

**The cost of import prohibition for political reason:
CGE analysis of the Russian ban on agri-food products¹**

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Abstract

In the summer of 2014 Russia imposed a ban on most agri-food products from countries enforcing Ukraine-related sanctions against Russia. A specific factors' Computable General Equilibrium (CGE) model simulates the short run impact of this retaliatory policy. The baseline is carefully designed to isolate the impacts of the ban on European Union (EU), Russia itself and a selection of key trade partners. The modelling of the ban follows a novel approach, where it is treated as a loss of established trade preferences via reductions in consumer utility in the Armington import function. Not surprisingly, the results indicate that Russia bears the highest income loss (about 3.4 billion euros) while the EU recovers part of its lost trade through expansion of exports to other markets. Finally, a comparison between simulation results and observed data validates the robustness of the modelling approach.

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Keywords: Trade, CGE, European Union, Russia

¹ The views expressed are purely those of the authors and may not in any circumstances be regarded as stating an official position of the European Commission.

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1. Introduction

In retaliation to the sanctions imposed on Russia for the political crisis in Ukraine, on August 7, 2014, Russia imposed a one-year import ban on a list of agri-food products from the European Union (EU), the United States of America (USA), Norway, Canada and Australia. This list covers almost all meat products (beef, pigmeat, poultry, and certain sausages), milk and dairy products, fruits and vegetables, as well as fish and crustaceans (DG AGRI, 2014a). Representing approximately four percent of EU agri-food exports, these restrictions were expected to put a degree of pressure on agriculture and food sectors, largely due to the unforeseen nature of the trade shock. A further decomposition by sectors revealed that some EU sectors were expected to be heavily affected (i.e., 29% of EU fruit and vegetable exports, 33% of cheese, 28% butter (DG AGRI, 2014a)). Internal EU estimates (DG AGRI, 2014a) suggested that the ban potentially jeopardised five billion euros worth of trade affecting the livelihood of some 9.5 million EU workers.

It is commonly accepted that implementing an import ban distorts domestic and foreign resource allocation. It exacerbates the terms of trade, and impacts on both consumers and downstream industries within the country imposing the ban. In addition, it jeopardises the long term competitiveness of domestic producers who are shielded from import competition, and from a fiscal standpoint results in a loss of tariff revenue. As a general rule, the World Trade Organisation (WTO) proscribes quantitative restrictions², including bans, on imports and exports (GATT article XI). However, the WTO recognises exceptions for economic reasons (safeguarding mechanism, developing countries exemption) and non-economic reasons (protection of human, animal or plant life/health, security interest).

The modelling and analysis of an import ban has been the subject of various multi-region Computable General Equilibrium (CGE) studies in the agricultural economics literature. These include the ban on Genetically Modified Organisms (GMOs) imports (Anderson and Jackson, 2005; Philippidis, 2010; Hensele, et al., 2013); the avian influenza outbreak (Rodriguez, et al., 2007) and the Bovine Spongiform Encephalopathy (BSE) outbreak (McDonald and Roberts, 1998; Philippidis and Hubbard, 2001; Chatterjee, et al., 2010). One recent study examines the Russian ban (Antimiani, et al., 2014) using a standard dynamic CGE approach (see section 3).

² This paper does not address import restrictions such as quotas (e.g., tariff rate quotas, seasonal quotas, etc.) which remain frequently used in international trade relations.

The current paper takes a novel approach in a number of ways. Firstly, the most recent version of the Global Trade Analysis Project (GTAP) database is employed (version 9). Secondly, the modelling of the ban follows a more intuitive approach (Philippidis, 2010). Thirdly, a carefully designed baseline is used to account for the specific macroeconomic and agri-food trade situation at the time the ban entered into force. Fourthly, precise import shocks are implemented using detailed tariff line trade data. Fifthly, the use of a specific factors variant of the GTAP model takes into account the short run time horizon associated with the ban. Finally, a comparison between simulation results and observed data is undertaken to test the robustness of the model findings.

The paper is structured as follows. Section 2 presents the methodology which includes the modelling approach, database preparation and scenarios. Then results are discussed in section 3 while section 4 compares model results with observed data. Section 5 concludes.

2. Methodology

2.1. Modelling approach

For assessing the implications of a trade shock and the resulting feedbacks on resource reallocation between competing activities; output; prices and trade flows, multi-region CGE models have become the *de facto* tool of choice. This study employs the well-known GTAP multi-region CGE model (Hertel, 1997). As a demand driven model, GTAP is based on standard neoclassical assumptions of constrained optimisation to derive intermediate-input, factor and final demand functions. Market clearing equations determine equilibrium prices, whilst a series of accounting conventions ensure that the circular flow of income, expenditure and output are equal. As is typical in such models, import trade is treated using an Armington function based on CES preferences. This parsimonious specification encompasses an exogenous treatment of region of origin (substitution elasticity) which allows for two way gross bilateral trade flows. Assuming that all domestic markets clear, neoclassical model closure ensures that withdrawals (savings and imports) equal injections (investment and exports) resulting in a net balance of payments of zero.

In this study, the modelling of the ban departs from the traditional ‘closure swap approach’ where an (endogenous) tariff reaches prohibitively high levels to target exogenous reductions in imports (Anderson and Jackson, 2005; Henseler, et al., 2013; Antimiani, et al., 2014). The underlying hypothesis is that tariff driven import price rises cause the fall in imports – which is not an accurate depiction of the Russian ban. Instead, this study follows Philippidis (2010) in depicting Russia's self-imposed ban as a loss of (previously established)

Russian trade preferences. More specifically, a bilateral utility scaling variable is introduced into the Armington function which also impacts on the price per unit of utility in the nest. Imports are exogenously reduced, whilst the corresponding utility scalar adjusts akin to a reduction in Russian consumer utility from lost trade preferences (Philippidis, 2010).

2.2. Database

The study employs version 9 of the GTAP database (Narayanan, et al., 2012). Benchmarked to the year 2011, it includes gross bilateral trade flows, trade protection and transport margins between 140 regions. The trade data are reconciled with input-output data disaggregated to 57 tradable sectors, supplemented by macro accounts data. As the most recent dataset of its type, it includes features like Ukrainian accession to the WTO. As a point of departure, further data updates are still required to correctly isolate the impacts of the ban (see section 2.3).

The choice of 37 regions (Table 1) is based on those trade partners most affected by the ban (i.e., EU, Canada, USA, Norway and Australia) and Russia's key trade partners across the selection of banned products (DG AGRI, 2014). Remaining EU member states largely unaffected by the ban (i.e., Cyprus, Malta) are aggregated within the Rest of the EU region. All remaining countries enter a residual rest of the world (ROW) region.

The twelve-sector aggregation focuses on those banned commodities (marked with an asterisk in Table 2) plus relevant adjacent industries (upstream livestock and raw milk sectors). Remaining sectors are grouped into four aggregates (cereals and oilseeds, other agriculture, other food, and the rest of the economy).

Table 1: Country/Region Aggregation

Russia	Italy	New Zealand	Ecuador
Austria	Lithuania	Ukraine	Argentina
Belgium	Netherlands	Belarus	Brazil
Denmark	Poland	Kazakhstan	Paraguay
Finland	Spain	Other CIS*	Uruguay
France	Rest of the EU	Turkey	China
Germany	USA	Israel	North Africa
Greece	Canada	Iran	Republic of South Africa
Hungary	Norway		Rest of the World
Ireland	Australia		

*Other CIS (Commonwealth of Independent States) includes Azerbaijan, Tajikistan, Turkmenistan and Uzbekistan.

Table 2: Sector Aggregation

Cereals and oilseeds	Live cattle	Fish*	Dairy*
Fruits and vegetables*	Live pig and poultry	Cattle meat*	Other food
Other agriculture	Raw milk	Pork and poultry meat*	Rest of the economy

* Sectors that are affected from the ban.

2.3. Database preparation

To isolate the impacts of the ban, a careful database update is performed prior to running the simulation experiments. A first step takes into account the changes in the main macro drivers between the benchmark year 2011 and 2014 (i.e., GDP, population, factor endowments, land productivity and Croatian accession into the EU). In a secondary step, changes in Russia's trade trends with its main partners for those commodities of interest to the ban are implemented exogenously employing additional data (United Nations Statistical Division, 2014). Importantly, the resulting updated data includes previous Russian bans on Canadian and US cattle meat (early 2014) and on EU pig meat due to African swine fever (February 2014) (Table A.1, in appendix).

