



AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

**CANADIAN PORK IMPORTS-
FEASIBILITY AND POTENTIAL IMPACT**

G.R. Griffith and B. Scott

Contributed paper presented at the 35th Annual Conference
of the Australian Agricultural Economics Society,
University of New England, Armidale
February 11-14, 1991

Authors are Senior Research Scientist, NSW Agriculture & Fisheries,
Armidale; and undergraduate student, Department of
Agricultural Economics and Business Management,
University of New England, Armidale.

This paper has been partly funded by the
Pig Research and Development Corporation.

1 INTRODUCTION *

1.1 Background

There has been a ban on the importation of uncooked pigmeat into Australia for many years. The ban was imposed on quarantine grounds to protect the Australian pig industry from the possible introduction of diseases such as Transmissible gastroenteritis (TGE) and Trichinosis. In September 1989, the Federal Government announced a decision to lift the ban on importation of unprocessed (fresh, chilled and frozen) pork from Canada. This decision was confirmed in July 1990, and the protocols between Australia and Canada were signed early in August 1990 (Department of Primary Industries and Energy, Media release, 1990).

1.2 Nature of the Problem

Two major points of contention exist between the Government and the Australian Pork Producers Federation (APPF).

The APPF is very worried about the possibility of Transmissible gastroenteritis (TGE) being introduced into the Australian pig herd through the imported meat. The Australian herd is TGE free at present. TGE is described as "...a debilitating exotic disease that we (the Australian pig industry) could well do without" (The Pig Farmer, December 1988, p. 4). Several points should be noted about the disease: a TGE outbreak would result in 100 per cent mortality in piglets under one week old; during initial outbreaks, losses in the whole herd are expected to be between 1.3 and 1.5 piglets per sow; TGE is present in small pockets of the Canadian and US herds. Farmers in these countries are not required to report outbreaks of the disease to any authority. Therefore information on the prevalence of the disease is largely unavailable; the disease is spread by many different means including through frozen pork (The Pig Farmer, September 1989, p. 3); there is no satisfactory diagnostic test or preventative vaccine available; and the disease is almost impossible to completely eradicate from the affected piggery and has been found to spread rapidly to neighbouring piggeries (Australian Pig Industry Delegation Report, 1990, p. 2).

A trial shipment of Canadian pigs were investigated by the Australian Animal Health Laboratory (AAHL) and a decision was made that imports should be allowed. However only 14 pigs were used in the AAHL trials and these pigs were selected and supplied by the Canadian authorities. The Government decision to lift the import ban based on technical quarantine grounds has led to a widespread belief among producers that the Government has been influenced by pressure from the Canadian authorities. This suspicion was further aroused by the news in November 1989, that Australian canned fruit will be given freer market access in Canada (The Pig Farmer, November 1989, p. 2).

The second major concern of the industry is the expected economic effects from the importation of Canadian pigmeat. Articles in The Pig Farmer magazine suggest that "the industry stands to lose millions of dollars". An estimate of reduced short-run returns of over \$13 000 for a 100 sow piggery has been suggested for the first shipments of Canadian pork (The Pig Farmer, September 1989, p. 3). In a later article the editor, David Dowling, commented that "...some observers believe that the imported product could be on the market up to 50 cents a kg cheaper than the local product." (The Pig Farmer, October 1989, p. 2). The APPF is concerned that the production subsidies paid to Canadian producers will give them an unfair advantage on the Australian market. The APPF president, Mr Geoff Baker, has been quoted as saying that the industry has "...no objection to competition on an equal basis." (The Pig Farmer, August 1989, p. 3).

To date, only a simple examination of the possible effects of imports of Canadian pigmeat has been undertaken. The Australian Bureau of Agricultural and Resource Economics (ABARE) used their Econometric Model of Australian Broadacre Agriculture (EMABA) to measure the trade effects of removing the ban.

* This paper is taken from the B.Ag.Ec. dissertation completed by Ben Scott in September 1990 (Scott 1990).

