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New Zealand Agricultural and Resource Economics Society (Inc.)

An analysis of agricultural trade policy reforms and their impact on the EU, China and New Zealand

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An analysis of agricultural trade policy reforms and their impact on the EU, China and New Zealand

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As a consequence of global changes to trade policy, there are likely to be significant impacts on international agricultural trade. Clearly producers in the European Union (EU) will experience considerable changes to the structure of their industry, and for a country such as New Zealand, heavily dependent on agricultural exports, changes to policy and markets have the potential to significantly affect the economy. The potential competition from China in terms of agricultural commodities as well as its potential as an export destination for NZ are also important considerations. This paper presents an analysis of the impact of both World Trade Organisation (WTO) and Common Agricultural Policy (CAP) reform in the agricultural sectors of the EU, New Zealand, and China. The analysis covers the livestock sectors of these countries. The model used for this analysis is the LTEM (Lincoln Trade and Environment Model).

Keywords: Trade policy reform, agriculture, trade modelling.

Introduction

Agricultural trade policy is undergoing a series of changes in recent years, and European Union (EU) agriculture in particular. Continuing from the Uruguay Round of reforms, Article 20 of the Agriculture Agreement committed members to begin negotiations on continuing the reform at the end of 1999. The World Trade Organisation (WTO) reforms are now well under way, using Article 20 as their basis. The November 2001 Doha Ministerial Declaration sets a new mandate by making the objectives more explicit, building on the work carried out so far, and setting deadlines (WTO 2004).

The negotiations are in the "modalities" phase at present, from November 2001, at the fourth WTO Ministerial Conference held in Doha, Qatar. The declaration reconfirms the long-term objective already agreed in Article 20: to establish a fair and market-oriented trading system through a programme of fundamental reform. Members have committed themselves to negotiations aimed at improving market access; reductions of, with a view to phasing out, all forms of exports subsidies; and substantial reductions of trade distorting domestic support.

Additionally, the Common Agricultural Policy (CAP) in Europe is and will be undergoing a number of reforms, particularly regarding dairy quotas and intervention prices of dairy products (OECD 2004). Another important change occurring in the area of international trade is China's accession to the WTO. This is likely to have impacts on markets around the world, as well as China itself.

This paper reviews the current WTO round of negotiations, the CAP reforms, and a background of China's accession to the WTO. Following this review, the impact of current proposed changes in EU policy, as well as broad WTO commitments in both the EU and China, are simulated using the LTEM (Lincoln Trade and Environment Model). The impact of these changes on the EU, China and New Zealand (NZ) are then discussed.

Developments in EU agriculture and environmental policy have both direct and indirect implications for NZ. Although the importance of the EU as a market for NZ produce has diminished, it is still significant, accounting for 15 per cent of NZ's exports, particularly in high value products and commodities such as sheep meat and dairy products (MFAT 2002). Direct impacts of changes in trade policy may affect NZ's access into the EU, particularly under preferential arrangements. Indirect impacts include the influence the EU has on the outcome of WTO negotiations, particularly in relation to agriculture. Policy and market changes in the EU also affect NZ indirectly by impacting on other potential export markets. Additionally, China has recently become a member of the WTO, which may also change the dynamics of agricultural trade. The potential competition from China in terms of agricultural commodities as well as its potential as an export destination for NZ is an important consideration.

Trade Policy Reform

WTO Negotiations

The current WTO round of negotiations was relaunched at Doha in November 2001. These negotiations covered a number of important factors, especially in relation to the reduction in export subsidies, the improving of market access, the rules for domestic subsidies as well as the technical grounds for restricting trade. The further removal / reduction in export subsides and improving market access will not be without controversy and negotiation, however both the EU and the US have agreed to this in principle and began the process under the last round and subsequent policy changes. The rules governing compensation payments as well as the technical barriers to trade which are expected to be the most controversial areas of negotiation between the EU and the US. However, the EU/US trade pact, announced in August 2003, shows willingness to negotiate despite the criticism from other countries that this pact contains little detail and may not meet demands of certain groups, notably the Cairns group (Agra Europe 2003).

Negotiations towards achieving the objectives of trade liberalisation under the Doha Declaration of November 2001 are still underway. The final deadline for completing the negotiations under the Doha declaration was January 1st, 2005, however this deadline has been postponed, without a new date being set.

The Doha Declaration builds on work already undertaken in the previous agriculture negotiations, confirms and elaborates the objectives, as well as sets a timetable. As mentioned above, member states have committed themselves to comprehensive negotiations aimed at:

- Market access: substantial reductions
- Export subsidies: reductions of, with a view to phasing out, all forms of these
- Domestic support: substantial reductions for support that distorts trade (WTO 2004).

The modalities programme aims to set targets for achieving the objectives set out in the Doha Ministerial Declaration. Members failed to achieve the 31 March 2003 deadline for these modalities, but agreed on a framework in the decision of July 2004, now officially document WT/L/579. Annex A, the "Framework for Establishing Modalities in Agriculture" outlines the key features of the modalities, without going into detail. This agreement is now the working document before the negotiators. The main features of the agreement, for the three "pillars" of the Doha Round, are described below:

Export subsidies

There were a number of proposals for dealing with export subsidies, with some countries proposing the total elimination of all forms of export subsidies, while others were prepared to negotiate further progressive reductions without total elimination. One proposal involved a 50 percent reduction as an immediate down-payment, followed by an elimination of subsidies completely in three years (for developed countries) or six years (for developing countries). Another proposal was similar, however included greater flexibility for developing countries. An alternative

to this type of proposal had more moderate reductions in some products, balanced by steeper reductions on other products, without eliminating export subsidies.

The draft modalities decision on export subsidies, agreed on by the WTO in July 2004, is based on the proposals from different countries and proposes an elimination at two speeds: in five years (ten years for developing countries) for one set of products, and nine years (12 years for developing countries) for the remaining products (WTO 2004).

Market Access

Since the Uruguay Round (UR), discussion on market access has tended to focus on two main issues: the high levels of tariffs outside quotas, and the quotas themselves. The discussions in the modalities phase cover six main areas: tariffs; tariff quotas; tariff quota administration; special safeguards; importing state trading enterprises, and other issues. The two areas of interest for this paper are tariffs and tariff quotas.

Two general proposals have emerged for tariff reductions. The first is known as the "Uruguay Round approach" and would follow the formula of the UR negotiations, which used an average linear reduction over all products, allowing some variation within this, providing a minimum reduction was met. Supporters of this approach claim it is simple and flexible, while opponents doubt it would produce significant improvement in market access, and would not deal with tariff peaks and escalation.

The "Swiss formula" approach envisages a flat rate percentage reduction for all products, with additional "non-linear" reductions on higher tariffs, expanding quotas and special treatment for developing countries. This would produce much steeper cuts on higher tariffs. Critics of this approach claim it would be too ambitious, would require too much adjustment, would be too complicated and could be inequitable.

The draft modalities approach suggests a compromise between the two approaches described above. The proposal for developed countries is shown in table 1 below:

Table 1: Developed Countries: Three Bands of Tariff Rates, Cut Over 5 Years

Tariff Rate	Average cut	minimum cut for any product
90%+	60%	45%
15 – 90%	50%	35%
0-15 %	40%	25%

Source: WTO 2004

The revised first draft modalities on tariff quotas proposes expanding the tariff quota volumes to 10 percent of domestic consumption for developed countries over five years, with no obligation to reduce in-quota duties (with some exceptions). The draft also proposes some flexibility, in that one quarter of total tariff quota is allowed to increase to only eight percent, providing another quarter is increased to 12 percent.

