The Impact of European Union Preferential Policies in the Rice Industry

A Dynamic Panel Gravity Approach

Valentina Raimondi
Margherita Scoppola
Alessandro Olper

FOODSECURE Working paper no. 04

INTERDISCIPLINARY RESEARCH PROJECT
TO EXPLORE THE FUTURE OF GLOBAL
FOOD AND NUTRITION SECURITY

The research leading to these results has received funding from the European Union under Grant FOODSECURE - Exploring the Future of Global Food and Nutrition Security (FP7 no. 290693). The views expressed are the sole responsibility of the author and do not necessarily reflect the views of the European Commission or any institution to which the authors are affiliated. This paper reflects work in progress and has not yet been peer reviewed; comments are welcome.

Available for free downloading from the FOODSECURE website (www.foodsecure.eu).

Valentina Raimondi, Margherita Scoppola, Alessandro Olper. The Impact of European Union Preferential Policies in the Rice Industry: A Dynamic Panel Gravity Approach. FOODSECURE Working Paper no. 4, October 2012

The Impact of European Union Preferential Policies in the Rice Industry: A Dynamic Panel Gravity Approach * [1]

Valentina Raimondi, Margherita Scoppola, Alessandro Olper

Selected Paper prepared for presentation at the International Association of Agricultural Economists (IAAE) Triennial Conference, Foz do Iguaçu, Brazil, 18-24 August, 2012

Abstract: The erosion of preferences due to multilateral tariff reductions is a long-standing concern for many developing countries. This paper focuses on the erosion of the preferences granted by the EU in the rice industry. Since 2004 there has been a sharp decrease in border protection for the EU rice industry. Because the EU grants trade preferences to a considerable number of rice exporting developing countries, the reform implied preference erosion as well. By addressing the impact of preference erosion on developing countries rice exports to the EU, this paper contributes two original insights to the literature: first, by proposing a new empirical approach to compute the preference margin when tariff rate quotas are in force which is based on the assumption of the existence of fixed costs and economies of scale in international trade; second, by estimating the trade elasticities of preferences by means of a dynamic panel gravity equation to deal with the issues of endogeneity of preferences and persistency in bilateral trade flows. The results show that the way preference margins are calculated matters significantly when assessing the existence and extent of their erosion and the values of trade elasticities. Finally, the estimations highlight the fact that the impact of preferences is still very strong for some of the countries concerned.

---

1. Introduction

The erosion of preferences due to multilateral tariff reductions is a long-standing concern for many developing countries and has become one of the key issues in the negotiations within the Doha Development Round. Developing countries benefitting from trade preferences are concerned that reductions of Most Favored Nation (MFN) tariffs by preference-granting countries may decrease their advantages with respect to non-preferred competitors and result in significant export losses. A number of recent papers focus on the assessment of the magnitude of preference and of losses from preference erosion (e.g. Francois et al., 2005; Amiti, Romalis, 2007; Hoekman et al., 2009; Low et al., 2009). Although using different methodologies and approaches most papers share the view that losses due to preference erosion for developing countries are, on the whole, relatively small for two main reasons: first, because preference margins are, in fact, rather small and, second, because preferences are often underused by the preferred developing countries. However, the literature also emphasizes that there

---

* Valentina Raimondi is professor at the University of Milan, Margherita Scoppola is professor at the University of Macerata, Alessandro Olper is professor at the University of Milan.

The authors wish to thank Giovanni Anania, Francesco Aiello, Piero Conforti and Luciano Gutierrez for their useful comments. The authors only are responsible for any omissions or deficiencies.

[1] A number of recent papers focus on the assessment of the magnitude of preference and of losses from preference erosion (e.g. Francois et al., 2005; Amiti, Romalis, 2007; Hoekman et al., 2009; Low et al., 2009).

are groups of countries and/or products for which this may not be the case. Low et al. (2009) find that the risk of preference erosion is high for certain agricultural products and for least developed countries. As regards the European Union (EU), Candau and Jean (2009) find that the value of preferences varies significantly from one developing country to another, with some countries showing rather high values of preferences.

This paper focuses on the erosion of the preferences granted by the EU in the rice industry. Rice is among the most sensitive products for many developing countries exporting to the EU; for some of them, the EU represents a major export market and rice is among their most important export products. The EU trade policy for rice has long been a consequence of domestic policy: both the level and the kind of trade protection were defined to guarantee the sustainability of domestic policy. After 2003, the reform of the Common agricultural policy implied a drastic reduction of border protection in the rice industry. Because the EU grants trade preferences to a considerable number of developing countries, this reform implied preference erosion as well. The objective of the paper is to assess the magnitude of preference erosion and its impact on rice exports to the EU of developing countries benefiting from preferences. For this purpose we use a gravity model. Compared to the previous literature estimating the trade impact of preferences by means of a gravity equation, this paper offers two main contributions. The first concerns the way in which the independent variable of interest, that is the trade preference, is considered. Unlike most papers estimating the trade impact of preferences (e.g. Carrére, 2006; Baier, Bergstrand, 2007; Martinez-Zarzoso et al., 2009), the independent variable here is the preference margin, that is a continuous – and not a dummy – variable. [2] Indeed, the use of a dummy implicitly assumes that the magnitude of preference is the same across countries, products and years; further, the dummy may capture other country specific effects. One empirical problem when using the preference margin is that of aggregating tariffs; our analysis is highly disaggregated, hence there is no need for - and no bias due to –tariffs aggregation. An innovative approach to calculate the preference margin is proposed: since EU preferences to many agricultural imports are granted by means of tariff rate quotas, to compute the preference margin one needs to evaluate the actual tariff equivalent of the tariff rate quota. This paper proposes a new empirical strategy to calculate the tariff equivalent of a tariff rate quota, which is shown to be consistent with the assumption of fixed costs and economies of scale in international trade. The paper compares the preference margin obtained using this new approach with that obtained by the standard approach used in the literature showing that the latter may lead to a substantial underestimation of the preference margin. Finally, we also take into account of the "effective" preference granted by the EU to the developing countries by considering the tariffs actually applied to the non-preferred exporters, instead of the MFN tariffs; as recently shown, the use of the MFN tariffs may lead to an overestimation of preferences (Hoekman et al. 2009; Carrére et al. 2010).

[2] Exceptions are Cipollina, Salvatici (2010) and Cardamone (2011).

The second contribution is the use of a dynamic panel gravity equation. As the literature has shown, the standard cross-section gravity model is unable to deal with endogeneity arising when estimating the trade preference effects, because of the difficulties in finding the appropriate instrumental variables (Baier, Bergstrand, 2007). Theoretically–based gravity models using panel data allow us to make adjustments for endogeneity due to omitted (selection) variable bias. However, the presence of sunk costs raises the question of hysteresis and persistency in bilateral trade flows. Thus, to account for the latter issue, a dynamic version of the gravity equation through a system-Generalized Method of Moment (GMM) estimator (Blundell, Bond, 1998) has been proposed, a framework that also represents a natural way to deal with the problem of endogeneity of preferences to trade flows.

Overall results show that the way preference margins are calculated matters significantly when assessing the existence and extent of preference erosion. Under the standard method there is no clear-cut evidence of preference erosion, while the opposite is true when the tariff equivalent proposed in this paper is used. In the latter case, the results suggest that during the examined period there has been considerable erosion of preferences, even though the extent of the erosion varies across the different groups of countries. The method to calculate the margin also significantly affects the estimated values of trade elasticity, both in a static and a dynamic environment. More specifically, where there are fixed costs and economies of scale, the use of the standard tariff equivalent of tariff rate quotas can significantly underestimate the (true) impact of preferences. Our estimations highlight the fact that the trade impact of preferences is currently still very high for some group of countries. Further, using the system-GMM estimator we estimate the short and the long run trade elasticities to preferences and the magnitude of the estimated long run coefficient confirms the inertial behaviour of exports.

The paper is organized as follows. The next section offers an overview of the EU trade policy in the rice industry. The third section explains the method used to calculate the tariff equivalent of tariff rate quotas and the preference margins. The fourth section addresses the issues arising when estimating the trade impact of the preferences by means of the panel gravity equation, while the fifth illustrates the estimated models and the econometric strategy. The sixth illustrates the data used, the seventh discusses the results, while the final section draws various conclusions.

2. EU trade policy in the rice industry during the period 2000-2008: an overview

The international market of rice covers a rather heterogeneous range of products, both from the point of view of their characteristics and value added. Two main distinctive types of rice are traded - the Japonica and the Indica – and four different products: paddy, husked, milled and broken rice. Most EU imports are of husked (more than 60%) and milled rice (about 20%), while paddy rice imports are very small (less than 1%). Although the EU accounts for only 5.5% of world imports, it is a very important market for certain developing countries. For example, in 2007 the EU accounted for the 95%, 65%, 47% and 40% of the value of rice exports of Cambodia, Guyana, Bangladesh and Suriname, respectively.[3]

The EU trade policy in the rice industry is rather complicated; the instruments and the level of the border protection vary significantly across products and between imports regulated by multilateral agreements and those covered by the various preferential schemes. Before 2004, the tariffs applied to the EU imports on a MFN basis were defined by the 1994 GATT Agreement; while for paddy and broken rice specific fixed bound tariffs were applied, for husked and milled rice the applied tariff was established to be the smallest one between the bound tariff and the difference between a threshold import price and the international price. This threshold import price for the husked rice was equal to 180% (for the Indica rice) and 188% (for the Japonica rice) of the intervention price; for milled rice, it was set equal to the intervention price plus a percentage to be calculated. As a consequence of this import regime, tariffs applied to husked and milled rice fluctuated with the international price: when this was high, the tariff was the difference between the threshold import price and the international price and, hence, smaller than the bound tariff, but when the international price fell below a certain level then the bound tariff was applied.