This included estimates of pigmeat imports, effects on Australian production and consumption and price effects (ABARE, 1989, p. 1). The simulations ABARE carried out made assumptions about exchange rates, growth in the Japanese beef import quota and feed grain prices. The price of Canadian pigmeat was varied using saleyard prices. ABARE also accounted for the fact that price stabilisation arrangements exist for the Canadian domestic pig industry. This results in lower market prices (ABARE, 1989, p. 2).

ABARE's results suggested that there would be little effect on the Australian pig industry because the level of imports is likely to be low and imports are unlikely to occur every year. The exchange rate was cited as the major influence on whether Canadian imports would enter Australia. At the time the ABARE report was written, the Australian dollar had declined in value relative to the Canadian dollar, putting the Australian pig industry in a stronger competitive position (ABARE, 1989, p. 3). However, the relationship between the two currencies has now moved back the other way, suggesting that trade may be becoming more feasible.

1.3 Aims and Objectives

It was decided to examine further the possible economic effects associated with importing Canadian pigmeat. Although ABARE has already done an analysis, this research was considered relevant because the economic environment has changed since the time of writing of ABARE's report (particularly changes in exchange rates and relative price levels), and a more complete picture of possible outcomes of importing Canadian pigmeat is anticipated so that the results may be viewed by producers and other interested parties as being an unbiased appraisal of the situation.

The objectives of this research are to evaluate the feasibility of Canadian pigmeat trade and to analyse the effects of various hypothesised quantities of Canadian pigmeat imports on Australian production and demand, farm and retail prices and industry revenues. As well as showing the effects at the industry level, the effect on an individual farmer's profitability is also examined. The impact of a possible break of TGE is not examined here, but may form the basis of some further research.

1.4. Hypothesis

The hypothesis to be tested is:

H₀: That there will be no significant economic effects on the Australian pig industry as a result of the importation of Canadian pigmeat (assuming there is no TGE impact).

H_a: That there will be significant economic effects on the Australian pig industry as a result of the importation of Canadian pigmeat (assuming there is no TGE impact).

2 THE AUSTRALIAN PIG INDUSTRY

2.1 Introduction

A study by Gill and Griffith (1987) outlines in some detail the market structure of the Australian pig industry. They describe the Australian pig market as an interactive national market with significant interstate transfers of pigmeat as a major characteristic. This may prove to be important if imports of Canadian pigmeat do occur. For example, pigmeat landed in Sydney could have effects on the whole national market rather than just the New South Wales market.

Participants in the market include pig producers, auction selling concerns, abattoirs, wholesalers, retailers and consumers. The main producing states are New South Wales, Victoria, Queensland and South Australia. The domestic market is the predominant outlet for pigmeat. Quantities of pigmeat and pigmeat derivatives exported are small, with imports, also small, restricted mainly to canned hams and bacon products.

Several processing channels may be followed once pigs have been sold. The live pigs, mainly heavier 'baconers' may be sold to processing firms that generally have their own slaughterhouse as part of their operation. The pigs are slaughtered and processed into various pigmeat products such as cured and canned hams, bacon and smallgoods. The finished products are distributed to retailers for sale to consumers.

Another channel is generally used for fresh pigmeat products. The pigs, mainly lighter 'porkers' are sold to wholesale and retail butchers and generally sent to independent abattoirs for slaughter. Retail butchers then sell the product directly to consumers while wholesalers distribute their product to retail outlets such as supermarkets.

Participants in the market must necessarily conform to a variety of health regulations, Meat Industry acts, Shops and Factories acts and local council regulations. Apart from these, the Australian pig industry is viewed as being largely unregulated (Gill and Griffith, 1987). There is no restriction on output, no interference in pricing and, unlike many other Australian primary industries, no requirement for producers to sell their product through a statutory marketing authority. Producers are required to contribute, through a levy on pigs slaughtered, to industry promotion and research.

