Lowering of SPS settings to international standards offers big gains all round: The case of Vietnamese pork trade

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Abstract

Analysis of trade-constraining costs and any counter-balancing domestic-benefits of stricter SPS-settings than global WTO-standards have generally been undertaken partially. An example is the analysis of the more obvious exporter costs from prospective importers' settings constraining market access. An example from the other side of the trade is the costs to a prospective importer from imposing stricter SPS-settings against exporters. But as with all trade constraints, there are costs on both the imposing country and prospective importers which offer the opportunity for trade liberalisation, unilaterally or more generally in the likely situation of the prospective trading partners also applying SPS-constraints, to deliver large net gains to all countries involved in the resultant trade. To fully measure these gains requires a CGE-approach to capture the significant gains from restructuring and the more efficient allocation of resources, ignored in a partial approach. Vietnam has strict SPS-settings applied to many of its internationally-competitive commodities (e.g. aquaculture and livestock) by some countries wanting to protect their inefficient commodities, and applies some of its own. Vietnam, along with its major trading-partners, is used in a case-study of the issue in respect of Maximum Residue Limits for pork, and development of options off the evidence-based policy analysis such as CGE-modelling and Cost-Benefit.

Keywords

Evidence-based policy analysis, CGE modelling, Sanitary and Phyto-sanitary, Vietnam, Pork

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Introduction

Sanitary and Phyto-sanitary (SPS) measures are rules and procedures that governments use in attempting to ensure that foods and beverages are safe to consume, and to protect animals and plants from introduced pests and diseases. Governments' roles can be rationalised through the (global) public goods aspects of disease and pest control, and the opportunity to reduce costs (Josling et al 2004). International SPS food safety standards are set by agencies like the Codex Alimentarius Commission (known as Codex) with the objective to protect human health and the environment. The standards are not mandatory, and the WTO requires risk-related scientific justification if stricter than international standards create an unnecessary constraint to trade, this last aspect bringing a narrow view of economics into the commitments.

Broader analysis of the economic benefits of the trade compared with any economic costs from the SPS risk associated with a more open system, provides a useful counterweight to pressures for trade-related regulations, either too restrictive or too lenient (Josling et al 2004). Another way of saying this is that the trade-off between the costs of constrained food trade and any associated food safety benefits should be a key issue in the SPS-arrangements (Otsuki et al 2001). The stated benefits of SPS-settings would appear to be basically met by Codex etc standards but the costs continue to increase with stricter settings. Otsuki et al (2001) show health benefits from some stricter European food safety standards would save only two Europeans in a billion per year but that this was at a cost of $670m in African exports, income that could be used to save a much greater number of African lives.

Some countries' SPS-settings at which they will consider imports are weaker than global ones, supporting that the global settings are an acceptable upper bound for international trade. It is often not sensible for countries to have harmonised domestic and international standards, especially on an economic basis which takes into account countries' different costs and benefits of harmonisation (Josling et al 2004).

In terms of countries' strictness, some Australian settings are 20 times higher than Codex (Chen et al 2008) and Australia made a large number of nominations under the SPS-Agreement. "Strict" or "strong" SPS arrangements (DPMC 2014) should not be confused with "best" which happens in some descriptions of Australian SPS-arrangements. More stringent SPS-settings with associated higher product prices could actually increase the risk of disease through encouraging smuggling, complacency with lower precautionary spending (e.g. the UK leading up to the last FMD outbreak) and industry responsibility, as well as lower natural immunity from greater isolation (CIE 1988), plus constrain opportunities of developing new industries such as with introduced Merinos centuries ago. A similar relationship was observed with higher protection of the poultry sector leading to a greater probability of experiencing an AI outbreak (Trewin 2009). As well as broader costs in stricter SPS-standards, there are broader benefits from lowering these to international standards in an analysis of the trade-offs in SPS-arrangements. For example, there could be benefits for domestic consumers from cheaper but still safe imported products. Domestic producers, say in developing countries like Vietnam, might be better off concentrating on their own market where they are more competitive if it had lower standards rather than bearing additional costs to access stricter standard overseas markets. The same might apply to international markets, for example Vietnam and Russia trade products like meats at lower than international standards (Perry et al 2005). Finally, other "non-strict SPS" domestic producers could benefit from the lowering of all SPS-standards to global levels

through the reduced threats of retaliatory actions on market access, as well as through lower input and other costs.

Analysis of the trade-constraining costs and, less often, any counter-balancing domestic-benefits of stricter SPS-settings than global WTO standards, have generally been undertaken partially. An example is the analysis of the more obvious export country costs from prospective import countries' settings constraining market access (e.g. Chen et al 2008). An example from the other side of the trade is the increased product prices to a prospective importing country from imposing stricter SPS-settings against exporters (e.g. James and Anderson 1997).

But as with all trade constraints, there are costs on both the imposing country and prospective import countries which offer the opportunity for trade liberalisation, unilaterally or more generally in the likely situation of prospective trading partners also applying SPS-constraints, to deliver large net gains to countries involved in the resultant trade (Otsuki et al 2001). To fully measure these gains requires a CGE-approach to capture the significant domestic gains from restructuring and the more efficient allocation of resources, ignored in a partial approach. Partial-equilibrium welfare-analysis is applied by James and Anderson (1997) but it was noted that CGE-analysis would be more comprehensive.

Vietnam has strict SPS-settings applied to many of its internationally-competitive commodities (e.g. aquaculture, livestock, fruit and vegetables) by some countries wanting to protect their inefficient commodities, and applies some of its own. Pork is chosen as the case study in this paper as Vietnam faces SPS-measures with its exports and appears to apply some of its own to pork imports (Boyer 2012). Vietnam SPS-standards are supposed to be harmonised with ASEAN ones which in turn are linked to Codex but Boyer (2012) suggests there are examples of Vietnam constraints aimed at protection, especially with trade from the US. For this reason, although the situation of Vietnam pork exports only facing constraining SPS-measures is the main analysis, that of its pork imports also facing constraining SPS-measures is analysed as well by modelling a shock that takes imports back to pre-2008 levels when they were thought not to be constrained by SPS-measures.