With the 2003 reform of the Common Agricultural Policy the EU decided to reduce the value of the intervention price for rice drastically, cutting it by 50%. The threshold import prices for husked and milled rice as well as tariffs consequently dropped. The EU and the main rice exporters then agreed to eliminate the threshold import price system and a new set of MFN bound tariffs for husked, milled and broken rice were negotiated, and entered in force in September 2004.[4] These new tariffs are significantly lower than the pre-reform values: in August 2004 the tariffs applied to imports were 197 Euro/t and 416 Euro/t for husked and milled rice, respectively, while in September 2004 these fell to 65 Euro/t and 175 Euro/t. However, only 55% of EU imports of rice is currently subject to these MFN tariffs (COGEA, 2009).

[3] These figures are drawn from COMTRADE database.

[4] While the value of the tariff applied to broken rice imports is fixed, for husked and milled rice three different values of tariffs may be applied depending upon the quantity imported. As for paddy rice, there was no need to set new tariffs as the threshold import price system was not in force in this case; hence, the applied tariff continues to be the 1994 GATT Agreement bound tariff.

A considerable amount of EU rice imports is currently covered by Tariff Rate Quotas (hereafter, TRQs), that is, a two-tiered tariff system with the volume imported within the quota charged at a lower tariff than out-of-quota imports. The 1994 GATT Agreement on Agriculture introduced several agricultural TRQs to improve market access where agricultural protection was very high but no TRQs on EU rice imports were included in the Agreement. However, after 1998, in applying article XXIV of the GATT, the EU granted a number of TRQs to the main rice exporters to compensate them for the 1995, 2004 and 2007 enlargements.[5] Country-specific TRQs were granted to the United States, Thailand, Australia, India, Pakistan and Guyana for husked, milled and broken rice; further, there are also non-country specific TRQs. Imports under these GATT TRQs are estimated to account for about 30% of total EU rice imports in 2007 (COGEA, 2009).

Additional TRQs are granted by the EU under preferential agreements (Table 1). In the rice industry, trade preferences are given exclusively by means of TRQs. Since the early Lomè Conventions a certain volume of rice from the ACP countries enters the EU at a lower tariff than the MFN one. More specifically, during the period examined in this paper, the EU granted a TRQ of 160,000 tons, 35,000 of which from the overseas countries and territories (OCT). In-quota tariffs were made up of two components: the first part is a percentage of the MFN tariffs, while the second is independent of the value of MFN tariff. Within the Generalized System of Preferences, Bangladesh benefits of a TRQ of 4,000 tons, with the in-quota tariff being made of two components as well. Under the Euro Mediterranean Agreement, the EU grants a TRQ of 32,000 tons to Egypt, with the in-quota tariff 25% lower than the MFN one. Finally, under the Everything But Arms initiative (EBA), a zero-duty TRQ has been in force since 2002, with the quota gradually increasing over the transitional period 2002-09. Almost 15% of total EU rice imports were covered by preferential TRQs in 2007 (COGEA, 2009).

An important feature of TRQs is the way by which licenses to import at the in-quota tariff are allocated. In the case of the EU preferential TRQs in the rice industry, import licenses are allocated on-demand, with pro-rat cuts if quantities exceed those available. The licenses-on-demand method assigns licenses based on the level of licenses requested by individual firms. If the sum of all requests is greater than the quota, then each firm receives a prorated number of licenses. Hence, all traders demanding licenses actually import within the quota. Licenses are administered both by the exporting and the importing countries and are generally not transferable.

3. Preference margins with Tariff Rate Quotas

3.1 The tariff equivalent of Tariff Rate Quotas

The presence of tariff rate quotas (TRQs) raises an important issue when calculating the preference margin (PM), that is, finding the tariff equivalent of a TRQ. Figure 1 illustrates the

[5] Hereafter, we will refer to these as the GATT TRQs.

usual partial equilibrium framework used to analyze the TRQ under the assumptions of *perfect competition* and upward export supply curve (s). The export supply curve is kinked: it is equal to $s+T^{in}$, where T^{in} is the in-quota tariff, when imports are lower than the quota $\bar{Q}$; it is vertical when imports are equal to the quota; and is equal to $s+T^{out}$, with T^{out} being the out-of-quota tariff, if imports are higher than the quota. The literature on TRQs suggests that the tariff equivalent varies according to which of the three elements of a TRQ regime is binding (Boughner *et al.,* 2000).

When import demand is D_1, the equilibrium quantity is lower than the quota (Q_1); the quota is not binding and the in-quota tariff is applied to all imports. In this case, the tariff that leaves imports and prices unchanged is clearly T^{in}, the one applied to the in-quota imports. In the second case the interaction between demand D_2 and supply determines an equilibrium quantity (Q_2) higher than the quota; hence, there are out-of-quota imports. In this case, the out-of-quota tariff is applied to the out-of-quota imports, while the in-quota tariff to the in-quota imports. The equilibrium price is $P_2 = s(Q_2) + T^{out}$; the difference between the price P_2 and the marginal cost faced by traders importing within the quota ($s(\bar{Q})+T^{in}$) is the unit rent caused by the quota.[6] Clearly, the tariff that leaves imports and prices unchanged is T^{out}, the out-of-quota tariff. Finally, if import demand (D_3) crosses the export supply curve on its vertical portion, the binding instrument is the quota itself. The value of the equilibrium price (P_3) is in between $s(\bar{Q})+T^{in}$ and $s(\bar{Q})+T^{out}$; the difference between the equilibrium price and the marginal cost faced by importers ($s(\bar{Q})+T^{in}$) is the unit rent. In this case the tariff equivalent is $P_3 - s(\bar{Q})$ (T^3 in Figure 1).

The empirical literature relies on this theoretical framework to compute the tariff equivalent of TRQs. Many authors consider the in-quota tariff as tariff equivalent when imports are lower than the quota (case 1), the out-of-quota tariff when imports are higher than the quota (case 2) and an in-between value when imports are equal to the quota (case 3) (e.g. Boumellassa *et al.,* 2009; Garcia-Alvarez-Coque *et al.,* 2010; Cardamone, 2011).

The tariff equivalent of a TRQ may be different when fixed costs and economies of scale are considered. The usual framework used to analyze the economics of TRQs, illustrated in Figure 1, assumes that the export supply curve is upward sloping and, hence, that the

[6] The way by which licenses are allocated affects the distribution of quota rents: if licenses are managed by the exporting (importing) country rents are captured by the exporters (importers) (Boughner et al., 2000). In the framework here used, however, there is no distinction between the importer and the exporter as there are just middlemen, i.e. the trading firms.

marginal cost incurred by traders is increasing. However, there are reasons to believe that this is not always the case. The costs faced by firms trading agricultural products include a variable component given, among other factors, by the cost of purchasing the agricultural good in the exporting countries. However, fixed costs are also often associated with international trading. These may arise because of the fixed costs traders incur when acquiring knowledge of foreign markets or to setup a foreign distribution chain; in addition, there is some evidence that there are also economies of scale in shipping and in transportation in general (e.g. Hummels, Skiba, 2004).

To investigate the tariff equivalent of TRQs with fixed trading costs, we rely on the basic international trade model under economies of scale and monopolistic competition *à la* Dixit-Stiglitz-Krugman (see Feenstra, 2003).[7] In this setting, a number of (symmetric) firms are assumed to trade differentiated products; [8] each firm is a monopolist for the variety it trades and, thus, it maximizes profits by equalizing marginal revenues with marginal costs; marginal costs are assumed to be constant. Because of fixed costs, the average cost declines with imports and is always higher than the marginal cost; as each firm's profits are positive, if there are no restrictions to entry, new firms enter the market. This reduces the market share of each firm and increases the average cost; in equilibrium, profits are zero and the price equals the average cost. Because of the assumption of symmetry, prices and quantities are identical across all varieties; the price and the imported quantity of the variety i are thus also the price and quantities of all imported varieties.

The average cost of a representative trader under a TRQ depends on whether it imports in-quota and/or out-of-the quota. If firms face identical cost and demand functions and licenses are allocated on demand with pro-rata cuts, each firm demands the same amount of licenses (because they face identical cost and demand functions) and have the same amount of

[7] The importance of fixed costs in international trade has been recently emphasized by the firm-level heterogeneity literature (e.g. Melitz, 2003). For simplicity, the framework here assumes symmetry both on the demand and supply side.

[8] Although many commodities are usually assumed to be homogeneous, there are reasons to believe that this may not be appropriate in the context of the issues addressed in this paper. TRQs are applied to products usually defined at a rather high level of aggregation. It is very likely that these broad groups include products that are perceived by consumers as different. In the specific case of rice, TRQs are defined at the 4 or 6 digit level (see Table 1). This means that a single TRQ is applied to all imports, for example, of husked rice from Egypt. However, Egypt exports to the EU different types of husked rice: round, medium or long grain rice. The physical dimension of grain shape is considered among the most important criteria of rice quality. Further, Egypt exports to the EU both parboiled and non parboiled husked rice. Hence, within the same TRQ the EU imports products that, in fact, are perceived as very different by consumers.

licenses, as licenses are cut to each firm by the same ratio.[9] Hence, imports within and outside the quota are equal among all firms.

