UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT

UNCTAD

POLICY SPACE IN AGRICULTURAL MARKETS

POLICY ISSUES IN INTERNATIONAL TRADE AND COMMODITIES
RESEARCH STUDY SERIES No. 73

UNITED NATIONS

UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT
UNCTAD

POLICY ISSUES IN INTERNATIONAL TRADE AND COMMODITIES
RESEARCH STUDY SERIES No. 73

POLICY SPACE IN AGRICULTURAL MARKETS

by

Alain McLaren
UNCTAD, Geneva

UNITED NATIONS

New York and Geneva, 2016

Note

The purpose of studies under the *Research Study Series* is to analyse policy issues and to stimulate discussions in the area of international trade and development. The *Series* includes studies by UNCTAD staff and by distinguished researchers from other organizations and academia.

The opinions expressed in this research study are those of the authors and are not to be taken as the official views of the UNCTAD secretariat or its member States. The studies published under the *Research Study Series* are read anonymously by at least one referee. Comments by referees are taken into account before the publication of studies.

The designations employed and the presentation of the material do not imply the expression of any opinion on the part of the United Nations concerning the legal status of any country, territory, city or area, or of authorities or concerning the delimitation of its frontiers or boundaries.

Comments on this paper are invited and may be addressed to the author, c/o the Publications Assistant, Trade Analysis Branch (TAB), Division on International Trade in Goods and Services, and Commodities (DITC), United Nations Conference on Trade and Development (UNCTAD), Palais des Nations, CH-1211 Geneva 10, Switzerland; e-mail: tab@unctad.org; fax no: +41 22 917 0044. Copies of studies under the *Research Study Series* may also be obtained from this address.

Studies under the *Research Study Series* are available on the UNCTAD website at http://unctad.org/tab.

Series Editor:
Chief
Trade Analysis Branch
DITC/UNCTAD

UNCTAD/ITCD/TAB/75

UNITED NATIONS PUBLICATION

ISSN 1607-8291

Abstract

As an outcome of the Uruguay Round Agreement on Agriculture, all agricultural products now have a bound tariff rate on their imports. This system of bound tariffs combines the rigidity of an upper limit that is independent of future economic conditions but discretion as governments have a whole array of choices in terms of applied tariffs as long as they are set below the bound rate. One recurring argument is that bound rates may limit countries' policy flexibility, or policy space, in response to particular economic circumstances. This paper looks at the use and availability of this policy space in agricultural markets. This is first done in a descriptive setting, then by assessing what plays a role in determining this space using an empirical analysis. A general finding is that policy space in agricultural products is generally available, and only limited for developed countries. Many developing countries have ample room to raise tariffs in most agricultural imports without infringing binding commitments. For LDCs there is virtually no imports for which policy space is not available. The findings indicate that four specific factors are related to the use of policy space, which are the elasticity of import demand, the fact that the goods are being used as intermediates, food security and protection of local producers. The results suggest that policy space tends to be used relatively less for products with lower elasticity of demand and for intermediate products. In regard of products relevant for food security, the results suggest that policy space is larger. In regard to products that face domestic competitors, the results indicate lower tariff water and more use of policy space, suggesting that producer protection is an issue related to the level of policy space to use and the level of market protection to set.

Keywords: International trade, policy space, WTO, tariffs.

JEL Classification: F10, F13

Acknowledgements

This study was prepared during my stay in the Trade Analysis Branch under the Division for International Trade and Commodities at UNCTAD. The author wishes to thank Marco Fugazza, Alessandro Nicita, and Ralf Peters for discussion and comments.

This paper represents the personal views of the author only, and not the views of the UNCTAD secretariat or its member States. The author accepts sole responsibility for any errors remaining.

Contents

1 INTRODUCTION 1

2 DATA 2

3 POLICY SPACE 3

4 EMPIRICAL SPECIFICATION 10

5 ROBUSTNESS CHECKS 15

6 CONCLUSION 17

BIBLIOGRAPHY 18

List of figures

Figure 1. Policy space and the share of trade covered 4
Figure 2. Policy space and gross domestic product per capita 5
Figure 3. Policy space in least developed countries, at the HS 2 digit level 6
Figure 4. Policy space in developing non-LDCs, at the HS 2 digit level 7
Figure 5. Share of imports from partners within RTAs, by income level 8
Figure 6. Policy space 9
Figure 7. Policy space for imported and produced goods 9

List of tables

Table 1. OLS and fractional heteroskedastic probit 12
Table 2. Water and true water by income group (OLS) 13
Table 3. MFN/bound and true MFN/bound by income group (OLS) 14
Table 4. MFN/bound and true MFN/bound by income group (Fract. Heter. Probit) 14
Table 5. OLS and fractional heteroskedastic probit at the HS 6 digit level 15
Table 6. OLS and fractional heteroskedastic probit excluding the import demand elasticity 16

1. INTRODUCTION

Trade in agri-food products is governed by a set of rules influencing market access conditions by limiting the level of protection countries can legitimately apply. At the multilateral level, the rules governing the trade of agricultural products are those agreed in the Uruguay Round Agreement on Agriculture (URAA). The URAA was concluded in 1994 and became fully implemented by 2005. As an outcome of the URAA each WTO member replaced border barriers with an equivalent tariff. This tariff is known as the "bound rate" and refers to the highest rate the country could then apply without infringing the agreement.[1] The rationale behind setting tariff ceilings was to increase policy certainty and limit negative spillovers of domestic policies on international markets. As noted in Horn et al. (2010), the system of bound tariffs combines the rigidity of an upper limit that is independent of future economic conditions but discretion as governments have a whole array of choices in terms of applied tariffs as long as it stays below the bound rate. Still, one recurring argument is that bound rates may limit countries' policy flexibility (or policy space) in response to particular economic circumstances.

In reality, countries often choose to apply a tariff that is well below the bound rate, and thus generally maintain significant flexibility in raising the tariffs of many agricultural products. This flexibility can be measured by the difference between the bound and the "most favoured nation" tariff rate (MFN) and is referred to as *tariff water* or *binding overhang*. In order to understand the use that developing countries do, or don't do, of such flexibility, this paper examines the availability and use of policy space related to agricultural trade.[2]

There are a certain number of reasons for which the desired MFN is often set below the bound rate and thus policy space remains available. Theoretical work by Amador and Bagwell (2012) considers that governments set tariffs so as to maximize a weighted average of consumer surplus, tariff revenue and profits in the import-competing sector. They will be influenced by many economic factors, some of which will affect several of them simultaneously. This paper investigates some of the most relevant factors that can influence the use of policy space. In particular, the paper examines the relationship between policy space and the elasticity of import demand, the fact that the goods are being used as intermediates, food security and protection of local producers.

The elasticity of import demand will have a direct impact on consumer surplus and will influence the amount of tariff revenue through changes in import volumes. For example, if a government's objective is to reduce demand of imports, small changes in tariffs on products with elastic demand would be rather effective, while any raise in tariff would not substantially impact imports of products with inelastic demand which lack of domestic substitutes. In contrast, tariff setting would be quite different if the government's objective is to increase tariff revenues. In practice, governments under fiscal constraints may be willing to use their policy space on products with inelastic demand. The use of policy space may also be related to whether the good is used as an intermediate product. In such cases policymakers may be inclined to keep the MFN applied relatively low thus favoring local processing

[1] The guidelines were the following for developed countries, as found in Multilateral Trade Negotiations on Agriculture (2000): for previously bound tariff lines, they had to keep on using the same rate if there was no NTB, and if there was an NTB they had to eliminate it or use the following tariffication formula: $T = \frac{P_d - P_w}{P_{dw}} * 100$. For lines that were not previously bound, they had to use the rate that was applied as of September 1986 if there was no NTB, and if there was an NTB they had to use the tariffication formula. For developing countries, the guidelines were the same for lines that were already bound. For those that were not previously bound, they had the choice to do as developed countries or offer a ceiling binding.