Domestic Support
The Amber Box consists of those measures which are considered to distort production and trade. The revised first draft modalities on aggregate measurement of support (AMS) would be reduced from final bound levels by 60 percent over five years. Developed countries *de minimus* levels of support would be halved from five percent of agricultural production to 2.5 percent over five years.

Green Box subsides are those which cause minimal trade distortion, and must not involve price support. They include environmental protection and regional development programmes. It was proposed that the Green Box would be maintained, with possible amendments such as adding fixed or unchanging reference periods, tightening rules on criteria for compensation that is allowed in the Green Box, and allowing compensation for increased costs of protecting animal welfare.

The blue box is an exemption from the general rule that all subsidies linked to production must be reduced or kept within *de minimis* levels, such as payments directly linked to animal numbers or acreage. Under the current first draft on the Blue Box, current payments would be capped and bound. They would then either be halved over five years, or merged into the Amber Box (WTO 2004). The new agreement would cap Blue Box payments at five percent of the total value of each country's agricultural production (Agra Europe August 13, 2004).

It was agreed that overall domestic support ceilings (AMS plus Blue Box and *de minimus* subsidies, would be reduced by 20 percent in the first year of the agreement (Agra Europe August 6, 2004).

A reasonable outcome is expected for export subsidies (i.e. their elimination in the not-too-distant future). The outcome on domestic subsidies may also be reasonable, depending on the definitions and loopholes countries negotiate. However there is unlikely to be any movement on market access, which is where the greatest economic and welfare gains are to be made (Anderson and Martin 2005).

CAP Reform

Alongside WTO reform, the EU is continuing with the reform of the CAP. There were various reforms to the CAP, on a piece meal basis, over the 1980s. However, it was the McSharry reforms in 1992 which formed the base for future reform. Whilst these left the basic price structure in place they reduced fixed prices for cereals to, or closer to, world market levels and compensated producers with direct payments, as illustrated in table 2.

The next set of reforms was Agenda 2000. This was radical in that it not only dealt with price cuts and detailed CAP policy but also the future financing of the CAP, the structure of funds, EU enlargement; and most importantly it replaced the original objectives of the CAP with a set of objectives for a rural policy.

Table 2: EU Prices and Subsidies in the Cereal, Dairy, and Beef Regimes under the McSharry and Agenda 2000 reforms

	Mc Sharry Reforms	Agenda 2000
Cereal prices	119.19 ecu/t	101.31 ecu/t
Arable area payments	54.34 ecu/t	63 ecu/t
Beef prices	2780 ecu/t	2224 ecu/t
Suckler cow premium	145 ecu/head	200 ecu/head
Special beef premium		
Bulls	135 ecu/head	210 ecu/head
Steers	109 ecu/head	150 ecu/head
Cattle Slaughter premium >8months		80 ecu/ head
< 8 months old		50 ecu/head
Dairy Intervention price – butter - SMP		 2789.7 ecu/tonne 1746.9 ecu/tonne
Dairy cow premium		17.24 ecu
Production Quota		Quota increase by 2.39%

Source: Agra Europe: various issues.

As shown in table 2, the Agenda 2000 reform built on the McSharry reforms, with further cuts in price and increases in direct payments. The new initiatives introduced under Agenda 2000, which provided the foundation for more radical reform, included the introduction of a rural policy under the agriculture directorate.

The most radical change in Agenda 2000 reforms was the removal of the production-oriented objectives of agricultural policy established in the Treaty of Rome and their replacement with objectives for a rural policy.

The Agenda 2000 reforms were then followed by the Mid–Term Review of the CAP in 2002. Under the Mid-Term Review, cereal and dairy prices were cut further, with a corresponding increase in direct payments, building again upon the principle of the McSharry reforms. However, the Mid-Term Review (MTR) also included other changes, such as entitlement to direct payments being conditional on cross compliance, including needing to meet legislative obligations as well as good farming practice. The Mid-Term Review also strengthened policies encouraging food quality and animal welfare.

The latest changes to the MTR are the Luxembourg, or Fischler reforms of 2003. These reforms do reinforce, and in some cases increase, the price cuts agreed initially in the MTR. Thus it was proposed to further reduce cereal prices by 5 per cent, however this proposal was not adopted. Skim Milk Powder prices are to be cut by 15 per cent and butter by 25 per cent and there is to be an increase in the milk production quota of 1.5 per cent per year in 2004, 2005 and 2006.

The major part of the Fischler reforms is the introduction of a Single Farm Payment Scheme (SPS), to replace all the direct hectarage and headage payments. This is predicted to involve a transfer of funds of 9 billion ecu between 2005 and 2013. Whilst the details of how this will be achieved are yet to be determined, and will also vary across countries, it does potentially decouple support even further. The degree of decoupling will vary across countries, and the SFP does depend upon certain environmental, food safety, animal and plant health and welfare standards being met.

The actual implementation of the SFP is very complex, with each country choosing its own implementation. It seems that no two states will apply the same scheme and in the case of the UK, the four countries may adopt different schemes (Swinbank 2005). There are two main ways the SPS can vary. This first is partial decoupling to avoid desertification. Thus in France and Spain 25 per cent of payment are attached to arable aid, in Austria, Belgium, France, Portugal and Spain 100 per cent of suckler cow premiums and in Denmark, Finland, France, Greece, Spain and Portugal 50 per cent of ewe premiums paid are tied to production (Agra Europe 2004). Secondly, the payments can be regionalised so the amount of money which the farms in a region could be entitled to can be pooled at regional level and a flat rate payment paid across all the land. Or, some combination of the two can apply, for example in England 10 per cent is to be regional, rising to 100 per cent in 2012; in Northern Ireland, Sweden, Denmark and Luxembourg there will be a combination of the two schemes with no transition (Agra Europe 2004).

The impact of all these reforms, and changes elsewhere in the EU, has reduced the importance of the CAP in the EU. The CAP now only takes around 45 per cent of the EU budget, compared to 90 per cent in 1970. However, the level of taxpayer support given to agricultural commodities is still considerable at a proposed 43.613 billion ecu in 2005, with an additional 6.841 on rural development and transitional arrangements, although the extra cost to consumers has been reduced (Agra Europe 2003). Market support has thus fallen from 91 per cent of the total in 1986 – 88 to 61 per cent in 2000 - 02, while area/headage payments rose from 2.8 per cent in 1986-88 to 27.3 per cent in 2000 - 02, (Agra Europe 2004).

How these changes affect and are affected by the current WTO negotiations has yet to be seen. As stated in section 2.1, the current WTO negotiations propose a ceiling on domestic support. It will be controversial whether the single farm payment is blue or green box, with the EU arguing that the change in systems shifts the payments from the blue box into the green box. However, the details have yet to be worked through. In addition, there are calls from Australia and the G-20 countries for the definition of the green box to be challenged to ensure payments are genuinely decoupled and do not encourage farmers to produce more (Agra Europe 2004).