To adequately accommodate the short run supply response from a one year ban, a 'specific factors' variant of the GTAP database is developed, where 75% of the production factors (capital and labour)³ are assumed sector specific, whilst the remaining 25% is free to move according to price signals⁴.

The updated 2014 benchmark reveals that the EU is a relevant exporter to Russia in all banned products except fish; providing 29% of Russia's fruits and vegetables, 24% of its cattle meat, 58% of its pork and poultry meat and 81% of its dairy imports (Table 3).

Table 3: Estimated share of Russia's trading partners in the trade of affected commodities and share of this trade in Russian production (pre-ban) (%),

	Fruits and vegetables		Fish		Cattle Meat		Pork and poultry meat		Dairy	
	Imp.	Prod.	Imp.	Prod.	Imp.	Prod.	Imp.	Prod.	Imp.	Prod.
EU-28	29.0	5.4	4.3	1.4	24.4	1.6	57.8	19.3	81.1	7.1
Australia	0.1	0.0	0.1	0.0	6.6	0.4	0.1	0.0	2.1	0.2
Canada	0.0	0.0	0.1	0.0	0.4	0.0	8.3	2.8	0.0	0.0
Norway			94.8	30.3			0.0	0.0	0.3	0.0
USA	2.8	0.5	0.4	0.1	0.1	0.0	13.4	4.5	0.2	0.0
BANNED COUNTRIES	32.0	5.9	99.6	31.8	31.5	2.1	79.5	26.5	83.6	7.4
New Zealand	0.1	0.0			1.5	0.1	0.0	0.0	4.8	0.4
China	7.1	1.3	0.1	0.0	0.0	0.0	0.2	0.1	0.2	0.0
Argentina	3.3	0.6			7.0	0.5	0.3	0.1	2.7	0.2
Brazil	0.1	0.0			33.8	2.2	17.3	5.8	0.0	0.0
Paraguay	0.0	0.0			7.3	0.5	0.0	0.0		0.0
Uruguay	0.1	0.0			11.4	0.8	0.0	0.0	1.0	0.1
Ecuador	6.5	1.2								
Belarus	0.0	0.0	0.0	0.0					6.1	0.5
Kazakhstan	0.0	0.0			0.0	0.0			0.0	0.0
Ukraine					1.7	0.1	1.7	0.6		
Other CIS	7.8	1.4							0.0	0.0
Israel	4.4	0.8	0.0	0.0			0.0	0.0	0.0	0.0
Iran	3.3	0.6	0.0	0.0	0.0	0.0			0.1	0.0

³ Land is already an immobile factor in the model.

⁴ Other combinations (50, 25 and 0%) of specific factors were also implemented. The results from these data variants are available upon request from the authors.

Turkey	15.4	2.8	0.1	0.0	0.2	0.0	0.2	0.1	0.2	0.0
North Africa	7.9	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
R. South Africa	2.1	0.4			0.0	0.0	0.0	0.0	0.0	0.0
RoW	9.9	1.8	0.2	0.0	5.5	0.4	0.9	0.3	1.4	0.1

Source: Authors' own calculations from GTAP database.

Table 3 also reveals that Russia is import-dependant on pork and poultry meats from the EU, Canada and the USA, which represent more than a quarter of domestic production.⁵ At the other extreme, cattle meat imports represent only 2% of domestic production.

In terms of Russia's market share of EU exports, Lithuania bears the highest burden from the ban (over 37% of produced fruits and vegetables, almost 15% of cattle meat, 7% of pork and poultry, 8.6 of dairy), together with Poland (over 18% of produced fruits and vegetables) and Denmark (13.3% of cattle meat and 8.8% of pork and poultry meat)⁶.

2.4. Scenario Design

Employing trade data from United Nations Statistical Division (2014), Russian import reductions on banned products from affected exporting countries are exogenously targeted subject to endogenous consumer utility reductions. The exact shocks implemented are shown in Table 4. In fruits and vegetables, there is almost blanket coverage of the ban, whilst in the remaining sectors, the depth of the ban varies significantly by exporter. In the cattle meat sector, there is an important component of trade (i.e., horse sheep and goat meat, as well as raw animal fat) which is not covered by the ban.⁷

Table 4: Import ban shocks (% change from 2014)

	Fruits and vegetables	Cattle meat	Pig and poultry meat	Dairy
Australia	-100.0	-54.3	0.0	-100.0
Canada	-100.0	-0.6	-100.0	-100.0
USA	-100.0	-6.5	-100.0	-2.3
Austria	-100.0	-5.0	-5.6	-100.0
Belgium	-100.0	-0.7	-89.4	-88.8
Denmark	-99.6	-4.8	-11.7	-100.0
Finland	-100.0	0.0	-98.9	-100.0

⁵ Given the peculiarity of the fish sector, model results for EU countries are not presented but are available upon request. Firstly, pre-ban fish trade between the EU and Russia was minor, so the impacts to the EU are minimal. Secondly, given broad sector aggregation for fishing activity, one cannot capture the heterogeneity on Russian fish preferences (e.g., between Norwegian and Mediterranean varieties). Given that more than 99% of the original imports of Russia, mainly from Norway, are banned and they accounted for more than 30% of domestic production, fish sector is especially impacted. Finding alternative sources of imports for Russia appears critical. Hence we present the results relevant to the Russian markets.

⁶ Data for the share of exports to Russia by EU member states are not presented in the text but is available upon request.

⁷ Cattle meat in GTAP database includes fresh or chilled meat and edible offal of cattle (bovine), sheep, goats, horses, asses, mules, and hinnies; raw fats or grease from any animal or bird. Other meat in GTAP database includes swine and poultry meat, offal, preserves and preparations of swine and poultry meat, swine and poultry meat offal or blood, flours, meals and pellets of meat or inedible meat offal; greaves.

France	-99.5	-1.1	-58.6	-89.5
Germany	-100.0	-2.0	-18.9	-96.5
Greece	-100.0	-100.0	-100.0	-86.8
Hungary	-100.0	-0.9	-50.2	-68.3
Ireland	0.0	-11.7	-85.9	-55.1
Italy	-100.0	-7.3	-4.8	-88.2
Lithuania	-100.0	-86.9	-87.7	-89.7
Netherlands	-100.0	-1.6	-95.5	-98.0
Poland	-100.0	-32.4	-51.8	-98.8
Spain	-100.0	-9.8	-4.6	-28.9
Rest of EU	-100.0	-1.2	-49.1	-94.3
Norway	-100.0	-100.0	0.0	-83.0

Source: Authors' own calculations

3. Results

The complexity of the CGE model framework renders a full discussion of all the results as unwieldy. Instead, the discussion focuses on the main outcomes by sector and region. All model results presented are changes with respect to the updated 2014 database.

3.1. Domestic effects / production exported to Russia.

Price and production effects are presented in Table 5. Due to factor immobility, output responses are limited, provoking (in some cases, significant) price falls. The magnitude of the price drop is related to the magnitude of share of national production exported to Russia.