[2] The present study does not look at whether the bound rate has a useful purpose when it is well above the applied rate. The literature tends to agree on the fact that the bound rate may nonetheless play a positive role for several reasons. For instance, Bacchetta and Piermartini (2011) note that this situation implies increased tariff stability as well as reduced uncertainty that exporters face in terms of trade policy. They also mention that theoretical work by Francois and Martin (2004) showed that there are welfare gains from both the reduced variability of tariffs and their lower average level. Bacchetta and Piermartini (2011) also put forward the argument found in Sala et al. (2010), who argue that a bound rate above the applied rate may not directly affect the intensive margin that will be influenced by the applied rate but may give a signal to exporters wishing to enter that there is more stability on the market. This was confirmed empirically in Handley (2014).

industries. However, it is possible that government strategies aimed to integrate vertical production processes use all their policy space so as to facilitate the emergence of domestic suppliers.[3] A third factor affecting the use of policy space is food security. In this regard, the main argument is to support local production so as to guarantee food supply from domestic producers while minimizing the effect of external shocks. However, countries with insufficient agricultural resources rely more on food supply from international markets and therefore may be seeking food security by facilitating trade on foodstuff thus making little use of any available policy space. Finally, a reason for which one may expect governments to set higher applied tariffs could be related to the presence of producers' lobbies which influence government decisions related to trade policy. If there aren't any domestic producers then there won't necessarily be an incentive to increase the price of the imported product.

In investigating the use of policy space this paper will first show some descriptive statistics of policy space in agriculture, by using a snapshot of recent data, namely 2013. It shows the distribution of policy space with respect to trade covered, the relationship between policy space and GDP per capita, and finally the distribution of policy space by product and by income level groups. A first finding indicates that in the vast majority of cases policy space is available, meaning that countries could raise tariffs if they wanted to. The second step is to perform econometric analysis to shed light on what determines policy space. This is done over a longer time span in order to benefit from the advantages of panel data techniques. The results suggest that the elasticity of import demand, intermediate goods, food security issues and protection of local producers are all correlated to the amount of policy space that is available. The information on what plays a strong role in influencing policy space and in which way can have important policy implications, especially in present times where negotiations on new bound rates are having trouble reaching consensus, and in particular in agriculture which has also been one of the tough areas in terms of trade policy negotiations.

The rest of the paper is organized as follows. Section 2 presents the data that will be used for the descriptive statistics and regressions, section 3 shows and discusses some stylized facts concerning policy space, section 4 presents the empirical specifications used, section 5 presents some robustness checks and section 6 concludes.

2. DATA

The tariff data used comes from the UNCTAD TRAINS database and includes ad valorem equivalents using the UNCTAD method 1. It includes bound rates and MFN applied rates as an import value weighted average at the HS 6 digit level. The import data comes from the UN COMTRADE database, food production data comes from the Food and Agricultural Organization (FAO) of the United Nations and the elasticity of import demand from Kee et al. (2008). All data except for production covers the period 2008-2013 at the HS 6 digit level, covering 98 importing countries. The production data stops in 2012 and is converted from the FAO classification to an equivalent HS 2 digit level.

[3] This relates to international trade and value chains, notably discussed in reports such as Humphrey and Memedovic (2006) and in the Organisation for Economic Co-operation and Development's (OECD) *Mapping Global Value Chains (2012)*.

3. POLICY SPACE

A first look at the data shows us that there is a reasonable amount of variation of policy space over time, both increasing and decreasing. It is the changes in MFN applied that reflect the changes in observed policy space.[4] MFN applied tariff decreases were observed to be more frequent than tariff increases, with about 9 percent of total lines (at the HS 6 digit level) that saw a decrease from one year to the next against less than 6 percent that went up.[5] However, the percentage of lines in the agricultural data over the period 2008-2013 that increased and hit the bound was only of 0.2 percent of all lines (and about 4 percent of increased tariffs), and just under 0.5 percent of all lines increased and were over 80 percent of the bound after the increase (whether they already were above this threshold or not). This shows us that although there is a reasonable amount of changes in the MFN applied rates, both up and down, all of the available policy space is nearly never used up.

The space between applied and bound tariffs will be measured in two ways, once as a ratio (MFN applied / bound) and once as a difference (bound - MFN applied). The first will tell us the percentage of the available space that is used up whereas the second will give information on the specific amount that can still be used. Two additional measures will be used which slightly modify the above mentioned computations so as to account for the presence of prohibitive tariffs when the latter are below the bound rate and for the presence of preferential tariffs which render the MFN applied tariff irrelevant.

These two measures are aggregated as in Kee et al. (2009) and in Foletti et al. (2011) in order to be at the same level as the production data, as shown in equations (1) and (2).

$$Tariff\ Water_{hs2,c} = \sum_{i \ni hs6} \frac{\varepsilon_{hs2,i,c} * M_{hs2,i,c}}{\sum_{i \ni hs6} \varepsilon_{hs2,i,c} * M_{hs2,i,c}} (B_{hs2,i,c} - T_{hs2,i,c}) \qquad (1)$$

$$Available\ space_{hs2,c} = \sum_{i \ni hs6} \frac{\varepsilon_{hs2,i,c} * M_{hs2,i,c}}{\sum_{i \ni hs6} \varepsilon_{hs2,i,c} * M_{hs2,i,c}} \left(\frac{T_{hs2,i,c}}{B_{hs2,i,c}}\right) \qquad (2)$$

Where $\varepsilon_{hs2,i,c}$ is the elasticity of import demand of product *i* within a given HS 2 digit product in country *c*, $M_{hs2,i,c}$ is the total imports of that country in that product, $B_{hs2,i,c}$ is the bound rate and $T_{hs2,i,c}$ the MFN applied rate. A value for tariff water of 10 implies that the MFN tariff can be increased by 10 percentage points (i.e. from 10 to 20 percent). Available policy space as shown in equation 2 can be seen in terms of its *use*. This index indicates how much of the available policy space is used and varies from 0 to 1. A value of 0.2 implies that the country is using only 20% of the policy space available in that specific product. A value of 0 implies an MFN rate of 0 and a non-zero bound (so no policy space is used). A value of 1 implies MFN=bound, thus all policy space is used. In most figures and tables this is labeled as "*MFN/bound*".

[4] The products for which there was room for negotiation may have been influenced by some of the variables that influence the MFN applied rates and that are discussed below. This may also have been the case for some bound levels in previous rounds. For this study one must bear in mind that time invariant variables could have influenced some of the bound rates but other than that policy maker's choices in recent years have only been affecting the MFN applied rates.

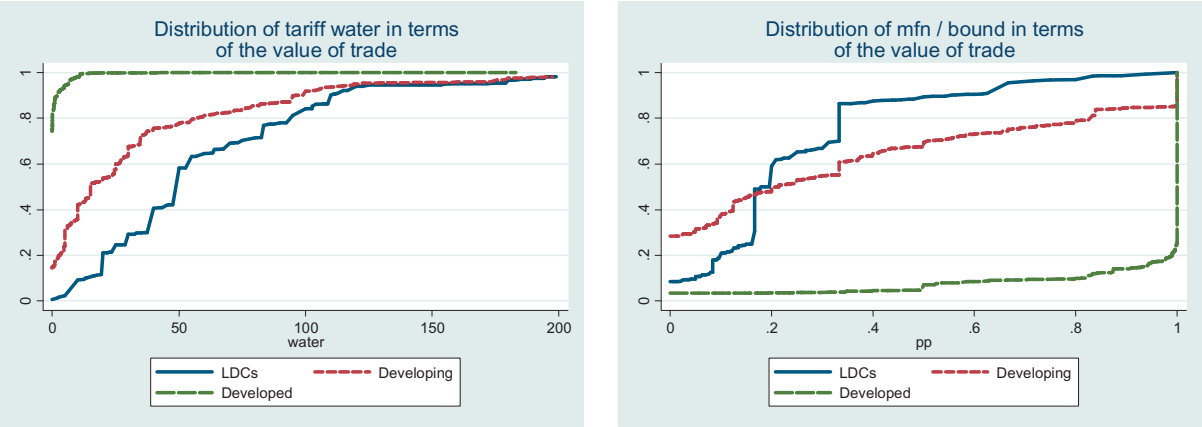
[5] This is consistent with findings such as those in Esteovadeordal et al. (2008), where they observe increases and decreases of MFN applied rates even when a bound rate has been set (in this case data isn't restricted to agricultural products). Studies such as Bacchetta and Piermartini (2011) find that the tendency for applied tariffs to increase is smaller in the presence of a bound rate compared to when there is none and the tendency for them to decrease is more likely in the presence of a bound.