If, as above, $\bar{Q}, T^{in}$ and T^{out} are the quota, the in-quota and the out-of-quota tariffs, respectively, of the representative trader, then under the TRQ the average cost is:

$$AC_{T^{in},T^{out}} = \begin{cases} \dfrac{FC}{Q} + c + \dfrac{T^{in}\bar{Q} + T^{out}(Q-\bar{Q})}{Q} & \text{if } Q > \bar{Q} \\ \dfrac{FC}{Q} + c + T^{in} & \text{if } Q \le \bar{Q} \end{cases} \qquad (1)$$

In equilibrium, the price is equal to $AC_{T^{in}, T^{out}}$. The Figure reports two demand curves faced by the monopolistic firm under equilibrium, which reflect different market sizes. As market size increases the firm can exploit economies of scale, thereby incurring lower average costs; positive profits attract new firms and this increases the degree of competition on the market and the elasticity of the demand faced by each firm. Thus, the larger the size of the market, the higher the elasticity of the demand faced by each firm. D_1 is the demand curve when the market size is small, relative to the quota; the equilibrium quantity is $Q_1 < \bar{Q}$ and the price under the TRQ is P_1. Clearly, the tariff that leaves unchanged the price and the imported quantity is the in-quota tariff T^{in}, such as under perfect competition. However, if the market size is large enough with respect to the quota (D_2), then the equilibrium quantity, Q_2, is higher than the quota and the equilibrium price is P_2. In this case, the tariff that would leave price and imports unchanged is the weighted average of the two tariffs. Finally, when the demand curve crosses $AC_{T^{in},T^{out}}$ for $Q = \bar{Q}$, the tariff equivalent is again the in-quota tariff T^{in}.[10]

Hence, within this framework if imports are no greater than the quota, the tariff equivalent is the in-quota tariff; alternatively it is the weighted average of the two tariffs. Thus, the tariff equivalent computed on the base of the economies of scale-monopolistic competition framework is always no greater than the one consistent with the perfect competition model.

3.2. The preference margin

[9] This assumption reasonable holds even under other allocation methods. For example, if licenses are allocated through auctions, symmetric traders equally have the same amount of licenses as they are likely to offer the same price for the licenses.

[10] It is worth noting that under the symmetry assumption here made, quota rents are zero; indeed, positive rents would attract new firms, the market share would diminish and the average cost would increase. Hence, in equilibrium there is no gap between the market price and the cost faced by the firm to import within the quota. See also Jørgensen and Schröder on this point (2007).

We use the following formula to calculate the PM in a certain year (Carrére *et al.,* 2010; Cipollina, Salvatici, 2010):

$$PM_{kj} = \frac{T_k^{MFN} - T_{kj}^{PREF}}{1 + T_{kj}^{PREF}} \tag{2}$$

where k and j are the product and the exporting country respectively, T_{kj}^{PREF} is the preferential *ad valorem* tariff (in our case, the tariff equivalent of the TRQ) and T_k^{MFN} is the *ad valorem* tariff applied to non-preferred exporters. According to equation (3), PM is measured as the percentage difference between the tariff faced by an MFN exporter and the tariff faced by the preferred country when it exports to the EU. As shown by Carrére *et al.* (2010), alternative measures of the PM, such as the simple difference between the two tariffs, could be misleading.

Under the perfect competition hypothesis, if Q_{kj} are total imports and $\bar{Q}_{kj}$ is the quota, in a given year the PM is the following: [11]

$$PM_{kj}^{P} = \begin{cases} \dfrac{T_k^{MFN} - T^{in}_{kj}}{1 + T^{in}_{kj}} & \text{if } Q_{kj} < \bar{Q}_{kj} \\[2ex] \dfrac{T_k^{MFN} - T^{out}_{kj}}{1 + T^{out}_{kj}} & \text{if } Q_{kj} > \bar{Q}_{kj} \\[2ex] \dfrac{T_k^{MFN} - \dfrac{(T^{out}_{kj} + T^{in}_{kj})}{2}}{1 + \dfrac{(T^{out}_{kj} + T^{in}_{kj})}{2}} & \text{if } Q_{kj} = \bar{Q}_{kj} \end{cases} \tag{3}$$

Differently, the PM under the assumption of economies of scale is:

$$PM_{kj}^{E} = \begin{cases} \dfrac{T_k^{MFN} - T_{kj}^{in}}{1 + T_{kj}^{in}} & \text{if } Q_{kj} \le \bar{Q}_{kj} \\[2ex] \dfrac{T_k^{MFN} - \dfrac{(T_{kj}^{out}(Q_{kj} - \bar{Q}_{kj}) + T_{kj}^{in}\bar{Q}_{kj})}{Q_{kj}}}{1 + \dfrac{(T_{kj}^{out}(Q_{kj} - \bar{Q}_{kj}) + T_{kj}^{in}\bar{Q}_{kj})}{Q_{kj}}} & \text{if } Q_{kj} > \bar{Q}_{kj} \end{cases} \tag{4}$$

[11] It is worth noting that the tariff T_{kj}^{out} applied to imports exceeding the preferential TRQ may be lower than T_k^{MFN}, because the EU may also grant the (preferred) exporting country TRQs within the GATT. For example, Egypt exports broken rice to the EU within preferential TRQs, but there are also additional imports which are charged at the in-quota tariff of the GATT TRQs.

When out-of-quota imports are zero, the tariff equivalents computed under the two hypotheses are identical and, thus, $PM^E = PM^P$. However, when there are out-of-quota imports, the tariff equivalent consistent with the assumption of perfect competition is higher and the margin is lower ($PM^E > PM^P$).

A final issue in calculating PM is which tariff T_k^{MFN} is considered. A common used approach involves the use of the MFN, bound or applied, tariff. However, as recently pointed out (Hoekman *et al.*, 2009; Low *et al.*, 2009; Carrére *et al.*, 2010), comparing the preferential with the MFN tariff may overestimate the preference, especially for countries or trading blocs such as the EU that extend the preferential access to many trading partners. Accordingly, T_k^{MFN} should be the tariff actually paid by all other exporters to the EU; this is computed as the import share-weighted average tariff imposed on the other countries exports. Clearly, under this *effective market access* approach the PM can be lower.

We have computed PM using both approaches for the tariff equivalent of the TRQs; further, both the "unadjusted" PM (with T_k^{MFN} being the MFN tariff) and the "effective" PM, (with T_k^{MFN} being the actual tariff faced by the other exporters) have been considered.

4. Estimating the trade effect of preferential margins with a gravity equation

The literature studying the effect of trade preferences using the gravity equation is largely based on the assumption that PM is an exogenous variable (e.g., Cipollina, Salvatici, 2010; Nilsson, Matsson, 2009; Cardamone, 2011). This approach consistently identifies the average treatment effect of PM if the economic agents' decision to select a programme is unrelated to unobservable factors. However, as discussed in Baier, Bergstrand (2007), in the context of free trade agreements (FTA), many trade-policy analysts have noted that trade inhibiting policies, such as non-tariff barriers, may be one of the main reasons why governments select a specific FTA. In this context we face a similar problem. Indeed, the EU decision to adopt a preferential regime could also be, among other things, a function of several unobservable factors: for example, the existence of specific domestic regulations as well as political motives unrelated to trade. Hence, countries select a preferential regime for reasons difficult to observe and that are often correlated with the level of trade. This raises the classical problem of endogeneity in RHS variables.

Endogeneity usually arises under three forms: omitted variables, measurement error, and simultaneity bias (Wooldridge, 2002). While the use of a continuous instead of a dummy variable to measure the preferences can mitigate *measurement error* bias, Baier, Bergstrand (2007) suggest that *omitted variable* (selection) bias and, to a lesser extent, simultaneity remain the major sources of endogeneity in the estimation of the effects of trade preferences by means of the gravity equation. The standard cross-country gravity equation is unable to account for endogeneity, as any potential instrument for trade preferences is also a determinant of bilateral trade (Magee, 2003). Moreover, the cross-sectional studies produce estimates based on between country-pair sample variation, with the questionable assumption that all other country differences have been adequately modelled. By contrast, the within country-pair estimations, obtained using panel data, result more appropriate to deal with the issue of trade liberalization (Lai, Trefler 2004). Thus, the most plausible estimate of the average effect of an FTA, that also allows to account for endogeneity due to omitted variable bias, is obtained from (theoretically-based) gravity models using panel data (Baier, Bergstrand 2007, Magee 2008, Martinez-Zarzoso *et al*. 2009). The panel gravity equation should include time-varying country dummies to account for time-varying multilateral-resistance terms as well as to eliminate the bias from the gold-medal error identified by Baldwin and Taglioni (2006). In this way, variables that are difficult to measure, such as "infrastructure, factor endowments, multilateral trade liberalization, and unobserved time-specific shocks, will be captured by the *importer-year* and *exporter-year* fixed effects." (Magee, 2008 p. 353). Finally, the presence of unobserved time-invariant bilateral factors simultaneously influencing the presence of an FTA and the volume of trade have to be controlled for by *country-pair* fixed effects (Baier, Bergstrand, 2007).

To estimate the average effect of the PM on rice exports to the European Union we follow this strategy although, unlike previous contributions, we use a continuous, instead of a dummy, preference variable. For the dependent variable, we take account of overall trade, and not just that benefiting from preferences, as was the case in some previous papers (e.g. Nilsson, Matsson, 2009). Indeed, there are several reasons that call into question the use of preferential trade only, related to both spill-over effects and the reallocation of market shares towards more productive firms. First, when a firm decides to export to the EU after the introduction of a preferential tariff it has to face sunk costs linked to the marketing of the product, such as the new (trade) infrastructures and transaction costs to meet the EU standards and, eventually, the setup of a foreign distribution chain (Arkolakis, 2008). These may generate spill-over effects on total trade, as they are likely to improve the country's overall ability to export to the EU. Second, as suggested by the recent trade theory, exposure to international trade induces the more productive firms to export while simultaneously forcing the least productive firms to exit. Both the exit of the less productive firms and the additional exports sales gained by the more productive firms reallocate market share towards the latter (Melitz, 2003). As a consequence of this, the ability of the average firm to export increases irrespective of the existence of preferences. Finally, this productivity boost of exporting firms is also attributable to the effect of the learning process (Greenaway, Kneller, 2007) that will clearly affect trade overall and not just preferential trade. This leads to the issue of *persistency* and *hysteresis* in bilateral trade that need to be accounted for in the empirical analysis. Indeed, even when the original reason for a high level of bilateral trade has disappeared, the stock of capital that firms have invested in the form of marketing and distribution networks, brand-name loyalty among customers, and so forth, live on for many years thereafter. The word *hysteresis* is sometimes applied to this phenomenon, suggesting that the effect is considered to be permanent. A set of theoretical models by Dixit (1989), Krugman (1989), and others suggest that hysteresis in trade may be due to sunk costs in entering the foreign market at the firm level. Thus, in order to tackle hysteresis in trade, we have estimated the gravity equation dynamically. This approach allows us to distinguish between the short-run and the long-run impact, with the latter capturing the observed evidence that countries trading with each other tend to have an inertial behaviour, possibly due to sunk costs.

