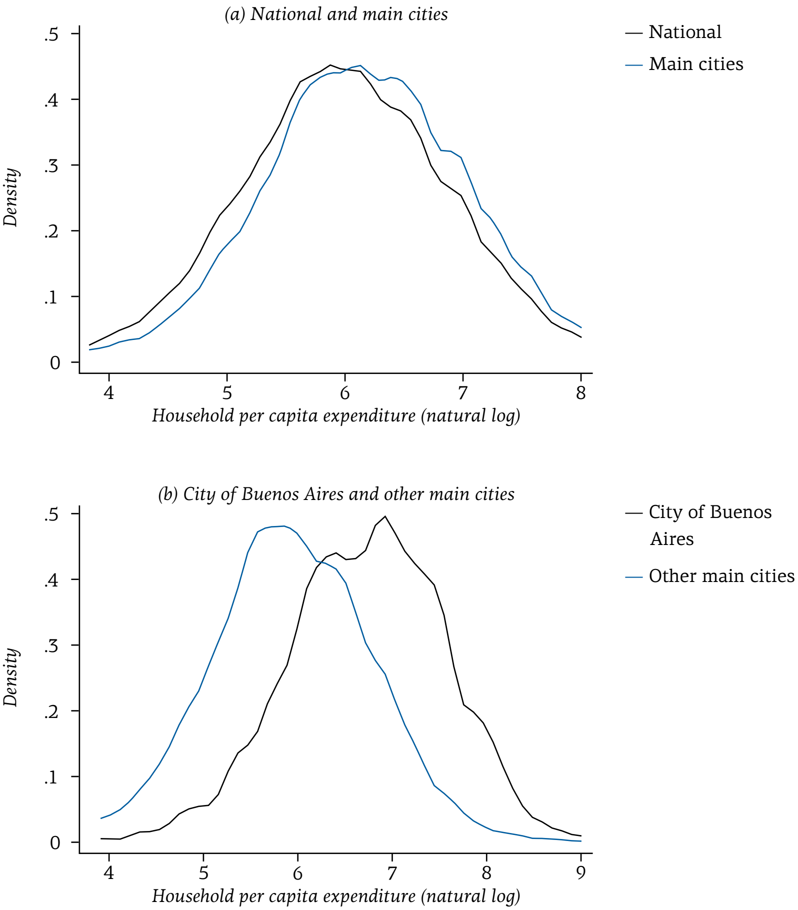
Similar results are shown in Figure 3, which presents the density functions of the distribution of the logarithm of per capita expenditure of households by kernel smoothing. These functions are represented by $g(x)$, where x is the logarithm of per capital total expenditure of households. Figure 3, panel (a), presents the distribution of well-being of the entire population of Argentina (including rural areas) and of the urban households located in the main cities.[34] Households in the main cities are, on average, better off than households at the national level, as reflected by the shift to the right of the distribution. However, Figure 3, panel (a), shows that the shape of the distribution of the logarithm of per capita total expenditure of households is similar in both cases, in line with the results in Table 1. Differences are even smaller when only urban areas are compared with the main cities.[35] Figure 3, panel (b), reveals disparities within the main provinces. The shift to the right of the distribution of per capita expenditure of the City of Buenos Aires reflects that, on average, households located there enjoy higher welfare than households in the other main cities. Large differences do not appear when any other pair of main cities is compared. For this reason, from now on, the analysis will be conducted separately for the City of Buenos Aires and the other main cities.

Table A1.1 in Annex 1 presents descriptive statistics at the national level (including rural areas) for the City of Buenos Aires and the other main cities (excluding rural areas), for each quintile of the per capita income distribution in each region. At the national level, total consumption per capita of the richest households is 7.6 times the total consumption per capita of the poorest households. Although these differences are lower in the City of Buenos Aires (5.3 times) and other main cities (5.6 times), they are still large. In line with Engel's Law, the share of food in total expenditure decreases with higher income. While the lowest quintile of the country spends more than half of its budget on food and 11 per cent on wheat-based products, for the richest households, these shares fall to 29.1 per cent and 3.3 per cent, respectively.

34 To avoid confounding consumer and producer effects, urban households that have at least one member whose principal occupation is in the agricultural sector have been dropped from the estimates when urban households are considered.

35 Unreported kernel density estimations of the distribution of per capita expenditure confirm that households in rural areas are on average poorer than households in urban areas.

Figure 3 Density estimation of per capita expenditure



Source: Author's estimations, based on the 2004–2005 ENGH.
Note: Epanechnikov kernel, bandwidth 0.06 (panel (a)) and 0.08 (panel (b)).

The second type of data used in this study is related to prices of cereals and final goods. International prices of wheat were taken from the World Bank Commodities Price Data series.[36] The construction of the series of domestic prices involved merging data from different sources. For the period until June 2009, spot prices from Rosario's Exchange Market (*Bolsa de Comercio de Rosario*) – the main physical market for grains in Argentina

[36] International prices of wheat correspond to prices of the variety of wheat Hard Red Winter (HRW) with ordinary protein, delivered at the United States Gulf port for prompt or 30-day shipment.

in terms of operations and volume – were used. These prices are reported voluntarily by buyers and sellers; their use is not compulsory but indicative. However, due to interventions in the wheat market, publication of these prices was interrupted in June 2009. From July 2009 onward, first position prices (for prompt delivery) in the Futures Exchange Market of Buenos Aires were therefore used.[37] Prices expressed in USD were converted into ARS using the monthly nominal exchange rate published by the Central Bank of Argentina.

Finally, the series of the consumer price index was built by merging data from two sources. Disaggregated data from INDEC were used for the period January 1994 to December 2006.[38] From January 2007 onward, the CPI series was extrapolated using the monthly inflation rate calculated by the provincial Institute of Statistics of Santa Fe for each category of products.[39] Data on money supply were obtained from the Central Bank of Argentina, and data on wage and employment from the Observatory of Employment and Entrepreneurship Dynamics and the Ministry of Labour, Employment and Social Security.

4.2 Methodology

The methodology contains three steps. The first step is to run non-parametric regressions of the share of wheat-based products on the logarithm of expenditure per capita. In the second step, a counterfactual scenario of domestic prices that would prevail in the absence of restrictions is constructed. This scenario is based on the key assumption of perfect pass-through from international prices (adjusted by export duties) to domestic prices in the absence of restrictions. Data on the pre-intervention period were used to test the accuracy of this assumption. The third step is to estimate the pass-through from prices of grain to prices of its derivatives as wheat is not directly consumed by households. Coefficients were obtained for 1994–2005 when export restrictions and price controls were not yet in

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[37] As the interest lies in the price level and not only in price variations, current prices in the Buenos Aires Futures Exchange Market from July 2009 to December 2011 were used to continue the series. Rosario's Exchange Market price series using the growth rate of prices on the Futures Market from July 2009 onward have not been extrapolated. To test the validity of this procedure, both series have been plotted together for 1995–2009. Except for a short period between 2002 and 2003, both markets exhibit an equal trend and levels.

[38] There was a methodological change in the computation of the CPI in October 2000, which changed the base year from 1988=100 to 1999=100 and modified some criteria for the calculation.

[39] This approach was adopted due to controversies that aroused in 2007 regarding data published by INDEC. In particular, there has been a debate about the official figures used to measure inflation rates during the last six years.

place. Using the results of these regressions, different frameworks were built, comparing the real scenario with the counterfactual one. The assessment of these frameworks may provide a benchmark for policy evaluation, through the calculation of welfare gains or losses for consumers generated by the interventions.

Step 1: Non-parametric estimations of the share of wheat-based products in per capita household expenditure

Figure 4, panels (a) and (b), show the results of the first step of the methodological approach. Following Deaton (1989a, 1989b) and Benjamin and Deaton (1993), non-parametric regressions of the budget shares spent both on food and wheat-based products along the distribution of total per capita expenditure of households were estimated. This was intended to assess the importance of wheat derivatives in total expenditure. The main advantage of the use of non-parametric techniques is that it eliminates the need to formulate further assumptions about the data-generating process. These regressions represent a weighted average of the values of the food shares along the expenditure distribution and can be expressed as follows:

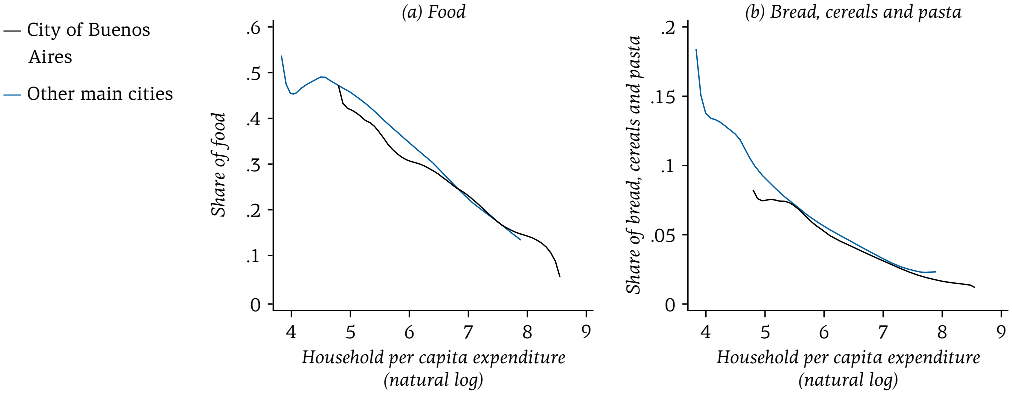
$$E\left[\frac{p_i\, q_i}{m}\middle|\, x\right] \qquad (1)$$

Variables in equation (1) are defined as in Section 4.1. Since the last wave of the ENGH was conducted in 2004–2005, it is assumed that budget shares calculated from this source remained largely unchanged for the period of analysis (2006–2011).[40]

[40] The validity of this assumption relies on several considerations. The first consideration is the absence of changes in the distribution of per capita expenditure between 2004 and 2005 and the period of analysis, 2006–2011. The second is that this assumption is more likely to hold if both the inflation rate between different groups of products and real income are constant. The third consideration is that it relies on the non-existence of changes in preferences of households. The lack of data on the per capita expenditure distribution and household preferences precludes a complete assessment. One proxy would be to analyse changes in the per capita income distribution of households. A comparison of the ratio of the income share between the highest and the lowest deciles between 2005 and 2011 is indicative of changes in the income distribution, biased towards a reduction in inequality. According to the Permanent Household Survey (*Encuesta Permanente de Hogares*) conducted by INDEC, this ratio was 11.4:1 in the second quarter of 2005 and 7.2:1 in the fourth quarter of 2011. Also, from December 2005 to December 2011, the accumulated inflation in Food and Beverages (196 per cent) was lower than in Bread, Cereals and Pasta (206 per cent), which could have generated a substitution of products within the Food and Beverages group, especially among the poorest households, which are more budget constrained. Both elements suggest that budget shares of the poorest households dedicated to wheat-based products could have been reduced between 2004–2005 and 2006–2011. If this were the case, results of the policies would be less pro-poor biased, reinforcing the results of this study associated with the inefficiency of policies to avoid welfare losses for households.

As shown in Figure 4, non-parametric regressions confirm that the poorest households spend a large share of total expenditure on food, and particularly basic goods such as bread and pasta, the demand for which is more inelastic to variations in prices. Therefore, changes in prices of consumption goods have a greater impact on the poorest households. Some differences between the City of Buenos Aires and other main cities appear in Figure 4, panel (a). When the expenditure distributions overlap, the poorest households in the City of Buenos Aires spend a lower share of total expenditure on food than households with the same level of per capita total expenditure located in other main cities. However, these differences disappear as we move to the right of the distribution. Figure 4, panel (b), shows a different pattern than panel (a). For those segments for which the expenditure per capita distribution overlaps, the share of total expenditure spent on wheat derivatives is similar for the City of Buenos Aires and for the other main cities.

Figure 4 Share of food and wheat-based products in total household expenditure



Source: Author's estimations, based on the 2004–2005 ENGH.
Note: Epanechnikov kernel, bandwidth 0.02, degree 1.

Step 2: Counterfactual scenario for domestic wheat prices

The construction of the counterfactual scenario accounts for the price variation of cereal prices that would prevail in the domestic market in the absence of quantitative export restrictions. If NTMs were not in place, domestic prices should follow the evolution of international prices adjusted by export duties, calculated as *IntPrice * (1 – export duties)*. The main assumption is that without quantitative export restrictions in the wheat market, there would be a perfect pass-through from international prices (adjusted by export duties) to domestic prices. Consequently, changes in adjusted international prices would be a good proxy for changes in domestic prices in the absence of NTMs.[41] To test this assumption, ordinary least squares (OLS) regressions of the logarithm of domestic prices on the logarithm of adjusted international prices were run.

The estimation of the elasticity of domestic wheat prices to adjusted international prices for the pre-intervention period (1994–2005) and the post-intervention period (2006–2011) is based on equation (2).[42] In this equation, the dependent variable is $ln\ (DPW)_{my}$, the logarithm of the domestic price of wheat. $ln\ (AdjIntPW)_{my}$ is the logarithm of international prices adjusted by export duties. Prices are expressed in ARS, on a monthly basis. δ captures yearly-fixed effects to take into account any year-specific factor that could affect the pass-through. Monthly-fixed effects expressed by γ capture any seasonal effect affecting this market across the year.

$$\ln\ (DPW)_{my} = \beta_o + \beta_1 \ln\ (AdjIntPW)_{my} + \delta_y + \gamma_m + \mu_{my} \qquad (2)$$

Before presenting the results of the regression, supportive evidence for the assumption of perfect pass-through in the absence of export restrictions is discussed in Table 2 and Figure 5. This evidence also confirms that the relationship between international and domestic prices changes after the implementation of quantitative restrictions, testifying to the efficiency of the policy in reaching its main goal of disconnecting domestic wheat prices from international prices. The fulfillment of this goal is fundamental to justify the construction of a counterfactual scenario.

Panel (a) in Table 2 shows the share of international prices received by wheat producers, calculated as the ratio of domestic prices to international prices.[43] Panel (b) shows the share of international prices adjusted by export duties received by domestic wheat producers, computed as the ratio of domestic prices to international prices adjusted by export duties. For

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[41] In 1995–2011, Argentine wheat FOB prices were at 98.2 per cent of international prices. This supports the hypothesis of international prices being a good proxy for domestic prices when tariff measures and non-tariff measures are not in place.

[42] See Annex 2 for a discussion related to the consistency of the OLS estimators presented in Table 3.

[43] Ghezán *et al.* (2001) made a similar analysis comparing the decade of the 1990s with the decade of the 1980s. During 1994–1996, the share of international prices received by producers was 94 per cent and 93 per cent for wheat and corn, respectively. However, these shares had been only 66 per cent and 72 per cent during 1983–1985. This was explained both by the export duties applied to these cereals during the 1980s and by the difference between the official exchange rate and the actual prevailing exchange rate. Both measures were removed in the 1990s, which could explain the reduction in the gap between national and international prices at that time.

1994–2001, when neither quantitative restrictions nor export duties were implemented, the share of international prices received by wheat producers averaged 90 per cent. The implementation of export duties in 2002 reduced the share received by producers to an average of 71 per cent for 2002–2005. However, once international prices are adjusted by export duties, these shares do not differ considerably from 1994–2001 (88 per cent in panel (b)). This suggests that the implementation of these duties reduced domestic prices only by the amount of the export duties, without generating additional distortions. The share of adjusted international prices received by producers declined sharply during 2006–2011 (to 59 per cent in panel (a) and 77 per cent in panel (b)).[44] Quantitative export restrictions reduced competition between millers and exporters, forcing producers to sell cereals at low prices to domestic mills. Hence, the implementation of quantitative restrictions could explain the emergence of additional distortions besides export duties in the cereals market, stemming from increased market power of domestic millers that allowed them to push domestic wheat prices down.[45]

Table 2 Share of international prices received by domestic producers (per cent)

	Wheat	Corn
(a) International prices		
1994–2001	90	95
2002–2005	71	74
2006–2011	59	65
(b) Adjusted international prices		
1994–2001	90	95
2002–2005	88	91
2006–2011	77	83

Source: Author's calculations, based on data from the World Bank, Rosario's Exchange Market and the Buenos Aires Futures Exchange Market.

[44] The gap between international and domestic prices of wheat was particularly high in the years 2008 and 2011, when the share of adjusted international prices received by producers averaged 71 per cent.

[45] Competition between millers and exporters was reduced because exporters were not able to sell abroad unless they managed to get an export licence. Exporters also offered low prices to domestic producers, arguing that they were compelled to store the grain until they could manage to get an export licence and that they could not anticipate the evolution of international prices. Producers could not actually know whether exporters had a licence and were forced to sell at low prices. In many cases, they were not able to store the grain and wait for convenient prices as they had to reimburse credits related to the current harvest.

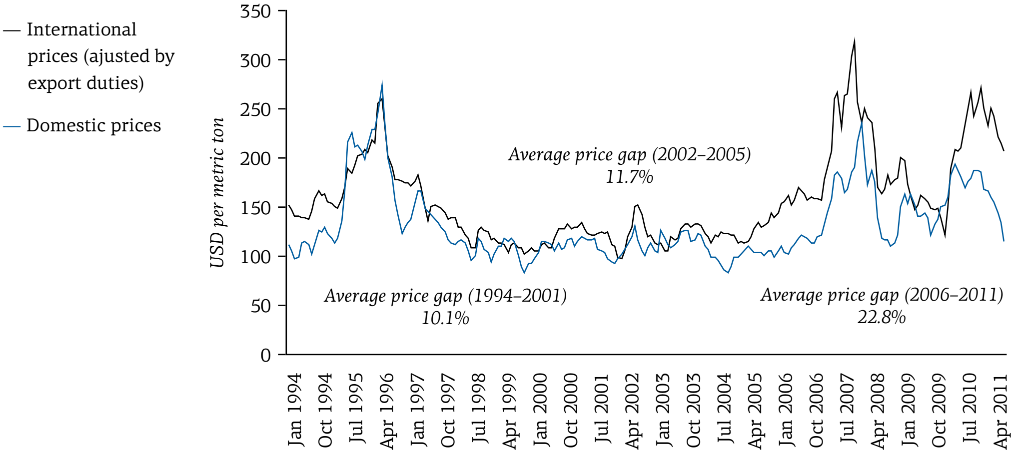
During the same period, corn also faced quantitative export restrictions that were timed similarly to wheat export restrictions. The share of international prices received by corn producers is also reported in Table 2, suggesting that both markets showed similar patterns in the share of international prices received by domestic producers. This helps to rule out the possibility that changes in the share of international prices received by wheat producers during 2006–2011 were associated with other circumstances particularly affecting the wheat market rather than with export restrictions.

Figure 5 shows monthly prices of wheat in the international and domestic markets (adjusted by export duties)[46] for 1994–2011. As can be seen, the evolution of domestic prices is in line with the evolution of international prices for the pre-intervention period. Even after the implementation of export duties (period 2002–2005), the price gap *((AdjIntPrice – DomesticPrice)/AdjIntPrice)* is similar to 1994–2001 and lower than for the post-intervention period 2006–2011.[47] In line with results presented in Table 2, Figure 5 shows that the gap between international and domestic prices increased during 2006–2011, even after controlling for export duties. This suggests that the existing price gap is measuring distortions associated with the implementation of quantitative export restrictions implemented in 2006–2011, which allowed domestic millers and exporters to exercise market power and reduce domestic prices.

[46] Figure A1.1 in Annex 1 presents the evolution of international prices and domestic prices not adjusted for export duties. These results reaffirm evidence from Figure A1.1 and Table 2. For 2002–2005, the price gap *((IntPrice – DomesticPrice)/IntPrice)* is lower than for the post-intervention period 2006–2011.

[47] Similar results are obtained using the first position prices (for prompt delivery) of wheat in the futures exchange markets of Chicago and Argentina.

Figure 5 Evolution of international and domestic prices of wheat, 1994–2011 (USD per metric ton)



Source: Author's calculations, based on data from the World Bank, Rosario's Exchange Market, Buenos Aires Futures Exchange Market, and Central Bank of Argentina.
Note: Prices are expressed in nominal terms. International prices of wheat are adjusted by export duties.

Results of the estimations of equation (2) are presented in Table 3. These results show how changes in international prices are transmitted to domestic prices and hence how sensitive producers are to international prices. Pre-intervention elasticity (columns 1–3) is higher than the post-intervention elasticity (columns 4–6), as expected. These results may be reflecting the implementation of export restrictions that force producers to sell in the domestic market at low prices, making it impossible for them to take full advantage of price increases in the international market. These results hold when *Export Duties* W_{my} are included in the estimations (see Table A1.2 in Annex 1).

Table 3 Pass-through from international to domestic prices during pre- and post-intervention periods

	(1)	(2)	(3)	(4)	(5)	(6)
	lnDPW - PRE	lnDPW - PRE	lnDPW - PRE	lnDPW - POST	lnDPW - POST	lnDPW - POST
ln(AdjIntPW)	0.99*** (0.02)	1.03*** (0.07)	1.09*** (0.05)	0.84*** (0.06)	0.72*** (0.08)	0.70*** (0.07)
Constant	–0.05 (0.10)	–0.34 (0.41)	–0.72** (0.32)	0.76* (0.39)	1.53*** (0.57)	1.61*** (0.50)

	(1)	(2)	(3)	(4)	(5)	(6)
	lnDPW - PRE	lnDPW - PRE	lnDPW - PRE	lnDPW - POST	lnDPW - POST	lnDPW - POST
Observations	144	144	144	72	72	72
Year FE	No	Yes	Yes	No	Yes	Yes
Month FE	No	No	Yes	No	No	Yes
R-squared	0.94	0.96	0.98	0.69	0.85	0.89

Source: Author's estimations, based on data from the World Bank, Rosario's Exchange Market and Buenos Aires Futures Exchange Market.

*Note: Robust standard errors in parentheses. Dependent variable: logarithm of domestic prices of wheat; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. FE stands for fixed effects.*

The evidence presented above confirms the hypothesis that adjusted international prices are a good proxy for domestic prices in the absence of quantitative restrictions. In particular, the results support the assumption of perfect pass-through from international to domestic prices. Therefore, the price variation in international prices of wheat is used to construct the counterfactual scenario. Moreover, regressions in Table 3 reinforce the hypothesis of changes in the relationship between international and domestic prices after the implementation of NTMs to exports. The hypothesis of equal trends and intercepts between the pre-intervention and post-intervention period can be rejected at 1 per cent confidence level.

Step 3: Pass-through estimations from wheat prices to final goods prices

Wheat plays only an indirect role in influencing consumer welfare through changes in the prices of its derivatives. The third methodological step consists of the estimation of the pass-through from wheat prices to prices of wheat-based products. Results of the estimations are used to calculate the share of the total variation in cereal prices that is actually perceived by consumers through changes of prices of basic consumption goods. Estimations are based on equation (3). $ln\ (CPIBCP)_{my}$ is the logarithm of the monthly CPI of Bread, Cereals and Pasta, $ln\ (DPW)_{my}$ stands for the logarithm of monthly average domestic prices of wheat expressed in ARS and X_{my} is a set of controls that includes different ways of capturing inflation. Among them, the logarithm of the CPI of other groups of products is included,[48] as well as the logarithm of the monetary base or money supply and the average wage of formal workers in different activities.[49] The nominal exchange rate, the

[48] The selection criterion was to choose sectors that seem less likely to be the target of government interventions aiming to contain inflation or implemented due to social reasons, such as Apparel and Recreation.

[49] These activities include food production, milling industry, production of bakery products and pasta, according to the International Standard Industrial Classification at 4 digits.

annual GDP at constant prices and a dummy variable *POST*, which equals 1 after January 2002, are included in different specifications. As in equation (2), yearly- (δ_y) and monthly-fixed effects (γ_m) are used:

$$\ln (CPIBCP)_{my} = \beta_1 \ln (DPW)_{my} + X_{my} + \delta_y + \gamma_m + \mu_{my} \quad (3)$$

Table 4 presents OLS estimations for different specifications of equation (3) for the pre-intervention period (1994–2005). The coefficient of interest, β_1, reflects the relationship between the logarithm of wheat price in the domestic market and the logarithm of wheat-based products CPI, the dependent variable. As additional controls, column (1) includes the logarithm of CPI of other groups of products to capture inflation, the logarithm of annual GDP and the nominal exchange rate. β_1 is positive and significant at 1 per cent confidence level. Specification (2) adds yearly- and monthly-fixed effects.[50] As additional controls, column (3) includes the logarithm of money supply *(M3)* and the logarithm of wages of formal workers in the bakery industry.[51] Neither of those variables enters significantly in regression (3). Specification (4) adds the money supply and the wages of formal workers lagged one and two periods. Only wages lagged two periods are positive and significant at 5 per cent. In all cases, the sign and significance of β_1 remain constant,[52] although smaller in magnitude. As a robustness check, column (5) replicates column (3) for the fresh bread CPI. The coefficient associated with the wheat price is still positive and significant at 1 per cent and with a higher magnitude than in previous specifications.

[50] Yearly-fixed effects are included to account for potential factors such as weather conditions, changes in the labour market or any other year-specific factors affecting the pass-through from wheat to Bread, Cereals and Pasta in a particular year. Monthly-fixed effects are included to account for potential seasonality in the relationship between variables.

[51] Data on this variable are only available from January 1995.

[52] This result is robust to multiple specifications not reported in Table 5, such as using lagged values of the logarithm of domestic prices of wheat or using a single measure of inflation (excluding either Recreation or Apparel CPI). Also, the effect of wheat prices on Bread, Cereals and Pasta CPI holds when different variables to measure wages, different monetary variables (as *M2* or monetary base) or lagged values of these variables are included. Results are robust to the change of the time period to 1994–2001. Finally, results do not change when regressions are run without a constant (see Table A1.4 in Annex 1).

Table 4 Price formation of final goods (OLS regressions)

	(1)	(2)	(3)	(4)	(5)
	ln(CPIBCP)	ln(CPIBCP)	ln(CPIBCP)	ln(CPIBCP)	ln(CPIBread)
$\ln(DPW)_t$	0.13*** (0.01)	0.07*** (0.01)	0.08*** (0.01)	0.06*** (0.01)	0.14*** (0.03)
$\ln(CPIRecreation)_t$	0.27*** (0.03)	0.23*** (0.05)	0.28*** (0.06)	0.24*** (0.06)	0.37*** (0.12)
$\ln(CPIApparel)_t$	0.10*** (0.02)	0.12** (0.05)	0.11* (0.06)	0.06 (0.06)	0.19** (0.09)
$ExchangeRate_t$	0.05*** (0.01)	0.07*** (0.01)	0.06*** (0.01)	0.10*** (0.01)	-0.03 (0.03)
$\ln(GDP)_t$	0.26*** (0.03)				
POST	0.01 (0.02)		0.01 (0.03)		0.13** (0.06)
$\ln(M3)_t$			–0.04 (0.02)	0.10 (0.09)	–0.11** (0.05)
$\ln(M3)_{t-1}$				–0.09 (0.11)	
$\ln(M3)_{t-2}$				–0.04 (0.08)	
$\ln(WagesBakery)_t$			0.02 (0.04)	0.02 (0.04)	–0.05 (0.07)
$\ln(WagesBakery)_{t-1}$				–0.04 (0.04)	
$\ln(WagesBakery)_{t-2}$				0.11** (0.04)	
Constant	–0.94*** (0.34)	2.54*** (0.21)	3.00*** (0.39)	2.84*** (0.36)	3.54*** (0.92)
Observations	144	144	132	130	132
Year FE	No	Yes	Yes	Yes	Yes
Month FE	No	Yes	Yes	Yes	Yes
d-statistic	0.62	0.88	0.89	0.93	0.52
R-squared	0.99	1.00	1.00	1.00	0.98

Source: Author's estimations, based on data from the World Bank, Rosario's Exchange Market, Central Bank of Argentina, National Institute of Statistics and Census, and Observatory of Employment and Entrepreneurship Dynamics.
*Note: Robust standard errors in parentheses; dependent variable: logarithm of wheat-based products CPI; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.*

Coefficients from Table 4, reflecting the pass-through from wheat prices to consumer prices, are far below 1. Because cereals represent only a small share of bread production costs, this result should not be surprising. Different studies presented by the Argentine Rural Confederation (CRA) in their monthly seminars titled "From land to the table"[53] highlight a lower incidence of producer prices of wheat on consumer prices of derivative goods in Argentina, compared with those in other countries such as the United States or New Zealand. According to CRA estimations, the share of wheat in bread price is only about 8 per cent. The remaining share of bread price is explained by other cost elements such as utilities, freights, wages, rents and taxes. Beibe *et al.* (2010) find that wheat explains only about 12 per cent of bread prices. Results in Table 4 are coherent with these findings and relevant in economic terms. An increase of 10 per cent in the price of wheat is associated with an increase ranging from 0.6 to 1.3 per cent in the price of derivatives. The incidence on consumer prices of changes in the wheat price is proportional to the share of the final good price that is explained by the primary input.[54]

When the different specifications of equation (3) are run for the post-intervention period (not reported), the coefficient of interest appears negative and not statistically different from zero. This could be reflecting a change in the elasticity of wheat-based product prices to wheat prices during the post-intervention period. If that were the case, then using the coefficients from Table 4 to calculate the price increase of final goods that could be attributed to wheat during the post-intervention period could be misleading. However, the change in magnitude and significance of β_1 could be better explained by the interventions in the wheat market. As already mentioned, the price of wheat effectively paid by the mill that ultimately affects consumers is the internal supply price set by law in 2007 and kept at an artificially low level during 2007–2011. The large gap between the internal supply price and the domestic price (see Figure 1) explains why domestic prices are not statistically significantly related to the CPI of wheat-based products for the post-intervention period.

To sum up, the share of wheat-based products in household expenditure and the estimation of price elasticity from wheat prices to final goods prices were presented in this section. These results will be used to estimate the welfare effect on households of wheat export restrictions compared with a

[53] In Spanish, *"De la tierra a la mesa"*.

[54] The analysis based on the unit root test and co-integration confirms the validity of the coefficients (see Annex 2). A pass-through of 8 per cent will be assumed in the welfare analysis presented in the next section.

counterfactual scenario in which restrictions are not in place. Table 3 supports the assumption of perfect pass-through from international prices to domestic prices prior to wheat market restrictions, which will make it possible to use the variation in international prices as a proxy for what prices in the domestic market would be in the absence of restrictions. Table 4 shows how much of the increase in wheat prices is transmitted onto consumers through changes in prices of final goods. Main results are presented in the following section.

5 Results

This section presents welfare effects on households arising as a result of the implementation of quantitative restrictions. Counterfactual scenarios are constructed assuming that from 2006 onward, the monthly growth rate of wheat prices that would prevail in the absence of quantitative restrictions is given by the monthly variation in international prices adjusted by export duties. Due to the partial pass-through from wheat to wheat-based products shown in Table 4, the difference in changes in final goods prices between the actual and counterfactual scenario is computed as follows:

$$\%\Delta PriceBCP = \frac{Counterfactual\ Wheat_t - Actual\ Wheat_t}{ActualWheat_t} * Elasticity_{BCP,\ Wheat} \tag{4}$$

In equation (4), *BCP* stands for Bread, Cereals and Pasta, the relevant group of products considered throughout the analysis. Once the change in prices of final goods attributed to changes in wheat prices is obtained from equation (4), the welfare impact on households can be calculated using equation (5):

$$Household\ Welfare\ Effects = \%\Delta PriceBCP * ShareBCP \tag{5}$$

In equation (5), *ShareBCP* is the share of total household expenditure spent on wheat-based products, as explained in Section 4.

Equation (4) is evaluated under two scenarios and estimates are presented in Table 5 as framework 1 and framework 2.[55]

[55] Prices for Table 5, frameworks 1 and 2, are expressed in USD, but the effects are the same when denominated in ARS.

Table 5 Estimations of price variation of wheat-based products

	Actual	Counterfactual
Framework 1	**Domestic wheat prices**	
2005	100.1	100.1
2011	164.0	184.4
Growth (2005-2011)	64%	84%
Difference in wheat prices	12.4%	
%ΔPriceBCP	1.0%	
Framework 2	**Internal supply prices**	
2005	100.1	100.1
2011	102.3	184.4
Growth (2005-2011)	2%	84%
Difference in wheat prices	80.2%	
%ΔPriceBCP	6.4%	

Source: Author's estimations, based on data from the World Bank, Rosario's Exchange Market, Buenos Aires Futures Exchange Market, Central Bank of Argentina, INDEC, and Statistics Institute of Santa Fe.
Note: Domestic and internal supply prices are calculated as annual averages.

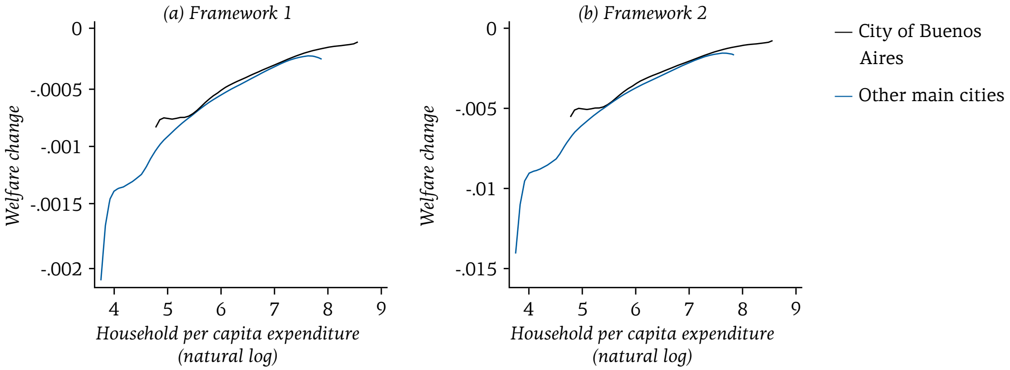
Framework 1 evaluates the effect of quantitative restrictions on prices of wheat-based products. It compares actual prices of wheat in the domestic market with counterfactual prices,[56] which are built under the assumption that in the absence of restrictions, the price variation in international markets is a good proxy for price changes in the domestic market. Counterfactual price data are built from January 2006. While domestic wheat prices increased by 64 per cent from 2005 to 2011, counterfactual prices would have increased by 84 per cent for the same period, thus making the average price of wheat 12.4 per cent higher in 2011. According to the estimations in Table 4, only about 8 per cent of the change in wheat prices is actually transmitted to final goods and thus has an effect on consumers. So, as per equation (4), in the absence of quantitative restrictions, the increase in prices of wheat-based products generated by changes in wheat prices would be 1 per cent higher than in the real scenario. Figure 6, panel (a) shows that consumer welfare effects generated under framework 1 are negligible. The sole adoption of quantitative export restrictions was not enough to produce a quantifiable effect on the welfare of urban households. If the restrictions were removed, for the City of Buenos Aires,

[56] Counterfactual scenarios in Table 5 were constructed extrapolating domestic prices of wheat since January 2006, using the variations in international prices adjusted by export taxes, as was previously explained. Alternative scenarios reported in Annex 3 rely on alternative assumptions to build counterfactual scenarios. Results do not differ systematically from the case presented in the main body of the study.

all households would suffer welfare losses lower than 0.1 per cent. For other main cities, only the poorest decile of the per capita distribution would experience welfare losses higher than 0.1 per cent, but not exceeding 0.2 per cent in any case.

Framework 2 jointly evaluates the effect of quantitative bans and ceiling prices artificially set at lower levels than domestic prices. To take account of the effects of both policies, framework 2 uses internal supply prices as a measure of actual prices of wheat. This assumption is justifiable because it is the internal supply price that ultimately determines the prices of final goods and hence affects consumers. Framework 2 in Table 5 shows that, in this case, prices of wheat-based products would be 6.4 per cent higher in the counterfactual scenario than in the real scenario. Non-parametric estimations of welfare effects of framework 2 are shown in Figure 6, panel (b). If neither export restrictions nor internal supply prices were implemented, urban households in the main cities would suffer welfare losses ranging from zero to almost 1.5 per cent compared with the real scenario. These effects are very modest for most households, even though the poorest households are the most affected, reflecting the pro-poor bias of the measures. For main cities other than the City of Buenos Aires, only the lowest quartile of the logarithm of the expenditure per capita distribution would suffer welfare losses higher than 0.5 per cent if the policies were removed. Welfare losses would be higher than 1 per cent only for the lowest percentile of the distribution. These effects would be even more modest for households located in the City of Buenos Aires, where welfare losses never exceed 0.5 per cent and are actually close to zero for the richest households.

Figure 6 Potential welfare effects on urban households



Source: Author's estimations, based on the 2004–2005 ENGH.
Note: Epanechnikov kernel, bandwidth 0.2, degree 1.

Together, results from frameworks 1 and 2 indicate that the implementation of wheat export restrictions alone does not seem to have generated quantifiable effects on consumers. When combined with ceiling prices and subsidies to the milling industry, welfare effects on households do appear, but are small in magnitude.

5.1 Effects of the macroeconomic context on final goods prices

Were the policies implemented in the wheat market sufficient to curb inflation in basic goods? What would be the evolution of prices of wheat-based products in the absence of interventions? It would be expected that lower actual domestic prices of wheat compared to counterfactual prices (see Table 5) would result in lower prices of final goods. High inflation in wheat-based products during 2006–2011 could have been even higher with counterfactual prices of wheat.

To address this concern, the coefficients from Table 4, column (2), are used to linearly predict the prices of wheat-based products that would prevail in the domestic market with counterfactual prices of wheat (i.e. in the absence of interventions in the wheat market). Counterfactual prices of wheat used for these linear predictions are the same as those used for the construction of frameworks 1 and 2. It is important to remember that coefficients in Table 4 were obtained for 1994–2005, and when using them to predict prices for 2006–2011, it should be assumed that price formation mechanisms were kept constant between periods.

Actual consumer price indices in Table 6 are the average CPI of the Bread, Cereals and Pasta group for 2005 and 2011. The counterfactual CPI for 2011 is obtained from the linear prediction explained in the paragraph above.[57]

Table 6 Consumer price index of wheat-based products

	Actual	Counterfactual
2005	154.5	154.5
2011	440.2	261.1
Growth CPI (2005–2011)	185%	69%
Difference in CPI	–40.70%	

Source: Author's estimations, based on data from INDEC and Statistics Institute of Santa Fe, and author's calculations presented in Table 4.
Note: Actual and counterfactual CPI of Bread, Cereals and Pasta for 2005 and 2011 are constructed as annual averages.

The counterfactual estimation in Table 6 does not allow for disentangling the effect of export restrictions from the remaining policies and macroeconomic conditions affecting Argentina in the last years. If the boom of international commodity prices were the main source behind domestic food inflation, it should be expected that predicted prices of wheat derivatives, estimated with counterfactual wheat prices (higher than domestics prices), would be higher than actual prices. However, while actual inflation in wheat-based products was 185 per cent between 2005 and 2011, inflation in the counterfactual scenario would only have been 69 per cent during the same period. According to the estimations in Table 6, prices of final goods would be 40.7 per cent lower with counterfactual prices of wheat.

The inefficiency of lower wheat prices in restraining inflation can be related to the minor role that wheat plays in the price formation of wheat-based products, as already discussed. Potential explanations for the increase in prices of wheat derivatives during 2006–2011 should be sought beyond the increase in wheat prices in international markets. Moreover, these results could reflect a change in the price formation mechanism of final goods.[58] Other causes might have spurred inflation in 2006–2011, or even the same cause might have played a different role. In this case, coefficients obtained in Table 4 for the pre-intervention period may not be a good fit to predict prices of final goods in the post-intervention period.

To sum up, the frameworks presented in Table 5 shed light on the idea that export restrictions by themselves were not enough to generate quantifiable welfare effects on consumers. Framework 1 shows that in the absence of export restrictions, domestic prices of wheat would only be 12.4 per cent higher than in the real scenario, causing a negligible impact on consumer welfare. Also, when ceiling prices and subsidies to millers are considered, a small impact on household welfare appears, as can be concluded based on framework 2. In this framework, counterfactual prices of wheat would be 80 per cent higher than real prices, making wheat-based product prices 6.4 per cent higher than in the real scenario. Because the share of wheat in final goods prices is about 8 per cent in estimations in Table 4, and the share of wheat-based products in total household expenditure is never higher than 20 per cent, the intervention in the wheat market does not seem to have generated a measurable effect on household welfare.

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[57] The counterfactual CPI for 2005 is the same as the actual CPI, since the counterfactual scenario were only estimated from 2006 onward.

[58] For example, in the post-intervention period, the inflationary environment may have played a higher role in pushing the prices of wheat-based products up than in the pre-intervention period. Between 2005 and 2011, the accumulated general inflation was 156 per cent, while in the pre-intervention period (1994–2005) the accumulated inflation was 78 per cent, supporting the idea of changes in the inflationary environment.

Evidence obtained so far supports the idea that policies applied to the wheat market fell short of the expected goals of the government. As suggested above, the increase in prices of final goods may have been even higher in the absence of interventions. However, high prices of wheat in international markets should not be blamed for the price spike in domestic prices of wheat-based products. Even if export restrictions helped to reduce the share of the price increase of final goods attributable to wheat prices, most of the increase in wheat-based product prices was not avoidable. Other price components of wheat-based products may have played a major role.

6 Conclusions

Studies addressing the effects of non-tariff measures are far from abundant. In this sense, this study presents one of the first attempts to evaluate the largely unexplored effects of this kind of trade policy in Argentina.

The implementation of quantitative export restrictions on cereals triggered an intense debate in Argentina between supporters and opponents of these measures. For supporters, the justification behind the implementation of export restrictions was twofold. First, in a situation characterized by high international prices of commodities, this policy intended to detach domestic from international prices and thus avoid a large increase in domestic prices. Since derivatives of wheat are an important component of the basic food basket of the typical Argentine household, export restrictions aimed to limit inflation. Second, the policy also aimed to keep an adequate provision of grains in the domestic market. Opponents of export restrictions emphasize the minor role that wheat plays in the price formation of final goods. If other components of final goods prices are not targeted, controlling the prices of primary inputs would not be enough to curb inflation.

Additionally, in the medium term, export restrictions could potentially affect incentives on the production side, reduce the supply of cereals in the domestic market and thus increase domestic prices. Debates around wheat export restrictions intensified in the early months of 2013, due to the spike in prices of wheat, flour and bread in the Argentine domestic market (Bertello, 2013; Koop, 2013). This recent increase in prices can be associated with a shortage of wheat for use in local industry, which led to the adoption of additional measures in this market.[59]

[59] See Bureau of Domestic Trade, Resolution 67/2013.

A main assumption of this study is that, in the absence of interventions, domestic wheat prices would move together with international prices. Evidence supporting this assumption allowed for constructing a counterfactual scenario in which the growth rate of domestic wheat prices would equal the variation in international prices adjusted by export duties. Also, the pass-through from wheat prices to prices of final goods was estimated. Combining both results, a calculation was made of the difference in the increase in final goods prices which can be attributed to the difference in the increase in wheat prices between the real and the counterfactual scenario. The share of household budget spent on wheat derivatives allowed an assessment of the welfare effect of export restrictions on urban households, through the evaluation of two different frameworks.

Main results suggest that non-tariff measures by themselves were not enough to generate a large welfare effect on households. In the absence of export restrictions, the price increase of wheat-based products attributable to wheat would only be 1 per cent higher than in the real scenario, with negligible welfare effects on urban consumers. If both export restrictions and subsidies to the milling industry were removed, prices of final goods would be 6.4 per cent higher in the counterfactual scenario. Welfare losses would be modest, ranging from zero to 1.5 per cent, mainly affecting the poorest households. For main cities other than the City of Buenos Aires, only the lowest quartile of the distribution would suffer welfare losses higher than 0.5 per cent. Welfare losses higher than 1 per cent would be limited to the poorest percentile of the per capita distribution. These results testify to the inefficiency of the set of policies (quantitative export restrictions, ceiling prices and subsidies) to curb inflation and generate quantifiable welfare effects on households, compared with a non-intervention scenario. It was only possible to limit the increase in food prices partially and at the cost of a large financial burden for the government in terms of subsidies. Additionally, export restrictions reduced the amounts collected by the government in the form of export duties, generating additional costs from the intervention.

To analyse the causes of food inflation does not fall under the scope of this study. However, results suggest that key causes of inflation in wheat-based products may be sought beyond the international boom in wheat prices. The design of policies aiming to control increases in food prices should therefore go beyond targeting commodity prices in the domestic market, as other price components seem to play a more important role in pushing the prices up.

As was previously discussed, a comprehensive analysis should incorporate the effects of NTMs on other actors involved in the wheat value chain than consumers. In particular, producer welfare effects should be addressed, but the lack of available data precludes this analysis. However, some general phenomena such as the high volatility in domestic wheat prices in 2013[60] and the reduction of wheat-sown areas could be indicative of the distortion of the incentives faced by wheat producers as a consequence of the policies implemented in the wheat sector. In addition, interventions may also have generated large gains for a limited group of millers and exporters receiving subsidies and export authorizations, while placing a large financial burden on the government.

New policies implemented after 2011, such as the creation of a trust in May 2013 to refund export duties to wheat producers, were intended to promote wheat production, with the aim to counterbalance the negative incentives emanating from the implementation of export restrictions. However, effects of these measures will only appear in the medium term and cannot be assessed at the moment.

Also, export restrictions may have had an impact on fostering the first and second processing stages. By providing a higher level of effective protection, NTMs might have promoted national value added and employment. Figures presented in Section 2 of the study support this idea; however, evidence is far from being conclusive.

Overall, although limited to first-order consumption effects on urban households, this study contributes to providing a benchmark to evaluate the effects of the policies in motion. These policies did not seem sufficient to generate large welfare effects on consumers compared with a potential counterfactual scenario. In addition, the implementation of export restrictions in the wheat market was not sufficient to contain inflation in wheat derivatives in Argentina from 2007 onward. These results are highly relevant in terms of policymaking because they seem indicative of the failure of NTMs to achieve the intended objectives. It is possible that, in the absence of interventions, the increase in prices of final goods would be even higher than it actually was. Still, it is not clear whether these welfare losses would be quantitatively larger than in the real scenario, provided that in both cases, households would suffer due to increases in wheat-based product prices.

[60] In October 2013, international wheat prices averaged USD 325 per metric ton (World Bank Commodities Price Data). In the same month, domestic wheat prices were almost double, averaging USD 617 per metric ton (Buenos Aires Futures Exchange Market). Higher domestic prices thus reversed any potential positive effect of export restrictions on consumers.

Moreover, changes in domestic wheat prices could even have generated negative welfare effects on the supply side. If this had been the case, negative welfare effects on producers could have offset the modest positive welfare effects on consumers. Therefore, it is possible that an alternative allocation of resources would be more beneficial from a social point of view.

To sum up, results obtained so far raise doubts about the effectiveness of export restrictions in achieving welfare goals. Future research on this topic should try to incorporate the supply side in the analysis, provided that microdata on producers are available. This could help assess the impact of these policies in a broader context. In addition, future analysis should assess medium- and long-term effects of export restrictions and other policies implemented in the wheat market. It would also be relevant to study the effects of export restrictions on other cereals, such as corn. Such analysis would help to estimate the overall impact that export-related NTMs have had on the welfare of households in Argentina as well as to better understand the effects of this type of policies. Finally, the effectiveness of export duties as a policy intended to curb inflation and generate welfare effects on households should also be discussed. Although the implementation of export duties was driven by fiscal considerations, it also had an effect on the prices of wheat derivatives. Also, by reducing the share of international prices received by producers, incentives and choices on the supply side were distorted. However, welfare effects associated with the removal of export duties were not studied here and will be left for future research.

Annexes

Annex 1

Table A1.1 Summary statistics by quintile of the income distribution, 2004–2005

	1st quintile	2nd quintile	3rd quintile	4th quintile	5th quintile
National					
Total per capita expenditure	169	288	420	614	1,291
Share of food in expenditure	50.9%	44.4%	39.1%	36.0%	29.1%
Share of wheat-based products in expenditure	11.0%	7.8%	6.0%	5.0%	3.3%
Equivalent adults per household	3.8	3.2	2.8	2.3	1.9
City of Buenos Aires					
Total per capita expenditure	477	701	984	1,435	2,530
Share of food in expenditure	37.6%	34.4%	30.7%	27.0%	24.2%
Share of wheat-based products in expenditure	5.6%	4.4%	3.7%	2.7%	1.9%
Equivalent adults per household	2.8	2.2	2	1.8	1.6
Other main cities					
Total per capita expenditure	210	331	457	628	1,167
Share of food in expenditure	47.8%	42.4%	38.8%	36.3%	29.8%
Share of wheat-based products in expenditure	9.7%	6.9%	5.7%	4.7%	3.4%
Equivalent adults per household	3.6	3	2.7	2.4	2

Source: Author's estimations, based on the 2004–2005 ENGH.
Note: Summary statistics are calculated at the household level. Total per capita expenditure is expressed in ARS.