Table 3:EU support levels for selected products 1986-88 and 2001/02 billion ecu

	1986-88 base EU 12	AMS 2001/02 EU 15	Blue Box 2001/02 EU 15
Cereals	20117	3659	13648
Sugar	5266	5732	
Dairy	8145	5814	
Beef	18485	9709	5028
Sheepmeat	918		

The framework agreement between the EU and the US commits members to blue box payments of no more than five per cent of the value of farm production (this would restrict EU blue box payments to around 12 billion ecu). Under current proposals if the SFP is defined as green box this should not be an issue for the EU, with the EU claiming it will transfer close to 90 per cent of blue box payments into the green box, (Agra Europe 2004). Also the agreement included a reduction in the Aggregate measure of Support by 60 per cent over 5 years, with specific ceilings on support for specific products. Again, given the base year, this is not anticipated to be a problem for the EU, for example in 2001/2 the AMS was 39.3 billion ecu which was well under the ceiling of 63.1 billion ecu (Agra Europe 2005). However, this will become more problematic if the commitment on the framework agreement is held that product specific AMSs are capped at their respective average levels. This will certainly affect the EU sugar regime. The total budget for the CAP is to be a maximum 42.293 billion ecu in 2013 with only 3.6 billion ecu for market support (Agra Europe 2004)

Table 4: The EU's level of support broken down into its commitment, declared and blue and green boxes. (Million ecus)

	AMS Commitment	AMS Declared	Blue Box	Green Box	Blue box as % of agricultural production
1995/6	78672	50026	20845	18779	10.1
1996/7	76369	51009	21520	22130	9.8
1997/8	74067	50194	20442	18166	9.4
1998/9	71765	46683	20503	19168	9.6
1999/0	69463	47885	19792	19930	8.5
2000/1	67159	43654	22222	21844	9.1
2001/2	67159	39281	23725	20661	9.6

Source: Swinbank (2005)

The other pressures for reform that the EU faces are of course its commitments under WTO export constraints. In general these are not seen to be constraining for most commodities, with the exception of rice, sugar, wine, and fresh fruit and vegetables. The problems with sugar and rice regimes are being addressed under current reforms, with proposed cuts in the sugar intervention price from 632 ecu

to 421 ecu equivalent to a 50 per cent cut in MFN (Most Favoured Nation) tariff (Swinbank 2005). In the case of rice, again a 50 per cent cut in intervention price is proposed.

It must be emphasized that EU agriculture will receive some form of assistance for the foreseeable future. The direct payments seem to be the most likely form this will take. However how these will be designed to meet green box requirements will be a matter of considerable interest.

Under the Uruguay agreement the most likely justification for these, over the long-term, are as direct payments for environmental reasons, as defined in Annex 2 of the agreement. That is, payments to farmers must be based upon extra costs, or loss of income involved, from environmentally friendly farming methods, the current basis for payments under the agri-environmental schemes. This would meet a number of EU policy objectives such as helping to maintain farm incomes, reducing environmental damage and increasing positive externalities from agriculture, as well as meeting international obligations.

China's WTO Accession

China's trade policy has typically been characterised by promoting exports while protecting its domestic market and China has historically maintained tight state control over agricultural trade to control the flow of imports. However, in 1986 China applied to join GATT (General Agreement on Tariffs and Trade), (GATT was replaced by the WTO in 1995), and from 1995-1997 cut import duties on many goods[1] but maintained high tariffs on others, particularly agricultural products.

After 13 years of negotiations, the US and China agreed to the terms for China's entry into the WTO in Beijing on 15 November 1999 (Agricultural Outlook 2000). The US and China also agreed on a bilateral trade deal under which China was to reduce trade-distorting barriers and practices that fell into three main categories: non-tariff trade barriers, domestic agricultural support, and export subsidies (Tuan and Hsu 2001). In addition, China committed to establish tariff-rate-quotas (TRQs) for wheat, rice, corn, cotton and soybean oil with gradually increasing quota levels, mostly over the same period.

China joined the WTO in 2001 with commitments to further reduce trade distorting support, especially in the case of agriculture. As a consequence, China agreed to eliminate export subsidies for farm products and to cap trade-distorting domestic farm subsidies. China also agreed to eliminate sanitary and phytosanitary barriers to agricultural imports not based on scientific evidence (Tuan and Hsu 2001). The commitments on market access are to lower tariffs of all agricultural products, remove quantitative restrictions on commodities and increase access to China's markets through tariff rate quotas (TRQs) for some commodities.

Various sectors are predicted to benefit from China's WTO membership, especially the textiles-apparel sector in China. Some food and agricultural industries are also

[1] Prior to WTO accession, China never published complete import quota regulations or a description of its import quota system (Tuan and Hsu 2001).

predicted to benefit from the fall in the agricultural import costs. The sectors predicted to lose are the producers of cereals and other major crops, due to the strong expansion of imports, together with most mechanical industries (CEPII 2000). The expansion of trade between 1999-2005 is likely to be faster under accession than with no accession (50 percent growth versus 25 percent).

Literature Review

There are a number of relatively recent studies analysing the impact of either CAP reform or WTO proposed reforms, or both, on the agricultural sectors of countries and regions around the world. These will be reviewed here briefly in order to provide comparison with the analysis in this paper. Few of the studies include NZ specifically, and if they do, the agricultural sector is generally at a high level of aggregation. Rae and Strutt (2004) simulate some Doha Round proposals and do look at the effect on NZ, however the focus of the paper is on environmental results and they do not provide a detailed analysis of the trade impacts on NZ.

Anderson and Martin (2005) examine the extent to which the world as a whole, and various regions, could gain from multilateral trade reform over the next decade. They use the GE model GTAP's database, amended to account for key protection changes to early 2005, integrated with the World Bank's economy-wide Linkage model. Anderson and Martin (2005) address a number of questions, relating to the Doha round and the consequences of alternative proposals.

The authors find that the potential gains from further global trade reform are huge in terms of global welfare, with developing countries gaining disproportionately from further global trade reform. They also state that agriculture is where the cuts are needed the most, because of the high rates of assistance in that sector relative to others. Subsidy disciplines are important, but Anderson and Martin (2005) find that increased market access in agriculture is crucial. They also state that outlawing agricultural export subsidies is the obvious first step, in order to bring agriculture into line with the basic GATT rule against such measures. Domestic support bindings must be cut substantially, and agricultural tariff bindings must be cut so that genuine market opening can occur. Anderson and Martin (2005) claim that the July Framework Agreement does not guarantee major gains from the Doha Development Agenda. Even if an agreement is ultimately reached, it may only be very modest.

Moreddu *et al*. (2004) evaluate the potential impact of the CAP reform on land use, extensification, welfare, market developments and the level and composition of support, using the OECD's AGLINK model. Moreddu *et al*. (2004) find pastureland for beef cows increases by 16 percent by 2008, due to significant extensification. Dairy production increases with the increase in quota (the quota continues to bind), while the domestic butter price decreases by around seven percent. Cheese prices are predicted to fall by around two percent, while cheese production would increase by about one percent. Milk producer prices would fall by 2.6 percent.

Binfield *et al.* (2004) analyse the Luxembourg reforms of the CAP, and the European proposal for agriculture under the WTO. The Luxembourg reform introduces a SFP, with the associated significant decoupling of payments from production. The authors use a dynamic partial equilibrium model of the agricultural sector, focusing on the

EU-15. The results from this analysis indicate that even if countries were to opt for the fullest possible degree of re-coupling, the EU would still be able to agree to reductions in domestic support outlined in their submission on modalities, or in the joint US-EU proposal with little or no further reform of the CAP. They find that the reforms are less likely to have an impact on export subsidy levels or market access. The reform is likely to further decrease the beef surplus, as beef cow numbers drop, and little impact on the dairy sector as the dairy quota remains in place. The EU does remain vulnerable to changes in export subsidy limits in the dairy sector.