2.2 Current Industry Situation (see Table 2.1)

2.2.1 Production of pigmeat

Production of pigmeat shows a cyclical behaviour. This is due in part to smaller farms moving in and out of production with fluctuations in prices. Since the number of small farms has been declining it is thought that the pig cycle is becoming less pronounced. Production was at a cyclical peak in 1980, declining slightly in 1981 and 1982 before increasing steadily since 1982 (Ribic, McGrath, Strong and Griffith, 1990). Production is expected to continue to rise to a peak in 1994 (ABARE, 1989). Pork products have averaged approximately 44 per cent of total pigmeat production since 1984.

2.2.2 Pigs slaughtered and average carcass weight

The number of pigs slaughtered in Australia decreased from 1980 to 1982. Since then slaughterings have increased at an average of about 3.2 per cent per year. Slaughterings in 1989 were close to 5 million head (Ribic et al, 1990). Similarly, average carcass weight has risen steadily since 1982 and, in 1989, was 62.1 kilograms (kg).

2.2.3 Per capita consumption of pigmeat

Per capita consumption of pigmeat in Australia has risen steadily from 15.9 kg/person/year in 1982 to 17.8 kg/person/year in 1989. As a proportion of red meat consumed, pigmeat consumption has increased from less than 18 per cent to over 22 per cent over the period 1980 to 1989 (Ribic et al, 1990). Pork consumption, as a percentage of total pigmeat consumed, has increased slightly from 1980 to be approximately 43 per cent in 1989 (Ribic et al, 1990).

2.2.4 Number of establishments by size of pig herd

The pig industry is characterised by a large number of small-scale producers and a small number of very large, highly integrated producers and processors. The number of establishments with pigs has declined by more than 60 per cent since 1980. The number of farms with over 500 pigs had increased from 752 in 1980 to 1032 in 1988, reflecting a greater proportion of smaller farms leaving the industry. However some of this decline can be attributed to changes in ABS definitions of pig enterprises.

2.2.5 Exports of pigmeat

Exports of pigmeat products are classified as carcass pigmeat (pork), canned pigmeat and miscellaneous pigmeat. Since 1980 exports have varied following no consistent pattern. However, the total amount of exports has not been greater than 2.9 per cent [1988] of domestic production.

Table 2.1
Australian Pig Industry Statistics

	Pigs Slaughtered ('000 head)	Average Carcase Weight (kg)	Production of Pigmeat (tcw)	Production of Pork (tcw)	Exports of Pigmeat (tcw)	Stocks in store (tcw)
1980	4154.6	55.6	230914	89850	4924.7	3311
1981	4153.1	55.5	230914	92189	4152.9	2247
1982	4016.8	57.2	229825	93148	3419.1	3256
1983	4292.8	57.5	247040	100104	4855.0	2215
1984	4473.4	57.5	256969	111106	1786.5	1530
1985	4515.7	59.1	266992	117615	2625.3	2900
1986	4609.9	59.6	274486	119419	3866.3	1205
1987	4793.0	60.2	288266	126482	7088.0	1411
1988	4957.5	61.2	303443	135638	8878.2	1890
1989	4999.3	62.1	310395	135300	6595.8	2004
1990	5085.0	61.8	314000	136900	6100.0	2000
1991	5210.0	62.2	324000	141300	7100.0	2000
1992	5310.0	62.7	333000	145200	7100.0	2000
1993	5510.0	62.8	346000	150900	9100.0	2000
1994	5710.0	62.9	359000	156500	13100.0	2000
1995	5510.0	63.2	348000	151700	8100.0	2000

	Per Capita Consumption Pigmeat (kg/yr)	Total Consumption Pigmeat (tcw)	Total Consumption Pork (tcw)	Saleyard Price Pigs (c/kg dcw)	Retail Price Pork (c/kg)
1980	15.6	228259	88378	142.2	415
1981	15.5	228553	91348	170.9	427
1982	15.1	225690	90022	193.7	474
1983	15.9	243072	97298	162.4	489
1984	16.5	256298	111054	171.1	491
1985	16.8	264797	115909	176.9	520
1986	17.0	273361	117833	182.2	538
1987	17.4	269208	119781	186.3	566
1988	17.8	299433	125064	201.0	601
1989	17.8	303795	131543	221.8	670
1990	17.7	307900	133321	237.0	715
1991	17.9	316900	137218	247.0	745
1992	18.2	325900	141115	257.0	775
1993	18.5	336900	145878	257.0	775
1994	18.7	345900	149775	247.0	745
1995	18.1	339900	147177	262.0	790

Source: Ribic et al., 1990; ABARE 1989, 1990.

tcw : tonnes carcase weight.
dcw : dressed carcase weight.

