INTERNATIONAL CONFERENCE OF AGRICULTURAL ECONOMISTS
ICAE
29th | Milan Italy 2015
UNIVERSITÀ DEGLI STUDI DI MILANO AUGUST 8 - 14
AGRICULTURE IN AN INTERCONNECTED WORLD

The Russian ban on EU agricultural imports: A bilateral extension of AGLINK-COSIMO

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Type On August 6 2014 the Russian Federation introduced a one year ban on imports into the Russian Federation of agricultural products, raw materials and food, originating from selected countries including the EU. This paper provides an initial assessment of the potential impact of this import ban on EU agricultural markets. Furthermore it provides an insight in the shifting trade patterns and price effects at EU, Russian and world level. We use the Aglink-Cosimo model, a recursive partial equilibrium model of the agricultural sector. Its gross trade specification is problematic for the study of bilateral trade. Therefore the model was extended with an ad hoc incorporation of bilateral trade. The initial results show that the impact for the EU remains rather limited as the EU can divert a considerable part of its trade with Russia to other markets. The impact on the Russian market is however expected to be considerable as imports can't be easily substituted and domestic production has problems to expand productions significantly within the timeframe of the ban.

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1 Introduction

On August 6 2014 the Russian Federation introduced a one year ban on imports into the Russian Federation of agricultural products, raw materials and food, originating from the United States, the countries of the European Union, Canada, Australia and Norway. This paper provides an initial assessment of the potential impact of this import ban on EU agricultural markets. Furthermore it provides an insight in the shifting trade patterns and price effects at EU, Russian and world level. We use the Aglink-Cosimo model, a recursive partial equilibrium model of the agricultural sector developed by the Organisation for Economic Cooperation and Development (OECD), and the Food and Agriculture Organization (FAO) and used by several (inter-) national institutions such as the European Commission[1]. Aglink is a gross trade model based on a balance sheet approach structured around a supply, utilisation and trade component. The gross trade specification is problematic for the study of bilateral trade. Therefore the model was extended with an ad hoc incorporation of bilateral trade.

The paper starts with an overview of potential approaches towards the modelling of bilateral trade in partial equilibrium models. The next section elaborates the pragmatic ad hoc solution employed in Aglink. Finally model extension is tested on the case of the Russian ban introduced earlier.

2 Bilateral trade specification in Agricultural PE models

A first step in the development of the Aglink bilateral trade extension included an inventory of the inclusion of bilateral trade in major PE models used in the area of international trade of agricultural goods. The inventory includes four PE models that are part of the part of the AgMIP project, a comparison of world leading global economic models (www.agmip.org) supplemented

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with four extra models used by major international institutions. A summary is presented in Table 1.

Half of the selected models are non-spatial PE models in their standard form. As explained before, that means this set of models does not differentiate goods based on their point of origin. One homogeneous world market is assumed from which all the modelled countries import or export to. In the case of net trade models, the specification also means that a country can't be an exporter and importer at the same time. The former assumption might hold for goods such as white sugar which can be considered identical independent from its origin. For other traded goods such as cheese horizontal product differentiation seems reasonable. Consumers do not consider Dutch Gouda to be equivalent to English Cheddar. But also vertical product differentiation exists in agricultural markets, for instance imports of broken rice from Thailand versus Basmati rice from India. Gross trade models allow for simultaneous imports and exports to the world market but do not allow the analyst to trace the origin and destination of these trade flows.

Within those models accounting for bilateral trade, the spatial models, three different approaches are used. A first approach consists of keeping trade shares constant based on observed historical trade patterns. This means that in the case of a shock to the system, imports and production increase or decrease with the same percentage. Although this approach allows for tracking bilateral trade, the specification limits the usability to model bilateral trade agreements. Bilateral trade agreements will change the competitiveness of a certain trade partner vis-à-vis other trade partners and domestic production, hence inducing a change in observed trade shares. This can however not be endogenously captured by a fixed sharers model.

A common approach, both in CGE and PE, is the so-called Armington specification (1969). This modelling approach does allow for national differentiation without specifying the underlying type of product differentiation, horizontal or vertical, as some more recent theories do (e.g. Krugman 1980). The Armington specification can be interpreted as a multi-level utility function with imperfect substitution between goods. For a PE model it is typically assumed that at a first stage the representative agent choses the total demand for a composite good (say total cheese use). This choice is influenced by the price level and the import demand elasticity. Then, within the composite good the agent chooses between the different sub-goods (Gouda from the Netherlands versus Cheddar from the UK) depending on the relative price of each variety and the substitution elasticity, commonly called the Armington elasticity. The choice of the utility function is not embedded in the Armington specification but for analytical traceability reasons most of the Armington based models rely on a CES utility function.

The Armington specification of bilateral trade has several shortcomings. First of all, empirical applications show that the magnitude of the Armington elasticity used in the model has a significant effect on the outcome of the modelled trade scenario. Secondly, Armington is based on the imperfect substitutability of different import goods. This means that if a good is initially consumed in both its domestic and imported version it will be continue to be consumed in both version. But also the opposite is true. If an imported good is not consumed in the initial equilibrium this good will not be imported even if the price of the domestic good increases sharply in the simulation. It also means that all changes are proportional to initial trade shares, hence impacts on trade are generally smaller than empirically expected and initial small trade shares will always stay small. This can be problematic especially when the observed small bilateral trade pattern is a direct effect of trade reducing policy measures. When such measures are reduced in a trade agreement one would expect bilateral trade to increase significantly which is constrained in the standard Armington specification. A way to accommodate for the latter within the standard Armington specification is to increase the Armington elasticities but this will make results very volatile and difficult to interpret. Different modellers have tried to accommodate these problems in specifically built PE and CGE models but the surveyed models all use a standard Armington specification with its inherent shortcomings. For a detailed discussion of the Armington model, its caveats and recent progress we refer the reader to Lloyd and Zhang (2006). Interestingly two of the models in Table 1 have a sub-module which activates the Armington specification when deemed necessary. For a net trade model this change can be based on whether or not the good considered can be homogeneous on the world market or to accommodate for specific bilateral trade agreements.

