

**Foot-and-mouth disease and trade restrictions: Latin American access to Pacific Rim beef
markets***

Allan N Rae, Chris Nixon and Peter Gardiner**

**Key words: beef, foot-and-mouth disease, Pacific Rim,
trade reforms, spatial equilibrium.**

* We gratefully acknowledge the financial support of the Agricultural and Marketing Research and Development Trust (AGMARDT) of New Zealand.

** Allan Rae, Department of Applied and International Economics, Massey University, Palmerston North, New Zealand; Chris Nixon, New Zealand Institute of Economic Research, Wellington, New Zealand; Peter Gardiner, The Treasury, Wellington, New Zealand.

Foot-and-mouth disease and trade restrictions: Latin American access to Pacific Rim beef markets

Abstract

Due to their eradication of foot-and-mouth disease Argentina and Uruguay have recently been granted access to the fresh beef markets of the USA and Canada. This raises the prospect of Latin American suppliers gaining access to other Pacific Rim markets, and of increasing the integration of the Pacific and non-Pacific beef markets. A two-commodity spatial equilibrium model with asymmetric demands is constructed for the base year 1995. Projections are then made for the year 2001 under various policy and other scenarios. In some instances, major changes in trade patterns may result.

INTRODUCTION

Foot-and-mouth disease (FMD) exists in many parts of the world, and affects cloven-footed animals. It is the prospect of disease transmission by the international movement of livestock or livestock products that has led some countries to ban the import of these commodities from infected regions. Such bans constitute technical barriers to trade (Hillman 1991). Infected animal products can contain large quantities of the FMD virus, although some further processing activities can prevent the spread of the disease. FMD has been present in Latin America for many years, and has prevented infected regions accessing the major Pacific Rim beef markets. Thus their fresh beef has been directed to regions that have not imposed trade bans for FMD-related reasons, or to products exported in a further-processed form and with perhaps lower returns.

Authorities in the USA and Canada opened their borders to imports of fresh, frozen or chilled imports of beef from Uruguay (in 1996) and Argentina (in 1997). Although initial volumes are small, access to these importing countries could be expanded in future, and other Pacific Rim beef importers could also grant access to beef from Uruguay and Argentina.

THE PACIFIC RIM BEEF MARKET

We define this market as those countries that are recognised as free of foot-and-mouth disease. Major exporting countries are Australia, Canada, New Zealand and the USA, while major importers are Japan, the Republic of Korea and the USA. The predominant trade flows are from North America to Northeast Asia, between Canada and the USA and from Australasia to both North America and Northeast Asia. All these countries impose bans on the import of fresh, chilled and frozen beef from regions where FMD is endemic, which separates this market from other beef markets within the Pacific Rim or elsewhere.

The FMD-free Pacific Rim beef market comprises (at least) two integrated markets, differentiated by product type. Australia and New Zealand have produced grassfed beef reflecting the climatic conditions that exist in these two countries. In contrast, the North American and Northeast Asian cattle industries are geared to grain feeding. The latter production system is also being adopted in Australia. Both types of beef are important in consumption in Japan, Korea and the USA. Since Argentina and Uruguay are producers of grassfed beef, analysis of their entry to the Pacific Rim beef market should consider the strength of the substitution relationship between both types of beef in consumption.

The USA is both a major exporter and importer of beef and exports have recently increased rapidly; those for 1997 are forecast to be 43% above the 1991-95 average (OECD 1997). Beef imports into the USA and Canada are predominantly grassfed product from Australia and New Zealand, with smaller quantities now admitted from Argentina and Uruguay.

The two largest import markets in Northeast Asia are Japan and Korea. While production in Japan has stabilised, it has increased in Korea by 72% between 1989 and 1995. Self-sufficiency has continued to fall in both countries in response to trade policy reforms and continued demand growth. Per head consumption of beef is relatively low in both countries, providing scope for further growth as the trend towards increased consumption of high-protein products continues and imported beef prices fall due to reforms of import policies.

Beef production in Australia and New Zealand has been affected during the 1990s by droughts and falling prices, although both countries have shown some recent recovery. While production in both countries is predominantly grassfed, grainfed production is becoming more important in Australia in response to Asian demand. The share of grainfed beef in Australia's exports to Japan has been forecast to increase from 40% in 1994 to 58% by 2000 (Doyle et al 1995).