The next section of the paper provides some key background of SPS-arrangements. This is followed by a section on the methodologies used in the analysis of SPS-arrangements, in particular CGE modelling as used in this paper. Analysis of the pork sector is then presented followed by the results the analysis. The final section presents conclusions, including some qualifications on the analysis, plus some discussion of policy options and future research.

Background on SPS-arrangements

Governments (and international agencies like Codex) roles in SPS-arrangements can be rationalised through the (global) public goods aspects of disease and pest control, and the opportunities to reduce economic costs (Josling et al 2004). Externalities exist which governments could address through their involvement in the market, like reducing informational asymmetries between consumers and producers (Korinek et al 2008). However, standards can also restrict rather than facilitate trade by preventing trade that consumers have a demand for but does not meet the set standards, and by adding costs to the trade. SPS-arrangements are based on science as well as economics, needing to be the least trade distorting if they do not follow international standards. Taking account of the trade-offs of net economic benefits of trade versus any economic costs from risk or market information failures linked to

a more open food systems, including forgone trade, is a useful counterweight to pressures for trade-related regulations, either in terms of addressing trade that is too restrictive or too lenient (Josling et al 2004). Unilateralism should dominate and international standards should only be adopted if this results in an increase in national welfare, not because it might result in greater market-access if others also adopted domestically the international standard. Cost-Benefit Analysis (CBA), even as a framework rather than a formal analysis, is a useful tool in an economic assessment of SPS-arrangements. However, national regulators are challenged to build on the legal aspects of SPS-arrangements and undertake CBA that might determine if the import protocols are economically defensible (see James and Anderson 1997 for a CBA that showed Australia's banana imports protocol was not economically defensible). Such a broadening of the narrow risk analysis approach for SPS-measures, in conjunction with a greater focus on safe food regulations regardless of their source, could be the start of a positive move towards opening up markets, expanding the supply of safe and cheaper foods, as well as lessening disputes.

Economic concerns like on the competitiveness of imported products are rightfully not an aspect of SPS-arrangements, though many seem to be operated as though they are. Take the case of Fijian fresh ginger imports to Australia. Fijian authorities requested the right to export fresh ginger to Australia in 2003 (Morgan 2013). It took a decade before an import risk analysis was completed which approved the importation to Australia of Fijian fresh ginger imports under certain conditions like fumigation. However, this approval was further delayed by the lobbying of an Australian Senate inquiry on the effect of these imports, including on the future of the local industry. The local industry had been unable to continuously supply domestic processors like Buderim Ginger a few years back due to a disease outbreak and they began to import early-stage processed ginger in brine. Australian processors have continued with these imports to protect their supply chain and diversify their supply risk. Prices of fresh ginger have come down as a result of the recent Fijian fresh ginger imports.

Trends in SPS-related areas include trade growing faster in high-valued products, including processed where SPS-arrangements are less applicable. But such processing is only worthwhile if the benefits from the broader market access are greater than the additional costs from the processing.

Another trend is that accepted standards are evolving in response to new "threats", such as scientific advances (e.g. GM foods), and changing consumer incomes and preferences, though the latter is generally better met more by the private sector with government facilitating the market with useful public information that would not be provided privately otherwise.

Undue harmonisation, which is increasing in line with Preferential Trade Agreements, can place limits on consumers' choices. Optimal levels of food safety vary across countries depending on their level of development, etc which implies export-oriented enclaves of international standard products might be a better approach than harmonisation across the whole country (Josling et al 2004).

There has been an increasing focus on process in SPS-arrangements which was mentioned above with respect to GM but exists in other forms like animal welfare (e.g. fishing methods requiring expensive equipment that prevents turtles being netted). This situation is more vulnerable to capture by interest groups when the products are indistinguishable in respect of the process (e.g. animal welfare processes). Objectives like animal welfare are best handled directly rather than via trade policy. Developing countries' differences, such as in intensive

versus extensive production systems offer threats (e.g. expensive equipment to prevent turtles being netted pricing them out of the market) as well as opportunities (e.g. higher-priced organic products) for developing countries.

Worryingly, protection through SPS-arrangements is also increasing as countries become more aware of the ability for them to be used for such a purpose.

Disputes over SPS-arrangements are increasing though not as significantly for developing countries that have less knowledge and resources to dedicate to this option. Compensation for a successful dispute case in the form of retaliatory tariffs is not a good outcome as it harms the injured party more than the wrong doer, imports being more important in trade liberalisation resource allocation effects than market access for exports.

Methods for analysing SPS-arrangements

Quantification of SPS-standards fall into two broad categories, namely *ex-post* methods such as Gravity-based econometric models to estimate the past impact of standards, in this case on trade flows, and *ex-ante* methods such as CGE model simulations to predict the impact of future standard regimes, like on economic welfare (Korinek et al 2008).

Quantification of *ex-post* impacts of standards on trade include frequency and coverage measures. Frequency measures of standards count the number of regulations or proportion of products or tariff line subject to standards within a given product classification, whilst coverage ones usually calculate the volume or value of imported goods subject to standards as a percentage of total imports in the product category or tariff line. These measures can give some perspective on potential trade impacts of standards (e.g. widely imposed standards are less likely to reflect underlying protectionism) but nothing on their economic size. Another *ex-post* approach of econometric estimation such as from Gravity-based models (see details below), which should include tariffs and other trade policies in their specification, is required for this last aspect. Some Gravity-modelling has included frequency and coverage measures to estimate the trade effect of SPS-standards (e.g. Fontagne, Mimouni and Pasteels 2005 – negative trade effects from standards were observed for pork) whilst others have used more direct measures of the SPS-standards when available like Maximum Residue Limits (MRLs)(e.g. Wilson et al 2003 – negative trade effects were observed for beef). The Gravity modelling can be used to estimate tariff equivalents of the standards which can then be used in further analysis such as General equilibrium modelling (see below for this and other quantitative approaches[2]).