Table A1.2 Pass-through from international to domestic prices of wheat – Export duties as control

	(1)	(2)	(3)	(4)	(5)	(6)
	lnDPW -PRE	lnDPW -PRE	lnDPW -PRE	lnDPW -POST	lnDPW -POST	lnDPW -POST
ln(AdjIntPW)	0.98***	0.95***	1.14***	0.77***	0.69***	0.66***
	(0.06)	(0.10)	(0.10)	(0.06)	(0.09)	(0.07)
ExportDutiesW	0.00	0.01	-0.01	0.02**	0.01	0.01**
	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Constant	–0.01	0.13	–0.85*	0.85**	1.46***	1.55***
	(0.28)	(0.50)	(0.48)	(0.37)	(0.55)	(0.45)
Observations	144	144	144	72	72	72
Year FE	No	Yes	Yes	No	Yes	Yes
Month FE	No	No	Yes	No	No	Yes
R-squared	0.94	0.96	0.98	0.71	0.85	0.89

Source: Author's estimations, based on data from the World Bank, Rosario's Exchange Market and Buenos Aires Futures Exchange Market.
*Note: Robust standard errors in parentheses. Dependent variable: logarithm of domestic wheat prices; *** p < 0.01, ** p < 0.05, * p < 0.1.*

Table A1.3 Pass-through from international to domestic prices of wheat – Estimations of first differences

	(1)	(2)	(3)	(4)	(5)	(6)
	lnDPW -PRE	lnDPW -PRE	lnDPW -PRE	lnDPW -POST	lnDPW -POST	lnDPW -POST
D.ln(AdjIntPW)	0.80***	0.72***	0.80***	0.31**	0.30**	0.30**
	(0.08)	(0.10)	(0.11)	(0.13)	(0.13)	(0.11)
ExportDutiesW	–0.00	–0.00	0.00	–0.00	–0.01	–0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)
Constant	0.00	0.02	–0.01	0.11	0.18	0.07
	(0.01)	(0.07)	(0.07)	(0.09)	(0.18)	(0.17)
Observations	143	143	143	72	72	72
Year FE	No	Yes	Yes	No	Yes	Yes
Month FE	No	No	Yes	No	No	Yes
R-squared	0.44	0.47	0.63	0.16	0.20	0.47

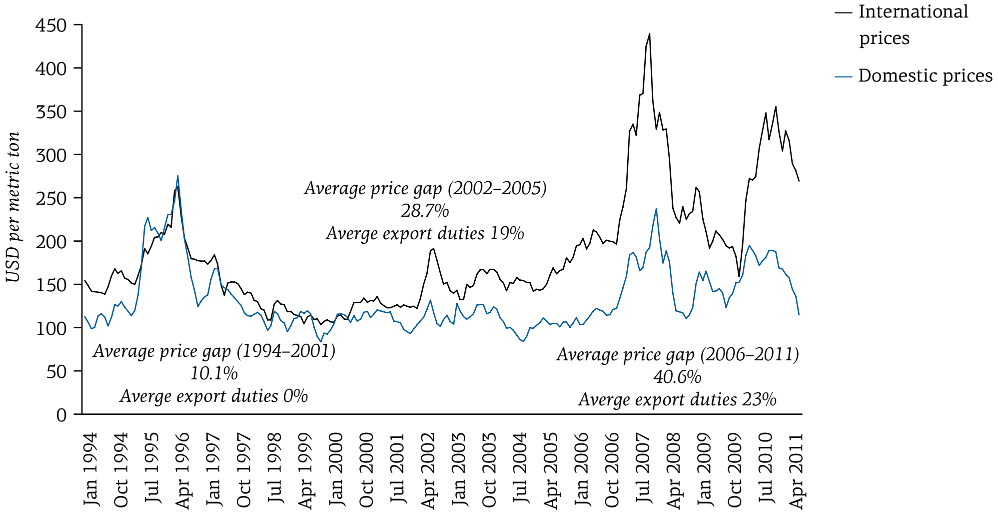
Source: Author's estimations, based on data from the World Bank, Rosario's Exchange Market and Buenos Aires Futures Exchange Market.
*Note: Robust standard errors in parentheses. Dependent variable: logarithm of domestic wheat prices; *** p < 0.01, ** p < 0.05, * p < 0.1.*

Table A1.4 Price formation of final good – Estimations without constant (OLS regressions)

	(1)	(2)	(3)	(4)	(5)
	ln(CPIBCP)	ln(CPIBCP)	ln(CPIBCP)	ln(CPIBCP)	ln(CPIBread)
ln(DPW)t	0.12***	0.07***	0.08***	0.06***	0.14***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.03)
ln(CPIRecreation)t	0.33***	0.23***	0.28***	0.24***	0.37***
	(0.03)	(0.05)	(0.06)	(0.06)	(0.12)
ln(CPIApparel)t	0.09***	0.12**	0.11*	0.06	0.19**
	(0.02)	(0.05)	(0.06)	(0.06)	(0.09)
ln(GDP)t	0.16***	0.21***	0.24***	0.22***	0.30***
	(0.01)	(0.02)	(0.03)	(0.03)	(0.08)
ExchangeRatet	0.05***	0.07***	0.06***	0.10***	-0.03
	(0.01)	(0.01)	(0.01)	(0.01)	(0.03)
POST	–0.01	–0.01			
	(0.02)	(0.02)			
$\ln(M3)_t$			–0.04	0.10	–0.11**
			(0.02)	(0.09)	(0.05)
$\ln(M3)_{t-1}$				–0.09	
				(0.11)	
$\ln(M3)_{t-2}$				–0.04	
				(0.08)	
$\ln(WagesBakery)_t$			0.02	0.02	–0.05
			(0.04)	(0.04)	(0.07)
$\ln(WagesBakery)_{t-1}$				–0.04	
				(0.04)	
$\ln(WagesBakery)_{t-2}$				0.11**	
				(0.04)	
Observations	144	144	132	130	132
Year FE	No	Yes	Yes	Yes	Yes
Month FE	No	Yes	Yes	Yes	Yes
R-Squared	1.00	1.00	1.00	1.00	1.00
d-statistic	0.59	0.88	0.89	0.93	0.52

Source: Author's estimations, based on data from the World Bank, Rosario's Exchange Market, Central Bank of Argentina, National Institute of Statistics and Census, and Observatory of Employment and Entrepreneurship Dynamics.
*Note: Robust standard errors in parentheses; dependent variable: logarithm of wheat-based products CPI; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.*

Figure A1.1 Evolution of international and domestic prices of wheat, 1994–2011 (USD per metric ton)



Source: Author's estimations, based on World Bank, Rosario's Exchange Market, Buenos Aires Futures Exchange Market and Central Bank of Argentina.
Note: Prices are expressed in nominal terms. International prices are not adjusted by export duties.

Annex 2

When working with time series, the consistency of OLS estimators is not guaranteed. To address the issue of potential spurious regressions, the existence of unit roots in the time series of interest is tested. For 1994–2005, the augmented Dickey-Fuller test does not reject the null hypothesis of the existence of a unit root for the logarithm of domestic and adjusted international prices.[61] However, different specifications of both the Johansen and the Engle and Granger tests reject the null hypothesis of no co-integration at 1 per cent for the pre-intervention period. These results support the existence of long-term equilibrium between variables and dissipate concerns about the consistency of OLS estimators in Table 3. For the post-intervention period, the unit-root hypothesis for the logarithm of domestic and adjusted international prices can be rejected at 5 or 10 per cent, when

[61] For domestic prices, when the specification includes a drift, the null hypothesis of the unit root could be rejected at 5 per cent with one lag and at 10 per cent with two lags. However, these results are not robust to the inclusion of a trend, or other number of lags.

the Dickey-Fuller test is performed, including a drift. These results are robust to the inclusion of different numbers of lags. Thus, results of Table 3 are also consistent for the post-intervention period.[62]

There is also concern regarding results in Table 4 reflecting spurious regressions, as evidenced by low values of Durbin-Watson statistics and high R-squared. For the pre-intervention period, all the relevant series[63] were found to be I(1), at standard levels of significance, including a drift and different number of lags. The hypothesis of no co-integration cannot be rejected when only *lnCPIBCP* and *lnDPW* are included in a Johansen test. However, the inclusion of a third variable such as GDP or a proxy for inflation (as Apparel or Recreation CPI) allows rejecting the hypothesis of no co-integration, supporting the existence of a stable long-term relationship between variables. Performing the Johansen co-integration test for the whole set of relevant variables *(lnCPIBCP, lnDPW, lnCPIRecreation, lnCPIApparel, lnGDP, ExchangeRate, lnM3* and *lnBakeryWages)* allows for the rejection of the no co-integration hypothesis. Results are robust to the inclusion of different number of lags and different combinations of variables. These results mitigate the concern regarding results in Table 4 being driven by spurious relations between variables.

Annex 3

In Section 5, different frameworks of welfare effects on urban households in the City of Buenos Aires and other main cities were reported. The counterfactual scenario assumed in that case was constructed considering that, from January 2006 onward, the growth rate of domestic wheat prices would be equal to the growth rate of international prices adjusted by export duties. Tables A3.1 and A3.2 in this Annex present the same frameworks as those found in Table 5 of Section 5, but consider different assumptions in the construction of counterfactual scenarios.

Frameworks 1A and 2A assume that in the absence of quantitative restrictions counterfactual prices would be the international prices adjusted by

[62] To avoid additional concern about the potential spurious regressions in Table 3, Table A1.3 presents the same regressions as Table 3 but with variables expressed in first differences. Because variables are found to be I(1), first differences of these variables are stationary. Results are supportive of a higher impact of international prices on domestic prices for the pre-intervention period.

[63] These series are the logarithm of Bread, Cereals and Pasta CPI, the logarithm of Recreation and Apparel CPI, the logarithm of the monetary base and money supply and the logarithm of wages in the bakery and milling industries.

export duties. Table A3.1 reports the corresponding prices and growth rates. If only quantitative restrictions were considered, prices of wheat in the counterfactual scenario would be 48.5 per cent higher than in the real scenario. Wheat-based product prices, ascribable to wheat, would be 3.9 per cent higher in the counterfactual scenario. If internal supply prices were also considered, price variation in wheat-based products attributable to wheat would reach 11 per cent. As can be seen in Figure A3.1, if this counterfactual scenario were assumed, interventions would avoid larger welfare losses than those estimated in the frameworks presented in Table 5. Even though, without the implementation of internal supply prices, export restrictions by themselves would not seem to generate quantifiable welfare effects, as shown in Figure A3.1, panel (a).

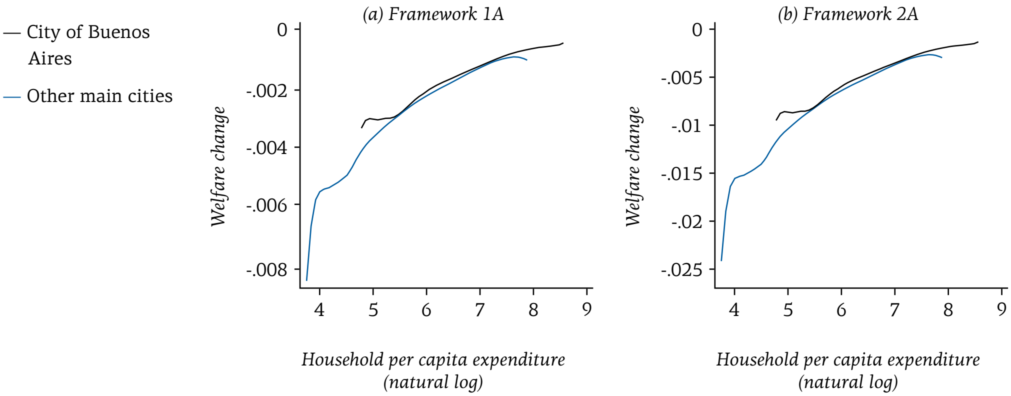
Table A3.1 Estimations of price variation of wheat-based products – Alternative counterfactual scenarios A

	Actual	Counterfactual
Framework 1	**Domestic wheat prices**	
2005	100.1	100.1
2011	164.0	243.5
Growth (2005-2011)	64%	143%
Difference in wheat prices	48.5%	
%ΔPriceBCP	3.9%	
Framework 2	**Internal supply prices**	
2005	100.1	100.1
2011	102.3	243.5
Growth (2005-2011)	2%	143%
Difference in wheat prices	138%	
%ΔPriceBCP	11%	

Source: Author's estimations, based on data from the World Bank, Rosario's Exchange Market, Buenos Aires Futures Exchange Market, Central Bank of Argentina, INDEC, and Statistics Institute of Santa Fe.

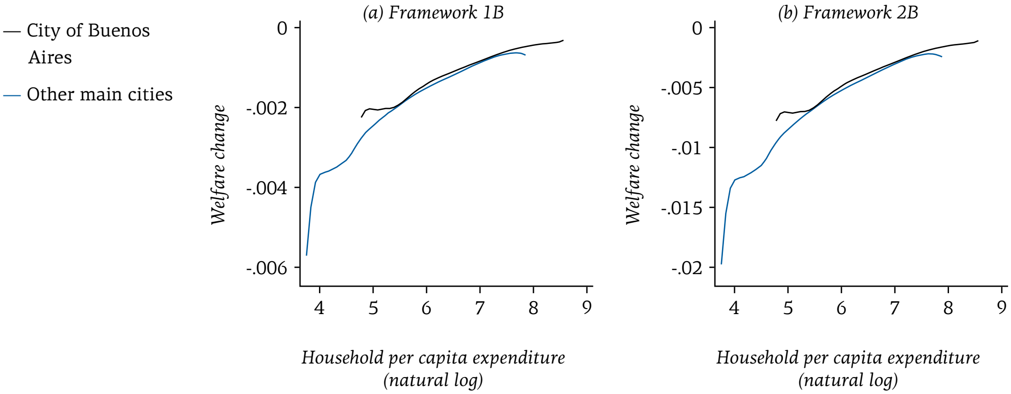
*Note: Domestic and internal supply prices are calculated as annual averages. Counterfactual prices of wheat are calculated as international prices adjusted by export duties (international prices * (1 – export duties)).*

Figure A3.1 Potential welfare effects – Frameworks 1A and 2A



Source: Author's estimations, based on the 2004-2005 ENGH.
Note: Epanechnikov kernel, bandwidth 0.2, degree 1.

Figure A3.2 Potential welfare effects – Frameworks 1B and 2B



Source: Author's estimations, based on the 2004–2005 ENGH.
Note: Epanechnikov kernel, bandwidth 0.2, degree 1.

Table A3.2 replicates Table A3.1 but assumes that prices that would prevail in the domestic wheat market in the absence of interventions would be equal to 90 per cent of international prices adjusted by export duties (0.90 * *AdjIntPrice*). This share mimics the average corresponding to 1994–2005. Results under this assumption are an intermediate case between those presented in Table 5 and Table A3.1. Non-parametric estimations under these frameworks are presented in Figure A3.2.

Table A3.2 Estimations of price variation of wheat-based products – Alternative counterfactual scenarios B

	Actual	Counterfactual
Framework 1	**Domestic wheat prices**	
2005	100.1	100.1
2011	164.0	217.7
Growth (2005–2011)	64%	117%
Difference in wheat prices	32.7%	
%ΔPriceBCP	2.7%	
Framework 2	**Internal supply prices**	
2005	100.1	100.1
2011	102.3	217.7
Growth (2005–2011)	2%	117%
Difference in wheat prices	112.8%	
%ΔPriceBCP	9%	

Source: Author's estimations, based on data from the World Bank, Rosario's Exchange Market, Buenos Aires Futures Exchange Market, Central Bank of Argentina, INDEC, and Statistics Institute of Santa Fe.
*Note: Domestic and internal supply prices are calculated as annual averages. Counterfactual prices of wheat are calculated as 0.9 * international prices * (1 – export duties).*

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China

The consumption effect of the renminbi appreciation in rural China

*Dahai Fu and Shantong Li**

Abstract

What does the recent appreciation of the renminbi mean for the poor in the People's Republic of China? This question is rarely asked, and the few responses to date have come in the form of opinions rather than hard evidence. The objective of this study is to provide elements of an answer by examining the consumption effect of the renminbi appreciation in rural China. Because households in different regions consume diverse baskets of goods, the main part of this study analyses the impact of the appreciation on changes in household consumption (excluding what is self-produced consumption) in response to exchange-rate-induced market price changes, by commodity and by region. The results of the analysis lead to the conclusion that the appreciation of the renminbi has generated significant gains for all households by reducing their consumption expenditure. However, gains have been lower for poorer households, especially those in the inland western provinces of China. The main reason for these lower gains is that households in these provinces spend more on commodities that are less responsive to exchange rate movements. Furthermore, the exchange rate pass-through and, hence, the impact of the renminbi appreciation on market prices, falls with the level of development of the market economy, which is lower in the inland provinces. Consequently, to enhance the positive effect of the renminbi appreciation on these households, the government should step up market development reforms to establish market-driven pricing mechanisms, in addition to providing households with direct assistance, such as subsidies for poor families.

* The authors would like to thank Ying Zhang and Yanrui Wu from the University of Western Australia and Yihong Tang from the Central University of Finance and Economics for their comments and suggestions, and the National Social Science Fund of China (Project No. 13CJL037) for co-funding the development of the study.

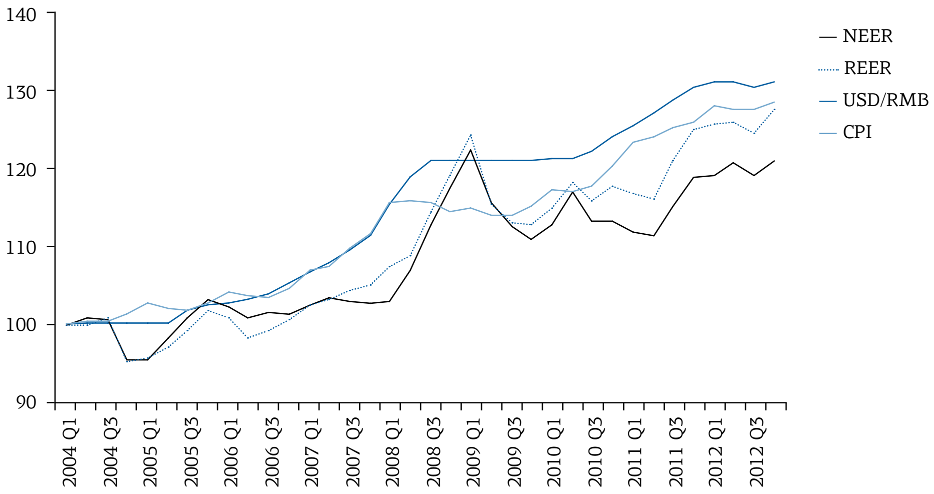
1 Introduction

The impact of trade liberalization on poverty in developing countries has been widely debated in policy circles and the research community (Hertel and Reimer, 2005). Great efforts have been made to investigate various channels through which trade liberalization might affect the poor (Winters, 2002; Porto, 2006; Goldberg and Pavcnik, 2004, 2007; Nicita, 2009; Topalova, 2010; McCaig, 2011). China – the most populous country in the world – has made poverty reduction one of the priorities of its development strategy, and has achieved remarkable progress during the past three decades since initiating market reforms in late 1978. However, with China still having the world's second-largest poor population in absolute terms after India, poverty reduction remains an important challenge for the Chinese government going forward.

China's Twelfth Five-Year Plan (2011–2015) placed the goal to "reduce poverty and to improve equity in the distribution of income" high on its agenda. General principles, however, are not enough. Appropriate policy formulation calls for detailed quantitative policy analysis. To date, numerous studies have examined the evolving pattern and determinants of poverty in China (Fang *et al.*, 2002; Yao *et al.*, 2004; Meng *et al.*, 2005; Appleton *et al.*, 2010). Little research has been carried out, however, on the effects of trade liberalization on poverty in China, which is particularly important for the country at present (Liang, 2007; Huang *et al.*, 2007). In particular, the appreciation of the renminbi (RMB) since July 2005 represents a momentous step forward in Chinese trade liberalization and has had a great impact on the country's trade flows, labour market, and economic growth. However, its poverty impact has not been addressed in the published literature.

In July 2005, China ceased to fix its exchange rate against the United States dollar and began to appreciate the RMB. The RMB was no longer solely pegged to the USD, but rather to a basket of currencies, including the USD and the Japanese yen, among others. Since then, the Chinese currency has appreciated over 30 per cent against the USD. Even in terms of the nominal effective exchange rate (NEER), it has strengthened by more than 20 per cent. During 2004–2011, the consumer price index (CPI) and real effective exchange rate (REER) also increased, even more rapidly than the NEER, as shown in Figure 1.

Figure 1 Exchange rate and consumer price index growth, 2004–2012 (2004 Q1 = 100)



Source: Authors' calculations, based on data from the International Financial Statistics, Bank for International Settlements and United States Federal Reserve Bank of St. Louis.

What does the recent RMB appreciation mean for the poor in China? This question is rarely asked. To date, opinions rather than hard evidence have been put forth on the issue.

According to existing literature, changes in exchange rates are expected to affect the poor primarily through three channels: price transmission, output variation, and economic growth (Ames *et al.*, 2001).

First, exchange rate movements directly affect the prices of imported intermediate and finished goods. An appreciation in the nominal exchange rate leads to reduced prices for producers and retailers, which could result in welfare gains. Moreover, an appreciation of the nominal exchange rate would reduce the demand for domestic goods both at home and abroad, which would exert downward pressure on the prices of domestic substitute products.

Second, exchange rate fluctuations would result in fluctuations in domestic output, which has a direct impact on the incomes of the poor. In particular, the RMB appreciation has made Chinese products more expensive abroad, and hence negatively affected the exporting sector, which employs a large proportion of unskilled workers who are more likely to come from poor households. Although many regional governments, concerned about labour welfare and social stability, have recently raised the minimum salary by 15–20 per cent, the positive impact of this measure on the poor seems marginal and slow to come to fruition.

Finally, the real exchange rate influences the country's external competitiveness and hence its growth rate, which can affect the poor in the long term through reduced employment opportunities and wages.

Due to data limitations, this study only examines the effect of the RMB appreciation occurring through the price channel. More specifically, it aims to estimate the impact of the RMB appreciation on household welfare that arises through exchange-rate-induced changes in consumer prices. The research is thus strongly associated with two established strands of literature.

The first strand of literature is related to the estimation of exchange rate pass-through (ERPT) to import prices or domestic prices (Goldberg and Knetter, 1997; Campa and Goldberg, 2006). The starting point in the examination of the price transmission of exchange rate movements is the law of one price (LOP). Most of the evidence indicates that the deviation from the LOP tends to be large and persistent, which points to incomplete ERPT. Empirical studies on ERPT in developing economies have become more frequent in recent years (Choudhri and Hakura, 2006; Devereux and Yetman, 2002; Frankel *et al.*, 2005). A general finding is that the ERPT in developing economies also tends to be incomplete and smaller for consumer prices than for import prices. Few studies covering China have been conducted to date. Ca'Zorzi *et al.* (2007) used the vector autoregressive model for a large number of emerging countries, including China, and found that a 1 per cent change in the exchange rate would lead to a 0.08 per cent change in China's consumer prices after one year, and 0.77 per cent after two years. Shu *et al.* (2008) found that a 10 per cent increase in the NEER of the Chinese currency would dampen consumer prices by 1.1 per cent within a year. Jin (2012) showed that a 1 per cent appreciation of the NEER reduced the CPI inflation rate by 0.132 per cent and the producer price index (PPI) inflation rate by 0.495 per cent over the long term from 1996 to 2009.

The second strand of literature is related to studies using household-level data to evaluate the distributional and welfare effects of relative price changes induced by macroeconomic shocks. Examples are Porto (2006), Nicita (2009), Chen and Ravallion (2004), and Ferreira *et al.* (2004). Porto

(2006) and Nicita (2009) studied the impact that a reduction of import tariffs has on household welfare via a fall in domestic prices. Chen and Ravallion (2004) examined the effect of hypothetical relative price changes induced by China's accession to the World Trade Organization (WTO) on household income and consumption in China. Ferreira *et al.* (2004) used a sectoral disaggregated model to quantify the effects of the depreciation in Brazil on wages and prices, and then link this to a household survey to assess the distributional effects. While many studies have investigated the price effect of tariff liberalization on household welfare, little research – except for Kraay (2008) – has been done on the welfare impact of exchange-rate-induced price changes. Kraay (2008) empirically investigated the effect of the large depreciation of the Egyptian pound on household welfare between 2000 and 2005. The average welfare loss due to exchange-rate-induced price increases was equivalent to 7.4 per cent of initial expenditure.

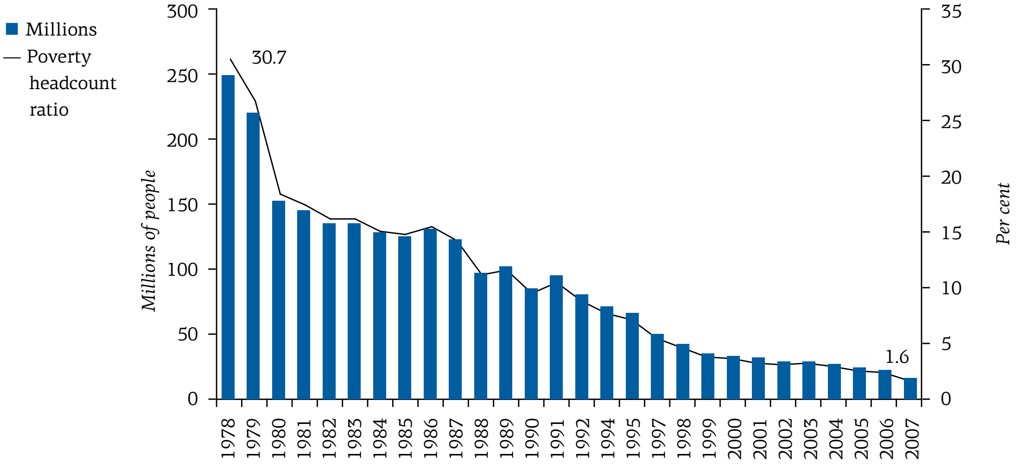
Following Kraay (2008), this study employs techniques from both strands of literature described above to analyse the case of the significant appreciation of the RMB since mid-2005. The potential distributional consequences of that appreciation have prompted widespread concern among policymakers. To the best of our knowledge, this study would be the first to combine econometric estimators of ERPT with household survey data to assess the poverty effects of the RMB appreciation. More importantly, in contrast to previous studies, this study estimates relatively disaggregated pass-through regressions. Because households in different regions consume diverse sets of commodities, it is necessary to analyse the price changes induced by exchange rate movements by commodity and by region. After obtaining the estimates of the ERPT in the first step, this study further analyses the impact of the ERPT-induced price changes on household welfare by calculating the compensating variations. The empirical results are discussed, and conclusions are provided at the end.

2 Poverty reduction in China

China's achievement in reducing poverty during the reform era has been remarkable, irrespective of the different alternative approaches to measuring poverty, be they in terms of official poverty or international standards, income or consumption, or the absolute number of poor versus the incidence, depth and severity of poverty (World Bank, 2009). Results and estimates on poverty may differ from one source to the other or from one author to the other depending on the approach and the data, but they consistently point to the same poverty trends over time.

According to the official rural poverty line,[1] more than 250 million people, or 30.7 per cent of the rural population, lived in poverty in rural China in 1978 (Figure 2). By 2007, the rural poverty rate had decreased dramatically to 1.6 per cent. There is no officially established urban poverty line. However, estimates using an urban poverty line comparable to the official rural poverty line found negligible poverty levels in urban areas already in 2002 (Ravallion and Chen, 2007). Both poverty estimates, for rural and urban areas, suggest that China has practically solved its poverty problem.

Figure 2 China's record of poverty reduction, 1978–2007 (selected years)



Source: Authors' calculations, based on NBS (2012).
Note: This poverty rate is based on the official poverty line of RMB 785 per person per year.

However, as shown by the World Bank (2009), the Chinese government's task of poverty reduction is not yet complete. The official poverty line remains relatively low compared with the international standard of USD 1.25 per day in purchasing power parity (PPP) terms, and also in relation to rising incomes and growing aspirations of the country. The World Bank statistics show that, according to international measures of poverty, there were about 254 million poor people in China in 2005. In addition, vulnerability to poverty caused by a variety of income shocks remains widespread.

[1] Until 2008, the official poverty line for rural areas in China was RMB 785 per person per year (approximately USD 0.57 per person per day at 2005 PPP prices).

Li *et al.* 2011 analysed poverty trends between 2002 and 2007 using two waves of household surveys conducted by the China Household Income Project (CHIP) for those years.[2] Three alternative poverty estimates are presented in Table 1, two using absolute poverty lines (the 2009 official poverty line[3] and the international poverty line of USD 1.25 in PPP terms) and one using a relative poverty line equal to half the median income.[4] According to the USD 1.25 poverty line in PPP terms, the incidence of poverty in China declined from 18.6 per cent in 2002 to 8 per cent in 2007. This reduction reflects the marked decline in rural poverty, which was due, among other reasons, to the reduction in rural taxes and fees that contributed to a more pro-poor type of growth after 2001. The rapid rise in agricultural subsidies (especially for agricultural inputs) and the establishment of rural social assistance programmes (especially *Di Bao*[5] and medical assistance) contributed further to the decline in poverty starting in 2005.

Absolute poverty among the registered urban and migrant populations also declined, although it was already rather low in 2002. In contrast, relative poverty measured by the poverty line of 50 per cent of median income remained more or less unchanged at 13 per cent. Stagnant relative poverty rates suggest that households in the lower tail of the income distribution were not catching up to the median, which is consistent with our findings of increased inequality. For all poverty lines, the overwhelming majority of the poor (more than 95 per cent) were living in rural China. For relative poverty, the share of rural poor was lower, but still close to 60 per cent.

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[2] See the introduction to the sampling procedure of the Chinese National Bureau of Statistics (NBS) 2002 Household Survey, available at: *http://www.stats.gov.cn/tjsj/ndsj/yearbook2003_c.pdf*. See also the introduction to the NBS 2007 Household Survey sampling procedure, available at: *http://www.stats.gov.cn/tjsj/ndsj/2008/indexch.htm*.

[3] In 2009, the government raised the official 2008 poverty line to RMB 1,196 (approximately USD 0.87 per person per day at 2005 PPP prices).

[4] All the estimates use the official definition of income, which does not include imputed rents from owner-occupied housing.

[5] The “Minimum Livelihood Guarantee Scheme”, known as *Di Bao* in Chinese, was established in 1999. According to the programme’s regulations, individuals whose per capita household income falls below a locally determined minimum living standard can benefit from the programme, irrespective of whether or not they already receive a basic living subsidy, unemployment insurance, or any other insurance.

Table 1 Poverty incidence and composition, 2002 and 2007 (per cent)

	Official poverty line		PPP USD 1.25 per day		50 per cent of median income	
	2002	2007	2002	2007	2002	2007
			Poverty incidence			
Rural	11.22 (964)	5.59 (1,123)	27.49 (1,451)	13.88 (1,689)	13.69 (1,051)	14.32 (1,714)
Urban	0.55 (1,338)	0.12 (1,503)	2.34 (2,013)	0.44 (2,260)	11.88 (3,379)	12.37 (6,412)
Migrants	2.43	0.08	5.80	0.17	18.57	7.00
Total	7.44	3.2	18.57	8.00	13.21	13.3
			Poverty composition			
Rural	96.72	98.35	95.02	97.70	66.52	60.63
Urban	2.48	1.57	4.21	2.23	30.01	37.73
Migrants	0.8	0.08	0.77	0.07	3.47	1.64
Total	100	100	100	100	100	100

Source: CHIP surveys for 2002 and 2007, and Li et al. (2011).
Note: Numbers in parentheses are the poverty lines expressed in RMB. The official rural poverty lines for 2002 and 2007 correspond to the 2008 poverty line value (RMB 1,196) adjusted for inflation. Poverty lines for urban areas and migrants are the same. Absolute urban poverty lines are equal to rural poverty lines adjusted by the urban-rural cost of living differential.

Moreover, poverty rates varied significantly across regions. As shown in Table 2, the incidence of absolute poverty in large municipalities, as well as in the eastern part of the country, was extremely low. In the west, the rate of absolute poverty measured using PPP USD 1.25 per day declined from 32 to 15 per cent from 2002 to 2007. Relative poverty was also very low in large municipalities, lower in the east, moderate in central China, and higher in the west, where more than 20 per cent of the population fell below the relative poverty line. Relative poverty nationwide and relative poverty in all regions stayed fairly stable between 2002 and 2007. By all measures, China's poor are concentrated in the west, where more than half of the absolute poor and over 40 per cent of the relatively poor live. Indeed, the share of the poor in the west increased over this period. The regional structure suggests the need for continuous efforts to alleviate poverty, especially in the western and central regions. Furthermore, it is notable that within all regions, poverty is largely rural. For example, in 2007, in the eastern, central and western regions, the rates of rural poverty measured using USD 1.25 per day were 4, 7 and 15 per cent, respectively. Such a pattern has implications for the design of anti-poverty programmes.

Table 2 Structure of poverty by region, 2002 and 2007 (per cent)

	Official poverty line		**PPP USD 1.25 per day**		**50 per cent of median income**	
	2002	2007	2002	2007	2002	2007
Poverty incidence						
Big cities	0.07	0.09	0.70	0.35	0.89	1.87
East	3.77	1.59	8.80	3.74	7.73	7.78
Central	6.98	2.74	19.87	7.47	14.21	12.81
West	15.53	6.07	31.64	14.77	20.49	21.99
Total	7.44	3.20	18.57	8.00	13.21	13.30
Poverty composition						
Big cities	0.03	0.09	0.12	0.14	0.21	0.44
East	18.33	17.59	17.16	16.51	21.19	20.65
Central	30.42	28.41	34.71	30.94	34.91	31.94
West	51.22	53.91	48.00	52.40	43.69	46.96
Total	100	100	100	100	100	100

Source: CHIP surveys for 2002 and 2007, and Li et al. (2011).

Notwithstanding the substantial reduction in poverty in China since 1978, the pace of that reduction has decelerated and new forms of poverty have emerged. Several factors are making it more difficult to reduce poverty, including the deteriorating quality of growth in terms of its potential to generate employment, and increased inequality. Moreover, a high proportion of the poverty that persists is geographically dispersed and transient. Poverty has also become less responsive to macroeconomic growth (World Bank, 2009).

3 Methodology and data

The empirical approach used in this study to measure the effects of the RMB appreciation on household welfare in terms of consumption expenditure is similar to Kraay (2008) and consists of two steps. The first step ties exchange rate changes to disaggregated consumer prices of different goods in different provinces. The second step evaluates the response of consumption expenditure of households to changes in consumer prices. A detailed discussion of each of these steps follows.

3.1 Estimation of the exchange rate pass-through

The key question addressed in the first step is the effect of the RMB appreciation on disaggregated consumer prices between 2004 and 2011. Following the standard ERPT models such as Feenstra *et al.* (1996) and Goldberg and Knetter (1997), we model the consumer price changes as a function of the exchange rate, trade costs, producer prices, prices of imported goods, money supply, and domestic demand. Therefore, the estimation equation is given by:

$$CP_{irt} = \beta_0 + \beta_1 ER_t + \beta_2 ER_t TC_r + \beta_3 CP_{irt-1} + \beta_4 PP_{rt} + \beta_5 MP_t + \beta_6 M2_t + \beta_7 TS_{rt} + \varepsilon_{it} \quad (1)$$

where CP_{irt} is the monthly price index for good i in region r at time t, which is published based on the current period previous year (CPPY) = 100. Here we work with price indices for food, clothing, medical care, durable goods, education, housing, and transportation and communications, which correspond to expenditure categories in the household survey. ER_t is the monthly average of NEERs of China at time t, which is drawn from the Bank for International Settlements.[6] We adjust it to be based on CPPY = 100 in order to make it consistent with other index data.

Because a primary concern is to measure the effect of exchange rate changes on domestic prices at the regional level, following Nicita (2009), we include an interaction term between the trade cost and the exchange rate ($ER_t TC_r$) to isolate empirically the local effect of exchange rate movements in the pass-through. Rather than measuring the trade cost (TC_r) by simply using the distance to the border, we use an alternative indicator, namely the marketization index (Fan *et al.*, 2011). The index comprises 19 components of institutional arrangements and policies in five major areas: (a) size of the government in the regional economy; (b) economic structure, mainly concerning the growth of the non-state sector and the reform of state enterprises; (c) interregional trade barriers, including price controls; (d) factor market development, including factor mobility; and (e) legal frameworks. Each province has an index between 0 and 10 that measures the relative position in the progress towards a market economy compared with other provinces. It is reasonable to expect that the regions with a high value in the marketization index would be more responsive to exchange rate

[6] NEERs are calculated as geometric weighted averages of bilateral exchange rates. The weighting pattern is time-varying, and the most recent weights are based on trade in 2008–2010. For more information, refer to the Bank's website at: *http://www.bis.org/statistics/eer*.

movements than those with a low value. The pass-through effects then can be captured by the coefficients of the exchange rate and exchange rate – trade cost variables.

PP_{rt} is the producer price index in region r at time t, which describes the percentage change compared to the same period of the previous year.[7] It is included to control for the impact of production costs on consumer prices. As considerable evidence has shown that domestic prices could be affected by the prices of imported goods, we include the price index of imported goods (MP_t). Following McCarthy (2000), we also control for the influence of the money supply, which is measured by the percentage change of $M2_t$ compared to the same period of the previous year. China's anchor is to maintain a relative pegging exchange rate, and therefore money supply is always used for price stability (Jin, 2012). Furthermore, we control for the impact of demand on consumer prices by including the variable of total sales in each region (TS_{rt}). It is also a monthly percentage change variable compared with the period of the previous year. Finally, ε_{it} is the error term.[8]

An important issue that arises when working with price equations is that prices tend to have some inertia and persistence in their formation. We need to deal with time dependence and potential autocorrelation problems that may bias our estimates if the data are not properly corrected. In addition, many textbooks suggest that error terms are heteroskedastic and/or serially correlated. According to Baltagi (2008), ignoring the presence of heteroskedastic and/or serially correlated disturbances will generate inefficient standard errors even though the coefficients are consistent. Therefore, we include the lagged dependent variable CP_{irt-1} in our regression and then perform feasible generalized least squares (FGLS) for the cross-sectional time-series linear model. FGLS estimators are appropriate when one or more of the assumptions of homoskedasticity and non-correlation of regression fail. In this case, FGLS estimation is more efficient than pooled ordinary least squares (POLS) estimation, leading to smaller standard errors, narrower confidence intervals, and larger t-statistics (Cameron and Trivedi, 2009). However, the FGLS method cannot deal with the potential endogeneity of the regressors.

The endogeneity problem may result from the two-way relationship between the dependent variable and independent variables, such as CPI and

7 We acknowledge that it would have been better to include the disaggregate PPI for each good, but this was impossible due to the unavailability of data.

8 All data used to estimate the ERPT, except for the NEER, were drawn from the database of the China Economic Information Network, available at: *http://db.cei.gov.cn*. They were adjusted to be based on CPPY = 100.

monetary policies. Furthermore, there would be a time lag effect of exchange rate changes, production costs, and import prices on domestic prices. Therefore, it seems reasonable to use lagged independent variables in our regression. In addition, given the possible serial correlation within panels, we include lagged independent variables for at least two months to explain the current prices. Equation (1) thus could be rewritten as:

$$\begin{aligned} CP_{irt} = {} & \beta_0 + \beta_1(L)\, ER_{t-n} + \beta_2(L)\, ER_{t-n}\, TC_r + \beta_3\, CP_{irt-2} \\ & + \beta_4\, PP_{rt-2} + \beta_5\, MP_{t-2} + \beta_6\, M2_{t-2} + \beta_7\, TS_{rt-2} + \varepsilon_{it} \end{aligned} \tag{2}$$

In this empirical model, we lagged all the independent variables two months to alleviate possible bias due to the endogeneity problem. As for the exchange rate variable, we included it in the equation once for each lag ($n \geq 2$). One advantage of this method is that we could examine the short-term and long-term pass-through while correcting for the possible multicollinearity problem. The ERPT can be captured by the sum of the coefficients on the exchange rate for each regression.

3.2 Welfare impact of exchange-rate-induced price changes

Having estimated the transmission effect of exchange rate changes to the prices of goods in different regions, it is now possible to evaluate the impact of price changes on household welfare. Following Kraay (2008), we employ the compensating variation *(CV)* to evaluate the welfare effects of price changes.[9] The compensating variation measures the change in expenditure that would be required for households to achieve their utility level before the external shock (u_0) at the price level after the shock (p_1). It can be mathematically expressed as:

$$CV = e\,(p_1, u_0) - e\,(p_0, u_0) \tag{3}$$

The compensating variation can then be approximated by a second-order Taylor expansion of the expenditure function around the initial period prices:

$$CV \approx \Delta p' \frac{\partial e\,(p, u_0)}{\partial p} + \frac{1}{2} \Delta p' \frac{\partial^2 e\,(p, u_0)}{\partial p \partial p'} \Delta p \tag{4}$$

[9] Due to data constraints, we can only analyse the aspect of consumption, although we know that exchange rate movements are also likely to affect household welfare via income and labour market channels. This could be a topic for future research.

where the matrices of the first and second derivatives of the expenditure function are evaluated at the price level before the shock (p_o). Estimating the substitution effects, however, requires data on goods prices at the household level. In the case of CHIP survey data, we do not have information on unit values for individual consumption items. We therefore stick to the first-order effect, namely, the direct effect of price changes resulting from exchange rate movements.[10] In particular, we can further write the direct effect of price changes as a share of initial expenditure, in a weighted average of the growth rate of the prices of each good, with weights (w_i) equal to initial expenditure shares:

$$\frac{\Delta p' x_o}{e_o} \approx \sum_i w_i\left(\frac{\Delta p_i}{p_i}\right) \equiv \sum_i \left(\frac{p_{io} x_{io}}{e_o}\right)\left(\frac{\Delta p_i}{p_i}\right) \tag{5}$$

From the perspective of consumption, a household is worse off if prices go up, and better off if prices go down.

4 Results and discussion

4.1 Estimations of the exchange rate pass-through to consumer prices

The ERPT to consumer prices for seven categories of expenditure items is estimated separately.[11] Based on these estimates, we calculate the short-term ERPT as the sum of the coefficients on the lagged exchange rate variables and their interaction terms, with the trade costs measured by the marketization index.[12] The estimates of the short-term impact of the exchange rate on consumer prices for each province and good are presented in Table 3. The coefficients in the table reflect the percentage change of consumer prices induced by a 1 per cent change in the NEER of the renminbi.

[10] Kraay (2008) considered the role of second-order effects, namely substitution effects, in response to the price changes, but made a restrictive assumption of a diagonal Slutsky matrix, which implies that all compensated cross-price elasticities are zero. The omission of the second-order effects in this study is due to the data limitation, and it might lead to an underestimation of the overall welfare changes due to the appreciation.

[11] The estimated results are not presented here for the sake of brevity but are available from the authors upon request.

[12] Campa and Goldberg (2006) pointed out that most of the pass-through response occurs over the first and second lagged quarters after the exchange rate change, so the interpretation of six months as short term is empirically validated in our study. In their study, Campa and Goldberg (2006) use lagged four quarters as long-term analysis.

More specifically, we find that the pass-through of exchange rate movements to consumer prices is incomplete and varies substantially across products and regions. The estimates show that the RMB appreciation has lowered consumer prices of goods, except for medical care and durable goods. One potential explanation is that the elasticity of substitution between domestic medicines and imported ones is low. Residents rely on domestic medicines and medical services, and rarely use imported alternatives. Therefore, consumers are less likely to gain from the appreciation of the domestic currency in the short term. For durable goods – such as televisions, refrigerators, air-conditioners, fans, washing machines, and microwaves – the exchange rate movement has had little influence on their price and there are no regional variations. One possible explanation is that Chinese manufacturers dominate the household appliance sector. China is now the world's largest manufacturer, with over 50 per cent of its production sold in overseas markets. Price competition in the home market is fierce and, therefore, these goods are rarely affected by the appreciation.

In comparison, the RMB appreciation has significantly reduced prices of food and housing expenditure. On average, a 1 per cent change in the exchange rate is translated into 0.345 per cent decrease in the consumer price of food. The degree of ERPT for the consumer price of housing expenditure, including purchase, construction costs, and maintenance and repairs, is even higher, reaching 0.479 per cent under the same circumstances. The most likely reason is that the RMB appreciation has led to a decrease in the price of fuel (Yang *et al.*, 2012), which constitutes a large part of variations in the price of food and housing expenditure. This suggests that consumer prices of food and housing expenditure may be relatively more responsive to exchange rate changes. With respect to clothing, the ERPT is low, about 0.03 per cent for each province. In addition, we find no regional variance in ERPT for clothing. This is mainly because production and consumption of clothing in China are highly domestic-oriented. The exchange rate movement has little impact on the sector's inputs and final products. Finally, the estimates of pass-through for education, and transportation and communications are also low, about 0.09 per cent.

Furthermore, we find that the variations of ERPT for different items across the provinces are low – less than 1 per cent. However, in general, we can see that retail prices seem to be more responsive to exchange rate changes in provinces with a high marketization index. This can be expected because the provinces with a more developed market economy are also located in coastal regions, and are more closely linked to foreign markets.

Table 3 Pass-through estimates for each province (per cent)

Province	Food	Clothing	Medical care	Durable goods	Education	Housing	Transportation & communications
Anhui	–0.345	–0.031	0.0948	0.001	–0.093	–0.478	–0.089
Beijing	–0.351	–0.031	0.0947	0.001	–0.100	–0.490	–0.090
Chongqing	–0.347	–0.031	0.0948	0.001	–0.095	–0.482	–0.089
Gansu	–0.338	–0.031	0.0949	0.001	–0.086	–0.466	–0.087
Guangdong	–0.356	–0.031	0.0946	0.001	–0.105	–0.497	–0.091
Guangxi	–0.343	–0.031	0.0948	0.001	–0.090	–0.474	–0.088
Guizhou	–0.339	–0.031	0.0949	0.001	–0.086	–0.467	–0.087
Hebei	–0.344	–0.031	0.0948	0.001	–0.092	–0.477	–0.089
Henan	–0.344	–0.031	0.0948	0.001	–0.092	–0.476	–0.089
Hubei	–0.345	–0.031	0.0948	0.001	–0.093	–0.479	–0.089
Hunan	–0.345	–0.031	0.0948	0.001	–0.093	–0.478	–0.089
Jiangsu	–0.353	–0.031	0.0947	0.001	–0.101	–0.492	–0.090
Jiangxi	–0.344	–0.031	0.0948	0.001	–0.092	–0.476	–0.089
Jilin	–0.343	–0.031	0.0948	0.001	–0.091	–0.475	–0.088
Liaoning	–0.349	–0.031	0.0947	0.001	–0.097	–0.485	–0.090
Shaanxi	–0.339	–0.031	0.0949	0.001	–0.087	–0.468	–0.088
Shandong	–0.350	–0.031	0.0947	0.001	–0.098	–0.487	–0.090
Shanxi	–0.341	–0.031	0.0949	0.001	–0.088	–0.471	–0.088
Sichuan	–0.346	–0.031	0.0948	0.001	–0.094	–0.480	–0.089
Xinjiang	–0.340	–0.031	0.0949	0.001	–0.088	–0.470	–0.088
Yunnan	–0.340	–0.031	0.0949	0.001	–0.088	–0.470	–0.088
Zhejiang	–0.353	–0.031	0.0947	0.001	–0.101	–0.492	–0.090
Mean	–0.345	–0.031	0.0948	0.001	–0.093	–0.479	–0.089
Standard deviation	0.005	0.000	0.000	0.000	0.005	0.009	0.001

Source: Authors' estimations.

4.2 Welfare impact of exchange-rate-induced price changes

We first use 2002 CHIP survey data for rural areas to calculate the initial consumption structure for each household.[13] In particular, when we calculate the share of food consumption, we focus only on the food consumption paid in cash, as this is expected to be more responsive to price changes. In rural China, a substantial part of food consumption, particularly cereals and vegetables, comes from self-production rather than expenditure in cash. However, the meat and fish consumed are usually purchased on the market. Table 4 presents average consumption shares of different items across the provinces in 2002. It shows that food has the largest share in the consumption basket, accounting for one quarter on average. Moreover, we find that the share of food consumption varies significantly across provinces, ranging from 19.4 to 33 per cent. One reason for this variation is differences in the levels of regional economic development (Zhou *et al*., 2003). For instance, Guangdong is the most developed province in China, while Anhui is at a medium level of development and Gansu is the least developed. In the developed provinces, rural residents have less farm land, but more opportunities to work in factories and thus buy more food on the market. On the other hand, residents from less developed regions have to produce food for themselves. Moreover, each province is also quite different in terms of culture, traditions, and other aspects of social life. These factors contribute to the different consumption patterns in different provinces. The share of housing expenditure is about 11.2 per cent, and all other consumption shares are lower than 10 per cent. The share of consumption of durable goods is the smallest, about 1 per cent.

Table 5 presents summary statistics of household income and expenditure per capita for different groups of households for 2002–2003 (when the survey was conducted), and a share of total consumption expenditure that households spend on food, clothing, medical care, durable goods, education, housing, and transportation and communications. Coastal households are richer than those inland in terms of average income and expenditure per capita. Inland households earn and spend less than the national average. However, these differences do not seem very large. When we classify households according to the international poverty line of USD 1.25 per day, we find that, on average, poor households spend 1.3 per cent less on food items than those living above the poverty line, but spend more on non-food items. This finding may seem surprising, since poor households usually tend to spend a higher share of expenditure on food than richer households. One should however bear in mind that we have excluded consumption of self-produced goods, which represents a substantial share of total consumption for poor households. This may reduce the differences in consumption patterns.

Table 4 Consumption shares across provinces (per cent)

Province	Food	Clothing	Medical care	Durable goods	Education	Housing	Transportation & communications
Anhui	25.4	3.9	2.4	1.0	7.3	12.8	5.7
Beijing	33.2	4.9	1.3	3.2	6.7	12.8	7.1
Chongqing	23.5	4.7	0.1	0.8	5.6	9.2	5.1
Gansu	19.4	6.1	4.2	1.3	10.7	10.7	4.7
Guangdong	30.6	3.3	2.4	0.9	9.5	11.6	8.4
Guangxi	20.2	3.5	2.2	0.6	8.1	12.6	4.9
Guizhou	19.5	6.1	1.8	1.3	9.5	9.4	3.8
Hebei	30.1	10.5	2.2	0.9	5.2	13.5	7.4
Henan	24.2	8.7	3.3	1.3	9.0	11.9	6.2
Hubei	21.5	5.7	1.0	0.8	2.9	10.5	6.0
Hunan	23.4	9.8	2.7	0.5	8.6	8.7	4.3
Jiangsu	25.0	6.4	2.6	2.6	2.4	11.5	6.7
Jiangxi	22.4	5.3	3.7	0.7	6.3	12.7	6.6
Jilin	28.3	7.0	4.9	0.7	7.7	15.1	7.9
Liaoning	27.9	7.4	3.0	0.6	3.5	10.9	6.9
Shaanxi	21.5	6.5	6.8	0.8	19.5	11.8	4.3
Shandong	28.7	6.7	5.4	2.1	12.3	10.0	6.0
Shanxi	29.0	8.8	1.8	1.3	8.6	10.3	6.6
Sichuan	21.0	5.2	2.9	0.8	6.1	9.6	4.7
Xinjiang	24.6	10.7	1.6	0.6	0.9	9.7	4.3
Yunnan	21.0	3.2	1.8	0.9	3.1	8.7	3.3
Zhejiang	32.6	4.8	4.7	1.7	7.2	11.9	9.2
Average	25.2	6.4	3.0	1.1	7.4	11.2	6.0

Source: Authors'estimations.