For the first time in over 60 years, Argentina was able to export fresh (ie uncooked) beef to the USA in 1997. Uruguay benefited from the same measure the previous year, and in each case a quota of 20,000 tonnes (product weight) was allocated. Uruguay and Argentina were also granted access to the Canadian market in the same year that US access was granted. Although drought reduced the size of the Uruguay cattle herd in 1989, cattle numbers have been increasing. They were expected to reach 11 million head in 1997 and to continue to expand in recognition of positive export prospects. Export volumes increased 32% from 1995 to 1996, and major destinations include the EU, Israel and other parts of South America. In Argentina, beef production reached over 2.5 million tonnes (carcass weight equivalent) in 1996, which was almost as great as the combined production of Australia, New Zealand and Uruguay. While cattle numbers are the lowest since 1971, higher future production could see export volumes by 2000 at 56% above the level forecast for 1997 (WTO 1997). The EU has been Argentina's major export market, taking over 105,000 tonnes in 1996 including a quota for 28,000 tonnes of high-quality beef.

METHODOLOGY AND DATA

The quadratic programming model

A quadratic programming spatial equilibrium model was constructed to study the impact of Latin American entry to the Pacific Rim beef market¹. Solutions derived from such a model are equilibria in the sense that they:

- specify a set of national prices that determine the levels of production and consumption in each country or region;
- require each country's production to be equal to its exports plus that portion of its production that is consumed domestically;
- require each country's consumption to be equal to its imports plus that portion of its production that is consumed domestically;

¹ This was formulated in the quantity domain, as a multi-commodity model with asymmetric demand coefficients - see Martin (1981).

- require that if trade occurs between two countries, the price in the exporter nation will equal that in the importer less the relevant transport costs, tariff charges and quota rents; and
- require that if no trade exists between two countries, then the price in the importer nation must be less than that in the exporter plus the relevant transport costs and tariff charges.

Regions and products

Seven Pacific Rim beef markets were modelled: North America (USA and Canada), Japan, South Korea, Australia, New Zealand, Argentina and Uruguay. A rest-of-the-world region was also represented, accessible only to Argentina and Uruguay. In the 1995 base year, the latter two countries exported no fresh beef to the above Pacific Rim markets, and the rest-of-the-world region was designed to allow for the possible continuation of their substantial non-Pacific trade. Thus whether Latin American exports occur to Pacific Rim markets will be influenced by the returns those exports could receive elsewhere.

Beef was modelled as two differentiated products, named 'grainfed' and 'grassfed' beef, although this is still an approximation to the reality - for example we assume all beef produced in Japan is identical to 'grainfed' imports. Table 1 indicates the types of beef that were assumed to be produced, consumed and traded in each region. For example, both 'grainfed' and 'grassfed' beef are produced in the USA, but we assume all their exports are 'grainfed' and all imports are 'grassfed' beef.

Table 1 Modelled beef differentiation across countries

Country	Production	Consumption	Exports	Imports
USA & Canada	both	both	gn	gs
Japan & Korea	gn	both	..	both
Australia	both	gs	both	..
New Zealand	gs	gs	gs	..
Argentina & Uruguay	gs	gs	gs	..

Note: gn = 'grainfed' beef
gs = 'grassfed' beef

The trade flows permitted in the model are, for 'grainfed' beef, those from North America to Japan and Korea, and that from Australia to Japan. 'Grassfed' beef trade flows modelled are those from Australia and New Zealand to North America, Japan and Korea and, in the relevant scenarios, from Argentina and Uruguay to North America, Japan, Korea and other non-Pacific destinations.

Base period quantities and prices

The model was initially constructed to simulate prices, quantities and trade flows in the base period of 1995. All ensuing scenario analyses involve projections to the year 2001, when the GATT/WTO Agreement on Agriculture is to be implemented.

Data on beef production, consumption, trade and stocks were taken from national sources and from the WTO (1996, 1997) and were converted, where necessary, to a carcass weight equivalent (cwe)

basis². These data then required adjustment for a number of reasons - inconsistencies between national and WTO data, the required absence of stocks in our model, and the 'netting out' of exports to and imports from countries not included in our model. Total 1995 exports and imports for North America are net of the trade flows between Canada and the USA.

Beef exports from Argentina and Uruguay include substantial quantities of manufactured beef products, and some scenarios examined the implications of this beef being diverted to the chilled/frozen beef Pacific Rim trade. Their exports also include sales to the European Union (EU) which provide returns above those that might be expected from Pacific Rim markets, and we assume this beef would not be diverted to Pacific Rim markets.