Ex-ante simulation methods that quantify the impacts of standards on economic welfare need to explicitly model how consumers and producers respond to standard-induced price changes such as through shocks to tariff equivalents. These methods can include benefit-cost analysis associated with risk assessments along the lines of environmental decisions in the US (Korinek et al 2008). A 2006 World Bank Report shows high back-of-the envelope benefit-cost ratios for Vietnam (Vietnam benefits come from accessing high-price markets with lower associated

[2] Tariff equivalents can also be estimated from the gaps between the domestic price of imported product in the presence of SPS-measures and the World price, which does not identify specific NTMs and abstracts from possible quality difference (Disdier et al 2007).

scientific-costs) but this is from over-coming questionable/ultra-conservative scientific-based policy constraints (which could be increased arbitrarily) with scientific investment[3]. This approach should be compared with a policy change where the importers lower their stricter standards to international levels, driven by their own economy-wide gains from doing so[4], and also the option put forward in Josling et al (2004) of not harmonising with international standards, even within export enclaves, unless this raises national welfare. The World Bank (2006) estimates of Vietnam benefits ($1b) are mainly due to access to higher price markets but the estimated costs of achieving this seem low, for example the adoption of required improvements is said to add 30-50% to the cost of food. In addition, the cost of trade forgone, like the exclusion of Chinese spinach in one of the case studies, which were 40% cheaper to consumers than high price Japanese product, is not implicitly incorporated in the analysis. The 2006 World Bank research report outlined the need to develop capacity for bio-security risk analysis off the science, including benefit-cost analysis of risks to food-safety and agricultural-health, as well in prioritisation of actions, and the choice of appropriate policies. The main difficulty with this methodological approach is the uncertainty on the size of the risks and their economic impacts, for example in relation to the probability of the spread of a disease and its associated costs, and in some cases the chance and controversial value of the loss of a human life (Korinek et al 2008). Other *ex-ante* approaches include partial, as well as more comprehensive General equilibrium models that capture the effects of reallocating resources.

Vietnam, along with its major trading-partners in pork, are used in the following case-study of the SPS issue and development of options off the evidence-based policy analysis such as mentioned above, in particular General equilibrium modelling.

General equilibrium modelling

We make use of a general equilibrium model to capture the interactions in the whole economy by linking all the sectors through input-output tables and by linking all countries through trade flows. The general equilibrium model used here is GTAP[5], a well-documented, static, multi-regional, multi-sector model that assumes perfect competition, constant returns to scale and imperfect substitution between foreign and domestic goods, and between imports from different sources. By examining non-tariff changes at an industry level, it is possible to make a reasonable estimate as to their likely effects on the industry's prices and production, consumption and trade. The key step is to determine the size and nature of the shock, the *ad valorem* equivalent of the non-tariff barriers. The model is static, with no phasing in of reforms or underlying growth in the economy. The results show the impact of the policy change at a given point in time.

The GTAP 8 database has 57 sectors and 134 regions/countries, but to run the model it is necessary to aggregate sectors and regions. Here, the 57 original sectors have been aggregated

[3] This is like only considering an engineering solution to an environmental problem like salinity say, rather than cheaper economic policy ones like tradable salt quotas.

[4] See the BAE (1985) "Red Book" for an example of this "own interests" approach, in this case pointing out that reform in the CAP would lower EC unemployment.

[5] For information on GTAP, see https://www.gtap.agecon.purdue.edu/.

into 20 sectors, including eight primary and processed agricultural sectors (Appendix table A1). In GTAP, pig meat and poultry meat is aggregated into one sector. In Vietnam about 60 per cent of the non-ruminant meat exports are pigmeat and most of the rest are poultry. There are only a small percentage of other non-ruminant meats. In this application, pork is separated from other meats using the GTAP utility SplitCom. Data from TASTE is used to separate the trade flows.[6]

The 134 regions are aggregated into the major exporting and importing countries. The EU is treated as one region.

Two approaches to measuring the impact of the removal or reduction in non-tariff barriers involve measuring the deviation in quantities or in prices from what might be expected.

The gravity model quantity approach

The first method is a gravity model to estimate what level of bilateral trade can be expected in the absence of barriers. Bilateral trade is thought to depend positively on the income levels of the two countries and negatively on the distance between them. Incomes, a proxy for the size of the markets, are commonly measured by GDP, and distance by transport costs. The traditional equation, expressed in logs, looks something like:

$$\ln(X_{ij}) = +\beta_0 + \beta_1 \ln(GDP_i) + \beta_2 \ln(GDP_j) + \beta_3 \ln(D_{ij}) \quad (1)$$

where X_{ij} is the trade flow between countries *i* and j, GDP is national output in the respective countries, D_{ij} is the distance between them and β_s are estimated coefficients. This relationship does not hold exactly so there are many attempts to estimate it econometrically by identifying other factors that might influence bilateral trade such as tariffs and a common border, currency or language.[7] If trade is less than might be expected, the difference may be attributed to non-tariff measures. In the application to the beef meat trade, Wilson et al. (2003) added the Maximum Residue Limit for imports in each country, MRL_i. The equation becomes:

$$\ln(X_{ij}) = +\beta_0 + \beta_1 \ln(GDP_i) + \beta_2 \ln(GDP_j) + \beta_3 \ln(D_{ij}) + \beta_4 \ln(MRL_i) \quad (2)$$

From this, it is possible to estimate a tariff equivalent, a tariff that would have the same effect on trade flows as the non-tariff measure. World Bank (2006), Chen et al, (2008) and Kee et al. (2009) provide examples of this approach which requires an estimate of the elasticity of demand for imports. Given an elasticity, the procedure involves finding an equivalent tariff that would restrict trade to the observed level.

The approach is dependent on an appropriate specification of the model, because the NTM is assumed to be captured in the basic residual. If the model is mis-specified, due perhaps to unobserved variables, and the basic residuals contain more than the NTMs then the estimate of NTMs will be biased. The basic residuals need to capture only the frequencies, MRLs or some

[6] TASTE is a GTAP database at the six digit level. However, no data are available for inter-sectoral flows so it is assumed cost structures for pork are similar to the aggregate GTAP sector for non-ruminant meats (omt) of which pork is the most significant component.

[7] See Deardorff 1998 for a discussion of gravity models.

other barrier which is limiting trade flows. A second difficulty is that the estimate reflects the combined impact of several measures, some of which may be binding and some not. For example, if a MRL is non-binding, its removal will have no effect. If the SPS constraints are not binding then it emphasises even more the sense for all such measures to be at Codex levels.