Availability and use of policy space is different across countries depending on the level of development.[6] Figure 1 shows us the amount of trade that is taking place under different levels of policy space, as defined by tariff water and MFN/bound.

Figure 1

Policy Space and the Share of Trade Covered

(a) (b)

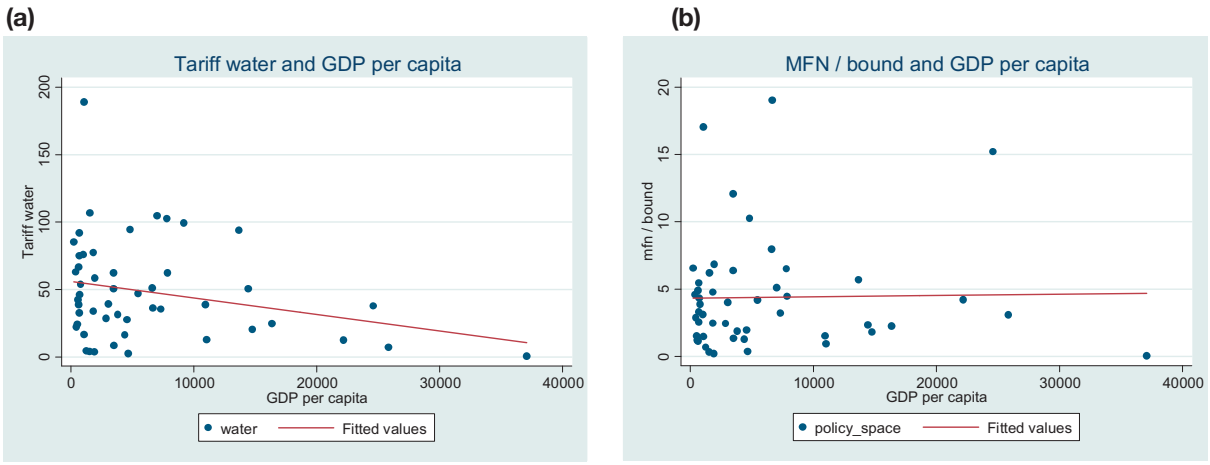


On one hand one can see that for LDCs there is virtually no imports for which policy space is not available. On the other hand, developed countries' imports have no available policy space. This can either be due to a bound of zero, which is the case for close to a half of HS 6 digit lines in developed countries, or because the countries are setting their MFN rate as high as possible, leaving themselves with no policy space. Differences in the availability and use of policy space are also evident when comparing across different levels of GDP per capita, as can be seen in Figure 2.

[6] Countries are categorized by geographic region as defined by the UN classification (UNSD M49). Developed countries comprise those commonly categorized as such in UN statistics. For the purpose of this paper transition economies, when not treated as a single group, are included in the broad aggregate of developing countries.

Figure 2

Policy Space and Gross Domestic Product Per Capita



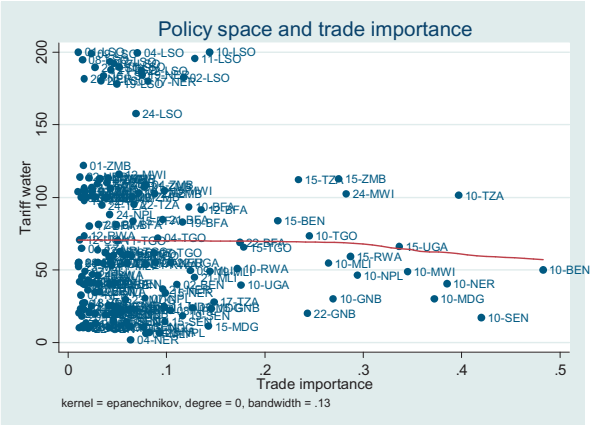
It illustrates the relationship between policy space and GDP per capita for countries with a GDP per capita below 40'000 USD. The aggregation by country is done by weighting each product by the imported value. More developed countries tend to have less policy space, whatever the indicator used. This is a reflection of developed countries' lower bound rates rather than higher MFN rates.

Figures 3 and 4 plot availability and use of policy space vis-à-vis the importance of the good for the set of developing countries differentiated by LDCs and non LDCs. The importance of each product (horizontal axis) is measured by its weight in the import basket (imports of the product / total imports). For example, a value of 0.05 implies that the given product represents 5 percent of the import basket. This standardization allows for comparison of countries with different levels of imports. Only products which represent more than 1 percent of total imports are taken into account. The right hand side of Figures 3 and 4 also display the importance of the trade flow in terms of its actual trade value.

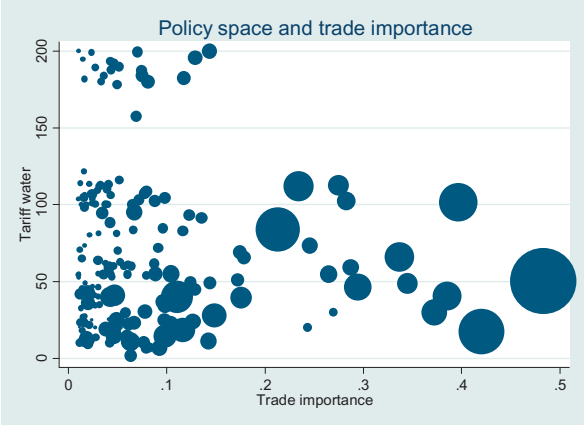
Figure 3

Policy Space in Least Developed Countries, at the HS 2 Digit Level

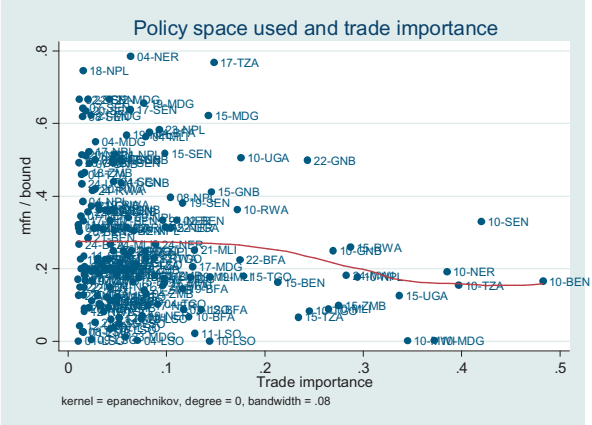
(a)



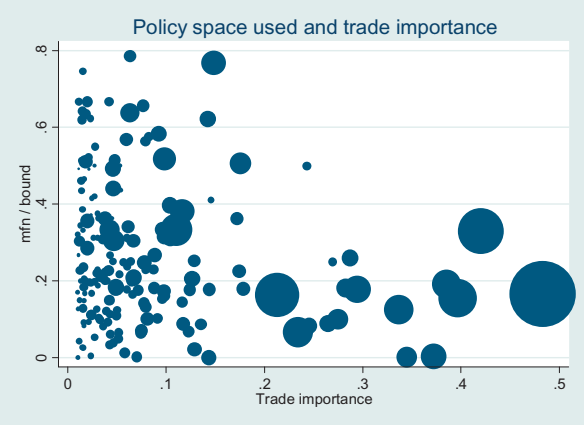
(b)



(c)



