Guidelines and methodology to analyze the different case studies

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Introduction

The literature on the economics of non-tariff measures (NTMs) in the agri-food sector is burgeoning and is motivated by growing concerns that efforts to liberalize trade could be impeded by an increasing number of NTMs. There have been many different approaches to analyze the market impacts of NTMs and Rau and Schlueter (2010) offer an excellent survey. The purpose of this document is to provide a description of the different methodologies used in the analysis of the case studies described in the working paper titled "Rationales for the selection of the case studies" which was produced by the consortium members of the NTM-Impact research project.

The methodologies in this document can be divided into two broad categories. In Part A, a first set of case studies employ gravity-based models to determine the impacts of NTMs on bilateral trade flows.

In their simplest form, gravity models - which borrows the precepts of the Newton theory on gravity - predicts that bilateral trade flows are increasing in the exporter's GDP and the importer's GDP and decreasing in distance between two nations. Many improvements and refinements have been made to the gravity framework since economists began estimating ad hoc gravity models in the 1960s. Since then, more sophisticated models add other variables to proxy for trade costs, such as whether or not two nations share a common border, a common language, or colonial relationships; have signed free trade agreements; separate dummies for each exporter and importer can also be included in the equation to account for multilateral resistance (Anderson and van Wincoop, 2003).

As an example a time-variant gravity model in its log-linearized form can be specified as follows[1]:

$$Ln(X_{ijt}^{k}) = \beta_0 + \beta_1 Ln(GDP_{it}) + \beta_2 Ln(GDP_{jt}) + \beta_3 Ln(Dist_{ij}) + \beta_4 Border_{ij} + \beta_5 Lang_{ij}$$
$$+\beta_6 Ln(Tarif_{ijt}^{k}) + \beta_7 NTM_{ijt}^{k} + u_{ijt}^{k}$$

Where X_{ij}^{k} is the bilateral trade of product *k* between importer *i* and exporter *j*.

GDP is the Gross Domestic Product of countries of the sample. They measure the economic size of countries under scrutiny but may be replaced or reinforced by the size of production in the exporting countries, the size of populations in all countries, etc.

$Dist_{ij}$ is the distance between the capitals of countries *i* and *j*.

$Border_{ij}$ is a dummy variable equal to 1 if *i* and *j* share a common border and 0 otherwise.

$Lang_{ij}$ is a dummy variable equal to 1 if *i* and *j* share a common language and 0 otherwise.

$Tarif_{ij}^{k}$ is the tariff set by country *i* on imports of products *k* from country *j*.

NTM_{ij}^{k} is any measure of the non tariff measure set by country *i* on imports of products *k* from country *j*.

[1] This is the basic specification common to all case-studies using gravity modeling. Then when presenting them in this document, only the variables which are not included in this main setting will be described in details, particularly the ones used to take NTMs into account.

Finally, u_{ij}^{k} is the error term.

The βs are the coefficients to be estimated. Their sign depends on their influence on bilateral trade. β_1 and β_2 are expected to be positive because trade is expected to increase proportionally with countries' wealth. β_3 is expected to be negative because the distance is a proxy of transportation costs and is considered as an obstacle to trade. In the same way the coefficient for the tariff variable β_6 is expected to be negative. β_4 and β_5 are expected to be positive because having a language or a border in common is considered as facilitating trade. When the size of the population is introduced in the equation the expected signs of the coefficients are negative or positive because a big country can export less (absorption capacity) or more (economies of scale) compared to a small country. The sign of β_7 is not *a priori* predictable because the effect of a standard on trade is not *a priori* positive or negative.

Gravity models can be supported by different theoretical models and have consistently provided some of the greatest successes in empirical trade analysis (Davis and Weinstein, 2002). This document emphasizes the differences and departures from the main gravity setting in each of the case studies.

Part B of this document presents a second category of models including applied partial and general equilibrium methodologies. If gravity models allow to use econometric techniques and then avoid imposing *a priori* direction of trade, the advantage of the second kind of approaches is that they can capture sophisticated complementary and substitution possibilities at both the consumption and production levels. Most of the time, these models rely on some form of calibration exercise that make it difficult to assess the reliability of the model predictions statistically. Yet, the flexibility these models offer can be a definite advantage in modelling complicated policies and barriers to trade.

The heterogeneity in the methodologies proposed in this working paper is considered an asset for the NTM impact as it allows researchers to consider specific issues that would otherwise be impossible to capture in a more homogeneous framework. This advantage must be weighed against the difficulties in harmonizing the output of the case studies. A future working paper will address this policy question.

A- Case studies using the gravity approach

1- Assessment of technical and sanitary norms and regulations upon poultry trade flows for the EU-27 and Brazil

H. Lee Burnquist, M.J. Pinto de Souza and L. Meneguelli

A product-level gravity equation – as presented in the introduction, will be used to investigate the effects of existing sanitary and phytosanitary regulations on Brazilian and European

Union (EU) poultry exports in selected markets. Whereas typical gravity equations are estimated for all *ij* pairs of countries in world trade, our dataset is specified for two sources of exports: Brazil and the EU. Thus, a trade flow observation in our dataset includes two exporters (*i*) shipping a particular poultry meat products (*k*), in time period (*t*) to *j* relevant importing markets. The set of *n* markets is allowed to differ for each *i* export origin according to its importance as an importing poultry market for Brazil and the European Union, respectively.

Two product-level gravity equations will be estimated within this framework. One equation will be set up considering Brazil as exporter and a set of selected major players in the international poultry market as importers, with data taken at a 6-digit HS disaggregation level. A second equation considers the EU-27 as exporter and a set of selected major players in the international poultry market as importers with data also taken at a 6-digit HS disaggregation level. Dummy variables are introduced to express the introduction of NTM by an importing country *j* applied to commodity *k* at period *t*.

The gravity model will be estimated using panel data disaggregated by different types of poultry meat, such that there may be considerable time and variation in the data that is not captured by the standard gravity model. To control for potential time and commodity variation in the data, a comprehensive set of time and commodity fixed effects is specified. One of the major advantages of this approach is to avoid biased coefficients since it provides control for country heterogeneity and therefore the effects of omitted non-observable variables which are difficult to measure (such as multilateral indices of resistance) (Cheng and Wall, 2005).

As the gravity equation is in its logarithmic form, it is implicitely assumed that zero trade flows do not exist. However, this is typically not the case, particularly when the database for the study is disaggregated (HS-4 or HS6 digit). To address the problem of "zeros" the model will be also estimated by Poisson pseudo-maximum-likelihood (PPML) as introduced by Santos Silva and Tenreyro (2006). This method has been considered appropriate for estimating gravity models when there is heteroskedasticity and null or missing bilateral flows in the database (Santos Silva and Tenreyo, 2006; Shepherd and Wilson, 2008).

Data on poultry meat exports will be obtained from UN/COMTRADE (*the Commodity Trade Statistics Data Base of the United Nation*) at HS 6-digit level. The time period for the estimation is 1996 to 2008, representing the post-Uruguay Round time period when SPS and TBT agreements became effective within the multilateral WTO trading system. Bilateral applied tariffs will be obtained from the WTO. The source for GDPs statistics is the *World Development Indicators* provided by the World Bank.

Dummy variables will be included to take into account the existence of NTMs in poultry trade. Information about the introduction of sanitary and phytosanitary, as well as technical requirements by WTO countries are based on notifications presented by Members between 1996 and 2008. In addition, the introduction of requirements will also be surveyed at national public and private institutions.
These requirements will be classified and organized according to TRAINS classification of NTMs and aggregated into a classification proposed by WP5 (and reproduced in Table 1. This classification will be used to specify five dummy variables to indicate the existence of different types of NTMs that affect trade of products from animal origin, such as the following list of variables:

NTM_1: dummy variable that represents specific product requirements;
NTM_2: dummy variable introduced to represent processes requirements;
NTM_3: dummy variable to represent labeling requirements (presentation);
NTM_4: dummy introduced to represent conformity assessment; and
NTM_5: dummy introduced to represent country requirements

Table 1 : Link between the WP5 Framework for Regulatory Requirements and TRAINS

WP5 Framework	TRAINS
Business/Firm-level Requirements	
Product	A200 Tolerance Limits A410 Microbiological criteria A700 GMO
Process	A420 Hygiene Practices A500 Treatment for elimination of pests/diseases A600 Other Production and Process Requirements A850 Traceability
Presentation	A300 Labeling, Marketing and Packaging
Conformity Assessment	
Enforcement, controls, and monitoring Laboratories, sampling and analysis and limits	A800 Conformity Assessment
Country Requirements	
Official controls in third countries	A 100 Prohibitions/Restrictions: based on regionality issues, eligibly, system approach
	A860 Quarantine

Source: NTM-Impact WP5, Deliverable D5.1

2- Assessment of NTMs on poultry meat and dairy exports to China

J. Yang and J. Huang

The purpose of the case study is to measure the effect of NTMs on EU exports for two groups of agrifood commodities (poultry meat, and dairy products) to China. The rationale behind the selection of these two commodities is described in the WP6 first deliverable of the NTM-Impact project. We propose a gravity model to evaluate the possible effects of NTMs on export of these two commodities from EU to China.

A gravity model (see introduction) has been chosen to model trade of commodity *k* (poultry meat and dairy products) between exporting country *i* and importing country *j* (i.e., China). Besides the usual variable (GDPs, distances, tariffs, etc.) an indicator of NTM (e.g., veterinary standards in commodity *k*) imposed by China is introduced.

The export value of a commodity *k* from trade partners to China is in 2000 US dollars. Data are from the UN/COMTRADE database. The period covered in the study is from1992 to 2009.

Instead of exporter's GDP, the production of commodity *k* of China's trade partners is used as the mass factor in the model. Production represents the potential capacity for export. This variable is expected to have a positive impact on export of the commodity to China. Production in the current year might be endogenous as it could be affected by the current export opportunities. However, we argue that current export would have no effect on the output of the previous year. To avoid any problem of endogeneity, this variable is lagged by one year. Data for production of the selected commodity are from the FAOSTAT database.

As China is the only import country, the GDP of China is introduced in the model. Data from 1992 to 2009 are taken from the Statistical Yearbooks of China in 2000 constant US dollars.

Data on distance between capitals come from the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII).

The import tariff, is used as another resistance factor in the model. Import tariff rates imposed by China are taken from the Chinese Bureau of Customs.

Finally, NTMs are represented by two factors. The first one is the maximum residual limit standard of veterinary, denoted MRL. We assess here the effect of China's MRL standard of coliform[2] on import of poultry meat (HS0207) and dairy products (HS0401-0406). The data on China's MRL of coliform are taken from the MRL database of the China National Food Safety Resource (NFSR). Imports of poultry meat are also significantly affected by the import restriction during the breakout of bird flu in other countries. A dummy variable (equal to 0 when there is no import restriction in case of bird flu; and equal to 1 when there is an import restriction) is used to capture the effects of import restriction on poultry meat.

3- The methodology for India's Case Study on Poultry Meat & Eggs

R. Mehta

We propose to use the gravity model developed by Mehta and Nambiar[3] to estimate the impact of food safety standards (FSS) on trade between India and the EU. The two products identified for this purpose are poultry meat and egg powder.

Our model follows the typical specification described in the introduction, but some more variables are introduced in the right-hand-side of the equation: imports, size of populations of both the importer and exporter and an index of food safety standards (Sanitary and PhytoSanitary measures) in the importing countries.

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[2] According to the report in 2008 by the General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China, there are many cases of withdrawal diary products and poultry meat from EU because of the violation of the MRL standard of coliform. Therefore, the change of MRL is chosen as the representative of changing standard of SPS regulation in China in current stage.

[3] Mehta, R. and Nambiar, R.G. *Food Safety Standards and Indian Food Exports* (under communication).