In some countries, the production or consumption data required disaggregation to 'grassfed' and 'grainfed' categories. For USA production, the data presented by Brester and Wohlgenant (1991) along with the assumption that all beef imported into the US is 'grassfed' and all that exported is 'grainfed', implied that 65% of total US beef production was classified as 'grainfed'. The same proportion was applied in the case of Canada. It was assumed that 15% of Australian beef production was 'grainfed' in 1995, based on an estimate of Australian grainfed exports to Japan³. Consumption data for North America, Japan and Korea was disaggregated into the two types of beef given the definitions of the types of beef produced by and imported into those countries.

Border prices were estimated from national trade data as unit values (cif or fob), and converted to US\$ at 1995 exchange rates. Domestic prices of both types of beef in Japan and Korea, and for 'grassfed' beef in North America, were set equal to the border price plus tariffs or tariff equivalents. Otherwise, domestic prices and border prices were identical. Beef prices in Argentina and Uruguay will be discussed in later sections, as the appropriate scenario is introduced. From international freight costs for Australian and New Zealand beef shipments to Japan, Korea and the USA, the relationship between cost per tonne and distance was estimated and then used to estimate freight costs for all other routes.

Domestic demand and supply relationships

Beef production was assumed to be influenced by the price of beef, the price of maize (for 'grainfed' beef production only) and productivity growth. Maize prices were included since changes in feedgrain costs could affect the relative competitiveness of 'grainfed' and 'grassfed' supplies. Price elasticities were taken from Sullivan (1992). In the cases of North America and Australia, where both beef types are produced, lack of data required the assumption of identical supply elasticities for 'grainfed' and 'grassfed' production. FAO data on beef production and slaughterings over the period 1985-95 were used to estimate the average annual growth in production per head, and was projected to 2001.

Cap (1995) reports a study of the growth potential of Argentina's agricultural sector, under various assumptions about the future adoption of currently available technologies. A number of factors that constrained the rate of adoption of productivity-enhancing innovations in the past are being eased and provide the potential for a major shift in the sector's supply capacity by the end of

² A conversion factor of 0.7 was used in all instances.

³ Personal communication, Australian Meat and Livestock Corporation.

this century. Cap (1995) examined the implications of new technology adoption on several beef production systems under a number of adoption scenarios. That considered 'most likely' implied a future growth rate in beef output per hectare of 4.75%. We used this rate of productivity growth in some of our scenarios.

Beef consumption was modelled as a function of beef prices, incomes per capita and growth in the total population. For those countries where both 'grainfed' and 'grassfed' beef consumption was modelled, demand relationships were specified for each beef type. In these situations, consumption of either type of beef could be influenced by changes in the prices of both 'grainfed' and 'grassfed' beef. This allows, for example, the entry of 'grassfed' supplies from Latin America to influence primarily the price of 'grassfed' beef, but also the potential substitution of 'grassfed' for 'grainfed' beef in consumption. Thus the markets for 'grainfed' and 'grassfed' beef are separately specified but interrelated.

Estimates of the various demand elasticities were taken from Brester and Wohlgenant (1991) for the USA, from Hayes et al (1990) for Japan, from Doyle et al (1995) for Korea⁴, and from Sullivan (1992) for remaining countries. The Brester and Wohlgenant study was based on improved estimates of 'ground' and 'table-cut' beef consumption in the USA, and their definition of ground beef was assumed to be identical to ours of grassfed beef. The Japanese results of Hayes et al were estimated for Wagyu beef and 'import quality' beef, the latter defined as either Japanese dairy beef or imported beef. While this does not match our own product definitions, it can be noted that the cross-elasticities from the Japanese study are within the 0.1 to 0.4 range of the USA cross-elasticities.

The USA estimates were assumed to apply to North America (ie including Canada) while the cross-elasticities for Japan were also assumed to apply in Korea. The Japanese income elasticities of Hayes et al were specified in terms of changes in meat (rather than total) expenditures, so were replaced by the estimate found in Rae (1995) which was assumed to apply to both types of beef⁵.