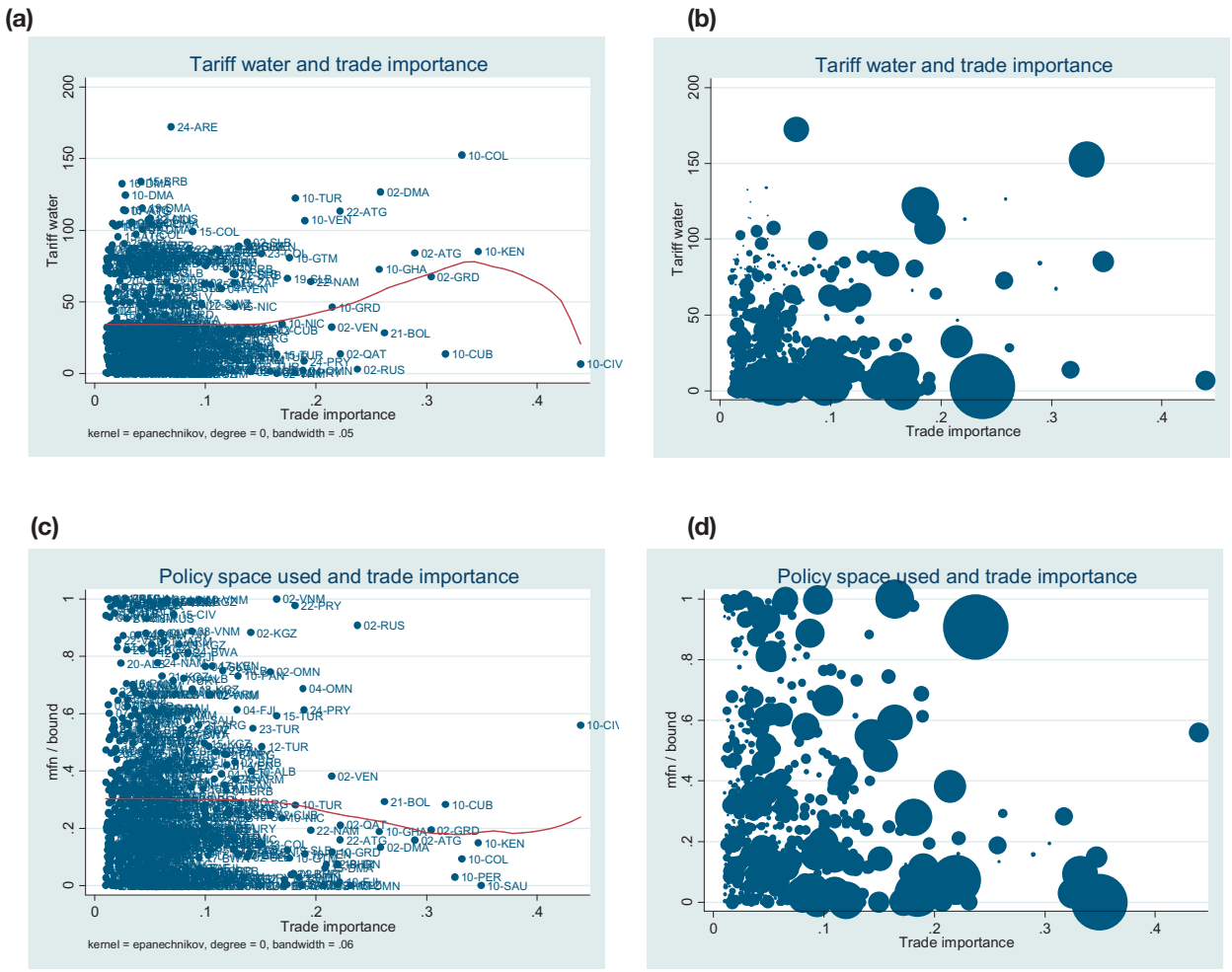
(d)



The *availability* of policy space in LDCs as measured by tariff water is illustrated in Figure 3a. Products that represent a very large share of imports still have a substantial amount of tariff water. Products with the highest amounts of tariff water (top left corner of Figures 3a and 3b) tend to be those that do not represent a too large share of a country's imports. The *use* of policy space in relation to the importance of the product is illustrated in Figure 3c. LDCs' use of policy space is not correlated to trade importance. With the exception of very few products on the top left corner of Figure 3c the amount of policy space used is generally below 50%, and rarely surpasses about 30% for the most imported products. Interestingly, almost all very strongly imported products are in cereals (10) or oils/fats (15), but even for these products which may be of importance for food security the use of policy space is relatively low. Overall, availability and use of policy space of LDCs (both when defined by tariff water or by MFN / bound) appear to not be very correlated to the importance of the product. As can be seen in Figure 4, the situation in developing countries is relatively similar to the one in LDCs with large amounts of available policy space and limited use of policy space even in the most important products.

Figure 4

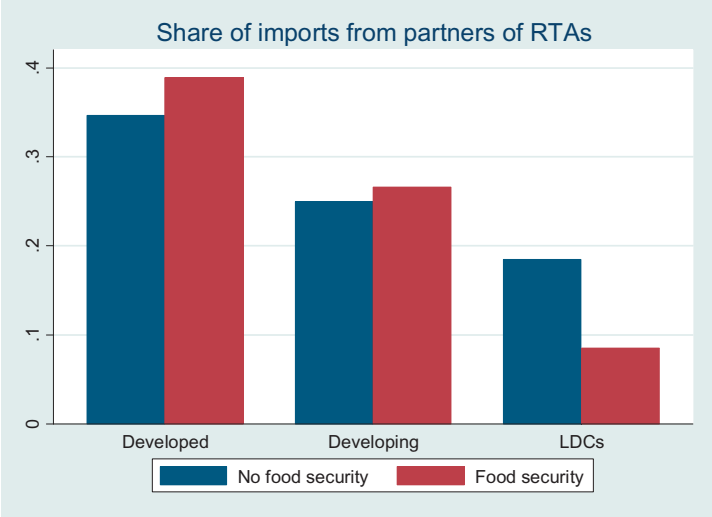
Policy Space in Developing non-LDCs, at the HS 2 Digit Level



Moreover, also for developing non LDCs there is no clear relationship between policy space and trade importance. Finally, in the case of non LDCs there are less products concentrated in the top left corner (for tariff water, which represents low importance and high policy space) than in LDCs. In addition, one observes that amongst highly imported products with very little policy space in developing countries there are some that are also very important in terms of value relative to what can be seen for LDCs, as shown in Figures 3b and 4b. In regard to the use of policy space, there is a substantial use of policy space in a number of cases (top portions of Figures 4c and 4d), including in products of trade importance. Still the use of policy space is rather limited in the vast majority of cases. Figure 5 shows the percentage of imports that are coming from partners of Preferential Trade Agreements (PTA) by income group, depending on whether they are related to food security or not.

Figure 5

Share of imports from partners within RTAs, by income level



What is considered important from a food security perspective in the present study is cereals and oils, fats as well as sugars, which correspond to HS 2 digit categories 10, 15 and 17. The main difference can be seen for LDCs for which there is considerably more imports from partners of PTAs in products that are not related to food security. This may shed some light on one of the differences found in the empirical section between the coefficients on food security for tariff water and true tariff water, which takes into account preferential trade.

Figure 6 looks at the MFN/bound and tariff water from 2008 to 2013 for all three income level groups. One can see that there hasn't been a drastic change of the space between the MFN applied and the bound rate over the last five years except for the large decrease of tariff water between 2008 and 2009 in LDCs, most likely reflecting a wave of protectionism due to the financial and economic crisis.