[13] Rural and urban areas are classified according to *Hukou*, a residence registration system formally set up in 1958 that divides the population into rural and urban households. This study focuses on rural areas, as we find that most people living below the poverty line are concentrated in rural China. Moreover, only the 2002 CHIP survey reports information on the consumption structure of households in rural areas, and it is necessary to make the strong assumption that the budget share based on this survey remained essentially unchanged during the examined period.

Table 5 Summary statistics of income and consumption structure by groups

	National	Coastal	Inland	Poor	Non-poor
Average income per capita	2,730	3,882	2,143	1,006	3,338
Average expenditure per capita	1,974	2,708	1,601	1,140[§]	2,269
Share of food	25.2	29.4	23.1	24.3	25.6
Share of clothing	6.4	6.2	6.5	5.5	6.7
Share of medical care	3.0	3.5	2.8	2.9	3.1
Share of durable goods	1.1	1.6	0.9	0.7	1.3
Share of education	7.4	6.8	7.0	7.7	6.7
Share of housing	11.2	11.5	11.1	10.1	11.6
Share of transportation & communications	6.0	7.4	5.3	3.7	6.9
Household size (number of persons)	4.2	3.9	4.3	4.6	4.0
Number of households	9,165	3,091	6,074	2,390	6,775

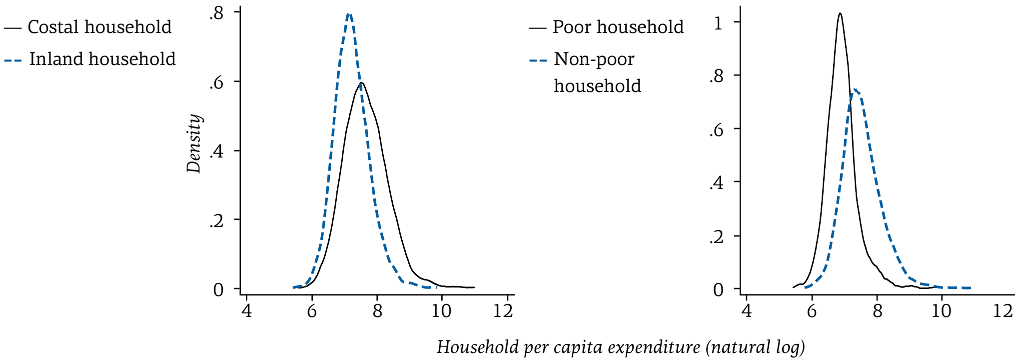
Source: Authors' calculations.

Note: Income and expenditure are expressed in RMB. Shares are expressed in per cent.

[§] The fact that poor households have higher average expenditure than income suggests they may have debts. In particular, they can easily become indebted because of health expenses, since most poor households are not covered by the national medical care system.

Figure 3 presents the density functions of the kernel densities of the logarithm of per capita expenditure of households. The left panel shows that coastal households have generally higher expenditure per capita, reflected in a shift to the right of the distribution. Similarly, the right panel reveals that non-poor households have relatively higher expenditure than poor families due to their income differences.

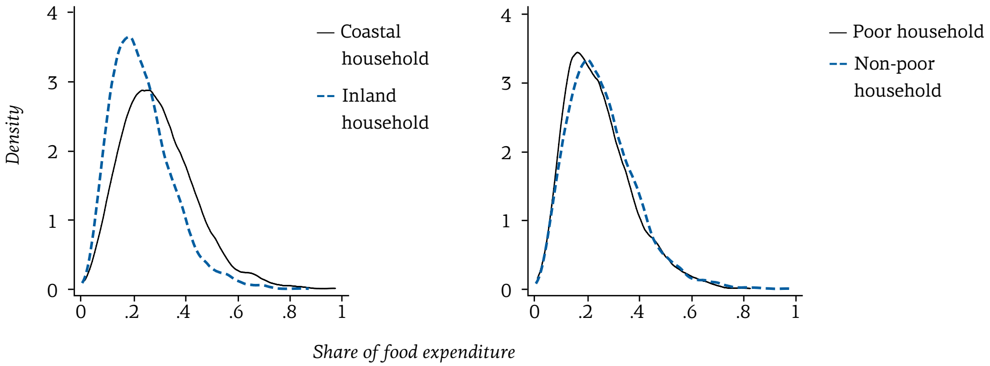
Figure 3 Kernel density estimation of per capita expenditure



Source: Authors' calculations.

Figure 4 presents the distribution of the share of food expenditure in total consumption for different groups of households. Coastal households have on average a higher share of food expenditure, mainly as a result of lower consumption of self-produced food than inland households. This can also explain why households living below the poverty line have a distribution of the food expenditure share similar to households living above the poverty line. Poor households in rural areas usually produce more food for themselves due to income constraints, while non-poor households have more income and are willing to pay more for food rather than produce it themselves. One useful piece of information that we can obtain from these figures is that location should be considered when estimating the impact of the RMB appreciation on household welfare, as households in different areas have different expenditure structures.

Figure 4 Kernel density estimation of share of food expenditure



Source: Authors' calculations.

After obtaining the consumption structure for each household, we can calculate the direct effects of the exchange-rate-induced price changes. These effects are the sum of multiplications of each item's share in initial total expenditure by the percentage change in its price due to the RMB appreciation. The average compensating variation for an average household is 0.14 per cent of initial expenditure as a result of a 1 per cent appreciation.

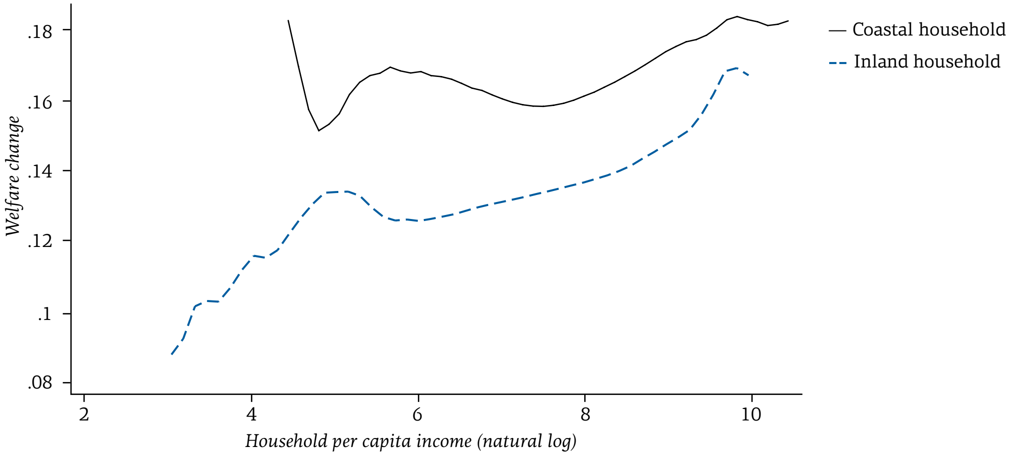
We now turn to analysing the relationship between the compensating variation and per capita household income through non-parametric regressions following Deaton (1989). Figure 5 shows a plot of the average welfare gains from the RMB appreciation conditional on the level of per capita household income. We see that the welfare impact of the RMB appreciation has a pro-rich bias in that poor households have little welfare gains from the appreciation. This result is mainly driven by differences in consumption patterns between these two types of households. Poor households spend less on food and housing, which become cheaper as a result of the appreciation, but usually spend more on medical care, the price of which has not decreased following the appreciation.

Figure 5 Non-parametric regression results – Overall welfare

Source: Authors' calculations.
Note: The dependent variable is the change in household welfare measured by the compensating variation.

Figure 6 shows similar regressions for coastal and inland households. We find that there is no big difference in welfare gains between poor and rich households in the coastal provinces. One possible reason is that poor households in these provinces have consumption patterns with regard to food that are similar to those of rich households. Poor households in coastal regions do not consume much self-produced food. They usually work in rural enterprises or as migrant workers in cities and buy a large proportion of food on the market. The other reason is that medical care and the educational system are well developed in coastal regions and poor households thus get better financial support in this regard compared to those inland. However, there is a significantly positive relationship between welfare gains and income per capita for households living in the inland provinces. The welfare gain of the richest households is about twice that of the poorest households. Also interesting to note in Figure 6 is that the effects of appreciation are greater in coastal areas than in inland provinces, conditional on per capita household income. This is because coastal provinces are more integrated into the world market via trade and foreign direct investment and are therefore more responsive to the appreciation.

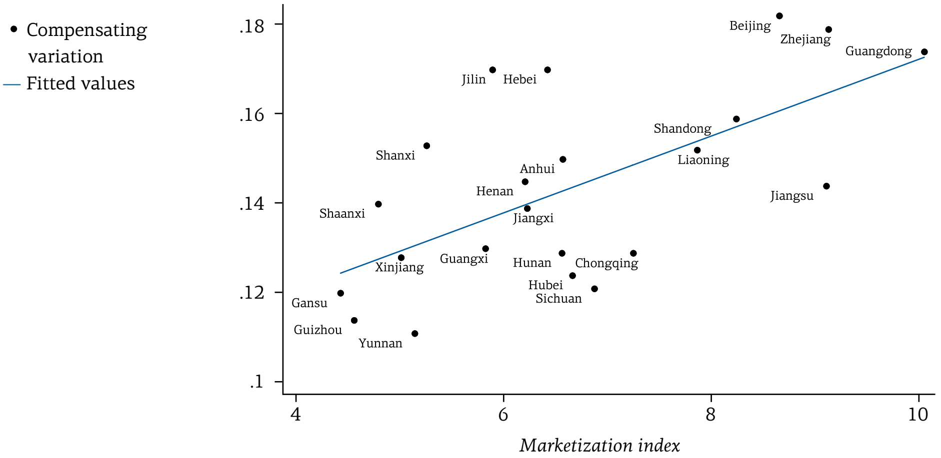
Figure 6 Non-parametric regression results – Coastal versus inland households



Source: Authors' calculations.
Note: The dependent variable is the change in household welfare measured by the compensating variation.

To show the heterogeneous welfare effects of the appreciation-induced price changes across regions, we calculated the average compensating variations along the quintile of income distribution for each province (see Annex). We found a positive relationship between the average compensating variation and the marketization level at the provincial level, which is illustrated in Figure 7. This suggests that people living in provinces with a more developed market economy could gain more from the RMB appreciation. This may be explained by the fact that provinces with a well-functioning economy are more responsive to exchange rate changes. Another explanation could be that these provinces are located in coastal regions and thus closer to foreign markets. In addition, the estimated compensating variations vary significantly across regions, ranging from a low of 11.1 per cent in Yunnan Province to a high of 18.2 per cent in Beijing. Within most provinces, the welfare gains increase with the average income of the household. However, there are also some exceptions. For example, the poorest household in Beijing gains 9.1 per cent more than the richest household. In Zhejiang, the relationship becomes U-shaped. These regional heterogeneities could be explained by the differences in consumption structures and ERPT across provinces.

Figure 7 Compensating variation and marketization index



Source: Authors' calculations.

5 Conclusions

This study estimated the consumption impact of appreciation of the renminbi, with particular attention to its effect on poor households in the People's Republic of China. The analysis was conducted in two steps. First, we investigated the impact of exchange rate changes on domestic prices, namely the ERPT, using disaggregated monthly consumer price indices between 2004 and 2011. Second, we used household surveys to investigate the consumption effects of price changes induced by exchange rate movements. Without information on labour income, we were only able to examine the price channel through which exchange rate changes influence household welfare. Using the information on consumption expenditure for each household from the CHIP survey data for 2002, we first calculated the consumption structure and then estimated the direct effects induced by the price changes.

The main results show that the price transmission from exchange rate changes to retail prices is incomplete and heterogeneous across consumption items and regions. Generally speaking, the RMB appreciation is found to drive down domestic prices of goods, except for medical care and durable goods. Moreover, the exchange rate changes are transmitted to consumer prices of food and housing to a higher degree than in the case of other consumption items. A 1 per cent appreciation reduces the prices of food and housing by 0.345 and 0.479 per cent, respectively. From the perspective of regional heterogeneity, it is found that consumer prices in provinces with a higher marketization level are highly responsive to exchange rate movements. Such diversity in ERPT is then expected to have a different welfare impact on people living in different regions.

According to estimates of compensating variations, we find that all households could experience gains from the RMB appreciation, although the magnitude of the effect looks small in the short term, equivalent to only 3 per cent of initial expenditure. In addition, the estimated compensating variation associated with the direct effect of exchange-rate-induced price changes is on average lower for poorer households. However, there is enormous heterogeneity across households and regions. The magnitude of the benefits is highly associated with consumption structures and locations of households.

We should nevertheless keep in mind that there are at least two caveats regarding the results of this study. The first is that we have only examined the impact of the exchange rate changes on household welfare that occurs through the consumption channel. The appreciation is also expected to have heterogeneous impacts on the income of households employed in different sectors. It is widely accepted that the RMB appreciation has been a challenge for the exporting sector, which employs a large number of unskilled labour from poor households in rural areas. It is plausible that as a result of the appreciation, households employed in the exporting sector would see decreases in earnings while those working in import-competing industries would see increases in earnings. The negative income effects due to the RMB appreciation could be large enough to offset the limited consumption benefits, and lead to an increase in poverty. Unfortunately, we could not empirically investigate these effects and their distributional consequences in any detail due to the lack of detailed employment information in the household survey.

The second caveat is that we conducted the analysis at a relatively aggregate level, since there is no information regarding a more disaggregated set of expenditure items in the official statistics and the household survey. Therefore, we could only estimate the direct effect of price changes induced by the appreciation, disregarding the substitution effects. As a result, we are likely to be underestimating the effects on household welfare. In addition, we should keep in mind that omission of self-produced food in our analysis might underestimate the welfare changes for poor households, since they usually produce food for themselves. Thus, we have to be cautious about making conclusions with regard to the total effect of the RMB appreciation on household welfare.

In spite of these caveats, we can still draw some policy implications from our results. The RMB appreciation could bring benefits for households by reducing their consumption expenditure. However, poor households in rural areas of inland provinces would gain less. Anti-poverty policies should therefore take into account regional heterogeneity – such as the consumption pattern of residents and the development level of the market economy – because according to our research these factors play an important role in the welfare effects of exchange rate changes.

Prices of food, which represents a large share of expenditure for the poorest households, have fallen more than prices of other items as a result of the RMB appreciation. This seems beneficial for the poor. However, poor households, especially those living in the inland provinces, usually produce a large proportion of food such as grain and vegetables for themselves. Therefore, they cannot reap the benefits of the food price decrease induced by the RMB appreciation. In contrast, the reduced food prices may lower the income of poor rural households in inland provinces, meaning that these may therefore not only gain less from lower consumption expenditure, but also suffer from the income effect of the appreciation. Therefore, the Chinese government should provide subsidies for poor families and pay attention to the fundamental factors that drive inflation. Furthermore, given the limited welfare gains from price transmission, the government should pay attention to labour market effects that are likely to affect the poor. Such effects are related to the negative impact of the RMB appreciation on the Chinese manufacturing export sector, which employs a large number of unskilled workers who are more likely to come from poor households.

Annex

Table A1 Estimated compensation variation by region and quintile of income distribution

		Quintile of income distribution				
	Mean	Lowest	Second	Third	Fourth	Highest
Anhui	0.150	0.142	0.143	0.149	0.162	0.165
Beijing	0.182	0.262	0.221	0.193	0.175	0.171
Chongqing	0.129	0.112	0.122	0.133	0.134	0.140
Gansu	0.120	0.112	0.123	0.132	0.131	0.123
Guangdong	0.174	0.158	0.170	0.160	0.170	0.182
Guangxi	0.130	0.135	0.127	0.120	0.141	0.164
Guizhou	0.114	0.103	0.117	0.128	0.143	0.169
Hebei	0.170	0.195	0.162	0.177	0.158	0.162
Henan	0.145	0.149	0.137	0.147	0.145	0.152
Hubei	0.124	0.122	0.123	0.123	0.120	0.137
Hunan	0.129	0.116	0.131	0.131	0.134	0.137
Jiangsu	0.144	0.155	0.143	0.133	0.138	0.150
Jiangxi	0.139	0.143	0.132	0.136	0.137	0.154
Jilin	0.170	0.187	0.174	0.167	0.159	0.166
Liaoning	0.152	0.152	0.147	0.149	0.152	0.157
Shaanxi	0.140	0.137	0.138	0.133	0.160	0.163
Shandong	0.159	0.149	0.153	0.149	0.159	0.175
Shanxi	0.153	0.146	0.148	0.152	0.156	0.176
Sichuan	0.121	0.124	0.114	0.117	0.120	0.150
Xinjiang	0.128	0.129	0.129	0.127	0.131	0.117
Yunnan	0.111	0.110	0.112	0.107	0.118	0.096
Zhejiang	0.179	0.180	0.159	0.162	0.180	0.186
Average	0.144	0.146	0.142	0.142	0.147	0.154

Source: Authors' calculations.
Note: Compensation variation results from 1 per cent appreciation of the RMB.

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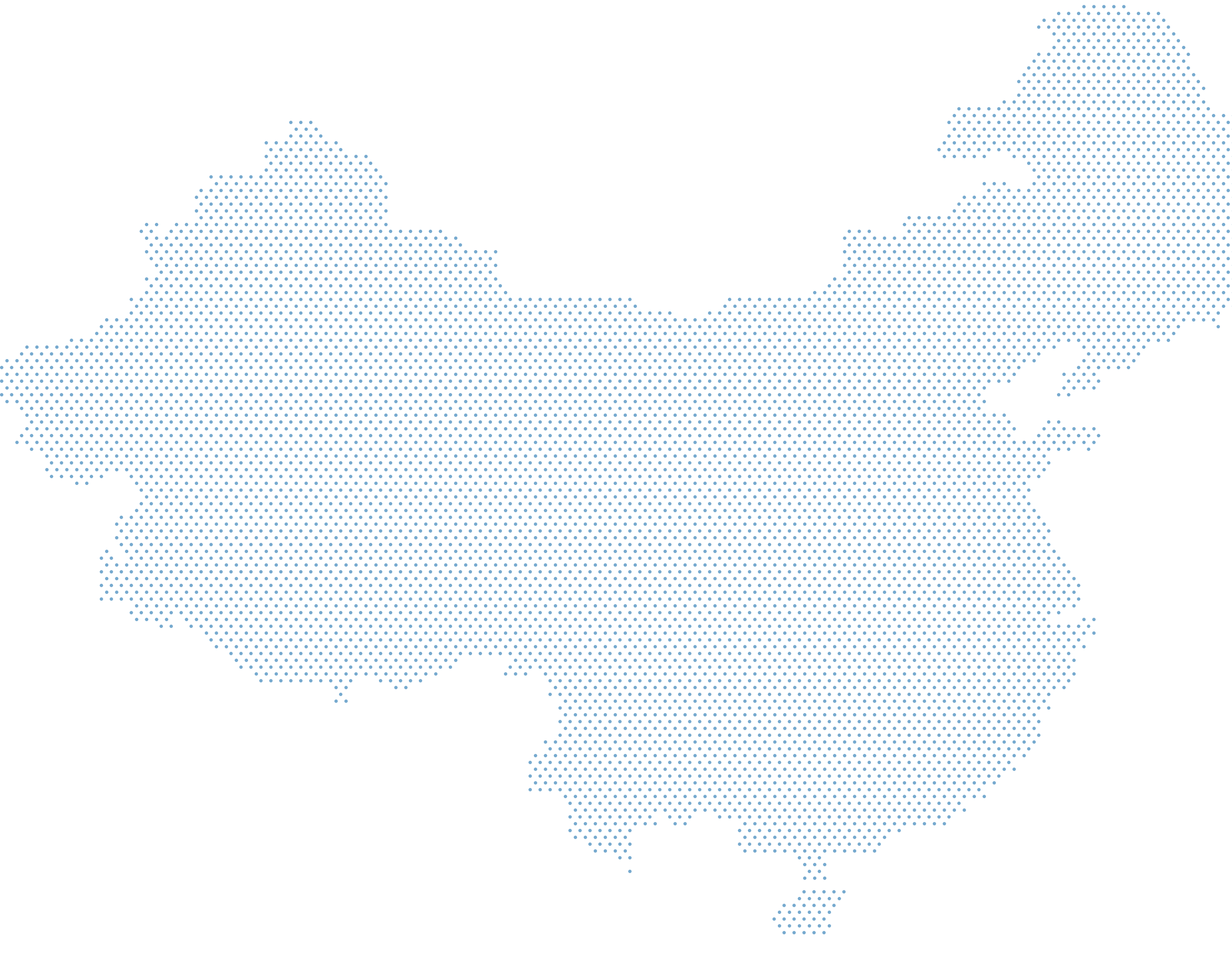


Costa Rica

Welfare effects of a change in the trade policy regime for rice in Costa Rica

Carlos Eduardo Umaña-Alvarado *

Abstract

The rice market in Costa Rica has several distinctive features. First, rice is an essential staple in the diet of Costa Ricans, particularly for the poorest segments of the population. Second, while rice is produced in the country, local production does not reach the level necessary to satisfy domestic demand. Third, rice imports have been subject to policy measures targeting both local production and imports, including a performance requirement for the importation of paddy rice from the United States. Fourth, a price-fixing mechanism designed as part of the policy package applied to the rice sector has increased paddy rice prices paid to local producers to double that of international prices. As a result, Costa Rican consumers have been paying a high price for a key commodity in their daily consumption basket. Despite the associated costs, the policies cited above have not been successful in either increasing productivity or improving conditions for small farmers. Costa Rica is also in breach of its World Trade Organization commitments as a result of the distortionary support received by producers through the price-fixing mechanism. For these reasons, Costa Rica's policies related to the rice sector are being redesigned. For example, the free trade agreement between Central America, the Dominican Republic and the United States will provide unlimited duty-free access for imports from the United States in 2025. This study shows that poor households in Costa Rica may be the segment of the population that will benefit the most from a reduction in the price of rice. In this sense, the free trade agreement may be an opportunity to effectively reduce rice prices in the domestic market and thus improve the welfare of consumers.

* The author would like to thank Henry Benavides and Karen Chan from the Ministry of Foreign Trade of Costa Rica for their support in the preparation of this study.

1 Introduction

In recent years there has been an ongoing discussion in Costa Rica about the trade policy regime for rice. Rice is an essential product in the daily diet of Costa Ricans. According to the 2004 National Income and Expenditure Survey (ENIG),[1] rice is one of the most important products for the lowest (one through four) income quintiles. For example, rice represented 4.97 per cent of expenditure in the first quintile and, taken together, quintiles one and two accounted for 48 per cent of rice consumption in the country (Arroyo *et al*., 2013). Based on these figures, a reduction in the price of rice would mainly benefit the poorest groups of the population.

Rice policies in Costa Rica are based on a combination of tariffs, a performance requirement for the importation of paddy rice,[2] and a price-fixing mechanism. The combined effect of these measures creates economic distortions in the sector. According to economic theory, market price support raises domestic producer and consumer prices. This results in an increase in production and a reduction in consumption, an equivalent of a welfare transfer from consumers to producers. Therefore, a market price support system distorts both production and consumption decisions (Umaña, 2011).

This mechanism is regressive in terms of incomes, as per capita spending on rice is relatively more important in low-income households. In addition, the level of distortionary subsidies resulting from the minimum producer price in Costa Rica exceeds by more than five times the level stipulated in the country's World Trade Organization (WTO) commitments. This situation has led to consultations at the WTO with partners concerned about the Costa Rican measures.

Several studies have specifically analysed Costa Rica's rice policies. According to Umaña (2011), import protection and price controls for rice in Costa Rica have not increased yields, but created instead significant rents for rice millers by transferring income from consumers to producers,

[1] ENIG stands for *Encuesta Nacional de Ingresos y Gastos*. At the time of this analysis, the 2004 survey was the most recent source of information on household consumption in Costa Rica.

[2] The performance requirement allocated to the millers is the right to import paddy rice in an amount proportional to the purchase of the local harvest.

[3] According to Umaña (2011), tariffs, water subsidies and price controls have not benefited small farmers, as millers have largely captured the rents associated with protectionism. Furthermore, it is hard for small farms to achieve economies of scale, a factor relevant for the efficiency of rice production.

and by maintaining local prices above international prices for years. Nor have the rice policies improved the livelihood of small and independent farmers,[3] or promoted the expansion of consumption opportunities for the poorest households. Because most mills are vertically integrated, they have favoured imports instead of dealing with the risky process of rice farming in the country. Gains from trade have thus benefited millers, as these firms have captured the rents from lower international prices (Umaña, 2011).

Arroyo *et al.* (2013) describe the main features of the rice market in Costa Rica and conclude that the pricing scheme is not contributing to important policy objectives such as increasing productivity and improving the access of consumers to affordable rice. Many producers receive lower prices compared to the fixed price due to the difference in rice qualities (inferior qualities are punished with lower prices), consumers pay prices above international prices, productivity remains stagnant or downward, and the pricing scheme may be working towards increasing costs of some inputs and services used in rice production. In addition, Petrecolla (2006) estimates that income transfers from consumers to the rice industry (producers and processors) reached a cumulative USD 396.4 million from 1996 to 2005. Of these transfers, 80 per cent were captured by processors and only 20 per cent by farmers. During the same period, millers, wholesalers, and retailers preserved their margins.

Costa Rica has entered into the free trade agreement between Central America, the Dominican Republic, and the United States (CAFTA-DR) that will provide unlimited duty-free access to imports from the United States when the phasing-out schedule ends in 2025. The agreement may be an opportunity to effectively reduce rice prices in the domestic market and thus improve consumers' welfare.

In this context, this study aims to quantify the welfare effects of the phasing-out process and the quotas stipulated in the CAFTA-DR. By assuming a perfect transmission of changes in tariffs to domestic prices, the study presents a forecast of the welfare effects for three different scenarios: for 2015, 2020, and 2025.

The study uses Costa Rica's 2004 National Income and Expenditure Survey, along with a forecast of the evolution of prices based on the CAFTA-DR phasing-out scheme, to undertake a non-parametric analysis. The results show that a reduction in rice prices will benefit consumers, particularly the poorest households for whom rice represents a larger share of total expenditure. However, in order to prevent importers from capturing new rents from the reduction of import tariffs, rice prices may need to be monitored on an ongoing basis. This task could be entrusted to the entities that are in charge of competition policies and consumers' interests, such as the Commission for the Promotion of Competition (COPROCOM).[4]

The next section describes developments in the rice sector in Costa Rica and the international trade regime for rice. The methodology applied in the study is then presented, followed by a discussion of the welfare implications of a reduction in the price of rice for households. The study then puts forward several policy recommendations and concludes with a summary of the main findings of the research.

2 The rice sector in Costa Rica

2.1 Production

Rice cultivation accounts for 3.9 per cent of total value added of agricultural, livestock, and fisheries production in Costa Rica (SEPSA, 2012). During the 2011–2012 harvest, 1,355 producers were engaged in rice production in the country. Micro and small producers represent approximately 80 per cent of the total number of farmers, but they cultivate only around 20 per cent of the total rice-planted land (Table 1). Medium-sized producers, with farms between 50 and 200 hectares (ha), and large farmers, with farms larger than 200 ha, supply 80 per cent of national production. After 1950, the rice sector underwent a structural change towards the organization of production in large and medium-sized agro-enterprises; today, small farms only account for a small share of total production (Arroyo *et al.*, 2013).

[4] COPROCOM stands for *Comisión para Promover la Competencia.* Its fundamental purpose is to protect and promote free competition, as well as investigate and punish monopolistic practices and other restrictions to the efficient functioning of the market. For more details, see the organization's website at: *http://www.coprocom.go.cr.*

[5] CONARROZ stands for *Corporación Arrocera Nacional*, which is an institution composed of producers, millers and the government that supports Costa Rica's rice sector by promoting good relationships between farmers and millers and the overall development of the sector. CONARROZ manages a parafiscal fund financed by a 1.5 per cent contribution levied on the price of delivered rice, which is paid both by producers and millers, and by a 1.5 per cent levy on the price of imported rice that is paid by importers. The purpose of the fund is to enable CONARROZ to fulfill the duties entrusted to it by Law No. 8285.

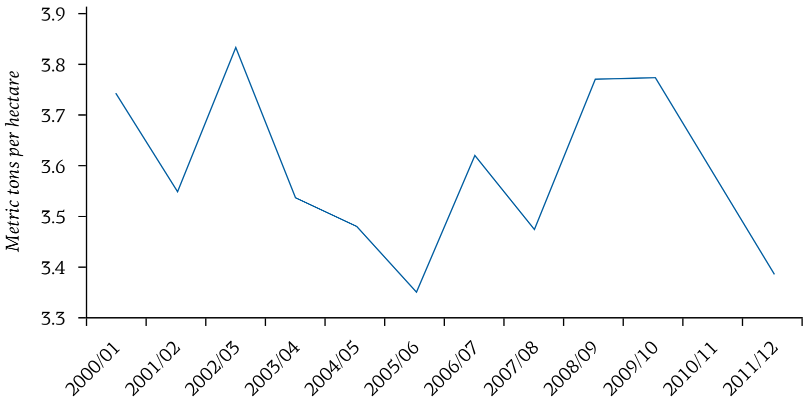
Table 1 Structure of rice production, 2011–2012

Type of producer	Size of farm	Number of producers	Hectares planted	Share of area planted (per cent)	Average size of area (hectares)
Micro	Less than 10 ha	542	3,118	4.0	5.8
Small	Between 10 and 50 ha	528	12,633	16.4	23.9
Medium	Between 50 and 200 ha	222	21,611	28.0	97.3
Large	More than 200 ha	63	39,877	51.6	633.0
	Total	1'355	7,240	100.0	56.9

Source: CONARROZ.

Between the harvests of 2000–2001 and 2005–2006, Costa Rica experienced a downward trend in paddy rice yields, which fell annually by 2.2 per cent, reaching 3.35 metric tons per ha during the 2005–2006 harvest (Figure 1). The decline in yields that occurred during the 2004–2006 period coincided with the emergence in the country of the acarus *Steneotarsonemus spinki*, which caused major losses in the sector, and an increase in production costs, according to the National Rice Corporation (CONARROZ).[5] During the subsequent two harvests, yields recovered up to 3.78 metric tons per ha. However, they declined again for the 2010–2012 harvest to settle at 3.39 metric tons per ha.[6]

Figure 1 Paddy rice yield, 2000–2001 to 2011–2012 (metric tons per hectare)



Source: CONARROZ.

[6] CONARROZ, *Informes Estadísticos*, various issues.

According to the Food and Agriculture Organization of the United Nations (FAO), average yields in metric tons per ha over 2008–2011 were much higher in several producing countries compared to Costa Rica (3.6 metric tons per ha). Those countries included Uruguay (7.8 metric tons per ha), Argentina (6.6 metric tons per ha), China (6.6 metric tons per ha), and Nicaragua (4.9 metric tons per ha). Furthermore, the national yield was low compared to the United States (7.7 metric tons per ha), the main supplier of Costa Rica's imports of rice.[7] However, larger farms in Costa Rica, with access to irrigation and more advanced technology, reached a yield close to 6 metric tons per ha (Umaña, 2011).

In Costa Rica, there is a significant difference in costs between the two common rice production methods: irrigated and rain-fed production. Irrigated rice is the country's most productive method of production, generating on average 24 per cent more yield per ha than rain-fed rice production. Nevertheless, most rice farmers in Costa Rica (70 per cent) use the rain-fed method. Irrigated fields are concentrated in the Tempisque River Basin, where 45 per cent of total national production takes place (Umaña, 2011).

During the 2011–2012 harvest, rice plantations covered 77,240 ha, 4.8 per cent less compared to the 2010–2011 harvest. The Chorotega Region represented 35 per cent of the total planted area, followed by the Huetar Norte Region (25 per cent) and the Brunca Region (23 per cent). Between 2006–2007 and 2010–2011, planted area increased by 72 per cent to 81,116 ha in 2010–2011 (Figure 2).[8] This was due to the rise in international rice prices and incentives to expand production provided in the National Food Plan, which aimed to enhance basic grain production (rice, beans, and white corn) in order to reduce the country's vulnerability to imports due to high international prices (Arroyo *et al.*, 2013).

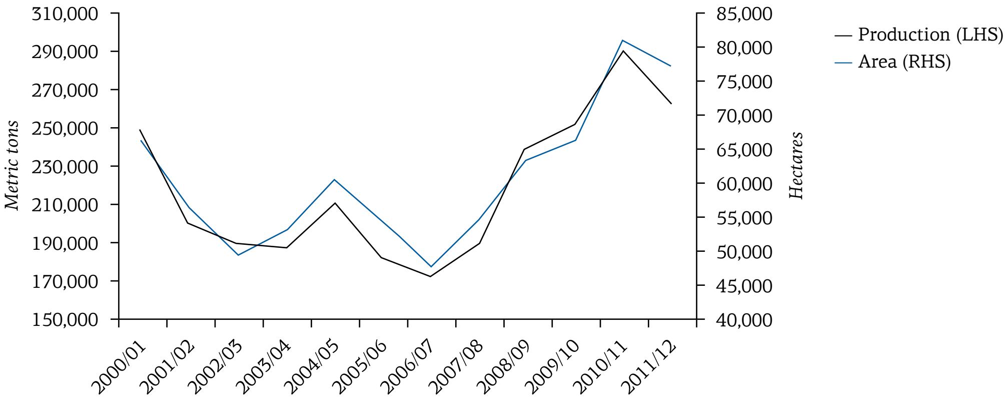
Paddy rice production, after a downward trend until 2006–2007, also began to rise and reached more than 290,000 metric tons in 2010–2011. This expansion caused storage capacity problems. For instance, the increase in planted area during 2009–2012 in the Huetar Norte and Atlántica Regions forced producers to transport their production to other regions. This increased transportation costs and sometimes caused a deterioration of rice quality due to the increase in time between the felling and the receipt of grain. This affected the final price producers received for their crop (Arroyo

[7] FAO statistics, available at: *http://faostat.fao.org/site/339/default.aspx*.

[8] According to the Regional Agriculture Sectoral Committee of the Chorotega Region (2008), which is the country's largest rice producer, 94 per cent of cultivated area in that region is occupied by traditional production such as sugar cane, rice, and livestock. Corn and bean crops are grown mainly in the districts of La Cruz, Santa Cruz, Nicoya, and Nandayure.

et al., 2013). As a result, producers agreed to reduce the planted area by 5 per cent during 2011–2012: this led to a 10 per cent decrease of paddy rice production during the same period.[9]

Figure 2 Paddy rice production and rice, 2000–2001 to 2011–2012



Source: CONARROZ.
Note: LHS stands for left-hand scale, RHS for right-hand scale.

2.2 Value chain

At the industry level, 15 plants were in operation during the 2011–2012 harvest, mainly in the Chorotega Region, where millers purchased 49 per cent of national paddy rice production. These plants provide storage, drying and milling, and they sell rice that should serve for direct consumption to wholesalers. Around 84 per cent of paddy rice produced by Costa Rica was purchased by industries in the Chorotega and Central Pacific Regions, where most of the rice industry is located.[10] The two regions have five mills each, followed by the Brunca Region with three, and the Central Region with two. Also, four plants owned by the National Production Council are used for grain storage (Arroyo *et al.*, 2013). According to CONARROZ, the rice industry purchased all the 2010–2011 rice harvest.

Four mills, which account for 70 per cent of production, source paddy rice from their own fields (vertical downstream integration). Domestic rice production does not satisfy total consumption demand. As a result, larger millers import paddy rice from the United States, using the performance

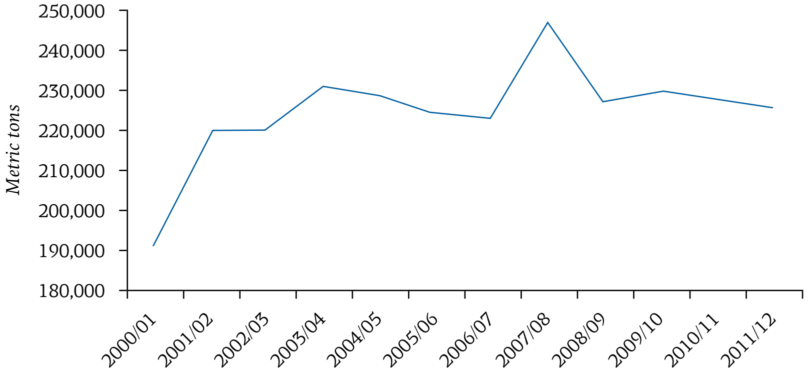
[9] CONARROZ, *Informes Estadísticos*, various issues.
[10] CONARROZ, *Informes Estadísticos*, 2010–2011.

requirement applied for the CAFTA-DR quota to keep the mills operating (Umaña, 2011; Arroyo *et al.*, 2013).[11]

During 2000–2012, milled rice stocks at the end of each month averaged 56,600 metric tons. These stocks increased between 2009 and 2012, reaching a maximum of 111,182 metric tons in November 2011, enough to cover 5.8 months with an average consumption of 19,000 metric tons. The increase in stocks of equivalent milled rice was related to the increased production promoted in the National Food Plan, which set a target of covering 80 per cent of consumption through domestic production. To achieve this goal, the sown area increased, but the ability to receive, dry, and store rice did not follow. Consequently, during the peak harvest months (September and October), there were not enough facilities to dry and store the grain (Arroyo *et al.*, 2013).

Between 2000–2001 and 2003–2004, milled rice sales grew at a 6.6 per cent annual average rate. The most significant expansion occurred during 2007–2008, when sales rose by 10.3 per cent compared to the 2006–2007 harvest (Figure 3). However, the subsequent four harvest periods reported lower sales, from 246,130 metric tons in 2007–2008 down to 225,169 metric tons in 2011–2012 (an 8.5 per cent decrease).[12] According to millers, this reduction may have been caused by the entry of 6,000 metric tons of milled rice imported by third parties (supermarket chains and wholesalers) under the tariff rate quota (TRQ) scheme of the CAFTA-DR (Arroyo *et al.*, 2013).

Figure 3 Milled rice sales by domestic industries, 2000–2001 to 2011–2012 (metric tons)



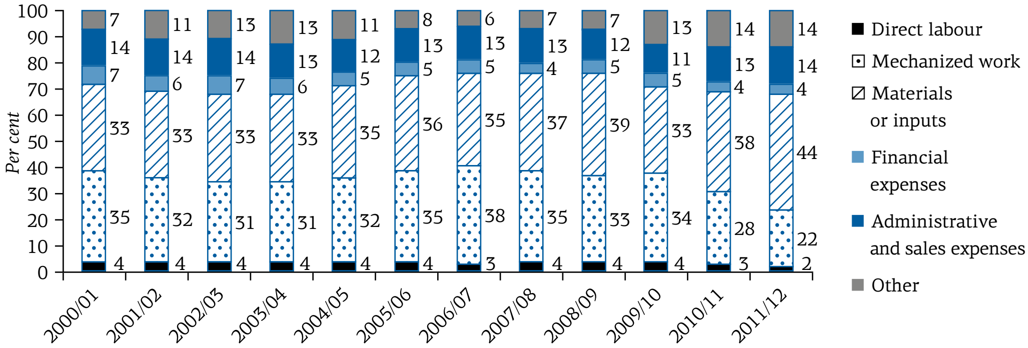
Source: CONARROZ.

[11] Section 2.4.2 explains the performance requirement applied by Costa Rica for the paddy rice import quota from the United States under the CAFTA-DR.

[12] CONARROZ, *Informes Estadísticos*, various issues.

Regarding the composition of costs related to paddy rice production in Costa Rica, materials or inputs represent on average 36 per cent of total costs, followed by mechanized labour (32 per cent), administrative and sales costs (13 per cent), other expenses (10 per cent), financial costs (5 per cent), and direct labour (4 per cent) (Figure 4). These data indicate that rice farming depends largely on machine work and has low labour requirements (Arroyo *et al.*, 2013).

Figure 4 Percentage composition of paddy rice production costs, 2000–2001 to 2011–2012



Source: Institute for Economic Sciences Research (Instituto de Investigaciones en Ciencias Económicas).

Retail rice marketing is basically in the hands of supermarkets that sell rice with little value added in the domestic market. There are many brands, with differentiation between them mainly based on the percentage of whole grain. In supermarkets, rice is usually marketed with 80, 90, 95, and 98 per cent whole grain. The percentage of whole rice, which is identified in each bag, and the brand are the main attractions for the consumer (Jovel and Díaz, 2007).

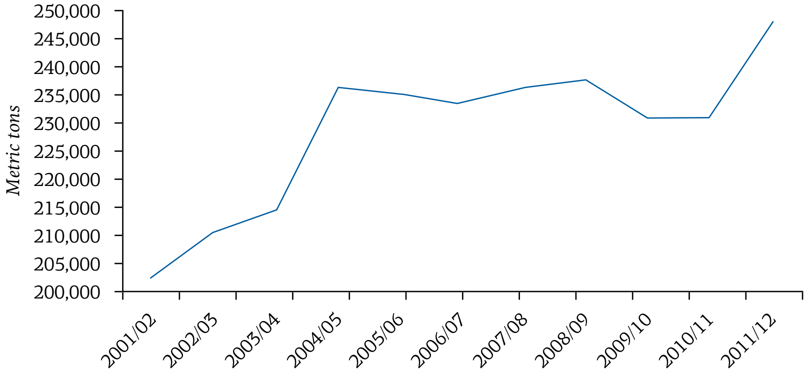
2.3 Consumption

Rice is essential to the diet of Costa Ricans, whose level of consumption is similar to that of Japan (57 kilograms per person per year). Rice represents 8 per cent of the total value of the food basket, and is a key source of total calorie intake (Umaña, 2011).

According to CONARROZ, consumption of rice (production plus imports minus exports) in 2011–2012 was estimated at 247,892 metric tons of milled rice, equivalent to per capita consumption of 53.71 kilograms, considerably higher than in previous periods. Domestic rice covered 69 per cent of national consumption, with imported rice accounting for the remaining 31 per cent. The shortfall of rice to meet domestic consumption was covered by imports from the CAFTA-DR quota and other rice imports.

Rice consumption remained between 230,000 and 238,000 metric tons between 2006–2007 and 2010–2011 (Figure 5), with a spike in consumption towards the end of the period.

Figure 5 National consumption of milled equivalent rice, 2001–2002 to 2011–2012 (metric tons)



Source: CONARROZ.

Although total consumption has increased, per capita consumption has remained steady since the mid-1990s. This suggests that the growth in national consumption is mainly due to the increase of the population (Arroyo *et al.*, 2013).[13]

Based on the 2004 ENIG, Table 2 shows the share of household expenditure on each type of rice compared to total rice expenditure, by per capita expenditure decile.[14] Throughout all income deciles, whole rice with quality classification (e.g. 92 per cent whole grain) is the type that accounts for the highest expenditure share, followed by rice without a quality classification (e.g. rice produced by households, which includes self-production) and pre-cooked rice.

[13] The Costa Rican population increased by almost 20 per cent from 2001 to 2012.

[14] Throughout this study, expenditure is used as a proxy for income.

Table 2 Share of household expenditure on each type of rice compared to total rice expenditure, by per capita expenditure decile (per cent)

Decile	Rice without quality classification	Whole rice with quality classification	Brown rice	Pre-cooked rice	Total
1	35.1	53.1	..	11.7	100.0
2	34.7	52.2	..	13.1	100.0
3	28.8	71.2	..	..	100.0
4	27.9	32.4	30.0	9.7	100.0
5	23.3	42.7	8.2	25.8	100.0
6	32.8	37.1	..	30.0	100.0
7	41.9	44.9	..	13.2	100.0
8	16.0	53.0	17.8	13.1	100.0
9	31.4	55.9	..	12.7	100.0
10	..	60.9	14.8	24.3	100.0

Source: 2004 ENIG.
Note: Two dots (..) indicate that data are not available.

2.4 The rice policy regime in Costa Rica[15]

The foreign trade regime applicable to rice in Costa Rica is composed of several elements, including the government price-fixing mechanism, tariffs and the performance requirement.

2.4.1 Government price-fixing mechanism

The most important form of assistance to the rice industry in Costa Rica is the support of the market price (Umaña, 2011). The country's rice market is comprehensively regulated. At almost every step along the production chain – as rice passes from the farmer to the miller, the wholesaler, the distributor, the retailer, and finally the consumer – the price of rice is controlled by the government through a system of established price ceilings. In addition, Decree 37699-MEIC, which entered into force in 2013, also defines price floors.

[15] The Ministry of Foreign Trade of Costa Rica (COMEX) is one of the main sources of information for this section.

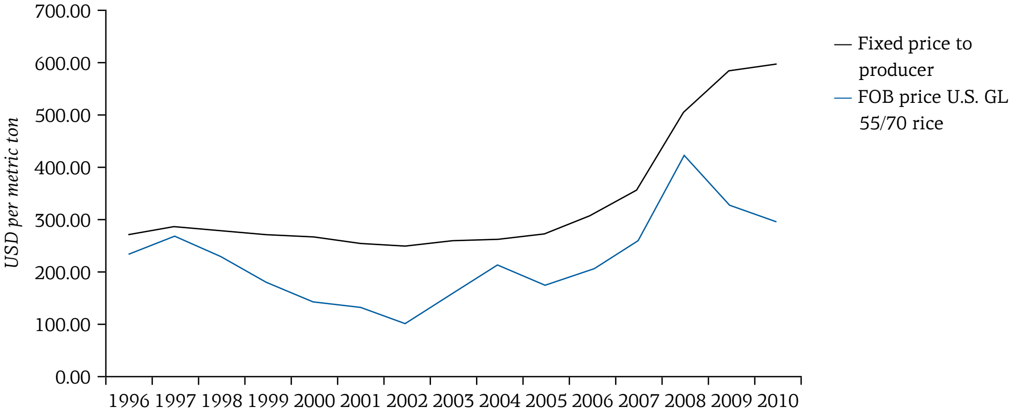
Rice should be purchased at the official price set by the Ministry of Economy, Industry and Commerce (MEIC). CONARROZ recommends the price for producers, and based on that recommendation, the MEIC defines prices for the other steps of the value chain. The price-fixing mechanism includes the official definition of a purchase price for the rice industry to buy from producers. This model considers an internal cost structure with a profit margin. The calculation is based on an irrigated farm of 250 ha, and considers all costs in the production of paddy rice assigned to the consumable units of each good and the respective costs, including a profit margin of 20 per cent on costs, excluding financial expenses (COMEX *et al.*, 2010).

The officially established price for producers increased significantly from USD 305 per metric ton in 2006 to USD 633 in 2010, which represents a 107 per cent increase in four years (see Annex 2, Table A2.2). Furthermore, when comparing the officially established price during 1995–2010 with the international price of GL55/70 rice, which is the type of rice imported by Costa Rica, the country's official price remained significantly higher than the international market price.

As shown in Figure 6, the transmission of the international price to Costa Rican households is direct when the trend is on the rise, but not when international prices fall. Between 2008 and 2010, the gap between the two prices widened considerably (COMEX *et al.*, 2010). Given that the definition of the producer price considers an internal cost structure, and due to the increase in the cost of inputs, the government raised the producer price.

Imported milled rice is currently sold at the floor prices defined in Decree 37699-MEIC, which are calculated on the basis of the price for domestic producers. This allows the imported milled rice, which has highly competitive prices, to fetch a greater profit margin compared to domestic milled rice. Similarly, importers (millers) of paddy rice, which has a much lower price than that paid to domestic producers, use this low-cost raw material in their production processes and capture profits defined by the above decree for each stage in the rice value chain.

Figure 6 Comparison between the fixed price to rice producers and the international price for GL55/70 rice, 1996–2010 (USD per metric ton)



Source: COMEX.
Note: FOB stands for free on board.

According to the WTO Agreement on Agriculture, price support measures such as the minimum price that the producers receive in Costa Rica represent a subsidy, which is classified as highly trade distorting and is subject to an annual value limit which a WTO member cannot exceed. The value of distorting subsidies is expressed in the aggregate measurement of support (AMS). For Costa Rica, the bound total AMS is USD 15.9 million (COMEX *et al.*, 2010). The amounts of subsidies provided to rice producers in recent years through the minimum producer price exceeded by more than five times Costa Rica's commitments in terms of its total bound AMS. Consequently, Costa Rica is in violation of its obligations under the Agreement on Agriculture.

This situation has led to consultations at the WTO with trade partners concerned about this measure. In 2013, the Costa Rican government, producers and millers agreed to work on an alternative mechanism that would substitute the existing price-fixing scheme. This mechanism is embodied in Decree 37699-MEIC, which aims to remove any rice price regulation scheme.[16] The decree also defines a coordinated programme of work between the government and CONARROZ to reduce the costs of inputs

[16] The decree also includes a transitional price-fixing scheme that regulates all qualities of milled rice, not only the 80/20 (80 per cent whole grain) milled rice quality.

