Enlargement of the European Union: A movement towards the optimal trade bloc size?

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Abstract

This paper analyses how the enlargement of a trade bloc will affect national welfare. We establish a partial equilibrium model of a trade bloc either operating as a monopoly with a competitive fringe or facing a duopolistic game in production taxes/subsidies. Given this framework, we demonstrate how member countries' welfare effects depend on their trade flow and the market power of the trade bloc. A numerical estimation of the effects of EU enlargement on the major grain crop markets suggests that welfare effects are negligible. Economic reasons are therefore unlikely to be a motivating force for further enlargement.

Keywords: *trade bloc, trade liberalisation, game theory, European Union*

JEL Classification: D42, F11, Q17, Q18

Introduction

Economic theory suggests that small countries may benefit from the formation of a trade bloc, if their combined market power will enable them to manipulate the terms of trade in their favour. It was demonstrated by Kennan and Riezman (1988), Bond and Syropoulos (1996) and Syropoulos (2002) that a trade bloc can win a tariff war if its size is sufficiently large. However, international trade agreements have reduced the scope for tariff setting and the WTO process may eventually lead to free trade in agriculture. At the same time as global tariffs are expected to fall, the use of non-tariff barriers is likely to become more prevalent (Rabinowitcz, 1999; Blandford *et al.*, 2003). The implementation of production subsidies is unlikely to be accepted by the WTO in future trade rounds. However, a properly configured regime of environmental, health or safety rules can have very similar trade effects, but will be difficult to be detected (Hungerford, 1991; Sumner, 2000).

The objective of this article is to analyse the conditions under which the member countries of a trade bloc will gain from enlargement. Given the limited scope for conventional border protection, the analysis considers a game in production taxes/subsidies between trade blocs, rather than a tariff war. A production subsidy may capture the production effect which can be induced by a combination of environmental, health or safety

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rules. Following Johnson (1953), most studies analysing retaliatory trade policies, are based on games between importing countries. By making use of Lerner's (1936) symmetry theorem, this paper chooses a different approach by considering a game between an importing and an exporting country trading in a single commodity.

The theoretical analysis is supplemented by a numerical analysis estimating the potential welfare gains of European Union (EU) enlargement. Several empirical studies have tried to estimate the overall economic effect of Eastern enlargement of the EU based on multi-sector trade models (Baldwin *et al.*, 1997; Keuschnigg *et al.*, 2001; Kohler, 2004; Nahuis, 2004). Other authors analysed the welfare implications of enlargement which would result from trade on agricultural markets, mostly based on the Common Agricultural Policy as it has been implemented prior to the 2003 CAP reform (Frandsen *et al.*, 2000; Banse and Twesten, 2001; Herok and Lotze, 2001; Baldwin *et al.*, 2004). The numerical simulation of this paper differs from previous studies, since it is based on a hypothetical scenario at which conventional border protection measures are completely abolished. Assuming that the EU and trading partners are merely allowed to implement optimal production taxes/subsidies, we calculate the national welfare effects of EU enlargement within a retaliatory setting. The analysis focuses on the grain market, where considerable market power exists (Paarlberg and Abbott, 1986; Abbott and Kallio, 1996).

The remainder of the paper is organized as follows. Section 2 presents the model, a partial equilibrium model of bilateral trade between trade blocs. The following section then analyses the conditions for optimal production tax/subsidy rates. Section 4 analyses how the welfare of a trade bloc is affected as a result of enlargement, while section 5 presents a numerical illustration. The article concludes with a summary of the main findings.

The model

We choose a partial equilibrium trade model to analyse how the enlargement of a trade bloc affects countries' social welfare. Consider two trade blocs, the home trade bloc (Country *h*) and the 'rest of the world' (Country *w*), trading in a single homogeneous agricultural good. Assume further that the home trade bloc is joined by another country (Country *j*) to form a new, enlarged trade bloc (Country *h+j*). Given the bipolar trade framework, enlargement of the home trade bloc necessarily reduces the size of the foreign trade bloc (Country *w-j*). Let consumers in country *i* (*i=h,j,w*) demand the quantity D_i of the agricultural good while producers supply the quantity S_i at cost $C_i(S_i)$. The supplied quantity $S_i(P_i)$ is determined by the domestic supply price (P_i), whereas demand $D_i(P_d)$ is a function of the world demand price (P_d). We assume supply and demand curves to be well-behaved and linear, hence, $\partial S_i / \partial P_i > 0$, $\partial D_i / \partial P_d < 0$ and $\partial^2 S_i / \partial P_i^2 = \partial^2 D_i / \partial P_d^2 = 0$. Domestic supply prices differ from the world price, because countries can introduce a tax, defined as a specific tax (t_i) or subsidy (-t_i) on production. Neglecting transaction and transportation costs, the margin between countries' supply price is solely determined by the tax/subsidy rate:

$$P_d = P_i + t_i \qquad\qquad (1)$$

After enlargement, country *h* and country *j* belong to the same trade bloc and will thereby implement the same tax rate ($t_h = t_j$), leading to a single producer price within the trade bloc ($P_h = P_j$). If factor markets and product markets operate perfectly, supply prices equal marginal production costs in all countries ($P_i = \partial C_i / \partial S_i$). Furthermore, the model is based on the trade equilibrium requirement of excess supply ($X_i = S_i - D_i$) of the home country being equal to excess demand of the rest of the world:

$$\left(X_h + X_j\right) = -\left(X_w - X_j\right) \tag{2}$$

Given these relationships, national welfare (W_i) can be expressed as the sum of consumer surplus, producer benefit and tax revenues:

$$W_i = \int_{\underline{P_d}}^{\infty} D_i dP_d + P_i S_i - C_i + t_i S_i \tag{3}$$

After enlargement of the home trade bloc, the welfare of the two trade blocs can be written as:

$$W_{h+j} = \int_{\underline{P_d}}^{\infty} \left(D_h + D_j\right) dP_d + P_h\left(S_h + S_j\right) - \left(C_h + C_j\right) + t_h\left(S_h + S_j\right) \tag{4}$$

$$W_{w-j} = \int_{\underline{P_d}}^{\infty} \left(D_w - D_j\right) dP_d + P_w\left(S_w - S_j\right) - \left(C_w - C_j\right) + t_w\left(S_w - S_j\right) \tag{5}$$

where $\partial S_w / \partial P_w > \partial S_j / \partial P_j$ and $\partial D_w / \partial P_d < \partial D_j / \partial P_d$.

Optimal domestic policies with and without retaliation

We first analyse the optimal policy response of the two trade blocs. The domestically optimal tax rates (t_i^*) can be obtained by setting the partial derivative of the domestic welfare functions of equations (4) and (5) equal to zero and solving for the domestic tax rates, respectively ($\partial W_{h+j} / \partial t_h = 0$, $\partial W_{w-j} / \partial t_w = 0$). Taking this rule and applying the constraints in equations (1) and (2) to simplify the result, we obtain:

$$t_h^* = \left(X_h\left(t_h^*, t_w\right) + X_j\left(t_h^*, t_w\right)\right)\left(-D_{hd} - D_{jd} + \alpha_w - \alpha_j\right)^{-1} \tag{6}$$

$$t_w^* = -\left(X_h\left(t_h, t_w^*\right) + X_j\left(t_h, t_w^*\right)\right)\left(-D_{wd} - D_{jd} + \alpha_h + \alpha_j\right)^{-1} \tag{7}$$

where $S_{ii} = \partial S_i / \partial P_i$, $D_{id} = \partial D_i / \partial P_d$ and $\alpha_i = S_{ii} - D_{id}$.

Equations (6) and (7) demonstrate that the optimal policy response for a net importing home trade bloc ($X_h + X_j < 0$) would be to introduce a subsidy policy ($t_h^* < 0$), whereas the rest of the world would implement a tax policy ($t_w^* > 0$). Note that the op-

timal tax rates of equations (6) and (7) represent reaction functions, since the traded quantities (X_i) are functions of both tax rates. The Nash equilibrium tax and subsidy rates (t_h^{duo}, t_w^{duo}) are given where both reactions functions intersect (Figure 1).

Consider that the foreign trade bloc is a net-exporter, implementing an optimal tax policy ($t_w^* > 0$). Equation (7) then suggests that the optimal tax rate for the foreign trade bloc is smaller the larger the price responsiveness of net exports ($\alpha_h + \alpha_j$) in the home trade bloc. This is plausible, since policy changes in a small country have only a small influence on its terms of trade. Hence, if the home country competes on the world market with many small independent countries, the average foreign tax rate will tend to zero ($t_w = 0$). The home country will consequently operate as a monopoly with a competitive fringe and implement its optimum subsidy rate t_h^{mon} (Figure 1). In practice, most agricultural markets can be characterized as an oligopoly with a competitive fringe, with a limited number of large trade blocs and numerous independent small countries. Hence, the average tax rate implemented in the rest of the world should be between zero and t_w^{duo}. Consequently, the optimal response for the home trade bloc would be to fix a subsidy rate between t_h^{duo} and t_h^{mon}.
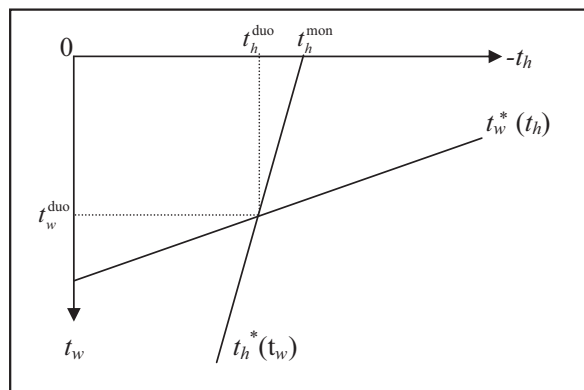