5. Empirical specification of the gravity equation

5.1 Static gravity equation

The standard gravity equation commonly estimated using cross-section data is:

$$m_{ijk} = \delta_0 \left(GDP_i\right)^{\delta 1} \left(GDP_j\right)^{\delta 2} \left(d_{ij}\right)^{\delta 3} \left(t_{ijk}\right)^{\delta 4} e^{\delta 5\left(Lang_{ij}\right)} e^{\delta 6\left(Cont_{ij}\right)} \varepsilon_{ijk} \qquad (5)$$

where m_{ijk} is the trade flow to country i from country j of good k; GDP_i (GDP_j) is the nominal gross domestic product in the destination (origin) country; d_{ij} reflects the impact of transport costs and is proxied by distance between countries; *Lang* and *Cont* are binary variables assuming the value 1 if i and j share a common language or a common border, and 0 otherwise. Finally, t_{ijk} are the trade policies, proxied by the *ad valorem* equivalent tariff factor imposed by country i on commodity k imports from country j: $t_{ijk} = \left(1 + T_{ijk}\right)$

with T_{ijk} being the *ad valorem* equivalent tariff. Rewriting equation (5) in logarithmic form and introducing the time dimension, as well as the fixed effects in accordance with the theory, the basic empirical model can be expressed as:

$$\ln m_{ijkt} = \beta_0 + \beta_1 \ln(1 + T_{ijkt}) + \alpha_{jt} + \alpha_{it} + \alpha_{ij} + \alpha_{hs6t} + \alpha_t + u_{ijkt} \qquad (6)$$

where α_{ij} are bilateral fixed effects to control for heterogeneities accounting for the impact on trade of any observed and unobserved characteristic of a country pair that is constant over time, such as the distance between countries (proxy of transportation costs), a common language or common border, colonial relationship as well as other historical, cultural and political ties between trading partners (see Magee, 2008); a_{it} and a_{jt} are the importer-year and exporter-year fixed effects that account for country variation in real GDP, population as well as other difficult to measure variables such as infrastructure, factor endowments or time specific shocks. These country-and-time effects account explicitly for the time-varying multilateral price terms (Anderson, van Wincoop, 2004; Baier, Bergstrand, 2007). Finally u_{ijkt} is the error term, and α_t and α_{hs6t} are year and product-time dummies to account for any shocks that affect global trade flows in a particular year or in a particular time-product group, respectively.

Because we consider the EU as the unique importer, the importer-year α_{it} and bilateral fixed effects α_{ij} are dropped because they are perfectly collinear with the time dummies and the exporter-year dummies. Moreover, our definition of PM (see equation 3) can be written as: $(1 + T_{kjt}^{PREF}) = (1 + T_{kt}^{MFN})/(1 + PM_{kjt})$.

Plugging this relation into equation (7) we obtain:

$$\ln m_{jkt} = \beta_0 + \beta_1 \left[\ln(1 + T_{kt}^{MFN}) - \ln(1 + PM_{jkt})\right] + \alpha_{jt} + \alpha_{hs6t} + \alpha_t + u_{jkt} \qquad (7)$$

Finally, if T_{kt}^{MFN} does not vary across exporters, it is fully captured by time-product fixed effects[12], thus the final static panel gravity specification becomes:

$$\ln m_{jkt} = \beta_0 + \beta_2 \ln(1 + PM_{jkt}) + \alpha_{jt} + \alpha_{hs6t} + \alpha_t + u_{jkt}. \qquad (8)$$

To estimate equation (9) consistently we follow the standard practice in gravity literature (see Martin, Pham, 2008; Helpman *et al.*, 2008) of implementing the Heckman two stage selection correction procedure (Heckman, 1979). In a panel data setting, this means to estimate a panel random-effects Probit equation with exporter and importer fixed effects and time effect, as first step selection equation. From this estimation, the inverse Mill ratio is retrieved and included as regressor in the so-called output equation, namely a least square regression with dummy variables (LSDV) that include time and exporter-year dummies (see Martinez-Zarzoso *et al.* 2009).

[12] This assumption precludes the inclusion in this model of the “effective” PM.

Finally, to check for robustness we also applied an alternative approach using the Poisson Pseudo Maximum-Likelihood (PPML) estimator proposed in the influential paper of Santos Silva and Tenreyro (2006) to solve heteroscedasticity problems in the gravity model.[13]

5.2 Dynamic gravity equation

To account for persistency and hysteresis in trade flows, equation (9) could be specified dynamically by adding the lagged dependent variable on the right-hand side:

$$\ln m_{jkt} = \gamma_0 + \gamma_1 \ln m_{jk(t-1)} + \gamma_2 \ln\left(1 + PM_{jkt}\right) + \alpha_{jt} + \alpha_{hs6t} + \alpha_t + u_{jkt} \qquad (9)$$

where γ_1 is the adjustment coefficient in the dynamic model.

The introduction of dynamics raises econometric problems when the time span of the panel is short, as in our application. Indeed, the correlation between the lagged dependent variable and the transformed error term renders the least squared within estimator biased and inconsistent in panels with large cross-sections and short time series. To avoid this inconsistency, Arellano and Bond (1991) proposed a Generalised Method of Moments (GMM) estimator as an alternative to LSDV. They suggested transforming the model into a two-step procedure based on first difference to eliminate the fixed effects, as a first step. In the second step, the lagged dependent variable is instrumented using the two period lagged differences (or two period lagged level) of the dependent variable.[14]

In the case of the gravity model, first-differencing the equation removes the fixed effect but also the time invariant regressors from the specification and, when the regressors are of interest, the resulting loss of information may be a serious drawback (De Benedictis, Vicarelli 2005). Moreover, with highly persistent data and short panel (along the time dimension), as in the case of bilateral exports flows and of our dataset specifically, the GMM estimator may suffer marked small sample bias due to weak instruments (Blundell, Bond, 1998).

To overcome this problem, Blundell and Bond (1998) built a system of two equations, known as System-GMM, which supplements the equations in first differences with equation in level. In particular, the System-GMM estimator utilises instruments in level for the first-

[13] Martin and Pham (2008) have shown that the Heckman method performs better if true identifying restrictions are available. Conversely, the PPML solves the heteroscedasticity problem, but yields biased estimates when zero trade observations are frequent. However, in our specific context it is impossible to fully account for the exclusion restriction suggested by the theory. Indeed, to implement it we have to find a (bilateral) variable that affects fixed trade costs but has a minor effect on variable trade costs. This variable should be used in the (first step) selection equation, but excluded in the (second step) outcome equation. Nevertheless, as we work with only one importer (the EU) and bilateral fixed effects (a_{jt} in equation 9), it is not possible to include in the selection equation an additional variable that affects fixed trade costs (e.g., language dummy, religion dummy) because it would be perfectly collinear with the included fixed effects.

[14] All runs using the Hansen (1982) two-step GMM estimator.

differenced equation and first-differenced instruments for the equation in level. Following the Blundell and Bond system equations, the gravity specification will be:

$$d \ln m_{jkt} = \gamma_1 d \ln m_{jk(t-1)} + \gamma_2 d \ln(1 + PM_{jkt}) + \gamma_3 d \ln v_{jt} + \alpha_{hs6t} + \alpha_t + u_{jkt} \quad (10)$$

and

$$\ln m_{jkt} = \gamma_0 + \gamma_1 \ln m_{jk(t-1)} + \gamma_2 \ln(1 + PM_{jkt}) + \gamma_3 \ln v_{jt} + \gamma_4 \ln dist_j + \alpha_{hs6t} + \alpha_t + u_{jkt}, \quad (11)$$

where d denotes first differences, $m_{jk(t-1)}$ the lagged dependent variable and is treated as predetermined; $dist_j$ the distance between the exporting country and the EU, considered as a strictly exogenous covariate; finally, the preferential factor $(1+PM_{jkt})$ and the exporter rice production volume v_{jt} that are treated as endogenous. Thus, the GMM estimator also represents a natural strategy to account for the endogeneity of the preference factor, as well as measurement error and weak instruments, while controlling for time-invariant country specific effects such as distance.

Following Martinez-Zarzoso *et al.* (2009), we consider that by including lagged bilateral exports in the right hand side of the equation we are able to control for the time-varying components of the multilateral resistance term. Consequently, neither time-varying exporter dummies nor other explicit fixed effect dummies are included in the GMM regressions.

6. Data

To compute PM we need the applied in-quota and out-of-quota tariffs and the quantities imported within the quota and out-of-the quota. Moreover, to implement the gravity framework we need bilateral trade observations and the standards gravity covariates. Our sample covers 36 rice products (HS-8 digit level) and 123 producing and/or exporting countries for 9 years (2000-08). A key advantage of using data at a highly disaggregated level is that there are no distortions due to tariffs aggregation, as the EU tariffs in the rice industry are defined at the HS-8 digit level. EU tariffs have been converted in *ad valorem* tariffs by using import unit values obtained by the ratio between the value and the quantity of the EU imports for each product and each year.