In the WTO perception, SPS measures (or Food Safety Regulations) imposed by importing countries are not considered as impediments to food trade. It implies that the coefficient of SPS index in our model should not be significant.

Our equation is a three-dimensional panel consisting of two sample product lines, for *n* importing countries and a four-year period from 2005 to 2008 (depending on the availability of data). The products under scrutiny are poultry meat and eggs; exporting countries are India, US, (and possibly EU or selected countries of EU, depending on availability of Index because the standards within EU countries could vary) ; time coverage is 2005 to 2008.

The characteristics of panel data imply that the random term (*u*) should capture the characteristics of food products and countries; hence

$$u_{ijt}^{k} = v_{it}^{k} + \mu_{jt}^{k} + \varepsilon_{ijt}^{k}$$

Then the model will be estimated by: (i) Ordinary Least Squares (OLS), (ii) Least squares with dummy variables (μ being fixed) or Fixed Effects Model, and (3) assuming μ as random i.e. Random Effects Model. In the Random Effects Model, we have to further assume that $E(\varepsilon_{ijt}^{k}) = 0$.

$$Var(\mu_{jt}^{k}) = \sigma_{\mu}^{2} \quad Var(v_{it}^{k}) = \sigma_{v}^{2} \quad Var(\varepsilon_{ijt}^{k}) = \sigma_{\varepsilon}^{2} \quad Cov(\varepsilon_{ijt}^{k}, \mu_{jt}^{k}) = 0$$

The Random Effects Model will be estimated by the Generalised Least Squares (GLS). A two-step procedure will be used for estimation purposes. In the first step, the variance components (σ_{μ}^2, σ_{v}^2 and σ_{e}^2) will be estimated by using the residuals from a OLS regression. In the second step, the flexible GLS estimates are computed using estimated variances from the first step.

The above methodology is given for one exporting country/region with *n* importing countries. We will try to expand this to *m* exporting countries (EU, US, Australia etc.) In that case three-dimensional panel data will become a four-dimensional and hence increase in number of observations and degree of freedoms.

Based on the estimated gravity equation, we will find how much trade is lost due to the heterogeneity in SPS index. The estimation of trade loss using Ordinary Least Squares or a 'Fixed effects model' is straightforward. However, in case the 'Variance Component Model is selected, the percentage loss of imports from *i* to *j* is equal to:

$$\left[\exp\left\{ \alpha_1 \ln(\frac{(1+NTM_{ij}^{k})_1}{(1+NTM_{ij}^{k})_0}) + \frac{1}{2}\sigma^2 \right\} - 1 \right] \times 100 \;;$$

and loss in imports of *j* from *i* as:

$$\left[\exp\left\{ \alpha_2 \ln(\frac{(1+NTM_{ji}^{k})_1}{(1+NTM_{ji}^{k})_0}) + \frac{1}{2}\sigma^2 \right\} - 1 \right] \times 100$$

where

$$\sigma^2 = \sigma_{\varepsilon}^2 \left\{ \alpha_1 \ln(1+NTM_{ij}^{k}) + \alpha_2 \ln(1+NTM_{ji}^{k}) \right\},$$

NTM_{ij}^{k} is the NTM measure (here the SPS standard) set by country *i* on imports from *j* and *vice-versa* for NTM_{ji}^{k}.

and

σ^2, α_1 and α_2 are the estimated coefficients of NTM_{ij}^{k} and NTM_{ji}^{k}.

4- Assessment of the impact of Maximum Level Residuals in exporting apples, pears and related processed products for the EU and selected competitors

S. Drogué and F. DeMaria

The (3.4) case study analysis on apples[4] has been updated to take into account some more products. In this case study we analyse the impacts of MLR of pesticides when exporting apples and pears and related processed products as juices and purees. MLR of pesticides vary greatly from a country to another. Even if the Codex has fixed international levels, some countries have standards that differ greatly from these levels. This is the case for example for Russia that applies MRL much stricter. We compare the impact of the difference in regulations for seven exporters (Argentina, Brazil, Chile, China, E.U, New Zealand and South Africa) on seven different import markets (Australia, Canada, Japan, Korea, Mexico, Russia and the US) in 2007-2009. The samples on which the econometric section is based consist of 7 bilateral trade relationships and 6 agricultural product lines at HS6-digit level.

We use a gravity model to estimate the impact of MLR regulations on trade of apples, pears and related processed products. The gravity equation is estimated by using both cross section and panel data. The model is specified as presented in the introduction, however some other variables have been introduced in the equation.

Data on trade are from UN/COMTRADE, GDPs and population data are from World Development Indicators of the World Bank (WDI). Data on distances are taken from the CEPII. Applied bilateral tariff data are from the MacMAp database of the CEPII. Besides these variables we introduce an index measuring the country *i* or *j* ‘s degree of transparency and corruption. Data come from Transparency International (www.transparency.org). The coefficient of this index is expected to be positive or negative depending on the degree of transparency and corruption of the importing country (Dutt and Traca, 2009).
A measure of the MLR of pesticides imposed by both importing and exporting countries on the products under scrutiny is added in the equation. This index is computed as the weighted average of the difference between country *i* and country *j'* MLR of pesticides. Data are from MRL database of the USDA, Foreign Agricultural Service.
If the MRL index is positive [resp. negative] this means that the standards of the importer are laxer [resp. stricter] than the standards of the exporter. An increase [resp. decrease] in MRL implies a slackening [tightening] of the constraint. The coefficient of this parameter may be positive or negative. A negative coefficient means a positive impact on trade while a positive coefficient would imply a negative impact on trade.

[4] See Deliverable D6.1 of the NTM-Impact FP7 Project: *Rationales for the selection of the case studies.*

In estimating a gravity model, there are some econometric issues to be addressed which are related to the non-observable heterogeneity of countries and to sample selection bias.

Country heterogeneity introduces a bias in the estimation because of the likely correlation between non–observable, country-specific effects and the explanatory variables of the gravity equation. Heterogeneity may be due to observable and unobservable factors (such as the propensity of a country to export more than others, cultural and historical links or business cycle effects), and/or to several other aspects of the relationships between each country-pair (i.e., common language, colonial past, shared border or religion). While these aspects based on observable factors can be handled by using a set of dummy variables, it is necessary to use a model with country fixed effects to control for non observable factors (Serlenga and Shin 2007). In order to take into account countries' heterogeneity, we decompose the error term of equation in importing fixed effect, exporting fixed effect and product line fixed effect.

In presence of zero trade value, the log-linearization of gravity equations fails and leads to biased estimates. The issue of zero-trade flows has been widely addressed in the literature on gravity empirics (Martinez-Zarzoso et al., 2007; Martin and Pham, 2008; Santos Silva and Tenreyro, 2006). In particular, Santos Silva and Tenreyro (2006) contribute to the discussion as to which estimator provides the most reliable results by assessing the potential bias of elasticities in a log linearized regression. They show that the consistency of an OLS estimator depends on a restrictive assumption regarding the error terms and suggest that the gravity equation could be estimated in its multiplicative form by using the Pseudo Quasi Maximum Likelihood Method (PQML) based on a Poisson Model. Moreover since the standard Poisson model is vulnerable to problems such as over-dispersion and excess zero flows, we use other estimation techniques, i.e. the Zero Inflated Poisson (ZIP) and the Negative Binomial Regression (NBR), as in Burger *et al.* (2009).

5- Assessment of the impact of avian influenza-related regulatory policies on poultry meat trade and on exporters' welfare

T. Heckelei, S. Schlueter, C. Wieck

5.1 Objective

Sanitary and food safety concerns stemming from animal disease outbreaks have limited the growth in trade for meat exporting countries affected by trade bans. Given the growing importance of poultry meat in international trade, many countries implement drastic measures to restrict trade in poultry meat associated with a perceived or actual risk of transferring avian influenza (AI) into their geography.
The objective of this case study is twofold: First, past AI-related policies over the period 2000 – 2007 are evaluated in terms of their trade impact by using a sample selection gravity model approach. Second, feasible future policies are evaluated ex ante: The change of the exporters' welfare due to variations in the importers' regulatory policies with regard to avian influenza is analyzed based on the gravity model's coefficient measuring the forgone trade linked to these policies and the resulting variations of both prices and quantities. The aspect of competitiveness of European poultry meat producers in terms of their potential to export is taken into account by comparing the trade and welfare effects of a change in import policies of two major importers - Japan and Russia – on four important poultry meat exporters –

Brazil, China, the EU25, and the USA - among each other. The welfare approach differentiates between two scenarios: (1) the implementation of an alternative regulatory policy to a ban in the case of low pathogenic notifiable avian influenza having a proportional risk mitigating effect; and (2) the implementation of an alternative regulatory policy to a ban in the case of high pathogenic avian influenza having a proportional risk mitigating effect.

5.2 The gravity approach

To receive coefficients measuring the forgone trade which can be incorporated into a welfare system a gravity model is estimated. We use a sample selection approach (Amemiya 1973, 1974, Helpman *et al.* 2008) accounting for the presence of zero trade flows. The estimation procedure includes two equations: First, the selection equation investigates the binary decision whether or not to trade and estimates this decision through a probit approach. Second, the level selection equation focuses on the quantity of trade. Poultry meat is split into two different product categories (uncooked[5] and cooked[6] poultry meat) which are connected (e.g. via prices) in some fashion. This relationship probably results in correlation between regressors and errors when using the simple sample selection model for estimation and yields biased and inconsistent estimates. Therefore a simultaneous equation model is developed using a two-stage or a three-stage estimation system. The differentiation between uncooked and cooked poultry meat is necessary because regulatory policies with regard to AI differ among these two product categories (see below).

Following data for the years 2000 – 2007 are used in the gravity model: Trade data (in value terms and quantity) comes from UN/COMTRADE. Yearly prices are constructed by dividing trade value by trade quantity for each of the two product categories and each country-pair. Bilateral data on the explanatory variable geographic distance originates from the CEPII homepage. Weighted distance is chosen as the distance variable, where the EU25 is centered on Germany. A time dummy variable is included as well as country-specific fixed effects. Tariff data stem from the UNCTAD TRAINS database. If available, the bilateral effectively applied tariff is chosen; otherwise, the most-favored-nations tariff is incorporated. Poultry meat production and consumption quantities result from the statistical webpage of the FAO. Poultry meat production and consumption can be interpreted as parameters representing a country's economic size in this sectoral analysis. We use poultry meat as an aggregate. The policy variable reflecting the importing country's regulatory policy with regard to avian influenza is constructed as follows: We have developed an ordinal scale of three different applicable AI regulatory policies (Table 2).

Table 2 : Regulatory policies for avian influenza

Regulatory policies	Ordinal number for estimation
ban on all poultry products	1
ban only on uncooked poultry products, but not on cooked poultry products (heat-treated meat and meat products)	2

[5] Uncooked poultry meat includes fresh, chilled, or frozen broilers, chickens, turkeys, ducks, geese, and guinea flows sold in cuts, parts, or whole birds (HS 0207).

[6] Cooked poultry meat includes all processed poultry products sold in preserved, smoked, prepared, or cooked form (HS 160231, 160232, 160239).

principle of regionalization within a country (disease-free zones)	3

It is assumed that a ban on all poultry products is the most severe policy measure in terms of trade restrictiveness, whereas adhering to the principle of regionalization is least trade restrictive. Next, we analyze the two importers' policy measures against each of the four exporting countries to receive a bilateral AI-related policy matrix for importation of poultry meat (Table 3). This is done for each year of the observed period 2000 – 2007. The period is chosen since the disease status of exporting countries with regard to AI has changed regularly during this period.

Table 3 : Bilateral AI-related policy matrix

Year: 2000	Exporter				
Importer	EU	BRA	US	CHN	ROW
RUS	e.g. 1	e.g. 2	e.g. 3	…	
JPN	…			1	
ROW	…				

The coefficient's outcome of the AI-related policy variable is used to build a simulation model. If statistically significant, the estimates are integrated into the partial equilibrium model to separate the policy variation impact from other effects.