An expanded gravity model specification provides some possible explanations of apparent inconsistencies in the data. Official data shows Vietnam exports to Hong Kong but not to China, a large market on its door step. It is possible there is some transhipment of Vietnamese pork to China through Hong Kong, and there may be some unreported trade over the shared border. However, another possible explanation is that China put a ban on products containing any tetracycline (USTR 2014) which may be the case with Vietnamese product.

The price-gap approach

A second approach to measuring the size of non-tariff barriers involves the price gap between domestic and border (CIF) prices, as followed by Cadot and Gourdon (2012). The 'law-of-one-price' stipulates that in the absence of transport costs and other barriers, an identical product should sell for the same price in different locations. The price gap approach is based on this concept. This approach requires an adjustment for transport and quality differences. This is less difficult for homogeneous primary products like rice or sugar but may be more complex for processed goods such as pork. Typically there is a problem of comparing domestic prices across countries and there are also difficulties in measuring a reference (international) price. The difficulties with this approach can be seen by comparing prices received by pork producers in Vietnam and China. China has a strict tetracycline level of 0.1 ppm whereas Vietnam has 0.2 ppm. Producer prices for pig meat in September 2014 were US$1.10/kg in China and US$1.20/kg in Vietnam, although there is much greater variation in other markets (see table 1). In table 1 we see that USA and Canadian prices are much lower than in other regions, especially after taking into account the 20-25 per cent loss in converting from live weight to carcass weight. After conversion, USA prices are about half the Vietnam prices. Are these differences due to transport costs, other SPS barriers like in Vietnam as suggested by Boyer (2007), or what? Ideally, prices should vary by no more than trade (transport and tariffs) costs and quality differences. It is not clear what determines this cost difference but it is unlikely to be just tetracycline levels. In recent years Vietnam has restricted pork imports with various SPS measures unrelated to tetracycline. Boyer (2012) lists three such measures: (i) the pork offal ban implemented in 2010; (ii) MRLs on pork offals; and (iii) zero tolerance for pathogens in pork products.

Table 1 Domestic pig prices in selected countries

Country	Domestic price (own currency)	US dollars (Live weight a lb)
USA (Iowa-Minnesota)	97.03 USD/lb carcass	$0.72
Canada (Ontario)	227.4 CAD/kg carcass	$0.75
Mexico (DF)	32.1 MXN/kg live weight	$1.10
Brazil (South Region)	4.38 BRL/kg live weight	$0.87
Russia	129 RUB/kg live weight	$1.58

China	14.83 RMB/kg live weight	$1.10
Spain	1.368 EUR/kg live weight	$0.80
Viet Nam	56,000 VND/kg live weight	$1.20
South Korea	4,731 KRW/kg live weight	$2.07

Source: Prices for 1st September 2014. Live weight prices are typically 20-25 per cent lower than carcass weight prices. The Pig Site http://www.thepigsite.com/swinenews/37628/viet-nam-hog-market.

There are three approaches to feeding NTBs into a general equilibrium model such as GTAP.

1. *Tariff equivalent*

Perhaps the most common approach is as a tariff equivalent. This implies that the "tariff revenue" is collected by the Government, and removal of the NTB will lead to a fall in "tariff revenue". The policy generates rents ("tariff revenues") which are transferred when the measure is reduced, just as with the removal of a tariff. This is appropriate where the rents from the NTB are captured by the importing economy, such as a licensing arrangement.

To implement this in GTAP, first the tariff equivalent needs to be estimated, for example by the gravity approach or the price gap method. Next, the Altertax procedure in GTAP is used to increase the database tariffs by the tariff equivalent. This is applied bilaterally or multilateral depending on how the NTM is implemented. In a simulation, these tariffs ('tms') are removed or reduced, either bilaterally or multilaterally as appropriate, and the impacts are reported.

It is possible that the NTMs are a constraint only on developing countries that cannot meet developed country standards. In that case it makes sense to apply the tariffs on bilateral trade rather than on imports from all sources.

2. *Export tax equivalent*

An export tax equivalent is appropriate when the exporter captures the rents. This would be the case when exporters are allocated quotas, such as under the Multi-Fibre Agreement (on textiles and clothing) or exports of beef from some countries to the European Union. Liberalisation means the importer gains from lower prices and the exporter loses the rents. This is implemented in GTAP by using Altertax to impose export taxes ('txs') into the initial database and these are removed or reduced in a simulation.

3. *"Productivity shock"*

The third approach is a "productivity" shock. This is applicable where there are no rents captured, such as with many SPS, TBT and other regulatory measures which create efficiency losses. Andriamananjara et al. (2003) refer to this as institutional frictions or 'sand in the wheels' rather than productivity. Liberalisation reduces the cost of trade between two countries.

These can be implemented bilaterally or multilaterally depending on whether the barrier affects all countries or can be specified bilaterally. This can be done in GTAP by shocking the productivity variable ('ams') which is a technical change variable on bilateral imports.

Analysis

Before undertaking the CGE analysis set out in the previous section it is worthwhile presenting some basic data on the World pork market (Table 2) and Vietnam's developing place in this (Table 3).

Table 2: World main pork exporters and importers, 2014

World main pork exporters	US$m	World main pork importers	US$m
US	2,321	Japan	1,320
EU	2,150	Mexico	815
Canada	1,180	China	810
Brazil	585	Russia	460
China	275	South Korea	440
Chile	165	US	430
Mexico	120	Hong Kong	350
Vietnam	40	Canada	210
Australia	37	Philippines	190
Belarus	22	Australia	185

Source: FAS USDA.

It can be seen from the table that many of the world's major exporters like the US, Canada, China, Mexico and Australia are also major importers of the general product of pork (imports are greater than exports for the last three mentioned countries). This product aggregation hides a trade of different specialist sub-products between these countries. Vietnam which is included amongst the World's major exporters has also been a significant importer in terms of its market size but these imports were generally of higher quality pork products (e.g. hams) from the US, Canada and the EU as well as some lower quality products from China. Japan, South Korea, Hong Kong and the Philippines are unable to supply their own strong demands for pork products and are thus just major importers. The EU and Brazil are mainly exporters who are able to supply their domestic markets with most of their pork product needs.