Figure 1. Reaction functions for the optimal tax rates (duopoly)

Welfare effects of enlargement

After the analysis of the equilibrium tax/subsidy rates, we will determine the conditions under which a member country of a trade bloc will benefit from enlargement. Since welfare effects will depend on the relative market power of the trading countries, we will first analyse the welfare effects for the monopoly case and later the welfare economics for a Nash-equilibrium of tax/subsidy rates (duopoly). The monopoly and duopoly scenarios lead to upper and lower bounds for the home country's welfare effects.

Let us first consider the monopoly case at which the home trade bloc implements its optimal tax/subsidy rate given by equation (6), whereas no tax/subsidy is implemented in the rest of the world. Consider further that the home trade bloc (country *h+j*) will be

joined by a third country, implying that the price responsiveness of country j's supply and demand will increase ($dD_{jd} < 0$, $dS_{jh} > 0$). Since the tax/subsidy rate will be introduced in the new member country, enlargement will influence the commodity price. An increase of the home trade bloc's supply sector will also change its optimal tax/subsidy rate. Hence, the welfare effects due to enlargement can be written as the total differential of the home country's welfare function:

$$dW_h = \frac{\partial W_h}{\partial D_{jh}} dD_{jh} + \frac{\partial W_h}{\partial S_{jh}} dS_{jh} = \left(\frac{\partial W_h}{\partial t_h} \frac{\partial t_h}{\partial D_{jh}} + \frac{\partial W_h}{\partial P_h} \frac{\partial P_h}{\partial D_{jh}} \right) dD_{jh} + \left(\frac{\partial W_h}{\partial t_h} \frac{\partial t_h}{\partial S_{jh}} + \frac{\partial W_h}{\partial P_h} \frac{\partial P_h}{\partial S_{jh}} \right) dS_{jh}$$

(8)

Making use of equations (1), (2), (6), equation (8) can be transformed into

$$dW_h\left(t_h^*, t_w^o\right) = \frac{\left(X_h + X_j\right)X_h}{\varpi^2} dS_{jh} + \frac{\left(X_h S_{jh} - X_j S_{hh}\right)}{\theta \varpi} dX_j$$

(9)

where $\varpi = \left(-D_{hd} - S_{jh} + \alpha_w\right) > 0$ and $\theta = \left(\alpha_h + \alpha_w\right) > 0$

Equation (9) suggests that it is ambiguous whether the home country may gain or lose as a result of enlargement. The welfare effect of enlargement depends crucially on the trade flow and the size of individual countries. The first term of equation (9) indicates the strength by which the size of the new member country's supply sector ($dS_{jh} > 0$) influences the home country's welfare. The second term characterizes how the trade flow of the joining member country (dX_j) affects the welfare of the home country.

The first term of equation (9) will be positive whenever the overall trade flow of the trade bloc shows into the same direction as that of the home country ($\left|X_h\right| > \left|X_j\right|$). This is plausible, because if the home country dominates the overall trade flow, the trade bloc's optimal tax rate will influence the term of trade in the home country's favour, as can be derived from equation (6). Enlargement will thereby push the world price even more towards the direction which is optimal for the home country.

The trade bloc's optimal tax rate will be also influenced in the home country's favour if the trade flow of the joining country shows into the same direction as that of the home country ($dX_j, X_h > 0$ or $dX_j, X_h < 0$), while the trade flow of the home country has a different sign than that of the other member country ($X_h > 0 \geq X_j$ or $X_h < 0 \leq X_j$). This implies a positive value for the second term of equation (9).