Francois *et al.* (2003) explore the likely economic effects of the Doha WTO round for Europe and major developing regions, using a CGE model. They simulate a linear liberalisation, where all trade instruments are reduced by 50 percent; a "Swiss formula" scenario, where the maximum import tariffs in agriculture and manufacturing are reduced by 25 percent; and finally a full elimination of all trade barriers. The results show positive results globally and regionally for Europe, Africa and most of Asia, and particularly for Australia and New Zealand. Imports in the EU increase slightly faster than exports.

Langley *et al.* (2003) examine the effects of policy changes on international dairy markets. Their overall results indicate that liberalisation would reduce supplies, increase dairy trade, and raise world prices. They use a PE model, adjusted to include the 2002 Farm Bill, and China's WTO accession. The analysis consists of a total liberalisation scenario for dairy products only, and then a complete liberalisation of all agricultural products in their model. They find that raw milk production increases in Australia and NZ by about 5-6 percent, with prices in those countries increasing by between 22 – 29 percent from the base in both scenarios. Dairy product prices decrease in the EU, by around 25 percent in both scenarios for butter and around six percent for cheese.

Boumamra- Mechemache *et al.* (2002) use a spatial equilibrium model of the EU dairy sector to analyse the economic and welfare impacts of various liberalisation scenarios, all of which lead to sharp decreases in milk prices.

In another analysis, Bureau *et al*. (2000) take the Uruguay Round Agreement on Agriculture as a starting point and measure the liberalisation in agriculture that will take place by the EU and US by the end of the implementation period. They compare the actual UR commitments with alternative schemes such as the "Swiss formula" and a uniform reduction in tariffs.

Mechemache and Réquillart (2000) analyse the effects of dairy policy in the EU using a PE model taking into account the supply of milk, the processing stage, and the demand for processed products. They compare the impact of Agenda 2000 with a reform involving a cut in export subsidies. The authors claim that if the objective of the EU is to reduce the difference between EU and world prices, it is a better alternative to cut export subsidies rather than to increase the quota. Their particular model is unable to evaluate the impact of quota liberalisation unfortunately.

Shaw and Love (2001) examine the economic effects of two types of reform – increasing market access and reducing export subsidies, on world dairy trade. They use the OECD's AGLINK partial equilibrium model. Cox *et al*. (1999) and Zhu *et*

al. (1999) investigate the impact of the UR Agreement on world dairy prices, using a spatial equilibrium trade model.

Methodology

The Lincoln Trade and Environment Model (LTEM) is a partial equilibrium (PE) model based upon VORSIM (Roningen, 1986; Roningen *et al*., 1991), and focusing on the agricultural sector. A detailed description of the LTEM and its characteristics are presented in Saunders and Cagatay (2003). The LTEM includes 19 agricultural (7 crop and 12 livestock products) commodities and 17 countries. The commodities included in the model are treated as homogeneous with respect to the country of origin and destination and to the physical characteristics of the product. Therefore commodities are perfect substitutes in consumption in international markets. Based on these assumptions, the model is a non-spatial model, emphasising the net trade of commodities in each region.

The LTEM is a synthetic model, with parameters adopted from the literature. The interdependencies between primary and processed products and/or between substitutes are reflected by cross-price elasticities which reflect the symmetry condition. Therefore own- and cross-price elasticities are consistent with the theory. The model is used to quantify the price, supply, demand and net trade effects of various policy changes. The medium- to long-term (until 2013) policy impacts are derived in a comparative static fashion based on the base year of 2000.

In general there are six behavioural equations and one economic identity for each commodity under each country in the LTEM framework. The behavioural equations are domestic supply, demand, stocks, domestic producer and consumer price functions and the trade price equation. The economic identity is the net trade equation, which is equal to excess supply or demand in the domestic economy. For some products the number of behavioural equations may change as the total demand is disaggregated into food, feed, and processing industry demand, and this demand is determined endogenously.

The model solves by simulating the commodity based world market clearing price on the domestic quantities and prices, which may or may not be under the effect of policy changes, in each country. Excess domestic supply or demand in each country spills over onto the world market to determine world prices. The world market-clearing price is determined at the level that equilibrates the total excess demand and supply of each commodity in the world market by using a non-linear optimisation algorithm (Newton's global or search algorithm).

Dairy Sector: Behavioural Specifics and Policy Incorporation

The dairy sector will be used as an example of the behavioural specification and policy incorporation in the LTEM as it is the most complex sector, however the concept can be applied to the other agricultural products in the model.

Domestic Supply: In the LTEM framework a uniform Cobb-Douglas (CD) constant elasticity functional form is specified at the level of the variables to reflect the aggregate domestic supply response of each commodity in each country with respect to own- and cross-prices. Colman (1983) refers to this type of agricultural supply

response function, whose theoretical underpinnings are of an *ad hoc* nature (assumed to be derived from producers' profit maximization problem), as directly estimated partial supply response models. An agricultural commodity is assumed to be produced in a single farm and therefore the agricultural sector is treated as a single multi-product farm producing under perfect competition and producers are assumed to be price takers in the domestic market. The conditions that allow this exact aggregation are given in Moschini (1989).

The dairy sector is modelled as five commodities, raw milk is defined as the farm gate product and is then allocated to the liquid milk, butter, cheese, whole milk powder (WMP) or skim milk powder (SMP) markets depending upon their relative prices subject to physical constraints. The domestic supply (*qs*) function for raw milk in region *a* (qsa_{mi}) is shown in equation 1. Here, subscript $_m$ stands for the country, $_i$ shows raw milk and $_j$ is used to show substitute commodities such as beef and veal, and $_k$ shows feed products such as wheat, coarse grain and oil meals. The variables *pp* and *pc* represent the producer and consumer price level respectively. Therefore, domestic supply of raw milk is specified as a function of producer price for raw milk, beef, and consumer prices of feed inputs. Domestic supply is assumed to adjust simultaneously to price changes since there are no time lags involved in the behavioural equation. The own-price elasticity of supply is shown by the exponent α_{ii} and it is positive. The cross-price supply elasticity with respect to beef price ($^{\alpha ij}$) and feed products ($^{\alpha ik}$) are negative since raw milk and beef are assumed to be gross substitutes and feed products are the production inputs. The total domestic raw milk supply is equal to the sum of supply in regions *a*, *b* and *c*, equation 2.

