China

The consumption effect of the renminbi appreciation in rural China

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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.

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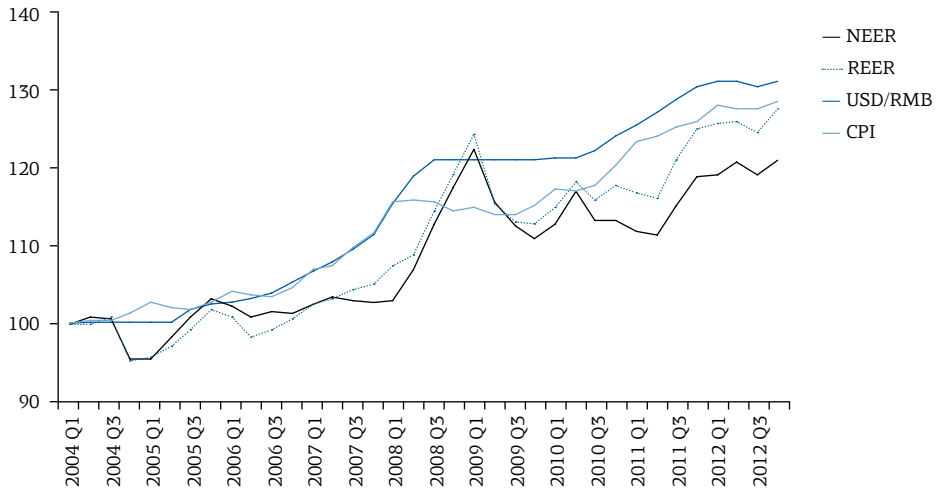
1 Introduction

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.

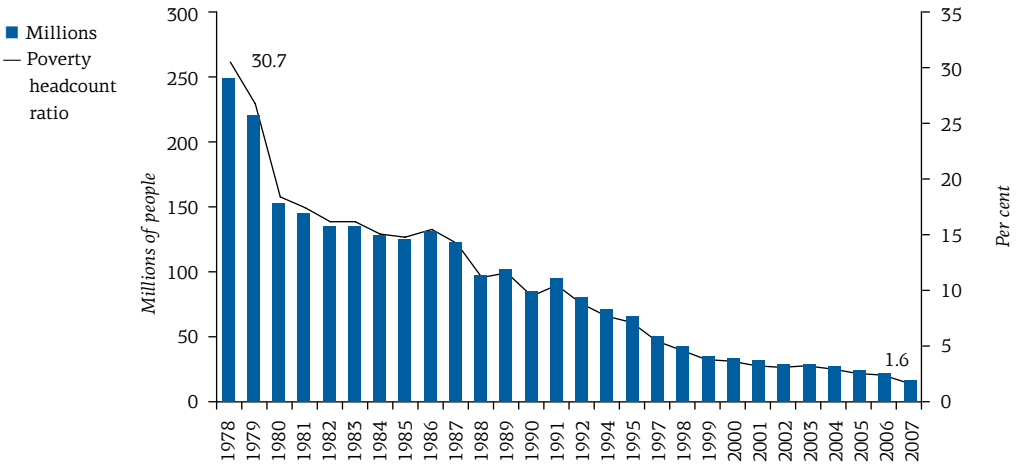
Following Kraay (2008), this study employs techniques from both strands of literature described above to analyse the case of the significant appreciation of the RMB since mid-2005. The potential distributional consequences of that appreciation have prompted widespread concern among policymakers. To the 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:

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

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_o) at the price level after the shock (p_1). It can be mathematically expressed as:

$$CV = e\,(p_1, u_o) - e\,(p_o, u_o) \quad (3)$$

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

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

[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

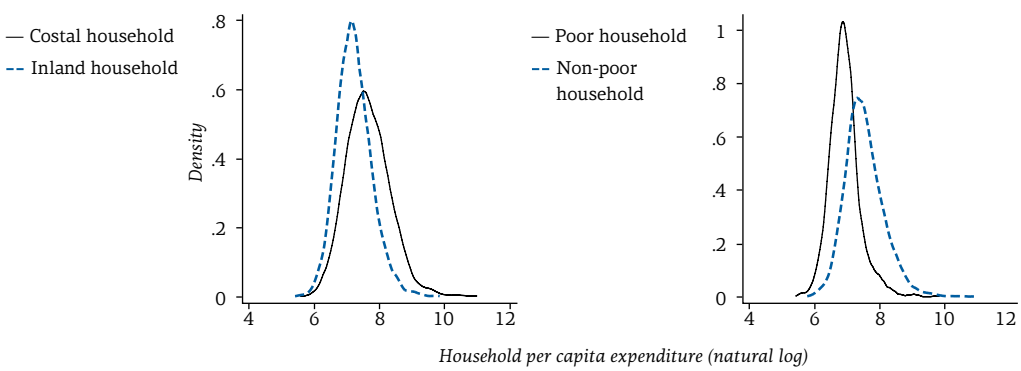
Source: Authors' calculations.