5.3 The simulation approach

In order to analyze the exporters' welfare effects of a change in the importers' regulatory policy with regard to avian influenza a Takayama-Judge type model for six types of poultry meat is developed. As depicted in Table 4 there are two meat categories: (1) cooked meat and (2) uncooked meat; and three exporting countries' disease statuses, (1) free of AI, (2) low-pathogenic avian influenza (LPAI), and (3) high-pathogenic avian influenza (HPAI). Countries may ban the importation of poultry meat irrespective of whether the exporter has notified the outbreak of LPAI or HPAI and irrespective of the product category. However, findings of LPAI should not lead to import bans according to the provisions of the OIE (2009). Furthermore, heat-treated products could be safely traded regardless of the AI status of the exporting country. In compliance with the provisions of the OIE bans are only justified in case of uncooked meat originating from sources with HPAI and have to adhere to the principle of regionalization. Producers in affected regions is then given the possibility to shift fresh meat production to production of cooked meat as both meat categories are limb substitutes.[7] The green and red cells of Table 4 indicate whether a ban is an appropriate measure for the respective meat category and disease status of the products' origins for preventing the dispersion of AI.

Table 4: Meat categories

Exporter's disease	Meat category

[7] The share of cooked poultry meat exports on total global poultry meat exports nearly doubled from 2004 to 2006 after outbreaks of HPAI in 2003 had major negative impacts on the global poultry industry (Taha 2007).

status	Cooked meat	Uncooked meat
Source free of AI		
Source with status LPNAI		
Source with status HPAI		

That means in the case of an exporting country having the status HPAI the potential importer can relax for instance its policy measure “ban on all poultry products” to a “ban only for uncooked products” allowing the import of heat-treated meat without changing the risk of importing a contaminated product. Two alternative policy scenarios will be analyzed in the welfare approach: (1) the implementation of an alternative regulatory policy to a ban in the case of LPAI and (2) the implementation of an alternative regulatory policy to a ban in the case of HPAI. We will try to include the consumers’ risk perception towards goods from origins with an AI status. It is assumed that consumers’ risk perception is not inevitably linked to the scientific risk associated with the product characteristic, i.e. consumers may overestimate the risk in the case of an actual food crisis. The risk perception is assumed to be time variant; after a period of one year the risk perception does not impact demand anymore.
Following eight regions are included in the partial equilibrium model: Japan, Russia and ROW_{im} (rest-of-world importers) as importing countries and Brazil, China, the EU25, the USA and ROW_{ex} (rest-of-world exporters) as exporting countries. Each exporter is assigned to one of the three AI disease statuses. Data on the disease status originates from the OIE.
Demands and supplies are derived from a behavioral double-log function. We will also try other functional forms (such as functions accounting for the so called small-shares problem which arises in CES-based Armington specifications).

6 Assessment of the NTM implications on the EU competitiveness of dairy products on the Russian markets

Marian Mraz and Jan Pokrivcak

6.1 Introduction

World cow´s milk production has been gradually increasing during the last decade. World milk production is expected to increase by 103 million tons (16%) between 2005 and 2015 (OECD-FAO 2006). In terms of the geographic coverage EU, USA and India are the world major milk producer countries followed by Russia Federation, Brazil, Ukraine and New Zealand. EU27 with its overall milk production represents 26 % of the world total production in 2008. The major European competitors on the Russian markets are in particular producers from countries like New Zealand, USA, Argentina and Ukraine.

World dairy exports have been growing over the last decade. The value of total dairy product exports reached 48.2 billion euros. In comparison between 2003 and 2008, the value of global dairy exports increased by 55.2 %. EU-27 dairy exports have been increasing in value during the whole period and reached 32.4 billion euros in 2008, which is a 41.7 % increase relative to the 2003.

EU exports of dairy products to Russia have been rising steadily, in particular cheese and butter. Among the major products exported from the EU are derived dairy products such as yogurts and butter. From the outlook for the next decade Russia is expected to remain a net importer of dairy products. The EU agricultural exports to Russia are increasing each year reaching in 2008 the level of around 11% of the total EU agricultural exports. EU exports of dairy commodities to Russia remain at around 1% of the total EU agricultural trade.

The major goal of this case study is to investigate the evidence on the existing non-tariff measures facing the EU27 dairy products exported to Russia and to compare the cost implications of the identified NTMs on the EU27 position on the Russian markets relative to other major exporters of dairy products to Russia. In addition, welfare analysis of the existing NTMs and potential changes in the strength of the current regulatory measures will be carried out. In order to capture the relativities between the EU27 and exporters from other countries competing on the Russian market, the underlying data describing the regulatory framework in all countries need to be collected and empirical models estimated.

6.2 Methodology

Within the initial stage of the study the background information on the adopted non tariff measures needs to be collected. Surveys among selected EU firms exporting dairy products to Russia will be carried out. These surveys are expected to provide further insights on how the non tariff measures affect firms' costs structure as well as help identify the major issues behind the adoption of the NTMs while highlighting the institutional dimension of the overall process. Surveys on non tariff measures have been widely used by number of international organizations e.g. see OECD (1999) or USITC (1998) and are considered to be a source of useful information on their potential impacts.

In order to carry out a welfare analysis of the most significant non tariff measures identified through the surveys, tariff equivalents of the selected non tariff measures have to be estimated. Here econometric methods based on gravity equation will be used. Besides the usual variables we include in the equation exporter and importer GDPs per capita, and production per capita and a vector of variables capturing the relevant non tariff measures Trade policies of the individual countries will be modelled by country-specific fixed effects. Coefficients of exporter's GDP per capita and importer's GDP per capita have ambiguous signs from theoretical point of view.

Dealing with commodity specific trade e.g. with dairy products, a variable capturing the per capita milk production for both exporting as well as for importing countries is introduced. The coefficient associated with exporting countries is expected to be positive while that associated with importing countries is expected to be negative. A non tariff measure influencing dairy exports to Russia will be included into the gravity equation. It is possible that the standards will be quantified directly by a variable like the maximum residue levels allowed in imported products (Wilson and Otsuki, 2004, Otsuki, Wilson and Sewadeh, 2001). This method can be used if there is sufficient variability in the applied maximum residue limits and if this variable is relevant for international trade.

Otherwise frequency and coverage ratios measures will be used as in Nogues et al. 1986, OECD, 1995, Fontagne et al., 2005 and others. The deficiency of this method is that it does not differentiate between measures with significant impact on trade and those that do not affect trade flows at all. Also the assumption that the higher the number of non-tariff measures and their wider application is conducive to restricting trade is not always true. There are some regulations that lead to increased trade as they reduce risk and provide relevant information to consumers. Moenius (2004) shows that trade increases when standards are mutually shared. Additionally exporter specific standards also promote trade while importer-specific standards promote trade in manufacturing while restricting trade in agriculture. The economic rationale behind this prediction comes from the interaction between compliance costs with the standard and information role of the standard that reduces search costs. Some gravity based approaches also use dummy variables that indicate the existence or absence of the non-tariff measures (Cao and Johnson, 2006 and Chevassus-Lozza et al., 2005).

Empirical estimation of gravity model suffers from the problem of heteroscedasticity and zero trade flows. Heteroscedastic errors lead to biased estimators (Silva Santos and Tenreyro, 2006). Zero trade flows occur because of errors, omissions, rounding and due to real absence of trade. The extent of zero trade flows is especially huge when disaggregated data are used. Zero values of dependent variable can lead to biased estimation. The reason is that the sample selection process is not independent from error terms and relevant explanatory variables are omitted. In the presence of heteroscedastic errors the Poisson pseudo maximum likelihood (PPML) estimator is the least biased. The PPML estimator however does not perform well when large proportion of observations is censored. In such a case, the least biased is estimator proposed by Eaton and Tamura.

The estimated tariff equivalent of the particular non-tariff measure represents an input into the structural model employed in order to carry out the numerical cross economy simulations of the relevant policy shock and evaluate its welfare implications. For our simulations we employ an aggregated version of the multi regional CGE model in lines with the GTAP model family. The model has been implemented in General Algebraic Modelling System (GAMS). Its aggregated version covers EU27, Russia and other major dairy product exporters on the Russian market. We stick with the traditional GTAP-like model structure such as long-term static setting and assume perfectly competitive markets with optimising agents. The model has been expanded with specific treatment of the four major dairy commodities allowing to pick the technological detail of dairy production as well as to accommodate the policy instruments implemented within their market organisation.

6.3 Database

Trade data have been collected from the UN/COMTRADE database. Gross domestic product will come from World Bank database and we draw on FAOSTAT database for production of commodities. Applied tariffs are taken from MacMAp CEPII tariffs database.

As a main source of information on the EU non tariff measures will serve the database developed within the WP4. The available data are expected to establish the existing level of the adopted measures in the EU 27 and serve further as a benchmark to evaluate the actual stringency of the other country policies relative to the EU27 requirements. Within the work carried out in WP4 also data on NTM’s employed in Russia are being collected. Some information on the adopted regulatory measures relevant for the dairy markets is adopted from the market access database (MADB). The MADB includes background information on three regulatory measures applied by the Russia authorities for dairy products[8].

- The Russian Federal Law no. 88 FL of 12/6/2008 on milk and dairy products has introduced sanitary requirements such as residue levels of antibiotics and microbiological criteria, which differ from international standards. This legislation also covers both sanitary and quality requirements. Recently Russia informed about an additional requirement that the establishments shall have valid contracts with Russian importers for milk products supplies.

- Russia applies very strict MRLs which are far lower than the recognized limits set by international bodies, even for allowed substances. While many pesticides and veterinary medicines are recognized as being not harmful for animals and humans by international bodies (with permitted MRLs) and are widely used in several countries worldwide are not permitted in Russia. Many of Russia's MRLs diverge from relevant international standards.

- The procedures on approval and controls are used in non-transparent, discriminatory and disproportionate manner in some cases. There is not always a procedure in place to review complaints and to take corrective actions when a complaint is justified. The inspection procedures often appear non-transparent and inspection reports do not seem to reflect the actual level of hygiene of banned establishments. In addition, the procedure of listing of establishments has not been transparent.

7- Assessment of sanitary NTM upon Beef trade flows for the UE (Germany) and Argentina

D. Lema, C. Tapia, G. Ghezan and D. Iglesias

The objective of the study is to measure the effect of non tariff measures on beef exports from Germany and Argentina. In this study, a gravity model will be used to evaluate the effects of existing sanitary NTM on German and Argentinean beef exports to selected markets.

Two product-level gravity equations will be estimated within this framework. One equation will be set up such that Germany is an exporter and with selected major players in the international beef market (importers and exporter) with data taken at HS4-digit level of desegregation. A second equation considers Argentina as exporter and a set of selected major players in the international beef market (importers and exporter) with data also taken at HS4-digit desegregation level.

The gravity model will be estimated using panel data. To control for potential time and commodity variations in the data, a comprehensive set of time and commodity fixed effects will be specified. One of the major advantages of this approach is that it provides control for

[8] Note that these measures also apply on the other products and are not exclusively focused on dairy products.

country heterogeneity and therefore the effects of omitted non-observable variables which are difficult to measure otherwise (Cheng and Wall, 2005).

Equations of this gravity model usually are specified in logarithmic form, assuming that zero trade flows do not exist. However, this is typically not the case, particularly at the current level of desegregation (HS4 digit). To address the problem of "zeros" the model will be also estimated by Poisson pseudo-maximum-likelihood (PPML) as introduced by Santos Silva and Tenreyro (2006). This method has been considered appropriate for estimating gravity models when there is heteroskedasticity and null or missing bilateral flows in the database (Santos Silva and Tenreyo, 2006; Shepherd and Wilson, 2008).