Figure 6

Policy space

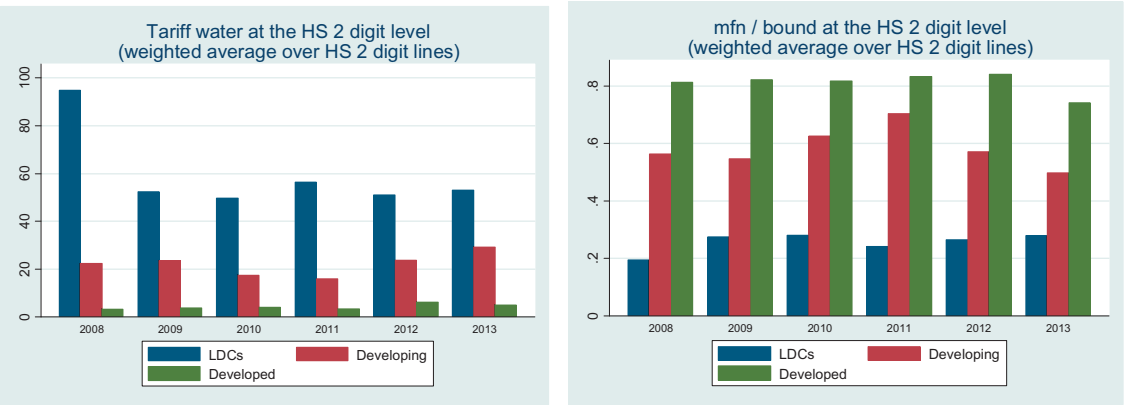
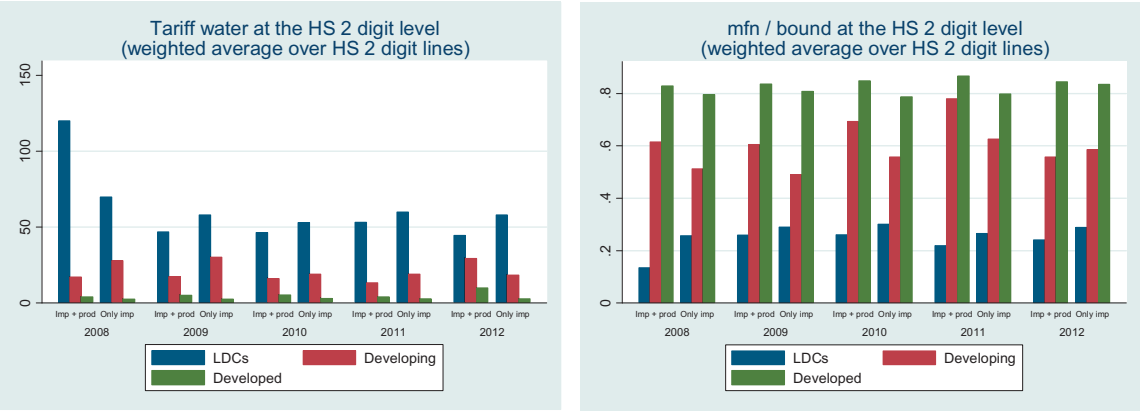


Figure 7 then shows the same two variables separated into products that were or that were not produced in the country during that year.

Figure 7
Policy space for imported and produced goods



It is very important to bear in the mind the descriptive aspect of this figure as opposed to a causal one. As will be discussed in the empirical section, production is an endogenous variable. Local production may be a reason for governments to set higher MFN applied rates and reversely higher MFN rates will reduce foreign competition and enable producers to have larger shares of the market. Nonetheless, by separating into two categories of produced versus non-produced locally, at a relatively aggregated level, one can see the general level of MFN/bound and tariff water in both groups. This isn't looking at the level of production which of course would be influenced by the MFN applied rate. Reverse causality may be taking place if sufficiently low MFN applied rates are enabling high enough imports to completely exclude local production across a whole HS 2 digit line. Even though this is possible, it may possibly be assumed that it is not frequent. What shows up in the figure is that except for LDCs in 2008 and for developing countries in 2012 the MFN/bound was sytematically lower when the country produced the product. This however did not tend to be the case in developed countries. The outcome for tariff water is similar for developing countries, and the same pattern now sticks out for developed countries too. However, this no longer seems to be the case for LDCs. One may however argue that the ratio of the MFN/bound better reflects the use of policy space, as the value is not absolute but relative.

In general there doesn't tend to be a clear relationship between the importance of the products in terms of imported value and policy space. Policy space (related to tariffs) is clearly very limited only in relation

to developed countries' imports. For LDCs there is virtually no imports for which policy space is not available. In general, policy space for developing countries is often available but to a different degree depending on specific products and countries. An important question that emerges from this analysis is why policy space seems to be used in some cases but not in others. This may be due to the protection of domestic production, food security and participation in global value chains. This question is addressed in the empirical section.

4. EMPIRICAL SPECIFICATION

The first step is to run regressions on tariff water and available space at the HS 2 digit level using the two measures presented in section 3. They are complemented by two measures that take into account the presence of prohibitive tariffs that are below the bound rate and for the presence of preferential tariffs. This is consistent with studies such as Foletti et al. (2011), and the reason is that countries won't increase their MFN applied rate above the prohibitive rate. This means that the implicit bound is the prohibitive rate and not the official bound rate in these cases. The preferential rate is below the MFN applied rate and the country is tied to its contractual agreements, making increases of these rates particularly complicated.

These two extra measures used are called true available space and true tariff water and are presented in equations (3) and (4). The true tariff water uses the idea of *dammed water* found in Foletti et al. (2011), where the prohibitive tariff is used when it is below the bound rate instead of using the bound rate itself, and where the whole expression is multiplied by the share of imports taking place under a PTA. This will therefore reduce tariff water if there is at least some trade taking place under a PTA, and reduces it to zero in the most extreme case where all trade takes place under a PTA. The same idea is used to create true available policy space. In this case the prohibitive rate is also used in place of the bound rate when relevant, and the whole expression is multiplied by 1 minus the share of imports taking place under a PTA in order to give us the loss of space due to PTAs. This loss of space is added to the initial available space (including the prohibitive rates). This will lead to a higher value, meaning less available space, with the extreme case being that the true MFN/bound is equal to 1 if all trade takes place under a PTA.

$$true\ tariff\ water_{hs6,c,t} = \sum_{d \ni D} \frac{\varepsilon_{hs6,c,t} * M_{hs6,d,c,t}}{\sum_{d \ni D} \varepsilon_{hs6,c,t} * M_{hs6,d,c,t}} \left(\min\left(B_{hs6,d,c,t}; P_{hs6,d,c,t}\right) - T_{hs6,d,c}\right) * \left(1 - \frac{MPref_{hs6,d,c,t}}{M_{hs6,d,c,t}}\right) \quad (3)$$

$$true\ available\ space_{hs6,c,t} = \sum_{d \ni D} \frac{\varepsilon_{hs6,c,t} * M_{hs6,d,c,t}}{\sum_{d \ni D} \varepsilon_{hs6,c,t} * M_{hs6,d,c,t}} \left(\frac{T_{hs6,d,c,t}}{\min\left(B_{hs6,d,c,t}; P_{hs6,d,c,t}\right)}\right) +$$

$$\sum_{d \ni D} \frac{MPref_{hs6,d,c,t}}{M_{hs6,d,c,t}}) * \left(1 - \sum_{d \ni D} \frac{\varepsilon_{hs6,c,t} * M_{hs6,d,c,t}}{\sum_{d \ni D} \varepsilon_{hs6,c,t} * M_{hs6,d,c,t}} \left(\frac{T_{hs6,d,c,t}}{\min\left(B_{hs6,d,c,t}; P_{hs6,d,c,t}\right)}\right)\right) \quad (4)$$

$\varepsilon_{hs6,c}$ is the import demand elasticity of a given HS 6 digit product in country *c*, $M_{hs6,d,c}$ are the imports of country *c* from country *d* for the same product, $B_{hs6,d,c}$ is the bound rate, $T_{hs6,d,c}$ the MFN applied tariff , and finally $P_{hs6,d,c}$ the level of the prohibitive tariff, computed following Foletti et al. (2011), with $P_{hs6,d,c} = T_{hs6,d,c} + \frac{1 + T_{hs6,d,c}}{\varepsilon_{hs6,c}}$.