2.2.6 Pigmeat stocks in store

The amount of pigmeat stocks in store varies greatly from year to year. However, as a percentage of total production, stocks in store rarely exceed 1.5 per cent. In 1989, stocks were 2004 tonnes carcass weight (tcw) out of 310 395 tcw total production.

2.2.7 Imports of pigmeat

The level of imports has been low in recent years. Uncooked pigmeat has been banned and imports of processed meats have been restricted to mainly canned hams and bacon, with quotas applicable to these products (Gill and Griffith, 1987). In 1986-87, pigmeat imports were valued at \$37 000 (ABS, 1988, p. 8).

2.2.8 Pigmeat prices

Australian national average saleyard prices showed a cyclical peak in 1982, dropping in 1983 and rising steadily from 1984 onwards. The Australian average saleyard price for pigs was 221.8 c/kg dressed carcass weight (dcw) in 1989. Retail prices did not reflect the trough of 1983. They have risen steadily since 1980. In 1989, the Australian national average retail price of pork was 670 c/kg dcw.

2.3 Industry Forecasts

Saleyard and retail prices are expected to rise to a peak in 1993, dip in 1994 and rise again in 1995. Production, slaughterings, exports and per capita consumption are all expected to increase steadily until 1994 and then decrease as a result of a lagged response to the projected fall in prices.

2.4 Summary of Australian Pig Industry

The Australian pig industry can be viewed as being well balanced. Domestic production largely meets the requirements of the domestic market in both quantity and variety. This is reflected by the low levels of both exports and imports. The industry is expected to maintain this balance with increases on the production side covering any increases in demand. The cyclical trends are expected to continue with consumption and production lagging behind prices. As the number of small farms continues to decline, the pig cycle is likely to become less pronounced.

3 THE CANADIAN PIG INDUSTRY

3.1 Introduction

The Canadian pig industry is much larger than its Australian counterpart. Commercial pork production is approximately four times greater than Australian production. Exports of pigmeat products and live pigs are very important to the Canadian economy. For example, the total value of pigmeat exports (including live pigs) was over C\$725 million in 1989 compared to Australia's exports of A\$32 million.

The industry is heavily influenced by the United States (US) pig industry due mainly to the volume of exports to that country. US pig prices and the value of the Canadian dollar, with respect to the US dollar, are major influences on the prices received by Canadian producers.

In recent years, exports to the US have been subject to a countervailing duty applied to live pigs and fresh, chilled and frozen pork. This has been a major problem for the Canadian industry resulting in reduced exports to the US. Reviews by the US Commerce Department have resulted in a drop in duty on live barrow and gilt exports for the fiscal years 1986/87 and 1987/88, resulting in a refund to exporters (Alberta Agriculture, July 1990, p. 15).

Canadian and US officials had been conducting reviews on the 'countervail case' against pork products. A recommendation from the General Agreement on Tariffs and Trade (GATT) has led to the US dropping its countervail case against imports of Canadian pork (Canadian Consulate spokesperson, pers. comm., September 1990). Alberta Agriculture (July 1990, p. 15) suggested that the outcomes of these decisions "...will have a major influence on trends in Canadian pork production and exports in coming years." As the decisions have only recently been made, one can only speculate about Canadian production and exports over the coming years. However, it would seem likely that the decrease in the duty will result in increased exports to the US and less pork available for other destinations, such as Australia, and for the Canadian domestic market.

3.2 Nature of Government Intervention

Agriculture in Canada is very heavily subsidised by the Federal Government. In 1981/82 Federal expenditure on agriculture was an estimated 31 per cent of agricultural gross domestic product. This figure had risen to 68 per cent in 1988/89 (Government of Canada, in Ryan-Clark, 1990).