The domestic supply of dairy products (liquid milk, butter, cheese, skim and whole milk powder) is determined based on the raw milk production (qs_{mi}) which reflects the physical constraint on processed dairy production, and producer prices of various dairy products. For example, in equation 3 domestic supply of liquid milk (qs_{ml}) is specified as a function of qs_{mi}, producer price of liquid milk (pp_{ml}) and producer prices of other dairy products (pp_{mh}). The exponentials β_{li}, β_{ll} and β_{lh} show the supply elasticity of liquid milk with respect to raw milk production, producer price of liquid milk and producer prices of other dairy products respectively.

$$qsa_{mi} = \alpha_{i0}\, pp_{mi}^{\alpha_{ii}}\, pp_{mj}^{\alpha_{ij}} \prod_k pc_{mk}^{\alpha_{ik}} \quad ; \qquad \alpha_{ii} > 0,\ \alpha_{ij} < 0,\ \alpha_{ik} < 0 \tag{1}$$

$$qs_{mi} = qsa_{mi} + qsb_{mi} + qsc_{mi} \tag{2}$$

$$qs_{ml} = \beta_{l0} qs_{mi}^{\beta_{li}}\, pp_{ml}^{\beta_{ll}} \prod_h pp_{mh}^{\beta_{lh}} \quad ; \qquad \beta_{li} > 0,\ \beta_{ll} > 0,\ \beta_{lh} < 0 \tag{3}$$

h: butter, cheese, skim and whole milk powder
i: raw milk
j: beef and veal
k: feed crops
l: liquid milk

In order to analyse the effects of land set-aside policy the supply function in the LTEM is respecified to include an exogenously determined shift factor which is given the value 1 initially, equation 4. The variable shf_{qs} proxies the supply side shift factors which is commonly used in PE trade models such as GAP, GLS,

SPEL,WATSIM[2]. For example, if the pasture and grazed areas are reduced, by five percent for example, in order to quantify the effect of this reduction in the acreage on domestic supply the value of the shift factor is decreased by the same amount in order to simulate the downward shift in the supply curve, equation 5

$$qsa_{mi} = \alpha_{i0} shf_{qs}^{\ 1} pp_{mi}^{\ \alpha_{ii}} pp_{mj}^{\ \alpha_{ij}} \prod_k pc_{mk}^{\ \alpha_{ik}} \quad ; \quad shf_{qs} = 1 \quad \text{initially} \tag{4}$$

$$qsa_{mi} = \alpha_{i0} (shf_{qs}^{\ 1} - 0.05) pp_{mi}^{\ \alpha_{ii}} pp_{mj}^{\ \alpha_{ij}} \prod_k pc_{mk}^{\ \alpha_{ik}} \quad ; \quad shf_{qs} = 0.95 \quad \text{with policy change} \tag{5}$$

Raw milk production quotas are incorporated exogenously during the simulation procedure by using a MIN function. For example if the amount of raw milk production in a country is limited by a maximum production quota amount, pq_{mi}, then this quota amount can be introduced as a constraint in finding the equilibrium level of domestic supply during the mathematical solution procedure, equation 6. With this method the production quota amount becomes binding if the calculated equilibrium qsa_{mi} is greater than the pq_{mi} and the model is pushed to choose pq_{mi} as the solution value. If the calculated equilibrium qsa_{mi} is less than the pq_{mi} then the model chooses the calculated qsa_{mi} as the solution amount.

$$qsa_{mi} = MIN((\alpha_{i0} shf_{qs}^{\ 1} pp_{mi}^{\ \alpha_{ii}} pp_{mj}^{\ \alpha_{ij}} \prod_k pc_{mk}^{\ \alpha_{ik}}), pq_{mi}) \tag{6}$$

Domestic Demand. A uniform CD type aggregate domestic demand function is used in the LTEM framework for each commodity and country. The behavioural relationship is assumed to be derived from consumer's utility maximization problem (of an *ad hoc* nature) acting under perfect competition. Domestic demand is assumed to adjust simultaneously to price changes. The variables per capita income and population are exogenous to the model and the interdependencies between primary and processed products and/or between substitutes are reflected by cross-price elasticities.

The domestic demand for raw milk is not modelled in the LTEM, instead the demand for dairy products are modelled endogenously at country level. The aggregate domestic demand relationship for dairy products is given by equation 7[3]. In this equation domestic demand for liquid milk, qd_{ml} is defined as a function of consumer prices of the own (pc_{ml}), substitute and complementary commodities (pc_{mh}), per capita income $(pinc_m)$ and population growth rate (pop_m). The exponents reflect the related elasticities. The cross-price demand elasticity (δ_{lh}) with respect to the prices of other raw milk products are positive since these products are assumed to be gross substitutes with liquid milk. The elasticity of demand with respect to income (δ_{l2}) and population growth (δ_{l3}) is also expected to be positive. In order to analyse the effects of demand side shifters other than income and population growth, the demand function is respecified to include an exogenously determined shift factor (shf_{qm}) which is given the value 1 initially, equation 8.

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[2] See Salomon (1998a; b) for GAP, Tyers and Anderson (1986) for GLS, Henrichsmeyer (1990) for SPEL and Lampe (1998) for WATSIM models.

[3] The demand for other dairy products (qd_{mh}) other than liquid milk is specified by using the same functional form and the same behavioural relationships that are in qd_{ml}.

$$qd_{ml} = \delta_{l0}\, pc_{ml}^{\ \delta_{ll}}\, pinc_{m}^{\ \delta_{l2}}\, pop_{m}^{\ \delta_{l3}} \prod_{h} pc_{mh}^{\ \delta_{lh}} \quad ; \ \delta_{l1} < 0,\ \delta_{l2} > 0,\ \delta_{l3} > 0,\ \delta_{lh} > 0 \tag{7}$$

$$qd_{ml} = \delta_{l0}\, shf_{qm}^{\ 1}\, pc_{ml}^{\ \delta_{ll}}\, pinc_{m}^{\ \delta_{l2}}\, pop_{m}^{\ \delta_{l3}} \prod_{h} pc_{mh}^{\ \delta_{lh}} \tag{8}$$

Stocks. The stocks are explicitly modelled in the LTEM framework based on the inventory demand theory (FAPRI 1989). The main determinant of the stock demand is the transaction motive, which responds to quantity of production or consumption, rather than speculative motives. In the dairy market it is assumed that raw milk is stocked in the form of butter, cheese and skim milk powder (in USA stock for whole milk powder is also allowed). Therefore, the behavioural equation for stock demand is given as in equation 9. In this equation φ_{hi} represents the elasticity of stock demand with respect to quantity of supply and is assumed to be positive.

$$qe_{mh} = \varphi_{h0}\, qs_{mh}^{\ \varphi_{hh}} \quad ; \qquad \varphi_{hh} > 0 \tag{9}$$

Net Trade. The net trade function for a commodity and country is defined as an economic identity which accounts for the difference between domestic supply and the sum of various demand amounts and stocks. Stocks are incorporated as change from previous year, Δqe_m, therefore it is the difference between ending stocks at time $_{t-1}$ (which is the beginning stocks at time $_t$) and estimated stocks at time $_t$. (which is the ending stocks at time $_t$). Since it is assumed that all produced raw milk is utilized in the form of processed products, raw milk is not traded. In equations 10 and 11 the net trade identity for the liquid milk and other dairy products are presented.

$$qt_{ml} = qs_{ml} - qd_{ml} \tag{10}$$

$$qt_{mh} = qs_{mh} - qd_{mh} - \Delta qe_{mh} \tag{11}$$

Prices. The domestic producer (pp_m) and consumer prices (pc_m) in the LTEM are determined by the trade price (pt_m) of the related commodity and country, domestic and border policies that affect domestic prices (tp_m and tc_m) and transportation costs (tc). Equations 13 and 14 present this price transmission mechanism, which consists of protection, $tp_{mh,l}$ and $tc_{mh,l}$, and stabilization $(WDp_{h,l}/ex_m)^{\varepsilon\tau}$ components (Tyers and Anderson 1986), for liquid milk and other dairy products. The trade price of a commodity in a country is determined by the world market price of that commodity, equation 12. The variable ex_m is the nominal exchange rate and the parameter ε_τ shows the price transmission elasticity. The price transmission elasticity shows how much a change in world prices is transmitted to the domestic market, which the effect is referred to as stabilization component. If a country for example is applying a fixed-price policy for a certain commodity then ε_τ takes the value of 0, or instead if there is a completely free market policy then ε_τ equals 1[4]. When there are no policy measures that affect domestic prices (protection component is 0) and under the assumptions of no transportation costs and homogenous, perfectly substitutable products then the domestic producer and consumer prices are determined by stabilization component and defined as in equations 13 and 14.