Data on actual imports within the quota are not easily available and, thus, many studies calculate in-quota imports by comparing the granted quota with total imports (e.g. Boumellassa *et al*., 2009; Cardamone, 2011; Garcia-Alvarez-Coque *et al*., 2010). If total imports are equal to or exceed the quota, in-quota imports are set as equal to the quota; alternatively, in-quota imports are equal to total imports. In this way, one is implicitly assuming that the quota is filled, that is, that preferences are fully used. However, evidence about the fill rate of TRQs suggests that usually the opposite is true. In this paper, in-quota imports at the HS-8 digit level are directly drawn from the EU Commission. By using the real amount of product imported at the in-quota tariff, no *a priori* assumption about the fill rate of the quota (i.e. the preference utilization) is made. Hence, the *actual* rate of utilization of preferences is here considered. As out-of-quota imports are not collected by the EU Commission, they are computed here as the difference between total yearly imports from the External trade statistics (Comext) produced by Eurostat and the in-quota imports data from the EC Commission. To compute the PM^P (equation 4) we have assumed that $Q > \overline{Q}$ (i.e. there are positive out-of-quota imports) only if total imports are greater than the 102,5% of the in-quota imports. In this way, tariff equivalent and preference margin values are not influenced by marginal or anecdotic flows of out-of-quota imports.[15]

Bilateral trade flows data used in the gravity equation come from Comext, rice production volumes come from FAOSTAT [16] database, while distances between countries come from the CEPII database.

7. Results

7.1. Preference margins under the two hypotheses about the TRQ tariff equivalent

Table 2 reports the values of the average PM for groups of preferred countries under the hypothesis of perfect competition (standard PM^P) and of economies of scale (weighted PM^E). Margins have been aggregated by product and by country through the weighted averages of the PM_{kj}, with the weights being the imported volume in the whole period of a certain country/product. The Table also reports the values of both the unadjusted PM (with T_k^{MFN} being the MFN tariff) and the effective PM (with T_k^{MFN} being the actual tariff).

The values of the unadjusted PM^E indicate that the margins clearly declined for almost all groups after 2004, with the EBA countries showing the sharpest decline. This may be explained by the different way in which the EU grants preferences to the ACP and Bangladesh compared to the EBA countries. The preferred tariffs granted to the ACP

[15] Indeed, at the 8 digit level for a number of observations there is a negligible positive difference between total imports (from Eurostat) and in-quota imports (from EU Commission) and often this occurs for few years. These marginal and anecdotic out-of-quota import flows are not likely to be representative of how the TRQ really works, and may be partly the consequence of using different sources of data. However, they significantly influence the value of the PM^P: even negligible out-of-quota imports drop to zero the PM^P. For this reason, we have assumed that when total imports are equal to in-quota imports ±2,5%, then the quota is filled (i.e. $Q = \overline{Q}$). A sensitivity analysis of this range has been performed by considering also the values of 5% and 10%, and results are qualitatively and quantitatively similar to those obtained with the threshold value of 2.5%. These additional results are available from the authors upon request.

[16] FAOSTAT includes production of paddy rice.

countries and to Bangladesh are partly linked to the MFN tariff (Table 1); as a consequence, the considerable reduction of the MFN tariffs after 2004 was not fully transmitted to the PM, because the preferred tariffs also diminished, albeit to a lesser extent. On the contrary, EBA countries during that period benefited from a zero in-quota tariff; hence, the reduction of the MFN tariffs was wholly translated into a reduction of the PM. Egypt benefitted before 2004 from lower preferences than Bangladesh, EBA and ACP countries. [17] The fall in the PM after 2005 is not due to the fall in the MFN tariffs: because the preferential tariff was defined as a percentage of the value of the MFN tariff, the former declined in proportion with the latter. In fact, Egypt's PM drastically declined in the final years of the period because Egypt started to export considerable amounts of broken rice out-of-the-quota at MFN tariffs. The values of the effective PM^E are, as expected, lower than the unadjusted margins, but show a similar trend.

The values of the PM^P, both the unadjusted and the effective one, for the four group of countries provide no clear indication of erosion after 2004; for example, there is no clear-cut evidence of preference erosion in EBA countries, mainly because in certain years they imported small quantities out-of-the quota - even if their TRQs were not wholly filled - and PMs drop to zero. The unadjusted PM^P for EBA becomes zero in three years and almost zero in 2005; as for Bangladesh, this is zero in six years because it was importing out-of-the quota, although its TRQ was not filled.[18] There is no clear-cut evidence of preference erosion for the ACP countries; the PM^P sharply declined in 2003 because of out-of quota imports which occurred despite the TRQ being unfilled, while in 2002 there were no out-of-quota imports and the margin was rather high. It is well known that least developing countries often face difficulties in exploiting preferences, because requesting preferences is a costly procedure especially when a quota is in place (Francois *et al.,* 2005). Overall, because Bangladesh, the ACP and the EBA countries never filled their TRQs, the fluctuation in the PM^P reflects the ability of countries to use preferences and this varies from year to year. The PM^P indicates that preferences to Egypt dropped to zero after 2004 but, as mentioned above, this is not due to the 2004 reduction of the MFN tariffs, but rather to Egypt's improved ability to export out-of-the quota at the MFN tariffs.

Hence, evidence about the erosion of preferences appears strongly conditional on how the PM is measured. Only when the PM is computed under the economies of scale-monopolistic

[17] In-quota tariff in this case was equal to the 75% of the MFN tariff (Table 1), which is much higher than the tariffs granted to Bangladesh, ACP and EBA countries.

[18] As for EBA countries, the fill rate ranged from 56% to 79% over the period, while for Bangladesh the fill rate ranged between zero (in the first three years of the period here considered) to 93% in 2006.

competition hypothesis there is clear evidence of preference erosion; differently, under the standard method to calculate the tariff equivalent, there is no evidence of erosion.

7.2 Static gravity model results

The PM determined on the basis of the different approaches have been used in the gravity equation to test whether the approach used matters when studying the trade effect of preferences. We start by estimating a cross-section gravity equation for single years of the time period covered. Table 3 provides the PM effect for the years 2001, 2005, and 2008. The estimated coefficient of interest is β_2 , that represents the trade elasticity to the factor margin $(1+PM_{jkt})$.

The two sets of estimates, for both the 'standard' margin PM^P and the 'weighted' margin PM^E present quite unstable coefficients from year to year and in some years are even negative as regards PM^P. With a value of about 14, the only statistically significant elasticity estimate is that related to 2008, and refers to PM^E. Thus, it appears quite difficult to reach any conclusion about the effect of PM on trade flows from these cross-section results.[19]

While several reasons can be put forward to explain this instability, this preliminary evidence confirms the recent literature that criticises the use of cross-section gravity approach to infer the average effect of PMs (Baier, Bergstrand, 2007; Martinez-Zarzoso *et al*. 2009); as discussed above, the inclusion of country fixed effects does not correct the endogeneity bias.

Econometric evidence based on panel data is reported in Table 4. Columns 1-2 present regression results when the gravity model is estimated using LSDV with country-time fixed effects. Under perfect competition, the trade elasticity of the PM factor in the rice sector is significant with a magnitude just lower than 5. This considerably increases in magnitude when the PM^E is considered, passing from 4.9 to 11.4. Columns 3 and 4 estimate the preference effects taking into account problems of selection bias by adding to the second step Heckman equation the inverse Mills ratio, retrieved from the first step (probit) selection equation.[20] The large presence of zero trade in our dataset (about 80%) makes the inverse Mill ratio significant. Both PM^P and PM^E coefficients notably increase in magnitude, and this is particularly true for PM^P. The estimated coefficient of $1+PM^E$ is now only slightly higher than the one of $1+PM^P$.

---

[19] The instability of coefficients of Table 3, obtained from the non-zero trade flows only, are generally unaffected by the use of the Heckman procedure to control for sample selection (results are not reported but available upon request).

[20] The probit selection equation (not reported) presents estimated coefficients that are statistically significant and with the expected signs. As expected, PM increases the probability of registering positive trade flows.

To check for robustness, columns 5-6 of Table 4 report the result of estimates using the PPML estimator.[21] The trade elasticities are consistently higher than the LSDV ones for $1+PM^E$, and (as expected) more close to those obtained with the Heckman procedure, confirming the importance of sample selection in the dataset. Also the PPML results display a trade elasticity of PM^E that is significantly higher than that of PM^P.

Thus, whatever the estimation method, the message is similar: the assumption of scale economies and imperfect competition (*vis-à-vis* perfect competition) to measure the TRQ tariff equivalent significantly increases the sensitivity of trade flows to PM. However, before drawing conclusions about the magnitude of the trade elasticity to the PM, we need to deal with a further econometric problem. The panel gravity specification (9) fails to control for potential persistency in trade flows due to fixed costs, an issue that is at the root of our modelling approach. Thus, in the next section we focus our attention on this potential source of bias by estimating a dynamic version of the panel gravity model that allows to control also for the endogeneity of the PM.

7.3 Dynamic gravity model results

Table 5 reports econometric results based on the dynamic LSDV specification (10), and the system of equations (11) and (12) estimated with the system GMM[22]. Using the LSDV estimator, the coefficients of the lagged exports are positive and strongly significant. With a magnitude of around 0.79, it confirms the existence of a strong persistence in bilateral trade flows. The estimated (short-run) trade elasticity to PM is positive for both PM^P and PM^E but only the latter is significant. However, as in the LSDV estimator the lagged variable is correlated with the fixed effects in the error term, this estimator does not eliminate the bias (Roodman, 2009).[23]

The coefficients of the lagged exports estimated through the system-GMM are, as expected, positive, statistically significant and particularly high, confirming that countries trading heavily with each other are expected to continue to do so. The magnitude of the persistence effect is quite similar to previous findings (e.g., Martinez-Zarzoso *et al*. 2009), especially

[21] In the PPML procedure, we used product dummies instead of time-product dummies due to convergence problems from the high number of dummies. Results obtained using a smaller sample show tiny variations in the estimated coefficients.