Data on beef exports will be obtained from UN/COMTRADE. The time period for the estimation is 1995 to 2005, representing the post-Uruguay Round time period when SPS and TBT agreements became effective within the multilateral WTO trading system. Bilateral applied tariffs will be obtained from the WTO. The source for GDPs statistics is the World Development Indicators provided by the World Bank.

Dummy variables will be included to take into account the existence of NTMs in beef trade. Information about the introduction of sanitary and phytosanitary, as well as technical requirements by WTO countries are based on notifications presented by Members between 1996 and 2008. In addition, the introduction of requirements will also be surveyed at national public and private institutions. These requirements will be classified and organized to specify dummy variables to indicate the existence of different types of NTMs that affect trade of products from animal origin.

8- Assessment of sanitary NTM on lemon trade flows for the UE (Spain) and Argentina

D. Lema, J. Santini, G. Ghezan and D. Iglesias

The objective of the study is to measure the effect of non tariff measures on lemon exports from Spain and Argentina. The gravity framework selected for this analysis uses the theoretical model presented in introduction.

Two product-level gravity equations will be estimated within this framework. One equation will be set up considering Spain as exporter with a set of selected major players in the international lemon market (importers and exporters) with data taken at the HS4-digit desegregation level. A second equation considers Argentine as an exporter and a set of selected major players in the international lemon market (importers and exporter) with data also taken at the HS4-digit desegregation level.

The gravity model will be estimated using panel data. To control for potential time and commodity variation in the data, a comprehensive set of time and commodity fixed effects will be specified. One of the major advantages of this approach is that it provides control for country heterogeneity and therefore the effects of omitted non-observable variables which are difficult to measure otherwise (Cheng and Wall, 2005).

Equations of this gravity model usually are specified in logarithmic form, assuming that zero trade flows do not exist. However, this is typically not the case, particularly at this level of disaggregation (HS4 digit). To address the problem of "zeros" the model will be also estimated by Poisson pseudo-maximum-likelihood (PPML) as introduced by Santos Silva and Tenreyro (2006). This method has been considered appropriate for estimating gravity models when there is heteroskedasticity and null or missing bilateral flows in the database (Santos Silva and Tenreyro, 2006; Shepherd and Wilson, 2008).

Data on citrus exports will be obtained from UN/COMTRADE. The time period for the estimation is 1995 to 2005, representing the post-Uruguay Round time period when SPS and TBT agreements became effective within the multilateral WTO trading system. Bilateral applied tariffs will be obtained from the WTO. The source for GDPs statistics is the *World Development Indicators* provided by the World Bank.

Dummy variables will be included to take into account the existence of NTMs in citrus trade. Information about the introduction of sanitary and phytosanitary, as well as technical requirements by WTO countries are based on notifications presented by Members between 1996 and 2008. In addition, the introduction of requirements will also be surveyed at national public and private institutions. These requirements will be classified and organized to specify dummy variables to indicate the existence of different types of NTMs that affect trade of citrus products.

B- Case studies using partial or general equilibrium approaches

9- The Impact of Nontariff Measures on the Import of Pigmeat into Australia

J.C. Beghin and M. Melatos

9.1 Introduction

In quantifying the impacts of NTMs, two broad strategies have been adopted in the literature. The first involves the derivation of a ‘tariff equivalent’, typically measured as the difference between the domestic (protected) price and the world price of the imported good. This approach, however, necessarily assumes that import volume is positive; a domestic protected price must be observed. The second approach to NTM quantification involves the use of the gravity model to predict bilateral trade flows. Here too, however, the vast majority of studies assume that trade flows are positive. Both these traditional approaches are, therefore, problematic in cases where bilateral trade in a particular good is systematically zero, as is the case for pigmeat imports into Australia.

Australia imports pigmeat from Denmark, Canada and the United States. However, imports from a number of other European countries, namely Sweden and Finland, are zero despite the fact that the current quarantine regime does not, at least in principle, preclude the importation of pigmeat from these regions. We posit that the zero trade flows observed are the result of prohibitive trade costs and/or a reflection of the preferences of Australian consumers of pigmeat.

Yue and Beghin (2009) have developed a new technique for estimating the tariff equivalent and trade effects of a prohibitive NTM. Their approach, adopted in this study, combines Wales and Woodland’s (1983) Kuhn-Tucker approach to predict when corner solutions are likely to arise in a utility maximization framework with Yue *et al.* (2006) approach to measuring the tariff equivalent which accounts for trade costs and imperfect substitution between goods of different origin.

9.2 Theory

The representative consumer consumes two broad types of goods: pigmeat and a composite good of all other products. The composite good is designated the numeraire. Multiple varieties of pigmeat are available. The consumer’s utility function is additive in consumption of pigmeat and the composite good. With respect to how the consumption of pigmeat varieties contributes to consumer welfare, different functional forms will be tried. All specifications will have the ability to accommodate zero consumption levels; as in the linear expenditure system or random utility models with consumption thresholds, for example. With respect to the composite good, various functional forms are used to ensure robustness with respect to the marginal utility of income which is the first partial derivative of the utility function with respect to all other goods.

Consumers discriminate between varieties in a couple of ways:

- First, consistent with Wales and Woodland's (1983) random utility approach, we allow for stochastic preferences over different products. This variation enters each consumer's utility function through consumption weights. These weights are functions of: (i) socio-demographic characteristics of the representative consumer, (ii) other factors that influence consumer preferences over different types of pigmeat (e.g., country of origin) and (iii) a vector of random components capturing preference variation only known to the consumer.
- Second, each variety has a minimum consumption threshold associated with it, which could also be explained by some shifters as just described

The representative consumer maximizes utility subject to her budget constraint and non-negative consumption of (all varieties of) pigmeat and the aggregate "all other consumption" good. Note that the domestic price of each pigmeat variety comprises a "world price" component and a trade cost component, itself made up of a "transportation cost" (here, geographic distance) component, an (ad valorem) tariff and the tariff equivalent of NTM policies affecting trade importation of the product, here pigmeat.

Many factors, apart from NTMs, can influence the demand for different varieties of pigmeat: input cost changes affecting meat cost (e.g. feed and labor costs for live animals) translating into a higher export unit value, exchange rate changes also affecting the export unit value perceived by the importer, prices of substitute products (e.g. chicken, mutton, beef etc) and market structure (e.g. size and vertical integration). These factors enter into demand decisions by affecting the unit price faced by the consumer

Since the Australian quarantine rules regarding pigmeat imports have changed regularly, we will try to estimate how the NTM tariff equivalent has changed over time for importers of pigmeat into Australia. In particular, significant changes in quarantine rules for pigmeat occurred in 1990, 1992, 1996, 1997 and 2004. We estimate the tariff equivalent associated with each NTM regime. This step will be conditioned on observing actual changes in trade flows once a prohibitive regime is removed.

Solving the consumer's problem yields first-order necessary and sufficient Kuhn-Tucker conditions for all goods of interest *j*, i.e., for each variety of pigmeat and for the composite good. In each case, these FOCs take the form $MU_j = \lambda p_j^{Aust}$ where λ, the Lagrange multiplier, can be interpreted as the marginal utility of income. Provided consumption of the composite (numeraire) good is strictly positive, then the marginal utility of consumption of the composite good equals λ.

It is now possible to derive an expression for the random (i.e. unobserved) components of the utility function as a function of all the other model parameters which relate to observed data. This expression can then be used to calculate the joint distribution given that the consumer only consumes a positive amount of a subset of varieties of pigmeat. Assuming that the random components of consumer utility are IID and normally distributed, a log-likelihood function can be derived to estimate the tariff equivalent NTM and the parameters related to observed data.

9.3 Estimation Method

<u>1st Stage – Estimation of Tariff Equivalent</u>

Using the methodology outlined in the previous section, we estimate the following 24 (at least) parameters:

- NTM tariff equivalent (at least **1**, more if we are able to identify the trade impact of changes to the NTM regime either over time or by type of cut).
- Country of origin parameters for: Australia, US, Canada, Denmark, Sweden, Finland and Rest of the World (ROW). **(7)**
- Marginal impact of geographic distance on the domestic price of pigmeat in Australia **(1)**
- Marginal impact of socio-geographic characteristics on pigmeat demand for: Australia, US, Canada, Denmark, Sweden, Finland and ROW. **(7)**
- Minimum consumption thresholds for: Australia, US, Canada, Denmark, Sweden, Finland and ROW. **(7)**
- Marginal utility of the composite good. **(1)**

If the minimum consumption thresholds, when estimated, are significantly different from zero then we can conclude that the country of origin (or other attributes) of a given variety of pigmeat matter even if that variety is not consumed.

In the pigmeat market, different exporting countries tend to specialize in different types of cuts: Denmark (mainly middles for bacon), Canada (mainly legs and shoulders for ham) and the United States (mainly shoulders and legs). The fresh pork market and small goods markets for "ham-on-the-bone" and uncooked salami are supplied entirely from local production. Therefore, country-specific NTMs may in fact be "product-specific". To model this, we can run the analysis on different cuts of meat separately; each modeling run would define "pigmeat" in a narrower way, effectively focusing attention on the impact of NTMs on the relevant bilateral trade relationships.

2nd Stage – Welfare Analysis

We also calculate the impact on Australian and foreign pigmeat producers of the removal of these NTMs. To do this, a partial equilibrium demand and supply model will be defined. Welfare effects will be estimated. The computation of welfare effects can be difficult with some functional forms of preferences because no close form solution exists to derive the mean and standard deviation of the compensating variation (see Yue and Beghin, 2009 and Phaneuf *et al.*, 2000).

9.4 Data

The following data is collected (or calculated) for the period 1980-2009. The period is chosen since Australian quarantine regulations have changed regularly between 1990 and 2004. We need data for a period long enough to envelope the period over which the NTM regime for pigmeat has changed. This will allow us to identify the impact of these regulatory changes.

Population, prices and bilateral exports of all countries that have (i) at least 2 years of positive trade flows in pigmeat with Denmark, Finland, Sweden and/or Australia and (ii) pigmeat consumption and production data reported by the FAO. This panel of "third countries" is used to approximate our representative consumer. The data are collected from the UN/COMTRADE database.

Individual country economic and demographic data (collected from the Penn World Tables). The distances between trading nations come from CEPII and are used to approximate transport costs.

The (FOB) bilateral export prices of Danish, US, Canadian and Australian pigmeat exports. When bilateral trade is zero, the unobserved export price is approximated by averaging FOB prices for all other exporters in that year.

The price of domestically produced pigmeat in Australia is approximated by their FOB price.

In markets outside of Australia and the EU, the price of pigmeat is a consumption-weighted average of imported and domestically-produced pigmeat.

Tariff rates on pigmeat imports into Australia and other countries.

If possible, we will also attempt to collect price data on substitute products such as chicken, mutton and beef).

10- Impact of NTMs on EU dairy exports to the US: methodology and data overview

N. Winchester

10.1 Introduction

The case study will analyse the impact of non-tariff measures (NTMs) on EU cheese exports to the US. Cheese is a significant agricultural export for the EU and accounts of around one-third of total EU dairy exports (Eurostat, 2009). It is beneficial to focus on EU cheese exports to the US as EU products account for nearly 73% of US imports of this commodity (USDA, 2009). The study will use a gravity approach to estimate ad valorem tariff equivalents (TEs) of NTMs and include these estimates in a bespoke computable general equilibrium (CGE) model to estimate the impact of NTMs on production, trade and welfare. In addition to modelling EU production and trade in detail, the model will also consider responses from the EU's major competitors in the EU cheese market (New Zealand, Switzerland and Australia).

10.2 Tariff equivalents of NTMs

Ferrantino (2006) identifies three approaches to quantify TEs of NTMs: (i) "handicraft" price gap methods, (ii) price-based econometric approaches, and (iii) quantity-based econometric methods. Handicraft methods estimate the price gap between domestic and international prices. Price-based econometric methods take advantage of systematic reasons why prices in some countries are higher than prices in other countries. Quantity-based econometric methods infer the impact of NTMs by comparing actual trade flows with a "free trade" benchmark.