Both Argentina and Uruguay export substantial quantities of manufactured ('cooked') beef, which in 1995 amounted to 245,000 and 22,000 tonnes (cwe) respectively. In addition, they exported in that year 92,000 and 22,000 tonnes (cwe) of fresh beef respectively to the EU⁶. All beef used for manufactured products, plus all fresh beef exports to the rest of the world with the exception of that to the high-priced EU market, was assumed available for diversion by Argentina and Uruguay as fresh product exports to the Pacific Rim. Two rest-of-the-world demand functions were constructed, namely those facing Argentina and Uruguay for non-Pacific sales. These functions were calibrated to the weighted average returns from non-EU chilled and frozen sales plus all manufactured beef sales, and the appropriate (cwe) quantities from 1995 trade data. The export demand elasticities were taken from Goddard (1988). They provide a mechanism to allow an equilibrium to be reached between sales from Latin America to the Pacific Rim markets and to non-Pacific markets.

⁴ Doyle et al quote Korean own-price and income elasticities for 'beef' as a homogeneous product. Their data are applied here to both 'grassfed' and 'grainfed' beef.

⁵ Hayes et al found that the income elasticities for both types were beef, with respect to total expenditures on meat, were almost identical

⁶ In 1995, average fob returns for Argentina were US\$1,393 per tonne for manufactured beef products, US\$1,347 per tonne for non-EU sales of fresh product and US\$4,543 per tonne for fresh beef sales to the EU. It is conceivable that returns from North American or Asian markets could encourage at least a portion these exports to be diverted as fresh sales to the Pacific Rim.

Projections of beef demand required projections of future population and income growth in each region. Future growth rates of GDP were based on the projections of the OECD (1997) for the USA, Canada, Australia, Japan and Korea⁷, on IMF data for Argentina and Uruguay, and on NZIER (1997) projections for New Zealand. Population projections were based on past growth rates from national data for Argentina and Uruguay, and from the same sources as above for remaining countries.

The linear demand and supply relationships were initially calibrated so that they simulated the 1995 data and exhibited the assumed elasticities. The demand relationships were determined for the projection year of 2001 by first projecting 1995 consumption given data on population and income growth and income elasticities, and then recalibrating the relationships so that they predicted that projected level of consumption at base period prices. For the supply relationships, the 2001 production projections were made by first applying the productivity growth rates to 1995 base data⁸ and then recalibrating the functions so that they predicted the correct supplies at base period prices, and were then further adjusted to reflect a projected 22% increase in corn prices⁹.

Trade policies

Whether specified for the base year of 1995 or for projections in the year 2001, the model replicated the trade policies as set out in the Uruguay Round Agreement on Agriculture. No quotas applied in Japan and tariff rates were 49.4% in 1995 reducing to 38.5% in 2001. Import quotas and other impediments to Korean imports have increased their domestic beef prices well above international prices. Doyle et al (1995) estimate the tariff equivalent of these non-tariff trade barriers as 89.7% in 1995. By the year 2001, Korea must remove its quantitative restrictions on beef imports and can apply a tariff of 40%.

Canada and the USA have a system of tariff rate quotas. Quotas have been allocated to specific countries. Within-quota tariffs are US\$44 per tonne (product weight) for the USA, and zero for Canada. Over-quota tariffs in each country were 30.3% in 1995, reducing to 26.4% in the year 2001.

RESULTS

We first compare a 2001 projection with the base situation in 1995. This scenario assumes that Argentina and Uruguay can access Canada and the USA under existing tariff rate quotas, but not other Pacific Rim markets. We next allow Latin American access to Japan and Korea, under similar policies as would be experienced in 2001 by other exporters and explore solution sensitivity to changes in transport costs from Latin America. The final scenario assumed an integration of NAFTA and MERCOSUR that would include free trade in beef between the countries of North and South America. This scenario also explored the impacts of higher beef productivity growth in Argentina.

⁷ We halved the published growth rate for Korea, given the economic situation that developed in that country in late 1997.

⁸ Unless otherwise stated, zero productivity growth was assumed for Argentina and Uruguay, rather than the negative historic rates of Appendix Table 3.

⁹The OECD (1996) projected a US export price of US\$133 per tonne fob for the 1997-99 period, compared with an actual average price of \$109 per tonne for the 1991-93 period.

Results for the first scenario are summarised¹⁰ in the first two data columns of Table 2. Beef consumption in North America is projected to increase by 9%, despite the projected 6% increase in “grainfed” beef prices. The income elasticities employed ensure that per person consumption of “grainfed” supplies increases, but that of “grassfed” beef decreases, with increases in incomes. The price of ‘grassfed’ beef is projected to decline by about 1% compared with 1995. Production in North America is projected to rise¹¹ by 10%, and that of “grainfed” beef at a faster rate than for “grassfed” beef, encouraged by the increase in the ‘grainfed’ price and modest productivity growth. While imports are projected to show some growth, exports from North America may increase by over 30% due to continued export demand growth and improving access to those markets by the end of the projection period. For Australia, Argentina and Uruguay, their quotas are restrictive in the 2001 projection, but the price differences between those countries and North America were insufficient to attract additional exports at the out-of-quota tariff of 26.4%. New Zealand did not fill its quota to North America.