Table 5: Change in market prices (P) and quantities (Q), %

	Fruits and vegetables		Cattle meat		Pork and poultry meat		Dairy	
	P	Q	P	Q	P	Q	P	Q
Austria	-0.8	-0.1	-0.1	-0.0	0.0	0.0	-0.6	-0.3
Belgium	-2.9	-0.4	-0.1	-0.0	0.0	0.1	-0.5	-0.3
Denmark	-0.7	-0.1	-0.1	-0.1	-0.0	0.1	-0.9	-0.3
Finland	-1.6	-0.2	-0.1	0.0	-0.1	-0.4	-5.7	-2.2
France	-0.6	-0.1	-0.0	-0.0	-0.0	0.0	-0.5	-0.3
Germany	-1.1	-0.1	-0.1	-0.0	0.0	0.0	-0.6	-0.2
Greece	-3.7	-0.3	-0.1	-0.0	-0.0	0.0	-0.4	-0.2
Hungary	-1.3	-0.5	-0.1	-0.0	-0.2	-0.1	-0.4	-0.2
Ireland	-0.5	-0.1	-0.1	-0.0	0.0	0.1	-0.5	-0.1
Italy	-0.9	-0.1	-0.1	-0.0	0.0	0.0	-0.4	-0.2
Lithuania	-13.3	-1.8	-5.5	-2.2	-0.6	-0.2	-3.2	-3.3
Netherlands	-1.6	-0.2	-0.1	-0.0	0.0	0.0	-0.8	-0.2
Poland	-11.2	-2.9	-0.3	-0.2	-0.0	0.0	-0.8	-0.5
Spain	-1.4	-0.1	-0.1	-0.1	0.0	0.0	-0.3	-0.2
Rest of EU	-0.7	-0.1	-0.1	-0.0	0.0	0.0	-0.5	-0.4
EU-28*	-1.9	-0.3	-0.1	-0.0	-0.0	0.0	-0.7	-0.3
Russia	9.5	0.7	0.4	-0.1	5.8	3.2	6.1	4.8
Australia	0.4	0.0	-0.2	-0.1	-0.1	-0.0	-0.2	-0.1
Canada	0.5	0.1	-0.1	0.0	-1.1	-1.0	-0.1	-0.0
Norway	-0.7	-0.1	-0.1	0.1	-0.0	0.1	-0.2	0.1
USA	0.0	0.0	-0.1	-0.0	-0.3	-0.3	-0.1	0.0
ROW	0.9	0.1	0.0	-0.0	0.1	0.1	0.2	0.1

Source: Authors' own calculations from model results

*EU-28 prices are production weighted average.

In the fruit and vegetable sector (Table 5), Lithuania and Poland are the most affected countries with price falls of over 10% (13.3% and 11.2%, respectively), and corresponding

falls in production of 1.8% and 2.9%. However, Poland is a large exporter, (over 150 million euros per year since 2010 of mainly apples), while Lithuania's exports of fruits and vegetables to Russia are smaller (less than 10 million euros per year, principally carrots or mushrooms). In addition, Greece (which exports mainly peaches, kiwifruit and strawberries), Belgium (pears, tomatoes and apples), the Netherlands (pears, onions, tomatoes and peppers) and Spain (peaches, citrus fruit, tomatoes and cucumbers) face significant price and production changes. At EU-28 level, fruit and vegetable prices and production decrease by 1.9% and 0.3%, respectively.

Assuming perfect factor mobility for labour and capital, and focusing on the case of Italy, Antimiani, et al., (2014) report significantly greater production response in their affected sectors. For example, they estimate production falls in fruits and vegetables of 1.12%, compared with only 0.1% in our study.⁸ As a result, it is expected (although not shown) that price effects in their study are much more modest compared to the current research. Changes for cattle meat are modest, due to the limited shocks imposed by the ban at this level of aggregation. Lithuania, which is the main fresh bovine meat exporter to Russia, is the only member state exhibiting price and production changes of more than 0.3%.

Variations are small in the pork and poultry meat sector. Historically, most EU exports are pig meat, but since most of this trade has been removed in our update procedure owing to food safety concerns in 2014, there is little margin for further impact in this sector. Historically, EU poultry exports to Russia are only moderate (principally from France and Germany) and consequently do not represent a large share of the exports.

Dairy and (upstream) raw milk sectors face notable drops in price and, in Finland (principally cheese, butter and milk) and Lithuania (principally cheese). Although both EU members are relatively modest producers, they featured within the top 4 dairy exporters to Russia. Due to the ban on dairy, the upstream milk sector in most EU countries experiences a drop in price of over 1% whilst short run production adjustments are minimal (results not shown). At the EU level, raw milk price and production decrease by approximately 1.5% and 0.2%, respectively.

⁸ In Antimiani, et al. (2014), complete bans are assumed across all sectors. In the case of fruits and vegetables, this closely approximates the reality, such that the comparison presented is largely explained by the sector specificity modelling assumption.

Across the whole EU, agricultural value added falls, particularly in those member states which are trading relatively more with Russia (Finland -7%, Lithuania -5% and Poland -3%).

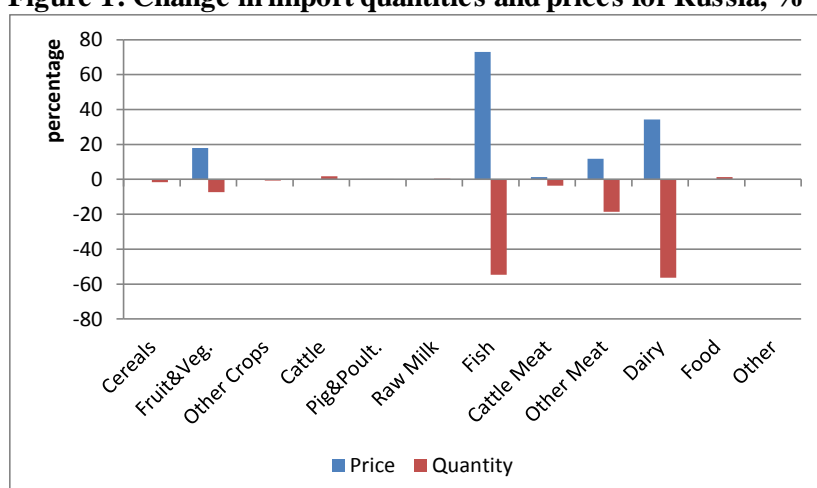
Examining the Russian market, prices in the fruit and vegetable and dairy sectors rise by about 9.5% and 6.1%, respectively. Production increases but with lower magnitude. In cattle meat, where the ban has a lower coverage, and raw milk sectors (not directly banned), increases in prices are rather small and changes in production are even negative. This result is related to allocative efficiency of the Russian production structure and changes in trade patterns.

As expected, those countries unaffected by the Russian ban witness a rise in market prices and production, such as Belarus which increases its dairy production by 3.3% with a price increase of 4.4% (not shown). On the other hand, the domestic price of fruit and vegetables in Ecuador, CIS countries, Israel, North Africa and Turkey rises between 3% and 7% without significant increases in production.

3.2. Trade effects

The highest quantity and price impacts on Russian imports occur in fish (-54%) and dairies (-56%) (Figure 1). Impacts on fruits and vegetables, cattle meat, cattle, and pork and poultry are lower but still significant. Russia can find new sources of imports for banned products, although this is more difficult for fish and dairy for which Russia's dependency on imports from the banned countries is significantly higher.

Figure 1: Change in import quantities and prices for Russia, %



Source: Authors' own calculations from model results

Table 6 shows that the regions that benefit from the Russian import ban are Turkey (fruit and vegetable exports increase by 433 million euros), and other CIS countries (fruit and

vegetable exports increase by 165 million euros), Brazil, Argentina, Paraguay and Uruguay (cattle meat exports increase all together by about 23 million euros), Belarus and New Zealand (dairy exports increase by 202 million euros and 201 million euros, respectively). The trade pattern is broadly consistent with that reported in Antimiani, et al., (2014). Nevertheless, the meat sector in our analysis is barely affected (due to the aggregation issue put forward in section 2.4). Thus Antimiani, et al., (2014) are likely to overestimate the extent to which Russia's cattle meat imports are redirected from banned to non-banned countries.

For remaining sectors, our study reports greater domestic price changes due to factor immobility, resulting in larger substitution effects in the Armington function and consequently larger trade increases between Russia and non-banned countries and between banned countries and third countries, compared to Antimiani, et al., (2014). These trade trends are confirmed when examining real trade data (see section 4).