In case a good is homogeneous but the analyst is interested in bilateral trade analysis the Armington specification might not be the best approach. The spatial market integration approach, also known as the Takayama and Judge (1971) model, provides a possible solution. Takayama and Judge (SE), by optimizing the Net Social Payoff, the sum of all payoffs minus individual transport costs, solve the so-called Spatial Equilibirum Condition (SEC) (Samuelson, 1952). The SEC bounds the price difference between two spatially separated but partially integrated markets by forcing the price difference to be smaller than the transaction costs of trade between the two partners. In this specification prices and quantities traded are a function of transportation costs, bilateral trade policies and marginal production costs. The SEC assumes that in equilibrium traders do not make a profit as the price difference is smaller than the transaction costs. In reality arbitrage options between markets exist, at the very least in the short run. The SE includes arbitrage forces around the equilibrium which will assure SEC to be realised in the long run but deviation of prices can exist in the short run. In that sense it differs from the law of one price which is a static solution to a dynamic equilibrium. A consequence of the SE specification is the fact that, similar to net trade models, a country is assumed to be either an importer or an exporter in the equilibrium situation, no bilateral trade flows occur as goods are consider perfectly homogeneous. However, the SE approach does not suffer from the 'small shares stay small' problem as changes in trade patterns are not proportional to initial observed trade patterns. One of the surveyed models uses the SE spatial specification. This is however a rare feature in in the analysis of bilateral trade.

Nolte (2006) compares the Armington assumption with the SE approach in a stylized representation of the European sugar market. The comparison shows that price changes are less pronounced in an Armington model, which translates to a less sensitive reaction in supply and demand following changes in bilateral trade policy. Therefore only the SE was able to confirm the expectations of market experts with regard to the modelled scenario.

In a perfect world the optimal trade specification would be based on the type of the trade agreement modelled and the characteristics of the considered commodity. However as raised before, due to model availability, human capital and time constraints, analysts often turn to a model that is not perfectly aligned with the impact to be analysed. This should not be a problem per se but the consequences of this choice should be well explained and accounted for when analysing the results.

3 Bilateral trade in Aglink-Cosimo

The Aglink-Cosimo model is a recursive partial equilibrium model of the agricultural sector developed by the Organisation for Economic Cooperation and Development (OECD), and the Food and Agriculture Organization (FAO) and used by several (inter-) national institutions such as the European Commission[2]. Aglink is a gross trade model based on a balance sheet approach structured around a supply, utilisation and trade component. Markets are cleared both at the national and the world level through their respective price. Aglink assumes perfect competition in all markets, and perfect homogeneity for products from different countries. The functional form of the behavioural equations is constant elasticity log-linear in most cases. A residual factor is added to all behavioural equations in order to calibrate the model to the historical base year. In this section we will present the trade component in more detail and suggest adaptations to include bilateral trade.

3.1 The general trade structure

Aglink is based on a modelling template with explicit behavioural import and export equations. The model assumes homogeneity on the world market for all commodities. All modelled countries can import from this market and/or export to this market. The market is cleared by a world price, P_w, that assures the worldwide net trade to be zero, that is total exports are equal to total imports. The Aglink model has however a second market clearing price in the domestic market. This means domestic prices are not traceable through a set of transmission equations as is often the case in PE models. Domestic market clearance in country j is assured through a domestic price, P_j, which satisfies

$$\mathrm{Q}_j + \mathrm{S}_{-1} + \mathrm{I}_j - \mathrm{S} - \mathrm{E}_j - \mathrm{C}_j = 0 \quad (1)$$

where Q_j is the quantity produced domestically, S the outgoing stocks, S_{-1} the incoming stocks , C_j the domestic consumption and I_j and E_j the imported and exported quantity. The latter two are

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determined by behavioural equations calibrated on price and trade data. For reasons of clarity we assume that all prices are expressed in the domestic currency.

Imports by country j from the world market are given by

$$\log(\mathrm{I_j}) = \mathrm{c}_{I,j} + \mu_{I,j} \log\left(\frac{\mathrm{P_j}}{\mathrm{P_w}(1+\mathrm{TAVI})}\right) + \log(\mathrm{R}_{I,j}) \tag{2}$$

in which $c_{I,j}$ denotes a constant which is estimated during the calibration phase of the model, $R_{I,j}$ the residual factor and $\mu_{I,j}$ the import elasticity. Equation 2 shows that the volume of imports in *j* depends on the price difference between the domestic price and the price of the imported good. The price of the imported good is calculated as the world price plus the import tariffs, *TAVI*. The tariff rate is a function of the import level itself. Theoretically, the effective tariff rate is equal to the in-quota tariff as long as imports are strictly below the tariff rate quota (TRQ) level, and equal to the over-quota tariff, if imports are above the TRQ level[3]. However, this relation only holds for the individual tariff lines. The relationship between import levels and the effective tariff rate will not strictly be like this when tariff lines are aggregated as is the case in most PE models. In this situation the relation between in quota and out of quota tariffs is approximated, in order to make the jump in tariffs less steep when imports increase. The approximated effective tariff rate takes the following form and is represented graphically below:

$$\mathrm{TAVI} = \mathrm{IQA} + \frac{\exp\left\{\min\left[0, \frac{(\mathrm{I}-\mathrm{TRQ})}{\mathrm{TRQ}} * \sigma\right]\right\}}{1+\exp\left\{-\frac{\mathrm{abs}[\mathrm{I}-\mathrm{TRQ}]}{\mathrm{TRQ}} * \sigma\right\}} * (\mathrm{OQA} - \mathrm{IQA}) \tag{3}$$

With *IQA* the in-quota tariff rate and *OQA* the over-quota tariff rate, both expressed in ad-valorem equivalent, *TRQ* the volume within the tariff rate quota and σ a parameter determining the shape of the approximated relationship. The role of σ is illustrated in Figure 1. When its value increase the approximated function approaches the effective main tariff line. The choice of σ hence depends on the properties of the trade measures in place for the modelled (aggregated) commodity.