Beef production in Japan is projected to grow by 5% between 1995 and 2001, outpaced by the 14% increase in consumption. Income growth was assumed to have a relatively strong impact on the demand for both ‘grainfed’ and ‘grassfed’ beef in Japan, and consumption will be further encouraged due to price reductions as Japan’s tariff reduced over the projection period. ‘Grassfed’ beef prices are projected to decline proportionately more than those of ‘grainfed’ beef since prices of the former product were assumed to be more sensitive to changes in supply than were those of ‘grainfed’ beef. Thus Japan’s beef imports could increase by 20%, with substantially increased supplies from North America and Australasia.

While beef production in Korea is projected to increase by less than 5% over the 1995-2001 period, consumption of beef increases substantially. Domestic prices of ‘grainfed’ and ‘grassfed’ beef are projected to fall by around 22% and 27% respectively by 2001 due to replacement of the import quota system with tariff-only protection of 40% in that year. Consumption could increase by over 30% despite the assumed moderated growth in incomes¹². Consequently, growth in import volumes is projected at 46%, supplied by increased shipments from North America and Australasia.

In Australia and New Zealand, beef production is projected to increase by 10% and 4% respectively due to productivity improvements, as prices of ‘grassfed’ beef are projected to decline slightly in both countries. Exports expand at similar rates¹³. Given the entry of the two Latin American suppliers to the North American market, Australasian export growth is directed at Northeast Asia.

¹⁰ All quantities have been aggregated over the two types of beef, and sometimes over countries, and are measured in carcass weight equivalents. All prices are inclusive of tariffs or quota rents, and are relative to the level of domestic prices in 1995.

¹¹ Our analyses recognise longer-term trends in productivity but do not attempt to replicate the USA beef cycle, which may be in a down-swing over the period covered by the projection.

¹² Our original GDP growth projection for Korea was 6% per year. At this rate, Korean beef consumption and imports would increase by 55% and 85% respectively over the 1995-2001 period.

¹³ Note that ‘grainfed’ exports as a proportion of total Australian exports have been restricted to the 1995 proportion (about 18%).

Table 2 Some impacts of Argentina and Uruguay access to Pacific Rim beef markets

	1995	Projections to 2001			
		LA access to NA only	LA access to NA + JK		
LA transport cost Reduction		nil	nil	10%	20%
North America					
Production	12,426	13,707	13,681	13,678	13,644
Consumption	12,512	13,647	13,684	13,687	13,738
Exports	612	809	809	809	807
Imports	697	750	811	818	901
<i>from Australasia</i>	697	686	747	754	837
<i>from LA</i>	0	64	64	64	64
Australasia					
Production	2,001	2,175	2,164	2,162	2,147
Exports	1,328	1,437	1,420	1,420	1,398
Japan/Korea					
Production	756	793	793	793	791
Consumption	1,998	2,353	2,354	2,354	2,354
Imports	1,242	1,560	1,561	1,562	1,562
<i>from Nth America</i>	612	809	809	809	807
<i>from Australasia</i>	630	751	673	666	561
<i>from LA</i>	0	0	79	87	194
Prices (1995=100)					
<i>North America</i>					
Grainfed	100	106.4	106.3	106.3	106.2
Grassfed	100	98.6	97.7	97.7	97.6
<i>Japan</i>					
Grainfed	100	98.0	97.9	97.9	97.8
Grassfed	100	91.3	90.5	90.4	89.4
<i>Korea</i>					
Grassfed	100	72.7	72.3	72.0	71.1
<i>Australasia</i>					
Grassfed	100	98.3	97.3	97.2	95.9

- Notes: 1. LA refers to Argentina and Uruguay, NA to North America and JK to Japan and Korea.
2. Production (consumption) is net of exports to (imports from) non-model countries, and exports and imports are those only involving modelled countries.
3. All volumes are in '000 MT (cwe).