[4] The ε_τ is assumed to be 1 for all dairy products in Australia, EU, New Zealand USA.

$$pt_{mh,l} = \left(\frac{WDp_{h,l}}{ex_m} \right)^{\varepsilon_\tau} \tag{12}$$

$$pp_{mh,l} = pt_{mh,l} + tp_{mh,l} + tc = \left(\frac{WDp_{h,l}}{ex_m} \right)^{\varepsilon_\tau} + 0 + 0 \tag{13}$$

$$pc_{mh,l} = pt_{mh,l} + tc_{mh,l} + tc = \left(\frac{WDp_{h,l}}{ex_m} \right)^{\varepsilon_\tau} + 0 + 0 \tag{14}$$

In the LTEM, various domestic producer and consumer support and subsidy measures in the dairy market are incorporated to the price transmission mechanism as ad-valorem distortions[5] which form a price wedge between domestic and world prices. These measures include direct payments ($sd_{mh,l}$), inputs subsidies ($simh_{,l}$), general services expenditures ($sgmh_{,l}$) and other market subsidy payments ($smmh_{,l}$) to the producers and consumer market subsidy ($cmmh_{,l}$). Border policies such as per unit import tariffs (or taxes) and export subsidies and taxes are also incorporated in the price transmission mechanism through the use of commodity based price wedge variables, $tp_{mh,l}$ and $tc_{mh,l}$, which differentiate the domestic and trade price of the commodity. Equation 15 and 16 show the $pp_{mh,l}$ and $pc_{mh,l}$ which are extended with ad-valorem domestic and border policy measures.

$$pp_{mh,i} = pt_{mh,i} + tp_{mh,i} + tc + sd_{mi} + si_{mi} + sg_{mi} + sm_{mi} \tag{15}$$

$$pc_{mh,i} = pt_{mh,i} + tc_{mh,i} + tc + cm_{mh,i} \tag{16}$$

In the LTEM an intervention price policy applied in dairy market is incorporated in the solution procedure. The producer price function, which is specified as in equation 15 before, is respecified here as in equation 17 by adding a MIN function. With this method the intervention price, $mp_{mh,,l}$, becomes binding if the calculated equilibrium $pp_{mh,l}$ is greater than the $mp_{mh,l}$ and the model is pushed to choose $mp_{mh,l}$ as the solution value. If the calculated equilibrium $pp_{mh,l}$ is less than the $mp_{mh,l}$ then the model chooses the calculated $pp_{mh,l}$ as the solution price level.

$$pp_{mh,i} = MIN((pt_{mh,i} + tp_{mh,i} + tc + sd_{mi} + si_{mi} + sg_{mi} + sm_{mi}), mp_{mh,l}); \quad \text{tc=0} \tag{17}$$

Scenarios

Based on the previous discussion regarding WTO commitments, CAP reform, and China's accession to the WTO, a number of scenarios were simulated using the LTEM. These are summarised in table 5 below, not including the base scenario, which assumes current policies and support measures remain in place. All scenarios simulate from a base year of 2000 and continue out to 2013. The first scenario represents the WTO proposal for elimination of export subsidies, beginning with an initial decrease of 50 percent in 2006 and eliminated over five years, for the dairy

[5] As introduced in the methodology of producer and consumer subsidy equivalent (PSE and CSE) measures, Cahill and Legg (1990).

and livestock sectors in the EU and China, and a reduction of tariffs by the same amount. The second scenario involves the CAP reform measure of increasing EU dairy quota, by 1.5 percent for three years beginning in 2005. The third scenario simulates the previous one in conjunction with a reduction in minimum prices of butter and skim milk powder (SMP) in the EU, by 25 percent for butter (seven percent for three years and four in the final year, beginning in 2004), and 15 percent for SMP (five percent for three years beginning in 2004).

The following two scenarios, four and five, aim to illustrate the difference between China joining the WTO and if it had not. Scenario four therefore simulates a liberalisation of all countries in the model, beginning in 2005. This assumes a complete removal of export subsidies and tariffs (however production quotas and intervention prices remain). Scenario five supposes that China has not joined the WTO and simulates that all countries in the model again liberalise their trade, with the exception of China, who maintains its tariffs and export subsidies. The final scenario, six, simulates China's market access commitments in dairy products and meat (beef and sheep), formally approved by the WTO in November 2001. China committed to reduce effective protection for dairy products and meat by varying amounts by January 2002 and even further by 2004. Details of these policies are shown in table 5.

Table 5. Scenario description

Scenario	Policy Type	Details
1	WTO draft proposal	Export subsidies and tariffs reduced by 50% for beef, dairy and sheepmeat in China and the EU (in 2006), and eliminated over five years.
2	CAP dairy quota increase	Milk quota increased by 1.5% each year from 2006 - 2008
3	Dairy quota increase + minimum price decreases	The above plus: Butter – reduced by 7% each year from 2004 – 2006; 4% in 2007 SMP – reduced by 5% each year from 2004 - 2007
4	Full liberalisation	Complete removal of all countries' export subsidies and tariffs in 2005
5	Full liberalisation (pre-China joining WTO)	Complete removal of all countries' export subsidies and tariffs in 2005, excluding China
6	WTO tariff reductions for China	Export subsidies and tariffs reduced by Butter-13.3% in 2001; 26.7% by 2005 Cheese- 15.2% in 2001; 22.8% by 2005 SMP- 35% in 2001; 5% by 2004 WMP – 35% in 2001; 5% by 2004 Beef – 21.8% in 2001; 11.2% by 2004 Sheep – 0.2% in 2001; 4.8% by 2004

Results

The model uses the year 2000 as the base year, and simulates out to 2013. The results are presented and discussed as the differences between the base scenario in 2013, and the results of the particular policy scenario simulated, in 2013. Although results are produced for all countries and commodities in the model, selected commodities only will be discussed here (from the beef, sheep and dairy sectors), and only for the EU, NZ and China. More detailed results are shown in Appendix tables 1 and 2. The results are discussed by scenario below, and summarised results presented by country in table 6.

Scenario One – WTO draft proposal

The first scenario, which assumes that export subsidies and tariffs in the EU and China are reduced by 50 percent in 2006 and subsequently eliminated over five years, predicts an almost universal decrease in producer prices and production in the EU by the end of the simulation period, 2013, for livestock products. The price reductions range from 9.3 percent for sheep meat, to 19.1 percent for WMP. It should be noted that although the export subsidies and tariffs have been removed, the dairy production quota and intervention prices in the EU remain. Production decreases are the most substantial in the beef sector (9.2 percent) and WMP (8.4 percent), with smaller decreases in sheep meat and raw milk production. Net trade in the EU is predicted to decrease across all the commodities of interest. The EU switches from being a net exporter of beef, cheese and SMP to being a net importer of these products. It is predicted to remain a net exporter of WMP, at a reduced amount, while it was already a net importer of sheep and butter in the base scenario. The EU is predicted to undergo a significant reduction in producer returns across the beef, sheep and dairy sectors. Beef is the greatest loser, at 21 percent, however sheepmeat and raw milk producers' returns are also predicted to decrease by 12 and 14 percent, respectively.