[3] Other trade measures such as specific tariffs are also incorporated in the model after their translation into ad valorem equivalents but were left out here to reduce the equation's complexity.

Exports are calculated in a similar way

$$\log(\mathrm{E_j}) = \mathrm{c}_{E,j} + \delta_{E,j} \log\left(\frac{\mathrm{P_j}}{\mathrm{P_w}(1 + \mathrm{TAVE})}\right) + \log(\mathrm{R_{E,j}})$$

with *TAVE* representing an ad valorem equivalent of all export taxes, calculated similar to the *TAVI*.

This representation does however not allow for bilateral trade analyses as all exports and imports are aggregated on one world market. Hence no differentiation based on the origin of the traded good can be studied.

3.2 Bilateral trade structure

The modification to Aglink proposed in this paper is an ad hoc approach to include selected bilateral trade flows that are of interest to the analyst. Therefore it differs significantly from the bilateral components that can be activated on demand presented in Table 1. A first step is to create a bilateral trade flows by singling out the bilateral trade pattern of interest from the world market (ROW). Secondly the export of country *j* to country *k*, $E_{j,k}$, is assumed to be equal to the imports of country *k* from *j*, $I_{k,j}$. The approach is graphically illustrated in Figure 2.

As the followed approach is ad hoc there is the possibility to adapt it to the needs of the analyst. Separating the bilateral trade flow makes the model spatial but the appropriate theoretical framework will depend on the characteristics of the trade pattern and the good modelled. The earlier overview showed that the choice between a SE or Armington approach depends on i) whether or not a good can be considered homogeneous, ii) whether initial trade shares are small or not.

2.2.1. Armington like spatial model

When a good is deemed heterogeneous, differentiated by its point of origin, and initial trade shares non-negligible the Armington specification is preferred. However, the Aglink model does not contain an explicit utility function in which the characteristic two stage demand system could be built in. Instead the standard behavioural import and export equations are calibrated on existing observed trade pattern without making explicit what exactly drives the trade equations.

Therefore we propose a modelling approach which follows the rational but not the exact structure as proposed by Armington.

Combining the existing trade equations with the idea behind Figure 2 the system of equations looks like this,

$$E_j = E_{j,ROW} + E_{j,k} = E_{j,ROW} + I_{k,j}$$

or

$$\log(E_j) = (c_{E,j,ROW} + \delta_{E,j,ROW} \log\left(\frac{P_j}{P_w(1 + TAVE)}\right) + \log(R_{E,j,ROW})) + \log(I_{k,j})$$

On the import side the equations take the following format,

$$I_k = I_{k,ROW} + I_{k,j}$$

or

$$\log(I_k) = (c_{I,k,ROW} + \mu_{I,k,ROW} \log\left(\frac{P_k}{P_w(1 + TAVI)}\right) + \log(R_{I,j,ROW})) + (c_{I,k,j} + \mu_{I,k,J} \log\left(\frac{P_k}{P_j(1 + TAVI_{k,j})}\right) + \log(R_{I,k,j}))$$

We made the arbitrary choice to keep the import equation for $I_{k,j}$, behavioural and set exports from *j* equal to imports in *k* instead of the other way around. This setup is in line with most bilateral trade agreements where negotiations mainly cover import measures (i.e. import duties), rather than the export measures. The new constants and residuals are calibrated based on exogenous bilateral trade data. The elasticities $\mu_{I,k,ROW}, \mu_{I,k,J}$ and $\delta_{E,j,ROW}$ can be changed compared to the original model to reflect the changed characteristics of the trade flow. However given the difficulties associated with estimating or assigning elasticities, we opted to keep the elasticities equal to the elasticities used for the trade with the world market, $\delta_{E,j}$ and $\mu_{I,k}$. This is however a parameter the analyst can play with if he considers the new ad hoc implementation of bilateral trade patterns a structural break affecting the size of the import and export elasticities.

Finally the parameter $TAVI_{k,j}$ will be recalculated based on the import measures in place in country *k* for imports from *j* following equation 3.

The behaviour of such a model is very similar to an Armington specification based model. The assumption of homogeneous good in the gross trade model is now replaced by two differentiated goods, differentiated goods, $I_{k,ROW}$ and $I_{k,j}$ that together represent total imports I_k. The volume imported from both sources is driven by the relative price difference. As prices are clearing both at the world market level and the domestic level we get a two stage calculation phase as is the case with Armington. Hence the substitution between both streams of imports is driven by the behavioural parameters in both import equations that regulate the response to the market clearing prices instead of explicit substitution elasticity in the classic Armington specification.

As the modification behaves similar to the Armington approach, it suffers from some of the similar shortcomings, in particular the small share problem. As products are not anymore perfectly substitutable, it means changes in trade can only happen relative to the initial trade share. This means that no assessment can be made for products that are only marginally or not traded bilaterally, not even when policy measures are the main reason for the low observed trade volumes.