Next, we will analyse the welfare economics of enlargement for the duopoly case. We will investigate how a member country of a trade bloc will be affected if the latter is joined by a third member country. Taking the total differential of the home country's welfare function, we can write:

$$dW_h = \left(\left(\frac{\partial W_h}{\partial t_h} \frac{\partial t_h}{\partial D_{jh}} + \frac{\partial W_h}{\partial t_w} \frac{\partial t_w}{\partial D_{jh}} + \frac{\partial W_h}{\partial P_h} \frac{\partial P_h}{\partial D_{jh}} \right) dD_{jh} + \left(\frac{\partial W_h}{\partial t_h} \frac{\partial t_h}{\partial S_{jh}} + \frac{\partial W_h}{\partial t_w} \frac{\partial t_w}{\partial S_{jh}} + \frac{\partial W_h}{\partial P_h} \frac{\partial P_h}{\partial S_{jh}} \right) dS_{jh} \right)$$

(10)

Based on and equations (1), (2) and (6), equation (10) can then be written as

$$dW_h\left(t_h^*, t_w^*\right) = \frac{\dfrac{\left(X_h + X_j\right)X_h}{\varpi^2}dS_{jh} + \dfrac{\left(X_h S_{jh} - X_j S_{hh}\right)}{\theta\varpi}dX_j}{+\dfrac{\phi\left(X_h\varpi + S_{hh}\left(X_h + X_j\right)\right)\left(X_h + X_j\right)}{\varpi\theta\mu^2}dS_{jh} + \dfrac{\left(X_h S_{jh} - X_j S_{hh} - X_h\theta\right)\phi}{\varpi\theta\mu}dX_j} \tag{11}$$

where $\mu = \left(-D_{wd} + S_{jh} + \alpha_h\right) > 0$ and $\phi = \left(S_{wd} - S_{jh}\right) > 0$

Equation (11) demonstrates that the welfare effects of enlargement based on the duopoly scenario can be larger or smaller than the welfare effects resulting from the monopoly case. The first and third term of equation (11) indicate the strength by which the size of the new member country's supply sector ($dS_{jh} > 0$) influences the home country's welfare. Both terms will be positive whenever the overall trade flow of the trade bloc shows into the same direction as that of the home country ($\left|X_h\right| > \left|X_j\right|$). Similar to the monopoly case, the trade bloc's optimal tax rate will influence the term of trade in the home country's favour, if the home country dominates the overall trade flow. Note that the first term of equation (11) has the same functional form as the first term of equation (9). We conclude that if the joining country has no effect on the overall trade flow of the trade bloc ($dX_j = 0$), a country benefiting from enlargement in the monopoly case will also benefit in the duopoly scenario and vice versa.

Let us now investigate the influence of the trade flow of the joining member country (dX_j) on the welfare of the home country. The influence of the new country's trade flow on the home country's welfare is given by the second and fourth term of equation (11). The conditions that the second term of equation (11) takes a positive value are the same that were given for the second term of equation (9), since both terms have the same functional form. However, note that the fourth term of equation (11) may have a different sign than the second term. The rationale is that if the joining country influences the home trade bloc's optimal tax rate in the home country's favour, it may have an adverse effect on the foreign trade bloc's optimal tax/subsidy policy. We conclude that the direction of welfare effects will be the same for the duopoly and monopoly scenario, if the size of the joining country is relatively large, while its net trade flow is small. For the opposite scenario of a small entrant with a large net trade flow, member country's welfare effects based on the duopoly and monopoly scenario may show into different directions.

Numerical analysis

Based on the theoretical analysis of the previous sections, we will estimate the scale of welfare effects resulting from EU enlargement. The numerical analysis of welfare effects will be undertaken for the markets of wheat, maize, barley and rye, as the major European grain crops. Three enlargement scenarios were considered. As the first enlargement round we modelled how the inclusion of the 10 Central and Eastern European countries in 2004 would affect the welfare of the 15 'old' EU member countries. Since grain production in most of the entry countries was very small in comparison to

EU production, we considered only Poland, Hungary, Slovakia and the Czech Republic as the major entrants. The second enlargement was based on the assumption that Bulgaria, Romania and Croatia would join the EU. The inclusion of Turkey was expected to occur in a third enlargement round (Daugbjerg and Swinbank, 2004). The analysis was based on average price, consumption and production data between 1995 and 2000 (FAO 2006). All calculations were based on an average supply elasticity of 0.5 and a demand elasticity of -0.4.

The results presented in Table 1 demonstrate that the direction of national welfare effects depends crucially on the net trade flow of the joining and existing member country as well as on whether a monopoly or a duopoly is considered. In the absence of any policy intervention, the combined net export of those countries joining during the first and second enlargement would be positive, whereas Turkey would become a net-importer.