Table 3: Vietnam trade in pork products ('000 USD)

	2008	2009	2010	2011	2012
Exporters to VN					
World	22,267	3,089	1,699	14,747	6,884
US	12,336	2,471	1,240	5,149	3,978
Canada	9,269	568	320	6,143	2,020
Spain	18	0	0	1,242	571
France	0	0	74	820	128
Poland	0	0	0	0	78
Importers from VN					
World	53,040	38,541	32,353	51,100	60,012
Hong Kong	40,203	29,858	28,136	43,288	50,669
Malaysia	8,589	6,362	3,480	3,592	6661
Singapore	0	0	172	3,852	2,260
Macau	0	0	0	0	221

Thailand	0	0	0	90	134

Source: Trademap.

Pig products are both imported to and exported from Vietnam. The table shows that Vietnam imports declined significantly after 2008 and have subsequently risen in 2011 and declined again but have not reached the 2008 level as yet. Canada had some constraints on US breeding stock that Vietnam might have also had concerns about and favoured Canadian over US imports in some of the later period when they also ramped up their engagement with Asian markets (at the expense of the US) following US constraints on their trade[8]. Vietnam's main exports to Hong Kong also declined after 2008 with product going onto the domestic market but have risen back up again to past 2008 levels through increased domestic production. Singapore appears to be a developing market. As can be seen from the final year in the table, some $60 million in pig meat was exported in 2012, of which $51 million went to Hong Kong, $6.6 million to Malaysia and $2.3 million to Singapore. The exports are mostly carcasses and half-carcasses of suckling pigs (HS 020311 and 020321). Imports amounted to a much smaller $6.9 million in 2012, mostly from the USA, $4.0 million, and Canada, $2.0 million. The imports are hams, shoulders and cuts thereof, with bone in (HS 020312).

Vietnam faces zero tariffs on pork exports to Hong Kong, China and Singapore. However, Vietnam would face high tariffs exporting to Japan (85 per cent) and the EU (25 per cent). Vietnam itself has zero tariffs on pork imports from the USA and Canada.

Vietnam imposes and faces sanitary and phyto-sanitary (SPS) as well as technical barriers to trade (TBT) constraints on its pork trade. Vietnam does not export to any developed country, although it has the advantage of being a low wage country and is competitive in several agricultural products including rice, coffee and cashews. In the livestock area, Vietnam is internationally competitive in shrimp and catfish, but not poultry, nor, it seems, pig meat[9] though it has a niche market in suckling pigs to Hong Kong. Moreover, the World Bank (2006) states its competitiveness needs further study (also studied by FAO and ILRI) as fundamentals suggest it should have a comparative advantage in pigs but it lacks competitiveness through high production costs (estimated by MARD as 60 per cent higher than Thailand), mainly in feed.

Nonetheless, the question remains as to whether Vietnam is kept out of developed country markets by onerous or spurious SPS measures. Examples include catfish exports to the USA, where the USA imposed anti-dumping duties prior to Vietnam joining the WTO and subsequently.

[8] The US recently introduced mandatory Country of Origin Labelling (COOL) requiring records on where animals were born, raised and slaughtered (WTO 2015), which raised Canadian costs such as from segregation, record keeping and domestic uncertainty to an estimated nearly $C1b and halved Canadian exports to the US. Such labelling, justified on informing US consumers, is generally best undertaken privately (Josling et al 2004). Canada has won various WTO dispute settlement on the issue but the policy remains in place.

[9] The terms pig meat and pork are used interchangeably. They refer to HS Code 0203.

Vietnam has also been accused by the USA and the European Union of imposing unreasonable SPS limits on pig offal imports.

To illustrate the impact of specific SPS regulations, we examine the use of tetracycline in the international pork trade and the potential impact on Vietnam of harmonising international standards. Tetracycline is an antibiotic used to promote growth in livestock. Antibiotic use in livestock is a concern because it may lead to antibiotic-resistant pathogens. This may lead to consumers acquiring bacteria which are resistant to antibiotics, though the estimate of the number of deaths this would cause is low (Wilson et al 2003). The question remains what level of particular drugs or contaminants may be safe. Codex sets these standards (Codex 2012), but they are merely guidelines. Many countries prefer to set their own, mainly higher standards.[10] While there are arguments in favour of a single standard, there are also arguments supporting countries setting their own standards which reflect their perception of risk, and the costs and benefits of accepting international standards (Josling et al 2004).

The current standards for tetracycline were revised in 2003. The standards are the same for all mammals, so the MRLs for pig meat are the same as for beef. However, there is a distinction between the types of meat. Muscle is distinguished from fat, liver and kidneys. The Codex limit for tetracycline in mammals is 0.2 parts per million (ppm) for muscle meat, 0.6 ppm for liver/kidney and 1.2 ppm for fat. Most countries follow Codex, although the European Union has half the limit (0.1 ppm), as does Australia, Chile, Malaysia, Hong Kong and China. At the other extreme, the USA has 2.0, ten times the Codex limit (Table 4).

Table 4: Tetracycline standard in Pork (muscle) by selected importing country

Importers	**Standard (ppm)**
Australia, Chile, China, EU, Hong Kong, Malaysia	0.1
Codex, Canada, India, Japan, Korea, Latin America, Mexico, Middle East & North Africa, Other ASEAN, Other Asia, Other developed, Philippines, Rest of World, Russia, Singapore, Sub-Saharan Africa, Vietnam	0.2
USA	2.0

Source: USDA/FAS http://www.mrldatabase.com/default.cfm?selectvetdrug=1, Codex (2014)

Wilson et al. (2003) examined the use of tetracycline in the international beef trade. They used a gravity model to estimate the relationship between restrictiveness of the standard and the trade flows. Their estimated coefficient implies that a 1 per cent decrease in the stringency of the standard increases trade flow by 0.59 per cent. They then use this coefficient to show what

[10] The terms 'high' and 'low' with reference to standards may be confusing because standards vary inversely with MRLs. Here, high standards refer to low (i.e. restrictive) MRLs.

might happen to bilateral and global trade if all countries reverted to the Codex standard of 0.2, or followed the EU standard of 0.1.[11]

Commented [r1]: Standard was for liver.