Next we retain the same assumptions as above, with the exception that Japan and Korea offer access to beef from Argentina and Uruguay under the same conditions as offered to North American and Australasian suppliers. Tariff rate quotas are still assumed to apply in the USA and Canada. South American exports to Northeast Asia have the opportunity to expand under this projection scenario (Table 2, third data column) until their marginal return equals that obtained from export sales outside the Pacific Rim arena (but excluding the higher-price EU sales). At the

new equilibrium, these exports are projected at 79,000 MT from Uruguay to Japan, in addition to the 64,000MT exported in total from both suppliers under quota to North America. Compared with the previous scenario where Pacific Rim sales from South America were limited to the US and Canada, the South American expansion into Northeast Asia displaces “grassfed” sales from Australia and New Zealand. Thus while North America’s share of the Japanese and Korean import markets remains a little over 50%, that of Australasia is projected to decline from 48% to 43%. No beef trade occurs under this scenario from Argentina to Northeast Asia: adding the Japanese import tariff to the landed cost of beef from Argentina makes beef from that source uncompetitive at the originally-estimated freight costs.

South American access to Asia has little impact on prices. Those of ‘grassfed’ beef in Australasia, North America, Japan and Korea are projected to be about 1% lower than they would have been had South American Pacific exports been restricted to the North American market, while those of ‘grainfed’ beef remain almost unchanged. At these prices, out-of-quota exports from South to North America would not occur. Average Argentina and Uruguay fob returns are estimated to rise by between 5 and 10% which produces a positive supply response in both countries. However, the projected income and population growth in these Latin countries gives rise to increases in domestic consumption so that the combined export surplus of beef (excluding fresh exports to the EU) falls from 277,000 to 124,000 tonnes. Further, medium-term demand expansion in the EU and other non-Asia/Pacific markets (ignored in this analysis) could further reduce the available supplies for Pacific Rim markets.

We next examined the sensitivity of the projections to reductions in the estimated freight costs from Latin America to Pacific Rim markets - all transport costs per tonne out of Argentina and Uruguay were reduced by 10% and 20%. The former reduction implied that Latin American freight costs per tonne to North America and Northeast Asia were about 10% less and 45% above, respectively, those from Australasia. A 20% freight cost reduction meant these costs were, respectively, 20% below and 30% above those from Australasia (Table 2, final two columns). Substantial quantities of Argentinian beef are diverted to Northeast Asia once their transport costs have been reduced by at least 20% from the original estimates. As these freight rates are successively reduced, increased sales from Latin America to Northeast Asia displace ‘grassfed’ sales from Australia and New Zealand. The latter countries respond through increased sales to North America - Australasian suppliers have excess quota in North America which can be utilised, whereas exports to that region from Latin America are constrained by their quotas - and through adjustments within their domestic markets. Only minor adjustments to prices occur - a 20% reduction in Latin American freight costs and the ensuing trade flow changes would have the effect of reducing prices of ‘grassfed’ beef in North America, Japan, Korea and Australasia by only 1%.

North American beef import policies could undergo further change over the medium term. Should the tariff rate quota system be retained, individual supplier allocations might change. The existing allocations to Argentina and Uruguay are relatively small, and could result in quantities of beef from those sources being shipped to Northeast Asia and causing a re-direction of Australasian sales from the latter markets to North America. One development that could change the quota allocations would be the integration of the MERCOSUR¹⁴ free trade area with NAFTA¹⁵. The

¹⁴ Argentina and Uruguay joined with Brazil and Paraguay in the common market called MERCOSUR in 1995. It is the third-largest free trade area after NAFTA and the EU and has eliminated most internal tariffs between the member countries. As a result trade amongst the member countries has increased fourfold between 1990 and 1996.

Summit of the Americas initiated a plan to create a free trade area of the Americas by the year 2005. This was seen as integrating all countries of North, Central and South America. Provided this free trade agreement was to cover all agricultural products, then the beef trade between South and North America would be duty free. This is of no little importance to Australia and New Zealand since it could have a considerable trade diversion effect.

To illustrate what such a diversion of trade might be with regard to beef, the final scenario assumes that North American tariff rate quotas currently applied to Argentina and Uruguay are eliminated and the beef trade between those countries is duty free. The North American tariff rate quotas that potentially restrict imports of beef from Australia and New Zealand remain in place. Otherwise, this scenario is similar to the previous ones.

Exports of beef from Argentina and Uruguay to Northeast Asia that might have resulted under earlier scenarios are redirected to either the USA or Canada where entry is free (Table 3, first two columns of data). Consequently, Australasian exports to North America are displaced and redirected to Northeast Asia. This diversion of trade, however, may be thought of as a correction of the trade diversion caused in earlier scenarios by the quota restrictions on South American beef into North America which encouraged their trade with Northeast Asia.