EU exports to other regions expand; although not sufficiently to compensate the loss of the Russian market (expansion in EU exports of banned commodities to third countries recovers around 25% of the lost trade volume with Russia). However, when exports of non-banned (agricultural and non-agricultural) commodities are also accounted, the EU recovers 81% of the banned exports to Russia by expanding trade with other regions. Since the domestic prices of banned commodities decline significantly, local producers in affected regions gain trade competitiveness through purchases of cheaper intermediate inputs.⁹

Table 6: Change in value of Russian imports at constant base year prices by source, million euros, %

	Fruits and vegetables		Cattle meat		Pork and poultry meat		Dairy	
	mil. €	%	mil. €	%	mil. €	%	mil. €	%
EU-28	-1,429.3	-100.0	-67.4	-12.2	-112.9	-47.9	-1,493.7	-95.1
Australia	-5.7	-100.0	-76.7	-54.3	0.0	0.0	-32.5	-100.0
N. Zealand	3.4	68.7	2.3	7.1	0.4	116.3	201.5	263.5
China	241.5	68.2	0.0	7.0	10.0	115.0	8.2	271.4
Canada	-1.6	-100.0	-0.1	-0.6	-322.6	-100.0	-0.2	-100.0
USA	-180.4	-100.0	-0.1	-6.5	-496.7	-100.0	-0.1	-2.3
Argentina	102.6	57.5	9.7	6.1	11.6	111.1	108.6	245.7
Brazil	4.0	68.6	44.7	5.8	708.9	97.9	1.4	268.7
Paraguay	0.0	66.8	8.7	5.3	0.7	112.2	0.0	267.1
Uruguay	3.3	66.1	14.2	5.5	0.4	113.5	38.1	243.2
Ecuador	188.4	51.4	0.0	4.8	0.1	109.6	0.1	265.0
Norway	-0.1	-100.0	-0.1	-100.0	0.0	0.0	-3.5	-83.0
Belarus	1.1	79.7	0.0	-8.0	0.1	107.3	202.0	179.9
Kazakhstan	0.2	64.5	0.0	6.1	0.1	110.0	0.9	267.7
Ukraine	0.0	70.2	2.5	5.6	56.4	59.2	0.0	268.6

⁹ The assumption of perfect competition is a key factor in this conclusion. In non-perfect markets, price changes may well be merely translated into margin changes along the food chain.

Other CIS	165.8	38.3	0.0	6.7	0.1	109.1	0.6	262.1
Israel	108.6	52.7	0.0	6.4	0.4	114.2	0.4	272.6
Iran	116.5	59.7	0.0	6.6	0.3	113.9	2.9	270.9
Turkey	433.0	56.5	0.4	5.5	8.4	110.3	9.5	268.1
North Africa	256.8	61.3	0.1	6.4	0.8	110.8	1.9	272.2
R. South Africa	80.7	65	0.0	6.9	0.8	113.5	1	272.1
ROW	382.5	68.2	8.9	7.0	44.4	114.2	65.1	271.6

Source: Authors' own calculations from model results

Table 7: Change in value of EU exports to non-EU countries at constant base year prices, million euros, %

	Fruits and vegetables		Cattle Meat		Pork and poultry meat		Dairy	
	mil. €	%	mil. €	%	mil. €	%	mil. €	%
Australia	1.5	7.3	0.0	-0.4	-2.3	-1.6	5.7	4.4
N. Zealand	0.2	9.5	0.0	-0.2	-0.4	-1.3	1.7	4.6
China	2.2	5.3	0.7	0.2	2.7	0.6	29.4	6.9
Canada	3.0	4.8	0.0	-0.1	-1.6	-4.7	4.2	3.0
USA	12.9	5.6	-0.1	-0.2	-10.4	-3.2	31.3	4.0
Argentina	0.7	12.3	0.0	1.4	0.4	4.6	0.6	9.5
Brazil	7.5	7.0	0.0	1.3	0.5	4.2	2.9	7.5
Paraguay	0.0	10.0	0.0	1.6	0.0	4.1	0.0	8.4
Uruguay	0.1	6.9	0.0	1.4	0.1	4.7	0.1	11.1
Ecuador	0.1	11.7	0.0	1.6	0.0	2.0	0.1	6.4
Norway	11.0	3.2	0.1	0.3	-0.2	-0.2	1.9	1.6
Belarus	17.1	15.3	1.3	9.7	2.8	1.7	1.6	40.5
Kazakhstan	7.6	39.7	0.4	2.9	0.7	5.3	4.1	17.6
Ukraine	26.2	20.5	0.6	1.6	10.9	10.2	6.1	13.2
Other CIS	2.1	31.2	0.3	1.4	0.8	5.3	7.2	13.0
Israel	2.0	12.9	0.8	1.8	0.1	0.4	1.7	3.3
Iran	1.6	8.8	0.3	1.0	0.1	3.9	3.3	4.8
Turkey	8.7	14.5	1.4	0.4	0.3	2.6	1.6	4.4
North Africa	32.1	7.3	0.3	0.6	0.6	4.7	43.1	3.8
R. South Africa	0.8	6.4	0.0	0.1	2.1	2.0	2.6	3.5
ROW	97.3	6.1	0.4	0.1	16.1	0.5	210.5	4.6
Total	234.9	7.3	6.6	0.4	23.4	0.5	359.6	4.6

Source: Authors' own calculations from model results

Bearing in mind that the model does not capture re-exportation effects, the EU re-orientates exports toward other regions, including those not affected by the ban which divert their production away from their own domestic markets. Table 7 shows that Ukraine, North Africa, Norway, USA, rest of the world (aggregate that includes a vast set of countries such as China or Gulf countries), Belarus, Kazakhstan and other CIS are key markets for EU export reorientation.

There are significant increases in intra-EU fruit and vegetable trade, especially with origin from EU members (i.e., Poland, Spain, Belgium, Netherlands and Greece) that are obliged to re-direct part of their ban affected fruit and vegetable exports towards the single market (Table 8). This increase in intra EU trade in fruit and vegetable represents 2% of the EU exports after the ban and corresponds to 41% of the loss in EU exports to Russia. However, this does not imply significant changes in EU consumption since the share of fruits and vegetables trade in consumption is rather small (Table A.2, in appendix). Nevertheless,

fruits and vegetables is the sector which exhibits the highest increase in internal market trade (626.7 million euros, Table 8) and the largest drop in market price (Table 5).

Table 8: Change in value of intra-EU trade at constant base year prices by source, million euros, %

	Fruits and vegetables		Cattle meat		Pork and poultry meat		Dairy	
	mil. €	%	mil. €	%	mil. €	%	mil. €	%
Austria	-0.6	-0.3	0.5	0.2	0.6	0.1	-1.9	-0.2
Belgium	117.6	7.1	-0.3	-0.1	8.4	0.4	-7.9	-0.4
Germany	0.7	0.1	-0.8	-0.1	0.4	0.0	20.6	0.3
Denmark	-0.4	-0.3	2.2	0.6	7.9	0.3	15.1	1.2
Spain	166.3	2.2	0.4	0.1	2.1	0.1	-13.2	-1.8
Finland	0.2	3.4	-0.1	-0.5	0.7	1.2	70.1	44.8
France	5.5	0.3	-0.7	-0.1	9.7	0.5	-38.0	-0.8
Greece	52.8	9.8	0.0	-0.1	0.2	0.4	-3.5	-1.2
Hungary	2.3	1.2	0.0	-0.0	11.6	1.6	-4.6	-1.5
Ireland	-0.4	-0.3	1.0	0.1	1.6	0.2	-12.8	-0.9
Italy	-10.0	-0.3	0.2	0.1	3.3	0.3	-18.5	-1.2
Lithuania	31.6	48.3	14.2	48.3	4.1	5.1	61.2	19.5
Netherlands	86.7	2.9	-0.3	-0.0	6.6	0.2	46.5	1.6
Poland	180.4	46.4	8.9	1.4	7.7	0.5	13.4	1.3
Rest of EU	-5.9	-0.4	-1.4	-0.1	3.6	0.2	-32.1	-1.0
Total	626.7	2.9	24.0	0.2	68.5	0.3	94.3	0.3

Source: Authors' own calculations from model results

For most member states, the percentage of banned items in cattle meat exports to Russia is less than 10%. Furthermore, the coverage of the ban is also rather more modest for non-EU countries facing the ban (below 1% for the USA, up to 50% for Australia). There are slight increases in EU exports of cattle meat to Belarus, Israel, and Turkey, but these are marginal.

The impacts on the pork and poultry meat are modest, since the pig sector has already been facing export restrictions in the Russian market. However, the EU pork and poultry meat sector is facing an indirect channel of impact. The countries covered by the ban are significant trade partners for the EU (13% of the EU exports go to Australia, the USA and Ukraine). Resulting excess domestic supply and falling market prices in those countries, has the indirect effect of strengthening import trade links between banned countries and to third countries unaffected by the ban (e.g., CIS countries and South Africa).