As noted, tetracycline standards are the same for pigs and poultry as for beef. Here, we analyse the impact of harmonisation of MRLs on the international pig meat trade from the perspective of Vietnam by using a general equilibrium model to capture the trade and inter-sectoral effects. We use the elasticity estimated by Wilson et al. (2003), 0.59. This is not strictly legitimate because the trade flows differ, but the approach serves to illustrate the sign and magnitude of the impacts. Our results should be regarded as illustrative rather than definitive. Further research will consider estimating a more specific elasticity for the current pork trade from a gravity model.

Harmonisation of standards scenario

We model the harmonisation of all more restrictive standards to the Codex level. This implies raising the MRLs in countries with levels lower than Codex. These countries are the European Union, Australia, Chile, Malaysia, Hong Kong and China. We do not reduce the USA standard down to the Codex level. It is currently ten times the level, and the only country for which we have data with a level greater than Codex. Current levels are shown in Table 4.

SPS constraints are normally regarded as multilateral, in that one set of standards applies to imports from all sources. However, in some case some exporters are locked out because they suffer from a particular characteristic that singles them out, such as the presence of swine fever or blue ear. In such a case, reducing the severity of the restriction may help just one country, to the detriment of its competitors. In this application, some exporters, such as Chile and Australia, have strict standards (0.1 ppm) so these counties do not benefit when an importer with similar standards shifts them to Codex levels. For example, Australia exports a small amount of pork to Hong Kong, which has the same strict standard of 0.1 ppm. If Hong Kong raises its MRL to the Codex level of 0.2, Australia loses out to countries that can now more easily meet the Codex standards at lower prices. These trade diversion effects can be important. These effects are identified in a global trade model.

The shock in each case is a 0.59 per cent increase in imports for each change of 1 per cent change in the MRL. In each case the MRL is increased by 100 per cent from 0.1 ppm to 0.2 ppm. Thus the percentage change in bilateral imports is 59 per cent. This means that there is an increase in imports in Chile, Australia, China, Hong Kong, Malaysia and the European Union. In the scenario, the shocks are applied bilaterally and only apply to exporters that have higher MRLs. The USA is the only country with less restrictive MRLs than the Codex limit. The USA is primarily an exporter and imports only from NAFTA members Canada and Mexico, and the European Union and Chile.

Easing of Vietnamese SPS restrictions scenario

Imports of pork into Vietnam fell by two thirds from 2008 to 2012. This corresponds with Vietnam imposing SPS restrictions thought not consistent with Codex (Boyer 2012). These

[11] Wilson et al. (2003) refer to a Codex standard of 0.6 which is for liver. The current standard, since 2003, is 0.2 ppm for the main trade of muscle meat, with higher levels for fat, liver, kidneys and offal.

measures are described above on page 9. They act as a quantitative restriction, by essentially banning several types of pork imports, such as offal. The scenario involves doubling pork imports from the USA to Vietnam to take them back to somewhere near 2008 levels. This is modelled in two ways, depending on whether we assume that rents are captured or dissipated. The first involves reducing the US-Vietnam bilateral tariff equivalent of 21 per cent to 6 per cent. The second involves reducing the trade costs on pork imports between the two countries.[12]

SPS restrictions are supposed to apply multilaterally, but they can be manipulated to affect one or selected suppliers. While this was not necessarily the case with Vietnam's SPS restrictions against pork, the scenario serves to illustrate the effects of bilateral versus multilateral restrictions, and the impact on welfare or rents.

Results

We first show the trade, output and welfare effects of harmonising stricter SPS standards to Codex ones on the pig meat trade (Table 5). The trade effects are threefold. There is an increase in imports into countries that raise their MRLs. There is an increase in exports from countries that previously could not fully satisfy the stricter standards. Finally, there is some trade diversion away from countries with stricter standards that now face competition from exporters with international standards.

The major change in imports occurs in Hong Kong. Its imports of pork increase by 59 per cent from the USA, Canada, Vietnam and Latin America (Brazil), as determined by the shock, but imports from other countries decrease by 82 per cent. The estimated increase in Hong Kong national imports is only 23 per cent, as shown in the first column.

There are also increases in imports in Australia, China, Chile and the European Union, as determined by the shock. For the European Union the percentage increase is deceptively small, because the increase in imports is diluted by intra-EU trade.

The exporters to gain include the USA, Canada, Vietnam and Latin America. The size of the gains depends on the share of their exports going to the liberalising countries. There is also some trade diversion. For example, Vietnam increases exports to Hong Kong and Malaysia by 59 per cent, but this requires a decrease in exports to other destinations, so the increase in Vietnam national exports of pig meat is 55 per cent. The increase in global exports of pig meat is 1.1 per cent.

The effects on national output are marginal with the exception of Hong Kong and Vietnam. In Hong Kong the imports displace local production to some extent. The change in output, -52 per cent, appears significant, but the initial levels of output are low. Hong Kong is only 16 per cent self-sufficient in pig meat. In Vietnam the estimated increase in output is 10 per cent. This is necessary to provide the additional exports to Hong Kong.

[12] In GTAP, this involves increasing the bilateral productivity parameter 'ams'.

The increase in annual global welfare is $398 million, taking into account the inter-sectoral effects.[13] The major beneficiaries are the exporters USA and Canada who enjoy positive terms of trade effects, and importers Hong Kong and China who have cheaper imports, along with Australia and Chile, traditional exporters. However, China loses some of the Hong Kong market. Vietnam gains $9 million[14]. There are marginally negative effects on the European Union, Korea and Mexico.

Table 5: Estimated impacts on pig meat sector of harmonising MRL for tetracycline

Country	Imports	Exports	Output	Welfare
	%	%	%	$m
European Union 27	0.17	-1.12	-0.31	-6.6
USA	0.02	7.86	0.92	102.2
Canada	0.5	4.93	2.3	24.1
Australia	37.15	-0.81	-3.88	25.5
Japan	0	-56.48	-0.03	0.2
Other developed	0.02	-0.26	-0.01	0.3
Korea	0.01	-3.1	-0.01	-2.5
China	29.69	-52.32	-0.76	82.2
Hong Kong	22.57	0.16	-51.74	128.7
Russia	-0.01	-0.11	0	2.6
India	0.01	-0.02	0	-0.2
Vietnam	0.35	54.91	9.64	9.0
Malaysia	1.26	0	-0.2	0.2
Singapore	0.04	-1.43	-0.05	-0.1
Philippines	-0.02	-0.01	0	0.3
ASEAN	0	-16.86	-0.06	-1.4
Other Asia	-0.01	-9.1	-0.02	-0.5
Mexico	-0.03	-0.02	0	-3.1
Chile	87.04	0.11	-4.57	13.4
Latin America	0.04	8.52	0.5	20.1
Middle East and North Africa	0	-1.64	0	1.0
Sub Saharan Africa	0	-0.01	0	1.1
Rest of World	0	-0.07	0	1.5

[13] This welfare estimate does not take into account the possible negative effects of a higher MRL though estimates of deaths from higher levels are relatively small (Wilson et al 2003).