2.2.2. Spatial equilibrium like model

A method to depict homogeneous goods in a bilateral trade model is the use of spatial price and allocation models introduced by Takayama and Judge. Under this modelling framework, the trade equilibrium between two regions is constrained by the spatial equilibrium condition (SEC),

$$\mathrm{P_k} \leq \mathrm{P_j} + \mathrm{c_{j,i}} + TAVI_{j,k}$$

where $c_{j,i}$ represents the cost of trading the good from *j* to *k*. This cost contains the transportation costs and other transaction costs. The spirit of the Spatial Equilibrium model (SE) can be introduced in Aglink through an integration of the markets of the bilateral trade partners. Instead of keeping the existing behavioural import equation we assume arbitrage correction will push the two markets towards the SEC equilibrium. Therefore the calibrated behavioural equation for $I_{k,j}$ is replaced by a new equation denoted as

$$\mathrm{I}_{\mathrm{k,j}} = \begin{cases} 0 \text{ if } \mathrm{P}_{\mathrm{k}} < (1 + \mathrm{c}_{\mathrm{j,k}} + TAVI_{j,k})\mathrm{P}_{\mathrm{j}} \\ (\mathrm{P}_{\mathrm{k}} - ((1 + \mathrm{c}_{\mathrm{j,k}} + TAVI_{j,k})\mathrm{P}_{\mathrm{j}}))\mathrm{Z} \text{ if } \mathrm{P}_{\mathrm{k}} > (1 + \mathrm{c}_{\mathrm{j,k}} + TAVI_{j,k})\mathrm{P}_{\mathrm{j}} \end{cases}$$

The parameter *Z*, representing the quantity trade for each euro difference between the imported and the domestically produced quantity, can be interpreted as the strength of the arbitrage correction. When *Z* increases the price between both markets will converge faster, reaching the SEC earlier. The size of *Z* will depend on the characteristics of the market considered such as the type of logistic infrastructure at place, trade capacity between the two markets etc.

In this specification the model will optimize the traded volume between the two bilateral partners in their (semi) integrated market. These imports are then complemented by imports from ROW to assure market clearance at the domestic level. Hence no substitution based on the origin of the good takes place, the traded good remains homogeneous as in the original gross trade specification and ROW is additive. As a direct consequence of ad hoc integration of markets trade patterns can be created or halted depending on the modelled scenario, overcoming the small shares problem of the Armington approach.

2.2.3. Illustration of both approaches

In order to better understand the behaviour of the two approaches a hypothetical scenario is developed. We focus on a commodity for which trade between two partners (A and B) is fully liberated, there are no import tariffs. However, one of the two partners, A, is considering the unilateral introduction of an import tariff for trade partner B. We further assume that the trade restrictions would be put in place in 2013 and evaluate the outcome in 2020. The baseline for the modelling approach and all the underlying macro-economic assumptions is taken from the European Commission's agricultural outlook report (European Commission, 2013). The Armington like specification could be calibrated solely based on observed trade data. For the SE approach the estimation of Z is crucial. As we assumed the starting point of the exercise to be fully liberalized, *Z* was calibrated in such a way that the trade at zero import tariffs was equal to the baseline for year 2020. Then the *TAVI* was raid up to 80% in steps of 10%.

Figure 3 presents the impact on imports in A from B when raising the import tariffs. The Armington like approach results in a decreasing rate of export reduction while the SE approach follows a constant path. Therefore trade with B would be halted in the SE case from a 47% tariff while in the case of Armington like there is still marginal trade at 80%. This is in line with the expectation that Armington can only adjust existing trade patterns but will not create new trade patterns or fully stop an existing trade flow. Looking at the graph it seems to suggest that SE is less responsive when introducing small import tariffs. However while the inclination of the SE graph depends on the import tariff, the point it cuts Armington line is conditional on the calibration of *Z*. By construction this intersection lays now at 0% tariff. If however Z would be calibrated on a different starting point, e.g. observed trade at a 20% tariff level the line would shift to be tangent with the Armington curve at the 20% tariff line in which case SE would be more responsive to changes in import tariff than the Armington approach. This indicates that the behaviour of the SE is highly dependent on the assumptions made by the analyst and the initial import tariffs, making its behaviour harder to predict in advance of the simulation. On the other hand the SE is much more flexible in accommodating expert opinions in the assessment if structural changes are expected that are not within the realm of reactions of the Armington approach, e.g. new trade patterns, structural adjustments etc.

Figure 4 shows that the behaviour of the domestic price in A behaves similar to the imports as could be expected. While the price increases strongly when import tariffs are introduced the rate of increase declines with further tariff increases. For the SE approach on the other hand, the increase is linear with the increase in import tariffs. This leads to lower price adjustments at low import tariffs but surpassing the Armington approach at larger import tariff changes.

Finally we tested the behaviour of the Aglink model to the bilateral trade specification independent from the choses approach. Therefore we assessed the impact of the bilateral trade pattern on total imports and the imports from other regions in the world. The results are depicted in Figure 5 where the absolute changes in import from B and the ROW are plotted. We observe that the loss of imports sourced from B due to increased import tariffs is only partly made up by imports from the ROW. Hence inclusion of import tariffs leads to both a trade substitution effect and a trade destruction effect. The ratio between both is about 1/3. This ratio holds for both the SE and Armington approach. The fact that the bilateral trade model does not result in a corner solution confirms that the Aglink model copes well with the new bilateral trade specification.

4 An application to the Russian ban on imports form selected trade partners.

The Russian import ban is modelled by removing the bilateral trade flow between Russia and the countries concerned for those commodities that were banned in August 2014. The size of the shock is generally based on observed trade patterns for 2013 with some updates for 2014 if these were needed. The ban is assumed to be introduced at the beginning of 2014 and results are given for the end of this year in order to reflect the one year ban. As we focus at the short run impact, only small changes in production are possible with the major adjustments situated in the trade flows, consumption and prices.

The following bilateral trade flows with Russia where assumed to be banned. We only included those trade flows that were non-marginal in 2013. Bilateral trade patterns where introduced following the Armington like specification introduced above. The market access for all other commodities was kept equal to the baseline. Hence, for the other commodities in the model, only indirect effects are reflected in the results.