Handicraft approaches are generally considered to be more accurate than “mass produced” econometric methods but the data and time required to implement handicraft studies can be unreasonable. Following Nahuis (2004), Philippidis and Carrington (2005), Philippidis and Sanjuán (2007a, 2007b) and Winchester (2009), we estimate TEs of NTMs using a series of gravity equations – as introduced in the present document - as this approach uses easily accessible trade data.

Residuals from the gravity equation can be used to estimate impediments to trade such as NTMs. Specifically, a difference between actual (x_{ij}^{A}) and predicted (x_{ij}^{P}) exports indicates the presence of a trade barrier not specified in the gravity equation. The size of the trade barrier is estimated from:

$$x_{ij}^{A} - x_{ij}^{P} = (1 - \sigma)\tau_{ij}$$

where σ is the elasticity of substitution between varieties from different countries and τ_{ij} is the TE of unobservable trade restrictions applying to exports from i to j.

Data and estimation techniques
Data on bilateral exports is sourced from UN/COMTRADE database. For distance, we employ harmonic-mean weighted distance measures available from the CEPII.[9] Guided by Head and Mayer (2002), bilateral distance between two countries is calculated as population-weighted average distances between the major cities belonging to those two countries. Data for our dummy variables capturing the effects of contiguity, sharing a colonial relationship (equal to one if two nations have had a colonial relationship after 1945) and speaking a common language (equal to one if a language is spoken by at least 9% of the population in both nations) are also sourced from CEPII.

Guided by Silva Santos and Tenreyro (2006), gravity equation is estimated using the Poisson pseudo–maximum likelihood (PPML) estimator. That is, we implement a Poisson regression of exports on the logarithm of distance, contiguous, common language and colonial heritage dummy variables, and importer and exporter fixed effect dummy variables.[10] As the PPML estimator is unlikely to fully account for heteroskedastcity we base inference on robust standard errors.

10.3 The economic impacts of NTMs

Our numerical simulations employ a modified version of the ‘GTAP7inGAMS’ model. GTAP7inGAMS draws on version seven of the Global Trade Analysis Project (GTAP) database (Narayanan and Walmsley, 2008) and is programmed using the General Algebraic Modeling System (GAMS). The GTAP database lists data for 113 regions and 57 sectors and

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[9] See http://www.cepii.fr/anglaisgraph/bdd/distances.htm.
[10] Silva Santos and Tenreyro (2006) show that estimating the gravity equation in multiplicative form using the (PPML) estimator has several advantages over applying OLS to the log-linear model. First, using Jensen’s inequality the authors show that estimating a gravity equation in logarithms using OLS can lead to severely biased and inconsistent estimates when heteroskedastcity is present. Second, as the logarithm of zero is undefined, the sample must be truncated or the dependent variable rescaled when exports between a particular pair of countries are zero.

includes a full set of bilateral trade flows in addition to accounting for intersectoral linkages. GTAP7inGAMS is a static, perfectly competitive, multi-regional representation of the global economy that determines the production and allocation of goods. Rutherford (2005) describes the model in detail. Salient features of the model and modifications to facilitate a rigorous analysis of dairy trade are outlined below. [11]

GTAP7inGAMS production technologies exhibit constant returns to scale and product and factor prices adjust to maintain zero profits. Output in each sector is governed by a Leontief nest of intermediate inputs (which are composites of domestic and imported varieties) and a primary factor composite. The intermediate input composite is derived from a further Leontief aggregation of different products. Specifically, production in sector *i*, Y_i, is determined by:

$$Y_i = min\left\{a_{i1}Y_{i1}, \dots\ a_{iJ}Y_{iJ}, A_i^{VA}\prod_f x_{if}^{\alpha_{if}^{VA}}\right\}$$

where Y_{ij} is the quantity of good *j* $(j\ \in 1, \dots, J)$ used as an intermediate input into sector *i*, x_{if} is the quantity of factor *f* employed in sector *i*, and a_{ij} , A_i^{VA} and α_{if}^{VA} are positive parameters.

Private consumption (PC) in GTAP7inGAMS is governed by a Cobb-Douglas function allocating expenditure across goods, which are composites of domestic and imported varieties:

$$PC = A^{PC}\prod_i DM_i^{\alpha_i^{PC}}$$

where DM_i is a composite of domestic and imported varieties of good *i* and A^{PC} and α_i^{PC} are positive parameters.

Important empirical observations not replicated in standard trade models include intra-industry trade and failure of the law of one price for traded goods. Accordingly, imports in GTAP7inGAMS are differentiated by country of origin using a constant elasticity of substitution (CES) function (i.e., the import demand specification is separable). Composite imports are also differentiated from domestic products using a CES function following Armington (1969). Elasticity parameters for our import specification are sourced from Hertel *et al.* (2007). For each region, the functional form of the Armington composite of good *i* is:

$$DM_i = \varphi_i^{DM}\left(\gamma_i^{DM}D_i^{\rho_i^{DM}} + \left(1-\gamma_i^{DM}\right)\left(\varphi_i^{M}\left(\sum_r \gamma_{ir}^{M}M_{ir}^{\rho_i^{M}}\right)^{1/\rho_i^{M}}\right)^{\rho_i^{DM}}\right)^{1/\rho_i^{DM}}$$

where D_i is the quantity of good *i* sourced domestically; M_{ir} denotes imports of good *i* from region *r;* φ_i^{DM} , φ_i^{M} , γ_i^{DM} , γ_{ir}^{M} are positive parameters, and

[11] The GTAP database is packaged with a model programmed using the General Equilibrium Modelling PACKage (GEMPACK). Readers familiar with GEMPACK should note that there are several differences between GTAP7inGAMS and the GEMPACK version of the GTAP model.

$\rho_i^q = {(\sigma_i^q - 1)}/{\sigma_i^q} \; (q \in DM, M)$, where σ_i^{DM} and σ_i^M are, respectively, elasticities of substitution between domestic production and aggregate imports, and imports from different regions.

GTAP7inGAMS identifies a fluid milk sector and a processed dairy sector. Fluid milk is almost exclusively used as an intermediate input into processed dairy. Building on Charteris and Winchester (2010), we augment the GTAP database and modify the production structure and import specifications in GTAP7inGAMS to include several processed dairy commodities. To minimize data requirements we only disaggregate production of the processed dairy sector in exporting regions of interest (the EU27, New Zealand, Switzerland and Australia). An important feature of dairy production is that fluid milk contains fixed proportions of protein and fat (Cox *et al*., 1999; Zhul *et al.*, 1999; Bouamra-Mechemache *et al.*, 2002; and Charteris and Winchester, 2010). Consequently, producer substitution between products requiring different protein-fat ratios is limited. For example, skim milk powder is produced from protein while cheese is a combination of fat and protein, which reduces producer responses to changes in the skim milk powder-cheese relative price.

As noted above, we only identify multiple processed dairy products in exporting regions of interest. In these regions, we model dairy production using a constant elasticity of transformation (CET) function to separate processed dairy, Y_d, into milk fat and milk protein:[12]

$$Y_d = \theta_d \left(\delta_d YF^{\rho^T} + (1 - \delta_d) YP^{\rho^T}\right)^{1/\rho^T}$$

where YF and YP are, respectively, outputs of milk fat and milk protein, θ_d and δ_d are positive parameters and $\rho^T = (\sigma^T + 1)/\sigma^T$ where σ^T is the elasticity of transformation between fat and protein.

Following the separation of processed dairy into fat and protein, each dairy commodity is produced by a CES function that combines the two components in different proportions. That is, production of dairy commodity *k*, Y_d^k, is:

$$Y_d^k = \theta_k \left(\delta_k YF^{\rho_k^D} + (1 - \delta_k) YP^{\rho_k^D}\right)^{1/\rho_k^D}$$

where θ_k and δ_k are positive parameters and $\rho_k^D = {(\sigma_k^D - 1)}/{\sigma_k^D}$ where σ_k^D is the elasticity of substitution between fat and protein in production of dairy commodity *k*.

We also modify the import aggregation to account for an expanded set of dairy commodities. Dairy imports from exporting regions of interest entering each region, M_{dr}, are a CES aggregate of *K* dairy commodities:

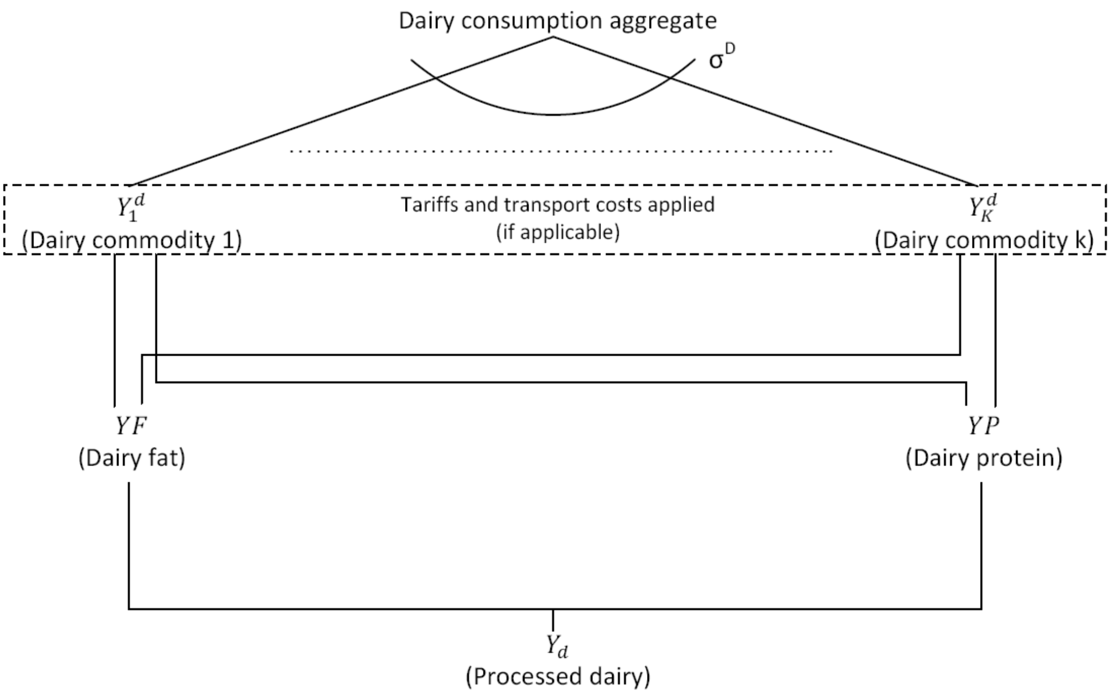
[12] Alternatively, joint production of fat and protein could be modelled in the fluid milk sector. Such an approach produces similar results to the approach outlined above.

$$M_{dr} = \varphi^D \left(\sum_k \gamma_k^D M_{dr}^{k\ \rho^D} \right)^{1/\rho^D}$$

where M_{dr}^k denotes imports of dairy commodity k from region r, φ^D and γ_k^D are positive parameters, and $\rho^D = (\sigma^D - 1)/\ \sigma^D$ where is the elasticity of substitution between dairy commodities.

Figure 1 summarises our modification to GTAP7inGAMS. For exporting regions of interest, as noted above, the processed dairy sector produces fat and protein in fixed proportions. Fat and protein is then assembled in different proportions to produce dairy commodities. Tariffs and transport costs, which are zero for domestic sales, are applied to international dairy flows. Processed dairy commodities are then aggregated into a single dairy good, which competes with processed dairy from other countries. Disaggregating the processed dairy sector only to aggregate dairy commodities into a single consumption good may seem cumbersome, but doing so allows us to apply exact trade barriers to each commodity and permits producers and consumers to respond to changes in relative dairy prices while minimising data requirements.