[14] Relevant GTAP welfare effects are due mainly to terms of trade ones ($6.5 million) but these are not significant in pork. Allocative efficiency-wise, there is a slight move out of beef to increase pork production but most of the gains in the sector are from the "productivity" improvement.

World	1.06	1.09	-0.07	398.0

Source: GTAP simulations.

The second scenario involves removing an unspecified SPS restriction that affects bilateral imports only. The shock is a fall in the bilateral tariff or in trade costs that increases bilateral pork imports from the USA by 100 per cent. Results for the two approaches are shown in table 6. The main difference is in national welfare. In both cases, total pork imports into Vietnam increase by much less than the 60 per cent that would be expected if there were no trade diversion. However, there is around a 40 per cent fall in imports from other sources (EU, Canada and Australia). In other words, consumers switch away from other supplies as cheaper imports from the USA become unconstrained. This highlights a feature of SPS constraints that is sometimes overlooked. There are substitution effects. In this case it is away from other suppliers. Total consumption of pork in Vietnam is estimated to increase by less than one per cent. There is a 6-8 per cent fall in demand for domestically produced pork.

These welfare results hinge on the assumption that rents accumulated from the quantitative restrictions are either captured by the Government, just as tariff revenues would be, or dissipated. In the first approach the rents are merely transferred from one group to another. Vietnam suffers an annual welfare loss of $1.72 million while the USA gains $5.8 million[15]. For Vietnam there are negative terms of trade effects ($3.3 million) that more than offset the allocative efficiency effects ($1.69 million).

If it is assumed that rents are dissipated initially, removing the restriction would generate welfare gains for Vietnam of $8 million. There are still terms of trade effects, but the productivity gains more than offset these. Global gains are also much greater. The essential difference is that under the first assumption the rents are transferred when the restrictions are imposed, while in the second the rents are dissipated initially. When the restrictions are removed, the initial losses show up as gains.

Table 6: Estimated impacts on Vietnam pig meat sector of removing SPS restrictions

	Rents captured (bilateral)	**Rents dissipated (bilateral)**	**Rents dissipated (multilateral)**
Imports (%)	40.0	36.1	55.6
Output (%)	-5.6	-7.2	-10.3
Welfare ($m)	-1.7	8.1	9.6

Source: GTAP simulations.

Suppose the same Vietnam SPS barriers faced all countries and were removed multilaterally rather than just bilaterally from the USA. This is shown in the final column of table 6. In this case, Vietnam's pork imports would increase 56 per cent, as opposed to 36 per cent, and welfare

[15] It should be borne in mind that the second scenario would most likely be undertaken in conjunction with the first scenario and that Vietnam's welfare effects would be a combination of those from the two scenarios, thus the welfare loss of $1.72 million would become a welfare gain of $7.28 million in this situation.

would increase by $10 million rather than $8 million. Global gains would also increase from $12 million to $16 million.

These scenarios involve a number of strong assumptions but they illustrate several points. The first is that constraints on trade impose a cost, and that these costs are distributed across producers and consumers, some of whom may even be in other countries under bilateral situations due to substitution effects. The assumptions made about whether the constraints are binding multilaterally or bilaterally, or perhaps not at all, are also important, multilateral delivering greater welfare gains. Finally, the distribution of rents may be important, welfare increasing rather than decreasing when the rents are not transferred but dissipated with the removal of the restrictions. Vietnam can benefit in welfare terms with the right liberalisation of trade constraints.

Conclusion

Australia, Chile, China, the European Union, Malaysia and Hong Kong have stricter MRL limits for tetracycline in pork that are half the recommended Codex level. Assuming an import elasticity of 0.59, the estimated benefits accrue to importers that raise their MRLs to international levels and to exporters like Vietnam that can take advantage of the raised levels. These exporters have Codex or less stringent levels themselves. Some exporters lose market share because they now face greater competition but generally the country gains in welfare terms from cheaper imports. Globally, there are welfare gains of around $400 million from increased trade, including for Asian and Latin American developing countries, but this ignores any benefits from a stricter MRL though these have been shown to be small in terms of lives saved (Wilson et al 2003).

We have seen no full cost-benefit analysis of the tetracycline standards, so it is difficult to estimate the benefits of more restrictive standards, or the costs of relaxing them. Otsuki et al. (2001) looked at aflatoxin standards in the European Union and concluded the benefits were extremely small, a saving of 1.4 lives per billion per year. Wilson et al (2003) did a similar analysis on tetracycline and quoted a report of the Institute of Medicine in the US which stated that "the likeliest estimates of excess deaths attributable to sub-therapeutic uses of penicillin and/or tetracyclines … is in the range of 6 per year". These results lend support to the notion that policy makers may be over cautious in setting standards that are twice as restrictive as Codex levels. Each SPS situation needs to be analysed separately and in some situations such as with Foot and Mouth Disease (FMB), the costs of an outbreak in Australia's extensive livestock industry with access to premium "non-FMD" markets would appear to justify costly disease protection policies (ABARES 2013).

Some of the analysis of tetracycline MRLs assumes there are no rents captured as a result of the restrictions. Presumably there are rents generated, because pig meat prices in countries with stricter MRLs appear to be higher than in countries with Codex levels, other things being equal. The MRL acts like a quantitative restriction, but the importing Government doesn't capture the rent by auctioning quotas. For this reason we do not model the MRL reform as a reduction in the tariff equivalent. No "tariff revenue" is lost when the restriction is removed. Alternative assumptions could be that rents are captured by the importer, or perhaps by the exporter. This depends on the nature of the restriction and how it is implemented. Exporters may gain if import quotas are allocated to particular countries or firms, eliminating competition. The analysis of the Vietnamese pork imports illustrates the importance of this assumption.