	EU	USA	CAN	AUS	NOR**
Pork*	Banned	Banned	Banned		
Beef*	Banned			Banned	
Poultry*	Banned	Banned			
Butter	Banned				
Cheese	Banned				

*The meat aggregates in the Aglink model include trade in unbanned products such as lard and some preparations. Therefore the trade flow was not set to zero but to the 2013 level of unbanned products within the aggregate. Figures might be different from other sources that use other aggregates.
** Fish and fish products are the main Norwegian exports to Russia. They are not covered in this assessment.

3.1.1. Meats

The total impact for the different meat sectors can be is characterised by a reduction in market receipts, driven essentially by a drop in domestic prices given that production cannot adjust at such short notice. These simulation results follow the same direction and order of magnitude of the actual impact of the Russian ban on EU pigmeat introduced in February 2014 following the discovery of a few cases of African Swine Fewer in wild boars close to the border with Belarus (i.e. trade diversion and decline in domestic prices).

Beef: Of the EU beef meat normally exported to Russia only 7% are expected to be diverted to other markets while the remaining tonnes would weigh on the domestic market. However, this would be partly compensated by a reduction in EU imports. The extra supply of the domestic market results in a price decline of -3.1%, which would allow for an increase in domestic consumption.

Poultry: In the baseline the EU is expected to export about 98 000 tonnes of poultry to Russia. In this simulation 49% of this volume would be diverted to other markets and while the rest would be would be lost for export. As poultry production has a shorter production cycle the domestic production already adapts during the year, -0.3%, thus reducing the price effect on domestic markets to only -1%.

Pigmeat: the pork sector is expected to be impacted the least as EU exports to Russia are already de facto banned since February 2014 following the presence few cases of swine fever in wild boars in North-East Europe. Therefore the impact on pigmeat is limited and only indirect. Pigmeat prices decrease as the other meats become cheaper, which in turn allows for slightly more exports to other regions. As Russia has to replace pigmeat imports from Canada and the EU some new export options are created for the EU that were before supplied by competitors.

3.1.2. Dairy products

The consequences for EU dairy farmers of the import ban for the considered dairy products mainly relate to the losses in cheese and to a lesser extent butter. While these losses in market receipts are substantial, it has to be stressed that average EU prices would remain well above safety net levels and no policy measures are triggered in these simulations.

Cheese: The impact on the EU cheese market is the most pronounced. About 30% of the EU's cheese exports are normally sent to Russia. 32% of these exports are expected to be diverted to other markets. Most of the export loss could be absorbed through a reduction in production of -1.9% compared to the baseline. The resulting effect on the EU domestic price is -4.5%. The decrease in cheese production is not fully reflected in a reduction of milk production and part of the excess milk supply would be used to increase production of SMP, WMP, butter and other dairy products. Thus the reduction in raw milk production is rather limited (-0.4%).

The contraction of EU cheese production and the reduced export creates a shortage on the world market leading to an increase in world market price of 1.6% for cheese.

Butter: The total export of butter would reduce by about -3 000 tonnes. The extra EU butter production as an outlet for fats and the reduction in exports result in a -3.8% decline in EU butter prices. Hence consumption increases. The world market price would increase, as there is a shortage in the world market following reduction in volume traded and an increased demand for butter from Russia.

3.1.3. Price effects and effects on other markets

The price effects for the different commodities are summarized in Figure 8. World prices for poultry decline following the diversion of exports from the EU and other countries affected by the import ban. For cheese and butter however the world price increases slightly (i.e. 1.9% and 2.9%) as for these commodities the EU mainly reduces production instead of diverting cheese to the world market. With Russia now sourcing from the world market the prices increase.

From a combined global and Russian perspective the ban has a most disturbing effect in the dairy market. Russian cheese production reacts in a dynamic way to the ban, increasing cheese production by 20%. However this increase cannot compensate for a reduction of imports of -32%. Hence the Russian domestic cheese price is projected to increase by almost 15% leading to a 2.8% drop in consumption.

Channelling raw milk towards cheese results in a production fall for the other dairy products despite an overall increase in Russian milk production of 1.2%. This leads to higher prices, about +2% for the whole milk powder and about +7.3% for butter. Imports increase but to a limited extent. Especially for butter increase in imports is difficult following the scarcity at the world market leading to higher world prices.

Although the world prices for the different meats are relative stable the ban has important effects on the Russian poultry sector. EU imports can only be partially replaced through alternative sources of imports such as Thailand, Brazil and China resulting in a decrease in imports of -66%. Russian poultry production is expected to increase with about 1.5%. For the Russian consumer this means a reduction in poultry consumption of -1.5% at a domestic price which is about 12% higher.

The situation is different for the Russian beef market. Despite a ban on beef imports from the EU, Canada and Australia import increase by 1.2%. With an unaltered world beef price there are a variety of exporters able to supply the world market and Russian market. Latin American countries with Brazil as a leader pick up exports. Also the US increases exports to regions different from Russia, partly replacing Latin American exports that are diverted to Russia after the ban.

In general, if Russia wants to reduce the impact on its consumers it may either reduce import tariffs or set up bilateral trade flow with selected partners, probably at a price higher than the world market.

5 Conclusions

The Aglink-Cosimo model, a gross trade model, has its limitations when assessing the impact of bilateral trade relationships. In this paper we develop a pragmatic ad hoc extension of the standard model that makes it possible to explicitly model bilateral trade flows using Aglink-Cosimo. The extension gives the user the possibility to specify bilateral trade either in an Armington like environment or following a spatial equilibrium type model depending on the commodity's specific characteristics. Using a generic commodity the behaviour of the extension is described.