The mean levels of elasticity within a given HS 2 digit line are taken by weighting by the value of imports and the share of intermediates is computed in the same way. For the two explained variables, namely tariff water and available space, the mean is computed as in equations (5) and (6), using imports as well as the elasticity of import demand as weights, this time aggregating over HS 6 digit line products also.

$$true\ tariff\ water_{hs2,c,t} = \sum_{hs6 \ni hs2} \frac{true\ tariff\ water_{hs6,c,t} * \varepsilon_{hs6,c,t} * M_{hs6,c,t}}{\sum_{hs6 \ni hs2} \varepsilon_{hs6,c,t} * M_{hs6,c,t}} \quad (5)$$

$$true\ available\ space_{hs2,c,t} = \sum_{hs6 \ni hs2} \frac{true\ available\ space_{hs6,c,t} * \varepsilon_{hs6,c,t} * M_{hs6,c,t}}{\sum_{hs6 \ni hs2} \varepsilon_{hs6,c,t} * M_{hs6,c,t}} \quad (6)$$

True tariff water will be bound between 0 and the classical tariff water measure. Concerning true available space, its value will be between the classical available space and 1. These two variables will be the explained variables, as shown in equation (7) which shows the empirical specification used:

$$Y_{hs2,c,t} = \alpha + \gamma\ \varepsilon_{hs2,c,t} + \rho\ intermediates_{hs2} + \delta\ food\ security_{hs2} + \tau\ production_{hs2} + \lambda_{c,t} + \mu_{hs2,c,t} \quad (7)$$

where $Y_{hs2,c,t}$ will either be tariff water or available space. $\varepsilon_{hs2,c}$ is as before the import demand elasticity of a given HS 6 digit product in country *c* which is aggregated to the HS 2 digit level using import values as weights. Intermediates is the trade weighted share of HS 6 digit products that are used as intermediates in the production process within a given HS 2 digit product category. Food security is a dummy variable that takes a value of 1 if the product, as mentioned above, is considered important from a food security perspective, namely cereals and oils, fats as well as sugars, which correspond to HS 2 digit categories 10, 15 and 17. Production is a dummy variable that takes a value of 1 if the good was produced in the country in the same year and 0 otherwise. The choice of a dummy rather than the value of production is clearly preferred in order to diminish the problematic endogeneity of the latter, without obviously overcoming it entirely. It is unlikely that there isn't at least one producer who stays on the market in the case of an MFN applied decrease. New producers starting to produce a product following an increase of the MFN applied will certainly happen, but it would be quite rare at that level of aggregation to observe a change on a whole HS 2 digit line. Finally, λ_{ct} are country-year fixed effects and $\mu_{hs2,c,t}$ is the error term. As the fixed effects are interacted, they not only control for anything specific to a given year or country, but also anything that is specific to a country in a given year. This controls for the macroeconomic variables mentioned above, amongst which one can mention GDP, inflation, the exchange rate and fiscal needs. Their expected influence on tariffs is reviewed below so as to have a comprehensive view of what is influencing tariffs. Increased GDP will tend to increase overall demand, therefore impacting consumer surplus. Inflation will tend to decrease producers' profits due to products being relatively more expensive with respect to imports. This will in turn influence demand for imports, increasing tariff revenue and influencing consumer surplus. The exchange rate will change the price of imports, therefore influencing consumer surplus, tariff revenue due to a change in the imported value and/or volume, and also producer profits due to a change in competitiveness. A country's fiscal needs will influence the level of tariff revenue to aim for.

The interest for the food security variable and intermediates doesn't enable us to use item specific fixed effects. Results of Ordinary Least Squares Regressions (OLS) run on equation (7) are presented in Table 1. One must bear in mind that the OLS estimations for available space are biased due to the fact that the explained variable is a fraction. This issue is explained and treated below, but the results of the OLS regression are still presented as a reference in Table 1. Papke and Wooldridge (1996, 2008) show why the bounded nature of a fraction and the possibility of observing values at the boundaries causes estimation issues. More specifically, the effect of a given explanatory variable cannot be constant over the whole range of values that it can take. Bluhm (2013) proposes a QMLE Stata routine entitled

fhetprob to perform a fractional probit estimation with heteroskedasticity based on the work of Papke and Wooldridge (2008).[7] In the present case, as in Bluhm (2013), time averages of all explanatory variables are included in order to account for unobserved heterogeneity in the form of Correlated Random Effects (CRE). The length of each spell is also included in the estimation and this is considered potentially endogenous. Spell lengths of 1 must be dropped in order to avoid perfect collinearity between the variable and its mean, as explained in Wooldridge (2008). Year dummies are also included and errors are clustered by product. The results of this procedure are presented in columns 5 and 6 of Table 1.

Table 1

OLS and fractional heteroskedastic probit

	water	true water	MFN/bound	true MFN/bound	MFN/bound	true MFN/bound
	OLS		OLS		Fractional Heterosk. Probit	
elasticity	0.006	0.055***	-0.000	-0.003***	-0.001	-0.024*
	(0.24)	(5.76)	(-1.10)	(-7.71)	(-0.60)	(-1.70)
intermediate	2.333***	-3.191***	-0.169***	-0.209***	-0.237***	-0.284***
	(4.97)	(-20.47)	(-32.50)	(-30.89)	(-3.09)	(-3.22)
food security	3.173***	0.786***	0.014**	0.014*	0.068	0.027
	(4.33)	(3.87)	(2.24)	(1.83)	(0.50)	(0.22)
production dummy	-0.890*	-0.366**	-0.005	-0.013**	-0.002	0.137***
	(-1.76)	(-2.11)	(-1.00)	(-1.99)	(-0.13)	(4.58)
constant	1.206*	1.668***	0.807***	1.024***	-1.890	-1.750***
	(1.87)	(5.92)	(17.94)	(53.46)	(-1.57)	(-4.61)
country x year dummies	Yes	Yes	Yes	Yes	No	No
year dummies	Yes	Yes	Yes	Yes	Yes	Yes
spell dummies	No	No	No	No	Yes	Yes
N	9774	9676	9774	9676	9601	9502
R^2	0.783	0.437	0.594	0.451		

t statistics in parentheses * p<0.10, ** p<0.05, *** p<0.01

The results discussed below look both at tariff water and use of policy space, for which the reference is the fractional heteroskedastic probit. Results are mostly consistent with the OLS case but there are some exceptions and as discussed higher up the OLS is potentially biased and is shown for transparency and reference. As can be seen in Table 1, the elasticity does not seem to play a role in the setting of tariff water or the MFN/bound (for which the term use of policy space is used below). However, the effect for true tariff water is positive and significant and for the use of policy space it is negative and significant. One must remember that higher values of tariff water are associated with

[7] Papke and Wooldridge (1996) put forward that this issue is very similar to the case of models with binary data. They propose, based on Gourieroux, Montfort, and Trognon (1984) as well as McCullagh and Nelder (1989) to use Bernouilli Quasi Maximum Likelihood Estimator (QMLE), arguing that it is easy to maximize and is a member of the linear exponential family and consistent. Papke and Wooldridge (2008) note that when in the presence of panel data, there is an extra problem as one must be sure that standard errors are robust to arbitrary serial correlation and on top of that one must address the fact the fact that the explanatory variables may be correlated to unobserved heterogeneity. They suggest the use of a probit rather than an logit estimator, which even though often very similar, has the advantage of better handling endogenous variables. The method they propose is however not adapted to unbalanced panel data. This issue is solved in Bluhm (2013), who proposes a QMLE Stata routine entitled *fhetprob* to perform a fractional probit estimation with heteroskedasticity based on the work of Papke and Wooldridge (2008). Bluhm (2013) explains that the conditional variance has to be able to vary with the nature of the unbalancedness, therefore requiring heteroskedasticity in the model.

lower ratios of the use of policy space, such that opposite signs on the coefficients of both variables are consistent. The coefficients on intermediates are positive for tariff water and negative for the use of policy space. The latter is also negative when considering the alternative true measure of the use of policy space. It is negative for true tariff water, which contrasts with the other coefficients. Reasons for this could be lower prohibitive rates in intermediate goods or more trade in intermediates with preferential trade agreement partners. Except for this, results for intermediates are consistent with the prior that the policymaker is keeping the price of inputs low to favor local production of processed products. Products that are important in terms of food security tend to have more tariff water and true tariff water. The use of policy space is not significantly affected by this variable in the fractional heteroskedastic probit regressions, which is the preferred method due to the potential bias using OLS. The coefficients on the production dummy tell us that when the country is producing the good there is less tariff water and less true tariff water, for the use of policy space there is no significant effect and for the true use of policy space it is positive (in the fractional heteroskedastic probit specification). This suggests some protection of local producers.