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.

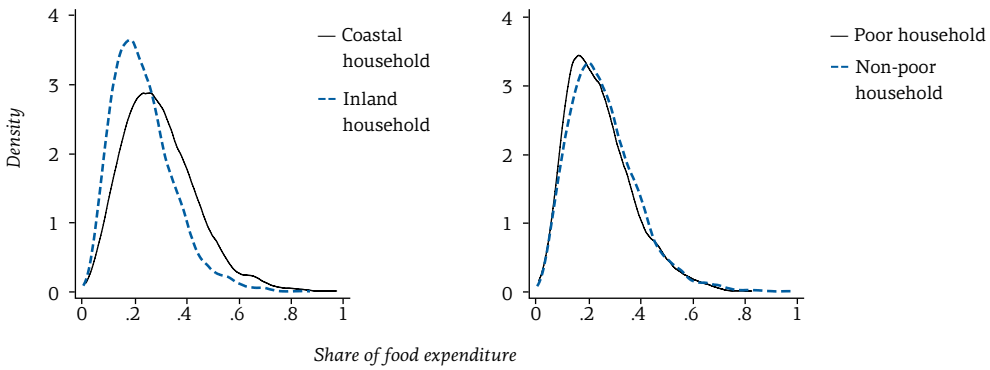
Figure 3 Kernel density estimation of per capita expenditure



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.

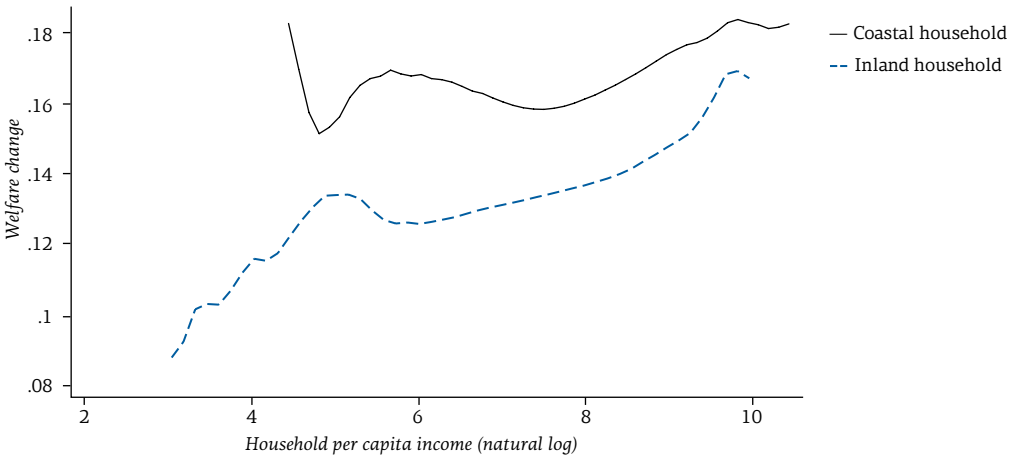
Figure 5 Non-parametric regression results – Overall welfare

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.

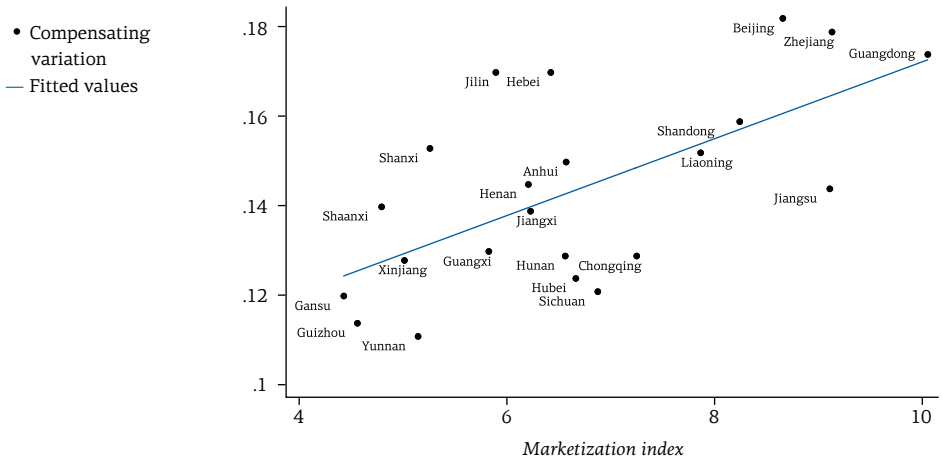
Figure 6 Non-parametric regression results – Coastal versus inland households



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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