EU exports of dairy products to all regions increase. The most prominent percentage increase is observed in exports to CIS which are close to Russia and present supply deficiency following the increase of demand from Russia. However, the increase in value of

production at constant prices¹⁰ is higher for the USA, China and North Africa where the EU already has a significant volume of trade. The ban also affects the trade of banned commodities between member states. However, such an increase in the trade of dairy products is modest compared to the increase in exports outside the EU.

The trade impacts for banned commodities consist of a reduction of exports for all the member states (Table 9). EU dairy exports suffer the most (Finland -182 million euros, Poland -157, Germany -127, France -105 and Netherlands -72). The fruit and vegetable sector is also heavily hit, Poland (-287 million euros) bears half of the EU export fall, while Spain (-58), Italy (-53) and Greece (-47) face most of the remaining decline.

Table 9: Change in value of EU exports at constant base year prices by source, million euros, %

	Fruits and vegetables		Cattle meat		Pork and poultry meat		Dairy	
	mil. €	%	mil. €	%	mil. €	%	mil. €	%
Austria	-1.0	-0.4	-0.7	-0.2	1.0	0.1	-13.8	-1.4
Belgium	-10.1	-0.5	-0.5	-0.1	1.2	0.1	-17.8	-0.7
Germany	-21.1	-1.3	-3.3	-0.2	4.0	0.1	-126.9	-1.6
Denmark	1.0	0.6	-1.1	-0.2	3.3	0.1	-32.9	-1.6
Spain	-57.6	-0.7	-3.1	-0.5	2.7	0.1	-12.5	-1.4
Finland	-3.2	-29.5	-0.1	-0.4	-4.9	-4.7	-182.1	-33.4
France	-20.3	-0.7	-1.6	-0.1	-4.9	-0.2	-104.6	-1.6
Greece	-47.3	-6.0	-0.3	-1.3	0.2	0.3	-3.9	-1.2
Hungary	-4.5	-2.2	-0.1	-0.1	-7.8	-0.8	-4.5	-1.3
Ireland	-0.2	-0.1	-0.8	0.0	0.4	0.1	-6.0	-0.3
Italy	-52.7	-1.5	-4.0	-0.7	1.5	0.1	-55.8	-2.5
Lithuania	-22.8	-14.8	-14.7	-21.2	-6.0	-6.3	-90.6	-16.6
Netherlands	-22.1	-0.6	-1.0	0.0	-8.7	-0.2	-71.6	-1.6
Poland	-287.3	-27.2	-4.3	-0.4	1.6	0.1	-156.7	-10.1
Rest of EU	-18.6	-1.1	-1.2	-0.1	-4.5	-0.2	-160.2	-4.0
Total	-567.8	-2.1	-36.9	-0.3	-21.0	-0.1	-1,039.8	-2.8

Source: Authors' own calculations from model results

3.3. Welfare effects

As expected, by imposing a unilateral ban, Russia suffers an equivalent variation (EV) or real income loss of 3.4 billion euros, which is equivalent to a 0.24% reduction in per capita utility. In comparison, the EU28 only witnesses an EV loss of 126 million euros (0.0025% per capita utility). Other countries whose exports are affected by the ban (i.e., Australia, Canada, USA, and Norway) also experience welfare losses, although once again, in per capita terms, the impacts are negligible.¹¹ As Russia seeks out alternative trade partners for those affected products, the main beneficiaries in per capita utility terms are Belarus, rest

¹⁰ All prices in the model are relative prices and are assumed to equal unity. Hence the quantities in the model are at the same time value of that economic variable at the constant base year prices. The term "value at the constant base year prices" is used to avoid any confusion for the readers.

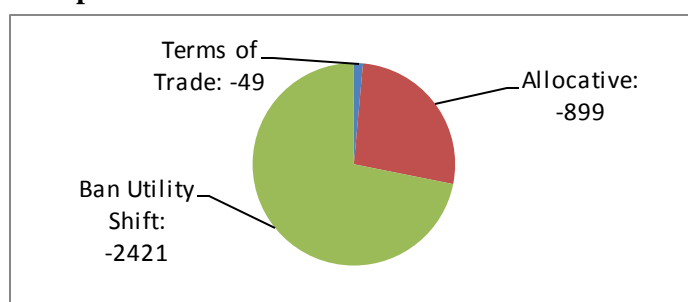
¹¹ In all the affected countries, the per capita utility (real income) loss is less than 0.01%.

of CIS, Israel and Turkey. Belarus records a per capita real income gain of 0.20%, whilst in the other three cases the magnitude is closer to 0.02-0.03%.

Russia's EV loss is decomposed into Terms of Trade (ToT), allocative efficiency (ALLOC), capital goods (CGDS) and trade preference (BAN) effects (Figure 2). The ToT is a money metric measurement of the rate of exchange between exports and imports (current account) and savings and investment (capital account). Examining the TOT result, the restriction on imports of certain agri-food commodities results in a short run rise in Russia's import price index, leading to a (small) TOT loss of -49 million euros.

The ALLOC measure is the result of changing resource or product usage in the presence of market distortions (taxes, tariffs and subsidies). Since a tax (subsidy) discourages (encourages) resource usage compared with undistorted or Pareto efficient markets, increases in taxed (subsidised) activities yield a positive (negative) marginal social value (Huff and Hertel, 2001). The reported ALLOC loss of -899 million euros reflects the net reduction in Russian agri-food imports (which face tariffs) and reductions in household import consumption (which face consumption taxes).

Figure 2: Decomposition of Russian welfare loss



Source: Authors' own calculations from model results

Finally, the trade preference effect, which is specific to Russia, measures the money metric equivalent of lost utility resulting from the prohibition of certain agri-food imports. Thus, the negative EV value of -2,421 million euros is the result of inward shifts in the utility function due to restrictions on import quantities, as well as (short run) inflationary impacts on Russian import prices.

Table 10: Trade preference effects in Russia by origin (country and commodity), %

	Fruits and vegetables	Fish	Cattle meat	Pork and poultry meat	Dairy	Total
Australia	0.15	0.01	0.71	0.01	0.47	1.35
Canada	0.04	0.01	0.01	3.90	0.00	3.96
USA	4.04	0.07	0.00	6.19	0.03	10.33
Austria	0.03	0.00	0.02	0.01	0.17	0.24
Belgium	3.94	0.00	0.01	0.10	0.30	4.36
Denmark	0.01	0.11	0.09	0.16	1.07	1.44

Finland	0.09	0.06	0.00	0.07	3.57	3.79
France	1.38	0.24	0.03	0.30	1.69	3.65
Germany	0.81	0.00	0.07	0.06	2.37	3.31
Greece	3.39	0.27	0.00		0.02	3.68
Hungary	0.22	0.00	0.01	0.37	0.02	0.61
Ireland	0.00	0.00	0.02	0.01	0.18	0.22
Italy	1.91	0.01	0.06	0.12	0.75	2.84
Lithuania	2.06	0.00	0.27	0.11	2.29	4.74
Netherlands	4.20	0.01	0.02	0.19	2.30	6.73
Poland	17.02	0.00	0.18	0.21	2.21	19.62
Spain	8.00	0.01	0.05	0.07	0.07	8.20
Rest of EU	0.76	0.09	0.01	0.15	1.77	2.77
Norway	0.00	18.12	0.00	0.01	0.06	18.18
Total	48.03	19.02	1.57	12.03	19.34	

Source: Authors' own calculations from model results

A further subdivision of the EV result by banned commodities and exporters is presented in Table 10. About 48% of the total (-1,163 million euros) is due to the ban on fruits and vegetables, of which 412 million, or 17%, comes from banned fruits and vegetables from Poland. Similarly, losses of 468 million euros (19%) result from banned dairy products, 460 million euros (19%) on banned fish (mainly from Norway), 291 million euros (12%) on banned pork and poultry meats and 38 million euros (1.6%) on banned cattle meat.

4. Comparison of model results with observed data

4.1. Trade

After seven months of embargo, EU agri-food exports to third countries increased by 2.3% between August 2014-February 2015 compared to the previous year (DG AGRI, 2015a). In February 2015, EU agri-food exports to third countries have increased by 6% compared to February 2014. This result is due to an increase of exports to the US and China, together with the euro depreciation against other currencies (DG AGRI, 2015a).