Figure 1 : Dairy production for regions with a disaggregated processed dairy sector



To facilitate the augmentation of GTAP7inGAMS, we source production data from the OECD's Commodity Balance Dataset and data on US dairy imports, tariffs and tariff rate quotas (TRQs) are taken from the US WTO Integrated Data Base (IDB). TRQs are converted to ad valorem TEs following Bouët *et al.* (2006).

10.4 Conclusion

The case study will investigate the impact of US NTMs on EU cheese exports. NTMs will be estimated using a series of gravity equations. Estimated NTMs will be converted to TEs and imposed on a CGE model tailored to dairy trade analysis. The model will account for responses from the EU's major competitors and will be used to assess the impact of US NTMs on EU production, trade and welfare.

11- Methodology of the case study on Canadian compositional standards for cheese

M-H. Felt, B. Larue and J-P. Gervais

11.1 Introduction

This case study will focus on recent modifications to regulations on compositional standards of cheese in Canada. The objective is to analyze the impacts of these regulations on the competitiveness of exporters in the Canadian market. The new compositional standards for cheese were issued by the Canadian government in December of 2007. The stated objective of the changes in regulations was to "guarantee the integrity and quality of Canadian cheese for consumers". The regulations amending the *Food and Drug Regulations* (FDR) and the *Dairy Products Regulations* (DPR) came into force in December of 2008. In essence, the new regulations require that a minimum proportion of the casein used to make cheese be derived from fluid milks and ultra-filtered milks rather than from other milk products, and that the whey protein to casein ratio for cheese be at most the same as that for milk. In addition, the casein content derived from milk must be at least as high as the percentage of the total protein content for a given cheese variety. The regulated proportions and ratios differ depending on the type of cheese.

11.2 Theoretical framework

We will use a partial equilibrium model to investigate the impact of changes in cheese compositional standards on prices and importers' market share in the Canadian cheese market. In what follows, the theoretical framework to achieve the objective is outlined. Let two countries (*A* and *B*) export cheese to Canada (Canadian variables are denoted with the superscript *C*). Cheese products are differentiated according to the country of origin (Armington assumption). Buyers' inverse demand for each product is:

$$p^j = \alpha - q^j + \gamma \sum_{i \neq j} p^i \; ; \; i = A, B, C$$

Cheese processors in country *i* use a constant returns to scale Leontief-type technology to produce cheese using butterfat (denoted x_F) and proteins (denoted x_{PR}). Proteins can come from fresh milk or concentrate and the technical coefficient of proteins from these two sources are identical (denoted by θ^i_{PR}) , thus the proportion of proteins to butterfat is independent of the source of proteins. The cheese production function can be written as:

$$y^i = \min\left\{\theta_F^i \, x_F^i, \theta_{PR}^i \, x_{PR}^i\right\}$$

where y^i denotes cheese output in country i and $x_{PR}^i = x_{PM}^i + x_{PC}^i$. This specification implies that proteins sources are perfectly substitutable and thus accost minimizing solution will necessarily entail a corner solution. In reality, there exist technical constraints on the sources of proteins for the production of cheese. For example, Canadian cheese processors were still using proteins derived from fresh milk even though they had access to lower-priced proteins from alternative sources. The new compositional standards in Canada address the ratio of protein sources used in the production of cheese. It is however useful to define two constraints for the purpose at hand. Let k be the ratio of protein from concentrate relative to the total protein amount. The two protein sources are perfectly substitutable until the ratio of proteins from concentrate to total proteins reaches a certain ceiling. This technical threshold will be different across countries because presumably different cheese products have different technical requirements. As such, define the technical constraint as $\bar{k}^i$ such that:

$$0 \le k^i \equiv \frac{x_{PC}^i}{x_{PR}^i} \le \bar{k}^i < 1 \ .$$

Define w_F , w_{PM} and w_{PC} as the price of butter fat, proteins from fresh milk and proteins from concentrate, respectively. The technical ratio above implies that k^i cannot be equal to one even if $w_{PC}^i < w_{PM}^i$. Moreover, the compositional cheese standard in Canada sets a regulatory constraint (denoted $k^{\max}$) on the protein ratio k^i, such that:

$$0 \le k^i \equiv \frac{x_{PC}^i}{x_{PR}^i} \le k^{\max} < 1$$

We have $k = k^{\max}$ if $w_{PC}^i \le w_{PM}^i$ and $k = 0$ if $w_{PC}^i > w_{PM}^i$. Obviously, the regulatory standard is not binding for processors in country i if $\bar{k}^i < k^{\max}$. In that case, the cost function of a processor in country i can be expressed as:

$$C^i\left(q^i, w_F^i, w_{PM}^i, w_{PC}^i\right) = \frac{q^i}{\theta_F^i} w_F^i + \frac{q^i}{\theta_{PR}^i} \min\left\{\bar{k}^i w_{PC}^i + (1-\bar{k}^i) w_{PM}^i, w_{PM}^i\right\}$$

To develop insights on the implications of the model, we will make a few assumptions that depart in some instances from observed market characteristics. First, assume that the only traded input is the protein from concentrate, other inputs are non-tradable inputs. Canadian proteins imports face a specific tariff τ_{PR} . Foreign cheese can be imported into Canada, but imports face a two-tier tariff system in which imports below a minimum access commitment face a low tariff (currently zero for most exporting countries), while imports exceeding the minimum access commitment face a much larger ad-valorem tariff (currently set at 245 percent). This tariff-rate quota system can be considered a pure import quota if there are no imports at the over-quota tariff. There exists also an import licensing system that set aside special reserves for certain countries. For now, we will just assume that Canadian cheese imports face a specific tariff that is made unconditional on the source of the product: $\tau^A = \tau^B = \tau$. Finally, the existence of supply management at the farm level involves supply rigidity at the processing level, at least in the short-run. We will consider the output of Canadian cheese to be perfectly inelastic in the short-run and fixed at $\bar{q}^C$. Obviously, predetermined output implies that the regulatory standard has no effect the Canadian cheese price. It only raises the cost structure of Canadian processors. We will relax this assumption below.

Given the previous assumptions, the profit functions of a single (representative) processing firm in *A* and *B* are:

$$\pi^A = \left(p^A - \tau\right)q^A - C\left(q^A, w_F^A, w_{PM}^A, w_{PC}^A\right) = \left(\alpha - q^A - \gamma p^B - \gamma p^C - \tau\right)q^A - C\left(q^A, w_F^A, w_{PM}^A, w_{PC}^A\right)$$

$$\pi^B = \left(p^B - \tau\right)q^B - C\left(q^B, w_F^B, w_{PM}^B, w_{PC}^B\right) = \left(\alpha - q^B - \gamma p^A - \gamma p^C - \tau\right)q^B - C\left(q^B, w_F^B, w_{PM}^B, w_{PC}^B\right)$$

where $p^C = \alpha - \bar{q}^C + \gamma p^B + \gamma p^A$. Given the existence of supply management at the farm level and that Canada is a net importer of cheese, it is natural to assume that the input prices elsewhere are lower than in Canada:

$$w_F^C > w_F^A = w_F^B = \bar{w}_F ; w_{PM}^C > w_{PM}^A = w_{PM}^B = \bar{w}_{PMF}$$

Setting input prices equal across supplying countries will allow us to focus on the impact of the regulatory standard on firms' market share. The baseline situation is the one above where both firms maximize profits.

A number of simulations can be carried out. The first set of simulations should focus on the importance of the standard on exporting firms' market share. Compliance costs could be added to the framework as these costs can be different across supplying countries (as concerns expressed by Canada's trade partners suggest). A second set of simulations could investigate the impact of preferential market access in relation to differences in the ability of foreign firms to meet the standard.

11.3 Empirical framework

The first direct implication of the new compositional standard will be on the cost structure of foreign cheese processors exporting to Canada. Hence, the standard could manifest itself on Canadian cheese import unit values. We propose to detect whether the standards had a significant impact on import unit values using univariate and multivariate regression models. First, an autoregressive process could be fitted to each series (import unit values from different suppliers). The empirical challenge is to detect potential structural change induced by the new compositional standards by relying on a short time period. New standard were implemented in December 2008 and thus we are likely to only have a dozen or so of observations that would fall in the post-implementation period. Andrews (2003) and Andrews and Kim (2006) developed powerful procedures to detect end-of-sample potential structural change. Their procedures work in the context of stationary and non-stationary data and in univariate as well as multivariate settings.

In the previous exercise, monthly import unit values can be used to detect potential impacts of compositional standards on marginal cost (and thus export prices) of foreign suppliers. The compositional standards can obviously impact market shares of the different suppliers. If the standard has an identical impact on the competitiveness of all suppliers, it is likely to have a minimal impact on the market share of the different countries. Yet the standard could have a significant impact on the relative competitiveness of the different suppliers. Detecting the effect of the standard on market shares is complicated by the fact that there are significant constraints on volumes in the Canadian dairy industry. These constraints are drawn up on an annual basis while we must use monthly observations to detect potential impacts.

12- Description of the analytical tool of the citrus market case study

C.B. Cororaton and D. Orden

A citrus simulation model, integrated with pest risk from imports, production loses this may impose within an importing country, and compliance cost that may be imposed on exporters allowed access to the importing-country market, is utilized by VT in its analysis in WP6. The model is based on Peterson and Orden (2008). The model structure is general but is best explained by taking one country as a focal point where domestic production competes with imports from various sources.

For this exposition, and because we have been developing the model on a corresponding basis, we will treat the United States as the focal point. But in the full specification, various countries can be treated with symmetric or non-symmetric levels of detail depending on the objective of the analysis and relevant specification. Thus, for “U.S.” one could read “Country i” where i is any country for which a detailed specification of non-tariff measures and their costs and effects are germane to the study.

12.1 Model framework

The model has four major blocs: U.S. production, U.S. consumption, import suppliers in the U.S., and other markets outside of the U.S. facing the import suppliers. At present, we have specified the first three blocs, and we are in the process of generalizing the specification by building up the fourth bloc.

For our study of NTMs and their effects on citrus trade the U.S. production of citrus is defined over two seasons: peak and off-peak seasons. The U.S. domestic citrus market is divided into 2 regions, depending on pest susceptibility. Import suppliers are selling to the U.S. markets and to all other markets including their own domestic markets.