Finally the bilateral extension is used to assess the potential impact of the August 2014 ban on imports from the EU, Canada, US and Norway for a limited set of commodities. The results show that for the sectors assessed in this note, meat and dairy products, the EU loss in market receipts as a direct consequence of the one year Russian import ban could be considerable.

For most products the EU can divert a significant share of their exports initially directed to Russia to other trade partners. This happened already for pigmeat which is banned since February and found alternative trade destinations in Asia. For dairy products the main response is a reduction in production of the most affected product (cheese), reduction which is impossible for the meat sectors (with the exception of poultry where production can adapt quickly). When making abstraction of the earlier ban on pig meat, beef is most affected sector. Compared to a situation without the ban, prices decrease by -3.1%. Poultry is less affected due to the faster adaptation in production and its competitiveness at the world market. For pork the price decrease is small, -0.4%, as exports to Russia are banned since February following the presence of few cases of swine fever in wild boars the EU.

With nearly 1/3 of EU cheese exports going to Russia (2.6% of EU production), the Russian import ban results in a contraction in cheese production which would decline by almost 2%. Domestic price would decrease by more than 4%.The reduction in cheese production leads to both a slight reduction in raw milk production, -0.4% and a diversion of fats and proteins to other dairy products such as the powders and butter. EU prices decline however for all dairy products except whey.

At world level the effect on prices is diverse. Poultry prices tend to decrease slightly following the diversion of EU produce to other export markets. Beef prices are stable while pig meat prices are slightly increased following increased Russian imports. The prices for butter and cheese slightly increase as the EU reduces production instead of oversupplying the world market.

Russian domestic prices increase strongly. Cheese and poultry prices increase with over 10% as neither domestic production nor imports from other sources can fully replace EU imports. The only way for Russia to limit domestic price inflation is to set up specific bilateral trade flows at potentially higher prices or by lowering import tariffs (for selected partners).

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Table 1: Trade specification in selected partial equilibrium models

Model (references)	**Institution**	**Trade specification**
GCAM (Wise and Calvin,2011)	PNNL, USA	Non-spatial, net trade
GLOBIOM (Havlik et al., 2013)	IASSA, AT	Takayama-Judge spatial equilibrium
IMPACT (Rosegrant et al., 2012)	IFPRI, USA	Non-spatial, net trade
MAgPIE (Lotze-Campen et al., 2008)	PIK, DE	Based on historical self-sufficiency rates
CAPRI (Britz and Witzke 2008)	University Bonn, DE	Armington assumption
TRIST (Brenton et al. 2011)	Worldbank, USA	Armington assumption
PEATSIM (Somwaru and Dirkse, 2012)	USDA, USA	Non-spatial, net trade but Armington module exists
ATPSIM (Peters and Vanzetti, 2004)	UNCTAD, CH	Based on historical self-sufficiency rates but Armington module exists