(agrochemicals and seeds), and prioritizes the implementation of a complementary agenda aimed at increasing productivity in the rice sector.[17]

In June 2013, the country's decision to reduce its rice subsidies was welcomed by WTO members as an achievement both for Costa Rica in bringing its support back within its WTO commitments, and also for the role of the WTO Agriculture Committee in solving possible contentious issues.[18]

2.4.2 Current import regime: Tariffs and the performance requirement under the CAFTA-DR

Costa Rica has traditionally been a net importer of rice. In recent years, imports of milled rice have mainly come from the United States and other countries in the Americas.[19] In 2012, 84 per cent of Costa Rica's imports came from the United States, 8.6 per cent from Central America, 4.9 per cent from Argentina, and 2.1 per cent from Uruguay.[20] During 1995–2009, the average size of imports and national production relative to total domestic supply was 37.9 per cent and 65.2 per cent, respectively (see Annex 2, Table A2.1). However, in recent years, domestic production has been contributing more to national consumption of rice due to the stimulus from the price-fixing mechanism.

The bound tariff for Costa Rica in the WTO on paddy and milled rice is 35 per cent; the most-favoured-nation (MFN) tariff for pre-cooked rice is 15 per cent.[21] In addition, Costa Rica applies a phytosanitary fee of USD 20 per metric ton (equivalent to around 5 per cent of the international price based on figures of 13 March 2013).

The import of rice from any country in Central America is duty-free under the Central American Common Market (CACM). Within the CAFTA-DR,

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17 The complementary agenda includes the adoption of: (a) good agricultural practices manuals and a Technology Development Plan for the rice sector; (b) agribusiness training, maintenance, and business management; and (c) a process to strengthen credit mechanisms.

18 "Members welcome Costa Rica's decision to bring its rice subsidies within agreed limits", WTO press release, 13 June 2013. Available at: *http://www.wto.org/english/news_e/news13_e/agcom_13jun13_e.htm.*

19 There is a phytosanitary ban imposed on rice originating from South-East Asia due to *Trogoderma granarium*. Although the risks associated with this pest have been estimated as being very low, the ban is still enforced.

20 Figures from COMEX, based on data from the Central Bank of Costa Rica.

21 The MFN tariff applied by Costa Rica to rice includes an additional duty of 1 per cent pursuant to Law No. 6946; this duty is applicable to all imports, with a few exceptions As a result, the MFN tariff for paddy and milled rice is 36 per cent, equivalent to the sum of the bound tariff (35 per cent) and the 1 per cent additional duty from Law No. 6946.

Costa Rica granted a duty-free import quota of 51,000 metric tons of paddy rice to the United States, which is increasing by 1,000 metric tons per year until 2024. This quota is allocated to the millers. In order to be granted a part of the import quota, millers must first purchase rice from domestic producers. The performance requirement here relates to the right to import rice only in an amount proportional to the purchase of the local harvest (Umaña, 2011).

There are two types of rice millers in Costa Rica: non-integrated independent producers with greater business risk, and integrated mills with lower business risk (Arroyo *et al.*, 2013). The latter often source rice from their own fields. Vertical integration of mills causes the rents of large producers to be added as they move through each step of their chain (production, manufacturing, and wholesale) as the mechanism guarantees a minimum price at the different levels (COMEX *et al.*, 2010). In addition, prices received by rice millers are higher compared to their competitors in major exporting countries. Costa Rican millers have benefited from prices that are consistently above world market levels due to the protectionist policies that have been implemented (Umaña, 2011).

The local mills also are the largest rice producers, so higher domestic prices of rice increase their income. Also, an increase in local prices of rice makes paddy rice imports from the United States relatively cheaper, and, as a result, a larger margin is left for millers when they process and finally sell this imported rice in the domestic market. But not only local mills benefit from a high price to producers. Small producers also gain, although large producers enjoy economies of scale and higher productivity levels that allow them to obtain greater benefits from an increase in rice prices.

As part of the commitments defined by the CAFTA-DR, rice was placed in a non-linear 20- year phasing-out category.[22] The objective is for the out-of-quota rice imports from the United States to be duty-free in 2025.[23] The base rate will remain in 2006–2015, but starting from 2016 (until 2020), tariffs will be reduced by 8 per cent annually, and after 1 January 2021 (until 2024), by 12 per cent per year. The CAFTA-DR should ultimately liberalize rice trade between Costa Rica and the United States, which after the 20-year phase-out period should be completely duty-free. At that

[22] The CAFTA-DR entered into force in Costa Rica in 2009; however, the tariff phasing-out schedule started in 2006, when El Salvador began to implement the CAFTA-DR.

[23] Prior to the CAFTA-DR, the tariff rate for imports of paddy and milled rice from the United States was 36 per cent. There was no quota providing preferential treatment to these imports.

time, there will not be a need to continue applying the quota (COMEX *et al.*, 2010). Furthermore, in 2020, pre-cooked rice imports will be duty-free.

In 2012, the CAFTA-DR quota for paddy rice imports from the United States, established according to industry participation in domestic purchases during the 2010–2011 harvest, was used up to its maximum by the millers (Table 3). Four millers accounted for 72 per cent of the quota, while 28 per cent of the quota was assigned to eight other millers (Arroyo *et al.*, 2013).

Table 3 Paddy rice tariff rate quota established and used, 2009–2012

Year	TRQ established (metric tons)	TRQ used (metric tons)	Share used (per cent)
2009	54,000	52,260	96.8
2010	55,000	54,762	99.6
2011	56,000	55,651	99.4
2012	57,000	57,000	100.0

Sources: COMEX and National Association of Rice Millers of Costa Rica.

With regard to imports of milled rice from the United States using the CAFTA-DR quota, an initial duty-free quota of 5,250 metric tons of milled rice is being increased by 250 metric tons per year until 2024. There is no performance requirement associated with access to the import quota for milled rice, so any relevant economic actor can apply for an allocation. Consequently, the quota is distributed among a larger number of actors. For instance, in 2012, the quota of 6,750 metric tons was distributed among 131 participants, although 10 industries or companies received 3,203 metric tons, equivalent to 47 per cent of the milled rice import quota for the year. The allocation process saw the participation of 84 new applicants that obtained a total of 1,349 metric tons, equivalent to 20 per cent of the quota, with each of them allocated a total of 16 metric tons (Arroyo *et al.*, 2013).

Both the size of the established milled rice quota and its use have been increasing. In 2009, 56 per cent of the quota (3,334 of 6,000 metric tons) was used. Table 4 shows that the share increased to 93 per cent (5,804 of 6,250 metric tons) in 2010 and 95 per cent (6,396 of 6,750 metric tons) in 2012. The exception was 2011, with 88 per cent of the quota (5,736 of 6,500 metric tons) used.

Table 4 Milled rice tariff rate quota established and used, 2009–2012

Year	TRQ established (metric tons)	TRQ used (metric tons)	Share used (per cent)
2009	6,000	3,334	55.6
2010	6,250	5,804	92.9
2011	6,500	5,736	88.3
2012	6,750	6,396	94.8

Source: COMEX.

3 Methodology

The purpose of this analysis is to quantify the effects on consumers of one of the two major changes in Costa Rica's rice policy discussed in the previous section: the adjustment in the country's trade regime applicable to rice as a result of implementation of the CAFTA-DR, which may lead to a reduction in the price of rice for consumers.

The methodology includes the estimation of non-parametric regressions of the welfare effect due to a price decrease of rice on Costa Rican households. Deaton (1989) uses non-parametric density estimations and regressions to study the distributional effects of changes in prices. In this case, the welfare effects from a price change can be assessed by comparing budget and income shares of the good:

$$cv^h = (\varphi_i^h - s_i^h)\, d\ln p_i \qquad (1)$$

where cv^h is the compensating variation (the revenue that the household would need to compensate for the effects of the price change), φ_i^h is the share of household income derived from the production of good i, and s_i^h is the budget share of the household spent on good i.

Based on this equation, after a decrease in the price of a good, net consumers will be better off and net producers will be worse off. Thus, the welfare effects of a price change can be assessed by comparing budget and income shares.[24]

In our case, the analysis only considers the consumption effect, not the income effect. This is because the number of producers in Costa Rica is around 1,000 but Costa Rica's ENIG only contains a few observations on these producers, which precludes running a complete analysis of producer welfare.

[24] In addition, the present study applies a kernel-weighted local polynomial regression.

Costa Rica's case is different from countries such as Madagascar, for example, which in its 2001 household survey reported almost 7,500 observations regarding rice production out of a total number of 11,781 households. For Costa Rica, the assumption is that, on average, households are net consumers of rice, as rice constitutes a basic element of the daily diet, and that the net effect of a decrease in the price of rice will consequently be an increase in welfare.

Our results reflect only partially the effect of price changes of rice on household welfare. In addition to consumption effects, there are other channels for the impact of price changes on welfare. For example, it may be important to address the issue of workers in the rice (and rice-related) sectors, since this source of income may be substantial in parts of the country. In this case, the lack of data prevents incorporating this issue into the estimates, but it is nevertheless important to be aware of these other channels through which price changes can affect welfare.

In a study of the welfare effects of Argentina joining the Common Market of the South (MERCOSUR), Porto (2006) affirmed that the first-order argument omits dynamic household responses, and that consumers may respond, for example, by substituting more expensive goods with cheaper ones. In rural areas, farmers may increase agricultural production, farm employment and wages, and purchases of inputs and services in local markets. Consequently, the net position of the household becomes endogenous: sufficiently large consumption and income responses may cause an *ex-ante* net consumer to become an *ex-post* net producer, thus benefiting from the price increase. Furthermore, according to Porto (2010), first-order effects omit the response of labour markets. Many households earn some of their living from wages. If wages depend on the prices of the goods affected by the trade reforms, then these mechanisms should be incorporated when classifying households as net producers or net consumers. Other variables to consider are the integration or segmentation of labour markets and the presence of spillovers and linkages. The way labour markets function may also depend on factors such as labour market regulations, labour laws and the flexibility to hire and fire workers, and migration costs.

Several authors have presented household models that include labour income effects occurring through other channels. For example, in a study on Cambodia, Soloaga (2005) relied heavily on defining the poor in terms of patterns of expenditure and sources of income (ordered by deciles of adult equivalent per capita expenditure) and then on describing their main sources of income. Each household has different endowments (e.g. different quality of land and different numbers of skilled and unskilled workers) that generate income. Also, each household has different patterns of expenditure (e.g. food and non-food expenditure). Soloaga (2005) found that the changes in prices and quantities that would be observed under the baseline scenario of implementation of the Doha Development Agenda would only have a marginal impact on Cambodia's poor. Meanwhile, under a more ambitious implementation of the agenda, the changes in international prices coupled with the elimination of all Cambodian tariffs would produce gains of about 7.5 per cent of per capita consumption on average.

McCulloch *et al.* (2001) provided an analytical framework for understanding the linkages between trade liberalization and poverty at the household level. They considered a number of potential generalizations related to the basic view of households, including the following:

- Households can provide several forms of labour (e.g. skilled and unskilled), so their endowments in this regard and the different wages they command need to be considered.

- Working on and off the farm may not be perfect substitutes for household members (travel costs for off-farm working) and the farm may be better served by family than by non-family labour (perhaps because non-family labour needs to be monitored more than a family member). Thus, the (implicit) "wage" paid to family members may be different from the wage paid to those outside the family, even for the same task.

- It is necessary to incorporate some assumptions about how households allocate their time across the many different activities in which they are involved. Poor households typically earn income in a wide variety of ways, and the allocation of their time to these different activities may change significantly with changes in trade policy.

- Some jobs may only be available for a fixed number of hours per day. Thus, if trade policy affects employment by increasing the amount of time that individuals work, it could have significant effects on poverty.

Several other authors have also examined the link between trade and poverty. Topalova (2010) used the case of the Indian trade liberalization in 1991 to measure the impact of trade liberalization on poverty and to examine the mechanisms underpinning this impact. McCaig (2011) analysed the effects of increased United States market access on poverty in Viet Nam and found that poverty fell faster in provinces that experienced the largest tariff cuts. Goldberg and Pavcnik (2005) investigated the relationship between protection and industry wage premiums in Colombia. The authors relate wage premiums to trade policy in an empirical framework that accounts for the political economy of trade protection. Goldberg and Pavcnik (2004) reviewed country case studies that analyse micro data from household or plant-level surveys and establish certain patterns that seem common across countries and trade liberalization episodes, and that may be informative with regard to how developing countries adjust to trade reforms.

The analysis of the decrease in rice prices is based on the reduction of import tariffs due to the application of the CAFTA-DR. Welfare effects under three scenarios will be analysed, each related to a particular tariff liberalization phase (2015, 2020, and 2025), based on the implementation of the CAFTA-DR's phasing-out process.

Since we assume a perfect pass-through of tariff reductions, the results here are an upper-bound estimate of the benefits of the tariff phasing-out under the CAFTA-DR. In this sense, the estimation of the pass-through effect for rice may be difficult because there are factors that influence the internal price and that are not easy to measure or quantify, such as political decisions and the degree of integration and competition regarding markets. Also, international prices may not reflect or accurately explain the evolution of internal rice prices in Costa Rica, as prices paid to producers are based on a cost structure that includes elements such as the value of inputs used in production.

The regressions will be run at the national level, but also disaggregated at the following levels: (a) urban versus rural households, (b) region, (c) education level of the head of the household, and (d) household size.

The results obtained from the non-parametric regressions across the different characteristics of households and their per capita consumption level will be particularly useful in terms of determining how an import tariff phase-out process may affect consumers

3.1 Definition of the scenarios: Estimate of the welfare effect from a decrease in the price of rice

The scenarios used in this study were defined based on the estimate of a weighted average tariff for the importation of rice under the CAFTA-DR phasing-out schedule and quotas for rice.[25] The period of analysis starts in 2009, when the CAFTA-DR entered into force in Costa Rica, and ends in 2025, when the phasing-out period for paddy and milled rice will be completed.[26]

It is assumed that the import quotas defined in the CAFTA-DR for paddy and milled rice will be completely used during the years ahead (2013–2024). The estimated share of intra-quota CAFTA-DR imports of rice in total rice imports from the United States for 2009–2012 was 69 per cent for paddy rice and 80 per cent for milled rice. These shares were applied to the respective CAFTA-DR quota volumes for each year from 2013 to 2024 in order to define the extra-quota volumes and, as a result, the total estimated imports of paddy and milled rice from the United States. Note that almost all of Costa Rica's paddy rice imports come from the United States.

For milled rice imports from the rest of the world (aside from the United States), the volume forecast for 2013 was obtained by multiplying the annual average growth rate for rice consumption in Costa Rica during the 2001–2002 and 2011–2012 harvest seasons (2.03 per cent) by the average imported volume during 2009–2012 from each of the countries of origin. For countries other than the United States, the same growth rate (2.03 per cent) was applied for the estimation of 2013–2024 milled rice imports.

Welfare evaluations are done for four points in time: a baseline scenario based on the data from 2009–2012, which represents the first four years of CAFTA-DR implementation in Costa Rica; a second scenario in 2015, the last year in which the MFN tariff will be applied to out-of-quota CAFTA-DR imports from the United States; a third scenario in 2020, when pre-cooked rice imports from the United States will enjoy duty-free access; and the final scenario in 2025, when all rice imports from the United States will be duty-free.

As shown in Table 5, the overall weighted average tariff for rice will move from 12.1 per cent in 2009–2012 to 6.6 per cent in 2020. In 2025, the overall weighted tariff will be zero. This general average tariff can be used to define a price change.[27] As a result, the estimated price change for each of the scenarios in relation to the baseline years (2009–2012) will be the following:

[25] These simulations include paddy, milled and pre-cooked rice. The weights used are based on the total imported volume of rice. Complete pass-through is a reasonable assumption in our case, as the domestic market for rice is influenced by political decisions that may be arbitrary and, as a result, difficult to reflect or quantify in the estimation of the pass-through.

[26] Costa Rica's import data for 2009–2012 are available at the 10-digit level of disaggregation (national tariff classification).

[27] Although the best way to justify complete pass-through assumption is by assigning each tariff change to the particular good in household expenditure, in our analysis this was not possible because the rice classification in Costa Rica's 2004 ENIG is different from the one in international trade statistics (based on the Harmonized System). Therefore, in order to address this limitation, we proceeded by establishing an "overall weighted average" obtained from tariff changes, which was then applied to the share of households' total expenditure on rice. Rice flour is not defined as an individual product according to the 2004 survey, and it was not considered for the estimation of the scenarios.

- 2025 scenario: –12.1 per cent
- 2020 scenario: –5.52 per cent
- 2015 scenario: –1.51 per cent

For pre-cooked rice, the average weighted tariff for each of the years from 2013–2024 results from the multiplication of the applied tariff in each year by the share that each exporting country represented in the total volume imported by Costa Rica in 2012. The base year 2012 for the exporting country's share was chosen because that year shows a better representation of how imports would be distributed by country of origin during the following years. In 2012, the United States accounted for the highest share of Costa Rica's total imports of pre-cooked rice (50.1 per cent).

Table 5 Weighted average tariff for rice imports to Costa Rica, 2009–2012, 2015 and 2020 (per cent)

Rice product	Weight	Weighted average tariff (by product)
		2009-2012
Paddy	83.4	12.3
Milled	13.2	11.4
Pre-cooked	3.4	9.3
Total	100.0	12.1
		2015
Paddy	81.8	10.9
Milled	14.8	10.0
Pre-cooked	3.4	6.0
Total	100.0	10.6
		2020
Paddy	81.1	6.5
Milled	15.5	8.3
Pre-cooked	3.4	0.0
Total	100.0	6.6

Source: Author's calculations, based on data from the Central Bank of Costa Rica and COMEX.
Notes: Figures in the table are forecasts. Annex 3 contains more information about weights, average tariffs and assumptions for the estimate of the weighted average tariff. The column entitled "Weight" indicates the share of imports of each type of rice in the volume of total rice imports. The column entitled "Weighted average tariff (by product)" gives the trade-weighted average tariff for each rice category as well as the average tariff applied to rice weighted according to the importance of each rice category in rice imports.

[28] The fact that the expenditure structure of the households will not change is established as a *ceteris paribus* assumption for simplicity purposes.

3.2 Data access and availability

This study uses Costa Rica's 2004 National Income and Expenditure Survey, which includes three databases. The first covers variables related to the characteristics of household members, such as education level, employment, income, and transfers. A second database includes variables linked to household characteristics, such as the type of dwelling, number of rooms, and availability of appliances, domestic workers, persons who receive government aid, household incomes, and other characteristics. A third database has a more disaggregated classification of household expenditures by specific products. For example, this database provides the share of household expenditure on rice in which all four types of rice are considered as a single product.

The fact that the survey dates to 2004 is not a limitation because tariff conditions for rice have not changed. Nor has there been much change in the composition of the poorest quintile. This study thus assumes that the structure of household expenditure has not changed between 2004 and the following years, including the baseline years of 2009–2012 and the phasing-out scenarios years (2015, 2020, and 2025).[28]

4 Welfare estimates for Costa Rica's households from a decrease in the price of rice

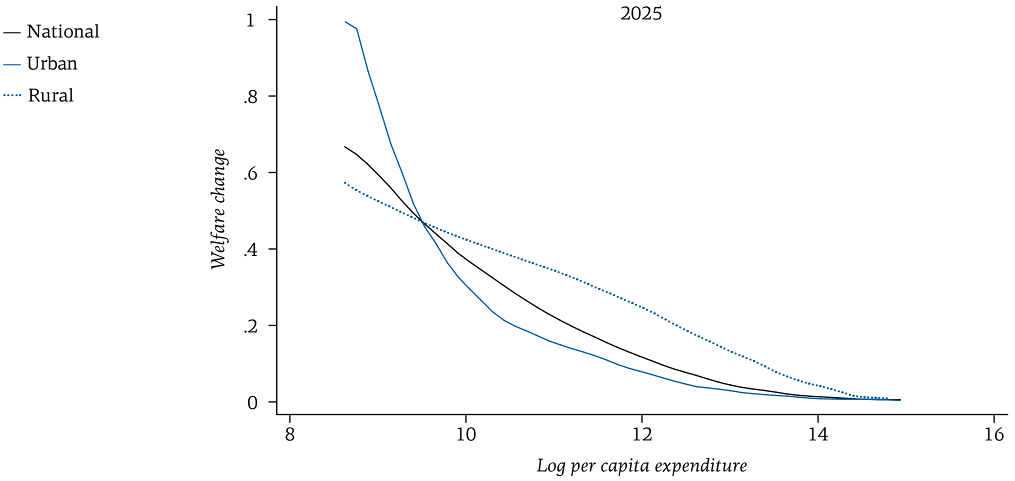
4.1 Estimates at the national, urban and rural levels

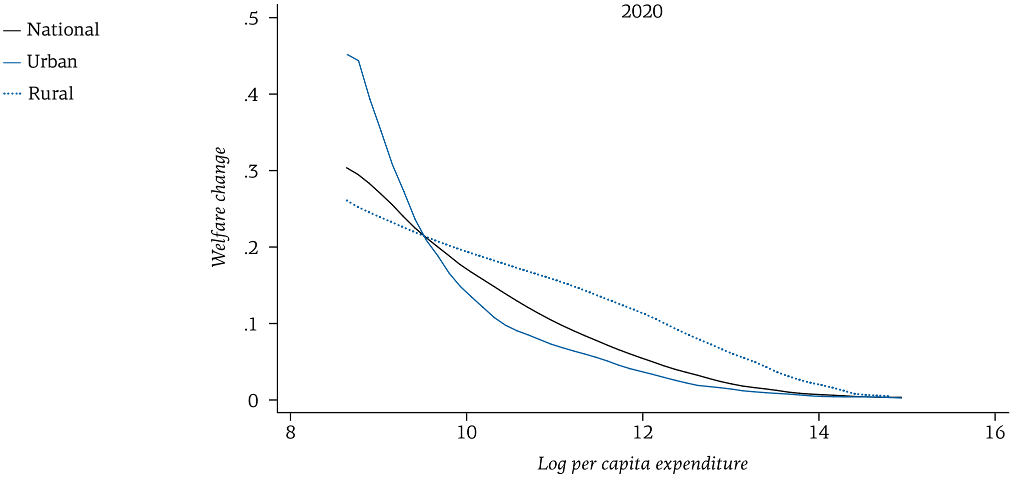
Figures 7–10 show welfare gains from the decrease in the price of rice in the years ahead, assuming that the reduction in import tariffs will be completely transmitted to local prices.

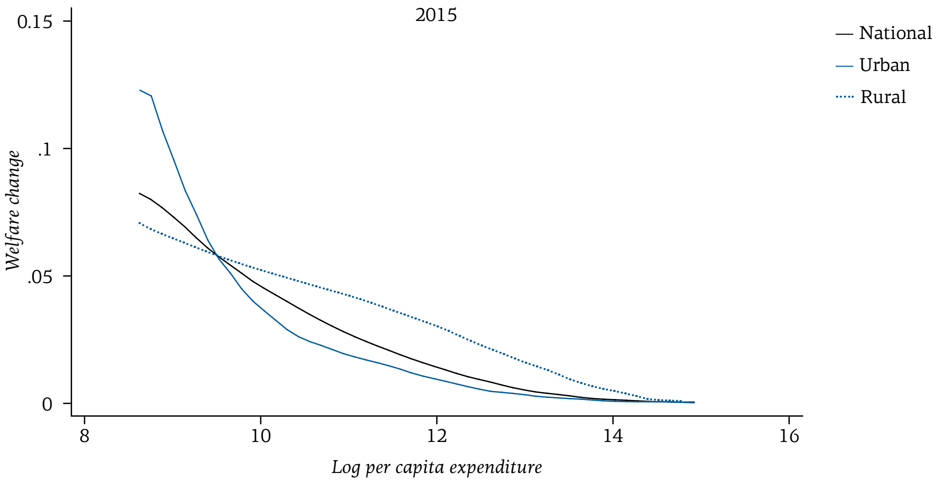
Welfare gains are expected to be positive during those years as tariffs decrease during the phasing-out process. As expected, welfare gains will become relatively more significant for poor households, particularly for poor urban households that are expected to benefit the most from a price decrease in rice. Their welfare gains may account for more than 0.05 per cent of their initial consumption level in 2015, around 0.30 per cent in 2020, and close to 1 per cent for the 2025 full tariff liberalization scenario (Figure 7).[29]

[29] Further research could assess welfare effects by showing estimates by deciles or centiles of income distribution (Nicita, 2004). The reason is that non-parametric regressions are local regressions by nature and, as such, they do not indicate the income percentile of households at each point of the estimated curve.

Figure 7 Welfare changes in the 2025, 2020 and 2015 scenarios compared to 2009–2012, at the national level and by urban and rural areas







Source: Author's calculations, based on the 2004 ENIG.

Middle-income households will also benefit from a reduction in rice prices. For example, under the 2015 scenario, welfare gains for this group of households will reach around 0.04 per cent; the 2020 scenario shows a benefit close to 0.15 per cent; and the 2025 scenario shows welfare gains of around 0.30 per cent. Welfare gains for the richest households are negligible, a fact that is consistent with Engel's Law, as the share of rice in their budget is relatively small compared to low-income households. Also, the wealthiest population can afford a more diversified diet, away from rice.

A complementary way to assess welfare effects from a reduction in the price of rice is by comparing the average welfare effect according to deciles of income distribution. In this way, and assuming that the reduction in import tariffs will be completely transmitted to local prices, Table 6 shows that, at the national level, welfare effects will be more relevant in the poorest deciles. For example, households in the first decile will show, under the 2025 scenario, a 0.66 per cent welfare increase from their initial consumption level. This is a result that complements Figure 7, as lower-income households will enjoy higher welfare increases due to a reduction in rice prices.

Table 6 Welfare changes in the 2025, 2020 and 2015 scenarios at the national level, by deciles of income distribution (per cent)

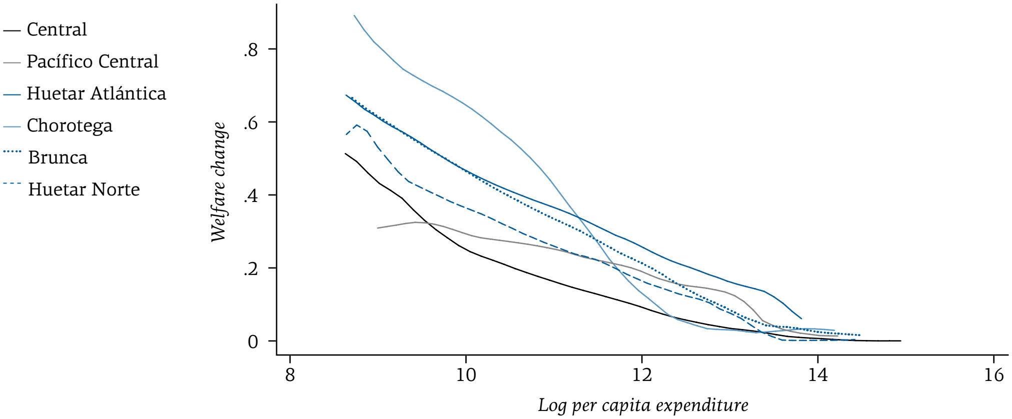
Decile	Scenario			Decile	Scenario		
	2025	2020	2015		2025	2020	2015
1	0.66	0.30	0.08	6	0.17	0.08	0.02
2	0.38	0.17	0.05	7	0.13	0.06	0.02
3	0.27	0.12	0.03	8	0.08	0.03	0.01
4	0.22	0.10	0.03	9	0.05	0.02	0.01
5	0.17	0.08	0.02	10	0.02	0.01	0.00

Source: Author's calculations, based on the 2004 ENIG.

4.2 Welfare effects by region

With regard to welfare effects by region, all regions show a common downward tendency as household income increases. Under the 2025 scenario, the region that shows the highest welfare increase for the poorest segments of the population is the Chorotega Region, followed by the Huetar Atlántica and Brunca Regions (Figure 8).[30] In these cases, welfare increases for poor households from a complete tariff liberalization of rice may reach, on average, 0.50 per cent or more from the baseline consumption level.

Figure 8 Welfare change in the 2025 scenario compared to 2009–2012, by region



Source: Author's calculations, based on the 2004 ENIG.

[30] Figure A1.1 in Annex 1 shows the results for the 2015 and 2020 scenarios.

[31] Figure A1.2 in Annex 1 shows the results for the 2015 and 2020 scenarios.

[32] Large households with more children may dedicate a larger budget share to rice.

The Chorotega Region, as well as the Huetar Atlántica and Brunca Regions, have consistently had high poverty levels. For example, according to the average poverty incidence for 2010–2012, the share of the population living in poverty was 34.1 per cent in the Brunca Region, 32.9 per cent in Chorotega, and 27.9 per cent in Huetar Atlántica.

Figure 8 shows that gains are larger for these poor regions in Costa Rica. In contrast, the Central Region shows the lowest welfare gains from a price decrease in rice (except for the poorest households), probably due to the fact that this region has recorded the lowest poverty incidence levels in Costa Rica. However, we must be cautious about interpreting this regional disaggregation, since the Chorotega Region is at the same time the largest producer of rice, and the present study does not consider income effects.

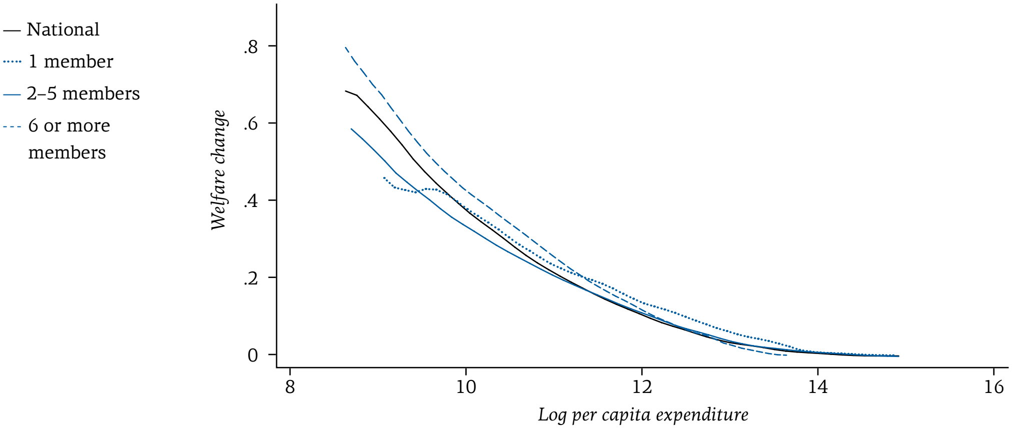
Furthermore, Figure 8 shows relatively large differences in the welfare effects across regions, conditional on per capita expenditure. This means that a poor household with the same per capita expenditure, on average, benefits more in the Chorotega Region than in the Brunca or Central Region. The differences in the expenditure share of rice across regions (e.g. due to differences in tastes) might be the underlying reason for these different effects. For instance, according to the 2004 survey, households with the same per capita expenditure dedicated 3.6 per cent of their average budget to rice in the Chorotega Region, followed by the Huetar Atlántica Region (3.1 per cent), and the Brunca Region (2.9 per cent), while they only spent, on average, 1.1 per cent of their budget on rice in the Central Region. Consequently, the increase in welfare resulting from a rice price decrease is, on average, more pronounced for households in regions with a higher share of rice in total expenditure.

4.3 Welfare effects according to household size

Figure 9 shows the welfare effects of a reduction in rice prices based on the number of household members (household size).[31] The 2025 scenario shows that the poorest and largest households, with six or more members, may enjoy the most significant welfare effects.[32] According to the 2011 census, the districts at the national level with a higher incidence of resource gaps, based on the unmet basic needs approach, are those that have a larger average size of households (4 members per household compared to 3.5 members per household at the country level) (Méndez and Bravo, 2011). Unmet basic needs refer to the housing quality, overcrowding, electricity, health, physical infrastructure, consumption capacity, primary and secondary school attendance and school achievement.

Differences in the welfare effects on households, as shown in Figure 9, can be explained by the disparities in the expenditure share of rice for different household sizes. According to the 2004 survey, in households with six or more members, rice represented, on average, 2.7 per cent of the household budget, while for households with two to five members the share was 1.6 per cent. In contrast, households composed of one member spent, on average, 1.4 per cent of their budget on rice. In other words, larger households spent, on average, a higher share of their budget on rice.

Figure 9 Welfare change in the 2025 scenario compared to 2009–2012, by household size



Source: Author's calculations, based on the 2004 ENIG.

A possible explanation for the differences in rice consumption across households is that households with only one member are less likely to cook and eat at home. Instead, they may go to restaurants or eat elsewhere. On the other hand, larger households are more likely to benefit from economies of scale when cooking and eating at home. According to the survey, single-member households spend on average 7.2 per cent of their budget on consumption of food and beverages prepared outside the home, compared to 5.4 per cent, on average, for households with two or more members.

[33] Figure A1.3 in Annex 1 shows the results for the 2015 and 2020 scenarios.

[34] Figures 7–10 remove extreme values. Fitted values from non-parametric regressions could be problematic when we are interested in the extremes, as they may have few observations to perform the regressions and thus produce imprecise estimations. For example, the dataset contains six observations for secondary education with log per capita < 9.5 (representing 0.6 per cent of the total number of observations for secondary education). Furthermore, in Figure 10, the national curve differs from the previous figure due to the different limits applied to remove potential extreme observations in the data.

[35] These four regions were Chorotega, Brunca, Huetar Atlántica, and Huetar Norte.

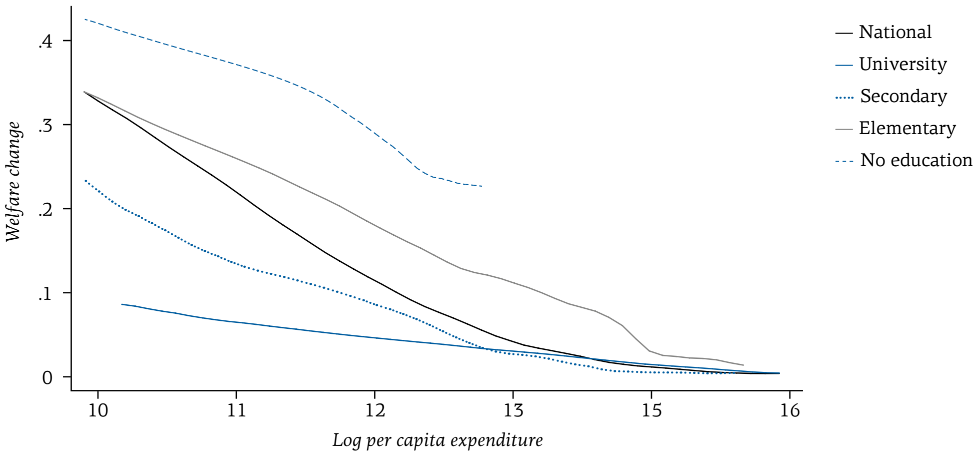
4.4 Education level of the household head

When comparing the education level of the household head, those who have not received an education experience the largest increase in welfare from a reduction in the price of rice (Figure 10).[33] Also, conditional on per capita household expenditure, their budget share spent on rice is higher.[34] For example, according to the survey, households whose head has no education display the highest rice expenditure budget share (3.6 per cent), followed by households whose head has an elementary education (2.4 per cent), secondary education (1 per cent), or university education (0.4 per cent).

As the education level of the household head decreases, the average welfare gain for households will progressively increase. Given that we are controlling for income, we do not have an *a priori* explanation for these differences. Probably, the education variable is correlated with another variable. The survey shows that in four of the six regions of Costa Rica, the share of household heads with no education or with elementary education (completed or not) reached the highest levels, with more than 65 per cent in each region.[35] The same four regions have the highest share of rice expenditure, as described in Section 4.2.

This classification thus serves as another tool to identify the profile of households that will obtain the largest gains from a decrease in the price of rice. For example, welfare gains for households whose head has no education will be double those of households whose head has a secondary education.

Figure 10 Welfare change in the 2025 scenario compared to 2009–2012, by education level



Source: Author's calculations, based on the 2004 ENIG.

5 Conclusions, policy recommendations and discussion

5.1 Conclusions

The rice market in Costa Rica has several distinct features. First, rice is an essential staple in the Costa Rican diet, particularly for the poorest segments of the population. Second, rice is produced in the country, but local production does not satisfy local demand. Third, rice has been subject to several policy measures targeting both local production and imports. The performance requirement for the importation of paddy rice from the United States, for instance, has benefited those producers that are vertically integrated (i.e. those that manage both the production and milling of rice). Fourth, the price-fixing mechanism has increased prices of paddy rice paid to local producers to double that of international prices. Consequently, Costa Rican consumers are paying a high price for a key commodity in their daily basket, the consumption of which is even more important for low-income households. Costa Rica's current rice policies have not been successful in increasing productivity, reducing prices for consumers, or improving conditions for small farmers. It is the large producers who receive the rents from the use of the performance requirement for paddy rice imports. Also, due to the price-fixing mechanism, Costa Rica is in breach of its WTO commitments, as the amount of distorting support received by producers in recent years has exceeded by more than five times the maximum amount allowed under those commitments.

At the same time, the trade regime for rice imports is changing as a result of the entry into force of the CAFTA-DR: the phasing-out process for out-of-quota import tariffs will begin in 2016, and unlimited duty-free access for imports from the United States is scheduled for 2025. The CAFTA-DR thus may be an opportunity to effectively reduce rice prices in the domestic market and in doing so improve the welfare of consumers.

This study analysed the effects of a price decrease of rice on consumers by estimating a reduction in prices for rice imports at several points in time (2015, 2020, and 2025). As a starting point, the study established a baseline scenario that considered the weighted import tariffs on rice for the period 2009–2012. The database used was Costa Rica's 2004 National Income and Expenditure Survey, and it was assumed that the expenditure structure of the households would not change.

By applying non-parametric regressions, the study arrived at several results. As expected, the poorest will benefit the most from a decrease in the price of rice. In the 2025 scenario with duty-free access for imports from the United States, the poorest urban households may record a welfare increase close to 1 per cent from the baseline period consumption level (2009–2012). Other results have shown the links between welfare gains and characteristics such as the area and region where households are located, household size and the education of the household head.

For comparison, we considered the results of Porto (2006), who analysed the welfare effects of Argentina joining the MERCOSUR, assuming that price changes are given by tariff changes. That study calculated the budget shares for these products, and estimated the welfare effects by multiplying these shares by the price changes. In that case, the total consumption effect was positive for almost all households, except the poorest ones. By adding the consumption effects of traded and non-traded goods, the total consumption effect increased monotonically with the level of livelihood, with changes ranging from around –0.2 per cent to over 2.2 per cent of initial expenditure. The richer the household, the larger was the welfare gain.

The results of our study have shown that households in the poorest regions of the country will enjoy a greater increase in welfare as a result of price reductions in rice. Poorest households in urban areas will gain the most. Moreover, households with six or more members will greatly benefit, as will households whose head has no education. However, if the decrease in import tariffs for rice from the application of the CAFTA-DR is not reflected in a price reduction for this product in the domestic market, then the subsequent welfare gains for the poor sectors of the population will be missed.

As mentioned earlier, this study has only included consumption effects, not income effects. It has not considered any general equilibrium effect coming from reductions in employment in the rice sector. It could be the case that although many households are net rice consumers, and as such benefit from price reductions, they are also affected by negative labour outcomes derived from losses in domestic production. Furthermore, we assume a perfect pass-through for tariff reductions, and, therefore, results here are an upper-bound estimate of the benefits of the phasing-out of tariffs under the CAFTA-DR.

This study is expected to be a starting point from which other analyses in Costa Rica can be performed using micro data. At the time of our analysis, the National Institute of Statistics and Census of Costa Rica was collecting information from households for preparation of the 2012–2013 National Income and Expenditure Survey. This database will provide up-to-date information for new studies regarding the quantification of welfare effects of trade policies.

5.2 Policy recommendations

The results of this study have shown that poor households in Costa Rica will likely be the segment of the population to benefit most from a reduction in the price of rice. In this sense, the phasing-out process scheduled in the CAFTA-DR may be an opportunity to effectively reduce rice prices in the domestic market.

For this to take place, the institutions in charge of defending the interests of consumers, as well as those that supervise the functioning of the domestic market, must develop an active stance towards surveillance of price behaviour for the imported product, especially after 2016. During 2009–2012, the weighted average import tariff for rice was 12.1 per cent; this percentage therefore represents the estimated reduction in local prices of rice in 2025 (the year when imports of milled and paddy rice will enjoy duty-free access) compared to the prices of 2009–2012.

This study has kept the international price at its current level. It is important to take into consideration the fact that international prices can change in the future. However, this study did not aim to perform forecasts with regard to price levels.

As a result of Costa Rica's price-fixing mechanism, there is no transmission of international prices of rice to domestic prices. If the international price falls, then the domestic price does not move, which is equivalent to zero transmission. In the domestic market, if the price to the producer increases by virtue of a decree, then consumer prices rise at a rate given by the margins.[36]

The implementation of the phasing-out process in the CAFTA-DR will progressively reduce the relevance of the performance requirement for paddy rice imports from the United States, as well as the import quota, since the out-of-quota import tariff will move closer to zero. This means that industries will not need to purchase domestic paddy rice in order to be able to import duty-free from the United States. Large producers, which are also millers, may have an incentive to import most of the paddy rice they will process, depending on how profitable producing locally or importing rice will become. If large producers have a better business opportunity by importing most of their rice and reducing their own production, this may require an active policy of stocks and safety nets to address international price spikes.

[36] Conceptually, then, this could not be called transmission.

The reduction of the price of rice is a pro-poor measure. The results presented in this study have identified with a greater level of detail which population groups may obtain the highest welfare gains from such a reduction: poor households living in urban areas, households whose head has a lower education level, large households, and households living in the Chorotega, Huetar Atlántica, and Brunca Regions.[37] These outcomes explain why the CAFTA-DR is an opportunity for Costa Rican households, in particular the poorest, to get better access to affordably priced rice.

5.3 Discussion

With the arrival of the CAFTA-DR, the local rice sector faces the challenge of increasing its competitiveness, including: (a) productivity, which has decreased in recent years; (b) capacity-building for rice producers; (c) improved and cheaper access to inputs, a growing concern for the sector; and (d) strengthening of credit mechanisms, which is specifically crucial for small producers who may require this kind of assistance. In this sense, Decree 37699-MEIC defines a coordinated programme of work between the government and the rice sector to increase competitiveness, facilitate access to credit, and achieve an effective reduction in the costs of inputs such as agrochemicals and seeds.

Costa Rica has to continue its efforts to comply with its commitments to the WTO. A continuous dialogue needs to take place between producers, millers and the government in order to enhance productivity levels, avoid the need to apply trade-distorting policies, and prevent a loss in welfare for consumers. The CAFTA-DR might serve as an automatic price control mechanism resulting in rice imports becoming progressively cheaper. Local producers may then be pushed to reduce their prices to avoid losing their market share.

The possibility of applying price fixing should not be politicized, even if Article 5 of the Law for Promotion of Competition and Effective Consumer Protection (Law No. 7472) allows the government to regulate the prices of goods and services in exceptional situations. This measure needs to be applied only temporarily, and the need for its application has to be properly established and justified.

It is important to consider that this study is an empirical exercise regarding the estimation of a possible price decrease due to the application of the

[37] As mentioned earlier, we must be cautious in interpreting this regional disaggregation because the Chorotega Region is also the largest producer of rice, and our study did not consider income effects.

phasing-out schedule of the CAFTA-DR. However, the real context is complex and includes other elements such as policy decisions and the organization of the market. For this reason, the analysis may be considered as a first step towards assessing the welfare gains for households from a decrease in the price of rice. In addition, this research considered only consumption effects, due to the lack of observations for rice producers in Costa Rica's 2004 National Income and Expenditure Survey. It also did not include the consequences of a price decrease of rice for producers.

Finally, the study agrees with Arroyo *et al.* (2013) that the current price-fixing mechanism is neither increasing productivity nor improving consumer access to affordable rice. Among the alternative policies that may thus be proposed are to:

- Continue using the price-fixing mechanism while ensuring that the total subsidy to rice farmers does not exceed Costa Rica's WTO commitments, and focus the support on small producers.

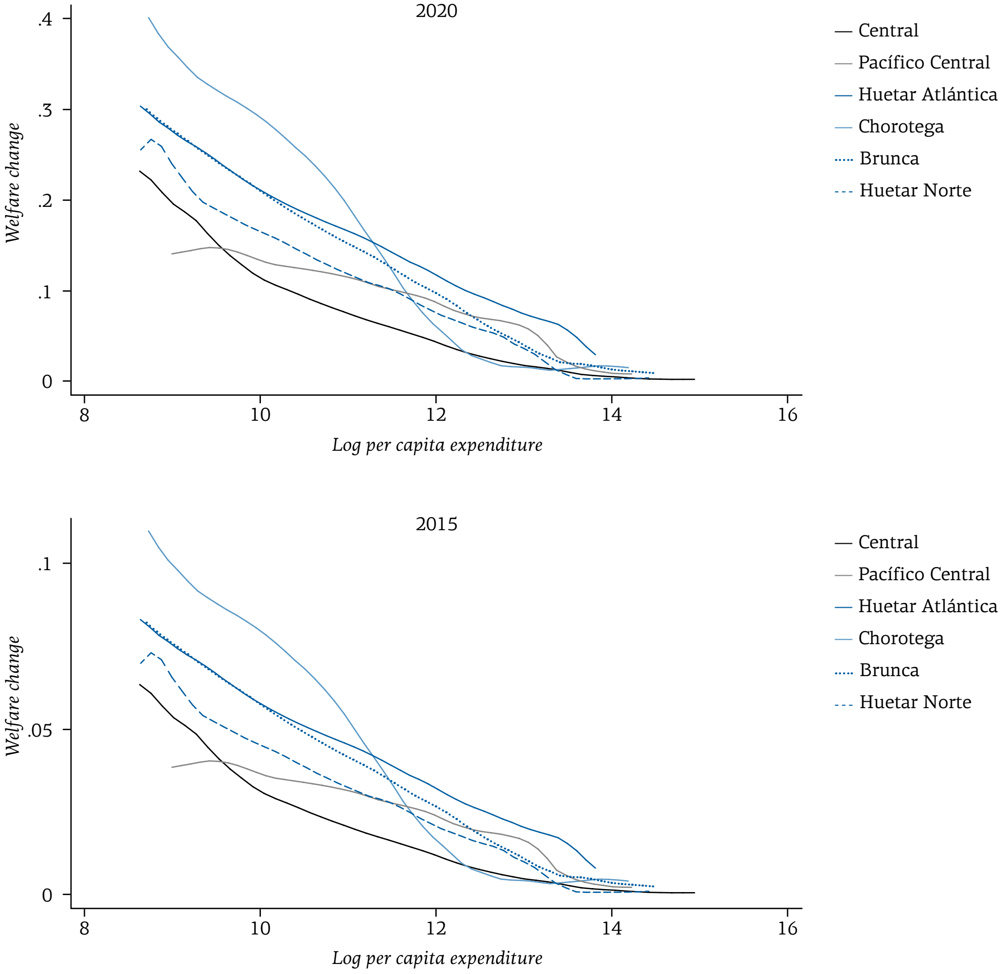
- Revise the legal scope of the current pricing mechanism to include alternatives that do not breach the commitments at the multilateral level (so-called "green box" measures in the WTO Agreement on Agriculture). The heterogeneity of the sector may be considered, as support should be more focused on small producers, who particularly need-to increase productivity and competitiveness. Measures may include extension services (such as research, training, and pest and disease control), as well as direct payments to producers, provided that such payments are decoupled from production.

Finally, and importantly, whatever pricing mechanism is ultimately implemented, it must consider the potential impact on consumers.

Annexes

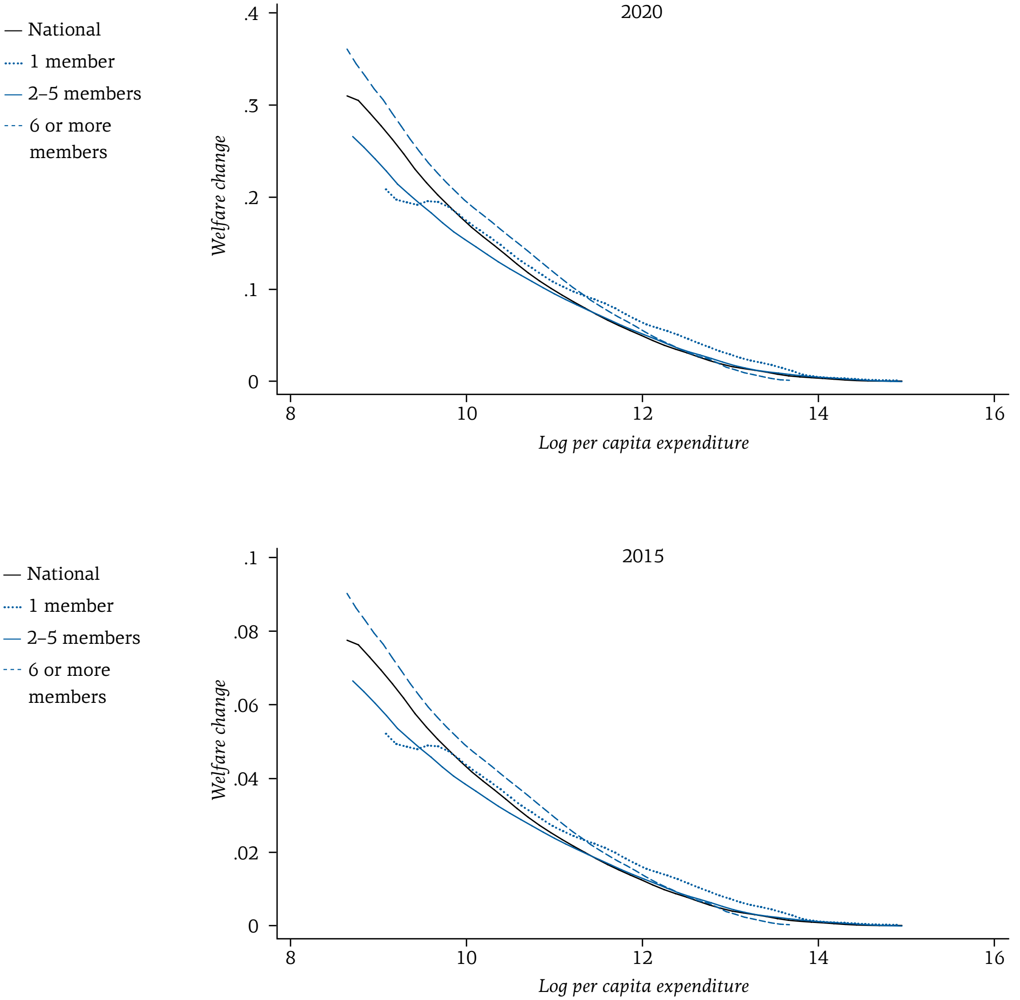
Annex 1: Figures from the econometric analysis

Figure A1.1 Welfare changes in the 2020 and 2015 scenarios compared to 2009–2012, by region



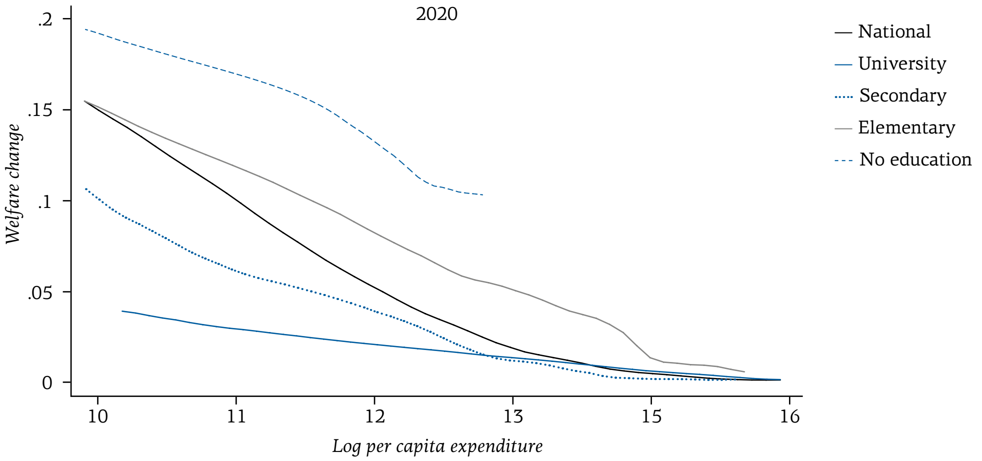
Source: Author's calculations, based on the 2004 ENIG.