In order to determine whether the effects of the different variables vary by income levels, regressions are run on three different samples, one for each income level. Even if there aren't necessarily strong priors on the differences one may expect, reasons for believing that there may be differences include the fact that wealthier governments may have more technical skills to set MFN applied levels according to given economic conditions and item specificities, and poorer countries may give more importance to issues such as food security. Results of these regressions are given in tables 2 to 4.

Table 2

Water and true water by income group (OLS)

	Water LDCs	Water Developing	Water Developed	True water LDCs	True water Developing	True water Developed
elasticity	0.096***	-0.008	0.032	0.207***	0.053***	0.010***
	(2.78)	(-0.29)	(1.20)	(4.93)	(5.06)	(3.40)
intermediate	7.623***	0.720	1.586	-8.026***	-2.045***	-0.162
	(6.22)	(1.33)	(1.39)	(-19.49)	(-12.11)	(-0.99)
food security	-4.614***	5.216***	7.346***	0.813*	0.932***	-0.257
	(-2.60)	(6.06)	(3.67)	(1.68)	(3.91)	(-0.91)
production dummy	-4.540***	-0.145	2.211	-1.255**	-0.118	-0.157
	(-3.47)	(-0.25)	(1.62)	(-2.22)	(-0.69)	(-1.03)
constant	51.930***	1.286*	5.126***	33.770***	1.154***	1.214***
	(6.78)	(1.76)	(4.66)	(6.03)	(5.38)	(8.05)
country x year dummies	Yes	Yes	Yes	Yes	Yes	Yes
N	1965	6781	756	1965	6781	756
R^2	0.734	0.744	0.445	0.316	0.434	0.129

t statistics in parentheses * p<0.10, ** p<0.05, *** p<0.01

Table 3
MFN/bound and true MFN/bound by income group (OLS)

	MFN/bound LDCs	MFN/bound Developing	MFN/bound Developed	True MFN/bound LDCs	True MFN/bound Developing	True MFN/bound Developed
elasticity	-0.001**	-0.000	0.001	-0.007***	-0.003***	0.001
	(-2.43)	(-1.04)	(0.90)	(-4.31)	(-6.84)	(0.77)
intermediate	-0.163***	-0.176***	-0.158***	-0.112***	-0.239***	-0.235***
	(-21.44)	(-26.13)	(-7.10)	(-9.06)	(-28.56)	(-8.49)
food security	0.054***	0.004	0.008	0.030**	0.008	0.044
	(4.22)	(0.49)	(0.40)	(2.12)	(0.81)	(1.51)
production dummy	-0.010	-0.005	-0.017	-0.018	-0.011	-0.020
	(-1.11)	(-0.75)	(-0.77)	(-1.49)	(-1.37)	(-0.77)
constant	0.375***	0.820***	0.307***	0.419***	1.035***	0.687***
	(4.99)	(17.98)	(8.88)	(2.58)	(49.88)	(10.44)
country x year dummies	Yes	Yes	Yes	Yes	Yes	Yes
N	1965	6781	756	1965	6781	756
R^2	0.415	0.578	0.675	0.205	0.483	0.510

t statistics in parentheses * p<0.10, ** p<0.05, *** p<0.01

Table 4
MFN/bound and true MFN/bound by income group (Fract. Heter. Probit)

	MFN/bound LDCs	MFN/bound Developing	MFN/bound Developed	True MFN/bound LDCs	True MFN/bound Developing	True MFN/bound Developed
elasticity	-0.012***	0.001	-0.017***	-0.055	-0.022	-0.010***
	(-3.47)	(1.30)	(-3.25)	(-1.56)	(-1.44)	(-2.77)
intermediate	-0.262*	-0.242***	-0.647	-0.176	-0.477***	-1.016
	(-1.72)	(-2.64)	.	(-1.30)	(-3.62)	(-1.62)
food security	0.202	0.024	-0.141	0.120	-0.027	-0.027
	(1.60)	(0.19)	(-0.68)	(0.98)	(-0.21)	(-0.18)
production dummy	-0.017	-0.007	0.160**	0.081*	0.289***	0.307*
	(-0.94)	(-0.30)	(2.09)	(1.73)	(6.67)	(1.78)
constant	-1.801***	-1.475***	-6.009***	-0.404	-1.144***	-5.430***
	(-3.11)	(-3.63)	(-4.67)	(-1.07)	(-3.59)	(-3.76)
year dummies	Yes	Yes	Yes	Yes	Yes	Yes
spell dummies	Yes	Yes	Yes	Yes	Yes	Yes
N	1982	6859	760	1965	6781	756

t statistics in parentheses * p<0.10, ** p<0.05, *** p<0.01

The elasticity of import demand coefficient for tariff water is positive and significant only for LDCs, but for true water it is positive and significant for all income groups. The effect remains the largest in LDCs, followed by developing and developed countries. When looking at the use of policy space (once again in the fractional heteroskedastic probit specification) the effect is negative for LDCs and developed countries and for the true use only in developed countries. As was shown in the descriptive statistics, there tends to be considerably more water in LDCs, in particular due to high bound rates. This may explain this pattern in which the effect on water sticks out for LDCs whereas it is more the case for the use of policy space in developed countries. The coefficient on intermediates is only positive in LDCs, and as in the regression with all regions together, this sign switches for true water and it is also negative for true water in developing countries. It is negative for the use of policy space in both these

income regions and only significant and negative for its true counterpart in developing countries. The coefficient on food security indicates that there is less tariff water in products related to food security in LDCs but more water in developed and developing countries. The sign changes for LDCs when considering true tariff water, which can have two potential explanations, on one hand prohibitive rates may tend to be higher in food products due to the goods being of primary necessity, and on the other hand, as illustrated in Figure 5 and discussed in section 3, there is more trade taking place with PTA partners in non-food security related products in LDCs. For other income groups the difference is only very slight, and in the opposite way. It could help explain the coefficient for developed countries going from positive and significant to non-significant. Food security doesn't seem to be related to the use of policy space, probably meaning that for food security products it is the absolute levels of the MFN applied and the bound rates that are playing a role. Finally, the production dummy coefficient tells us that tariff water and true tariff water is lower in LDCs when the good is also produced by the country but that there tends to be no difference for the two other income groups. For the true use of policy space it is positive in all income groups.

5. ROBUSTNESS CHECKS

Regressions are run at a lower level of aggregation to check the consistency of results at the cost of losing the production dummy. Results for regressions run at the HS 6 digit line level are shown in Table 5. Nearly all coefficients are consistent. There are two cases where the confidence level changes but the coefficient remains significant and still of the same sign, namely food security in the OLS regression on the true MFN/bound (column 4) and the import demand elasticity in the fractional heteroskedastic regression once again for the true MFN/bound (column 6). The same coefficient but for the classical MFN/bound goes from not significant in the HS 2 digit case to negative and significant (consistent with the true MFN/bound coefficient) in the HS 6 digit case. Finally, food significance went from being non-significant for the HS 2 digit to positive and significant for the HS 6 digit true MFN/bound specification (column 6).