To further validate our model specifications, the model results are compared with HS6 observed trade data from COMEXT (DataM, 2015a), which are aggregated to the GTAP sectoral and regional concordance employed in this paper. To adequately cater for seasonality and the impact of the ban, we compare trade figures between August 2014 (i.e., start of the ban) and November 2014 (i.e., latest available observations). Finally, since model results are mostly reported in real terms, we look at the real change in trade volume. That is, we deflate the 2014 export values to 2013 prices and compare with the reported value of exports in 2013). Our findings suggest that the trends observed are significantly close to the results presented in our simulation (Table 11).

Aside from price signals, it should be remembered that many non-price factors outside the scope of our model can explain changes in EU markets: the weakening of the euro against

other currencies, local climatic conditions, the implementation of emergency measures (e.g., market support for perishable fruits and vegetables, promotion of EU agricultural products, etc.)¹².

Table 11: Change in exports of EU-28 by product and destination, %, 2014 compared to 2013

	Fruits and vegetables		Cattle meat		Pork and poultry meat		Dairy	
	share (%)	change (%)	share (%)	change (%)	share (%)	change (%)	share (%)	change (%)
Austria	2.04	-10.7	1.57	7.5	2.32	-3.9	1.90	9.3
Belgium	4.31	-10.7	2.86	4.4	2.97	2.2	6.26	8.6
Denmark	1.89	2.9	3.90	4.3	2.62	9.0	1.73	23.1
Finland	1.09	1.9	0.48	11.7	0.74	0.5	0.79	-9.1
France	10.01	-2.6	13.71	-0.1	8.37	-1.4	6.94	-2.5
Germany	22.81	-5.6	12.29	9.9	11.85	-1.3	13.32	-0.5
Greece	0.50	13.3	3.16	0.2	1.76	-8.1	1.77	-8.2
Hungary	0.58	29.2	0.45	-7.7	1.55	-7.1	0.86	-6.4
Ireland	1.34	17.2	1.70	26.6	1.96	-9.6	1.94	0.5
Italy	4.36	3.8	13.31	-7.9	8.23	10.7	9.41	-0.8
Lithuania	0.72	21.9	0.14	25.9	0.60	-4.5	0.73	15.4
Netherlands	6.13	-6.6	8.27	-0.1	5.57	2.6	8.33	9.4
Poland	2.77	4.6	0.53	-0.4	3.97	-4.3	1.67	7.7
Spain	3.85	16.6	3.78	6.3	2.08	-0.8	4.55	-0.8
Rest of EU	19.32	-1.1	17.42	1.5	24.97	-2.2	15.69	-8.0
Russia	0.48	-88.0	0.38	-82.5	0.31	-92.0	0.26	-93.0
Australia	0.12	56.4	0.03	-86.5	0.74	75.9	0.49	-1.0
New Zealand	0.02	-27.7	0.01	6.7	0.19	84.4	0.20	34.0
China	0.15	55.5	4.42	31.0	1.38	2.9	1.65	-10.8
Canada	0.33	48.1	0.06	1851.2	0.24	81.8	0.36	5.4
USA	0.77	-1.8	0.08	-6.8	1.20	20.1	2.70	11.4
Argentina	0.02	7.0	0.01	-26.2	0.01	12.3	0.01	-24.8
Paraguay	0.00	-82.6	0.00	-	0.00	-15.2	0.00	157.8
Uruguay	0.01	30.3	0.00	-6.2	0.07	558.9	0.02	256.6
Ecuador	0.01	160.6	0.00	-	0.00	-71.1	0.00	-56.4
Norway	1.81	-0.6	0.28	73.5	0.79	25.7	0.28	7.0
Belarus	1.35	103.0	0.16	205.7	0.05	-88.0	0.47	1884.7
Ukraine	0.30	-25.3	0.17	64.1	0.31	-26.2	0.12	-47.5
Israel	0.18	-29.9	0.08	-4.7	0.05	6.9	0.17	47.7
Iran	0.00	-65.7	0.01	-	0.00	252.8	0.06	82.1
Turkey	0.19	42.6	0.05	1279.5	0.07	-13.3	0.34	37.2
North Africa	3.38	22.5	0.36	-1.9	0.16	36.1	2.78	48.9
Brazil	0.80	93.6	0.00	-100.0	0.06	28.1	0.08	-27.1
Kazakhstan	0.12	87.3	0.15	108.1	0.02	-77.9	0.16	47.2
Other CIS	0.11	79.8	0.16	-3.1	0.40	116.0	0.28	22.1
South Africa	0.10	8.7	0.05	103.8	0.86	30.1	0.32	56.1
ROW	8.04	23.88	9.94	26.69	13.54	26.49	13.38	10.30

Source: Authors' elaboration from DataM (2015a)

Consistent with our findings, actual trade data show that EU-28 fruit and vegetable exports to Belarus and North Africa have increased significantly. Exports to Canada, Turkey, Kazakhstan and other CIS countries also increase although not as much as foreseen by the model. The actual trade data also reveals that the EU-28 recovered 43% of its lost trade with Russia, compared with 35% reported in our model results.

¹² For a full picture of EU policy responses to the Russian import ban, see DG AGRI (2015a).

Focusing on commodity aggregates, the actual data also supports our finding that intra-EU fruit and vegetable trade increases¹³. For example, Spain, Greece and Poland increase their exports to the EU-28 (intra-EU trade), although contrary to our simulation, exports from the Netherlands, France, Germany and Hungary to the EU-28 decline. On the other hand, model results suggests an overall 2% increase in EU-28 fruit and vegetable exports while actual data shows that it declined by 1.9% mostly due to the mentioned fall in exports of Germany, France, Hungary and Netherlands.

In terms of extra EU-28 cattle meat exports, observed trade data reveal that quantity changes are small. The only significant increase in EU-28 exports was to China. There were slight increases in EU-28 exports of cattle meat to Belarus, Turkey, Kazakhstan and Ukraine but these are marginal as suggested by our model results. As simulated, impacts on the pork and poultry meat market arising from the Russian ban were insignificant, leading to 0.3% increase in EU-28 exports.

Observed dairy sector, observed trade data confirms our model simulations except for China, Ukraine and Brazil, i.e., EU-28 exports to all regions of the world increased. The most prominent increase in percentage terms is observed in EU-28 exports to Belarus, the USA and North Africa which is consistent with our model results. Meanwhile, increases in other CIS countries are not as high as the model suggests.

4.2. Prices

Comparison of observed prices with the model results corroborates the main findings presented in our simulations. We compared the model domestic price changes reported in this paper with the actual changes in domestic prices reported in DG AGRI (2015b) and national statistical offices of key affected EU member states.

According to our simulations, Lithuania and Poland experience the highest domestic price fall. In both countries the effect of the ban on fruits and vegetables prices is apparent and consistent with the model results (Figure A.1, in appendix). In Lithuania and Poland, the declines in prices are significantly high while the decrease in the EU28 average price is rather low. EU average price starts rising after November, bringing the price even above the pre-ban level.

Observed data for beef price in Poland and Lithuania confirm that the fall in beef price is milder compared to the fall in vegetable and fruits prices (Figure A.2, in appendix). On the

¹³ Calculated results from the observed data for intra-EU trade are not included in the text but are available upon request.

other hand, it also verifies that prices in Lithuania have fallen significantly while the price fall in Poland was relatively milder.

In the dairy markets, significant price falls in Lithuania and Finland reported in our results are validated by observed price changes. The average EU28 price also declines as suggested by the model results. However, the magnitude of the fall in dairy prices is higher compared to the model results (Figure A.3, in appendix).

Focusing on the effects in Russia, our model results are in line with observed changes. According to statistics from the Russian government, in 2014 agricultural output increased by 3.7% (USDA, 2015), that is coherent with our results (see Table 5). As noted above, additional non price factors such as the weakening of the rouble against other currencies, local climatic conditions, or state support to agricultural production and rural social development programs amounting to 151.3 billion roubles (about 3 billion euros) (USDA, 2015) will also have had an impact on Russian agriculture.