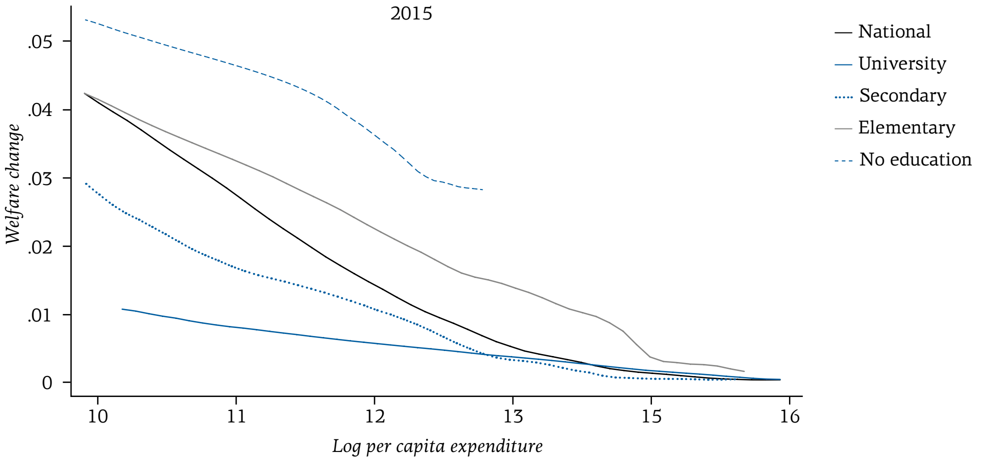
Figure A1.2 Welfare changes in the 2020 and 2015 scenarios compared to 2009–2012, by household size



Source: Author's calculations, based on the 2004 ENIG.

Figure A1.3 Welfare changes in the 2020 and 2015 scenarios compared to 2009–2012, by education level





Source: Author's calculations, based on the 2004 ENIG.

Annex 2: Facts about the domestic rice market in Costa Rica

Table A2.1 Imports and national production relative to domestic supply of milled equivalent rice in Costa Rica, 1995–2009 (per cent)

Year	Imports/ Domestic consumption	National production/ Domestic consumption
1995	32.0	70.9
1996	30.2	73.1
1997	30.6	75.5
1998	38.3	66.2
1999	24.1	80.2
2000	20.5	81.7
2001	28.7	77.3
2002	35.6	66.4
2003	47.2	54.3
2004	46.6	55.3
2005	58.4	43.1
2006	56.3	44.1
2007	52.3	49.7
2008	34.2	70.6
2009	32.8	69.6
Average	37.9	65.2

Source: COMEX.
Note: Since domestic supply = imports + national production – exports, the sum of imports and national production in each row may not equal 100.

Table A2.2 Official fixed price to rice producers and national production that benefited from the price-fixing regime, 1995–2010

Year	Official fixed price (USD per metric ton)*	National production (metric tons)
1995	260.9	164,866
1996	267.6	212,873
1997	280.7	223,676
1998	280.2	215,099
1999	271.0	264,317
2000	267.3	266,422

Year	Official fixed price (USD per metric ton)*	National production (metric tons)
2001	257.8	216,700
2002	248.2	189,689
2003	259.6	183,497
2004	258.3	197,211
2005	271.7	183,251
2006	305.5	175'775
2007	353.4	179,729
2008	506.7	220,870
2009	581.3	256,612
2010	633.4	290,475**

Source: COMEX, based on data from CONARROZ.
** Based on figures provided by Costa Rica in notifications to the WTO Committee on Agriculture.*
***According to 2010–2011 harvest figures from CONARROZ.*

Annex 3: Average tariffs and weights applied to intra-CAFTA-DR imports and to non-CAFTA-DR imports[38]

Pre-cooked rice

Weights applied for 2009–2012 are based on the total sum of the share of imported volume in each year, multiplied by the applied tariff, for each import partner. Weights estimated for 2015 are based on the share of imported volume, by import partners, in 2012 (Table A3.1).[39] For 2020, it is assumed that all pre-cooked rice will be imported duty-free from the United States.

[38] Sources of information for this Annex include the CAFTA-DR phasing-out schedule for Costa Rica, trade statistics from the Central Bank of Costa Rica, and Costa Rica's MFN applied tariffs from the WTO.
[39] The same weights are applied throughout 2013–2019.

Table A3.1 Weighted average tariff for pre-cooked rice imports to Costa Rica, 2009–2012 and 2015 (per cent)

	United States	El Salvador	Uruguay	Total weighted average tariff
2009–2012				
Weight	2 < *w* < 50	17 < *w* < 47	23 < *w* < 71	9.3*
Applied tariff	8 < *at* < 11	0.0	15.0	
Weighted average tariff	2.0	0.0	6.3	
2015				
Weight	50.1	26.8	23.1	6.0
Applied tariff	5.0	0.0	15.0	
Weighted average tariff	2.5	0.0	3.5	

Source: Author's calculations.
Note: w stands for weight and at stands for applied tariff.
**During 2009–2011, Costa Rica imported pre-cooked rice from other countries that are not included in this table, which is why the total weighted average tariff (9.3 per cent) does not coincide with the sum of the weighted average tariffs of the United States and Uruguay (8.3 per cent).*

The CAFTA-DR does not apply tariff rate quotas for pre-cooked rice. The phasing-out process from a 15 per cent base rate is shown in Table A3.2

Table A3.2 Phasing-out of the pre-cooked rice import tariff in the CAFTA-DR (per cent)

	Year	CAFTA-DR tariff		Year	CAFTA-DR tariff
1	2006	14	9	2014	6
2	2007	13	10	2015	5
3	2008	12	11	2016	4
4	2009	11	12	2017	3
5	2010	10	13	2018	2
6	2011	9	14	2019	1
7	2012	8	15	2020	0
8	2013	7			

Source: Author, based on Costa Rica's phasing-out schedule in the CAFTA-DR.

Paddy rice

The weights applied in Table A3.3 are based on total imported volume of paddy rice, by import partners, during the period 2009–2012.

Table A3.3 Weighted average tariff for paddy rice imports to Costa Rica, 2009–2012, 2015 and 2020 (per cent)

	Intra-quota CAFTA-DR	Out-of-quota CAFTA-DR	El Salvador*	Total weighted average tariff
2009–2012				
Weight	65.4	34.3	0.3	12.3
Applied tariff	0	36	0	
Weighted average tariff	0	12.3	0	
2015				
Weight	68.6	30.3	1.1	10.9
Applied tariff	0	36	0	
Weighted average tariff	0	10.9	0	
2020				
Weight	68.6	30.3	1.1	6.5
Applied tariff	0	21.6	0	
Weighted average tariff	0	6.5	0	

Source: Author's calculations.
**Imports of paddy rice from El Salvador are duty-free due to the CACM. Annual forecast growth of imports from El Salvador is based on annual growth of rice consumption between 2001–2002 and 2011–2012 crop seasons (2.03 per cent).*

The following assumptions are made: (a) the CAFTA-DR TRQ is completely used, and (b) 69.4 per cent of imports from the United States are intra-CAFTA-DR quotas (based on the share reported in 2009–2012).

The MFN tariff is 36 per cent, the applied tariff for intra-CAFTA-DR imports is zero, and tariffs for out-of-quota CAFTA-DR imports from 2009 to 2025 are specified in Table A3.4.

Table A3.4 Phasing-out of the out-of-quota import tariff for paddy rice in the CAFTA-DR (per cent)

	Year	CAFTA-DR out-of-quota tariff		Year	CAFTA-DR out-of-quota tariff
4	2009	36	13	2018	27.4
5	2010	36	14	2019	24.5
6	2011	36	15	2020	21.6
7	2012	36	16	2021	17.3
8	2013	36	17	2022	13.0
9	2014	36	18	2023	8.6
10	2015	36	19	2024	4.3
11	2016	33.1	20	2025	0.0
12	2017	30.2			

Source: Author's calculations, based on Costa Rica's phasing-out schedule in the CAFTA-DR.

Milled rice

The weights applied in Table A3.5 are based on total imported volume of milled rice, by import partners, during 2009–2012.

Table A3.5 Share of milled rice imports to Costa Rica, by country of origin, 2009–2012, 2015 and 2020 (per cent)

	Import weights		
Country of origin	**2009–2012**	**2015**	**2020**
Argentina*	12.3	10.8	10.5
Brazil*	0.5	0.5	0.4
China*	0.2	0.2	0.2
Ecuador*	0.1	0.1	0.1
El Salvador**	6.7	5.9	5.7
United States intra-quota CAFTA-DR	40.3	47.2	48.3
United States out-of-quota CAFTA-DR	13.1	11.5	11.8
Guatemala**	3.0	2.6	2.5
Guyana*	0.2	0.2	0.2
Nicaragua**	18.5	16.3	15.8
Uruguay*	5.2	4.6	4.5
Total	100.0	100.0	100.0

Source: Author's calculations.

**Imports of milled rice are subject to a 15 per cent MFN import tariff.*

***Imports of milled rice from El Salvador, Guatemala, and Nicaragua are duty-free due to the CACM.*

The following assumptions are made: (a) the CAFTA-DR TRQ is used; (b) 80.4 per cent of imports from the United States are within the intra-CAFTA-DR quota (based on the share reported for 2009–2012); and (c) annual forecast growth of imports from countries other than the United States is based on annual growth in rice consumption between the 2001–2002 and 2011–2012 crop seasons (2.03 per cent).

The MFN tariff is 36 per cent, the applied tariff for intra-CAFTA-DR imports is zero, and the tariff treatment for out-of-quota CAFTA-DR imports from 2009 to 2025 is the same as that applied to out-of-quota CAFTA-DR imports of paddy rice (as presented previously in this Annex).

As a result, the weighted average tariffs for milled rice are shown in Table A3.6.

Table A3.6 Weighted average tariff for milled rice imports to Costa Rica, 2009–2012, 2015 and 2020 (per cent)

	2009–2012	**2015**	**2020**
Argentina	4.4	3.9	3.8
Brazil	0.2	0.2	0.2
China	0.1	0.1	0.1
Ecuador	0.0	0.0	0.0
El Salvador	0.0	0.0	0.0
United States intra-quota CAFTA-DR	0.0	0.0	0.0
United States out-of-quota CAFTA-DR	4.7	4.1	2.5
Guatemala	0.0	0.0	0.0
Guyana	0.1	0.1	0.1
Nicaragua	0.0	0.0	0.0
Uruguay	1.9	1.7	1.6
Total	11.4	10.0	8.3

Source: Author's calculations.

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Peru

Estimation of the pass-through and welfare effects of the tariff reduction for yellow corn in Peru between 2000 and 2011

*Carmen Cecilia Matta Jara and Ana María del Carmen Vera Ganoza**

Abstract

Using non-parametric regressions, this study examines the welfare effects on households that are attributable to the reduction of the effective tariff on yellow corn between 2000 and 2011, through its impact on the reduction of chicken meat prices. The analysis focuses on Peru's coastal regions, which meet their yellow corn demand mainly through imports and where more than 90 per cent of the broiler production is located. The study calculates the welfare effect of the tariff change on consumers of yellow corn's main derivative product, chicken meat, which accounts for an important share in the household food expenditure basket. For this purpose, the study estimates the extent of the tariff pass-through to wholesale prices of yellow corn, and the price pass-through of yellow corn to retail prices of chicken meat. The results show that, on average, the reduction in chicken meat retail prices induced by the tariff reduction for yellow corn generates a welfare gain of 0.24 per cent for households in the coastal regions. Welfare gains are slightly higher in urban areas (0.24 per cent) than in rural areas (0.22 per cent). Finally, the induced effects of the yellow corn tariff reduction have a pro-poor bias: the poor households on the coast experience the highest welfare gain (0.29 per cent).

* The views expressed in this study are solely those of the authors and do not necessarily reflect, and should not be represented as, the views of the Ministry of Foreign Trade and Tourism of Peru.

1 Introduction

Yellow corn[1] is the third most important agricultural crop in Peru and the main input for the poultry industry. It is mainly used for the production of livestock compound feed and not for direct human consumption. The broiler industry that produces chicken meat and uses yellow corn as feed represents approximately 90 per cent of poultry meat production.[2]

Domestic production of yellow corn has not increased significantly in recent years. In fact, since 2004, domestic demand for yellow corn has mainly been met through imports. Due to small-scale operation and an informal sales market for local production, broiler firms depend highly on imports of yellow corn.

As the world price of yellow corn was increasing and national per capita consumption of chicken meat started to show significant growth, the government introduced new trade measures aimed at reducing the effective tariff applied to yellow corn: the tariff was cut from 33.3 per cent to zero between 2000 and 2011. However, during the same period, average domestic prices of yellow corn and chicken meat increased by 31.1 and 28.4 per cent, respectively. It is therefore of interest for policymakers concerned with international trade and social development to measure the degree of transmission of yellow corn tariff reductions to domestic prices of yellow corn and chicken meat, as well as their impact on household welfare.

As regards national demand for yellow corn, this study finds evidence of two purchasing patterns: Peru's coastal regions meet their yellow corn demand mainly through imports, while the highlands and jungle regions consume mostly domestically produced corn. Therefore, one would expect that trade policy measures aimed at reducing tariffs for yellow corn would have a more significant effect on the coast, especially if one takes into account that more than 90 per cent of the production of the broiler industry is concentrated there. For these reasons, this study estimates the tariff and price pass-through for the markets of yellow corn and chicken meat in the coastal regions of Peru.

On the one hand, the objective of this study is to estimate the extent of the tariff pass-through to domestic prices of yellow corn due to the reduction of tariffs between 2000 and 2011. On the other hand, given the importance of yellow corn as an input in the production of chicken meat and the

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[1] A variety of hard yellow corn, known as *maíz amarillo duro* in Spanish.

[2] The production of duck and turkey meat represents the other 10 per cent (MINAG, 2012).

importance of chicken meat as an item in the Peruvian food expenditure basket,[3] the study measures the extent to which tariff reductions for yellow corn translated into changes in household welfare in the coastal regions through the consumption of chicken meat. This study is the first to address this question, and may therefore be used by policymakers as a starting point for further discussions about the effectiveness of unilateral tariff reductions implemented by the government of Peru in several sectors.

The study first estimates the tariff pass-through to wholesale prices of yellow corn and the price pass-through of yellow corn prices to retail prices of chicken meat. Then, using non-parametric regressions, it analyses the relationship between the level of livelihood and the welfare changes induced by the tariff reduction for yellow corn through its effect on chicken meat retail prices. This analysis is run across rural/urban areas and three income groups (extremely poor, poor and non-poor) on the coast of Peru.

The next section (Section 2) explains the rationale for the analysis, while Section 3 describes the main characteristics of the yellow corn and broiler industries in Peru. The study then explains the methodology for measuring the tariff and price pass-through and the welfare changes at the household level (Section 4). The final section outlines the conclusions of the study and proposes policy recommendations emanating from the analysis.

2 Statement of the problem

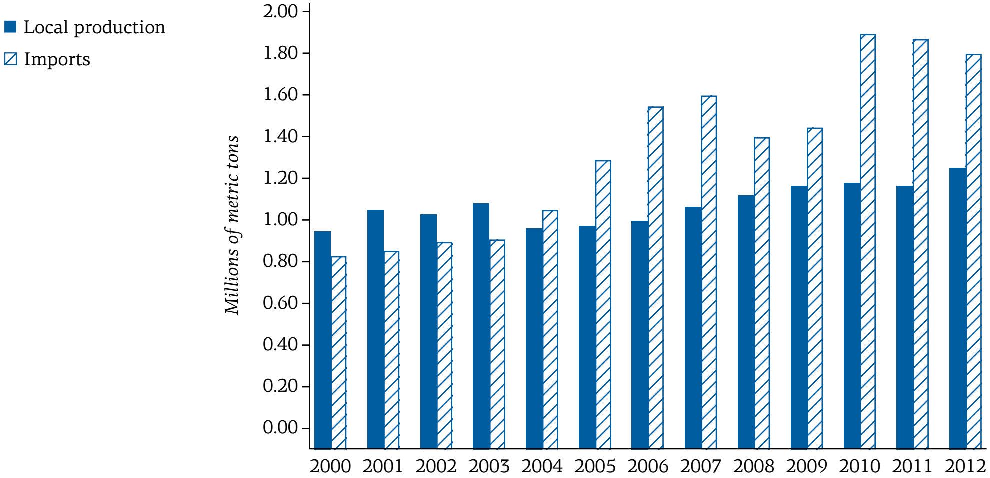
Yellow corn is the third most important agricultural crop in Peru and the main input for the production of chicken meat. Taken together, the production of yellow corn and chicken meat accounted for 23 per cent of agricultural gross domestic product (GDP) in 2012. Yellow corn is mainly used for the production of livestock compound feed for the broiler industry, but it is also required for industrial products such as starch (for beer) and vegetable oil.

Despite its importance, domestic production of yellow corn has not recorded significant growth in recent years. In fact, between 2000 and 2012, it only increased at an average annual rate of 3.2 per cent. In contrast, the volume of yellow corn imports rose by an average annual rate of 7 per cent,

[3] According to the methodology adopted by the National Institute of Statistics, food and beverages account for 26 per cent of the household expenditure basket. With a consumption share of 4.3 per cent in household expenditure (obtained from the 2011 National Household Survey), chicken meat represents about 15 per cent of the food expenditure basket.

from 0.85 million metric tons in 2000 to 1.83 million metric tons in 2012. As a consequence, since 2004, domestic demand for yellow corn has been covered mainly by imports (Figure 1).

Figure 1 Total supply of yellow corn – Domestic production and imports, 2000-2012 (millions of metric tons)



Source: Peruvian Customs Agency and Ministry of Agriculture.

The main reasons for the low levels of domestic yellow corn production are that most producers operate in the informal sector and do not work together in associations or cooperatives. According to the 2012 agricultural census, 68 per cent of local producers are smallholders (with less than five hectares (ha) of land). Due to the limited amount of land they cultivate, their negotiating power with intermediaries or wholesalers is very limited. At the same time, because the farmers work mainly in the informal sector, they do not have access to formal credit and thus have difficulty improving productivity through the acquisition of new equipment, fertilizers, and certified seeds. Consequently, they are unable to meet the broiler industry's demand for yellow corn.

In the late 1990s, in order to protect domestic production, the government of Peru introduced additional duties (specific and *ad valorem*) to the most-favoured-nation (MFN) tariff on imports of yellow corn. However, at the end of 2007, when world prices of yellow corn and per capita consumption of chicken meat started to rise, the government was concerned about the effect of these duties on local prices of yellow corn and chicken meat, and consequently on household welfare. It therefore took steps to reduce local prices by reducing the effective protection applied to yellow corn. In fact, between 2000 and 2011, the effective tariff dropped from an annual average of 33.3 per cent to zero.

Meanwhile, during the same period, national wholesale prices of yellow corn rose by 31.1 per cent and retail prices of chicken meat increased by 28.4 per cent.[4] It is therefore important to find out whether and to what extent the tariff reduction was transmitted to domestic prices of yellow corn and chicken meat, as well as what impact the tariff reduction had on household welfare.

3 Peruvian yellow corn and chicken meat markets

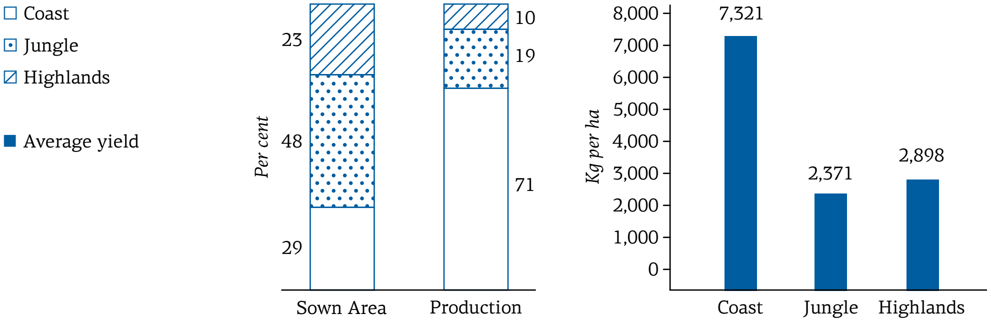
3.1 Domestic production of yellow corn

The 3.2 per cent annual increase in domestic production of yellow corn between 2000 and 2012 can be broken down into 3.4 per cent in coastal regions and lower rates of 2.5 and 2.6 per cent in the highlands and jungle regions, respectively. Farming units in the coastal regions have higher productivity due to more intensive use of new technologies and favourable weather conditions. Moreover, they have the advantage of being located near the largest broiler industry firms and feed mills that are the main buyers of yellow corn. In contrast, farming units in the highlands and jungle regions do not have access to modern machinery or production techniques, and are far away from the biggest centres of demand located on the coast. Significant infrastructure shortcomings in roads from the highlands and jungle regions to the coast increase transport costs, rendering producers in those regions unable to competitively supply buyers on the coast.

In 2012, coastal regions accounted for 71 per cent of total production of yellow corn in the country, while the highlands and jungle regions produced 19 per cent and 10 per cent, respectively, in spite of accounting for 71 per cent of the total area devoted to yellow corn (Figure 2). Half of the total production was concentrated in three coastal regions: La Libertad (22 per cent), Lima (19 per cent), and Lambayeque (11 per cent). Additionally, coastal regions were the most productive, with an average yield of 7,321 kilograms (kg) per hectare. The most productive were Lima (9,892 kg per ha), Ica (9,062 kg per ha), and La Libertad (8,981 kg per ha).

[4] Data from the National Institute of Statistics of Peru, average of regional prices for chicken meat.

Figure 2 Sown area, domestic production and average yield by region, 2012



Source: Ministry of Agriculture.

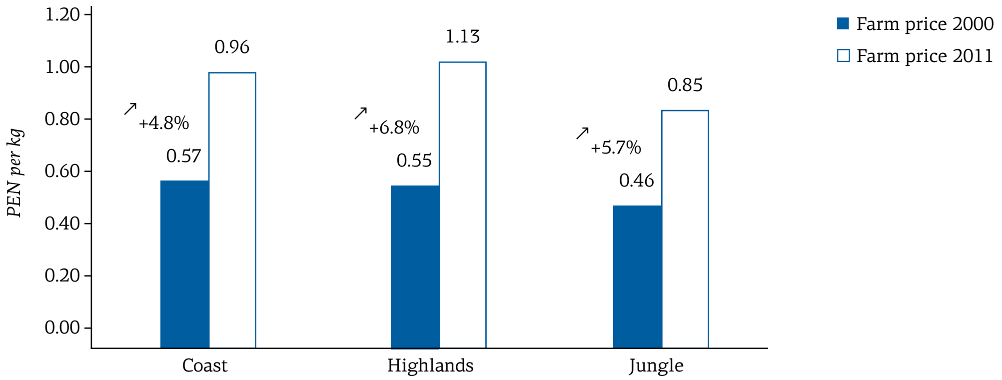
3.2 Domestic and international prices of yellow corn

Farm prices of yellow corn increased from Peruvian nuevos soles (PEN) 0.54 per kg in 2000 to PEN 1.00 in 2011 (with an average annual growth rate of 5.8 per cent). In the coastal regions, prices grew less than the national average (at a rate of 4.8 per cent). The regions with the lowest growth rates were Moquegua (2.77 per cent), Lambayeque (3.99 per cent), and Tacna (4.13 per cent). In contrast, in the highlands and jungle regions, prices increased more than the national rate, by 6.8 per cent and 5.7 per cent, respectively (Figure 3). The regions with the highest growth rates were Puno (9.18 per cent), Huancavelica (9.10 per cent) and San Martín (8.88 per cent).

It is important to highlight that in 2000, the difference between the highest and lowest price was only 11 cents, while in 2011 the difference was 17 cents.

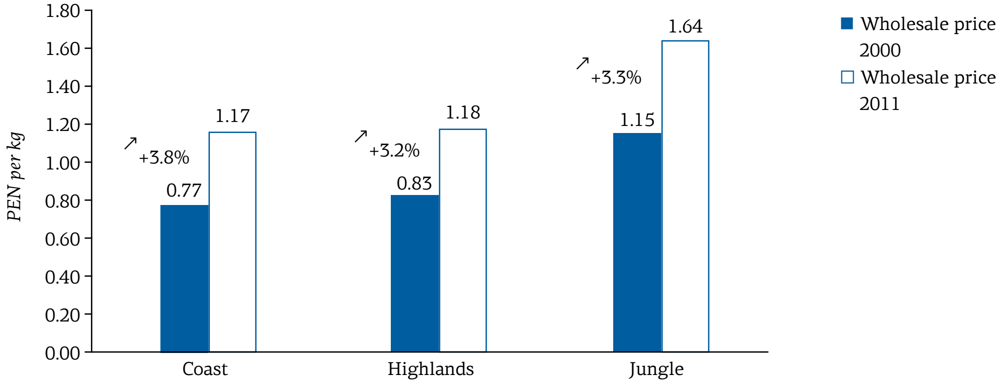
Between 2000 and 2011, wholesale prices of yellow corn increased at an average annual rate of 3.5 per cent. Coastal regions recorded a rate higher than the national average (3.8 per cent), while highlands and jungle regions had rates of 3.2 per cent and 3.3 per cent, respectively (Figure 4). In 2011, coastal and highlands prices only differed by 1 cent. In contrast, prices in jungle regions exceeded the other prices by approximately 40 per cent. The low supply of corn makes the prices higher in the jungle regions. However, buyers prefer to use local corn than to buy from the highlands or coastal regions in order to avoid paying extra transport costs.

Figure 3 Farm prices of yellow corn by region, 2000 and 2011 (PEN per kg)



Source: Ministry of Agriculture.
Note: Prices are expressed in nominal terms.

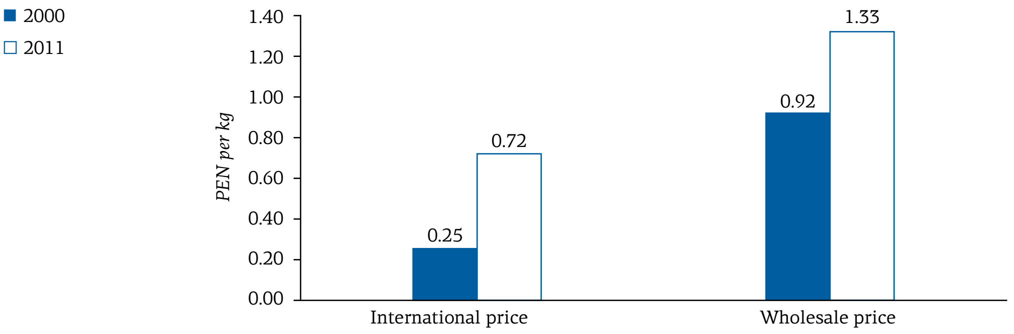
Figure 4 Wholesale prices of yellow corn by region, 2000 and 2011 (PEN per kg)



Source: Ministry of Agriculture.
Note: Prices are expressed in nominal terms.

The international price of yellow corn expressed in PEN increased by 186 per cent between 2000 and 2011 (from PEN 0.25 in 2000 to PEN 0.72 in 2011).[5] On average, the wholesale price was 3.6 times higher than the international price in 2000 and 1.8 times higher in 2011 (Figure 5). This difference may be due to internal transport costs and the presence of many intermediaries between farmers and wholesalers. This matter will be discussed in the following sections.

Figure 5 Wholesale and international prices of yellow corn, 2000 and 2011 (PEN per kg)



Source: Ministry of Agriculture.
Note: Prices are expressed in nominal terms.

3.3 Effective tariffs applied to yellow corn

To measure the effect of tariff changes on wholesale prices of yellow corn, we use the effective tariff rate for this product. Between 2000 and 2011, imports of yellow corn were subject to MFN *ad valorem* tariffs that are charged on the cost, insurance, and freight (CIF) value. In addition, there were a number of other special regimes that affected yellow corn, as detailed below.

3.3.1 Most-favoured-nation tariff

The MFN tariff is the tariff rate that World Trade Organization (WTO) members impose on imports from other members unless these countries are part of preferential trade agreements (such as a free trade area or a customs union). This means that, in practice, MFN rates are the highest (most restrictive) that the WTO members can charge one another.

[5] This increase in international prices of yellow corn can be attributed to, among other factors, growing demand from emerging economies such as Brazil, India, and China (corn as a food item), and from the United States (corn as an input to produce biofuels).

Between January 2000 and September 2007, the MFN tariff applied to Peruvian imports of yellow corn was 12 per cent. In the subsequent years, it was reduced to 9 per cent (October 2007), 6 per cent (January 2011), and zero (April 2011).

3.3.2 Additional tariff surcharge

In April 1997, the government added an *ad valorem* tariff of 5 per cent to the MFN tariff applied to yellow corn (Supreme Decree No. 035-97-EF). This policy was in force until June 2000.

3.3.3 Specific tariff

From August 1998 to May 2001, Peruvian importers of yellow corn had to pay a specific duty per metric ton that varied according to a free on board (FOB) reference price fixed by the central bank. The reference price changed every month and was an average of different market prices (USA 2YC-15.5 FOB Gulf and USA 3YC-15.5 FOB Pacific).[6] When the FOB price reached a ceiling value (also established by the central bank), importers paid no additional duty. On the contrary, the duties increased when the FOB reference prices were reduced. In June 2001, this mechanism was replaced by the Price Band System.

3.3.4 Price Band System

The Price Band System introduced in June 2001[7] increases or reduces the amount paid by importers resulting from the MFN tariff applied to yellow corn (and to other products such as milk, rice, and wheat). This amount is charged per metric ton – it can therefore be considered to be a specific tariff. It varies according to whether a CIF reference price is below (or above) a CIF floor price (or a CIF ceiling price):

- If the CIF reference price is below the floor, a specific duty per metric ton is added to the MFN *ad valorem* tariff.
- If the CIF reference price exceeds the ceiling, a specific duty per metric ton is detracted from the amount paid for the MFN *ad valorem* tariff. This reduction is applied up to a maximum of the MFN *ad valorem* tariff.

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[6] Supreme Decree No. 083-1998-EF. Available at: *http://www.mef.gob.pe/index.php?option=com_docman&task=cat_view&gid=127&limit=15&limitstart=60&order=date&dir=ASC&Itemid=100602&lang=es.*

[7] The Price Band System, introduced by Supreme Decree No. 115-2001-EF in June 2000, aimed to protect national agriculture from price distortions caused by agricultural policies of the major producers.

The floor and ceiling prices, as well as the specific duties, are presented in a custom table established by the central bank. The table is published twice a year (1 January and 1 July) in the Official Gazette and includes a list of the CIF reference prices that will be in force during the coming semester. In addition, to establish which of the CIF prices listed in the custom table is applicable on a daily basis, the central bank fixes a reference CIF price every two weeks.

Table 1 summarizes the information from the custom table published on 1 July 2013. Using this information, we illustrate how to use the Price Band System. For instance, if a firm wants to import 10 metric tons of yellow corn on 5 August, it will have to search for the CIF reference price that is in force from 1 August to 15 August. In this case, the price is USD 239 per metric ton.[8] According to Table 1, the latter price is below the floor price (USD 294), thus the importer has to pay a specific tariff of USD 56 per metric ton. Considering that since April 2011 the MFN *ad valorem* tariff has been zero, the total amount paid by the importer will be USD 560, which is equivalent to an *ad valorem* tariff of 23 per cent.[9]

Table 1 Price Band System – Custom table, July–December 2013 (USD per metric ton)

CIF reference price USD 100-198	Additional or reduction specific tariff	CIF reference price USD 199-353	Additional or reduction specific tariff	CIF reference price USD 354-450	Additional or reduction specific tariff
100	200	199	98	354	-1
...	...	...	...	...	...
138	160	237	58	392	-40
139	159	238	57	393	-41
140	158	239	56	394	-42
141	157	240	55	395	-44
142	156	241	54	396	-45
143	155	242	53	397	-46
144	154	243	52	398	-47
145	153	244	51	399	-48
...	...	...	...	...	...
187	110	286	8	441	-91
188	109	287	7	442	-92
189	108	288	6	443	-93
190	107	289	5	444	-94
191	106	290	4	445	-95

[8] To see this and other two-week reference CIF prices, go to: *http://www.mef.gob.pe/index.php?option=com_docman&Itemid=100602.*

[9] Ratio of USD 560 to USD 2,390.

CIF reference price USD 100-198	Additional or reduction specific tariff	CIF reference price USD 199-353	Additional or reduction specific tariff	CIF reference price USD 354-450	Additional or reduction specific tariff
192	105	291	3	446	-96
193	104	292	2	447	-97
194	103	293	1	448	-98
195	102	294	0	449	-99
196	101	> 294 Floor Price	0	450	-100
197	100	< 353 Ceiling Price	0		
198	99	353	0		

Source: Central Reserve Bank of Peru.

3.3.5 Preferential tariffs

During the period covered by this study, Peru granted preferential tariffs to its main suppliers of yellow corn. In 2000, it offered a 100 per cent MFN reduction on its imports from Bolivia (under the Andean Agreement), and in 2006 it conceded a 15-year liberalization phase for Brazil and Argentina (under the Partial Preferential Agreement No. 58). In addition, in February 2009, the government granted the United States 100 per cent quota-free imports under the Trade Promotion Agreement.[10]

The effective tariff rate shown in Figure 6[11] is obtained as a ratio between the total amount of duties applied to imports of yellow corn and the total CIF imports of this crop:

$$Effective\ tariff\ rate_t = \frac{\sum Total\ duties\ on\ imports\ of\ yellow\ corn}{\sum Total\ imports\ of\ yellow\ corn} \qquad (1)$$

Figure 6 shows the monthly series (from January 2000 to December 2011) of the MFN *ad valorem* tariff rate and the effective tariff rate applied to Peruvian imports of yellow corn. There is an important difference between both series. Between January 2000 and November 2002, the effective tariff rate was higher than the MFN rate. In fact, during some months, the effective tariff exceeded the MFN rate by more than 30 percentage points.[12]

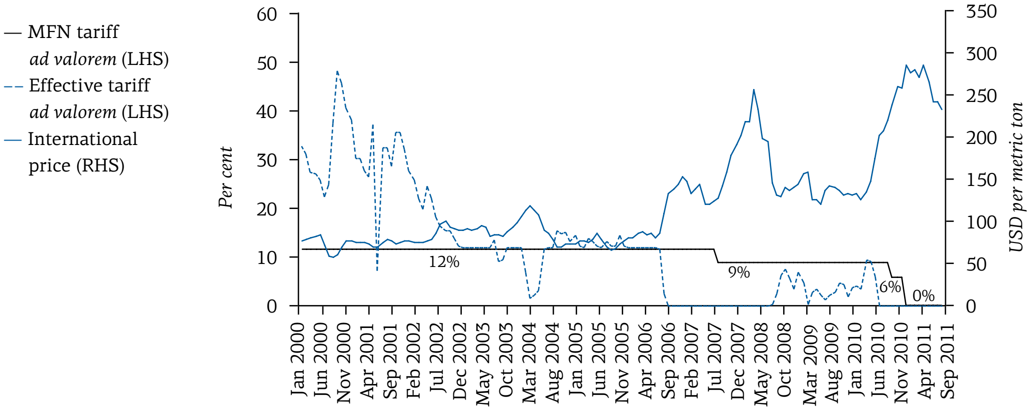
[10] If the volume imported from the United States does not exceed the quota established in the Agreement, importers do not have to pay duties. The Agreement established a duty-free tariff quota of initially 500,000 metric tons, with annual increases of 6 per cent and full duty-free access in 12 years.

[11] The effective tariff rate plotted in Figure 6 is an indicative measure of the protection applied, but it does not represent the official formula used by Peruvian customs authorities.

[12] The effective tariff cannot exceed the bound tariff to which Peru has committed under the WTO agreement (consolidated tariff), which is 68 per cent.

This difference is attributed to the specific tariffs paid by importers due to lower international prices of yellow corn. In contrast, when international prices increased significantly, the effective tariff was below the MFN tariff. For instance, from February 2007 to August 2008, the effective tariff paid by importers was zero due to high international prices.

Figure 6 Effective and MFN tariff rates, 2000–2011



Source: Peruvian Customs Agency.
Note: LHS stands for left-hand scale, RHS for right-hand scale.

3.4 Linkages between the yellow corn and broiler industries in Peru

Yellow corn is the main input for the production of chicken meat – the combined production of yellow corn and chicken meat accounted for 23 per cent of the country's agricultural GDP in 2012, with chicken meat taking a larger share of approximately 18 per cent. In 2012, the production of chicken meat (broiler industry) represented approximately 90 per cent of the production of the poultry industry,[13] which also includes turkey and duck meat. This study focuses only on the relationship between the yellow corn and broiler industries. Yellow corn accounts for about 45 per cent of the broiler industry production costs, while soybeans represent 15 per cent.[14] Other important expenditure items for the broiler production are baby chickens, vaccines, heating expenses, and labour costs.

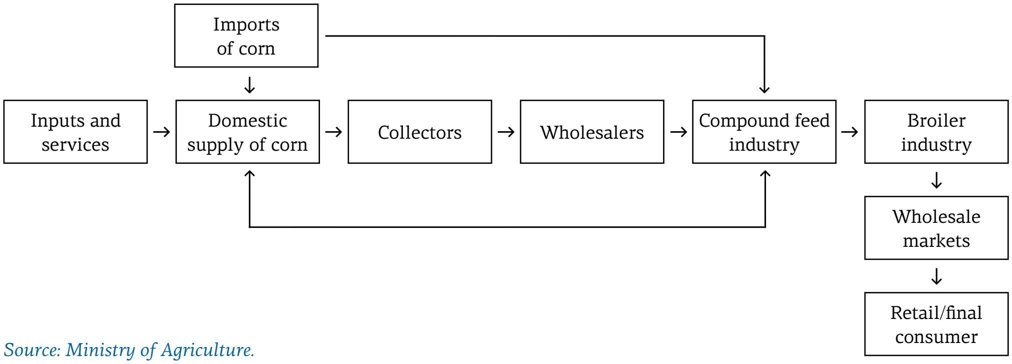
[13] According to the Ministry of Agriculture, the production of poultry meat was 1,168,951 metric tons. Using the percentage calculated by MINAG (2012) for the production in 2011, the production of chicken meat therefore was approximately 1,052,056 metric tons in 2012.

[14] Based on the rating report of Apoyo & Asociados (2012) on San Fernando, the largest company in the broiler industry.

[15] Sales represented 83 per cent of total production on the coast, 63 per cent in the highlands, and 75 per cent in the jungle regions.

In order to understand the tariff pass-through to yellow corn and chicken meat prices, Figure 7 describes the linkages between the yellow corn and broiler production.

Figure 7 Yellow corn – broiler production chain



Source: Ministry of Agriculture.

3.4.1 Farmers and wholesalers

Between 2000 and 2011, domestic production of yellow corn accounted for 47 per cent of the yellow corn commercialized on the Peruvian market. The 2012 agricultural census determined that 80 per cent of domestic production was sold, while the remainder was used by farmers to feed their own animals.[15] Most of the farmers do not issue invoices or pay taxes, so they cannot become suppliers to formal sector firms in the compound feed or broiler industries. In addition, they cannot supply the volumes of yellow corn demanded by those firms.

According to MINAG (2012), farmers sell their product to collectors directly from the farm. Occasionally, collectors provide working capital to farmers with a promise of purchase. In those cases, collectors have the power to fix farmer prices. Also, by consolidating their purchases from several farmers, collectors are able to reduce their provision/transaction costs. Otherwise, they would have to purchase corn from different farmers who are located far from one another.

Collectors sell the crop to wholesale markets or feed mills located in urban areas. According to MINAG (2012), wholesalers' clients are mainly informal or small-scale chicken farmers who require small quantities of yellow corn and usually produce their own compound feed.

3.4.2 Importers and the compound feed industry

Between 2000 and 2012, the volume of imports rose on average by 7 per cent annually, increasing from 0.85 million metric tons in 2000 to 1.83 million metric tons in 2012 (Table 2). Argentina was the major yellow corn supplier to Peru (70 per cent on average over 2000–2012). However, in 2012, its exports to Peru fell by 18 per cent; consequently, its share in the country's imports shrank from 80 per cent to 68 per cent. At the same time, imports from Paraguay and Brazil increased by 103 per cent and 38 per cent, respectively. Corn exports from the United States to Peru were almost nil in 2012 due to lower prices from other sources, limited production following the severe drought in the United States, and the fact that feed producers prefer Argentine or Peruvian corn because of its superior quality.

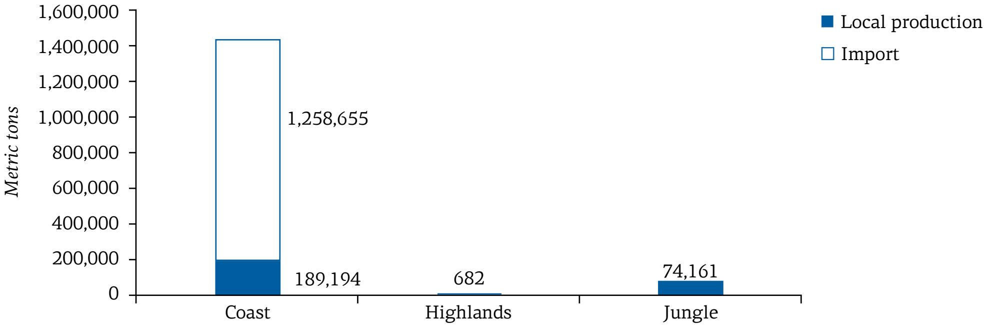
Table 2 Total imports of yellow corn by main suppliers, 2000–2012

Country	2000	2002	2004	2006	2008	2010	2011	2012	Variation 2011–2012
Argentina	562.9 66.5	719.4 78.6	815.3 75.0	954.1 64.2	1,070.6 76.9	1,059.7 55.7	1,515.1 79.8	1,242.3 67.8	–18
Paraguay	0 0	0 0	35.2 3.2	128.5 8.6	44.8 3.2	156.3 8.2	156.5 8.2	318.0 17.4	103
Brazil	0 0	0.1 0.0	0.6 0.1	0.7 0.0	54.0 3.9	58.9 3.1	163.0 8.6	225.7 12.3	38
Bolivia	0.6 0.1	1.5 0.2	5.6 0.5	25.1 1.7	8.2 0.6	2.3 0.1	0 0	45.3 2.5	
United States	282.5 33.4	191.9 21.0	230.2 21.2	378.6 25.5	214.6 15.4	626.4 32.9	63.1 3.3	0 0	–100
Other	0.4 0.0	2.0 0.2	0 0	0 0	0 0	0 0	0 0	0 0	
Total metric tons	846.4	915.0	1,087.0	1,486.9	1,392.2	1,903.5	1,897.8	1,831.3	–4

Source: Peruvian Customs Agency.
Note: The imports of yellow corn are shown in thousands of metric tons (first line), and as a share of every country in Peruvian imports (second line, in per cent). The variation (the far right column) is expressed in per cent.

As mentioned earlier, domestic farmers cultivating yellow corn are not in a position to supply the volumes required by formal firms in the compound feed industry. For this reason, the industry mostly satisfies its requirements through imports, and complements those imports with domestically produced corn purchased from collectors. In fact, in 2011, the compound feed industry mainly used imports for its production (83 per cent of its needs, or 1.2 million metric tons). As shown in Figure 8, imports were concentrated in the coastal regions (about 60 per cent), while the highlands and jungle regions mainly purchased the domestic variety.

Figure 8 Demand for yellow corn by the compound feed industry, by source and region, 2011 (metric tons)



Source: Ministry of Agriculture.

The largest importer of yellow corn is the largest firm in the broiler sector (San Fernando), which accounted for 26 per cent of total imports during 2000–2011. In fact, San Fernando and the other leading firms, which are located on the coast, purchase mainly the imported variety. These firms are vertically integrated and thus also produce their own compound feed.[16]

In addition to the first type of buyers of yellow corn described above – large or medium-size formal firms in the compound feed and broiler industries located mainly in coastal regions – there is a second type of buyers. These buyers are small firms or informal producers of chicken meat that are not able to import themselves or require small amounts of yellow corn. These buyers are concentrated in the highlands and jungle regions.

3.4.3 The broiler industry

The production of chicken meat increased by 113 per cent during 2000–2011 (average annual growth of 7.3 per cent) and per capita consumption grew from 19 kg in 2000 to 37 kg in 2011. According to Shimizu (2011),

[16] The vertical integration in the broiler industry might affect the transmission of yellow corn tariff reductions to retail prices of chicken meat. This issue will be discussed in the next section.

increases in the production of chicken meat are due to the introduction of new technologies (i.e. breeding, nutrition, medicine, and equipment) and to the tendency towards vertical integration in the broiler industry.

The broiler industry is composed of about 30 large and medium-sized firms that account for 90 per cent of domestic production. The leading firms in 2012 were San Fernando (36 per cent of total sales), Redondos (19 per cent), Ganadera Santa Elena (12 per cent) and San Luis (4 per cent). Additionally, there are between 200 and 300 small firms, many of them subcontractors to the industry leaders. The main producing areas are located in the coastal regions: in 2012, Lima accounted for 55 per cent of domestic production, followed by La Libertad (20 per cent), Arequipa (9 per cent), and Ica (4 per cent).[17] The firms are close to the coast because most of the facilities of the broiler industry (such as breeding farms, hatchery plants, feed mills, grow-out farms, slaughtering plants, and processing plants) are located there. Moreover, they are close to the Ports of Callao (Lima), Pisco (Ica), and Salaverry (La Libertad), the main points of entry for imported corn.

The most important characteristic of the Peruvian broiler industry is related to its distribution process. In developed countries, almost all broilers are slaughtered and processed before they are distributed to wholesalers. In Peru, by contrast, around 80 per cent of broilers are distributed alive to wholesalers (Shimizu, 2011), and according to MINAG (2012) approximately 65 per cent are sold in Lima.

4 Methodology and results

4.1 Tariff and price pass-through estimation

The previous section identified two patterns of yellow corn demand: the coast meets its demand mainly through imports, while the highlands and jungle regions consume mostly domestically produced corn. Therefore, one would expect that trade policy measures that reduce tariffs on yellow corn would have a more significant effect on the coast.

In this context, the objective of this study is to estimate the extent of the tariff pass-through to domestic prices in the coastal regions of Peru due to the reduction in yellow corn tariffs between 2000 and 2011. Given the importance of yellow corn as an input for the production of chicken meat and, in turn, the importance of chicken meat in the Peruvian food expenditure

[17] Data from the Ministry of Agriculture.

basket, we also measure the extent to which tariff reductions on yellow corn have translated into changes in household welfare in the coastal regions through the consumption of chicken meat.[18]

This section first estimates the tariff pass-through to wholesale prices of yellow corn and then examines the price pass-through of yellow corn to retail prices of chicken meat.

Following the theoretical framework applied in Nicita (2009), we start with the estimation of the tariff pass-through coefficient in the yellow corn market, for which it is assumed there are no differences between imported and domestic varieties of yellow corn. However, given that yellow corn is not consumed directly by households, but used as a production input for the chicken meat (broiler) industry, we will use wholesale prices of yellow corn instead of retail prices as our dependent variable. We will model yellow corn wholesale prices (pd_{it}) as a function of yellow corn producer prices (pp_{it}), yellow corn international prices in domestic currency ($p*_t$), trade costs (trc_t),[19] an index of market concentration ($mrkc_t$), effective tariffs (et_t), and a trend variable ($year$).[20] This can be expressed in logarithms as:

$$\ln pd_{it} = \beta_1 + \beta_2 \ln pp_{it} + \beta_3 \ln p*_t + \beta_4 \ln trc_t + \beta_5 \ln mrkc_t + \gamma \ln(1 + et_t) + \theta\, year_t + \varepsilon_{it} \qquad (2)$$

where i is the subscript associated with regions and t is the subscript associated with monthly periods.