While the total quantities of grassfed beef imported into Japan and Korea show little change (only the sources are different), quantities of beef imported into North America increase by around 25%. Sales of 'grassfed' beef from Argentina and Uruguay to North America could reach almost 400,000 tonnes, compared with today's quota allocations that allow a maximum of 64,000 tonnes (cwe). Projected imports of 'grassfed' beef into North America in 2001 amount to more than 1 million tonnes compared with the projection of 811,000 tonnes under the TRQ system, exerting downward pressure on beef prices in North America, especially of grassfed beef. Market shares change substantially - that of Australasian exporters could fall from over 90% in the previous scenario to 60% of total North American imports.

This projection assumes no growth in Argentinian beef productivity between 1995 and 2001 - should productivity grow by 4.75% per year, exports from Argentina and Uruguay to North America could reach 776,000 tonnes, or 60% of projected North American imports (Table 3, third data column). And if the South American freight costs used in the model are reduced by up to 20%, Latin American sales could exceed 1 million tonnes and would dominate the North American import market (Table 3, final two columns). Clearly, this combination of events would produce major changes to Pacific Rim beef markets. The Australasian 'grassfed' industries adjust through a reduction in total production and exports. Beef prices in Australasia could be reduced by more than 10% from the level that would have applied had the tariff rate quotas been maintained, and could be almost 15% below 1995 prices.

¹⁵ The North American Free Trade Agreement, involving the USA, Canada and Mexico.

Table 3 Impacts of North-South American integration on Pacific Rim beef markets: 2001

	Existing TRQ's	NAFTA-MERCOSUR Integration			
Argentina productivity growth	0	0	4.75% per year		
LA transport reduction	nil	nil	nil	10%	20%
North America					
Production	13,681	13,598	13,477	13,438	13,400
Consumption	13,684	13,802	13,979	14,034	14,090
Exports	809	805	800	798	797
Imports	811	1,008	1,302	1,394	1,486
<i>from Australasia</i>	747	611	526	499	472
<i>from LA</i>	64	397	776	895	1,014
Australasia					
Production	2,164	2,127	2,072	2,055	2,038
Exports	1,420	1,369	1,290	1,266	1,239
Japan/Korea					
Production	793	791	790	790	790
Consumption	2,354	2,354	2,354	2,354	2,354
Imports	1,561	1,563	1,564	1,565	1,564
<i>From Nth America</i>	809	805	800	798	797
<i>from Australasia</i>	673	758	764	767	767
<i>from LA</i>	79	0	0	0	0
Prices (1995=100)					
<i>North America</i>					
Grainfed	106.3	106.0	105.6	105.4	105.3
Grassfed	97.7	95.1	91.2	90.0	88.7
<i>Japan</i>					
grainfed	97.9	97.7	97.3	97.3	97.1
Grassfed	90.5	88.0	84.2	83.0	81.8
<i>Korea</i>					
Grassfed	72.3	70.0	67.0	66.1	65.2
<i>Australasia</i>					
Grassfed	97.3	94.2	89.5	88.0	86.5

- Notes: 1. LA refers to Argentina and Uruguay
2. Production (consumption) is net of exports to (imports from) non-model countries, and exports and imports are those only involving modelled countries.
3. All volumes are in '000 MT (cwe).

CONCLUDING REMARKS

If South American entry to the Pacific Rim beef market was limited to existing quotas in North America, results suggest that impacts on Pacific Rim markets would be minimal. However, importing countries such as Japan and South Korea may have opened their markets to beef from

FMD-free regions of South America before the year 2001. This presents the potential for more substantial impacts on regional markets.

South American export supplies of fresh beef might be expanded through the diversion of product from use in 'manufactured' beef to fresh uses, or through productivity gains. Our analysis indicates that these are important determinants of Argentina's penetration of Pacific Rim markets. Considerable exportable surpluses are likely to result and could find their way to Asian markets given competitive freight costs.

Whether or not South American suppliers would choose to export to Asian markets depends critically on their freight costs. Under some circumstances, our results show that South American suppliers could win substantial market share in Northeast Asia should their freight costs per tonne be no more than 20%-30% above rates from Australasia.