Table 1. National welfare effects on grain markets as a result of EU enlargement

$X_h(t_h^0, t_w^0)$	*Welfare change (1,000 Euro)*	*1. Enlargement*		*2. Enlargement*		*3. Enlargement*	
		Monopoly	*Duopoly*	*Monopoly*	*Duopoly*	*Monopoly*	*Duopoly*
+	Denmark	39	-255	32	-169	-13	385
+	France	1.648	-7.176	1.510	-4.631	-1.172	10.902
+	Germany	198	-1.266	163	-841	-71	1.915
–	Austria	-23	34	-24	18	28	-53
–	Belgium-Luxembourg	-186	706	-176	449	151	-1.074
–	Finland	-12	22	-12	12	14	-34
–	Greece	-70	240	-68	151	62	-366
–	Ireland	-50	174	-48	110	44	-266
–	Italy	-425	1.516	-405	958	361	-2.310
–	Netherlands	-304	1.179	-286	752	242	-1.795
–	Portugal	-197	763	-185	486	157	-1.161
–	Spain	-468	1.650	-447	1.041	400	-2.516
+	Sweden	0	-51	-2	-36	8	76
+	United Kingdom	-14	-193	-25	-140	55	287
+	Czech Republic			82	-302	-55	702
+	Hungary			318	-1.011	-241	2.374
+	Slovakia			22	-95	-13	219
–	Poland			-187	320	186	-802
+	Bulgaria					-108	1.090
+	Croatia					-40	444
+	Romania					23	414

Based on the monopoly scenario, the net-exporting countries Denmark, France and Germany would be better off as a result of the first and second enlargement. This is plausible since the overall trade flow of the EU will be dominated by exporting member

countries. Since the joining countries are also net-exporters, the EU tax rate will be influenced in favour of net-exporters. The reverse reasoning may explain that the same countries will be worse off if the net-importer Turkey joined the EU. It also explains that net-importing countries would be worse off after the first two enlargement rounds, but gain from the inclusion of Turkey. The results thereby indicate that the welfare effect induced by an increase of the domestic supply sector (first term of equation 9) is smaller than the welfare effect induced by the joining country's influence on the net trade flow of the EU (second term of equation 9). This may also explain that most countries being better (worse) off due to enlargement if the EU operated as a monopoly would lose (gain) if the EU had to compete with the rest of the world within a duopoly.

The results suggest further that the scale of welfare effects is positively related to the size of a member country's supply sector and the quantity of its net trade flow. However, welfare effects are generally low, if the welfare estimates of Table 1 are compared to the total production value. Even the largest welfare gain (€ 10.9 millions) which could be realized by France, if the EU competed with the rest of the world within a duopoly, represents only less than 0.2% of the value of French grain production. A sensitivity analysis shows that the share would not significantly increase if different values for the price elasticity of demand and supply were considered.

Conclusions

The study was motivated by the question of whether welfare gains might provide an argument for the enlargement of the EU, once trade is liberalised. In this context, it was demonstrated that it is not guaranteed that all member countries will gain from the enlargement of a trade bloc, since welfare effects depend crucially on a member country's trade flow in relation to that of other member countries. The direction of welfare effects depends also on the relative market power of the trade bloc in comparison to that of foreign competitors.

While other studies estimated welfare effects from EU enlargement based on the status quo of existing trade barriers, the approach chosen in this paper was to analyse welfare effects based on a hypothetical scenario. It was assumed that tariffs were abolished, while countries were allowed to use a production tax/subsidy as a substitute. This scenario may represent the final stage of the WTO process, at which tariffs will be eliminated, whereas domestic support measures such as environmental, health or safety regulations, might be used as a substitute.

Since the world grain market is dominated by a few large countries and trade blocs, the grain market structure may be best represented by an oligopoly with a competitive fringe rather than a monopoly or duopoly. However, it is difficult to determine the extent to which Europe's trading partners may act strategically in designing domestic policy. Based on the hypothetical scenario that the EU operates either as a monopoly with a competitive fringe or competes with the rest of the world within a duopoly, upper and lower bounds of potential welfare effects resulting from enlargement were estimated. The numerical analysis confirmed that some countries may gain from enlargement, if the EU could operate as a monopolist, but may lose under a duopoly scenario and vice versa.

The numerical results suggest that welfare effects on the major European grain mar-

kets are very small in proportion to the total production value. When extrapolating this result to other markets, we may conclude that economic reasons are unlikely to play an important role with regard to further enlargement decision. Although economic reasons might have provided some incentives for previous enlargement rounds given the level of trade distortions existing in the past, the economic reasons will lose importance as trade is further liberalised. Political reasons are likely to remain the driving force for further EU enlargement.

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