The impact of the removal of export subsidies in the EU and China is predicted to lead to benefits for the NZ livestock sector. Prices and production of all commodities increase. The largest price increase is predicted for Cheese, of 13 percent. Exports also increase steadily, from between four percent for beef, to 12 percent for cheese. Producer returns increase for all products studied, from 8.4 percent for beef to nearly 18 percent for sheepmeat.

Rae and Strutt (2005) simulate various WTO reform scenarios in the form of tariff removals, and analyse the effects on NZ. Their simulations are carried out in the general equilibrium model GTAP and therefore cover all sectors, but include less agricultural detail than here. They do predict increases in export volumes of dairy products across their scenarios, however they also predict decreases in export volumes of other livestock products, as well as production of these products.

The impact on China of removing its export subsidies, was for prices and production to decrease across the board. Producer returns were predicted to fall for all sectors analysed, from 8.6 percent in the beef sector to just over two percent for raw milk.

Moreddu *et al.* (2003) simulate two CAP reform scenarios which involve converting existing payments under the CAP to a SFP. Although the scenarios are different from the one here, the results show the same trend in the EU: a reduction in price and production from the base scenario.

Scenario Two – EU Dairy quota increase

The second scenario, which simulates an increase in dairy production quota in the EU, predicts a decrease in prices across the dairy sectors of not only the EU, but also China and NZ. Prices of beef and sheep remain unchanged. Production in the EU increases in the dairy sector as a result of the increase in production quota. Beef production decreases slightly, while sheep production remains as in the base. Trade of dairy products from the EU increases, with the exception of cheese, exports of which are predicted to reduce. Producer returns change by less than one percent for EU producers however, because of the fall in producer prices.

NZ and China are predicted to reduce their production of dairy products. Sheep and beef production change only marginally. Prices for agricultural commodities in NZ and China are also predicted to fall in this scenario. Trade of all the commodities of interest increase in China, with the exception of WMP, while NZ exports of dairy products decrease. Producer returns for both China and NZ are expected to fall following this increase in EU dairy quota (with the exception of beef prices in China which increase by 0.1 percent).

These EU results may be compared with the Bouamra-Mechemache *et al.* (2002) study. In one of their scenarios they simulate an increase in dairy quota by 5.3 percent (this study simulates a total increase of 4.5 percent). The impact on EU dairy prices is comparable between the studies, the only significant difference between that study and this one is in SMP, where they find a decrease in prices of 20 percent, whereas in this study it is only 3 percent. Production increases are also comparable, they do have a greater disaggregation of dairy products however, the only major difference in production is in WMP where this study predicts an increase of six percent and their study 21 percent. Net trade impacts are also relatively similar, given the differences in modelling strategy and assumptions.

Scenario Three – Dairy quota increase combined with intervention price reductions

The results from this scenario are exactly the same as the results from the previous scenario. This is because the original minimum prices did not bind in either the base or the production quota increase scenario, so lowering these intervention prices has no effect.

Scenario Four – All countries liberalise

This scenario simulated a removal of all export subsides and tariffs in all countries in the model. The results show a general decrease in prices in the EU. Production is also predicted to decrease in the EU, for most commodities except raw milk, which remains at the quota level. Net trade decreases for all the commodities analysed here, and producer returns are predicted to decrease across the sectors analysed here, ranging from four percent for raw milk to nearly 20 percent for beef.

The effects on NZ are again positive. Prices and production are both predicted to increase for all commodities here. The increases in this scenario are the largest of any of the predicted changes simulated for this paper. Net trade increases correspondingly across the commodities of interest, and again by the largest amounts of the simulations so far. Producer returns increase therefore as well, from between 14 percent for beef to 37 percent in the dairy sector.

Although China also liberalises in this scenario, the effects on China are mixed. Prices for beef and sheep decrease, while dairy prices are predicted to increase. The price increases are relatively minimal, although SMP is predicted to increase by 11.9 percent. Production also increases in the dairy sector, but decreases in beef and sheep. The increases in production are relatively minor, again SMP production is the exception, at 12.5 percent. Net trade increases for cheese and the milk powders. Trade in butter is predicted to decrease slightly, while sheep and beef trade decreases considerably. Producer returns in this scenario are predicted to increase in the dairy sector, but fall in the sheep and beef sectors (by 4.5 and 5.4 percent respectively).

Binfield *et al*. (2004) simulate a SFP under different dates of implementation. Their results are similar for the dairy sector as the results discussed here, but prices for beef and sheepmeat increase in their simulations. Langley *et al.* (2003) find relatively similar changes to this study following an international liberalisation of agricultural markets. Their predictions for price increases in NZ are generally significantly larger than this study, while the price changes in the EU are of a more comparable magnitude, with the exception of SMP price, which they predict to increase by six percent (compared with a decrease of four percent in this study).

Scenario Five – All countries liberalise, excluding China

This scenario assumes that China has not yet joined the WTO and thus is not obligated to liberalise its tariffs and export subsidies. Therefore all other countries in the model liberalise, while China does not. This situation does not have a significant impact on the EU, that is, the changes are not markedly different from the previous scenario where China also liberalised. The general trend in this scenario is that the changes in the EU are of a slightly greater magnitude than in the previous scenario, with the exception of sheepmeat, whose price and production levels differ by greater amounts than other commodities to the previous scenario.

The effect this scenario has on NZ is to slightly dampen the increases in price, quantity and net trade, in comparison with the previous scenario, particularly in the beef and sheepmeat sectors. The effect on the dairy sector is very minor. Producer returns for NZ, although considerably higher than in the base scenario, are less than the returns from the previous scenario, particularly for sheepmeat. Sheepmeat undergoes the largest change between the two liberalisation scenarios in both NZ and the EU.

China clearly benefits the most from this situation. Prices increase for all the commodities of interest, from 1.6 percent for liquid milk, to around 20 percent for both cheese and SMP. Production increases in general, although sheep and beef production do not increase significantly. Net trade increases for all of these

commodities, with both butter and cheese changing from net importing to net exporting.

Scenario Six – China implements its WTO commitments

This scenario predicts general decreases in producer prices, production and trade in China in comparison with the base scenario. Scenario six predicts the impacts in 2013 of China's commitments in order to gain accession to the WTO. Price decreases are predicted to range from 1.2 percent for liquid milk to nearly nine percent for cheese, while production is predicted to decrease by similar amounts. Producer returns decrease across the three sectors, by around five percent for both beef and milk, and seven percent for sheepmeat.

The effect this scenario is predicted to have on the EU and NZ is positive, but by relatively minor amounts. Producer returns in the EU increase by less than one percent in the dairy sector and 4.5 percent for sheepmeat. NZ sheepmeat producers are expected to gain the most, with an increase in returns of nearly seven percent. Dairy returns in NZ, similarly to the EU, are also only predicted to increase by less than one percent, with beef returns increasing by two percent. Net trade effects in these countries are also positive but very minor.