Figure 2 : Citrus simulation model

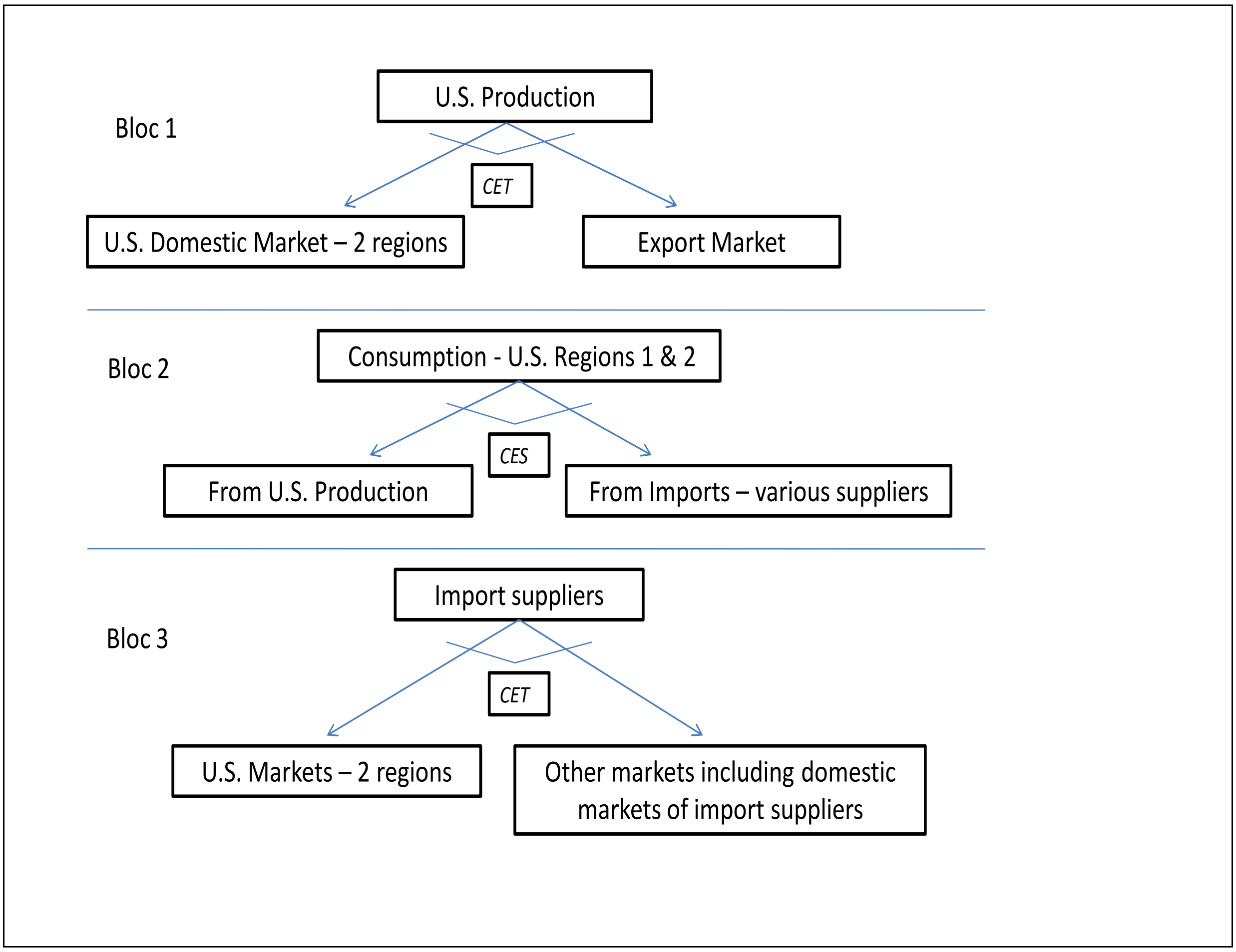


Figure 2 presents a schematic diagram of the first three blocs of the citrus simulation model. U.S. citrus producers face two markets: domestic markets in the U.S and the export markets. The producers maximize revenue from these markets subject to a transformation curve defined by a constant elasticity of transformation (CET) function. The producers selling to these markets would decide where to sell depending upon the relative prices of the two markets and the degree of substitution between the domestic and export markets.

The second bloc defines the demand for citrus. There are two stages involved in the consumption bloc. The first stage (not shown in the diagram) specifies a constant elasticity of substitution (CES) utility function which is a function of consumption of citrus and all other goods in the consumption basket. Maximization of the utilization function subject to income constraint yields the demand function for citrus. In the second stage (shown in the diagram), a consumer chooses between domestically produced citrus and imported ones. It is assumed that domestically produced citrus and imported citrus are imperfect substitutes and are differentiated by product qualities which are reflected in differences in prices (actual differences enter the model when it is calibrated). The decision process of the consumer is based on minimizing citrus expenditure subject to CES Armington function between domestically produced citrus and imported ones. The first order conditions define the demand for domestically produced citrus as well as the demand for imported citrus.

The supply from the domestic producers of citrus in the first bloc and the demand for domestically produced citrus in the second bloc is cleared by a market price.

The third bloc defines the interaction between the demand for imported citrus in the U.S. and the import suppliers of citrus. Import suppliers are facing two markets: markets in the U.S. and all other markets including their domestic markets. These suppliers will maximize revenue from these markets subject to CET transformation function. The suppliers selling to these markets would decide on quantities depending upon the relative market prices and the degree of substitution between the U.S. market and all other markets.

The demand for imported citrus in the U.S. defined in the second bloc and the supply of imports from the suppliers in the third bloc is cleared by a market price.

The key NTM-related components in the citrus simulation model are the pest risks from imports, damages and costs associated with pest outbreaks in the importing country and compliance cost associated with exporters having market access. These items are integrated into the model based on various specifications.

The pest risk component is specified as follows. Let j be the import supplier. The frequency of pest outbreak ($freq_j$) is determined by the probability of pest infecting the fruit in supplier j ($prob_j$)[13] multiplied by the level of imports from j to the U.S ($qusnus_{j,us}$). That is

(1) $$freq_j = prob_j \cdot qusnus_{j,us}$$

The total frequency of pest outbreak is the sum over all import suppliers of citrus j to the U.S., that is

(2) $$tot_{freq} = \sum_j freq_j$$

A pest outbreak will result in productivity loss in citrus production in the U.S. The productivity loss is specified as

(3) $$prod_{loss} = tot_{freq} \cdot pcteff \cdot ploss$$

where *pcteff* is the percent of crop in the importing region affected by infestation, *ploss* is the percent productivity loss from infestation in the importing region. The impact of pest outbreak in production is given by

(4) $$ya = v \cdot (1 - prd_{ploss})$$

where *ya* is output of citrus, and *v* aggregate factor input. Thus, the higher the productivity loss due to pest outbreak, the greater is the reduction in output. The aggregate factor input is a function of output price, *pya*, and is given by the following linear equation

[13] In Peterson and Orden (2008), there are a series of probabilities where infection can occur; from the orchard, to packing, to shipment until the commodity crosses the border.

(5) $v = \emptyset + \varphi \cdot pya$

The compliance cost component is given by

(6) $$cc_j = \frac{cc_{cost1_j} + cccost2_j \cdot qusnus_{j,us}}{qusnus_{j,us}}$$

where cc_j is the per unit compliance cost and cc_cost1_j and cc_cost2_j are fixed and variable components of that cost. Higher compliance cost can be imposed in response to a pest outbreak. This increases the price of imported citrus in the U.S. market, *pmsrg*, through the following equation

(7) $$pmsrg_{j,ss,rgn} = pqusnus_{j,us} \cdot (1 + cc_j) \cdot (1 + tm_j)$$

Where *ss* is season, *rgn* region in the U.S. tm_j import tariff and *pqusnus*, CIF price of imported citrus.

12.2 Coding, calibration and empirical Extensions

This model has been coded in GAMS and we have calibrated the model to data on lemons with the U.S. as the focal importer. The primary initial exporters to the U.S. are Mexico, Chile and Spain. We have experimented with various preliminary scenarios such as introducing Argentina as an additional exporter. The next step is to further develop the empirical NTM specifications for the lemon case.

Subsequently, this model will be extended to take more fully into account the demand for citrus in the markets outside of the U.S. This will define the fourth bloc in the model and once developed various importing regions become co-equal focal points with the U.S. Global trade patterns will be simulated as they are affected by NTM decisions among the various counties. The extended model will be calibrated to several categories of citrus fruits so it is also multi-sectoral. A preliminary description of global citrus production, consumption and trade is provided on Cororaton and Orden (2009).

13- Response of Poultry Meat Import to Incidence of Infectious Diseases and Standards on Pesticide and Veterinary Medicine Residues in Japan

T. Otsuki and F. Kimura

13.1 Introduction

Sanitary and Phytosanitary (SPS) regulations have been implemented to ensure the health of animals, plants and human beings of countries engaged in trade. Such regulations take various forms such as import bans, tariffs, standards and other technical requirement whose specifications often follow the importing country's domestic regulations. In Japan, the government enacted the Food Sanitation Act in 1947; the Plant Quarantine Law in 1950 along with the Domestic Animal Infectious Diseases Control Law in 1951, and these SPS rules have been enforced on both domestically produced and imported foods. Japan's Food Sanitation Act had initially prohibited the use of all synthetic antimicrobial drugs, but in 1992, maximum residue limits (MRLs) were introduced to address the residues of such drugs instead. Furthermore, the Food Sanitation Act was modified to adopt the "positive list system" in May 2006, which defined 0.01 ppm as the uniform limit for hazardous chemical residues that were not listed in the MRL table. In contrast, import bans have been normally applied to incidence of infectious diseases such as the avian influenza and Newcastle disease.

In our case study, we will quantify the effect of Japan's various food safety threats and quarantine regulations on poultry meat imports. Particular attention will be given to (1) incidence of avian influenza, (2) residues of pesticides such as dieldrin, heptachlor and furaltadone, as well as (3) residues of veterinary medicine such as tetracycline antibiotics. Furthermore, we will also pay attention to persistency of negative reputation associated with detection of food safety threat. Food safety threat may have persistent trade limiting effect after it is detected. Recovery of the import from the ex-infection countries may take a substantial time after the elimination of the ban, and they tend to continue to purchase domestic meat and imported meat from countries with no infection history. Also, consumers tend to have strong preference toward the competing domestic products. Thus, it is necessary to employ analysis of demand to allow for (1) substitution between products with different origins, and (2) duration of impact of food safety threat.

13.2 Empirical methodologies

This study attempts to evaluate the change in Japan's demand for poultry product imports in response to various SPS regulations using monthly data of price and quantity of poultry products since 1988.

In regards to residue limits for pesticides and veterinary medicines, we will focus on chemicals that are most infectious and chemicals whose maximum residue limits were altered during the studied period. In addition, we will examine the impact of the introduction of the positive list policy which is thought to have had a significant impact on imports as a number of unlisted chemicals became restricted upon its enactment.

In the case of infectious diseases, trade bans led to a complete cessation of imports when they were imposed on the entire group of poultry products from the targeted country. The resulting absence of data under no trade limits our analysis, so we estimate a hypothetical amount for imports that would have resulted in the absence of an import ban by using international prices for the same products. Then, we predict import quantities under alternative scenarios such as the adoption of region-based schemes for poultry meat as well as total elimination of the ban. Here we consider the consumers' reaction in response to imports from ex-infection countries when analyzing the case of total elimination of the ban.

We employ the Source Differentiated Almost Ideal Demand (SDAIDS) model as the estimation framework for the demand analysis by regarding imported produced poultry meat from different origins as imperfect substitutes. The SDAIDS model was proposed by Yang and Koo (1994) and it extends Deaton and Muellbauer's (1980) AIDS model by allowing for differentiation of products by countries of origin. The expenditure function is rewritten to reflect the preference of importing country consumers over different origins:

$$\ln[E(p,u)] = (1-u)\cdot \ln[a(p)] + u\cdot \ln[b(p)],$$

where $\ln[a(p)] = \alpha_0 + \sum_i \sum_h \alpha_{ih} \ln(p_{ih}) + \frac{1}{2}\sum_i \sum_j \sum_h \sum_k \gamma^*_{ih\,jk} \ln(p_{ih})\ln(p_{jk})$,

and

$$\ln[b(p)] = \ln[a(p)] + \beta_0 \prod_i \prod_h p_{ih}^{\beta_{ih}} ,$$

where α, β and γ^* are parameters, u = utility level and p = prices. The subscripts i and j denote goods (chicken meat, duck meat, turkey meat, etc.), h denotes the origin of good i, and k denotes the origin of good j. We can obtain the import share equations for each of good-origin pair, w_{ih}, by taking derivatives with respect to log price for a given good-origin pair.

$$w_{ih} = \alpha_{ih} + \sum_j \sum_k \gamma_{ih\,jk} \ln(p_{jk}) + \beta_{ih} u \beta_0 \prod_i \prod_h p_{ih}^{\beta_{ih}} .$$

By using the above equations along with food-safety related variable for type s, z_{sik}, we can obtain an estimable SDAIDS model with relevant restrictions on the technology parameters:

$$w_{ih} = \alpha_{ih} + \sum_j \sum_k \gamma_{ih\,jk} \ln(p_{jk}) + \beta_{ih} \ln\left(\frac{E}{P^*}\right) + \delta_s z_{sik} ,$$

where

$$\ln(P^*) = \alpha_0 + \sum_i \sum_h \alpha_{ih} \ln(p_{ih}) + \frac{1}{2}\sum_i \sum_j \sum_h \sum_k \gamma^*_{ih\,jk} \ln(p_{ih})\ln(p_{jk}) .$$

We will extend the Yang and Koo (1994) SDAIDS model such that it can test the impact of food safety threats and SPS regulations. While their SDAIDS model does not incorporate variables associated with food safety threats and SPS regulations, our model includes those variables to serve as demand shifters. Piggott and Marsh (2004) incorporated variables associated with food safety information in their domestic demand analysis of meat products. Their Generalized AIDS model allows one to include food safety information variables. We will incorporate domestically produced poultry meat in the SDAIDS model as well, and regard imported and domestically produced goods as imperfect substitutes as was done inWinters (1984a, 1984b), for example.