The latest support scheme in the livestock industries is the Tripartite Red Meats Program (TRMP), first implemented in 1986. The program was designed to replace the numerous provincial programs already in place. The scheme is essentially a buffer fund arrangement with equal funding from producers, the provincial governments and the federal government as a percentage of the volume of marketings (Agriculture Canada, 1989, p. 2,74). The basis for the scheme is to support prices received by producers.

For pig producers, "...the support price is set quarterly and is equal to the current cash costs of production plus 95 per cent of the average margin during the same quarter of the preceding five years." (Agriculture Canada, 1989, p. 75). Margins are calculated as the price less cash costs for the product produced in that particular period. Calculations are made using national prices and costs rather than provincial figures. When the average market price is lower than the support price, participants in the scheme are paid the difference from the stabilisation account (Agriculture Canada, 1989, p. 75).

In 1989, only four provinces were enrolled in the TRMP for pigs. These were Alberta, Saskatchewan, Manitoba and Ontario. These provinces accounted for about 60 per cent of slaughterings in 1989. The largest producing province is Quebec accounting for approximately 32 per cent of domestic slaughter in 1989 (Agriculture Canada, 1989, p. 75). While government subsidisation of the Canadian pig industry is a concern of Australian producers, it should be emphasised that only 60 per cent of slaughterings in 1989 were covered by the TRMP and that the scheme does not always produce payments. In the first quarter of 1990, C\$9.67 per slaughter hog marketed was paid, but it is expected that there will be no further payments for the rest of 1990 (Alberta Agriculture, July 1990, p. 16).

3.3 Current Industry Situation (Table 3.1)

3.3.1 Production of pigmeat

Canada's commercial pork production appears to show a cyclical behaviour. However, the pattern is difficult to predict being due to the influence of the US pig industry. Production has increased steadily since 1982 with an average of 2.6 per cent per year (Agriculture Canada, March 1990, p. 98). In 1989 commercial pork production was 1203.5 kilotonnes (kt) or approximately four times as much as Australia's production.

3.3.2 Pig marketings

Pig marketings in Canada are classified under domestic slaughter, exports of live pigs and imports of live pigs. Domestic slaughter has followed the trend of production since 1982. Exports of live pigs to the US have fluctuated from a low of 147 300 head in 1981 to a high of 1.35 million in 1984. Exports of live pigs in 1989 were approximately 1.2 million. Imports of live pigs from the US have been under 1000 head since 1980 (with the exception