[22] Although the large presence of zero in the dataset, our estimations include only positive trade due to the econometric complexity in solving, jointly, sample selection and endogeneity problems in dynamic panel data models. Kyriazidou (2001) considers the problem of estimating dynamic panel data model in the presence of sample selection but when variables are strictly exogenous, while Semykina and Wooldridge (2010) solve endogeneity and selection problem in static panel data models.

[23] Standard results for omitted variable bias indicate that the OLS level estimator is biased upward, while the within estimator is biased downward (Bond, 2003). As a result, the consistent estimator should lie between OLS and within groups estimate.

when the data used are highly disaggregated. The bottom of the Table reports the AR(2), the Hansen tests and the difference-in-Hansen tests to check the consistency of the GMM estimator, the lack of autocorrelation of the residuals and the validity of the instrumental variables. The Arellano-Bond test for autocorrelation AR(2) indicates that second order correlation is not present.[24] The standard Hansen test confirms that in all cases our set of instruments is valid (difference-in-Hansen checks the validity of a subset of instruments). As suggested by Roodman (2009), the number of instruments should not exceed the number of groups; hence, to control for instruments proliferation that could cause a weak Hansen test, we used only 3 lags instead of all available lags for instruments.

The coefficients of distance and production display the expected sign, but the former is not significant and the latter is relatively small. The last result is probably due to the fact that production is here proxied by quantities, and not by values as required by the gravity theory.

In line with results reported in the previous section, the short-run trade elasticity of the unadjusted PM factor under the assumption of perfect competition is never significant. In contrast, the short-run elasticity estimated under the hypothesis of monopolistic competition and economies of scale has a significant and positive impact on trade, with a magnitude higher than 5. Thus, a one percent increase in the unadjusted PM factor is associated with a 5.5% increase in rice exports to the European Union, *ceteris paribus*. The long-run trade elasticity can be obtained by dividing the short-run coefficient by $(1-\gamma_1)$, where γ_1 is the coefficient of the lagged dependent variable; this elasticity is almost 14, confirming the inertial behaviour of exports possibly due to sunk costs.

Finally, Table 6 reports the results when four different preferential groups of countries are considered (ACP, Bangladesh, EBA, Egypt). The coefficients estimated using PM^P are never significant, while those obtained using PM^E are significant only for ACP and EBA countries. With a magnitude of almost 9, the strongest impact of preferences on trade is found for the ACP, followed by EBA countries. Indeed, although for ACP countries the cut in PM^E after 2004 has been softened by the reduction of both MFN and preferential tariffs (see section 7.1), preferences preserve a strong short-run impact on trade. On the contrary, for EBA countries, whose preferences drastically decreased after 2004, we detect a minor short-run effect of preferences. Finally, as regards Egypt and Bangladesh, the PM factor coefficients are not statistically significant and this possibly suggests a weak dependence on preferences of Bangladesh and Egypt's rice exports to the EU. Indeed, unlike ACP and EBA countries, in the past few years Egypt has been able to export even outside the preferential scheme at the

[24] Only first order correlation is present, indicating inconsistency of the OLS estimator.

MFN tariff considerable amounts of broken rice; hence, the lack of statistical significance of the PM factor reflects this observed less dependence on preferences.

8. Concluding remarks

The impact of preference erosion is still a major concern for many developing countries. This paper has studied the magnitude and impact of erosion by analyzing the case of the EU import policy for rice, which is one of the most sensitive industries for a number of developing countries, particularly the least developed ones. In addressing these issues, we contribute to the literature, first, by proposing a new empirical approach to calculate the preference margin when tariff rate quotas are in force and, second, by assessing the trade impact of the preference margins by means of both static and dynamic panel gravity models to deal with, simultaneously, endogeneity of the preference margin and persistency in bilateral trade flows. One of the main objectives of the paper is to show how the magnitude and the impact on trade of preferences change according to the way in which the preference margin is determined.

A key result of the paper is that, especially when dealing with highly disaggregated data, the use of the "standard" tariff equivalent of tariff rate quotas, i.e. the one consistent with the assumption of perfect competition, may lead to an overestimation of the tariff, and thus to an underestimation of the preferences, if there are fixed costs and monopolistic competition in international trade. Further, on the basis of the value of the "standard" preference margins one concludes that no preference erosion has occurred, while this is not the case when using the preference margins based on the tariff equivalent proposed in this paper. Thus, one main implication is that, when preferences are granted in the form of TRQs, the implicit assumptions on the market structure are very important. Although, to the best of our knowledge, no empirical evidence is available on the market structure and the costs of EU rice traders, we do believe that the existence of fixed costs and economies of scale in international agricultural trade are reasonable assumptions. In this case the use of the "standard" tariff equivalent of tariff rate quotas may result in misleading conclusions on the extent of the trade preferences and preference erosion itself. We have also computed the effective preference margin by taking into account the tariff actually faced by the rivals of the preferred countries; our results confirm previous studies and our expectations, that is, the effective margins are lower than the unadjusted ones, with the EBA countries showing the most relevant differences (up 15 percentage points).

The estimation of the gravity equation, and particularly its dynamic specification, has shown that EU preferences still matter significantly as regards the ability of developing countries to export rice to the EU; further, the way in which the tariff equivalent of TRQs is determined considerably affects the results. Trade elasticities are never statistically significant with the tariff equivalent based on the perfect competition assumption, while these become significant and of a considerable size if one uses the margin based on the assumption of fixed costs and monopolistic competition. This suggests that the assumption on market structure not only matters in determining the magnitude of preference erosion, but it is also important when assessing the trade impact of preferences. Finally, we find heterogeneity in trade preference elasticities across country groups, with ACP countries showing significantly higher values than the EBA group, while Bangladesh and Egypt's rice exports to the EU appear less dependent on preferences.

Overall, we believe that the findings of this paper regarding EU rice imports provide a contribution to the general debate about the measurement of preferences and the assessment of the impact of preference erosion. Agricultural products are among the most affected by preference erosion and many of the current preferential agreements grant agricultural preferences by means of tariff rate quotas; this paper has shown that the way by which the tariff equivalent of tariff rate quotas is assessed may significantly affect the measurement of the preference margin and the trade impact of preferences, especially when dealing with highly disaggregated data. Further, we have pointed out the importance of considering the existence of sunk costs in international trade when assessing the impact of preferences; this may continue for many years because the stock of capital firms have invested to export to the preference-granting country live for many years. Our findings confirm that the magnitude of this persistency is rather high. Finally, this paper confirms that, despite the underuse of preferences and the overall small size of the preference margins, EU preferences are still relevant for the exports of a number of developing countries.

References

Amiti, M., Romalis, J., 2007. Will the Doha Round Lead to Preference Erosion? IMF Staff Papers, 54 (2) 338-84;

Anderson, J.E., van Wincoop, E., 2004. Trade Costs. Journal of Economic Literature, Vol. XLII, n. 3, 691-751.

Arellano, M., Bond, S., 1991. Some tests of specification for panel data: Monte Carlo evidence and application to employment equations. Review of Economic Studies 58, 227–297.

Arkolakis, C., 2008. Market Penetration Costs and the New Consumers Margin in International Trade, NBER Working Paper No. 14214, Washington, D.C.

Baier S.L., Bergstrand J.H., 2007. Do free trade agreements actually increase members' international trade? Journal of International Economics 71, 72–95.

Baldwin R., Taglioni D., 2006. Gravity for dummies and dummies for gravity equations. Cambridge: National Bureau of Economic. Research Working Paper 12516.

Blundell, R. W., Bond, S. R., 1998. Initial conditions and moment restrictions in dynamic panel data model. Journal of Econometrics 87, 115–143.

Bond, S., 2003. Dynamic Panel Data: a Guide to Micro Data Methods and Practice. Cemmap Working Paper CWP09/02.

Boughner, D., de Gorter, H. and Sheldon I., 2000. 'The Economics of Tariff-Rate Quotas in the Agricultural Agreement in the WTO', Agricultural and Resource Economics Review 20, 58–69.

Boumellassa, H., Laborde, D., and Mitaritonna, C., 2009. A picture of the tariff protection across the world in 2004: MAcMapHS6 version 2. , IFPRI Discussion paper No. 00903, October.

Candau, F., Jean, S . 2009. What are European Union Trade Preferences Worth for Sub-Saharan African and other Developing Countries? in B. Hoekman, W. Martin, and C. A. Primo Braga, A., (eds.), *Trade Preference Erosion: Measurement and Policy Response* Washington, D.C.: World Bank; Houndmills, U.K. and New York: Palgrave Macmillan pp. 65-102;

Cardamone, P., 2011. Preferential trade agreements granted by the European Union: an application of the gravity model using monthly data, European Review of Agricultural Economics, European Review of Agricultural Economics 38 (4), 553-586

Carrére, C. 2006. Revisiting the Effects of Free Trade Agreements on Trade Flows with the Proper Specification of the Gravity Trade Model. European Economic Review, 50, 2, 223–47.

Carrére C., de Melo, J., Tumurchudur, B., 2010. Disentangling Market Access Effects of Preferential Trading Arrangements with an Application for ASEAN Members under an Asean-EU FTA, The World Economy, 33, 1, 42-59;

Cipollina M., Salvatici L., 2010. The impact of European Union agricultural preferences. Journal of Economic Policy Reform 14 (1), 87-106.

COGEA, 2009. Evaluation des measures de la PAC relative au sector du riz, November 2009, http://ec.europa.eu/agriculture/eval/reports/rice/fulltext_fr.pdf;

De Benedictis L., Vicarelli C., 2005. Trade potentials in gravity panel data models. Topics in Economic Analysis & Policy 5 (1), 1-31.

Dixit, A., 1989. Hysteresis, Import Penetration, and Exchange Rate Passthrough. Quarterly Journal of Economics 104:2 (1989), 205–228.