Sources: von Lampe et al. (2013) and own elaboration

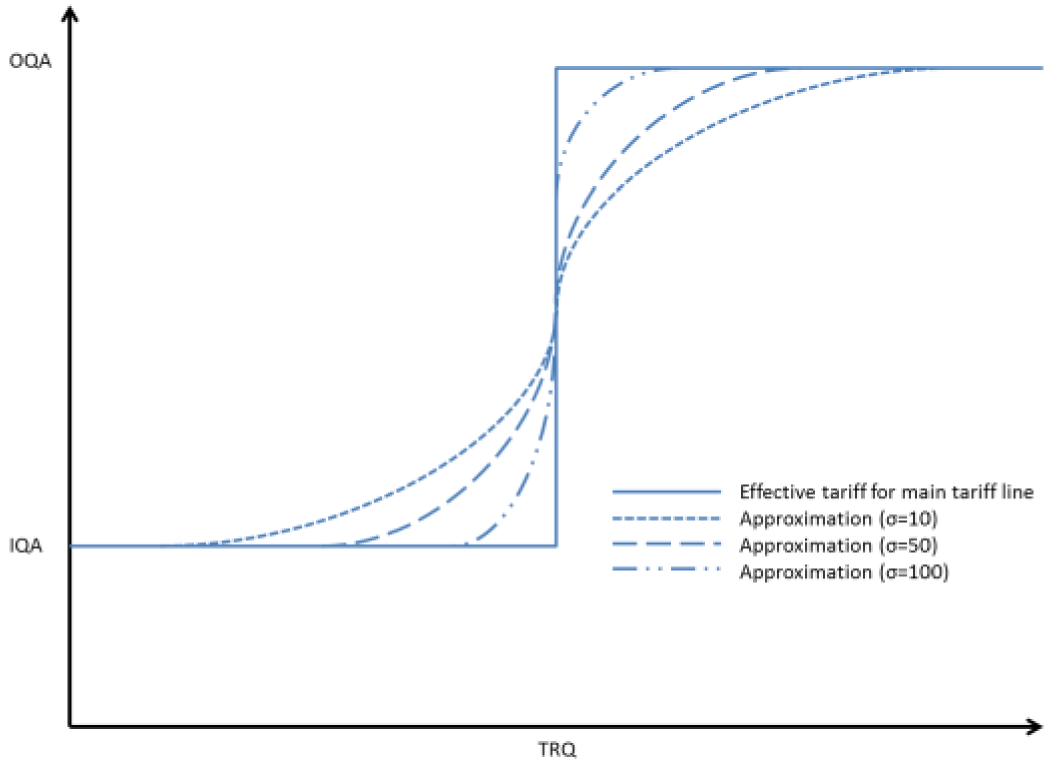

Figure 1: The approximated TRQ inclusion

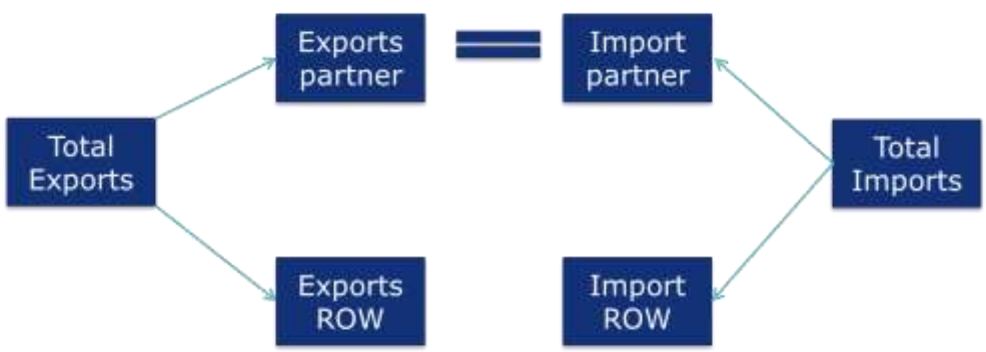

Figure 2: The creation of bilateral trade in Aglink

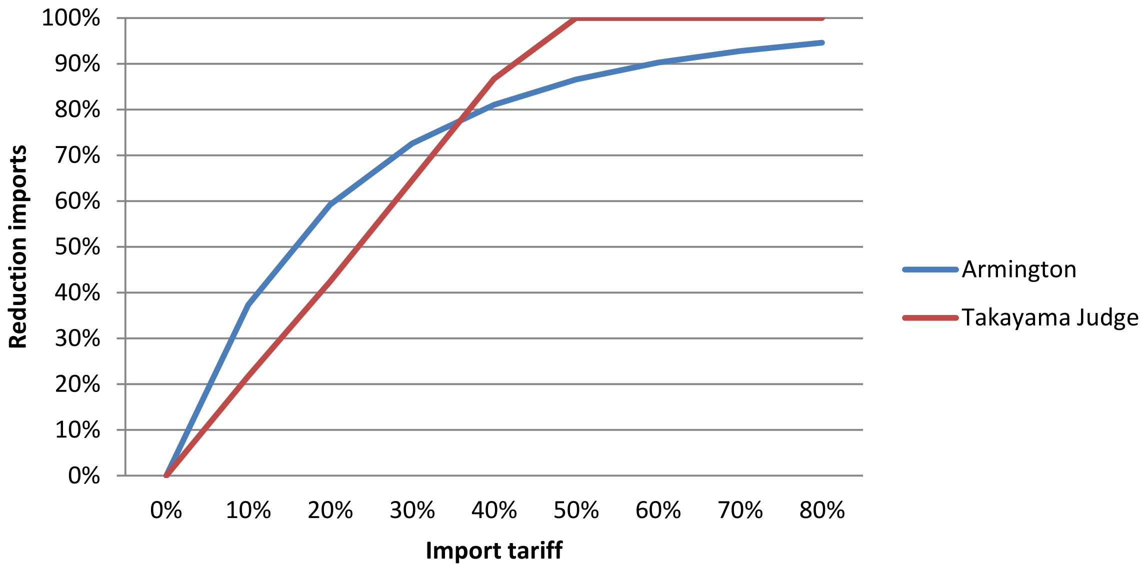

Figure 3: Changes in imports with bilateral partner

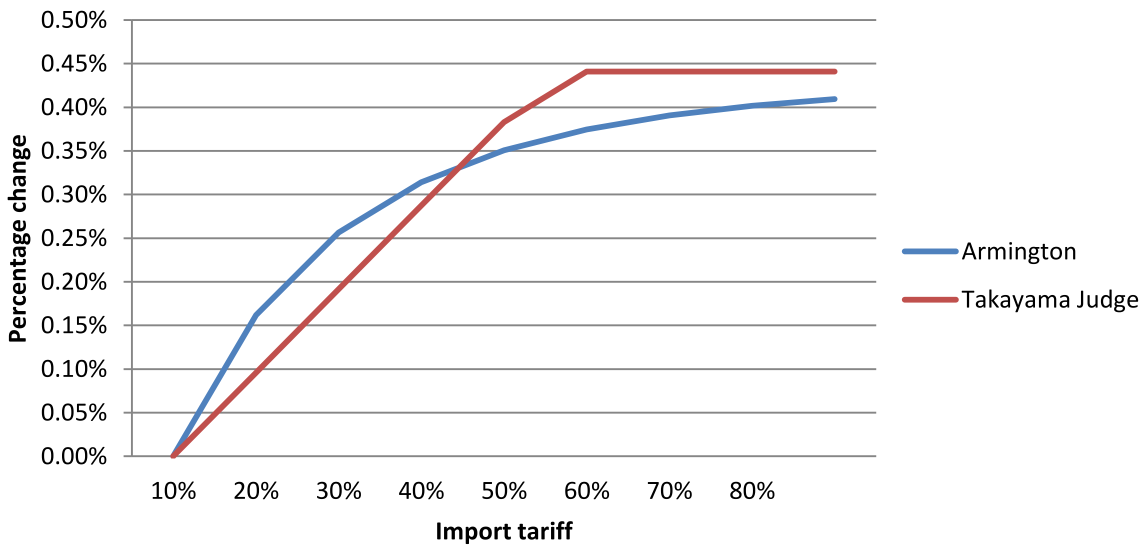

Figure 4: Changes in EU producer price