The tariff pass-through elasticity is represented by γ, the percentage increase in local prices derived from a 1 per cent increase in the tariff. In order to estimate the tariff pass-through for yellow corn, we will use monthly data[21] from January 2000 to April 2011 for eight coastal regions of Peru where most of the production of and demand for yellow corn are concentrated.[22] Our panel database is balanced. Wholesale and producer (farm)

[18] Originally we also intended to measure the impact on producer welfare on the coast. However, there were no households/units of production of corn/chicken meat represented in the 2011 Household Survey for the coastal regions that reported income resulting from the sale of these items. Therefore, we only focused on the analysis of the impact on consumer welfare.

[19] Trade costs are assumed to affect only imported goods.

[20] To capture the effect of a trending factor common to all coastal regions (such as the influence of demand preferences and agricultural policies).

[21] A description of our statistical sources is presented in the Annex.

[22] Lambayeque, La Libertad, Ancash, Lima, Ica, Arequipa, Moquegua, and Tacna. Two regions on the coast (Tumbes, Piura) were excluded due to the fact that they registered few observations of the dependent variable.

prices of yellow corn are available by region. The international price of yellow corn corresponds to the closing spot price of yellow corn number 2 on the Chicago Commodities Exchange, expressed in local currency (PEN). The effective tariff includes the MFN tariff and specific/additional tariffs that were in force during the period covered by this analysis. Trade costs are measured as monthly averages of freight and insurance costs per unit (kg) of Peruvian imports of yellow corn. The index of market concentration is the C4 market share[23] of yellow corn importing firms in Peru.

We estimate two panel data specifications to explain the behaviour of the dependent variable (wholesale yellow corn prices) using fixed- and random-effects estimation.[24] Due to the fact that we are working with different regions on the coast of Peru, it seems reasonable to assume that there is a component of time-invariant unobserved heterogeneity across entities, which could be correlated with some explanatory variables (e.g. differences in productivity and entrepreneurial behaviour may be correlated with producer prices). Therefore, to allow for arbitrary correlation between regional unobserved heterogeneity and the predictor variables, we estimate a fixed-effects model, whose results will then be compared with those of a random-effects model through a Hausman test.

Given that a reverse causality relationship exists between yellow corn producer prices and wholesale prices (endogeneity), contemporary producer prices in both models are instrumented by their four-month lag, using two-stage least squares.

In both models, all coefficients are significant at the 1 per cent confidence level and with the expected signs (all positive). According to the results of the Hausman test, the null hypothesis of no systematic differences between fixed- and random-effects estimators cannot be rejected, so we should take the coefficients from the random-effects model[25] to estimate the welfare effects on households on the coast of Peru derived from the tariff changes in yellow corn (and the changes in chicken meat prices that those changes induce).

As shown in Table 3, our tariff pass-through coefficient for wholesale prices of yellow corn is 0.74, which suggests a moderate to high transmission

[23] The aggregated market share of the four biggest importers.

[24] We do not estimate our panel by ordinary least squares because the necessary assumption of zero correlation between the error term and the explanatory variables would be violated.

[25] In this context, this model provides consistent, more efficient results than fixed-effects estimation.

of tariffs to domestic prices in the yellow corn market, consistent with the fact that most of the yellow corn demand on the coast of Peru destined for compound feed production is met by foreign producers (on average, imports cover more than 60 per cent of total supply).

Our results are also consistent with previous studies of the tariff pass-through of agricultural/food products in other Latin American countries,[26] which find an incomplete adjustment of the wholesale/retail price of the product to changes in its border price.

Table 3 Tariff pass-through dependent variable – Yellow corn wholesale price

	Model 1	**Model 2**
Variable	Fixed effects with instrumental variable estimation (2SLS)	Random effects with instrumental variable estimation (G2SLS)
Constant	–45.06*** (5.99)	–45.05*** (5.97)
Yellow corn producer price	0.47*** (0.05)	0.47*** (0.05)
Yellow corn world price	0.24*** (0.03)	0.24*** (0.03)
Trade costs	0.02*** (0.01)	0.02*** (0.01)
Market concentration	0.10*** (0.04)	0.10*** (0.04)
Tariff	0.74*** (0.09)	0.74*** (0.09)
Year	0.00*** (0.00)	0.00*** (0.00)

Source: Authors' estimations.
*Note: All variables are in logs. Standard errors, computed using default variance estimator in STATA, are shown in brackets. Significance levels of 1, 5, and 10 per cent are marked with ***, **, and *, respectively. 2SLS stands for two-stage least squares; G2SLS stands for generalized two-stage least squares.*

[26] Nicita (2009) finds that the tariff pass-through coefficient in Mexico is about 0.33 for an aggregate of agricultural products. Duran and LaFleur (2011) find a tariff pass-through coefficient of 0.08 for an aggregate of food products.

Had the movement in the wholesale price of yellow corn been determined exclusively by the effective tariff cut, the wholesale price would have experienced a reduction of 24.68 per cent (Table 5), which is obtained as the result of multiplying the tariff reduction (–33.3 per cent) by the tariff pass-through coefficient (0.74) estimated over the period 2000–2011.

We next address the pass-through between wholesale prices of yellow corn (as a production input) and retail prices of chicken meat, given that we want to measure the welfare effects on coastal households derived from the consumption of chicken meat, which is an important item in the food expenditure basket.

For this estimation, we also use monthly data[27] from January 2000 to April 2011 from the most representative coastal region (Lima).[28] Here we use the retail price of chicken meat as the dependent variable, and include as explanatory variables the wholesale price of yellow corn and the international price of soybeans (both production inputs for the compound feed used by the broiler industry),[29] as well as the retail price of fish meat (to allow for the possibility of substitution between chicken and fish in household demand).[30]

As shown in Table 4, we obtained a price pass-through coefficient from yellow corn to chicken meat of 0.22, which is significant at the 1 per cent confidence level and has the expected sign. Despite the fact that yellow corn accounts for more than 60 per cent of compound feed production costs on the coast, the magnitude of the price pass-through coefficient is consistent with the fact that there is evidence of a relatively high concentration in the broiler industry (in 2012, the market share of the four biggest firms in Lima was 70 per cent). Moreover, there is vertical integration in the firms that are both the biggest importers of yellow corn and the major producers of chicken meat, which suggests that limitations in competition may have hindered the transmission of the tariff reduction to the prices of yellow corn and chicken meat for consumers on the coast.

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[27] A description of our statistical sources is presented in the Annex.

[28] According to MINAG (2012), 65 per cent of chicken meat sales take place in Lima.

[29] Compound feed costs account for approximately 75 per cent of production costs in the broiler industry.

[30] We also included the retail prices of red meat and pork, gasoline prices, and an index of wholesale price inflation in the estimation, but they were rendered insignificant.

Table 4 Price pass-through dependent variable – Chicken meat retail price

	Model 1
Variable	Ordinary least squares
Constant	1.49*** (0.07)
Yellow corn wholesale price	0.22*** (0.07)
Soybean world price	0.10*** (0.04)
Fish retail price	0.20*** (0.04)

Source: Authors' estimations.
*Note: All variables are in logs. Standard errors, computed using default variance estimator in STATA, are shown in brackets. Significance levels of 1, 5, and 10 per cent are marked with ***, **, and *, respectively.*

For the estimation of household welfare changes, we use a retail price change for chicken meat induced by the tariff reduction in yellow corn equal to –5.5 per cent. It is obtained by multiplying the tariff change[31] between 2000 and 2011 (–33.28 per cent, as shown in Figure 9) by both the tariff pass-through rate (0.74) and the price pass-through rate from yellow corn to chicken meat (0.22).

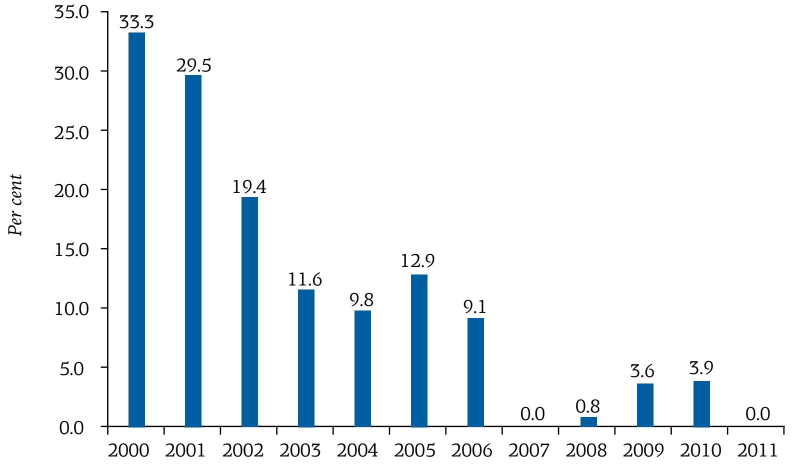
Table 5 Chicken meat price changes induced by yellow corn tariff changes

Product	**Yellow corn tariff change (per cent)**	**Tariff pass-through rate (fraction)**	**Price pass-through rate from yellow corn to chicken meat (fraction)**	**Price change attributed to yellow corn tariff change (per cent)**
Yellow corn	–33.28	0.74		–24.68
Chicken meat	–33.28	0.74	0.22	–5.50

Source: Authors' estimations.
Note: The changes were estimated for the 2000–2011 period. The tariff pass-through rate was taken from the estimation results for the tariff variable in Table 3 (Model 1). The price pass-through rate from yellow corn to chicken meat was taken from the estimation results for the yellow corn wholesale price variable in Table 4. The price changes in the last column are the result of multiplying the factors in each row.

[31] Obtained by subtracting the average effective tariff in 2011 from the average effective tariff in 2000.

Figure 9 Effective tariff for yellow corn, annual average, 2000–2011 (per cent)



Source: Peruvian Customs Authority.

As mentioned previously, despite the reduction in the tariff applied to yellow corn during 2000–2011, wholesale yellow corn prices rose by 31.1 per cent and retail prices of chicken meat rose by 28.4 per cent during the same period. Nevertheless, our estimation results suggest a reduction of 24.68 per cent in yellow corn prices and 5.5 per cent in chicken meat prices induced by the yellow corn tariff reduction (see Table 5). A counterfactual interpretation of these results implies that, if the tariffs had not been reduced, local prices of yellow corn and chicken meat would have risen by 55.78 per cent and 33.9 per cent, respectively. This shows that the measures adopted mitigated increases in local prices that would otherwise have been observed.

4.2 Estimation of welfare changes

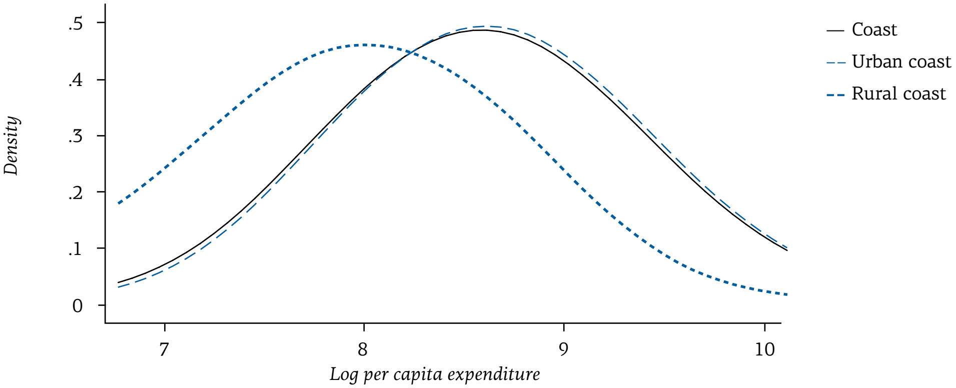
This section measures the extent to which tariff reductions in yellow corn have affected household welfare through consumption of chicken meat, considering only first-order consumption effects.

First, using non-parametric regression methods, we analyse the relationship between per capita expenditure of the households located on the coast of Peru and the welfare effects derived from the changes in retail prices of chicken meat induced by the tariff reduction in yellow corn. This analysis is conducted according to two criteria: (a) rural/urban location, and (b) poverty characteristics in terms of monetary poverty (i.e. non-poor, poor, and extremely poor households).

We work with data from the 2011 National Household Survey in Peru, which included 9,561 households on the coast. Eighty-six per cent (8,262) of surveyed households on the coast were in urban areas. The number of households that recorded a non-zero consumption share of chicken meat was 7,270.[32] Even though the majority of chicken meat production units are located on the coast of Peru, these firms are not represented in the household survey, which implies that we are only able to measure the welfare changes on the consumption side.

Following Deaton (1989), we use a kernel density estimator to characterize a smooth density function of log of per capita expenditure.[33] As shown in Figure 10, urban areas present higher levels of expenditure than rural areas.

Figure 10 Kernel density estimation of per capita expenditure



Source: Authors' estimations, based on the 2011 National Household Survey.

As shown in Table 6, chicken meat accounts on average for 4.28 per cent of household expenditure on the coast. On average, consumption shares of chicken meat are higher in urban than in rural areas on the coast, with the highest share in the capital (Metropolitan Lima). In addition, poor households show a higher consumption share of chicken meat than non-poor households, while extremely poor households have the lowest expenditure share, as it is likely that inferior goods have the highest shares in their food consumption basket.[34]

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[32] According to the survey, 2,291 households recorded a zero consumption share of chicken meat.

[33] We use Epanechnikov kernel and bandwidth = 0.5.

[34] Inferior goods refer to such products as potatoes, rice, entrails and offal, among others.

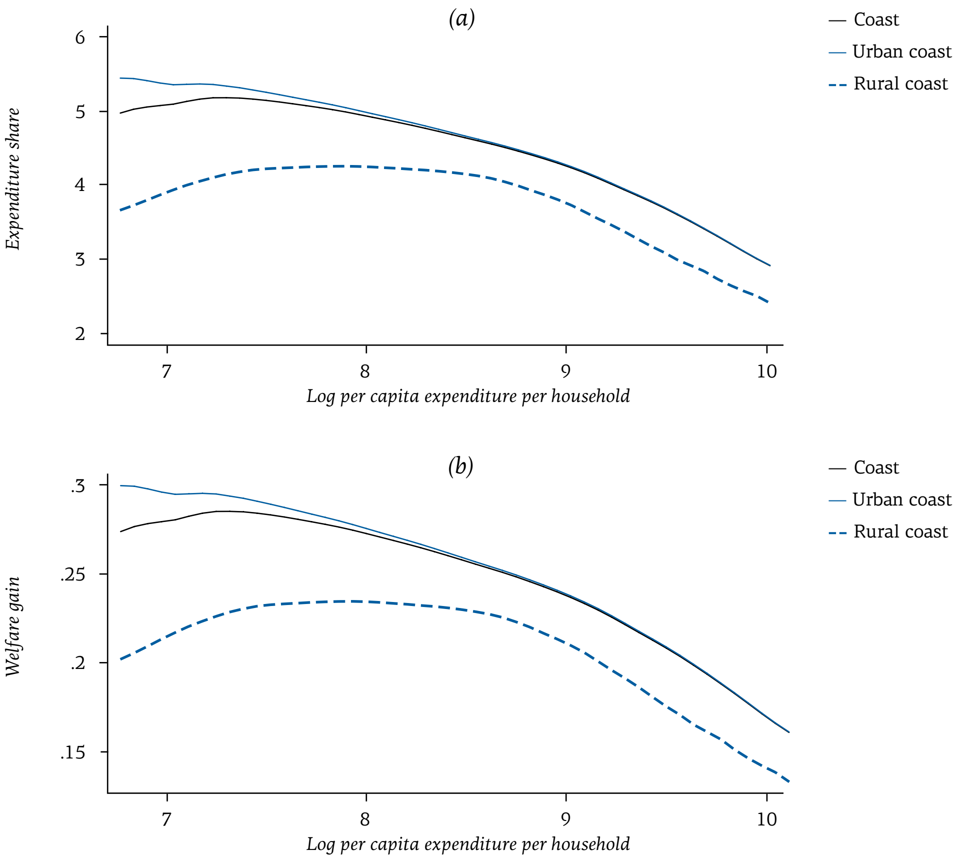
In panel (a) of Figure 11, we plot expenditure shares of chicken meat against per capita expenditure in the household, while in panel (b), we plot the welfare changes obtained against household per capita expenditure. When analysing the plots in panel (a), it can be seen that in urban areas on the coast, household consumption shares of chicken meat decrease almost monotonically with per capita expenditure. However, in rural areas, consumption shares of chicken meat increase with household per capita expenditure up to middle levels of this variable, only to decrease later.

Now, recalling the results in the previous section, we obtain that the reduction in the effective tariff of yellow corn induced a *ceteris paribus* reduction in the retail price of chicken meat of 5.5 per cent. To measure the effect that this price reduction has had on household welfare through the consumption of chicken meat, we calculate for each household the welfare gain derived from the induced change in retail prices of chicken meat. In order to do that, we multiply the price reduction (–5.5 per cent) by the household expenditure share of chicken meat.[35] This procedure is run for all households, and then the results are averaged across two criteria: (a) urban/rural location, and (b) poverty classification (i.e. non-poor, poor, and extremely poor households).[36] As shown in panel (b) of Figure 11, for the poorest households on the coast (black line), welfare gains first increase with per capita expenditure, but then decrease monotonically. Rural areas on the coast show smaller welfare gains than urban areas, and these gains tend to be steady among middle levels of income. On the other hand, the poorest households in urban areas obtain the biggest welfare gains, which, however, decrease with per capita expenditure.

[35] The expenditure share of chicken meat is calculated as the ratio between chicken meat expenditure and total household expenditure. The numerator of the ratio considers only products that were purchased in the market.

[36] Defined according to the following expenditure ceilings for a five-member household: PEN 1,420 for poor households, and PEN 755 for extremely poor households. These references are the standard established by the National Institute of Statistics of Peru.

Figure 11 Expenditure shares and welfare changes due to the impact of yellow corn tariff reductions on consumption of chicken meat



Source: Authors' estimations, based on the 2011 National Household Survey.

The results in Table 6 show that the reduction in chicken meat retail prices induced by the tariff reduction for yellow corn generates an average welfare gain of 0.24 per cent. Due to the fact that urban areas show a higher consumption share of chicken meat than rural areas, welfare gains are slightly higher in the former (0.24 per cent versus 0.22 per cent). Also, it can be seen that the induced effects of yellow corn tariff reductions have a pro-poor bias. Poor households on the coast get the highest welfare gain of 0.29 per cent, compared to the non-poor group (0.23 per cent).

Table 6 Average welfare changes due to the impact of yellow corn tariff reductions on consumption of chicken meat (per cent)

Coastal areas	Average expenditure share of chicken meat	Average welfare gain
Center	4.38	0.24
North	4.19	0.23
South	3.75	0.21
Metropolitan Lima	4.59	0.25
Urban	4.32	0.24
Rural	4.02	0.22
Non-poor	4.15	0.23
Extremely poor	3.48	0.19
Poor	5.19	0.29
Total coast	**4.28**	**0.24**

Source: Authors' estimations.

5 Conclusions and policy recommendations

In recent years, the effectiveness of tariff reductions applied to yellow corn imports in Peru has come under scrutiny because their expected benefits do not seem to have been significantly transferred to buyers of yellow corn and of its main derivative product, chicken meat. While the effective tariff of yellow corn was reduced by 33.3 percentage points between 2000 and 2011, average prices of yellow corn and chicken meat increased by 31.1 per cent and 28.4 per cent, respectively.

This study used two approaches to try to provide a tentative explanation to this apparent mismatch between the reduction of tariffs and the increase of domestic prices by undertaking: (a) estimations of the tariff pass-through to domestic prices of yellow corn and chicken meat; and (b) estimations of the first-order household welfare effects – excluding effects on wages – induced by the tariff reduction for yellow corn.

First, the estimation results show that the tariff reduction for yellow corn helped mitigate increases in local prices of yellow corn and chicken meat that otherwise would have occurred. In fact, a counterfactual interpretation of these results implies that if the tariffs had not been reduced, local prices of yellow corn and chicken meat would have risen by 55.78 per cent and 33.90 per cent, respectively.

Second, the findings show that the reduction in chicken meat retail prices induced by the tariff reduction for yellow corn would have generated an average welfare gain of 0.24 per cent on the coast of Peru. Slightly higher welfare gains would have been obtained in urban areas (0.24 per cent) as opposed to rural areas (0.22 per cent). The estimated effect of yellow corn tariff reductions would have had a pro-poor bias, with poor households obtaining the highest welfare gain (0.29 per cent), compared to the non-poor group (0.23 per cent).

However, the results suggest that the benefits of the tariff reduction may not have been fully transmitted to consumers, and it could be the case that they have mostly been captured by the firms importing yellow corn and by the largest broiler producers, which are vertically integrated firms.

As regards the effects on producer welfare, we were not able to capture them because no income resulting from the sales of yellow corn and chicken meat was reported in the household survey for coastal regions. However, as the theory suggests, we would expect that net producers of yellow corn and derived products would have incurred welfare losses as a result of the tariff reduction.

In line with previous findings in the applied literature on trade policy transmission to household welfare, this study showed that when designing tariff policies that should mostly benefit consumers, special attention needs to be paid to the design of complementary policies aimed at encouraging a greater degree of competition in the relevant market. In this case, while there is some evidence that the yellow corn market in Peru is moderately competitive, the opposite happens to be true in the broiler industry, where the four biggest producers account for 70 per cent of total sales in Lima, and the major players are vertically integrated.

In addition, different patterns of yellow corn demand by the broiler industry on the coast (met mainly through imports) versus the highlands and jungle regions (which mostly use locally produced corn) suggest a low degree of integration in the national yellow corn market. This is also reflected in the significant differences in wholesale prices of yellow corn across regions. Therefore, trade policy measures aimed at altering tariffs for yellow corn would have had a more significant effect on the coast and a marginal effect on the highlands and jungle regions. This result highlights the importance of furthering market integration as a means of extending the benefits of trade policy, particularly to the poorest groups in the highlands and jungle regions. In sum, the effectiveness of tariff reductions such as those in the Peruvian yellow corn market should be increased through port and highway infrastructure development in order to enhance market integration.

Annex

Table A1 Data sources

Variable	Primary sources
Yellow corn wholesale prices	Ministry of Agriculture, National Institute of Statistics
Yellow corn producer prices	Ministry of Agriculture, National Institute of Statistics
Yellow corn world prices (yellow corn no. 2 – Chicago Commodities Exchange)	Reuters/Bloomberg
Trade costs (average freight and insurance costs per kg of Peruvian imports of yellow corn)	Peruvian Customs Agency – calculated by the authors
Market concentration (C4 market shares of yellow corn importing firms in Peru)	Peruvian Customs Agency – calculated by the authors
Effective tariffs on yellow corn	Peruvian Customs Agency
Chicken meat retail prices	National Institute of Statistics
Soybean world prices	Reuters/Bloomberg
Fish meat retail prices	National Institute of Statistics
Nominal exchange rates (USD/PEN)	Central Reserve Bank of Peru

Source: Authors' estimations.

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Nigeria

The welfare impact in Nigeria of the ECOWAS Common External Tariff: A distributional effects analysis

Olayinka Idowu Kareem *

Abstract

Trade policies often have a different impact on economic agents due to the transmission mechanism through which they operate. In this context, this study uses micro- and macro-economic data to investigate the distributional effects in Nigeria of the Common External Tariff of the Economic Community of West African States. These effects are examined from the perspective of households as producers, consumers, and factor owners. The analysis proceeds in three steps investigating: (a) the tariff pass-through to domestic prices, (b) the linkages between prices and wages, and (c) the impact of both prices and wages on household welfare. The findings indicate that during the period covered by this study, domestic prices declined due to the high tariff pass-through. This decline was higher in the states located closer to ports and borders, where the costs of trade are lower. The Common External Tariff had net positive effects on the welfare of households, largely due to the gains from the expenditure basket. The expenditure gains through lower prices outweighed losses in households' purchasing power incurred through lower income. Poorer households experienced larger welfare gains than richer ones, and urban households were better off than their rural counterparts. The study concludes that the price transmission mechanism and household characteristics are important determinants in assessing trade policy effects in Nigeria. Concerning the price-wage nexus, it does not find strong evidence of price influence on wages. The study suggests that competitiveness of domestic producers should be enhanced through investment in infrastructure and strengthening of relevant government programmes to create employment and improve household income in agriculture and the manufacturing sector. It also recommends social safety net measures, particularly for vulnerable subsistence agricultural households in rural areas, in order to mitigate the effects of the Common External Tariff on their income.

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* The author would like to thank Suleman Adebayo Audu, Minister from the Permanent Mission of Nigeria to the United Nations at Geneva, Nigeria Trade Office to the World Trade Organization (WTO), for his support in the preparation of this study, Dare Alaba for her research assistance, Idri Ademuyiwa for helping to obtain data from the National Bureau of Statistics, Fatima O. Kareem for assisting with the analysis, and Marco Sanfilippo, Kristina Czura, Timea Pal, Johanna Gereke and Andrej Tusicisny from the Development Study Working Group, European University Institute, Italy, for their comments on the study.

1 Introduction

The economic integration of developing countries such as Nigeria into global markets offers the opportunity for rapid growth and poverty reduction (Martinez and Poole, 2004), but it also entails risks. For example, Nigeria is endowed with abundant natural resources, especially crude oil, from which it derives over 90 per cent of its foreign earnings. The country has experienced average growth of around 7 per cent during the past five years. However, this growth has not trickled down to the majority of the population, thus reinforcing Nigeria's status as a rich country populated by poor people (World Bank, 1996). The unemployment rate reached 24 per cent in 2011 (NBS, 2012a) and the share of the population living below the poverty line increased from 54 per cent in 1986 to 68 per cent in 2010.[1]

Explaining Nigeria's situation demands a careful analysis of government policies and their effects. This study will focus in particular on the trade dimension and analyse the impact on household welfare of Nigeria's adoption of the Common External Tariff (CET) of the Economic Community of West African States (ECOWAS).[2]

To integrate its economy into global markets, particularly in the ECOWAS sub-region, Nigeria committed itself in 2005 to adopting the ECOWAS CET. During the transition period of 2006–2007, it therefore reduced its tariff rates on all products from a high of 150 per cent to a maximum of 50 per cent.[3]

The CET represents the most-favoured-nation (MFN) rates ECOWAS applies in relation to non-member countries and is part of the move towards a customs union that aims to enhance sub-regional trade integration through the flow of goods and services, especially inputs and intermediate goods for the industrial sector. The ECOWAS CET has four tariff bands: 0 per cent for social needs and basic necessities, 5 per cent for raw materials, 10 per cent for intermediate goods, and 20 per cent for

[1] Data from the World Bank World Development Indicators database, available at: *http://data.worldbank.org/data-catalog/world-development-indicators.*

[2] The 15 West African states that constitute ECOWAS are: Benin, Burkina Faso, Cape Verde, Côte d'Ivoire, the Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone and Togo.

[3] This was the maximum tariff rate on both goods and services during the country's transition period leading to the adoption of the CET.

[4] The four bands mentioned above are the current ECOWAS CET bands and are not the same as the bands Nigeria used during the transition period.

finished goods that are not produced locally. Nigeria was granted the possibility of adding a fifth band of 35 per cent for finished goods manufactured locally.[4] Following the adoption of the CET, Nigeria's simple average tariff on agricultural imports dropped from about 32 per cent in 2000 to 15 per cent in 2010, while its tariff on manufactured products fell from 25 per cent in 2000 to 11 per cent in 2010.[5]

Nigeria accounts for more than half of the sub-region's imports. In nominal terms, its total imports increased from USD 6 billion in 1990 to USD 64 billion in 2011, while ECOWAS's total imports rose from USD 14 billion in 1990 to USD 111 billion in 2011 (UNCTAD, 2012). In terms of import composition, Nigeria accounted for 40 per cent of ECOWAS's agricultural imports in 2009 and 79 per cent in 2011, while its industrial imports represented 79 per cent and 65 per cent of those of ECOWAS in 2009 and 2011, respectively. These data confirm the huge trade impact of Nigeria on the sub-region and explain its late and reluctant acceptance of the ECOWAS CET.

In addition, Nigeria's imports from ECOWAS declined over the years in terms of their share in the country's total imports. In 1994, the share of imports from ECOWAS in Nigeria's total imports was about 5 per cent. It then declined to 3.2 per cent in 2005, and fell further to 2.3 per cent in 2012 (IMF, 2013).[6] This reduction in the flow of imports from ECOWAS to Nigeria was a result of inadequate infrastructure and implementation of the sub-regional trade liberalization scheme.[7]

The adoption of the CET has had different effects on Nigerian households, depending on whether they are net consumers or producers of commodities, and on household labour returns. The literature on the transmission mechanism and welfare impact of this type of trade policy does not provide unequivocal conclusions. The different transmission channels through which trade policies operate are usually responsible for the variation of

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[5] Data from the World Bank World Integrated Trade Solution (WITS) database, available at: *http://wits.worldbank.org/wits.*

[6] This suggests that more than 97 per cent of Nigeria's imports of goods and services in 2012 came from countries outside ECOWAS. UNCTAD (2012) shows that less than 7 per cent of Nigeria's imports are sourced from Africa.

[7] The sub-regional trade liberalization scheme, which covers unprocessed goods, traditional handicrafts, and processed and semi-processed goods originating from member countries, aims to ensure the free flow of goods and services across members without subjecting them to tariffs and non-tariff barriers. However, in reality this is not the case, due to bureaucratic processes, lengthy import procedures, corruption in customs and road transport, etc. For more details, see Section 2.

the effects.[8] Most often, trade policies affect domestic prices and returns to production factors (labour), which in turn have effects on the consumption and production decisions of households (Nicita, 2004, 2009; Goldberg and Pavcnik, 2003, 2007; Marchand, 2012; Topalova, 2005, 2010; Porto, 2006; McCaig, 2011; Castilho *et al.*, 2012). This study therefore asks the following questions: To what extent has the ECOWAS CET affected domestic prices? And what has been its effect on household welfare?

In order to address these questions, this study conducts an empirical investigation of the distributional effects of the ECOWAS CET in Nigeria. These effects consist mainly of the impact on the markets where the households operate, on the goods they produce, and on the labour markets where they are active. It is therefore important for the Nigerian government to be aware of the level of CET pass-through to domestic prices, and to ascertain the effects of the price changes on factor income and household welfare. Providing this critical information is the primary objective of this study.

Despite the wide range of analysis in the literature on the distributional impact of trade liberalization, very few studies evaluate the trade liberalization policy of the ECOWAS CET in Nigeria. Balogun and Dauda (2012), Urama *et al.* (2012), Oduh (2012), Ajayi and Osafo-Kwaako (2007), Oyejide (2012), and Nwafor (2006) look only at the macroeconomic impact of the CET on Nigeria. The potential distributional impact has been examined exclusively through *ex-ante* studies: Nwafor *et al.* (2005) use a Computable General Equilibrium (CGE) model to examine the potential impact of the adoption of the CET on rural and urban poverty, and Marchat and Rajhi (2004), Soludo and Oji (2003), and Kuji Ltd. (2002) conduct *ex-ante* analyses at the sectoral and household levels. There are few, if any, *ex-post* studies that examine the distributional effects of the ECOWAS CET on Nigerian households or the level of tariff pass-through onto the country's domestic prices. This study aims to fill this gap by analysing the impact of the ECOWAS CET on Nigeria's households through an *ex-post* econometric analysis using household survey data.

The empirical strategy of this study was adopted from Nicita (2009), Porto (2006), and Marchand (2012). The price effects on household welfare

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[8] While this study focuses on the price and factor return effects of the ECOWAS CET, it is acknowledged that there are other effects that should also be considered, such as those related to employment, agricultural outputs, and investment.

[9] Due to inconsistencies in the implementation of the scheme by members, there are still non-tariff barriers such as certificates of origin, standards requirements, bureaucratic problems, unofficial fees, delays at borders, waste and theft at ports, harassment by the police and other security agents at a number of locations, and inter-country payment difficulties (ECOWAS Vanguard, 2013).

depend on the budget share of each commodity, the share of household income from the commodity, and the price change of the commodity due to trade. The methodology first determines the impact of the ECOWAS CET on domestic prices; it then examines the linkage between domestic prices and wages. The final analysis combines the effects of price and wage changes on household welfare. The results show that the ECOWAS CET has net positive effects on household welfare, mainly due to the gains from the expenditure basket. During the period covered by the study, consumers benefited from the CET through the expenditure gains that outweighed the losses due to lower income. Poorer households experienced larger welfare gains than richer ones, and urban households were better off than their rural counterparts. This is because urban households depend less on product sales, especially those of agricultural products.

The study therefore provides evidence that the price transmission mechanism, household characteristics, and the sector of labour activity are important determinants in the assessment of trade policy effects in Nigeria.

The study is organized as follows. Section 2 explains the context of the analysis undertaken by the study. Section 3 describes the data used. Section 4 details the methodology and research findings. The conclusions are presented in Section 5.

2 Policy context

The volume of intra-regional trade flows depends to a large extent on the trade and other economic policies implemented by ECOWAS member countries. The ECOWAS Trade Liberalization Scheme (ETLS) has aimed to promote cooperation and integration among member states through trade liberalization and progress towards the creation of a common market. When the scheme started in 1979, it included only handicraft, agricultural and unprocessed products, but in 1990 it was expanded to accommodate industrial products, with the application of rules of origin in line with WTO agreements. The ETLS has not yet been fully implemented by member states,[9] which has affected intra-ECOWAS trade flows – as a percentage of the sub-region's total imports those flows declined from 13.2 per cent in 2000 to 10.7 per cent in 2011. Total intra-regional trade has been increasing, but at a decelerating rate (UNCTAD, 2012),[10] despite the zero

[10] For instance, the intra-ECOWAS trade in 2005 was 131 per cent above the 2000 trade value, but it only grew by 34 per cent between 2005 and 2011. Thus, there has been marginal trade creation in the sub-region.

preferential tariffs agreed upon in principle within the sub-region. Each member country has its own tariff schedules applicable to imports without preferential arrangement.

Nigeria's trade policy has been rather protective. Only recently, the country has made efforts, along with other sub-regional partners, to liberalize trade in order to reap benefits related to trade liberalization. One such effort was Nigeria's acceptance of the ECOWAS CET. Prior to consenting to the CET, Nigeria had a maximum tariff peak of 150 per cent, which was reduced to 50 per cent during the transition period. This indicates that the country liberalized its trade by about 67 per cent following the ECOWAS CET. Imports responded accordingly, with a 967 per cent increase in 2011 compared to the 1990 level.

Table 1 Nigeria's imports and tariffs, 2000–2010

Sector	Year	Total imports (millions of USD)	Weighted average tariffs (per cent)
Agriculture	2000	963	30.2
	2002	1,506	32.9
	2005	2,054	22.4
	2008	3,845	9.8
	2010	3,436	8.8
Manufacturing	2000	4,852	17.8
	2002	7,252	15.4
	2005	15,669	9.8
	2008	34,092	9.9
	2010	30,202	10.7

Source: World Bank WITS.
Note: The value of imports is expressed in nominal terms.

Table 1 shows that agriculture was the most liberalized sector, with a weighted average tariff declining from 30.2 per cent in 2000 to 8.8 per cent in 2010. Correspondingly, imports of agricultural commodities rose from USD 963 million in 2000 to USD 3.4 billion in 2010, an increase of more than 250 per cent over ten years. However, the share of agricultural imports in the gross domestic product (GDP), which was 2 per cent in 2000, declined to about 1.5 per cent in 2010. Manufacturing sector imports grew from slightly less than USD 5 billion in 2000 to more than USD 30 billion in 2010, which was 13 per cent of GDP for that year compared to about 11 per cent in 2000. The weighted average tariff fell from 17.8 per cent in 2000 to 10.7 per cent in 2010, which, among other factors, could be responsible for the 522 per cent rise in the import of manufactured products into

Nigeria during the period. Aggregate imports rose from about USD 9 billion in 2000, which represented 18.8 per cent of the GDP, to USD 44 billion in 2010, a share of 19.3 per cent of GDP. However, both agricultural and manufactured imports declined between 2008 and 2010. This was due in part to internal unrest in the oil-rich Niger delta zone, which led to a considerable drop in crude oil earnings. This affected exploration activities of oil companies and the country's foreign exchange earnings, which in turn impacted the economy, especially the propensity to import.

Nigeria's global integration was boosted by trade liberalization, which was accompanied by substantial adjustments in the prices of both agricultural and manufactured goods between 2005 and 2011. There was a mild consistency in price movement across states and years in both agricultural and manufactured products (see Table A1 in the Annex). Some oscillations are observed in the variance of the log of prices across states and years, suggesting that there were considerable price differentials across and within the states over these years, probably due to the states' preferences and endowment differentials, varying input costs, transportation costs, and market regulations.

3 Data description

This study uses several data sources. Tariff data were taken from the World Bank World Integrated Trade Solution database, while world prices were sourced from the World Bank Commodities Price Data[11] at nominal USD that were converted into domestic currency at the prevailing exchange rates. Nominal domestic consumer prices[12] from 2006 to 2011 come from the National Bureau of Statistics (NBS).[13] NBS (2012b) provides statistics for the shares of the following food items in total household consumption in Nigeria: rice (6 per cent), maize (3 per cent), other cereals including sorghum (7 per cent), poultry including chicken (0.4 per cent), fruit including oranges (1.2 per cent), beans and peas including

[11] The Commodities Price Data (also known as "Pink Sheet") are a monthly collection of commodity prices and indices published by the World Bank. Available at: *http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTDECPROSPECTS/0,,contentMDK:21574907~menuPK:7859231~pagePK:64165401~piPK:64165026~theSitePK:476883,00.html.*

[12] These prices cover agricultural items such as rice, maize, sorghum, soya beans, chicken, groundnut, and oranges, as well as five manufactured processed goods: groundnut oil, tea, wheat flour and bourn-vita. The selection of products in both agricultural and manufacturing sectors is based on their importance to the average Nigerian household. The study uses the actual (nominal) prices of these commodities and not price indices.

[13] These data are not available in any NBS publication or online. They were requested specifically for this study.

groundnut (6 per cent), oil, fat and oil-rich nuts including groundnut oil (2 per cent), chocolate, confectionary, bourn-vita, (1 per cent), and wheat flour-related food items including bread (2 per cent). All Nigerian states, including the Federal Capital Territory, were considered. Efforts were also made to categorize the states along their geopolitical zones in order to reflect policy directions and stimulate national strategic planning and programmes. There are six geopolitical zones in Nigeria: South-West, South-East, South-South, North-West, North-East, and North-Central (see Figure A1 in the Annex).

The trade cost in this study, measured by the distance of each state to the nearest seaport, is calculated using the GlobeFeed distance calculator.[14] Nigeria has 21 seaports that can be used to import goods (Jaja, 2011). The major seaports are Tin Can Island, Apapa, Kirikiri (Lagos), Warri (Delta), Port Harcourt (Rivers State), and Calabar (Cross River).[15] Most seaport activities take place in the Lagos and Rivers States. Thus, this study uses the distance from each state's capital to the closer one of the two major seaports where most seaport activities take place.

For the price-wage nexus estimation, information on households was obtained from two surveys conducted by the NBS: the 2010 General Household Survey-Panel (Post-Planting), and the 2011 General Household Survey-Panel (Post-Harvest).[16] The surveys provided information on expenditure, income, household characteristics, wages, sector of activity, education, and gender. The wages were individual average monthly wages from the household surveys. Activities were grouped in six sectors: agriculture, manufacturing, commerce, services, transport and construction.

4 Methodology and findings

This study builds on the methodological approaches of Porto (2006), Nicita (2009), and Marchand (2012) to measure the effects of the ECOWAS CET on household welfare through prices and wages. It investigates the impact of the ECOWAS CET on domestic prices, the linkage between domestic prices and wages, and the combined effect of price and wage changes on household welfare.

[14] Available at: *distancecalculator.globefeed.com.*

[15] All these seaports are located in the southern part of the country.

[16] The World Bank's Migration and Remittances Household Survey was dropped due to the non-availability of variables of interest, especially household wage income and sales.

4.1 Tariff-price nexus

This sub-section makes some specific assumptions for the model. It is assumed that consumer goods are not differentiated by origin, and that their prices are at average levels of imported and domestic producer prices. Also, it is assumed that trade costs only affect imported goods. Thus, the retail price that households face by consuming a good g at time t in state s, P_{gts} will depend on the domestic producer prices of the good (PP^{α}_{gts}), the international prices in domestic currency (P^*_{gt}), tariffs (τ_{gt}), and trade costs (TC_{gts}). This is written as:

$$P_{gts} = PP^{\alpha}_{gts} \left[P^*_{gt} (1 + \tau_{gt}) \, TC_{gts} \right]^{1-\alpha} \tag{1}$$

where α measures the extent to which the local varieties dominate the imported ones, and $1-\alpha$ is the pass-through which indicates the extent to which international prices, tariffs, and trade costs affect domestic prices. If α=0, then there is a complete pass-through and the full extent of the border price changes is reflected in the consumer prices, which is likely to occur when no local production exists. If α=1, then the pass-through is nil, indicating that there is no effect of border price changes on the price of goods paid by consumers, which corresponds to a situation of relative autarky where domestic markets are dominated by local producers. Equation (2) presents the linearized form of equation (1):

$$\ln P_{gts} = \alpha \ln PP_{gts} + (1-\alpha) \ln P^*_{gt} + (1-\alpha) \ln(1+\tau_{gt}) + (1-\alpha) \ln TC_{gts} \tag{2}$$

Following Nicita (2009) and Campa and Goldberg (2002), the unrestricted form of equation (2) is assumed, which gives the following equation:

$$\ln P_{gts} = \beta_0 + \beta_1 \ln PP_{gts} + \beta_2 \ln P^*_{gt} + \beta_3 \ln TC_{gts} + \gamma \ln (1+\tau_{gt}) + \varepsilon_{gts} \tag{3}$$

In equation (3), the shortest distance to the nearest main port of entry is used as a proxy for trade costs. Thus, in line with this study's objective of distilling the effect of trade policy on domestic prices at the state level, we include an interaction term between distance and the tariff rate in the final equation. This is to isolate the domestic impact of tariff changes on the pass-through. Thus, in line with Nicita (2009) and Marchand (2012), the following econometric equation is adopted to estimate the tariff pass-through effect in the case of Nigeria:

$$\begin{aligned} \ln P_{gts} = {} & \beta_0 + \beta_1 \ln PP_{gts} + \beta_2 \ln P^*_{gt} + \beta_3 \ln TC_{gts} + \beta_4 \ln (1+\tau_{gt}) \\ & + \beta_5 \ln (1+\tau_{gt}) \, TC_{gts} + \beta_6 [\ln (1+\tau_{gt}) \, TC_{gts}]^2 + \pi_t + \varepsilon_{gts} \end{aligned} \tag{4}$$

where P_{gts} represents the domestic price of good g in state s at time t, PP_{gts} is the producer price of the good, P^*_{gt} is the world price, TC_{gts} is the trade cost, τ_{gt} is the tariff, π_t are time-fixed effects, and ε_{gts} is the error term. By controlling for time, the study assumes that the error term does not include factors that affect simultaneously tariffs and prices.

Reduced-form models often assume a perfect pass-through, i.e. changes in tariffs perfectly transmitted to domestic prices, and thus to households. However, there are many market imperfections and transaction costs that may affect the transmission chain and explain the absence of clear empirical results in line with the theoretical predictions. This is especially the case in developing countries such as Nigeria, where geographical locations and domestic markets are highly segmented.

The nominal consumer prices for seven agricultural products and four manufacturing goods were sourced from the NBS. The same source also provided the producer prices. The world prices, converted into local prices at the prevailing exchange rates, were sourced from the World Bank Commodities Price Data. The nominal domestic consumer prices for each product were collected across the 36 states and the Federal Capital Territory. Distance from each state's capital to the nearest seaport was taken from the GlobeFeed distance calculator. The World Bank World Integrated Trade Solution database provided the tariffs at the Harmonized System 2-digit level for the period from 2006 to 2011.

Table 2 shows the estimates of tariff pass-through for prices of both agricultural and manufactured goods.[17] The table presents the estimated results for four different specifications of equation (4): estimation without tariff-distance interaction in specification 1; estimation without tariff-distance interaction but with time-fixed effects in specification 2; estimation with tariff-distance interaction in specification 3; and estimation with tariff-distance interaction and time-fixed effects in specification 4. Table 2 is based on national data in which the estimations were performed using feasible generalized least square (FGLS) cross-sectional time series, which corrected for any heteroskedasticity in standard errors.[18] The table shows evidence of significant pass-through in the estimates of prices of all agricultural goods. The pass-through tends to increase substantially with the inclusion of time-fixed effects. This indicates that the pass-through in the agricultural sector is time-specific. The tariff-distance interaction, which

[17] The producer prices are the domestic substitute prices; the estimated coefficients are significant in all the cases.

[18] The Hausman-Taylor estimation reveals that the instrument variables are not required.

is another variable of interest, is statistically significant, with the expected sign in the agricultural estimates. The results with regard to manufactured goods show pass-through much higher than 100 per cent, which is not plausible. These extreme results may be due to the quality of the data and are therefore not taken into account in this study.

For agricultural goods, the tariff pass-through coefficient is estimated to be between 73 and 99 per cent. The results show that any exclusion of time-fixed effects reduces the estimated pass-through for agricultural goods. This indicates that the pass-through depends on time, thus confirming the findings of Marchand (2012).

The magnitude of the pass-through also shows that the consumers of agricultural goods benefited from the tariff reduction through the ECOWAS CET. When the distance is interacted with the tariffs, the pass-through is found to significantly decline with distance from the seaports. Table 2 shows that all the coefficients of interest (tariffs and tariff-distance) have the expected signs and are significant in agricultural goods estimates. All standard errors are mitigated against heteroskedasticity in the FGLS estimation.

Table 2 Tariff pass-through to domestic prices

	Dependent variable – Log of prices			
	Specification 1	**Specification 2**	**Specification 3**	**Specification 4**
	Agriculture			
Constant	–1.4507*** (0.1682)	–1.0552*** (0.1702)	–1.4960*** (0.1674)	–1.0983*** (0.1694)
Tariffs	0.7377*** (0.1120)	0.9910*** (0.1152)	0.3694** (0.1534)	0.6570*** (0.1533)
World price	0.3133*** (0.0141)	0.2652*** (0.0149)	0.3168*** (0.0140)	0.2687*** (0.0148)
Domestic substitute price	0.7565*** (0.0107)	0.7319*** (0.0109)	0.7751*** (0.0113)	0.7503*** (0.0114)
Tariff*Distance			–0.0011*** (0.0004)	–0.0011*** (0.0004)
Tariff*Distance squared			5.08e-06*** (1.12e-06)	5.24e-06*** (1.12e-06)
Wald Chi-square	5925.85 (0.0000)	6194.61 (0.0000)	6086.7 (0.0000)	6351.66 (0.0000)
Observation	1273	1273	1273	1273
	Manufacturing			
Constant	6.9652*** (0.3145)	7.0759*** (0.3067)	6.9123*** (0.3092)	7.0257*** (0.3029)

	Dependent variable – Log of prices			
	Specification 1	**Specification 2**	**Specification 3**	**Specification 4**
Tariffs	2.8358*** (0.2762)	2.4836*** (0.2746)	3.0516*** (0.3023)	2.7305*** (0.3007)
World price	–0.3428*** (0.0385)	–0.3709*** (0.0378)	–0.3197*** (0.0382)	–0.3500*** (0.0377)
Domestic substitute price	0.4909*** (0.0320)	0.4952*** (0.0312)	0.4654*** (0.0320)	0.4737*** (0.0313)
Tariff*Distance			–0.0033*** (0.0008)	–0.0028 (0.0007)
Tariff*Distance Squared			1.01e-05*** (2.56e-06)	8.04e-06*** (2.55e-06)
Wald Chi-square	262.57 (0.0000)	307.64 (0.0000)	280.61 (0.0000)	320.65 (0.0000)
Observation	733	733	733	733
Time effects	No	Yes	No	Yes

Source: Author's estimations.
*Note: All variables are in log. The standard errors, corrected for heteroskedasticity, are presented in parentheses, except for the Wald Chi-square, for which the parenthesis reports the probability value. The significant variables are denoted by *, ** and *** at 10, 5, and 1 per cent significance levels, respectively. The tariff-distance interaction isolates empirically the local effects of tariff transmission (see Nicita, 2009).*

4.2 Pass-through estimates

Using specification 1[19] in Table 2, the pass-through in the country is estimated at 74 per cent for agricultural goods, which is in a relatively high range compared to the 33 per cent for agriculture and 27 per cent for manufacturing in Nicita (2009). Campa and Goldberg (2002) found a 40 per cent pass-through for manufacturing in the United States and 70 per cent in Germany. Frankel *et al.* (2005) obtained a 50 per cent pass-through to imported prices in a group of developing countries, while Marchand (2012) reported between 33 and 49 per cent for rural areas and 64 and 68 per cent for urban areas in India. In our analysis, the world price pass-through for agricultural goods has significant positive effects in all the specifications. The elasticities of world prices range between 27 and 31 per cent.

The results also present the elasticities of the interaction of tariffs and distance, which show the extent to which trade costs, through distance, affected tariff pass-through. The estimates of tariff-distance interaction show that there are virtually no regional differences across states in the effects of the ECOWAS CET on prices of manufactured goods; however, there are relative

[19] This estimation was done without the interaction of distance with tariffs and time-fixed effects.

regional differences with regard to prices of agricultural goods. This result is different from Nicita (2009), who found regional differences in manufactured goods but no differences across states in agricultural goods. The tariff pass-through for agricultural goods prices is statistically significant, indicating that the tariff reduction is significantly transmitted to consumers across states through lower prices of agricultural goods. In other words, the consumers of agricultural goods benefited from the ECOWAS CET.