Table 5

OLS and fractional heteroskedastic probit at the HS 6 digit level

	water	**true water**	**MFN/bound**	**true MFN/bound**	**MFN/bound**	**true MFN/bound**
	OLS		OLS		Fractional Heterosk. Probit	
elasticity	-0.004	0.034***	0.000	-0.001***	-0.005***	-0.009**
	(-1.03)	(22.86)	(0.55)	(-15.40)	(-4.25)	(-2.17)
intermediate	3.303***	-2.606***	-0.120***	-0.138***	-0.315***	-0.445***
	(15.20)	(-32.66)	(-64.26)	(-55.54)	(-8.17)	(-9.69)
food security	3.097***	0.766***	0.005**	0.029***	-0.002	0.117**
	(13.07)	(6.18)	(2.16)	(8.95)	(-0.06)	(2.1)
constant	0.511**	1.800***	0.848***	0.949***	-0.335***	-2.151***
	(2.16)	(10.26)	(54.97)	(82.60)	(-6.45)	(-3.86)
country x year dummies	Yes	Yes	Yes	Yes	No	No
year dummies	Yes	Yes	Yes	Yes	Yes	Yes
spell dummies	No	No	No	No	Yes	Yes
N	66801	62898	66801	62898	65129	60952
R^2	0.623	0.306	0.558	0.407		

t statistics in parentheses * p<0.10, ** p<0.05, *** p<0.01

Table 6

OLS and fractional heteroskedastic probit excluding the import demand elasticity

	water	true water	MFN/bound	true MFN/bound	MFN/bound	true MFN/bound
	OLS		OLS		Fractional Heterosk. Probit	
intermediate	2.330***	-3.221***	-0.169***	-0.208***	-0.239***	-0.281***
	(4.96)	(-20.58)	(-32.49)	(-30.57)	(-3.14)	(-2.95)
food security	3.175***	0.806***	0.014**	0.013*	0.069	0.024
	(4.32)	(3.96)	(2.23)	(1.71)	(0.52)	(0.21)
production dummy	-0.892*	-0.394**	-0.005	-0.011*	-0.004	0.131***
	(-1.77)	(-2.28)	(-0.98)	(-1.77)	(-0.23)	(4.51)
constant	1.201*	1.616***	0.807***	1.027***	-1.987**	-1.852***
	(1.86)	(5.76)	(17.95)	(53.36)	(-2.06)	(-5.22)
country x year dummies	Yes	Yes	Yes	Yes	No	No
year dummies	Yes	Yes	Yes	Yes	Yes	Yes
spell dummies	No	No	No	No	Yes	Yes
N	9774	9676	9774	9676	9601	9502
R^2	0.783	0.433	0.594	0.446		

t statistics in parentheses * p<0.10, ** p<0.05, *** p<0.01

Another concern that one may have is the use of the import demand elasticity as an explanatory variable. The reason for this is that it is also used in the weighting of the explained variables. Table 6 shows the main results run without this variable. All results are consistent with coefficients that are all of the same sign and level of significance in all specifications, except for the production dummy in the OLS regression run on the true use of policy space (column 4), for which the confidence level goes from 5 percent to 10 percent.

6. CONCLUSION

This paper investigates the extent of policy flexibility and its use in relation to tariff setting in agricultural products. To this end, the magnitude of flexibility - the policy space countries have under international commitments - is measured by the difference between the bound rate and the MFN applied rate. The use of policy space is measured by the ratio of the MFN applied to the bound rate. Using econometric methods this study analyzes whether policy space is influenced by four specific factors: the elasticity of import demand of the product, the use of the product as an intermediate good, whether the product is important for food security, and whether the product is also domestically produced.

A general finding is that policy space in agricultural products is generally available, and only limited for developed countries. Many developing countries have ample room to raise tariffs in most agricultural imports without infringing binding commitments. For LDCs there is virtually no imports for which policy space is not available. The findings indicate that four specific factors are related to the use of policy space. In particular, policy space tends to be used relatively less for products with lower elasticity of demand. This is consistent with relatively higher rates of protection on elastic products. The results also find that policy space is seldom used for intermediate products. This may suggest that processing industries are lobbying governments to keep taxation relatively lower on intermediate products. In regard of products relevant for food security, the results find that policy space is larger but that there is no difference in its use. This suggests two things. First, governments may be aiming for access to cheaper food products, therefore helping consumer welfare. Second, governments may retain policy space so as to increase the MFN applied in case of need. In regard to products that face domestic competitors, the results indicate lower tariff water and more use of policy space, suggesting that producer protection is an issue related to the level of policy space to use and the level of market protection to set. When looking at the results for different country groupings, it appears that for LDCs, the overall results are similar to the results with all income groups. They even tend to be larger in magnitude for the availability of policy space. Results for developing countries indicate that although the four main factors still play a role, they do so to a lesser extent. For developed countries there is a similar tendency, despite intermediates no longer playing a significant role.

Overall, the main message of this paper is that most developing countries retain a large degree of policy space as the MFN applied rates are usually well below the bound rates. Policymakers seem to be basing the choice of the applied tariffs on a number of product-specific variables that seemingly correspond to a complex mixture of optimization of consumer surplus, producer profits and fiscal needs, all this associated with the fact that governments preferably want to have some available space in order to be able to adjust to any future economic shocks. The impact of the different variables on policy space seems stronger in LDCs, but especially when considering tariff water. This tendency is less pronounced for the use of policy space. As a final caveat, it is important to underline that the analysis does not take into account any policy restrictions on the use of non-tariff measures. Indeed, one interesting path for future research would be to explore whether policy space is limited by some of these types of trade policy instruments.

BIBLIOGRAPHY

Amador, M. and K. Bagwell (2012), "Tariff Revenue and Tariff Caps", *American Economic Review*, **102(3)**, 459-65.

Bacchetta, M. and Piermartini, R. (2011), "The Value of Bindings", WTO staff working paper.

Bluhm, R. (2013), "fhetprob: A fast qmle stata routine for fractional probit models with multiplicative Heteroskedasticity", *Forthcoming as UNU-MERIT working paper*.

Estevadeordal, A., C. Freund and E. Ornelas (2008), "Does regionalism affect trade liberalization toward nonmembers?", *The Quarterly Journal of Economics*, **123(4)**, 1531-75.

Foletti, L., M. Fugazza, A. Nicita and M. Olarreaga (2011), "Smoke in the (Tariff) Water", *The World Economy*, **34(2)**, 248-64.

Francois J. and W. Martin (2004), "Commercial Policy Variability, Bindings and Market Access", *European Economic Review*, **48(3)**, 665-79.

Gourieroux, C., A. Monfort and A. Trognon (1984), "Pseudo-maximum likelihood methods: theory", *Econometrica,* **52(3)**, 681-00.

Handley, K. (2014), "Exporting under trade policy uncertainty: Theory and evidence", *Journal of International Economics*, **94(1)**, 50-66.

Horn, H., G. Maggi and R. Staiger (2010), "Trade Agreements as Endogenously Incomplete Contracts", *American Economic Review*, **100(1)**, 394-419.

Humphrey, J. and Memedovic, O. (2006), "Global Value Chains in the Agrifood Sector", UNIDO Working Paper Series, UNIDO Strategic Research and Economics Branch, United Nations Industrial Development Organization.

Kee, H.L., A. Nicita and M. Olarreaga (2009), "Estimating Trade Restrictiveness Indices", *Economic Journal*, **119(534)**, 172-99.

McCullagh, P. and J. A. Nelder (1989), *Generalized Linear Models,* 2nd edition, Chapman and Hall, New York.

Multilateral Trade Negotiations on Agriculture - A Resource Manual (2000), Part 2 - Agreement on Agriculture, Module 2 - Preparing for Negotiating Further Reductions of the Bound Tariffs, R. Sharma - Commodities and Trade Division, Food and Agriculture Organization of the United Nations, Rome.

Organisation for Economic Co-operation and Development (2012), "Mapping Global Value Chains", Policy Dialogue on Aid for Trade, Trade and Agricultural Directorate and Trade Committee, The OECD Conference Centre, Paris.

Papke, E. and J. Wooldridge (1996), "Econometric Methods for Fractional Response Variables with an Application to 401 (K) Plan Participation Rates", *Journal of Applied Econometrics*, **11(6)**, 619-32.

Papke, E. and J. Wooldridge (2008), "Panel Data Methods for Fractional Response Variables with an Application to Test Pass Rates", *Journal of Econometrics*, **145(1-2)**, 121-33.

Sala D., Schroder P.H. and E. Yalcin (2009), "Market Access through Bound Tariffs", *Scottish Journal of Political Economy*, **57(3)**, 272-89.

Printed at United Nations, Geneva
1600845 **(E)** – January 2016 – 245

UNCTAD/ITCD/TAB/75

United Nations publication
ISSN 1607-8291