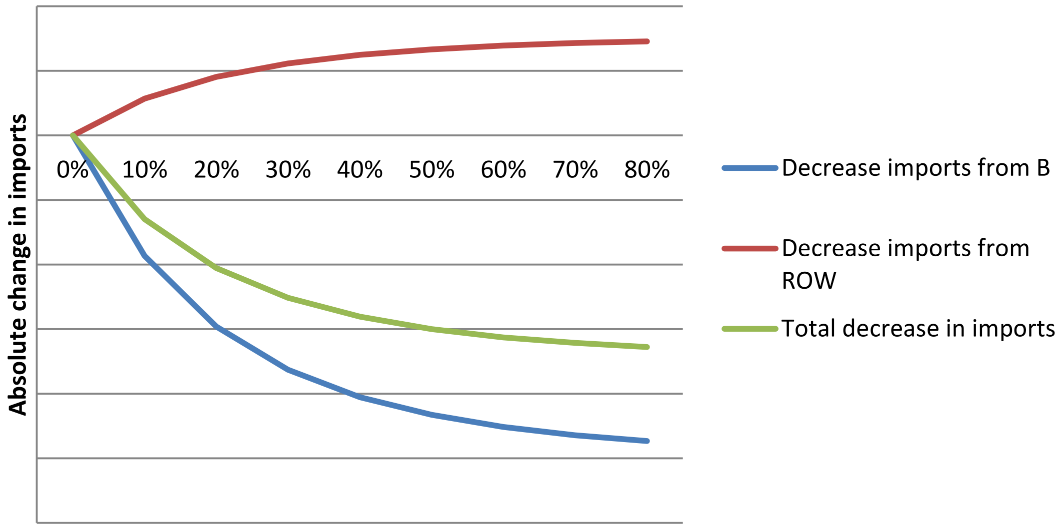

Figure 5: Absolute changes in imports in A when changing import tariffs with B

Figure 6: Impact on EU meat markets - percentage change

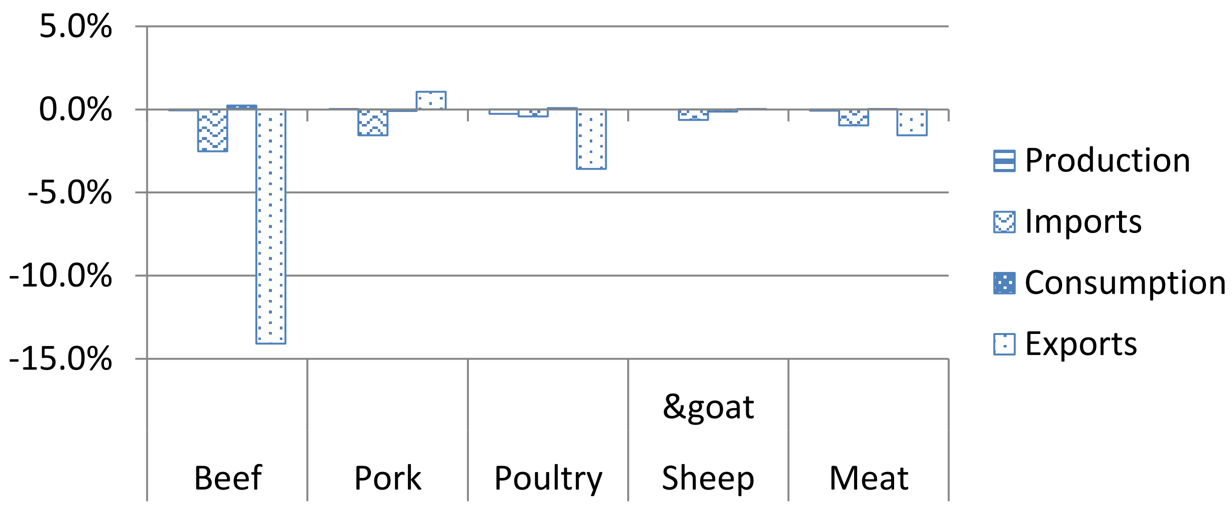

Figure 7: Impact on EU dairy markets - percentage change

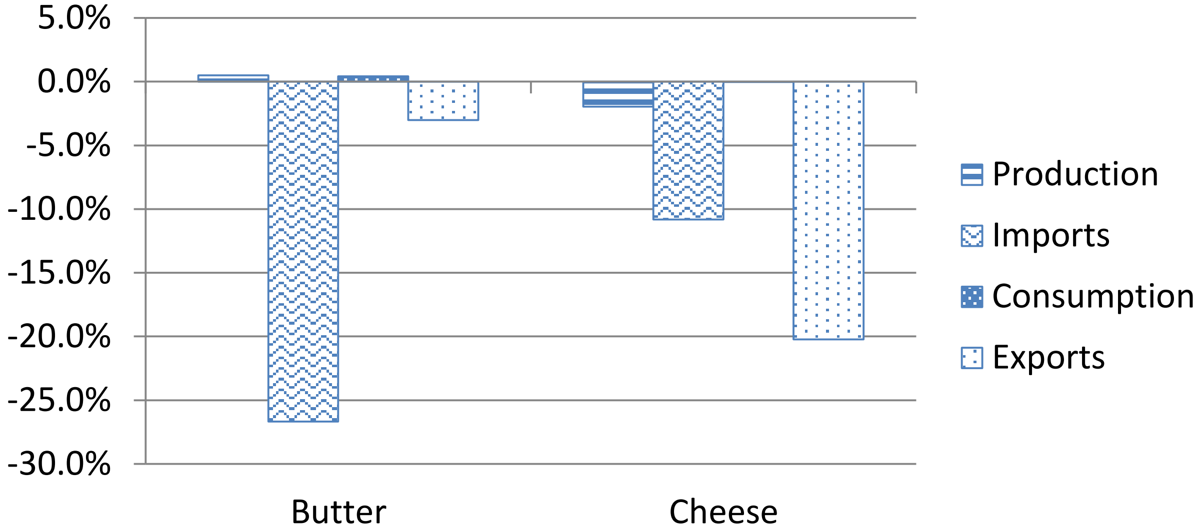

Figure 8: Percentage price change for selected commodities