Once the SDAIDS model is estimated, we will demonstrate the decline of import demand due to influenza-related bans and other SPS regulations. The impact of region-based regulatory schemes and the total elimination of the bans on poultry meat imports from Europe can be estimated. Also, the amount of increased imports from other origins such as Thailand, China and Brazil can be estimated as well. In the case of zero imports due to a ban for an entire country of origin, we will simulate the normal import amount that would have occurred had there not been a ban. We will also demonstrate changes in welfare associated with selected food safety regulations based on the estimated parameters.

13.3 Data

We will employ monthly data of poultry meat import from Trade Statistics of Ministry of Finance from 1988 to 2010. We categorize products into “chicken meat”, “turkey meat”, and “duck meat” based on Japan’s Harmonized System (HS) Code: namely, HS code from 020711000 to 020714220 for chicken meat, 020724000 to 020727200 for turkey meat, and 020732100 to 020736220 for duck meat. Due to missing data, inclusion of all countries is not possible. Therefore, exporting countries will be selected based on data availability and import share. Among the EU countries, France and Denmark will be chosen, and among the rest of the World, China, Brazil, the United States and Thailand will be chosen. Data on domestic sales of poultry meat will be obtained from the Agricultural and Livestock Industries Corporation in Japan. Data on import suspension due to avian influenza will be obtained from the Animal Quarantine Services of Ministry of Agriculture, Forestry and Fisheries of Japan. Data on other SPS regulation will be collected from several sources including the publicized MRLs on pesticides and veterinary drugs, and Lexus Nexus.

14- Impact of non tariff barriers on competitive edge of European imports of vegetables and fruits to Russia

D. Rylko, N. Karlova

This research aims at estimating the economic impacts of Russian NTMs on imports of fresh apples and tomatoes from the EU and other countries.

Among NTMs, which strongly complicate imports of fresh fruits and vegetables (common term: fresh produce) into Russia one can distinguish the following:

- The Russian threshold requirements on residues of pesticides, nitrites, heavy metals, etc. are in many cases established on much lower levels compared to its trading partners.
- Heavily complicated procedure of customs clearance at the points of customs control, which is especially harmful for fresh produce commodities, having short shelf life. It results in delays of getting import permits (which causes spoiling or shrinking economic value of the cargo), as well as in the requirement of getting another permission if the cargo is moved to another Russian region.
- Customs value indicative levels are often established on levels much higher than real market prices. It causes VAT overpayment. As a result most price competitive suppliers lose their competitive advantages.

The impact of these measures is obvious, as well as the economic costs, which, at the end are shifted towards the final user (consumer). NTMs policies and administrative practices in the field of fresh produce imports finally result in higher consumer prices.

Two kinds of economic impacts arise: redistribution effect and loss effect or protective effect and consumption effect.

- The redistribution effect is associated with income redistribution from consumers to producers, which competes with import.

- The consumption effect is the result of consumption shrinkage because of increase in domestic product price.

- Protective effect expresses the economic losses of the country, which emerge because of lower efficiency of domestic production in comparison with competing nations.

The technical barriers play as a tool of hidden (latent) protectionism and that is why are difficult to quantify. Russia is a special case, as many of measures are highly flexible, multi-layer, and in many cases have "target applications". Keeping in mind above difficulties, we suggest as background methodology a survey of market participants involved into the fresh apples and tomatoes Russian imports. The survey (questionnaire) will be combined with the study of activities of concrete (although anonymous) companies. To analyze and quantify the impact of NTM barriers on the price of imported fresh produce the *trade coverage ratio* will be computed.

The envisaged number of respondents is 3 importers of apples, 3 importers of tomatoes, and 2 customs brokers. The survey is targeted on the revelation of the existing import barriers, the level of their influence (on market price, volume of supply, consumers demand) competitiveness of imported apples and tomatoes on the domestic market), the role of customs brokers in customs clearance procedures.

One should highlight that under the conditions of a wide range of hidden NTMs the practice of using so called customs brokers have received a high popularity. The customs broker bears the function of customs clearance of importers' cargoes. The customs broker bears the risks and expenses of domestic customs clearance while dealing with customs and certification authorities, mostly based on personal informal connections. Thus, the services of customs brokers may be considered as an opportunity cost of overcoming hidden import barriers.

Based on the concrete example of the company involved into imports of fresh apples/tomatoes the functioning of the vertical pipeline will be exercised so that it is to be compared with the relevant practice inside EU countries. The NTM barriers will be measured and quantified in value terms per unit of product. There will be made a virtual break-down reflecting the partial shift of expenses towards the final consumer on one side and cut up of companies profits on the other side.

The index shows the relation between world parity level and domestic market price on the fresh apples and tomatoes. The index allows (at least partially) quantify the cost of NTMs. Of course, one should remember that the price difference between domestic and world parity level (in our case including transportation ands import duties) depends on numerous factors, not only NTM barriers.

While importing fresh produce in Russia the nominal customs duties amount to not more than 15%, the NTM barriers raise the domestic prices to much higher levels (preliminary observations shows that they may be compared with import tariffs). It is associated with not only technical barriers, but with application of higher indicative prices, which are much higher than real import prices.

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Table 4 : a summary of the case studies

	Partners		Product coverage		NTMs targeted		EXPORT country	IMPORT country		Methodology applied		Division of labour between teams
Meat (6 cases)												
1.1	INTA, Argentina		Beef 0201 0202		Foot and Mouth Disease status and application of regionalization principles by importers; authorization of establishments and producing areas; veterinary certification; border inspection; traffic and internal compliance. Third country effects of the 2009 EU-US settlement in the beef hormone dispute.		Argentina vs. EU (= Germany)	Russia		Gravity model of trade with dummy variables to take NTM into account.		
1.2	USYD, Australia		Pigmeat 0203		Australian quarantine regulations: revisions that settled the 2003-07 WTO dispute between EU and AU NTM data: changes to the rules over time (monthly?) specific to exporting countries and possibly also product-specific		EU (= Denmark) vs. US, Canada, (Brazil)	Australia		Estimation of a tariff equivalent which accounts for trade costs and imperfect substitution between goods of different origin. (Yue Beghin, 2009). Use of these tariff equivalents for a welfare analysis.		
1.3	UBonn, Germany Otsuki and Kimura, Japan		Poultry meat 0207, 1602-31-32-39		Import bans and requirements related to bird flu. Scenarios on alternative risk-mitigating strategies than import ban for low-pathogenic and high-pathogenic avian influenza, for cooked and uncooked meat. Example: wider application of regionalization principle in Japan to EU exports		EU vs. US Brazil China	Japan Russia		Gravity model of trade and trade and welfare analysis (Takayama and Judge type model) Source Differentiated Almost Ideal Demand System (SAIDS) model for analysing the demand of import poultry meat from different origins on the		

										Japanese market.		
1.4	CCAP, China		Poultry 0207		Assessment of the Maximum Residue Level on Coliform imposed by China on its imports and bird flu import restrictions. NTM data: Changing rules, regulations of NTM and import ban related to bird flu after China's WTO accession		EU vs. New Zealand, Australia, US	China		Estimation of a gravity model of trade with NTM indicator (MRL of coliform imposed by China) + dummy for bird flu import restriction		
1.5	RIS, India		Poultry and Eggs		Food safety standard imposed by India on poultry and egg powder.		EU vs. US Australia	India		Gravity model of trade with an index of food safety standards.		
1.6	ESALQ-SP, Brazil		Chicken		NTM data: SPS and TBT notifications and information from public and private national institutions + WTO notifications (classified and organized according to MAST -2008)		EU vs. Brazil	Russia		Estimation of gravity equations with introduction of dummies to take NTM into account.		
Dairy (4-5 cases)												
2.1	Ulaval, Canada		Cheese / dairy-based ingredients 0406 -10,-20, -30, -40, -90		Canadian compositional standards for cheese and mandatory import licensing NTM data: costs of compliance for producers (other data: trade barriers in cheese market; product composition of exports, domestic market structure in production and processing)		EU Vs. New Zealand Australia US	Canada		Partial equilibrium model with cheese products differentiated according to the country origin (Armington assumption)		
2.2	U of Otago, New Zealand		Cheese 040690		Overall non-tariff measures, not NTM-specific		EU, vs. New Zealand, Switzerland, Australia	US		Gravity model of trade to compute tariff equivalents on NTM. Use of these tariff equivalents in GTAP CGE model for trade and welfare analysis.		
2.3	SAU, Slovakia		Dairy		Maximum residue levels for veterinary drugs and pesticides. Russian standards		EU	Russia		NTM data: selection of relevant NTMs on basis of		

					are not bound by WTO principles and more stringent than international recommendations. Other issue: policy support for Russian dairy farming.					questionnaire and interviews with exporters and regulatory agencies, including a ranking based on perceived compliance cost. Gravity model of trade to compute tariff equivalents CGE model to carry out welfare and trade simulations.		
2.4	CCAP, China		Dairy 0401- 0406		Assessment of the Maximum Residue Level on Coliform imposed by China on its imports and bird flu import restrictions. NTM data: Changing rules, regulations of NTM and import ban related to bird flu after China's WTO accession		EU vs. New Zealand, Australia, US	China		Estimation of a gravity model of trade with NTM indicator (MRL of coliform imposed by China)		
join 1 of above	WUR (LEI), Netherlands		Dairy ?		To be determined		To be determined					

Fruits & vegetables (4 cases)												
3.1	IKAR, Russia		Apples 0808 Tomatoes 0702		Russian requirements on pesticide MRLs and other contaminant limits including conformity assessment procedures (pre-listing of products and firms, certificates or origin), phytosanitary rules, customs clearance procedures (time as a trade barrier), transaction costs for trade within the Russian federation.		EU	Russia		Survey-type approach. Quantification of the NTM cost by comparison of the world price and domestic price and computation of a *trade coverage ratio.*		
3.2	Virginia Tech, USA		Citrus 0805		US, EU and other importers' phytosanitary requirements, primarily related to control for citrus canker, medfly and other citrus pests. Equivalence of measures; effects of revised regulations NTM data: Datasets on US import requirements and requirements faced by exports developed by VT, Purdue University and USDA; country regulations		Spain vs Argentina and other southern hemisphere countries, US and others	US, Japan, EU and others		Partial equilibrium model with 3 blocks (production, consumption and imports on the US citrus market)		
3.3	INTA, Argentina		Lemon 080550		US phytosanitary requirements, primarily related to control for Mediterranean fruit fly, huanglongbing (citrus greening) and other pests/diseases. NTM database: USDA/APHIS documents		Argentina vs. EU (Spain)	US		Gravity model of trade with dummy variables to take NTM into account.		
3.4	INRA, France		Apples and pears 0808		Maximum Residue Level of pesticides on apples and pears.		EU vs. Argentina, Brazil, Chile, China, New Zealand, South Africa	Australia, Canada, Japan, Korea, Mexico, Russia, US.		Gravity model of trade with a MRL of pesticides index.		