North American beef import policies could undergo further change over the medium term. For example, the tariff-rate-quota allocations could be adjusted should the MERCOSUR free trade area be integrated with NAFTA. In this case, exports of 'grassfed' beef from Argentina and Uruguay to North America could reach well over 500,000 tonnes compared with today's quota allocations that allow a maximum of 64,000 tonnes (cwe). This would produce major changes into the Pacific Rim beef markets.

Our analyses have attempted to differentiate beef products depending upon whether they derived from grainfed or grassfed animals. This required estimates of the relevant cross-elasticities of demand. The estimates used for North America were derived from product classifications that fitted rather closely to those adopted in this study. However, further work is required on the degree of substitution in Japan. It is possible that the actual strength of the substitution relationship for our beef aggregates could be somewhat higher than that employed here. The implications for our results are that we may have over-estimated the degree of independence of the two beef markets in Japan, and hence over-estimated the impacts of Latin American entry on the grassfed beef market.

Both Australia and Argentina are major producers of grain. Australia has already begun producing grain-finished beef for the Japanese market, and is expected to increase that product's share of total exports to Japan. In this way the beef sector can to some extent be separated from the implications of South American entry into grassfed beef markets. Although our analyses assumed that South American producers do not adopt grainfeeding, a move in this direction would lessen the impacts on grassfed beef markets of their entry to Pacific Rim markets.

Finally, integration of the North American Free Trade Agreement with the Latin American free trade area MERCOSUR is already under discussion. Our results indicate that should this occur, South America wins a large share of the North American market at the expense of New Zealand and Australian suppliers. Should the beef industries of Australasia wish to maintain a substantial presence in the US market, work will be required to improve access conditions. One approach would be to push forward the idea for closer relations between Australasia and NAFTA. Unless something like this occurs, Australasian suppliers are likely to lose important North American markets, and not just those for beef, in the advent of a North American-South American free trade area becoming a reality.

REFERENCES

- Brester, G.W. and Wohlgenant, M.K. 1991, "Estimating interrelated demands for meats using new measures for ground and table cut beef", *American Journal of Agricultural Economics* 73: 1182-1194.
- Cap, E.J. 1995, *Argentina: The sustainable growth potential of the production possibilities frontier in the agricultural sector - an outlook*, National Institute of Agricultural Technology, Buenos Aires, November.
- Doyle, S., Bui-Lan, A., Rodriguez, A., Benard, A. and Whish-Wilson, P. 1995, "Pacific Basin beef trade: the influence of South Korea", *Australian Commodities* 2(3):326-339.
- GATT 1993, *The Final Act*, Multilateral Trade Negotiations, The Uruguay Round. Trade Negotiations Committee. GATT Secretariat, 15 December 1993.
- Goddard, E.W. 1988, "Export Demand Elasticities in the World Market for Beef", Ch 8 in Carter, C A and Gardiner, W H (eds.), *Elasticities in International Agricultural Trade*, Westview Press, Boulder.
- Hayes, D.J., Wahl, T.I. and Williams, G.W. 1990, "Testing restrictions on a model of Japanese meat demand", *American Journal of Agricultural Economics* 72: 556-566.
- Hillman, J.S. 1991, *Technical Barriers to Agricultural Trade*, Westview Press, Boulder.
- Martin L.J. 1981, Quadratic Single and Multi Commodity Models of Spatial Equilibrium: A Simplified Exposition *Canadian J. of Agr. Econ.* Vol 29 (1): 21-48.
- NZIER, *Quarterly Predictions* (various issues), New Zealand Institute of Economic Research, Wellington.
- OECD 1996, *The Agricultural Commodities Outlook Database, 1970-2000*, Paris.
- OECD 1997, *The Agricultural Outlook 1997-2001*, Paris.
- Rae, A.N. 1995, *East Asian Food Consumption Patterns: Projections for Animal Products*, Agricultural Policy Paper No. 18, Centre for Applied Economics and Policy Studies, Massey University, November.
- Sullivan, J., Roningen, V., Leetma, S. and Gray, D. 1992, *A 1989 Global Database for the Static World Policy Simulation (SWOPSIM) Modeling Framework*, Economic Research Service, United States Department of Agriculture, Washington, D.C.
- World Trade Organisation 1996, *International Bovine Meat Agreement*, Second Annual Report. The International Markets for Meat, 1995/96, Geneva, November .
- World Trade Organisation 1997, *International Bovine Meat Agreement*, Third Annual Report. The International Markets for Meat, 1996/97, Geneva, August.