5. Concluding remarks

A CGE model simulates the ban on agricultural products and foodstuffs Russia decreed on August 2014. In the short term, due to factor immobility, production has very little leeway to adjust, provoking notable variations in prices which absorb most of the import ban shock. As expected, the magnitude of the price decrease is related to the share of national production which is exported to Russia. The strongest price decrease occurs in the fruit and vegetable sector in Poland, Lithuania, Greece and Belgium and in the raw milk and dairy sectors, in Finland and Lithuania. In the longer term (if the ban is maintained beyond one year, full results available on request), where factors of production exhibit greater mobility between sectors, the magnitude of the price (quantity) changes is expected to be lower (higher)

Dairy and fruits and vegetables are the sectors where the EU exports suffer most. Lithuania, Finland and Poland are facing the largest decreases. The EU can recover about 25% of the lost trade volume with Russia in banned commodities through expansion of exports in other markets. While Russia is able to substitute imports for some banned products, alternative sources seem limited. Regions whose trade with Russia increases the most are those closer to Russia for fruits and vegetables and dairy (Turkey, Commonwealth of Independent States), while South American exports of meat to Russia rise.

Results indicate that Russia is the region with the highest welfare loss (about 3.4 billion euros). Banned countries suffer a welfare loss due to the reduction in exports to Russia while in countries which substitute exports from banned countries, particularly Turkey and Brazil,

welfare increases. A comparison with observed trade data (post ban) suggest that the model assumptions and scenario design presents a plausible picture in highlighting the most important alternative markets for EU exporters and most significant changes in the domestic prices of the EU member countries.

As in any modelling exercise the usual caveats apply, i.e. assumptions, estimated or calibrated parameters, commodity aggregation bias, and other stylised specification features. In addition, one should keep in mind that the modelling strategy does not capture some critical trade elements. First, exports to the Russian market face non-tariff barriers (e.g. SPS measures) which might delay the creation of alternative sources to banned imports.¹⁴ Second, those countries unaffected by the ban have to consider that deepening economic relations with Russia could damage their international reputation; this factor could additionally reduce Russian imports from third countries but cannot be taken into account by an economic model. Finally, the model design impedes imports to be re-exported, especially if entering in the Russian market through its custom union with Belarus and Kazakhstan.

¹⁴ As an illustration, New Zealand cheese plants need certification to export to Russia. Those products with certification, already exported to Russia, could cope with an increase in trade if production capacity allows. However, those without certification are likely to not enter the market or to get a certification with associated cost of compliance.

6. Bibliography

- Anderson, K., and Jackson, L. (2005). Standards, trade and protection: the case of GM crops. Paper presented at the 41st Panel Meeting of Economic Policy in Luxembourg, 15-16 April 2005.
- Antimiani, A., Castellotti, T., and Solazzo, R. (2014). L'impatto dell'embargo russo sull'agroalimentare italiano. Rome: INEA.
- Central Statistical Office of Poland. (2015). Prices in Agriculture – Average market Place Prices received by farmers. Retrieved May 7, 2015
- Chatterjee, A., Ghose, A., and Dhar, P. (2010). Trade and Distributional impact of Genetically Modified Crops in India: A CGE analysis. Thirteenth Annual Conference on Global Economic Analysis. Penang: GTAP.
- DataM. (2015a). DataM, provided by the European Commission - Joint Research Centre. Elaboration based on original data coming from: EuroStat(s), COMEXT database. Retrieved 04 15, 2015, from <http://www.datamweb.com>
- DataM. (2015b). DataM, provided by the European Commission - Joint Research Centre. Elaboration based on original data coming from DG AGRI. Retrieved 04 25, 2015, from <http://www.datam.web>
- DG AGRI. (2014a). Information note on the Russian ban on agri-food product from the EU. Brussels: DG AGRI.
- DG AGRI. (2014b). EU agri-food exports to Russia. Brussels: DG AGRI.
- DG AGRI. (2015a). EU responses to the Russian import ban on agricultural products. Retrieved May 20, 2015, from Agriculture and Rural Development: http://ec.europa.eu/agriculture/russian-import-ban/index_en.htm
- DG AGRI. (2015b). EU Market Prices for Representative Products from 2007. Retrieved April 25, 2015, from <http://ec.europa.eu/agriculture/markets-an>
- Henseler, M., Pio-Lepetit, I., Ferrari, E., Gonzalez Mellado, A., Banse, M., Grethe, H., Parisi, C. and Helaine, S. (2013). On the asynchronous approvals of GM crops: Potential market impacts of a trade disruption of EU soy imports. *Food Policy*, 41, 166–176.
- Hertel (Ed.), T. W. (1997). *Global Trade Analysis: Modeling and Applications*. Cambridge University Press.
- Huff, K., and Hertel, T. (2001). Decomposing Welfare Changes in GTAP. GTAP Technical Paper No. 05.
- McDonald, S., and Roberts, D. (1998). The Economy-Wide Effects of the BSE Crisis: A CGE Analysis. *Journal of Agricultural Economics*, 49(3), 458-471.

- Narayanan, B., Aguiar, A., and McDougall, R. (. (2012). Global Trade, Assistance, and Production: The GTAP 8 Data Base, Center for Global Trade Analysis. Purdue University. Available online at: <http://www.gtap.agecon.purdue.edu/databases/v8/v8>.
- Philippidis, G. (2010). EU import restrictions on genetically modified feeds: impacts on Spanish, EU and global livestock sectors. *Spanish Journal of Agricultural Research*, 8(1), 3-17.
- Philippidis, G., and Hubbard, L. J. (2001). General Equilibrium and the Ban on British Beef Exports. *Journal of Agricultural Economics*(52), 87-95.
- Rodriguez, U., Garcia, Y., Garcia, A., and Tan, R. (2007). Can Trade Policies Soften the Economic Impacts of an Avian Influenza Outbreak? *Asian Journal of Agriculture and Development*, 4(2), 41-50.
- Statistics Finland. (2015). Producer Prices of Agricultural Products. Retrieved May 7, 2015, from http://www.stat.fi/til/matutu/index_en.html
- Statistics Lithuania. (2015). Purchase Price Indices of Agricultural Prices. Retrieved May 07, 2015, from <http://osp.stat.gov.lt/>
- United Nations Statistical Division. (2014). UN COMTRADE. International Merchandise Trade Statistics, United Nations Statistics Division. New York, USA. Retrieved 08 15, 2014
- USDA. (2015). 2014 key results of the Russian Ministry of Agriculture. Washington DC: Grain Report number RS1528.

7. Appendix

Table A.1: Baseline preparation (% change from 2011)