States closer to ports are found to be more exposed to the impact of changes in agricultural tariffs. Considering the state/regional differences, the tariff pass-through at the border is 66 per cent for the agricultural sector and it declines to 11 per cent at 100 kilometres from the port or border of entry.[20] The decline in the tariff pass-through as one gets farther away from ports of entry or borders is due to the associated trade costs, inadequate trade facilitation, and, most importantly, the poor state of infrastructure, which reduce household consumption gains from the tariff reduction and income loss for producers. The results for manufactured goods go in the same direction.[21] However, possibly due to the quality of the available data, the estimates are out of a plausible band, which does not allow for a consistent interpretation.

The transmission of tariffs to domestic prices varies marginally across states. Table A2 in the Annex presents state-specific tariff elasticities that were obtained from specification 4 of Table 2.[22] Results show that households that are close to ports of entry benefit significantly from the tariff reduction. The relatively higher pass-through in agriculture in the Lagos and Rivers States is due to the location of functional ports of entry there. In fact, Lagos ports account for more than 70 per cent of port activities in Nigeria (Jaja, 2011). In addition, smuggling activities at the ports and borders in these states, which are the result of Nigeria's porous borders (Adeola and Fayomi, 2012; Ohai, 2013),[23] may have an effect on these elasticities.[24] Smuggled goods, especially agricultural goods, avoid tariffs and are cheaper than tariffed goods.

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[20] The tariff pass-through at the border is the coefficient of tariffs in specification 4 in Table 2, while the estimate of the tariff-distance interaction gives the change in tariff pass-through for every kilometre of distance from the port or border.

[21] Nicita (2009) opined that the tariff-distance square coefficient could take any sign depending on the rate of decline of the pass-through with distance.

[22] The state-specific pass-through elasticities were obtained by finding the derivatives of equation (4) with respect to the tariff and then inserting the value of the coefficients from specification 4 in Table 2 before estimating it for each state.

[23] This is the reason for the recent directive by the federal government (the Nigerian Customs Service) that all rice importation must now go through the seaports.

[24] There are 1,497 illegal and 84 legal routes (borders) to Nigeria (Owete, 2013).

4.3 Price-wage nexus

In linking domestic prices to wages,[25] wage-price elasticities are estimated following the framework proposed by Nicita (2009). The estimating equation considers product prices and worker characteristics:

$$\ln W_{ijst} = \sum_{gsr} \theta^{r} \ln P_{gst}\, x^{g,r} + l_i \varnothing + H_j \varphi + \varepsilon_{ijst} \qquad (5)$$

where W_{ijst} is the observed wage of individual i in household j, state s at time t, P_{gst} is the price of good g[26] in state s at time t, l_i is a vector of individual characteristics, H_j represents a vector of household attributes, θ^{r} indicates a dummy variable for worker skills[27] and $x^{g,r}$ measures responses of wages of skilled and unskilled workers to prices.

The wages are individual monthly wages as observed in the household surveys. The control variables are age, level of education, gender, region (rural and urban), and occupation sector.[28] The consumer prices from the tariff pass-through are used in the wage equation. The wages of individuals between the age of 15 to 65 were used. In the estimation, the reference categories are the construction sector for occupation, female for gender, rural for region, and first degree holder for education. The state- and year-fixed effects are included in the regression to control for state and year specific effects. The construction of the aggregate price was based on the average prices of the basket of agricultural and manufacturing products, in line with Nicita (2009).

The results of the relationship between prices of agricultural and manufactured goods and wages are presented in Table 3. The table shows the estimates of wage-price elasticities under two different specifications of equation (5): without state- and time-fixed effects in specification 1, and with state- and time-fixed effects as in Nicita (2009) in specification 2. These estimations are carried out using the FGLS in order to fit the panel

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[25] The wages were obtained from the surveys and included all members of households that engaged in either farm or non-farm economic activities for wage income. NBS (2012a) reports that about 80 per cent of urban families earn income from non-farm business activities, while about 60 per cent of agricultural households also have non-farm enterprise earnings.

[26] A composite agricultural good and a composite manufactured good are used in this analysis.

[27] Wage earners with nine or more years of education are regarded as skilled.

[28] Ten different education levels were considered: no education, primary, junior secondary, senior secondary, technical, grade II, ordinary national diploma, higher national diploma, first degree, and postgraduate degree. The occupation sectors include agriculture, manufacturing, commerce, services, transport, and construction.

data linear model.[29] Age, highest education attained, gender, region and sector of occupation of the workers are used as the control variables. The state-fixed effects in this framework account for the productivity differential across the states due to each state's policy specificities.

Table 3 Wage-price elasticities

	Dependent variable - Log of wage	
	Specification 1	**Specification 2**
Constant	6.4145*** (0.3075)	6.6170*** (0.3471)
Manufacturing price skilled	0.0150 (0.0329)	0.0017 (0.0323)
Manufacturing price unskilled	0.0095 (0.0366)	0.0119 (0.0360)
Agriculture price skilled	–0.0171 (0.0115)	–0.0140 (0.0149)
Agriculture price unskilled	0.0065 (0.0168)	0.0139 (0.0165)
Age	0.0633* (0.0358)	0.0280 (0.0365)
Agriculture	–0.2002** (0.0820)	–0.1140 (0.0819)
Manufacturing	0.0002 (0.0982)	0.0828 (0.0984)
Commerce	–0.0553 (0.0883)	0.0037 (0.0847)
Services	0.0571 (0.0831)	0.1038 (0.0829)
Transport	0.1505 (0.1068)	0.1955* (0.1061)
Sex	0.1326*** (0.0280)	0.1098*** (0.0281)
Region	0.1162*** (0.0299)	0.0670** (0.0322)
No education	–0.9740*** (0.3511)	–1.0326*** (0.3457)
Primary	–0.7931** (0.3511)	–0.8772*** (0.3448)

29 It allows estimations in the presence of the AR(1) autocorrelation within panels and cross-sectional correlation and heteroskedasticity across panels.

	Dependent variable - Log of wage	
	Specification 1	**Specification 2**
Junior secondary	–0.6736*** (0.1714)	–0.7150*** (0.1692)
Senior secondary	–0.3189 (0.2194)	–0.3041 (0.2163)
Technical	–0.5633*** (0.1666)	–0.6047*** (0.1643)
Grade II	–0.3974** (0.1698)	–0.4262*** (0.1674)
Ordinary national diploma	0.1613 (0.2409)	–0.1121 (0.2422)
Higher national diploma	–0.1482 (0.1720)	–0.1630 (0.1692)
Postgraduate	–0.3677 (0.4029)	–0.2975 (0.3958)
Wald Chi-square	481.74 (0.0000)	546.87 (0.0000)
Observation	8780	8780
State-fixed effects	No	Yes
Time-fixed effects	No	Yes

Source: Author's estimations.

Note: All variables except the dummies are in log. The standard errors are presented in parentheses except for the Wald Chi-square, for which the parenthesis reports the probability value. The error term is free from autocorrelation. Skill takes the value of 1 when the worker has at least a secondary education, otherwise it is zero. Sex is 0 for female and 1 for male. The estimation uses female, construction occupation, rural and first degree holders as references.

The estimates from Table 3 show that the coefficients of many of the control variables are significant, with the majority having the expected signs. Wages tend to increase with education and age. For education, all coefficients have the expected signs, except for ordinary national diploma and postgraduate degree, but are non-significant. Wages also tend to be higher for male workers and for workers in urban areas. There is a difference in the coefficient controlling for occupation, as lower wages are found in agriculture, while the highest wages are in transport occupations.

In general, the results show a positive correlation between manufacturing and agricultural prices and wages, except for the interaction of agricultural prices and skilled labour that is negative. The results also indicate that skilled wages are more responsive to manufacturing prices when state- and time-fixed effects are not included in the estimation. However, with state- and time-fixed effects, unskilled wages are more responsive. Skilled wages are also more responsive to agricultural prices. There are few differentials in wages between states over time in the manufacturing sector and virtually none in agriculture. This implies that there are virtually no state-specific peculiarities that influence wages. Thus, the result shows that there is no significant relationship between prices and wages,[30] indicating that the nexus between prices and wages is not established in this study.

4.4 Welfare impact

The empirical analysis in this sub-section examines the impact of the ECOWAS CET on Nigerian households by focusing on the price changes of traded goods and wage income. The specific results regarding the welfare effects of trade liberalization in geopolitical zones and states are presented in Table A2 in the Annex.

In Nigeria, many households are simultaneously wage earners, producers and consumers of goods. It is therefore important to recognize these roles when analysing the impact of any policy on household welfare.[31] The share of wages in the income of most households is small compared to the income from sales of agricultural and manufactured goods. In rural areas, agricultural sales often constitute the bulk of the household income. This income is then increased through wages earned from labour rendered by the members of the household in other farm or non-farm activities.[32] However, in urban areas, income from manufacturing sales and wages represents the most important component of household income. Expenditure on agricultural products, especially food items, often forms the bulk of household expenses.

Following Porto (2006), Nicita (2009), and Marchand (2012), this study estimates the effects of trade policy on household welfare. It indicates that changes in utility dU_{hs} of household h in state s depend on the changes in local prices (both goods and factors), household-specific labour income, agricultural production, and consumption. This relation is presented in equation (6).

$$dU_{hs} = \sum_r \theta_h^r dW_s^r + \sum_g \theta_{hg}^x dP_{gs} - \sum_g \theta_{hg}^c dP_{gs} \tag{6}$$

where θ_{hg}^c is the income share spent on good g by household h, θ_{hg}^x is the income share obtained from selling goods produced at price P, θ_h^r is the

[30] This could be due to rigidity on the part of employers in adjusting wages, even in the presence of price changes. Also, the country's minimum wages determined by the federal government tend not to react fast to price changes.

[31] See Singh *et al.* (1986) for the farm household model, a standard model which is often used to measure changes in households' welfare.

[32] The largest proportion of Nigeria's labour is in the agricultural sector (IFAD, 2012).

income share earned from labour, and dP_{gs} and dW_s^r are changes in prices and wages, respectively. Aggregate welfare change is therefore given by the sum of the welfare changes of all households. Thus, households' exposure to changes in prices and wages will depend on their income structure and expenditure allocation. The calculation for each household was done taking into consideration expenditure and income, the different types of labour supplied (skilled and unskilled), and the fact that the price effects estimations vary among states. Aggregating the results across households, the study finds that the effects of the ECOWAS CET on households in Nigeria vary both across income groups and states. This is due to the differences in economic behaviours, endowments and pass-through across the states. Due to the insignificance of the wage elasticities, this analysis only considers the effects of price changes on welfare.

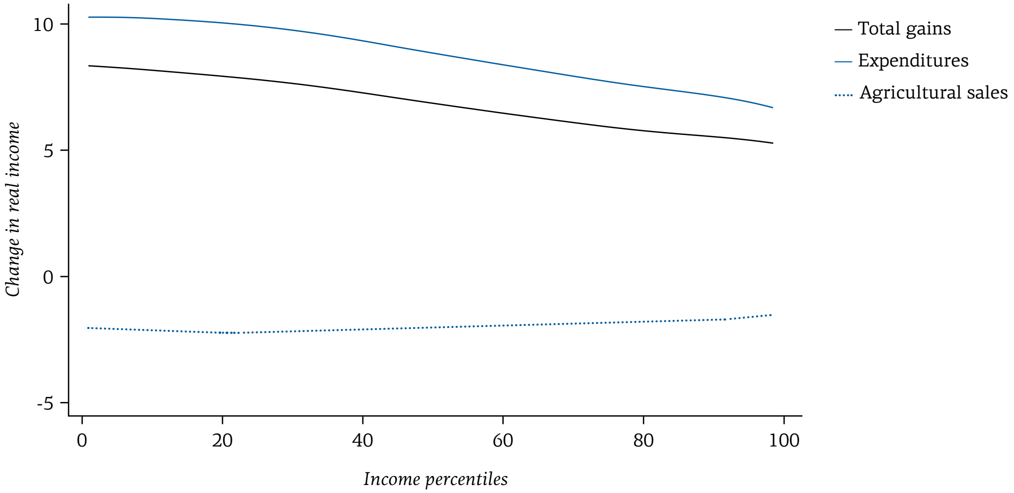
Earlier results indicated that tariff liberalization led to price reductions in both agricultural and manufactured goods. Unskilled and skilled wages in both sectors remained basically unchanged after trade liberalization. Some selected details about the impact of the ECOWAS CET are presented in Table A2 in the Annex. It can be seen that the CET has resulted in an increase of overall household welfare of 6.9 per cent at the national level. The gains originate from the expenditure basket (8.9 per cent), which compensated for the losses incurred by households from sales of agricultural goods (1.9 per cent). Disaggregating the effects indicates that there are differences across geopolitical zones and states as well as between rural and urban areas.

In terms of the geographical distribution of welfare gains due to the CET, the analysis finds that households in the northern states have benefited more than those in the southern states, due to higher expenditure gains. Furthermore, the overall change in real income due to the CET in the agricultural sector indicates that the producers in this sector have been adversely affected due to the generally high level of pass-through. Although the CET has negatively affected the producers of agricultural products, consumers of agricultural products have been better off due to the availability of wider variety of cheaper goods.

This study also finds that the effects of the CET vary along the income distribution. The mean expenditure gains across income percentiles are shown in Figure 1.[33] On average, all household income groups have experienced expenditure gains, but to varying degrees.

[33] The figure shows changes in real income due to changes in expenditure, agricultural and manufacturing sales.

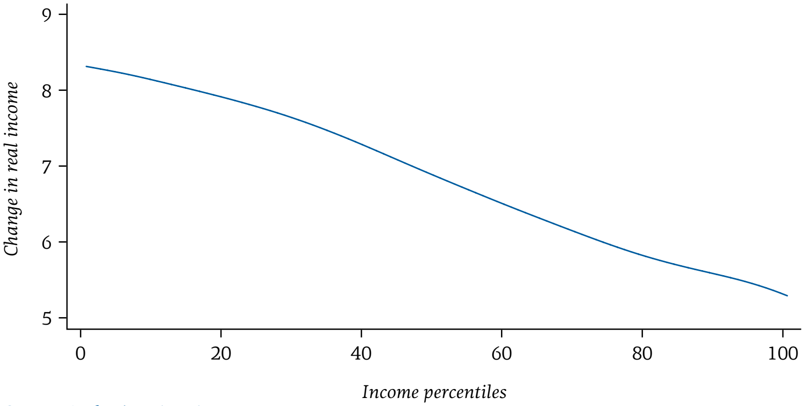
Figure 1 Changes in real income



Source: Author's estimations.

Figure 2 shows average total gains. All income groups have benefited from trade liberalization, and households at lower income levels have experienced higher welfare gains. It can be seen from the figure that all households have benefited from lower expenditure due to lower prices, with those in the 80th and 100th percentiles gaining less and those in the lowest income percentile gaining the most. Thus, the poorest households in Nigeria on average have benefitted more from the CET than the richest households, due to a greater share of agricultural goods in their expenditure basket. High-income households have experienced lower welfare gains due to the small share of agricultural commodities in their expenditure. The real income of households has changed due to the fact that agricultural sales have been negative for households relying mostly on sales of these products.

Figure 2 Total gains



Source: Author's estimations.

5 Conclusions

This study examined the extent to which households have been affected by the Common External Tariff of the Economic Community of West African States. The empirical analysis examined economic consequences of the CET from the perspective of households as producers, consumers and workers, as well as the transmission of the tariff reduction under the CET to domestic prices. The results show that the ECOWAS CET has reduced domestic prices of agricultural goods. The study did not find a significant link between wages and prices. The findings also indicate that so far the CET has had a net positive effect on households in Nigeria, largely due to the gains from expenditure which outweighed the losses in the households' purchasing power due to lower income from the sales of agricultural products. Consequently, household welfare has improved as a result of the CET, particularly for poor households in rural areas; the gains for higher-income households have been more modest. Some groups of households whose income depend largely on activities in the agricultural sector, specifically product sales, have seen a depletion of their purchasing power.

Despite the overall net positive effects of the CET, the study finds differences in the distribution of welfare gains across states, geopolitical zones and income groups. Richer households have experienced lower welfare gains than poorer households. The welfare gains of urban households and male-headed households have been higher than those of rural households and female-headed households, respectively. Rural households in states

[34] This would include labour market reforms.

with ports of entry and near borders have seen their purchasing power eroded more than households in urban areas. Consumers in states with ports of entry have been more exposed to goods available at relatively lower prices due to the CET than those in other states. Thus, the study provides evidence that domestic price transmission, household characteristics, and sectors of economic activity are significant in assessing the welfare effects of trade policies in Nigeria.

This study provides relevant findings about welfare implications of the ECOWAS CET which could serve in the formulation of Nigeria's national economic transformation agenda in the areas of trade and investment, agricultural productivity, and wealth and job creation.[34] The capacity of producers should be enhanced through an informed, integrated and inclusive policy for both the manufacturing and agricultural sectors that would stimulate productivity and value addition. The government should boost investment in vital sectors of the economy by improving infrastructure, access to finance and quality of education, promoting science and technology, facilitating land acquisition, etc. For instance, the Commercial Agriculture Development Programme, as well as other programmes of the Ministry of Agriculture and Rural Development, should be reinforced. This could enhance the competitiveness of domestic producers and increase the volume of output, employment and income levels.

Policy measures are also needed to mitigate the domestic effects of government trade policies. In this context, the National Poverty Eradication Programme, the National Directorate of Employment's Programme, the Subsidy Reinvestment and Empowerment Programme, and other relevant government programmes should be strengthened to create jobs and wealth in agriculture and the manufacturing sector. Social safety nets and security measures should also be put in place at the rural level, especially for vulnerable populations, in order to mitigate the negative income effects of the CET on rural households.[35]

Finally, efforts could also be made to reduce the number of banned products, as such import bans may have the tendency to encourage smuggling because some of the banned goods are in demand given their limited domestic production. This leads to a situation whereby government bans, while trying to protect domestic producers, result in a proliferation of illegal/informal importation.

[35] The National Poverty Eradication Programme could liaise with the Ministries of Youth and Women's Affairs to come to the aid of vulnerable populations by empowering them economically.

Annex

Table A1 Domestic prices by year and state, 2006–2011 (log)

	Agriculture				Manufacturing			
	2006	**2007**	**2009**	**2011**	**2006**	**2007**	**2009**	**2011**
Abia	5.386 (1.201)	5.418 (1.160)	5.580 (1.145)	5.738 (1.270)	5.375 (0.645)	5.509 (0.671)	5.731 (0.583)	5.902 (0.614)
Adamawa	5.205 (1.256)	5.143 (1.373)	5.413 (1.150)	5.559 (1.266)	5.389 (0.631)	5.468 (0.640)	5.678 (0.638)	5.778 (0.602)
AkwaIbom	5.419 (1.182)	5.445 (1.165)	5.615 (1.125)	5.861 (1.258)	5.470 (0.648)	5.555 (0.673)	5.714 (0.624)	5.858 (0.595)
Anambra	5.274 (1.105)	5.380 (1.166)	5.616 (1.232)	5.712 (1.251)	5.430 (0.625)	5.473 (0.632)	5.647 (0.582)	5.817 (0.571)
Bauchi	5.118 (1.373)	5.082 (1.332)	5.352 (1.190)	5.900 (1.336)	5.429 (0.700)	5.474 (0.651)	5.570 (0.579)	5.769 (0.594)
Bayelsa	5.708 (1.226)	5.473 (1.038)	5.612 (1.063)	5.871 (1.393)	5.436 (0.597)	5.599 (0.471)	5.680 (0.623)	5.900 (0.621)
Benue	5.151 (1.276)	5.178 (1.423)	5.427 (1.229)	5.722 (1.393)	5.422 (0.652)	5.465 (0.631)	5.681 (0.592)	5.837 (0.601)
Borno	5.187 (1.394)	5.169 (1.396)	5.337 (1.230)	5.516 (1.189)	5.399 (0.646)	5.417 (0.588)	5.591 (0.579)	5.812 (0.608)
Cross River	5.405 (1.173)	5.362 (1.129)	5.522 (1.124)	5.847 (1.184)	5.456 (0.654)	5.532 (0.655)	5.688 (0.610)	5.870 (0.604)
Delta	5.289 (1.070)	5.432 (1.110)	5.587 (1.039)	5.812 (1.196)	5.389 (0.642)	5.509 (0.666)	5.864 (0.772)	5.852 (0.610)
Ebonyi	5.241 (1.070)	5.320 (1.155)	5.594 (1.120)	5.761 (1.127)	5.432 (0.665)	5.486 (0.666)	5.646 (0.587)	5.778 (0.593)
Edo	5.417 (1.078)	5.461 (1.112)	5.568 (1.150)	5.821 (1.223)	5.398 (0.598)	5.468 (0.610)	5.711 (0.628)	5.821 (0.589)
Ekiti	5.245 (1.170)	5.312 (1.296)	5.657 (1.357)	5.698 (1.253)	5.237 (0.760)	5.512 (0.652)	5.646 (0.561)	5.821 (0.576)
Enugu	5.252 (1.194)	5.390 (1.263)	5.612 (1.171)	5.635 (1.246)	5.369 (0.613)	5.398 (0.595)	5.657 (0.601)	5.785 (0.576)
Gombe	5.016 (1.284)	5.120 (1.396)	5.345 (1.226)	5.546 (1.298)	5.394 (0.634)	5.418 (0.637)	5.575 (0.616)	5.741 (0.574)
Imo	5.356 (1.067)	5.374 (1.157)	5.534 (1.186)	5.901 (1.321)	5.430 (0.630)	5.418 (0.605)	5.658 (0.598)	5.846 (0.584)
Jigawa	4.840 (0.965)	4.952 (1.246)	5.298 (1.189)	5.486 (1.184)	5.505 (1.883)	5.371 (0.619)	5.671 (0.627)	5.787 (0.591)
Kaduna	4.898 (1.099)	5.067 (1.377)	5.423 (1.289)	5.635 (1.353)	5.362 (0.609)	5.391 (0.613)	5.598 (0.589)	5.775 (0.580)

Kano	5.025 (1.291)	4.984 (1.338)	5.432 (1.396)	5.537 (1.270)	5.735 (1.210)	5.863 (1.390)	5.728 (0.637)	5.912 (0.683)
Katsina	5.023 (1.231)	5.052 (1.309)	5.384 (1.304)	5.591 (1.371)	5.401 (0.750)	5.332 (0.620)	5.614 (0.623)	5.912 (0.683)
Kebbi	5.143 (1.216)	5.084 (1.288)	5.397 (1.185)	5.598 (1.285)	5.308 (0.643)	5.400 (0.649)	5.582 (0.568)	5.790 (0.575)
Kogi	5.098 (1.100)	5.132 (1.180)	5.632 (1.261)	5.777 (1.293)	5.382 (0.624)	5.438 (0.620)	5.651 (0.590)	5.838 (0.598)
Kwara	5.127 (1.302)	5.141 (1.376)	5.481 (1.254)	5.699 (1.344)	5.342 (0.596)	5.464 (0.605)	5.637 (0.578)	5.838 (0.592)
Lagos	5.269 (1.108)	5.361 (1.184)	5.658 (1.233)	5.780 (1.237)	5.355 (0.632)	5.446 (0.619)	5.646 (0.569)	5.793 (0.589)
Nasarawa	5.212 (1.393)	5.158 (1.445)	5.472 (1.284)	5.701 (1.460)	5.398 (0.653)	5.436 (0.616)	5.603 (0.561)	5.885 (0.627)
Niger	5.104 (1.266)	5.131 (1.332)	5.385 (1.180)	5.618 (1.318)	5.383 (0.638)	5.483 (0.618)	5.601 (0.545)	5.782 (0.578)
Ogun	5.128 (1.130)	5.245 (1.246)	5.583 (1.180)	5.730 (1.201)	5.342 (0.601)	5.378 (0.607)	5.582 (0.551)	5.786 (0.569)
Ondo	5.219 (1.234)	5.278 (1.282)	5.514 (1.197)	5.721 (1.238)	5.399 (0.604)	5.461 (0.608)	5.631 (0.575)	5.852 (0.572)
Osun	5.218 (1.301)	5.216 (1.408)	5.465 (1.256)	5.648 (1.301)	5.337 (0.610)	5.456 (0.636)	5.624 (0.551)	5.82 (0.587)
Oyo	5.169 (1.285)	5.175 (1.326)	5.480 (1.231)	5.668 (1.318)	5.368 (0.616)	5.513 (0.627)	5.665 (0.593)	5.811 (0.605)
Plateau	5.177 (1.311)	5.143 (1.411)	5.577 (1.338)	5.669 (1.345)	5.368 (0.643)	5.468 (0.619)	5.714 (0.611)	5.873 (0.631)
Rivers	5.438 (1.186)	5.422 (1.179)	5.633 (1.155)	5.841 (1.242)	5.460 (0.651)	5.530 (0.649)	5.688 (0.604)	5.868 (0.609)
Sokoto	5.371 (1.461)	5.068 (1.119)	5.454 (1.155)	5.652 (1.307)	5.353 (0.616)	5.433 (0.649)	5.593 (0.576)	5.737 (0.554)
Taraba	4.822 (1.225)	5.172 (1.375)	5.336 (1.136)	5.609 (1.281)	5.450 (0.614)	5.406 (0.653)	5.624 (0.609)	5.762 (0.579)
Yobe	5.023 (1.138)	5.105 (1.238)	5.420 (1.242)	5.711 (1.400)	5.391 (0.617)	5.482 (0.654)	5.581 (0.586)	5.730 (0.516)
Zamfara	5.101 (1.292)	4.993 (1.273)	5.354 (1.200)	5.604 (1.343)	5.312 (0.618)	5.188 (0.830)	5.631 (0.621)	5.852 (0.624)
Federal Capital Territory/Abuja	5.133 (1.265)	5.252 (1.368)	5.585 (1.317)	5.769 (1.443)	5.372 (0.642)	5.578 (0.643)	5.678 (0.611)	5.810 (0.599)
National	5.195 (1.171)	5.222 (1.219)	5.496 (1.155)	5.585 (1.161)	5.408 (0.604)	5.467 (0.606)	5.651 (0.541)	5.818 (0.534)

Source: Author's estimations.

Note: Prices are expressed in nominal terms. Nominal domestic prices are the unit values that were sourced from NBS commodity prices and averaged across the states. Variances are shown in parentheses. Rice, maize, sorghum, chicken, soya beans, meat, fish, groundnut, oranges, and shrimps were used for agricultural commodities, while manufactured products consist of processed items.

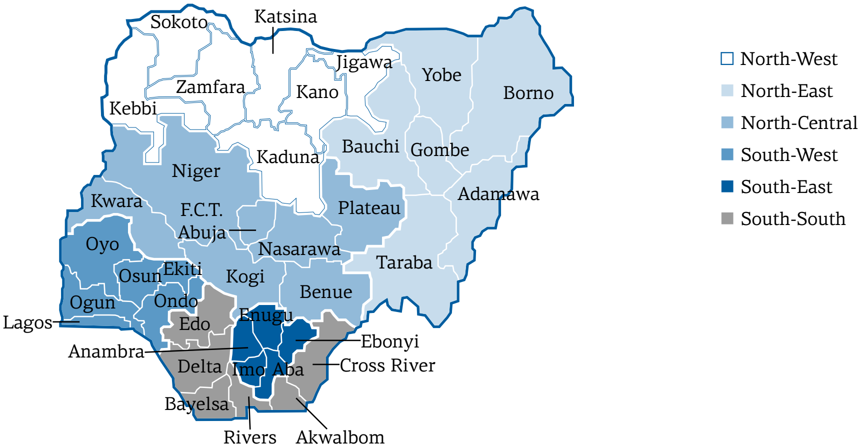
Table A2 Overview of results, 2006–2011 (per cent)

	Pass-through	Income share		Expenditure share		Changes in real income due to		Overall changes in real income due to the CET
	Agriculture	Agriculture	Manufacturing	Agriculture	Manufacturing	Agricultural sales	Consumption expenditure	Total
North-Central	–	**7.3**	**72.5**	**62.8**	**36.4**	**–1.8**	**11.5**	**9.7**
Benue	44.07	23.03	69.82	60.87	38.19	–7.99	21.11	13.12
Kogi	43.98	4.43	81.79	67.86	31.67	–1.48	22.72	21.23
Kwara	46.40	13.09	83.12	66.68	32.56	0.00	0.00	–0.41
Nasarawa	44.30	0.04	45.57	69.66	29.79	0.00	8.39	8.38
Niger	45.45	0.02	90.22	66.06	33.55	0.00	2.56	2.56
Plateau	50.22	2.20	56.42	59.07	39.69	–0.70	18.73	18.03
Federal Capital Territory	47.10	3.48	55.42	46.05	52.62	–0.26	3.40	3.14
North-East	–	**17.1**	**73.7**	**66.9**	**31.8**	**–4.4**	**15.5**	**11.1**
Adamawa	51.99	27.13	72.86	64.72	34.63	–8.80	20.98	12.19
Bauchi	56.08	2.72	74.80	64.2	32.87	–0.36	8.49	8.13
Borno	141.49	20.11	76.31	74.23	24.87	–4.39	16.20	11.81
Gombe	88.4	27.7	55.60	63.75	35.88	–5.75	13.25	7.49
Taraba	53.97	25.58	58.35	79.89	18.70	–7.23	22.58	15.35
Yobe	86.38	7.26	92.72	53.66	45.89	–1.70	13.90	12.02
North-West	–	**9.3**	**75.5**	**71.0**	**28.5**	**-0.4**	**11.9**	**10.2**
Jigawa	77.25	7.33	79.20	66.76	33.11	-0.70	6.39	5.69
Kaduna	52.19	14.49	66.33	66.10	33.10	–3.42	15.58	12.16
Kano	71.16	6.17	73.94	78.12	21.47	–1.03	13.02	11.99
Katsina	74.59	0.02	86.86	59.58	40.16	0	11.66	11.65
Kebbi	54.80	14.88	85.07	76.59	22.49	–1.00	5.14	4.14
Sokoto	62.72	21.88	70.53	67.18	32.67	–6.93	21.29	14.35
Zamfara	59.78	11.40	60.87	87.34	11.81	1.40	10.76	9.36
South-East	–	**15.4**	**65.6**	**58.1**	**40.6**	**–0.9**	**2.9**	**2**
Abia	56.17	1.98	66.78	52.22	46.03	–0.07	1.95	1.88
Anambra	13.13	24.36	66.9	62.68	36.49	–0.67	1.73	1.06
Ebonyi	48.69	0.01	79.1	36.58	63.01	0	0.35	0.35
Enugu	44.49	12.82	56.65	54.96	42.14	–0.28	1.21	0.93
Imo	58.06	24.85	58.92	72.18	26.41	–2.52	7.32	4.80
South-South	–	**12.6**	**61.7**	**59.8**	**39.0**	**-3.3**	**11.8**	**8.4**
AkwaIbom	55.44	10.89	32.41	59.21	38.90	–1.98	10.75	8.78

	Pass-through	Income share		Expenditure share		Changes in real income due to		Overall changes in real income due to the CET
	Agriculture	Agriculture	Manufacturing	Agriculture	Manufacturing	Agricultural sales	Consumption expenditure	Total
Bayelsa	57.53	49.1	44.38	64.28	33.83	–24.81	33.16	8.35
Cross River	52.54	15.43	84.59	61.39	36.61	–2.19	8.70	6.51
Delta	51.86	17.97	82.01	61.06	37.92	–3.29	11.19	7.90
Edo	46.82	1.61	81.54	63.81	35.52	–0.28	11.14	10.86
Rivers	65.37	4.18	53.76	55.34	44.17	–0.70	9.22	8.53
South-West	–	**8.6**	**81.1**	**56.7**	**42.1**	**0.1**	**1.4**	**1.6**
Ekiti	47.18	13.13	75.98	56.55	41.98	–0.36	1.54	1.18
Lagos	65.26	0.27	89.1	51.37	47.61	–0.04	7.27	7.23
Ogun	57.97	0.03	81.72	53.3	44.16	0	2.61	2.61
Ondo	48.14	20.21	78.36	65.00	34.09	–0.54	1.73	1.19
Osun	49.38	14.36	77.43	58.80	39.45	1.04	–4.24	–3.21
Oyo	54.50	8.06	79.02	56.07	42.6	0.03	–0.23	–0.20
National	**59.9**	**11.7**	**71.6**	**62.2**	**36.7**	**–1.9**	**8.9**	**6.9**
Rural	–	24.9	59	79.5	19.1	–7	22	15
Urban	–	11.7	71.9	61.6	37.1	–1.8	8.6	6.8

Source: Author's calculations.

Figure A1 Geopolitical zones of Nigeria



Source: Nairaland, available at: http://www.nairaland.com/359384/scrap-36-states-now-anyaoku/3.

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Viet Nam

Household welfare and pricing of rice: Does the Large-Scale Field Model matter for Viet Nam?

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Abstract

Since 2006, Viet Nam's rice exports have soared, and in 2011 the country surpassed Thailand to become the world's largest rice exporter. Even though one would expect higher rice exports to directly benefit rural households at all levels of well-being, most rice producers in Viet Nam are still poor, living on less than USD 2 per day. The government's efforts to ensure a minimum rate of return for farmers by imposing price floors (minimum prices) have not been successful, as there is no enforcement mechanism in place. This study examines the potential impact on household welfare in Viet Nam of value chain upgrading in rice production through the Large-Scale Field Model. The possible effects of the adoption of such a model are: (a) an increase in the farm gate price of rice, (b) an increase in the productivity of rice farmers, and (c) a reduction in farmers' production costs. The study shows how these changes would affect household welfare, taking into account the ripple effect that a change in the farm gate price of rice would have on other prices in the economy, and hence on household consumption, production, and wage income. The policy simulations in this study assume that farmers do not pass on any cost reductions and productivity improvements to the price of paddy. The results suggest that the implementation of the Large-Scale Field Model in the Mekong River Delta would increase the welfare of households by 4.1 per cent in the short term and 4.9 per cent in the longer term, and reduce poverty rates by approximately 0.55 per cent among the 10 per cent poorest households and by 0.42 per cent among the 20 per cent poorest households in that region.

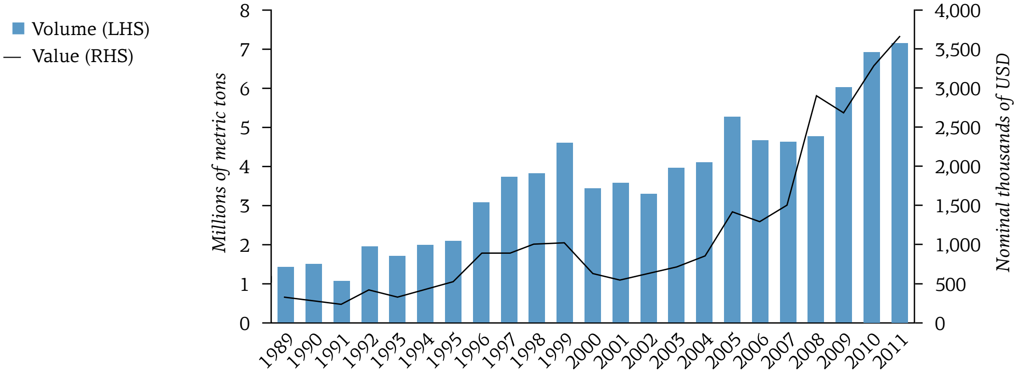
* The authors would like to thank Dang Kim Son and Tran Cong Thang from the Institute of Policy and Strategy for Agriculture and Rural Development, and Bui Trinh from the General Statistics Office of Viet Nam, for their support in the preparation of this study.

1 Introduction

Doi Moi, a Vietnamese term meaning "renovation", marked the beginning of Viet Nam's transition from a centrally planned to a more market-driven economy. Initiated by the Communist Party Congress in 1986, *Doi Moi* became a major phenomenon in Viet Nam during 1986–1990. Its main aim was to promote a multi-sectoral economic system encompassing both state-owned and private enterprises. In the framework of the *Doi Moi* policy, state-owned enterprises were reformed, private sector enterprises and companies with foreign investment emerged *de novo*, and the domestic market was liberalized to allow for free market prices. In agriculture, Politburo Resolution No. 10 made it possible to conclude "end-product contracts" with households; and land use rights were granted for 15 years in 1988, a period further extended to 20 years in 1993 (Pham *et al.*, 2007).

One of the most striking features of Viet Nam's transition was a high growth rate of the gross domestic product (GDP), coupled with a remarkable increase in exports. Before the *Doi Moi*, Viet Nam had to import food for domestic consumption. After the agricultural reforms in 1988, agricultural output rose tremendously and in 1989, Viet Nam became a rice exporter (Pham *et al.*, 2007). The value of the country's rice exports has soared particularly since 2006 (Figure 1). In 2011, Viet Nam surpassed Thailand to become the world's largest rice exporter, with more than 7 million metric tons of rice exported, of which 95 per cent was contributed by farmers – net rice producers – in the Mekong River Delta (Jaffee, 2012a).

Figure 1 Viet Nam's rice exports, 1989–2011

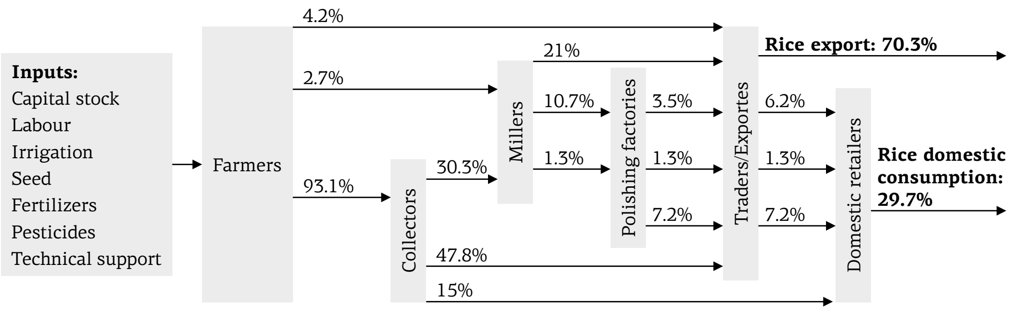


Source: Authors' calculations, based on data from the Vietnam Food Association (VFA, 2006) and General Statistics Office (GSO) of Viet Nam.
Note: LHS stands for left-hand scale, RHS for right-hand scale.

Although higher rice exports could be expected to directly benefit rural households at all levels of well-being, most rice producers in Viet Nam remain poor, living on less than USD 2 per capita per day (Coxhead *et al.*, 2012).

Viet Nam's current rice value chain, shown in Figure 2, explains the main reason for the low incomes of Vietnamese farmers. Owing to the many intermediaries in the chain, the benefits of the remarkable increase in rice export volumes and prices have not accrued to the households that actually grow the rice. As a matter of fact, 95.8 per cent of total paddy rice produced by those households is sold to collectors and (subsequently) to millers, and only 4.2 per cent is sold directly to exporters.

Figure 2 Viet Nam's rice value chain, 2010



Source: Vo and Nguyen (2011).

Collectors, who tend to participate more actively in the value chain (millers or polishing factories act as service providers for collectors), earned 10 times more than farmers in 2011 (Tran *et al.*, 2013). Having more market power than farmers, collectors usually set low prices, particularly if there is a good crop (a surplus of paddy rice supply). Additionally, as most farmers are poor, their biggest need for cash is in the period right after the harvest. They therefore have to sell their output as quickly as possible and at any price (usually lower than the floor farm gate price, i.e. the minimum price set by the government) to settle their debts in time. Table 1 shows that interest payments on farmers' loans alone account for more than 17 per cent of total costs related to rice cultivation. Another problem is the losses directly attributable to poor post-harvest technologies, which do not allow farmers to retain rice for later sale. Post-harvest losses occur as a result of the lack of storage facilities (most farmers use small storehouses and have no storage systems), as well as inadequate paddy drying technology. To save on costs, most farmers prefer sun drying. However, as sun drying is associated with a number of technical constraints,[1] most farmers sell their wet paddy to collectors at considerably lower prices because longer delays mean a higher water loss, which causes shrinkage and loss of weight of their wet paddy harvest.[2]

Table 1 Share of inputs in costs of paddy cultivation (per cent)

	Inputs	Per cent
1	Seed, fertilizers, pesticides	42.4
2	Labour (self-employed)	9.6
3	Labour (hired)	20.6
4	Capital stock (including depreciation)	2.8
5	Irrigation fee	2.5
6	Interest (loan of inputs)	2.8
7	Interest (bank loan)	14.4
8	Transportation	1.6
9	Other (commission for collectors)	3.3
	Total	100.0

Source: Vo and Nguyen (2011).

Over the past five years, the Vietnamese government has experimented with a number of price policy instruments aimed at ensuring a minimum rate of return of 30 per cent for farmers who are engaged in growing paddy. The main instrument consists of "floor prices" for paddy both for exports (minimum export free on board (FOB) price) and for purchases from rice farmers (minimum farm gate price for paddy).[3] Exporters are requested not to sell rice for a price lower than the floor export FOB price, the level

[1] First, sun drying is not possible during rain and at night, so there is a risk that farmers will not be able to dry their paddy right after harvest. Second, the process is labour-intensive and has high requirements with regard to the size of drying pavements/mats that need to be available. Third, temperature control is difficult, with a high likelihood of overheating or rewetting of grains, which in turn can result in low milling quality because of cracks developing in the kernels (IRRI, 2006).

[2] According to Tran *et al.* (2013), only 5 per cent of farmers sell dry paddy to collectors.

[3] The minimum export FOB price of rice is set based on the price of rice on the world market (Circular 89/2011/TT-BTC issued on 17 June 2011), whereas the farm gate price of paddy is set above the average production cost of paddy for each crop (Decree 109/2011/NDD-CP issued on 4 November 2010). Therefore, if the world price of rice falls, according to Circular 89/2011/TT-BTC, exporters have to maintain their profit by reducing other costs but not the farm gate price of paddy.

of which is set on the assumption that exporters would buy paddy directly from farmers for the recommended floor farm gate price.[4]

As shown in Figure 2, exporters (or even domestic retailers) almost never buy paddy from farmers, but rather from millers and/or polishing factories. What prevents farmers from selling directly to exporters and/or domestic retailers?

One of the main reasons is the imperfect competition among Vietnamese rice exporters. In Viet Nam, 50 per cent of rice is exported through government-to-government (G2G) contracts. The Vietnam Food Association has the right to allocate 80 per cent of total volume of G2G contracts to its members, which are mostly state-owned enterprises (SOEs) (Tran *et al.*, 2013).[5] As SOEs have little incentive to improve performance (Boycko *et al.*, 1996) and G2G contracts do not require high-quality rice, these public exporters have become less active in searching for new markets or improving the quality of exported rice. As a result, Viet Nam's current export prices are typically the lowest when compared with those of Thailand (see Table A1 in the Annex), India and Pakistan. The apparent lack of capacity of public exporters to bargain for a higher export price of Vietnamese rice puts pressure on them to lower the domestic price of rice to maximize their margin. Therefore, public exporters prefer to buy rice from collectors rather than directly from farmers, as this allows them to avoid paying the official floor farm gate price for paddy. The government currently lacks enforcement measures, so collectors, who are non-registered entities (i.e. operate in the informal sector), can evade the floor farm gate price enforcement.[6] As a result, in the event of a good crop, prices of paddy paid to farmers fall and exporters benefit from these lower prices offered by collectors.

Other reasons preventing a direct linkage between farmers and exporters are high transportation and transaction costs. One of the characteristics of the Mekong River Delta is the existence of interlacing drainage and irrigation canal systems, which also serve as transportation routes. Boat

[4] Resolution No. 63/NQ-CP issued on 23 December 2009, and Decree 109/2011/NDD-CP issued on 4 November 2010.

[5] Two SOEs, Vinafood I and Vinafood II, which supply most of the volume of G2G contracts, accounted for 15 per cent and 41 per cent, respectively, of total rice export in 2008 (AgroInfor, 2009).

[6] According to Circular 89/2011/TT-BTC issued on 17 June 2011, exporters have to report their export prices to the VFA, but collectors do not have the same obligation. Since the linkages between collectors and farmers take place within the informal economy, it is very difficult for the VFA to determine which collectors buy from farmers and what volume/value of paddy they procure from them.

transportation is the only means for transporting paddy from the fields to the market. As paddy is grown in small fields, which mostly have a size of 0.5 to 2 hectares (ha) (see Figure 4 in Section 2.2), it is not possible for exporters to buy large volumes because these cannot be delivered by small individual farmers. Moreover, even if exporters could buy directly from farmers, it would be costly (in terms of transportation costs and losses directly attributed to transport) and less convenient (in terms of differences in harvest time). That is why collectors, who own small boats, have long played a key role in connecting small farmers who produce only limited volumes of rice for sale with exporters who require larger volumes of paddy to fulfil their export contracts.

Owing to the multi-layered rice value chain and the lack of a mechanism to effectively enforce the floor prices, efforts by the Vietnamese government to ensure a minimum rate of return for farmers by imposing price floors have not been successful. To address existing constraints and help farmers increase their income from growing rice, local authorities in the Mekong River Delta area have designed and are currently piloting a set of policy measures under a project called the Large-Scale Field Model (LSFM).

This study examines the potential impact of the LSFM on household welfare in Viet Nam. Possible effects of the adoption of the project are: (a) an increase in the farm gate price of rice, (b) an increase in the productivity of rice farmers, and (c) a reduction in farmers' production costs. The study shows how these changes would affect household welfare, taking into account the ripple effect that a change in the farm gate price of rice would have on other prices in the economy, and hence on household consumption, production, and wage income.

The policy simulation in this study suggests that implementation of the LSFM in the Mekong River Delta would increase the welfare of households by 4.1 per cent in the short term and 4.9 per cent in the longer term. It would also reduce poverty rates by approximately 0.55 per cent among the 10 per cent poorest households and by 0.42 per cent among the 20 per cent poorest households in that region.

The next section of this study explains the LSFM and the various channels through which it affects those involved in the rice production. Section 3 provides a literature review of the impact of rice price changes on household welfare in Viet Nam. Section 4 presents the methodology used to estimate *ex ante* price changes and welfare effects, and Section 5 describes data sources used in the estimations of price changes and welfare effects.

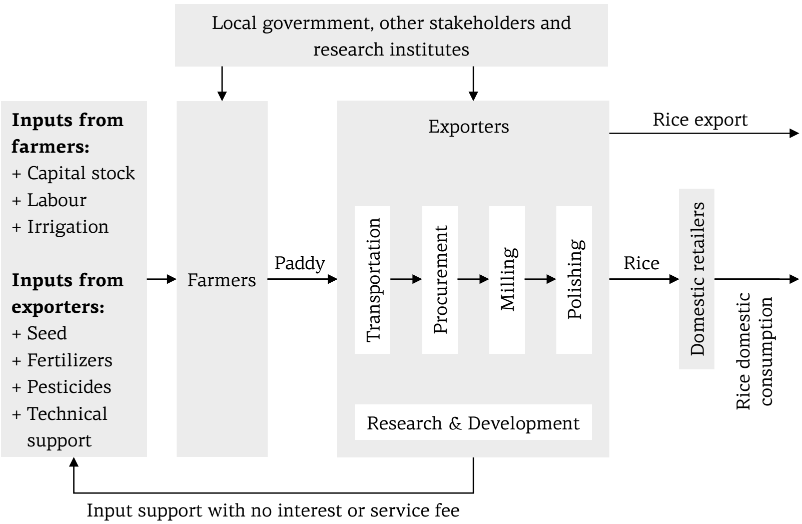
Section 6 presents the pass-through and price change estimations and Section 7 puts forth a policy simulation with *ex ante* estimations of the welfare effects of the LSFM. Section 8 summarizes the main findings and, based on them, proposes several policy recommendations.

2 The Large-Scale Field Model

2.1 How the Large-Scale Field Model works

Figure 3 shows the design of the LSFM, which is an upgrade all along the current rice value chain described in Figure 2. The core of the intervention is to set up a large-scale field with participation of farmers and exporters. Once the linkage between farmers and exporters has been established, the various actors previously involved in the relation between them (collectors, millers, and polishing factories) become superfluous, and paddy produced by farmers can be sold directly to exporters.

Figure 3 The LSFM – A value chain upgrading intervention



Source: Authors, based on the case of An Giang Plant Protection Joint Stock Company (Dao et al., 2013).

According to a study by Dao *et al.* (2013) of an LSFM recently put in place by the An Giang Plant Protection Joint Stock Company (AGPPS),[7] the LSFM works as follows:

- The government's land consolidation programme allows for the swapping of fragmented agricultural fields between households to form a large-scale field, without any change in title to the land.[8] Hence, a large-scale field can be set up under a common agreement among all participating small farmers, who continue to be responsible for the cultivation of a small portion of the aggregated large field.

- An exporter coordinates the agglomeration of all the small farmers. However, unlike the collective farming that dominated Viet Nam's agriculture between 1954 and 1988,[9] the LSFM is not a public entity. Its focus is on pursuing the objectives of efficiency and profit maximization rather than addressing the objectives of social welfare maximization set by the government.

- Once a farming agreement has been signed between farmers and the exporter, the exporter provides the following to control the quality of growing paddy: (a) inputs (e.g. seed, fertilizers, pesticides)[10] for rice production in the form of no-interest loans; (b) technical services conducted by the exporter's technical expert (called "farmer friend"), directly linked with the exporter's research institute (if any) or other research institutes; (c) free on-farm transportation and procurement services (because the volume of crop harvested from the LSFM is large enough to set up on-farm grain silos, traditional boat transportation is not necessary); (d) in the case of AGPPS, one month of free storage for paddy

[7] A total of 1,000 ha of large-scale fields were first piloted by AGPPS in An Giang Province for the winter-spring crop of 2010–2011. By 2013, the total area of the AGPPS LSFM had reached more than 80,000 ha located in three provinces of the Mekong River Delta: An Giang, Dong Thap, and Long An (Dao *et al.*, 2013).