A further assumption is that lifting the MRLs opens the market up multilaterally rather than just bilaterally. This means that all exporters can benefit rather than just one or so. By their nature, SPS restrictions are multilateral, but in reality they may be binding on one or more suppliers. There are numerous provisions controlling the import of pork. The level of tetracycline is only one. Pathogens and processes like those concerning animal welfare are others. If imports are restricted by pathogen levels or animal welfare related processes (that are better addressed more directly), lifting MRLs on tetracycline would make no difference. We do not have sufficiently detailed information to model the different restrictions, however, the level of tetracycline, pathogens, animal welfare etc in aggregate are likely to be binding so assuming the tetracycline ones are binding could be considered representative of the effect of the binding ones being lowered to international standards. USTR (2014) contains details from an USA perspective of the SPS measures being applied in various trading partners or potential trading partners.

A possible limitation of the analysis is the assumed elasticity of 0.59. This was estimated via a gravity model for the beef trade, and while the MRL levels in beef and pork are the same, the trade flows and elasticities need not be. Nevertheless, the estimate appears to be a reasonable starting point.

A further assumption is that there is one representative firm in each country. In reality there are numerous heterogeneous firm, some that may meet the specified standard, Codex or otherwise, and some that may not. Canada has a standard of 0.2 ppm, but some firms are able to export to the European Union by meeting its more restrictive standard of 0.1 ppm, though usually following some registration requirements.

Nonetheless, in spite of these strong assumptions, the general conclusions hold. Economics as well as science needs to have a role in SPS-arrangements. A broader economic framework is required to take into account the full costs to consumers as well as producers. Overly restrictive SPS-measures impose cost on domestic consumers and producers, and can lead to greater SPS risks. They function as a tax without raising any revenue. The analysis undertaken here illustrates the potential impacts of removing or easing some restrictions. There can be large gains from shifting international standards above Codex levels to these levels. There can also be gains, including to Vietnam, from unilaterally removing any inappropriate, protectionist SPS constraints on its pork imports. Greater transparency is required on such benefits and any associated costs to change or support societies' market perceptions.

These results do not mean there is no role for SPS restrictions, nor that all countries should conform to Codex standards. There are sound reasons why standards might differ, and countries should add up the benefits and costs of actions such as harmonisation before taking unilateral action. However, overly restrictive standards are an indication that policy makers may be attempting to protect domestic producers rather than consumers or the environment.

In this paper, only the policy options of lowering stricter standards to Codex levels has been analysed. There are many other policy options raised in the literature on SPS-arrangements. For example the World Bank (2006) pushes for Vietnam (government and private sector) to bear the high costs of meeting the stricter standards whereas the analysis in this paper would suggest a better approach would be to achieve similar gains from increased trade by countries with stricter standards lowering these to Codex levels which would be in the countries with stricter standards own interests, though overall gains would be larger if this was undertaken multilaterally. Harmonisation of standards even at more liberal Codex levels, as analysed in this paper, may not always be sensible as the optimal level of food safety, especially from an

economic perspective, can even vary across a country. This implies export enclaves may be an even better approach to that analysed in this paper (Josling et al. 2004). Some countries may be better off focusing on lower standard markets, including domestically where they are more competitive, and likely to become more so with greater international competition. However, the detailed information to undertake analysis of such an option is currently not available.

Other "non-standards" policy options include more private ones like processing, as in the case of Fijian ginger, to make some SPS constraints on raw product ineffective, along with approaches like pre-shipment inspections, and period isolations. However, such policy options require more micro-economic analysis using detailed information on changed costs, prices and so on, than in this paper's analysis.

One WTO policy aimed at assisting developing countries in adjusting to SPS measures is Special & Differential Treatment (SDT) as occurs in many other areas of the WTO agreement. However, as pointed out in Josling et al. (2004) such an approach could backfire badly on developing countries if the SDT involved allowing lower than international standard trade by giving the market a signal or perception that their trade may be inferior. It would be better if developing countries were assisted to build up their capacity to be able to fully address with SPS issues, including the setting of international standards. Another WTO policy of offering compensation for a successful dispute settlement in the form of retaliatory tariffs harm the injured party more than the wrong doer.

One general policy option would be to look at greater private sector involvement in the SPS-arrangements which currently are heavily government dominated. Who should pay the costs of SPS arrangements is an important question in SPS-approaches and generally the market would determine this as it does with any rents but there are market failures (e.g. externalities like with public health risks) that might require regulation. The market worked in the above-mentioned China-Japan vegetable trade example in that Chinese sales were down due to the bad publicity when allowed back into the market. A well-informed market could work to increase sales of wrongly perceived poor products as well and there would appear less rationale for government involvement in questions of quality and labelling (e.g. COOL) as distinct from public health (Josling et al. 2004).

If the SPS-constraints are removed will anything happen to trade? It has been said in Vietnam that they are unable to measure standards to test imports so setting them at one value or another will make little difference unlike a ban. In developed countries, often removing one constraint just leads to the introduction of other constraints, including "private" ones, for example Australian supermarkets have played the "jingoism" card with New Zealand apples and Philippine bananas, trying to appeal to an uninformed public by saying they will not sell them even if they are allowed in the country (and enjoying higher returns on margins as a result). It does not make sense to use resources on chasing such upward moving targets when the increasing costs exceed possible benefits. What is required is more transparent information (including professional societies' endorsement) showing that it is in a countries' own best interest to open up markets and have a greater focus on safe food regulations regardless of their source, expanding the supply of safe and cheaper foods.

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Appendix

Table A1 GTAP Aggregation

Sectors	**Regions**
Animal products nec	European Union 27
Pork	USA
Poultry	Canada
Cattle	Australia
Beef and veal	Japan
Rice	Other developed
Other crops	Korea
Fats & oils	China
Dairy	Hong Kong
Other food, beverages & tobacco	Russia
Resources	India
Textiles	Vietnam
Wood products	Malaysia
Manufactures nec	Singapore
Utilities and construction	Philippines
Transport and communication	ASEAN
Other services	Other Asia
	Mexico
	Chile
	Latin America
	Middle East and North Africa
	Sub Saharan Africa
	Rest of World