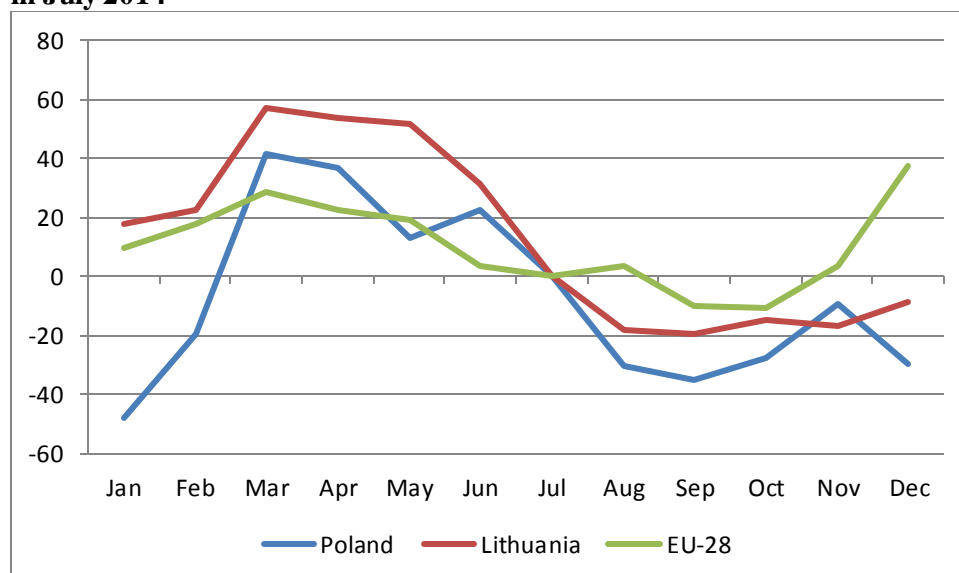
	Trade updates 2011/2013				Swine fever ban		Russian Ban Shocks			
	Fruits and vegetables	Cattle meat	Pig and poultry meat	Dairy	Pig and Poultry	Pig and poultry meat	Fruits and vegetables	Cattle meat	Pig and poultry meat	Dairy
Australia	50.0	-36.2	150.9	120.7	0.0	0.0	-100.0	-54.3	0.0	-100.0
Canada	-80.1	-76.9	-25.0	0.0	0.0	0.0	-100.0	-0.6	-100.0	-100.0
USA	51.4	-99.1	-24.8	143.5	0.0	0.0	-100.0	-6.5	-100.0	-2.3
Austria	-76.1	23.9	202.3	131.6	0.0	-94.7	-100.0	-5.0	-5.6	-100.0
Belgium	-36.2	-16.8	33.0	138.5	0.0	-84.0	-100.0	-0.7	-89.4	-88.8
Denmark	-91.0	4.0	23.4	72.0	-66.5	-91.2	-99.6	-4.8	-11.7	-100.0
Finland	-73.3	-16.8	2.6	6.5	-0.6	-68.0	-100.0	0.0	-98.9	-100.0
France	-48.7	-7.3	-18.5	46.9	-28.5	-67.7	-99.5	-1.1	-58.6	-89.5
Germany	-51.9	-56.2	-25.6	-37.6	0.0	-96.4	-100.0	-2.0	-18.9	-96.5
Greece	40.3	0.0	0.0	-3.1	0.0	-100.0	-100.0	-100.0	-100.0	-86.8
Hungary	-38.4	173.5	154.9	261.8	-0.4	-50.6	-100.0	-0.9	-50.2	-68.3
Ireland	-99.7	-51.3	69.3	409.0	-64.5	-97.8	0.0	-11.7	-85.9	-55.1
Italy	-24.6	-0.2	37.3	75.7	0.0	-31.4	-100.0	-7.3	-4.8	-88.2
Lithuania	-16.9	-53.3	419.4	13.0	-49.5	-75.4	-100.0	-86.9	-87.7	-89.7
Netherlands	-20.8	17.2	154.4	101.7	0.0	-89.8	-100.0	-1.6	-95.5	-98.0
Poland	105.4	34.9	400.0	154.8	-0.4	-77.0	-100.0	-32.4	-51.8	-98.8
Spain	19.2	-54.6	-30.1	-29.9	-1.2	-90.1	-100.0	-9.8	-4.6	-28.9
Rest of EU	-36.2	-22.3	80.0	66.9	-1.4	-67.5	-100.0	-1.2	-49.1	-94.3
Norway	-34.9	0.0	44.2	11.9	0.0	0.0	-100.0	-100.0	0.0	-83.0

Table A.2: Change in consumption of banned commodities in Russia and EU, %

	Fruits and vegetables	Cattle meat	Pork and poultry meat	Dairy
Russia	-0.6	-0.4	-2.8	-3.0
Austria	0.0	0.0	-0.0	0.4
Belgium	0.0	0.0	-0.0	0.4
Denmark	0.0	0.1	-0.0	0.6
Finland	0.0	0.0	0.0	4.0
France	0.0	0.0	-0.0	0.3
Germany	0.0	0.0	-0.0	0.4
Greece	0.0	0.0	-0.0	0.2
Hungary	0.1	0.0	0.0	0.1
Ireland	0.0	0.0	-0.0	0.3
Italy	0.0	0.0	-0.0	0.3
Lithuania	0.1	1.9	0.1	1.1
Netherlands	0.0	-0.0	-0.1	0.5
Poland	0.4	0.1	-0.0	0.3
Spain	0.0	0.0	-0.0	0.2
Rest of EU	0.0	0.0	0.0	0.3

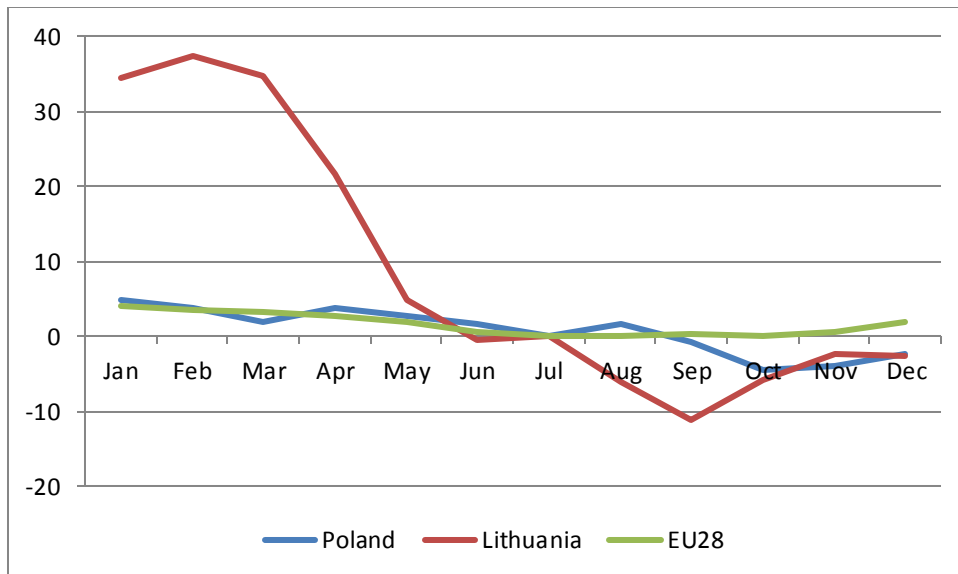
Source: Authors' own calculations from model results

Figure A.1: Change in fruit and vegetable price in Poland, Lithuania and EU28, % from price in July 2014



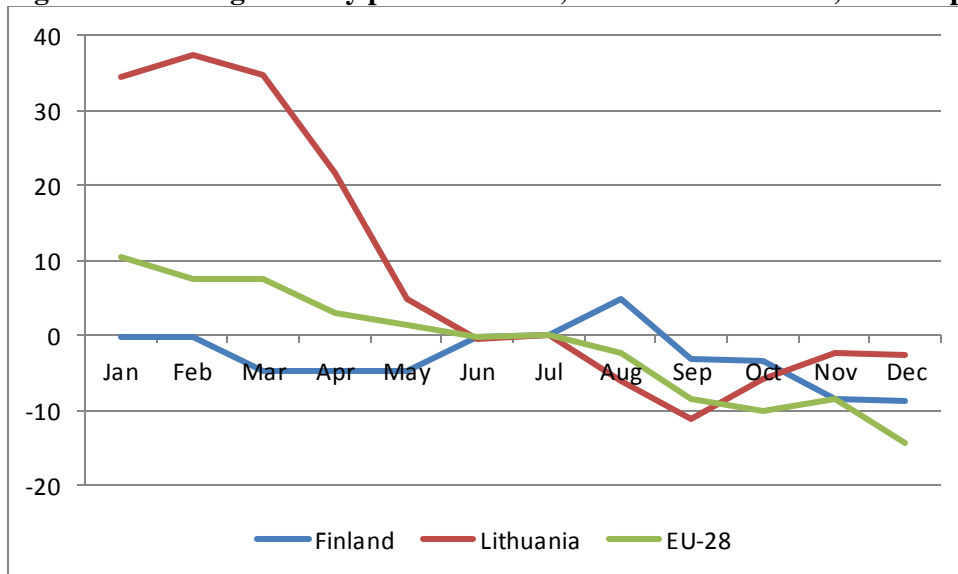
Source: Statistics Lithuania (2015), Central Statistical Office of Poland (2015), DG AGRI, (2015b)

Figure A.2: Change in cattle meat price in Poland, Lithuania and EU28, % from prices in July 2014



Source: Statistics Lithuania (2015), Central Statistical Office of Poland (2015), DG AGRI, (2015b)

Figure A.3: Change in dairy price in Poland, Lithuania and EU28, % from price in July 2014



Source: Statistics Finland, (2015), Statistics Lithuania, (2015), DG AGRI, (2015b)