Francois,J., Hoekman,B., Manchin, M., 2005. Preference erosion and multilateral trade liberalization. The World Bank, Policy Research Working Paper Series: 3730 AN: 081061

Feenstra, R.C., 2003. Advanced International Trade: Theory and Evidence, Princeton University Press, Princeton;

Garcia-Alvarez-Coque, J-M, Martinez-Gomez, V., Villanueva, M, 2010. Seasonal protection of F&V imports in the EU: impacts of the entry price system, Agricultural Economics 41, 205-218

Greenaway, D. and Kneller, R., 2007. Industry differences in the effect of export market entry: Learning by exporting ? Review of World Economics vol. 143(3), 416-432.

Hansen, L., 1982. Large sample properties of generalized method of moments estimators. Econometrica 50 (3), 1029-54.

Heckman, J., 1979. Sample Selection Bias as a Specification Error. Econometrica 47(1), 153-161.

Helpman E, Melitz M, Rubinstein Y. 2008. Estimating trade flows: Trading Partners and Trading Volumes. Quartely Journal of Economics, 123(2), pp. 441-487.

Hoekman, B., Martin, W., Primo Braga, C.A. (eds), 2009. Trade Preference Erosion: Measurement and Policy Response, World Bank, Washington D.C.;

Hummels, D., Skiba A., 2004. A Virtuous Circle? Regional Tariff Liberalization and Scale Economies in Transport, in FTAA and Beyond: Prospects for Integration in the America. (eds. Estevadeordal, Rodrik, Taylor, Velasco), Harvard University Press.

Kyriazidou, E., 2001. Estimation of dynamic panel data sample selection models. Review of Economic Studies 68: 543-572

Krugman, P., 1989. Exchange Rate Instability. Cambridge, MA: MIT Press.

Lai, H., Trefler, D., 2004. On estimating the welfare gains from trade liberalization, mimeo. University of Toronto, Toronto.

Low P., R. Piermartini and J. Richtering 2009. *Non-Reciprocal Preference Erosion Arising From MFN Liberalization in Agriculture: What are the Risks?* in B. Hoekman, W. Martin, and C. A. Primo Braga, A., (eds.), *Trade Preference Erosion: Measurement and Policy Response* Washington, D.C.: World Bank; Houndmills, U.K. and New York: Palgrave Macmillan pp. 277-355.

Magee C., 2003. Endogenous preferential trade agreements: an empirical analysis. Contributions to Economic Analysis and Policy(2) 1. Berkeley Electronic Press.

Magee C. 2008, New measures of trade creation and trade diversion. Journal of International Economics 75, 349-362.

Martin W., Pham C., 2008. Estimating the Gravity Equation when Zero Trade Flows are Frequent. MPRA Paper No. 9453.

Martínez-Zarzoso I., Nowak-Lehmann D. F., Horsewood N. 2009. Are regional trading agreements beneficial? Static and dynamic panel gravity models. North American Journal of Economics and Finance 20 (1), 46-65.

Melitz, M.J., 2003. The impact of trade on intra-industry reallocations and aggregate industry productivity. Econometrica 71 (6), 1695–1725.

Nilsson L., Matsson N. 2009. Truths and myths about the openness of EU trade policy and the use of EU trade preferences. European Commission, Working Paper.

Roodman, D., 2009. Practitioners' corner. A note on the theme of too many instruments, Oxford Bulletin of Economics and Statistics 71 (1), 135-158.

Santos Silva J.M.C., Tenreyro S., 2006. The Log of gravity. The Review of Economics and Statistics 88 (4), 641-658

Jørgensen J.G., Schröder P. J. H. 2007. Effects of Tariffication: Tariffs and Quotas under Monopolistic Competition, Open Economies Review, 18 (4), 479-498.

Semykina, A., Wooldridge, J. M., 2010. Estimating panel data models in the presence of endogeneity and selection. Journal of Econometrics 157, 375-380.

Wooldridge J. M., 2002. Econometric Analysis of Cross-Section and Panel Data. MIT Press, Cambridge, MA.

Table 1.

Table 1. Preferential tariff rate quotas granted by the EU in the rice industry

Countries	Years	Product	In-quota tariff	Quota
ACP	2000-03	Paddy and husked rice	$(T^{MFN}*0.5)$ - 4.34 Ecu/t	125,000 t
		Milled rice	$(T^{MFN}$ - 16.78 Ecu/t)*0.5 - 6.52 Ecu/t	
		Broken rice	$(T^{MFN}*0.5)$ - 3.62 Ecu/t	20,000 t
	2003-08	Paddy and husked rice	$(T^{MFN}*0.35)$ - 4.34 €/t	125,000 t
		Milled rice	$(T^{MFN}$ - 16.78 Ecu/t)*0.35 - 6.52 €/t	
		Broken rice	$(T^{MFN}*0.35)$ - 3.62 €/t	20,000 t
OCT	2000-08	Paddy, husked and milled rice	0	35,000 t
Egypt	2000-08	All products	$T^{MFN}*0.75$	32,000 t
	2005-08	All products	0	5,605 t
	2008	Husked rice	11 €/t	57,600
		Milled rice	33 €/t	196,000 t
		Broken rice	13 €/t	5,000 t
Bangladesh	2000-07	Paddy and husked rice	$(T^{MFN}*0.5)$ - 3.6 Ecu/t	4,000 t
		Milled rice	$(T^{MFN}*0.5)$ - 5.4 Ecu/t	
	2008	Paddy and husked rice	$(T^{MFN}*0.5)$ - 4.34 €/t	4,000 t
		Milled rice	$(T^{MFN}$ - 16.78 Ecu/t)*0.5 - 6.52 €/t	
EBA	2002-08	All products	0	from 2,895 t to 6,694 t

Note: OCT are the overseas countries and territories.

Source: EU Regulations

Table 2. Preference margins under the different approaches

Unadjusted preference margin

	Standard PM^P				Weighted PM^E			
	ACP	EBA	Bangladesh	Egypt	ACP	EBA	Bangladesh	Egypt
2000	17%			8%	18%			8%
2001	6%			1%	20%			8%
2002	24%	0%	0%	9%	24%	46%		9%
2003	1%	77%	19%	10%	23%	77%	19%	10%
2004	7%	0%	0%	7%	25%	65%	15%	8%
2005	2%	1%	0%	0%	8%	21%	4%	10%
2005	9%	0%	0%	0%	11%	7%	6%	3%
2007	2%	28%	0%	0%	11%	28%	5%	1%
2008	6%	25%	0%	0%	7%	25%	3%	2%

Effective preference margin

	Standard PM^P				Weighted PM^E			
	ACP	EBA	Bangladesh	Egypt	ACP	EBA	Bangladesh	Egypt
2000	11%			4%	13%			4%
2001	11%			0%	16%			5%
2002	16%	0%		4%	19%	31%		4%
2003	0%	22%	11%	6%	18%	61%	11%	4%
2004	3%	-1%	0%	2%	19%	50%	3%	2%
2005	1%	0%	1%	0%	6%	16%	2%	4%
2005	7%	3%	0%	0%	9%	10%	1%	1%
2007	1%	20%	0%	0%	9%	20%	1%	-1%
2008	2%	17%	0%	-1%	6%	17%	1%	1%

Note: The average PM for groups of preferred countries is obtained by aggregating by product and by country through the weighted averages of the PM_{kj}, with the weights being the imported volume in the whole period of a certain country/product. Further details are in the text.

Source: Author's computation on Eurostat and EU Commission data.

Table 3. The trade effect of the preference margin: Cross-section regressions

	Dep. Variable: $\ln(import_{jkt})$					
	PM^P - Standard			PM^E - Weighted		
	2001	2005	2008	2001	2005	2008
$\log(1+PM_{jkt})$	-0.14	-2.51	4.66	4.38	9.72	14.24**
	(7.15)	(4.73)	(6.59)	(6.38)	(7.74)	(6.07)
No. of obs.	300	363	425	300	363	425
R-Sq	0.43	0.47	0.57	0.43	0.47	0.57

Notes: Exporter, and 6-digit product dummies included in each regression.
Robust standard errors in parentheses. *, ** and *** indicate statistically significance at 10%, 5% and 1% level, respectively.

Source: Authors' analysis based on data described in the text.

Table 4. The trade effect of the preference margin: Static panel regression (2000-2008)

Dependent variable:	ln(Import$_{jkt}$)				Import$_{jkt}$	
	LSDV		HECKMAN		PPML	
	Standard-PM^{P}	Weighted-PM^{E}	Standard-PM^{P}	Weighted-PM^{E}	Standard-PM^{P}	Weighted-PM^{E}
	(1)	(2)	(3)	(4)	(5)	(6)
log(1+PM$_{jkt}$)	4.91**	11.45***	20.54***	20.75***	10.64***	18.36***
	(2.28)	(2.14)	(4.41)	(5.19)	(1.90)	(1.38)
Mills ratio			3.37***	1.85**		
			(0.74)	(0.82)		
No. of obs.	3.195	3.195	3.195	3.195	17.944	17.944

Notes: Exporter-year, time and 6-digit product-time dummies included in regressions (1)-(4). Exporter-year, time and 6-digit product fixed effects included in regressions (5)-(6) (see text). Robust standard errors clustered by country-pair in parentheses. *, ** and *** indicate statistically significance at 10%, 5% and 1% level, respectively.

Source: Authors' analysis based on data described in the text.