Table 6. Change in producer returns between base and scenario, in 2013 for China, EU and NZ

	China				
scenario	**1**	**2**	**4**	**5**	**6**
Beef	-8.6	0.1	-5.4	6.3	-5.0
Sheep	-5.3	0.0	-4.5	6.5	-7.2
Raw milk	-2.1	-2.7	2.7	10.3	-5.1
	EU				
Beef	-21.3	-0.6	-19.9	-20.1	1.0
Sheep	-12.4	0.1	-11.5	-16.9	4.5
Raw milk	-14.5	0.4	-4.2	-4.5	0.4
	NZ				
Beef	8.4	-0.7	13.9	10.2	2.3
Sheep	18	-0.1	20.4	11.2	6.9
Raw milk	17.1	-6.5	37.4	36.3	0.9

Discussion and Conclusion

The removal of export subsidies as proposed in the WTO framework would clearly benefit a country such as NZ. Producers in the EU and other heavily supported countries would be negatively affected, however the introduction of decoupled support such as the SFP would help to offset these reductions. A country such as China is predicted to be affected by smaller amounts, depending on the sector.

The CAP reform of the production quota (scenario 2) also has mixed impacts. In terms of producer returns, the impacts on the EU are minimal. Impacts on other countries vary, interestingly the dairy sector in NZ is reasonably significantly

affected. As mentioned previously, if the production quota reform is introduced concurrently with the removal of export subsidies and tariffs, the increase in quota is not filled and the effect is the same as the export subsidy phasing out scenario.

Scenarios four, five and six highlight the effect of China having joined the WTO. With China liberalising its trade completely, at the same time as all other countries in the model, as in scenario four, NZ's profits increase, and the decreases experienced in the EU are slightly less when China is in the WTO than when it is not. For China, while the gains from being in the WTO (scenario five) are certainly less than if they were not committed to liberalising, their prices and production of some commodities (particularly dairy) still increase above the baseline as they take advantage of the liberalisation occurring in other countries. Scenario six highlights the effect of China's commitments as part of its accession to the WTO, assuming that trade policies in other countries do not change. The effect on China is negative, however the EU and NZ do benefit from this, particularly in the sheep sectors of these countries.

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APPENDIX TABLE ONE – PERCENTAGE CHANGES BETWEEN BASE AND SCENARIOS IN 2013 FOR CHINA, EU AND NZ

		Export subsidies reduced			EU dairy quota increase			All countries fully liberalise			All countries fully liberalise except china			WTO tariff reductions in China for dairy products and meat.		
		China	**EU**	**NZ**	**China**	**EU**	**NZ**	**China**	**EU**	**NZ**	**China**	**EU**	**NZ**	**China**	**EU**	**NZ**
producer prices	**beef**	-5.9	-13.3	4.9	0.0	0.0	0.0	-3.8	-13.3	7.2	4.2	-13.3	4.7	-3.5	0.6	1.7
(% change)	**sheep**	-4.6	-9.3	9.8	0.0	0.0	0.0	-3.8	-8.5	10.8	5.2	-12.5	6.0	-5.6	3.2	3.8
	raw milk	-1.5	-14.0	9.0	-1.7	-4.0	-3.6	1.5	-4.2	18.6	6.5	-4.5	18.3	-3.4	0.4	0.4
	liquid milk	-0.9	-19.9	-5.1	-0.2	-5.7	2.2	-0.1	-2.2	-10.8	1.6	-2.3	-10.4	-1.2	0.2	-0.4
	butter	-7.5	-15.9	8.5	-2.6	-2.3	-3.0	1.8	-7.4	19.4	16.4	-7.8	19.1	-8.8	0.5	0.4
	cheese	-2.4	-11.0	13.3	-4.2	-3.9	-4.9	5.9	-3.5	22.9	19.3	-3.9	22.4	-8.9	0.5	0.7
	WMP	-4.4	-19.1	7.8	-2.8	-2.3	-3.1	1.2	-14.4	14.1	11.9	-14.9	13.4	-7.0	0.4	0.6
	SMP	-1.7	-16.0	7.4	-3.8	-3.3	-4.2	11.9	-4.4	22.3	20.3	-4.5	22.2	-5.6	0.0	0.0
quantity produced	**beef**	-2.9	-9.2	3.4	0.1	-0.6	-0.7	-1.7	-7.6	6.3	2.0	-7.9	5.3	-1.6	0.4	0.6
(% change)	**sheep**	-0.7	-3.4	7.5	0.0	0.1	0.0	-0.8	-3.3	8.7	1.2	-5.0	4.9	-1.6	1.3	3.0
	raw milk	-0.7	-0.6	7.4	-1.0	4.5	-2.9	1.2	0.0	15.8	3.6	0.0	15.2	-1.8	0.0	0.5
	liquid milk	0.0	-5.5	1.1	-0.1	3.0	-0.4	0.1	1.1	2.3	0.1	1.1	2.2	0.0	-0.1	0.1
	butter	-4.4	-3.2	8.4	-1.1	5.6	-3.3	1.1	-2.8	18.8	7.9	-2.9	18.2	-4.2	0.1	0.5
	cheese	-2.0	-0.4	9.2	-4.0	4.1	-3.6	5.5	0.0	18.8	17.4	0.0	18.2	-8.0	0.1	0.6
	WMP	-4.2	-8.4	8.4	-3.1	6.2	-3.3	1.7	-12.8	17.6	12.7	-13.2	16.9	-7.2	0.1	0.6
	SMP	-5.9	-3.2	8.4	-4.7	5.6	-3.3	12.5	-2.8	18.8	28.6	-2.9	18.2	-9.3	0.1	0.5
producer returns	**beef**	-8.6	-21.3	8.4	0.1	-0.6	-0.7	-5.4	-19.9	13.9	6.3	-20.1	10.2	-5.0	1.0	2.3
(% change)	**sheep**	-5.3	-12.4	18.0	0.0	0.1	-0.1	-4.5	-11.5	20.4	6.5	-16.9	11.2	-7.2	4.5	6.9
	raw milk	-2.1	-14.5	17.1	-2.7	0.4	-6.5	2.7	-4.2	37.4	10.3	-4.5	36.3	-5.1	0.4	0.9

APPENDIX TABLE TWO – CHANGES IN NET TRADE BETWEEN BASE AND SCENARIOS IN 2013.

		Base scenario			Export subsidies reduced			EU dairy quota increase			All countries fully liberalise			All countries fully liberalise except China			WTO tariff reductions in China for dairy products and meat		
		China	**EU**	**NZ**	**China**	**EU**	**NZ**	**China**	**EU**	**NZ**	**China**	**EU**	**NZ**	**China**	**EU**	**NZ**	**China**	**EU**	**NZ**
net trade	**beef**	-2766	766	558	-3567	-134	580	-3355	766	562	-3403	-16	601	-2499	-100	595	-3355	766	562
(000 tonnes)	**sheep**	-283	-200	503	-383	-351	555	-438	-147	524	-373	-343	563	-158	-428	538	-438	-147	524
	butter	-18	-130	380	-33	-322	416	-35	-125	382	-19	-235	460	1	-242	458	-35	-125	382
	cheese	-8	80	301	-20	-283	337	-50	102	303	15	0	375	69	-17	373	-50	102	303
	WMP	27	433	446	21	322	483	16	435	448	29	290	524	45	286	521	16	435	448
	SMP	4	60	302	3	-28	328	1	61	303	9	23	360	13	22	358	1	61	303