[8] Before 1945, agricultural land in Viet Nam was privately owned; 24.5 per cent of land belonged to only 4 per cent of the population. From 1953 to 1957, when Viet Nam was divided into two separate states, 810,000 ha of agricultural land were redistributed to more than 2 million households in the north of the country, based on household size (Le, 2007). Redistribution of land was, however, not implemented in the south of Viet Nam. Therefore, while all households in the north have access to agricultural land today, poor households in the south do not have their own land. For this reason, land is highly fragmented in the north (Red River Delta) and less fragmented in the south (Mekong River Delta). However, households do not have the ownership title to their agricultural land (all land belongs to the state) but are only granted a land use right. In the framework of the *Doi Moi* policy, land use rights were granted for 15 years in 1988, a period further extended to 20 years in 1993. Land use rights are considered as assets and can be transferred or used as collateral.

grain, which allows farmers to keep rice for later sale; and (e) a commitment to buy all paddy harvested. If farmers for any reason do not want to sell their rice to the exporter, they have to compensate the exporter by refunding the inputs provided, the costs of packaging bags, transportation costs, and the costs of procurement services (if any).

As can be seen, applying the LSFM would provide a secure and stable supply source of high-quality paddy grain for rice exports.[11] Consequently, the exporter could bargain for a higher export price of Vietnamese rice on international markets. The profits from the increased export price would be shared between the farmers – through an increased farm gate price (pass-through effect) – and the exporters (who would thus also be compensated for the "free" transportation, milling, polishing, and storing services provided to the farmers).[12]

2.2 Location – Why not the Red River Delta?

In Viet Nam, the Red River Delta and the Mekong River Delta are the two main sources of rice supply.[13] While 95 per cent of rice exports are produced in the Mekong River Delta, rice from the Red River Delta is destined for domestic consumption. Therefore, the Mekong River Delta was the natural first choice as the location for the LSFM. Additionally, as shown in Figure 4, almost all farmers in the Red River Delta cultivate small farms (under 0.5 ha and even under 0.2 ha), whereas in the Mekong River Delta, more than 60 per cent of farmers have larger agricultural lands (0.5 ha and above). It is therefore more feasible to create a large-scale field needed for the project in the Mekong River Delta.[14]

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9 Politburo Resolution No. 10 (1988) put an end to the collective farming model of the planned economy because of its inefficiency.

10 Seed is important in determining the quality of exported rice. Paddy is sensitive to the natural condition of the flooded parcel of arable land (e.g. soil) as well as the technique of cultivation (the way farmers use fertilizers, pesticides, and water from irrigation). Using the wrong seed can lead to a low or even no crop yield.

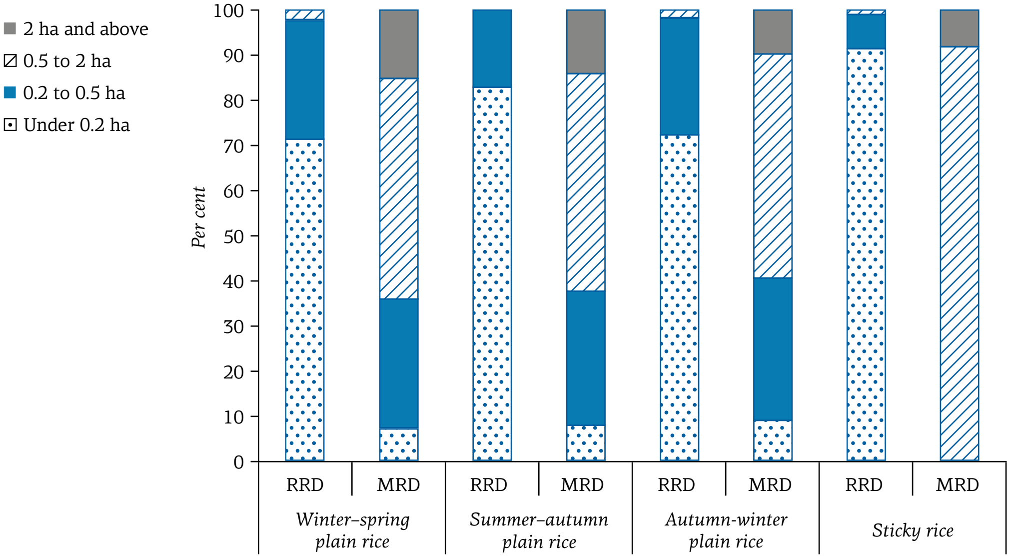
11 Exporters would apply quality management procedures to assure that the cultivation process strictly follows the Vietnamese Good Agricultural Practices and the Global Good Agricultural Practices.

12 As it is not expected that state-owned exporters would have an incentive to efficiently implement the LSFM scheme, private exporters who are not protected against competition will likely lead its implementation. However, in order to broaden the scope of the LSFM scheme, the government should also encourage it through policy measures.

13 See Figure A3 in the Annex for the geographical location of the Red River Delta and the Mekong River Delta.

14 Finally, the policy simulation's finding that farmers in the Red River Delta might not benefit from the LFSM's paddy price increase (see the baseline scenario in Section 7.2) provides more supporting evidence for the choice of location for the LSFM.

Figure 4 Farm size (per cent)



Source: Authors' calculation, based on the 2010 Viet Nam Household Living Standards Survey (VHLSS).
Note: RRD stands for Red River Delta, MRD stands for Mekong River Delta.

2.3 Paddy price increase

What would be the expected increase of the farm gate price if the LSFM were implemented? The increase is computed using information on the prices along the value chain from Vo and Nguyen (2011). The focus is on the best-case scenario for farmers under the assumption that rents previously captured by collectors, millers and polishing factories would be transferred to farmers. Furthermore, the export price of rice is assumed to remain unchanged at Vietnamese dong (VND) 9,737 per kilogram (kg). As shown in Table 2, under the best-case scenario for farmers, if total rents originally distributed among intermediaries were allocated to farmers, one could assume that the farm gate price of paddy would increase from VND 5,212 to 5,728 per kg. Hence, the marginal increase in the farm gate price of paddy would amount to 9.9 per cent.

Table 2 Price and value added in the current and upgraded rice export value chain (VND per kg)

	Current rice export value chain			Upgraded rice export value chain		
	Cost	Value added	Price	Cost	Value added	Price
Farmers	4,672	540	5,212	4,672	1,056	5,728
Collectors	1,208	280	6,700			0
Millers	447	186	7,333			0
Polishing factories	793	50	8,176			0
Exporter	1,139	422	9,737	3,587	422	9,737
Total	–	1,478	–	–	1,478	–

Source: Vo and Nguyen (2011) and authors' calculations.

As explained above, the current low quality of Vietnamese rice makes exporters less competitive in the international market. One of the benefits of the LSFM is that it facilitates the production of high-quality paddy. Because Viet Nam's rice export prices were similar to those of Thailand during 2008–2010, one could expect that, in the medium term, Viet Nam's export prices would increase by 11.4 per cent, which equals the smallest gap between Viet Nam's and Thailand's export prices in 2011–2013 (see Table A1 in the Annex). As can be computed from the data in Table 2, under the upgraded rice value chain, production cost per kg of exported rice (VND 5,728) accounts for about 59 per cent of the export price of rice (VND 9,737). If farmers could keep the same share of the increase in the export price of rice, there would be a further marginal increase of the farm gate price of paddy by an expected amount of 11.4 per cent.[15]

2.4 Reduction of production costs

A reduction of production costs would arise because farmers in Viet Nam currently cultivate fragmented agricultural land. The small size of plots prevents them from taking advantage of modern agricultural machinery (such as tractors) and thus raises labour costs (Markussen *et al.*, 2012). Table 3 shows the costs of growing paddy associated with three main crops per year observed among a group of farmers cultivating a

[15] Exporters could agree to pass on 59 per cent (which equals the share of production costs in the export price of rice) of the increase in the export price of rice to farmers, as their increased bargaining power in international markets would result from the higher quality of paddy produced by farmers under the LSFM.

large-scale field and another group cultivating fragmented fields. Table 3 shows that by achieving economies of scale, cost saving (1) would be VND 456 per kg of paddy, which equals 11.1 per cent of the average production costs under the case without the LSFM (VND 4,096 per kg of paddy). Farmers would benefit from direct linkages with exporters in terms of cost savings by having access to interest-free input-material loans, and free packaging bags for paddy storage. Thus, the cost saving (2) from having access to these services would be about 3 per cent of the farm gate price of paddy. Hence, the total cost saving (3) would be 14.1 per cent of the current average production costs under the case without the LSFM.[16]

Table 3 Production costs savings under the Large-Scale Field Model

	With the LSFM	Without the LSFM
1. Production costs per kg of paddy (VND)		
Winter-spring crop	2,951	3,309
Summer-autumn crop	3,921	4,311
Autumn-winter crop	4,050	4,669
Average production costs	3,640	4,096
Cost saving (1)	456	
Cost saving (1) as a share of the average production costs under the case without the LSFM (per cent)	11.1	
2. Benefits from exporters per kg of paddy (VND)		
No-interest loan on inputs	83	0
Free packaging bags	40	0
Cost saving (2)	123	
Cost saving (2) as a share of the average production costs under the case without the LSFM (per cent)	3.0	
3. Total cost saving (3) as a share of the average production costs under the case without the LSFM (per cent)	14.1	

Source: Authors' calculations, based on data from Dao et al. (2013).

2.5 Productivity increase

The difference in productivity (yield per farm size) between large farms (2 ha and above) and small farms (under 0.2 ha) can be used as a proxy for

[16] This study assumes that there is no pass-through of cost reductions on the farm gate price of paddy. Further discussion of this assumption can be found in Section 4.3.

the expected productivity increase under the LSFM. Table 4 suggests that a large farm size could improve average yield by 14 per cent.[17]

Table 4 Productivity by farm size (kg per square metre)

Productivity	Winter–spring crop	Spring–autumn crop	Autumn–winter crop	Average yield
Under 0.2 ha (1)	0.577	0.448	0.44	
0.2 to 0.5 ha	0.602	0.449	0.418	
0.5 to 2 ha	0.65	0.477	0.467	
2 ha and above (2)	0.655	0.501	0.513	
Productivity improvement (per cent) if upgrade from small farm (1) to large farm size (2)	13.5	11.8	16.6	14.0

Source: Authors' calculations, based on the 2010 VHLSS.
Note: The average yield is computed as a simple average across the three crops.

3 Related literature

At the macroeconomic level, it is expected that trade liberalization would stimulate growth and that higher growth would in turn lead to welfare gains and poverty reduction. Chi-Chung *et al.* (2002) investigate the behaviour of main rice exporters (in Thailand, Viet Nam and the United States) and rice importers (in Brazil, Europe, Japan, the Philippines and the former Soviet Union) and find that there are welfare gains of USD 1,492 million when all trading countries comply with the free trade agreement (which implies that all countries are price takers and act as perfect competitors).

At the microeconomic level, there is consensus that households are affected by price changes: after a price increase, net consumers are worse off and net producers are better off. The impact of a price change of rice has been largely studied in Viet Nam. On the one hand, a number of authors have reported a positive impact of a price increase of rice exports on household welfare. Minot and Goletti (1998) find that rice export liberalization in Viet Nam would raise food prices but also increase average real income and reduce poverty. In a later study, they show that a rice price increase of 14 to 22 per cent could bring about USD 200 million in welfare gains, a quarter of which would be distributed to households and the rest to SOEs (Minot

[17] This study assumes that there is no pass-through of productivity increases on the farm gate price of paddy. Further discussion of this assumption can be found in Section 4.3.

and Goletti, 2000). Benjamin and Brandt (2002) find that significant increases in the price of rice have a largely beneficial impact on rural household welfare. On the other hand, Coxhead *et al.* (2012), using a macro-micro model, find a negative effect of an increase in the price of rice on household welfare, especially among the poor.

Despite the availability of numerous studies on the effects of rice price changes on household welfare, it is still not clear whether Vietnamese households would on average win or lose from rice price increases. One of the possible reasons may be that most of the studies were conducted long before Viet Nam's rice export prices soared in 2006. Since 2006, there has been a large change in policy instruments that have influenced both prices and volumes of rice exports. Another reason may be the limitation of data. In their macro-micro model, Coxhead *et al.* (2012) investigate the impact of the price change in 2008 but use the 2003 Social Accounting Matrix and the database of household income and expenditure in the 2004 VHLSS.

4 Methodology

As discussed in Section 2, the LSFM will affect household welfare through the effects that it will have on: (a) farm gate prices of paddy, (b) productivity of rice farmers, and (c) production costs. This section models how these changes would affect household welfare, taking into account the ripple effect that a change in the farm gate price of paddy would have on other prices in the economy, and hence on household consumption, production, and wage income.

4.1 Modelling price changes

One of the main channels through which the LSFM will affect household welfare is via the increase in farm gate prices of paddy. At the same time, any change in prices of paddy will result in changes in prices of other goods in the economy.

There are several ways of modelling the ripple effect that a change in the farm gate price of paddy would have on other prices in the economy. The econometric estimation model (Nicita *et al.*, 2005; Balat *et al.*, 2009) and the global simulation model (Francois and Hall, 2009) are useful for simulating effects of tariff reductions and global, regional, or unilateral trade policy changes. But they are not useful for simulating the effects of price changes of a certain sector's products on the prices of another sector's products in an economy. Moreover, the data limitation with regard to key inputs (such as export-supply elasticities and import-demand elasticities) is a major constraint in these estimations, particularly in terms of reconciling the trade data classification with the living survey classification.

To estimate the price changes that result from a change in tariffs or prices of goods, one could use the Computable General Equilibrium (CGE) model (Chen and Ravallion, 2004). However, this model has many limitations in terms of assumptions with regard to the functioning of an economy. A major weakness of the CGE model is the limitation of data required to calibrate the parameters of the model to accurately represent the studied economy. Therefore, studies using CGE models to represent the Vietnamese economy have so far borrowed the parameters from other economies (Coxhead *et al.*, 2012).

Taking into account the methods and data availability, this study therefore prefers to use the cost-push Leontief price model to estimate the price changes (Miyazawa, 1976; Oosterhaven, 1996; Dietzenbacher, 1997; ten Raa, 2005; Miller and Blair, 2009). In this model, the value-added coefficient is the difference between the revenues per unit of output (the price of the commodity) and the material costs per unit of output. Hence, the cost-push Leontief price model has the following equation:

$$p = A'p + v \tag{1}$$

where p is the column vector of index prices (number of sectors (n)); v is the column vector of the value-added coefficient, i.e. value added per unit of output (number of sectors (n)), and A is a transposition of the input coefficient matrix (number of sectors (n) by number of sectors (n)).

If the farm gate price of paddy increases, which is considered a price shock, we could estimate the changes in prices of other goods using equation (1). Following Miyazawa (1976), we split the set of n sectors of the input-output (I – O) table into two subgroups: the P sector, which consists of the paddy sector, and the S sector, which consists of the rest of the $n-1$ sectors of the economy. The $n \times n$ input coefficient matrix A is:

$$A = \begin{bmatrix} P & P_1 \\ S_1 & S \end{bmatrix} \tag{2}$$

where P (1×1) and S_1 $(n-1 \times 1)$ are the submatrices of input coefficients of the paddy sector, and P_1 $(1 \times n-1)$ and S $(n-1 \times n-1)$ are the submatrices of input coefficients of the rest of the $n-1$ sectors.

Equation (1) could be re-written for the two subgroups as follows:

$$\begin{cases} p_p = P' p_p + S_1' p_s + v_p \\ p_s = P_1' p_p + S' p_s + v_s \end{cases} \tag{3}$$

where p_p and p_s are column vectors of index prices of the *P* sector's product (which is paddy) and *S* sector's products (which are the rest of the $n - 1$ products in the economy), respectively; v_p and v_s are *P* sector's and *S* sector's column vectors of value-added coefficients, respectively; and P', S_1', P_1' and S' are transpositions of the matrices *P*, S_1,P_1, and *S*, respectively.

As we want to estimate the effects of paddy rice price changes on prices of other goods in the economy, in system (3), we take p_p and v_s as exogenous variables, whereas p_s and v_p are endogenous variables.

Under the cost-push effect, if the price of paddy rises from p_p to $(p_p+\Delta p_p)$, we could determine the price increase in other *S* sectors by solving the system as follows:

$$\Delta p_s = (I - S')^{-1} P_1' \Delta p_p = T' P_1' \Delta p_p = (P_1 T)' \Delta p_p = T_1' \Delta p_p \tag{4}$$

Note that the price increase in other *S* sectors estimated under equation (4) could be viewed as a result of: (a) direct effects of change in the price of paddy, (b) second-order or indirect effects, and (c) paddy input in *S* sectors induced by internal propagation in *S* sector industries $T_1 = P_1 T = P_1 (I - S)^{-1}$ (Miyazawa, 1976).

4.2 Estimating labour income effects

Wages are the key source of income for many households. They depend on the prices of goods, particularly given the fact that the Vietnamese labour market is segmented (M4P2, 2009). To estimate the elasticity of wages with respect to changes in prices, we can modify system (3) by splitting the value-added component of each sector into a wage component *w* (compensation of employees per unit of output) and a capital stock component *r* (rent paid to capital stock per unit of output):

$$\begin{cases} p_p = P' p_p + S_1' p_s + w_p + r_p \\ p_s = P_1' p_p + S' p_s + w_s + r_s \end{cases} \tag{5}$$

where $\begin{cases} v_p = w_p + r_p \\ v_s = w_s + r_s \end{cases}$

If we take p_p and v_s as exogenous variables, whereas p_s and v_p are endogenous variables, from system (5), the variation of v_p could be seen as the change in wage in the P sector due to the change in price of the P sector's product (Miyazawa, 1976). Under the cost-push effect, if the price of the P sector's product increases from p_p to $(p_p + \Delta p_p)$, under the assumption that capital stock coefficients r_p and r_s are constant in the short term and thus have not been affected by price changes, we obtain:

$$\Delta w_p = \{ (I - P') - S_1' \, T' \, P_1' \} \; \Delta p_p \tag{6}$$

The term Δw_p is the response of equilibrium wages in the P sector to the change in the prices of the P sector's product.

The responses of the equilibrium wages to prices under equation (6) will differ across different sectors (industry wage premiums), but will be the same for household members working in the same sector, regardless of their labour skills.

4.3 Modelling welfare effects

Non-parametric density estimations and regressions are used here to study the distributional effects of rice price changes in relation to household characteristics, particularly living standards and geographical locations. The idea of non-parametric analysis was first introduced by Deaton (1989a) and then extensively used in various studies on welfare analysis (Deaton, 1989b; Budd, 1993; Benjamin and Deaton, 1993; Barrett and Dorosh, 1996; Sahn and Sarris, 1991). An extension of Deaton (1989a) considers the responses of the labour market because a change in the price of a good will affect labour demand and then the wage in the production sector of this good.

For each household, the welfare impact could then be calculated as follows:

$$du^h = \sum_p (\Phi_p^h - C_p^h) \, dp_p + \sum_{p,j} \theta_j^h \, \varepsilon\omega_p \, dp_p \tag{7}$$

where Φ_p^h is the share of household income from production of good p; C_p^h is the income share of household consumption spent on good p; θ_j^h is the share of wage income in total household income for member j; and $\varepsilon\omega_p$ is the elasticity of wages earned with respect to the price of good p, estimated in equation (6).

Note the following:

- One would expect that farming must be fairly competitive, so cost reduction and productivity increases could lower the farm gate price of paddy. However, in the LSFM scheme, all paddy harvested in the large-scale fields will be purchased by exporters, as agreed upon by both parties under the contract. On the one hand, this ensures a secure source of high-quality rice for the exporter, on the other hand, farmers do not face competitive pressures (from other producers in the market), and hence do not need to reduce their paddy price.

- Therefore, in the policy simulation, we assume that there is no pass-through of productivity increases and production cost savings to the farm gate price of paddy sold by farmers who join the LSFM. Hence, the change in productivity and the lower cost of production only affect (positively) the household income from paddy production in which the productivity gain (crop yield) leads to higher income, and the saving with regard to costs results in a lower cost of growing paddy.

- The increase in the price of paddy and the change in the price of other goods (first step) affect both household incomes earned from production of these goods and household consumption of these goods. Slight increases in wages (second step) affect wage incomes of household members. Households' exposure to price and wage changes depends on the structure of their income and the allocation of their expenditure

5 Data access and availability

For estimation of the price changes, this study uses the 2007 national I-O table published by the General Statistics Office of Viet Nam, which is the latest national benchmark I-O table based on a direct full survey released in 2010. Viet Nam's 2007 I-O table classifies commodities and industries into 138 three-digit level commodities/industries.

For estimation of welfare effects, this study uses data from the 2010 Viet Nam Household Living Standards Survey, which was conducted by the GSO, with technical assistance from the United Nations Statistics Division, the World Bank, and Statistics Sweden. The surveys are representative at the national level.

In terms of sample design, the 2010 VHLSS is a classical three-stage stratified random survey covering ordinary households at the national level.

The sample size is quite large, with 45,000 households surveyed in the full sample each year. However, because a detailed questionnaire (including expenditures and other subject-specific modules) was applied to a random subsample of about 9,000 households, our policy simulations are based on the 9,000 households in the VHLSS that were selected for the full questionnaire out of the 45,000 households surveyed.

The 2010 VHLSS includes a number of modules providing information on demographics, education, employment, health, income, and labour supply. An expenditure module and extensive modules with information on farm activities related to agriculture, livestock, and aquaculture (including production, sale, inputs, and investment) are also included.

To reconcile the I-O table classification with the VHLSS sector classification, we aggregate the I-O table into 138 sectors and 81 sectors for estimations of household consumption/income effects and labour income effects, respectively.

Finally, we use data on monthly export prices of rice of Viet Nam and Thailand (in USD, current prices) as shown in Table A1 in the Annex. For the estimation of price transmission effects of the paddy price increase in the Mekong River Delta on other parts of the country (see Section 7.3), we use domestic prices of rice and farm gate prices of paddy (current prices) in the Mekong River Delta and the Red River Delta regions, which are available from the Information Center for Agriculture and Rural Development (AgroInfor) for the period from January 2008 to the present.

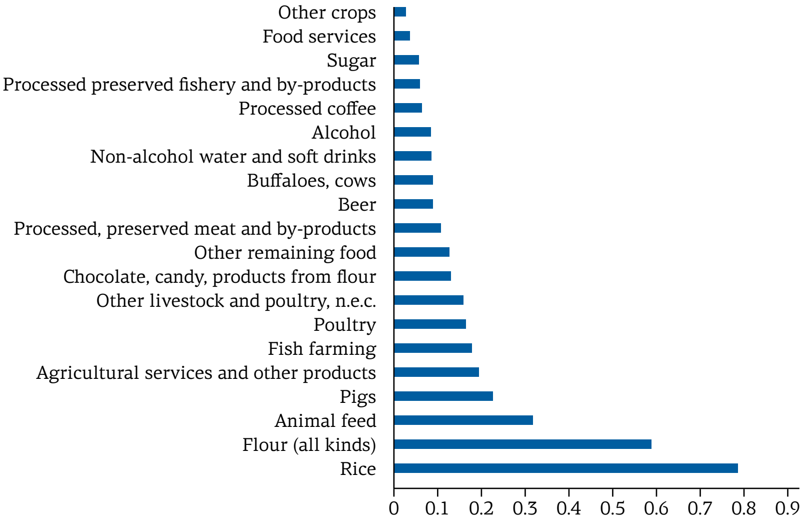
6 Estimation of price change

The Vietnamese 2007 I-O table classifies commodities and industries into 138 three-digit level categories. This classification is almost perfectly concordant with the household consumption data and production income data. For labour income effects, we have to reconcile the I-O table with sectors of the household survey containing data on labour income. We thus aggregate the 138 sectors with the 81-sector classification of the household survey's labour income data.

Figure 5 presents our estimation of the top 20 price increases (out of 138) resulting from a 1 per cent increase in the farm gate paddy price, using equation (4). This vector of price changes for the 138-sector classification is used for the estimation of the consumption and production income effects. The largest price increases are recorded for rice (0.8 per cent), flour

(0.6 per cent), animal feed (0.3 per cent), and other agricultural and aquacultural sectors. The cost-push effects tend to be concentrated in some agricultural commodities and processed foods.[18]

Figure 5 Estimation of the top 20 price increases due to a 1 per cent increase in the farm gate price of paddy (per cent)



Source: Authors' estimations.
Note: n.e.c. stands for not elsewhere classified.

7 Policy simulation

7.1 Scenario definition

This section uses the estimates for the farm gate price of paddy, productivity increases, and production cost reductions from Sections 2 and 6 to simulate the impact of the LSFM on household welfare in the Mekong River Delta and Red River Delta (only baseline scenario). Results from Section 2 are used to define the scenarios described in Table 5. The baseline scenario incorporates only a 1 per cent increase in paddy price. The objective of this scenario is to test the distributional effects of a 1 per cent increase in the farm gate price on the welfare of households in the Red River Delta and the Mekong River Delta, and hence, provide more supporting evidence for the choice of location for the LSFM.

[18] A comprehensive list of the 138-sector and 81-sector price changes, and the estimation of wage increases (using equation (6)) are available from the authors upon request.

Table 5 Definition of scenarios

	Location	Parameters
Baseline scenario	Red River Delta and Mekong River Delta, rural areas	Paddy price increase by 1 per cent
Scenario 1	Mekong River Delta, rural areas	Paddy price increase by 9.9 per cent (owing to the direct farmers-exporters linkage) Production cost reduction by 14.1 per cent Productivity increase by 14 per cent
Scenario 2	Mekong River Delta, rural areas	Paddy price increase by 9.9 per cent (owing to the direct farmers-exporters linkage) Production cost reduction by 14.1 per cent Productivity increase by 5 per cent
Scenario 3	Mekong River Delta, rural areas	Paddy price increase by 9.9 per cent (owing to the direct farmers-exporters linkage) Production cost reduction by 14.1 per cent Productivity increase by 10 per cent
Scenario 4	Mekong River Delta, rural areas	Paddy price increase by 9.9 per cent (owing to the direct farmers-exporters linkage) Further paddy price increase by 11.4 per cent (owing to the 11.4 per cent increase in the export price of rice) Production cost reduction by 14.1 per cent Productivity increase by 14 per cent

Source: Authors.

Scenario 1 is our short-term policy simulation, which incorporates not only the paddy price increase (9.9 per cent), but also the improvement in productivity (14 per cent) and the lower cost of paddy production (14.1 per cent).

It might be bold to assume that the increase in productivity following the LSFM would simply be equivalent to the difference in the observed productivity of large versus small farms. In scenarios 2 and 3, we therefore use productivity growth of only 5 and 10 per cent, respectively, to see how sensitive welfare is to changes in productivity growth.

It is important to note that the simulations assume that the farmers do not pass any cost reductions and productivity improvements on to the price of paddy. This assumption is based on the observed case of the LSFM run by the AGPPS (Dao *et al.*, 2013), where farmers who join the LSFM are not in competition with other farmers in the market (see Section 4.3).

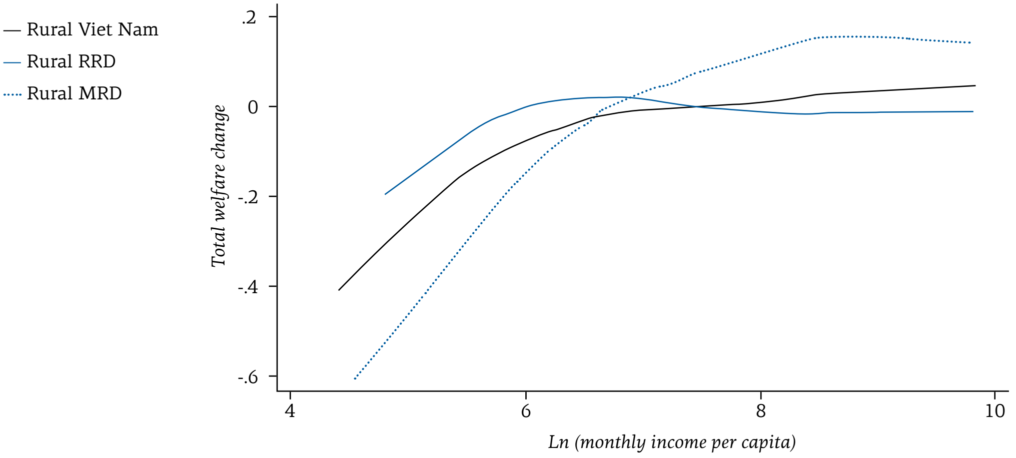
Scenario 4 is designed for a longer term: productivity grows by 14 per cent but, due to the upgrade of rice quality, exporters will have a stronger capacity to bargain for an increase in the export price of rice. As discussed in Section 2, they could then agree to pass 59 per cent (equal to the share of paddy price in the export price of rice) of the increase in the export price of rice on to the producers. This would result in an 11.4 per cent increase of the farm gate price of paddy, in addition to the 9.9 per cent increase due to the direct farmers-exporters linkage.

7.2 Results

7.2.1 Baseline scenario simulation

Figure 6 shows total welfare effects. For rural households in the Red River Delta, estimations show that a 1 per cent increase in the farm gate price of paddy would not benefit the average household welfare across the entire income distribution. Losses decrease as household income increases, but the total effects on poor households are found to be significantly negative. The middle-income and rich households would be neither hurt nor better off. Due to the very small size of farms in the Red River Delta, the poorer households tend to be net consumers of rice – their gains from selling paddy are not large enough to offset the negative consumption effect, whereas the labour income effect is zero. Therefore, it is not surprising that, even though most of the poor rural households in the Red River Delta are rice farmers, faced with the paddy price increase, they are not better off.[19]

Figure 6 Baseline scenario – Total welfare effects

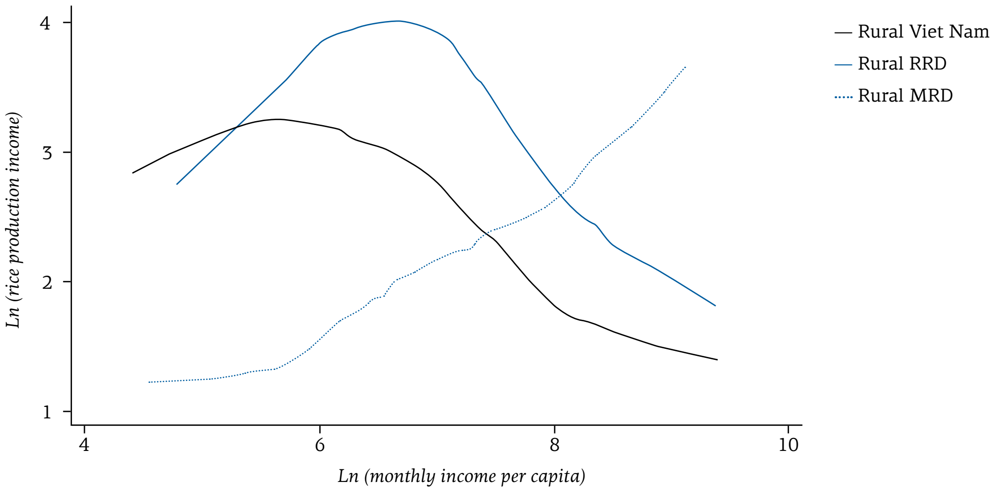


Source: Authors' calculations.

In the Mekong River Delta, we find a pro-rich bias in welfare gains. Welfare losses for poor households amount to 0.6 per cent of the initial income. For middle-income and rich households in the rural areas of the Mekong River Delta, total welfare effects are found to be positive and gains extend to nearly 0.2 per cent of initial income. The negative welfare effects on the poor in the Mekong River Delta are due to the fact that these households are larger net consumers of rice than richer households.[20]

Figure 7 highlights the difference in income from rice production between households in the Mekong River Delta and the Red River Delta. In the Red River Delta, only poor households depend on rice production income. This situation is reversed in the Mekong River Delta, where richer households earn a significant share of income from selling paddy.

Figure 7 Distribution of income from rice production



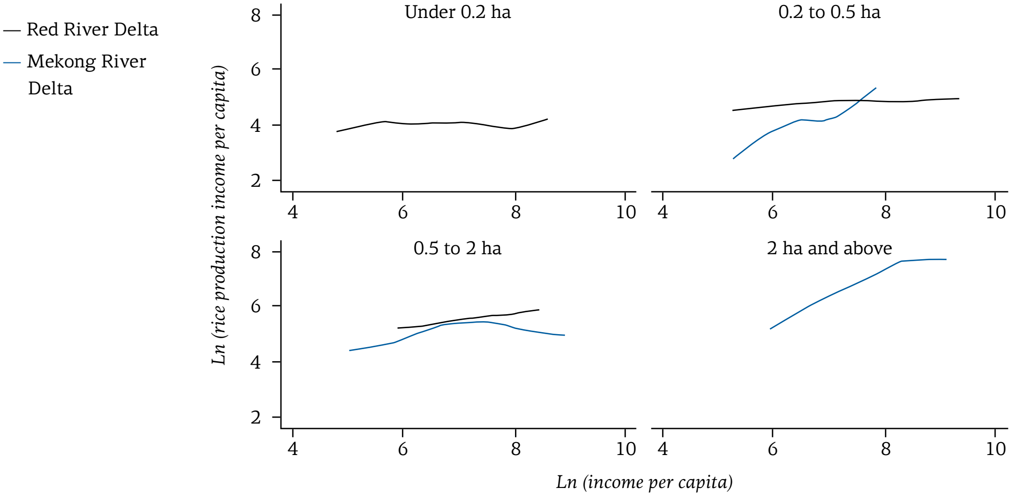
Source: Authors' calculations.

[19] Rice is the main source of calories in the diet of the Vietnamese population. It accounted for 57 per cent of the daily calorie intake in Viet Nam over 2005–2007, compared to 26 per cent in China, 38 per cent in Thailand, 48 per cent in the Philippines, and 49 per cent in Indonesia. Per capita consumption of rice in Viet Nam is 135 kg, the second highest among Asian countries, just after Myanmar (Jaffee *et al.*, 2012b). According to Jaffee's calculation, in-house rice consumption per capita is higher among rural populations and among the poorest income group.

[20] Figures A1 and A2 in the Annex focus only on the effects on consumption and production in the Mekong River Delta (effects on wage income are zero).

Figure 8 shows rice income by farm size. In the Red River Delta, income from rice production does not merely depend on farm size or the level of household income. As discussed in Section 2.2, larger fragmentation in the Red River Delta is a constraint for farmers to achieve economies of scale. In the Mekong River Delta, however, productivity gains would be higher and income earnings from rice production hence greater for larger farms and higher levels of household income (poor households usually have no land for cultivation and gain income by working for other richer households).[21]

Figure 8 Rice income by farm size



Source: Authors' calculations.

In conclusion, our baseline scenario suggests that farmers in the Red River Delta who work on small farms are net consumers of rice and hence might not benefit from the paddy price increase under the LSFM. However, farmers in the Mekong River Delta are likely to be potential members of the LSFM policy target group. Because larger gains would be captured by richer households, households with a farm size of 2 ha or above would benefit more from participating in the LSFM.

[21] As explained above, agricultural land in Viet Nam belongs to the state and is only for lease for a 20-year period (according to the Land Law). Unlike farmers in the Red River Delta, to whom agricultural land was redistributed according to their household size during 1953–1957, farm size in the Mekong River Delta is a result of the historical development of this region and does not depend on the size of households.

7.2.2 Policy simulation: Scenarios 1 to 4

As farmers in the Red River Delta might not benefit from the LSFM scheme, our simulations only focus on the Mekong River Delta. Table 6 shows *ex-ante* average effects of policy simulation in terms of rural household welfare effects and poverty reduction effects in the Mekong River Delta. The LSFM would increase the average rural household welfare in the region. The average gains are 4.1 per cent of initial income in the short term (scenario 1) and 4.9 per cent of initial income in longer term (scenario 4).

Table 6 Simulation results (per cent)

Labour income	Production income	Consumption	Total effects	Reduction in poverty rate among the poorest 10 per cent	Reduction in poverty rate among the poorest 20 per cent
Scenario 1					
0	5.458	-1.337	4.121	0.548	0.082
Scenario 2					
0	4.956	-1.337	3.619	0.548	0.082
Scenario 3					
0	5.235	-1.337	3.898	0.548	0.082
Scenario 4					
0	7.808	-2.873	4.935	0.548	0.420

Source: Authors' calculations.
Note: When the poverty line is defined as the income of the richest among the 10 per cent poorest households in rural areas of the Mekong River Delta, the poverty rate is 5.5 per cent. When the poverty line is defined as the income of the richest among the 20 per cent poorest households in rural areas of the Mekong River Delta, the poverty rate is 13.46 per cent.

Figures 9 and 10 show the total distributional welfare effects in the Mekong River Delta under scenarios 1 (short term) and 4 (long term), respectively. The estimated total welfare curves all slope upward, indicating larger gains for richer rice producers. The average gains are positive and significantly different from zero at all levels of income in both scenarios 1 and 4, except for the poorest in scenario 4. Rural household gains are much larger in scenario 4 than in scenario 1 (the gains extend up to 8 per cent in scenario 4 instead of about 5 per cent in scenario 1). The results suggest that, in the long term, middle-income and rich households gain more from rice production income as a result of the increase in the price of paddy. Figures 9 and 10 show that production income for the richer households is up to

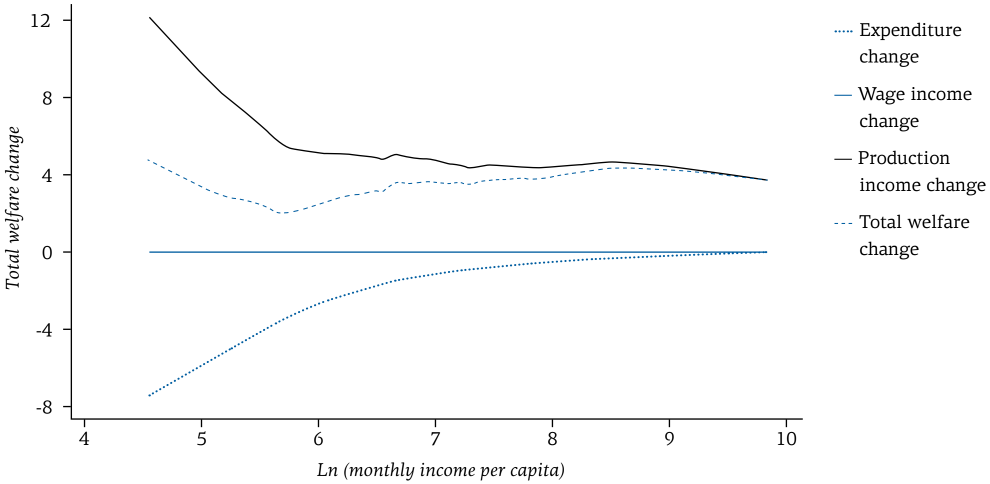
8 per cent in scenario 4 compared to 4 per cent in scenario 1. Expenditure on rice also increases for all households. However, the poorest households are the most adversely affected because their rice expenditure increases by 8 per cent in scenario 1 and by 16 per cent in scenario 4. This is more than the increase in these households' income from rice production, making the total welfare effect of the rice price increase negative for them.

Policy simulation results presented in Table 6 also show poverty reduction effects in the Mekong River Delta. Poverty rate estimations use per capita income from the 2010 VHLSS. In both short-term and longer-term scenarios, the reductions in the poverty rate among the poorest 10 per cent are the same, namely 0.548 per cent. This is because the poorest 10 per cent in the Mekong River Delta do not produce rice at all, as they do not have access to agricultural land, as explained above. Therefore, different scenarios only affect them as net consumers.

With regard to poverty reduction among the poorest 20 per cent, because we include one richer decile of households among the poorest rural deciles, an additional 11.4 per cent increase in the paddy price under scenario 4 does move some of the poor across the poverty line. As a result, attainable poverty reduction is higher in the longer term (0.420 per cent versus 0.082 per cent).

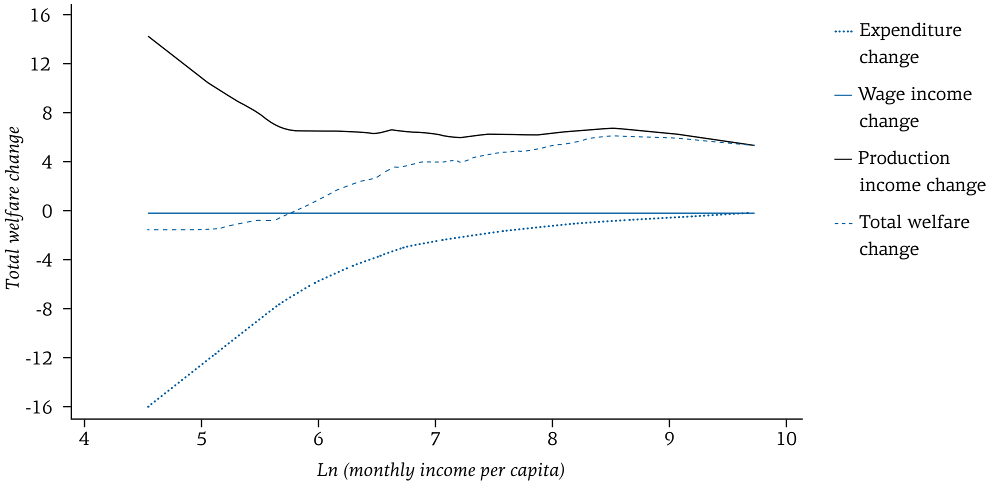
In scenarios 2 and 3, we try to see how sensitive our simulations are to the assumed productivity increase. Results presented in Table 6 show that total welfare effects decrease (due to the lower level of productivity gains) but that the impact on poverty reduction remains unchanged in both poverty rate definitions (10 per cent and 20 per cent, respectively).

Figure 9 Scenario 1 – Total welfare effects



Source: Authors' calculations.

Figure 10 Scenario 4 – Total welfare effects



Source: Authors' calculations.

7.3 Discussion of potential side effects of the Large-Scale Field Model

Although it is not quantitatively shown in our simulation results, the joint effects of the LSFM would not only increase rural household welfare in the Mekong River Delta but also increase the volume and value of rice exports (through productivity improvements and higher export prices). Therefore, some side effects of the LSFM might be of concern to policymakers. These effects may relate to: (a) national food security – whether or not it could be compromised if and when the LSFM results in an increase in the value and the volume of rice exports, and (b) whether there would be price transmission effects of the paddy price increase in the Mekong River Delta on other parts of the country.

Regarding the first potential side effect, Jaffee *et al.* (2012b) show that, in 2030, the expected output would be far in excess of national food security needs even under the worst-case scenario of a reduction of paddy land to 3 million ha (from 4 million ha), given the current low level of productivity (5.8 metric tons per ha) and assuming that the domestic rice consumption remains at 120 kg per capita per year and there is no change in post-harvest losses (10 per cent at the farm level).

Regarding the second side effect, because the paddy price change would directly affect the domestic price of rice, we could assume that the law of one price holds. This implies that any change in the farm gate price of paddy would be fully transmitted to the domestic price of rice in the Mekong River Delta. Therefore, we could apply a simple framework to examine the price transmission effects of the paddy price increase in the Mekong River Delta. The domestic price of rice in time t in the Red River Delta is a function of domestic prices of rice in the Mekong River Delta:

$$\ln p_t^{MRD} = \beta_o + \beta_1 \ln p_t^{RRD} + \varepsilon \qquad (8)$$

Econometric estimations use panel data on weekly domestic paddy prices from 1 January 2008 to 20 August 2013. The results are shown in Table A2 in the Annex. We use dummies for monthly fixed effects. The estimated pass-through elasticity is close to zero and statistically significant. This implies no price transmission between the Mekong River Delta and the Red River Delta. This result confirms that an increase in the farm gate price of paddy following the LSFM would not affect the domestic price of rice in the rest of Viet Nam.

If the LSFM were applied on a region-wide scale, it is likely that additional exporters would join the scheme. As the LSFM leads to productivity gains and cost reductions, one would expect the domestic price of paddy to decrease over the longer run (at least partially in the Mekong River Delta region), due to greater market competition among farmers.

8 Conclusions

This study has examined the potential impact of the adoption of the Large-Scale Field Model on household welfare and poverty reduction in the Mekong River Delta.

The study has first found that an increase of 1 per cent in the price of paddy would benefit households in the Mekong River Delta but not households in the Red River Delta. The larger fragmentation of land in the Red River Delta makes it difficult to implement the LSFM. We therefore suggest that farmers from the Mekong River Delta be given priority for the application of the LSFM. Within this policy target group, households with a farm size of 2 ha or above would likely benefit more from participating in the LSFM.

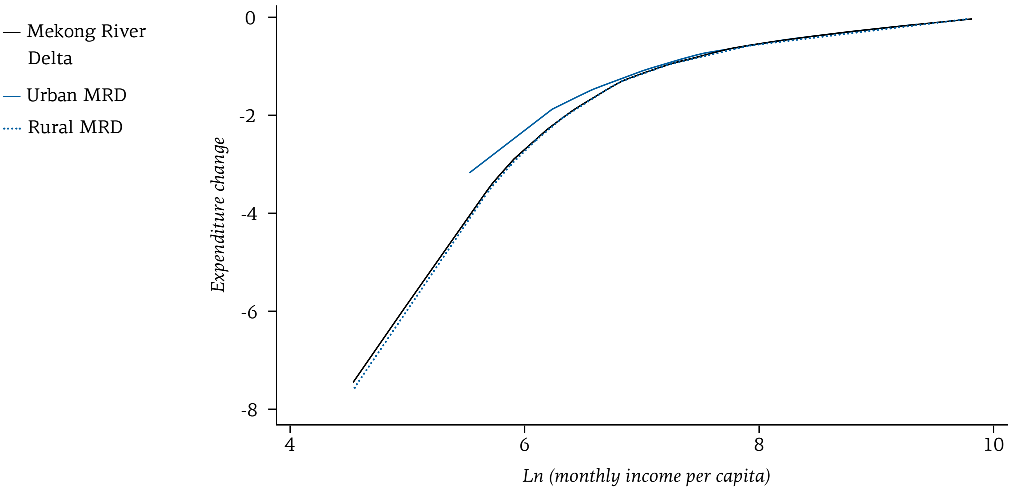
The estimation of *ex-ante* effects shows that the LSFM would improve average rural household welfare by 4.1 per cent in the short term and by 4.9 per cent in the longer term. In all scenarios, the LSFM would result in poverty reduction in the Mekong River Delta. The effective poverty reduction would be higher in the longer term, when exporters could bridge the gap between export prices of Viet Nam and Thailand.

As the LSFM idea has been met with considerable interest by the government of Viet Nam, as well as by local authorities in provinces in the Mekong River Delta, we suggest that to attain the government's objective of a minimum rate of return of 30 per cent for rice farmers, the LSFM might be a better policy option than setting price floors for export prices and farm gate prices of paddy.

As discussed above, the combined effects of the LSFM would not only improve household welfare in the region but also foster Vietnamese rice exports. As state-owned exporters may have fewer incentives to implement the changes proposed by the LSFM scheme, private exporters would likely be better candidates to lead the implementation of this policy. The rice export quota granted to SOEs could be a bottleneck, however, because the implementation of the LSFM requires that some level of competition be established among Vietnamese rice exporters.

Annex

Figure A1 Baseline scenario – Consumption effects



Source: Authors' calculations.

Figure A2 Baseline scenario – Production income effects

Source: Authors' calculations.

Figure A3 Viet Nam regional map

Source: General Statistics Office of Viet Nam.
Note: The eight socio-ecological zones recognized by the GSO are: (1) Red River Delta, (2) North-East, (3) North-West, (4) North Central Coast, (5) South Central Coast, (6) Central Highlands, (7) South-East, and (8) Mekong River Delta.

Table A1 Monthly FOB export prices in Thailand and Viet Nam ports for 5 per cent broken rice, January 2011 – August 2013 (USD per metric ton)

Month	Year	Thailand	Viet Nam	Difference (per cent)
January	2011	519	501	3.4
February	2011	519	487	6.5
March	2011	487	469	3.8
April	2011	467	481	-3.0
May	2011	474	476	-0.3
June	2011	504	466	8.1
July	2011	522	503	3.7
August	2011	557	552	0.9
September	2011	590	557	5.9
October	2011	616	579	6.3
November	2011	604	565	7.0
December	2011	584	512	14.1
January	2012	538	477	12.8
February	2012	543	447	21.4
March	2012	536	430	24.8
April	2012	497	446	11.4
May	2012	591	447	32.4
June	2012	591	418	41.4
July	2012	581	414	40.4
August	2012	573	434	32.2
September	2012	585	462	26.7
October	2012	565	452	25.0
November	2012	551	455	21.2
December	2012	555	425	30.7
January	2013	564	411	37.0
February	2013	573	410	39.8
March	2013	562	409	37.2
April	2013	544	394	38.2
May	2013	562	380	47.7
June	2013	540	371	45.4
July	2013	480	397	21.0
August	2013	480	400	19.9

Source: Authors' calculations, based on data from AgroInfor.

Table A2 Price transmission effects – Dependent variable Ln (RRD paddy price)

	Ln (RRD paddy price)	Ln (RRD rice price)
Ln (MRD paddy price)	0.000222*** (24.49)	
Ln (MRD rice price)		0.0000852*** (26.77)
January	0.0776* (1.92)	–0.0146 (–0.54)
February	0.0842** (2.03)	–0.0334 (–1.22)
March	0.119*** (2.93)	–0.00776 (–0.29)
April	0.127*** (3.11)	0.0108 –0.40
May	0.123*** (3.06)	0.0328 (1.23)
June	0.110*** (2.74)	0.00687 (0.26)
July	0.0596 (1.49)	–0.0180 (–0.68)
August	0.0473 (1.17)	–0.0303 (–1.13)
September	–0.0405 (–0.96)	–0.0186 (–0.66)
October	–0.0436 (–1.06)	–0.0341 (–1.24)
November	–0.0213 (–0.51)	0.0113 (0.41)
Constant	7.593*** (127.48)	8.522*** (239.83)
Number of observations	331	331
Adjusted R^2	0.652	0.686

Source: Authors' estimations.

*Note: t-statistics in parentheses. *, ** and *** stand for p ≤ 10%, p ≤ 5% and p ≤ 1%, respectively.*

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