Table 5. Dynamic panel model: LSDV vs. system-GMM (2000-2008)

	LSDV_dynamic		System-GMM	
	Standard-PM^{P} (1)	Weighted-PM^{E} (2)	Standard-PM^{P} (3)	Weighted-PM^{E} (4)
log(trade$_{jk(t-1)}$)	0.79***	0.79***	0.63***	0.62***
	(0.02)	(0.02)	(0.08)	(0.07)
log(1+PM$_{jkt}$)	2.45	4.36**	10.05	5.51**
	(1.75)	(1.72)	(6.14)	(2.62)
log(distance$_{j}$)			0.05	0.07
			(0.18)	(0.19)
log(production$_{jt}$)			0.19***	0.20**
			(0.07)	(0.08)
constant	2.23***	2.23***	2.09	2.08
	(0.29)	(0.29)	(1.48)	(1.55)
No. Obs.	1,910	1,910	1,683	1,683
No. Groups			390	390
No. Instruments			104	104
AR(2)			0.209	0.323
Hansen p-value			0.559	0.405
diff-in-Hansen p-value			0.851	0.662

Notes: Time and 6-digit product-time dummies included in each regression. Robust standard errors in parentheses. *, ** and *** indicate statistically significance at 10%, 5% and 1% level, respectively. We used all variables as instruments in model. The System-GMM estimator is implemented in STATA using the xtabond2 routine with option laglimits (3).

Source: Authors' analysis based on data described in the text.

Table 6. Dynamic panel model: results across different preferential groups (2000-2008)

		System-GMM	
		Standard-PM^P (1)	**Weighted-PM^E** (2)
log(trade$_{jk(t-1)}$)		0.69***	0.66***
		(0.07)	(0.06)
log(1+PM$_{jkt}$)	***ACP***	7.86	8.96**
		(6.64)	(3.69)
	EBA	9.61	2.77**
		(25.71)	(1.23)
	Bangladesh	28.49	30.48
		(64.17)	(30.90)
	Egypt	23.88	55.80
		(19.72)	(51.60)
log(distance$_j$)		0.13	0.23
		(0.15)	(0.18)
log(production$_{jt}$)		0.16**	0.17***
		(0.07)	(0.06)
constant		1.23	0.61
		(1.44)	(1.54)
No. Obs.		1,683	1,683
No. Groups		390	390
No. Instruments		116	135
AR(2)		0.383	0.256
Hansen p-value		0.789	0.990
diff-in-Hansen p-value		0.830	0.972

Notes: Time and 6-digit product-time dummies included in each regression. Robust standard errors in parentheses. *, ** and *** indicate statistically significance at 10%, 5% and 1% level, respectively. The System-GMM estimator is implemented in STATA using the xtabond2 routine with option laglimits (2).

Source: Authors' analysis based on data described in the text.

Figure 1. The tariff equivalent of a tariff rate quota under perfect competition

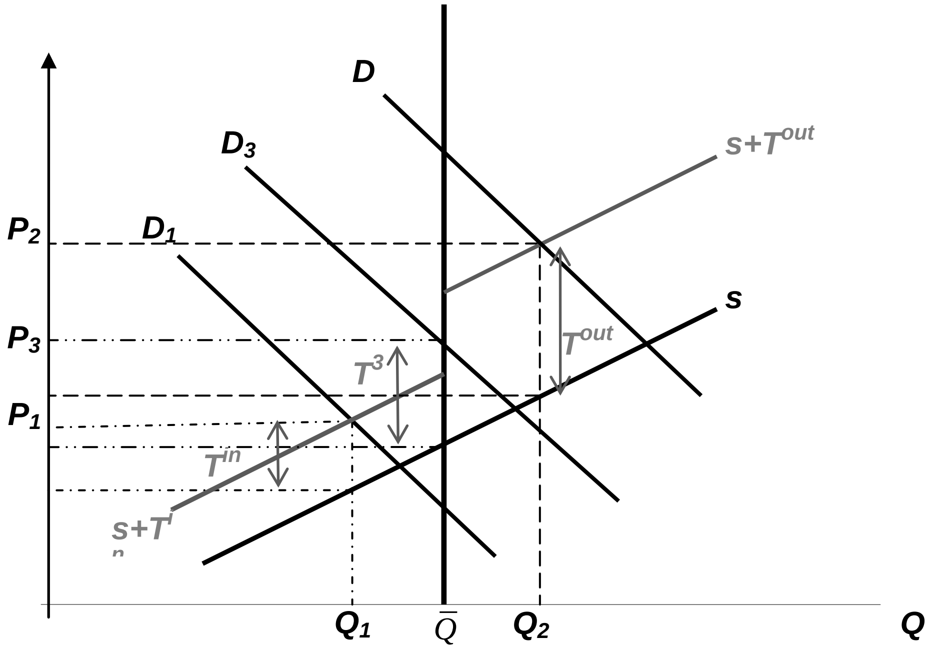
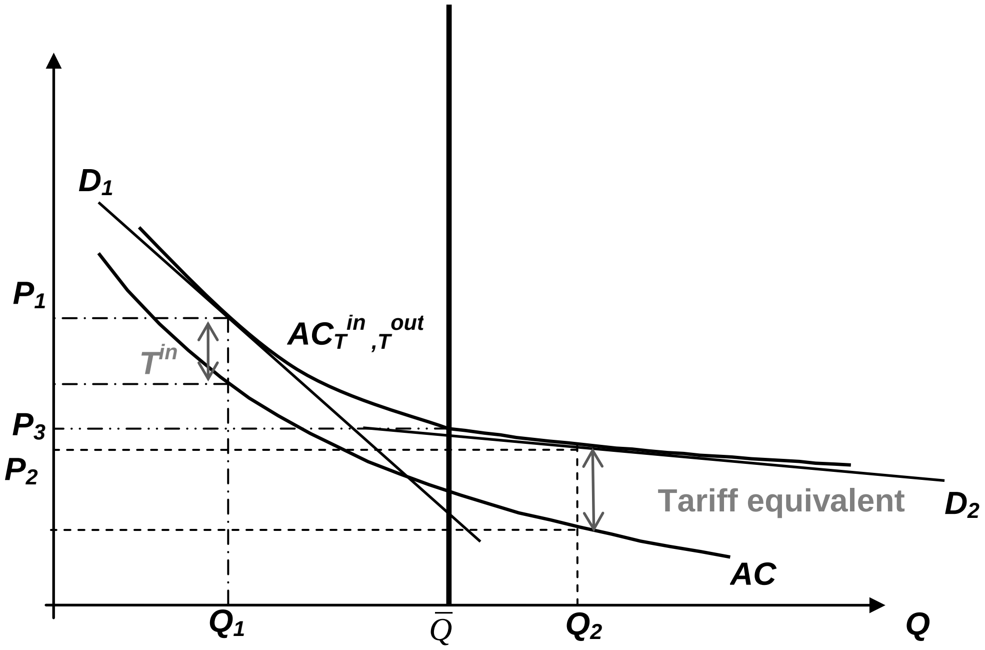


Figure 2. The tariff equivalent of a tariff rate quota under economies of scale and monopolistic competition



[always the back page]

The FOODSECURE project in a nutshell

Title	FOODSECURE – Exploring the future of global food and nutrition security
Funding scheme	7th framework program, theme Socioeconomic sciences and the humanities
Type of project	Large-scale collaborative research project
Project Coordinator	Hans van Meijl (LEI, part of Wageningen UR)
Scientific Coordinator	Joachim von Braun (ZEF, Center for Development Research, University of Bonn)
Duration	2012 – 2017 (60 months)
Short description	In the future, excessively high food prices may frequently reoccur, with severe impact on the poor and vulnerable. Given the long lead time of the social and technological solutions for a more stable food system, a long-term policy framework on global food and nutrition security is urgently needed. The general objective of the FOODSECURE project is to design effective and sustainable strategies for assessing and addressing the challenges of food and nutrition security. FOODSECURE provides_a set of analytical instruments to experiment, analyse, and coordinate the effects of short and long term policies related to achieving food security. FOODSECURE impact_lies in the knowledge base to support EU policy makers and other stakeholders in the design of consistent, coherent, long-term policy strategies for improving food and nutrition security.
EU Contribution	€ 8 million
Research team	19 partners from 13 countries
Project officer	Marie Ramot

FOODSECURE Coordination: LEI part of Wageningen University and Research Centre • Alexanderveld 5,The Hague, Netherlands • **Tel:** +31 (0) 70 3358370 • **Fax:** +31 (0) 70 3358196 • **E-mail:** foodsecure@wur.nl • **web:** www.foodsecure.eu

This project is funded by the European Union under the 7th Research Framework Programme (theme SSH) Grant agreement no. 290693

The FOODSECURE project in a nutshell

Title	FOODSECURE – Exploring the future of global food and nutrition security
Funding scheme	7th framework program, theme Socioeconomic sciences and the humanities
Type of project	Large-scale collaborative research project
Project Coordinator	Hans van Meijl (LEI Wageningen UR)
Scientific Coordinator	Joachim von Braun (ZEF, Center for Development Research, University of Bonn)
Duration	2012 - 2017 (60 months)
Short description	In the future, excessively high food prices may frequently reoccur, with severe impact on the poor and vulnerable. Given the long lead time of the social and technological solutions for a more stable food system, a long-term policy framework on global food and nutrition security is urgently needed. The general objective of the FOODSECURE project is to design effective and sustainable strategies for assessing and addressing the challenges of food and nutrition security. FOODSECURE provides a set of analytical instruments to experiment, analyse, and coordinate the effects of short and long term policies related to achieving food security. FOODSECURE impact lies in the knowledge base to support EU policy makers and other stakeholders in the design of consistent, coherent, long-term policy strategies for improving food and nutrition security.
EU Contribution	€ 8 million
Research team	19 partners from 13 countries

FOODSECURE project office
LEI Wageningen UR (University & Research centre)
Alexanderveld 5
The Hague, Netherlands

T +31 (0) 70 3358370
F +31 (0) 70 3358196
E foodsecure@wur.nl
I www.foodscecure.eu

This project is funded by the European Union under the 7th Research Framework Programme (theme SSH) Grant agreement no. 290693