Table 3.1

Commercial Hog and Pork Balance Sheet, Canada, 1970-90

	HOGS				PORK COMMODITIES								
	Domestic slaughter	Exports of live hogs	Imports of live hogs	Hog marketings	Commercial pork production	Beginning pork commodity stocks	Imports of pork commodity	Domestic pork supply	Ending pork commodity stocks	Exports of pork commodities	Domestic disappearance of pork commodities ¹	Per capita disappearance	
	(thousand head)				(thousand tonnes)								(kg/capita)
1970	10 351	88.2	3.9	10 435.3	745.7	11.1	11.9	768.7	12.2	32.3	619.3	29.0	
1971	11 352	88.7	0.8	11 439.9	813.1	12.2	12.3	837.6	13.1	45.2	779.3	36.1	
1972	10 997	88.7	1.0	11 084.7	787.1	13.1	20.4	820.6	8.5	52.4	678.6	31.1	
1973	10 657	90.2	0.8	10 746.4	763.4	8.5	24.6	796.5	15.0	57.1	645.7	29.3	
1974	10 700	196.8	0.7	10 896.1	767.2	15.0	31.6	813.8	10.4	42.0	682.5	30.5	
1975	9 164	30.7	0.7	9 194.0	654.7	10.4	44.1	709.1	7.8	40.8	593.1	26.1	
1976	8 969	45.0	0.9	9 013.1	643.2	7.8	111.2	762.3	12.5	50.7	632.9	27.5	
1977	9 037	43.6	0.5	9 080.1	647.7	12.5	117.5	777.8	9.8	59.5	641.7	27.6	
1978	9 940	188.0	1.8	10 126.2	741.4	9.8	69.9	821.2	11.8	72.1	660.9	28.1	
1979	12 001	122.6	1.1	12 122.5	889.3	11.8	42.5	943.6	11.9	101.6	738.5	31.1	
1980	13 978	237.6	0.7	14 214.9	1 033.6	11.9	22.0	1 067.5	14.4	149.3	797.4	33.1	
1981	13 692	147.3	0.8	13 838.5	1 015.2	14.4	24.9	1 054.5	12.1	164.4	773.5	31.8	
1982	13 458	305.3	0.5	13 762.8	1 005.9	12.1	18.8	1 036.8	9.4	207.9	715.9	29.1	
1983	13 702	459.3	0.5	14 160.8	1 029.6	9.4	24.2	1 063.2	10.5	201.2	745.5	30.1	
1984	13 886	1 346.5	0.2	15 232.3	1 043.8	10.5	18.2	1 072.4	11.1	223.9	730.0	29.2	
1985	14 452	1 152.4	0.3	15 604.1	1 088.4	11.1	21.2	1 120.7	9.0	250.8	748.8	29.7	
1986	14 444	502.2	0.9	14 945.3	1 097.3	9.0	17.9	1 124.2	8.1	271.9	731.2	28.8	
1987	14 854	427.6	0.7	15 280.9	1 130.9	8.1	22.1	1 161.0	8.4	301.1	735.1	28.7	
1988	15 526	868.3	3.3	16 391.0	1 188.3	8.4	15.7	1 212.4	9.7	318.7	760.2	29.3	
1989	15 530	1 204.2	0.6	16 733.6	1 203.5	9.7	13.7	1 226.9	10.4	310.7	778.9	29.7	
1990	15 375	1 025	0.6	16 399.4	1 179.4	10.4	12.0	1 201.8	10.0	264.1	797.8	30.1	

¹ Domestic disappearance includes a reduction from supply for manufacturing and waste.

Source: Statistics Canada (historical); Agriculture Canada (forecast).

of 1988 when Canada imported 3300 pigs). Imports of live pigs were limited to 600 head in 1989. Total pig marketings for 1989 were approximately 16.7 million head (Agriculture Canada, March 1990, p. 98).

3.3.3 Per capita consumption of pigmeat

Per capita of pigmeat has fluctuated since 1980 with no clear pattern. The average consumption has been 29.9 kg/capita over the period 1980-89 (Agriculture Canada, March 1990, p. 98). In 1989, consumption in Canada was approximately 66 per cent higher than consumption in Australia on a per capita basis.

3.3.4 Exports of pigmeat

Exports of pigmeat products can be broken down into exports of live pigs and pork commodities. Exports of pork commodities had been increasing from 1980, reaching a peak in 1988. The level of exports in 1989 was 310.7 kt or approximately the same as Australia's total domestic production for the same year. It is interesting to note that exports of fresh and frozen pork totalled 228.44 kt in 1989 (Agriculture Canada, March 1990, p. 93). Of this, over 93 per cent went to either the US or Japan. This left only 15.1 kt for exports to other destinations. New Zealand was the destination for 772 t of this quantity.

3.3.5 Imports of pigmeat

Imports of pigmeat products are relatively low, both absolutely and with respect to exports. Since 1980 the highest amount imported has been 24.9 kt in 1981 (Agriculture Canada, March 1990, p. 98). In 1989 Canada imported 13.7 kt, representing approximately 4 per cent of exports for the same year.

3.4 Industry Forecasts

It is difficult to make forecasts about the Canadian industry due to its dependence on the US industry. Agriculture Canada (March 1990) had forecast that total output of pork would be lower in 1990 than in 1989, falling further in 1991. However, recent high prices may lead to an increase in production towards the second half of 1991.

Prices in both the US and Canadian markets have been extremely high for the first half of 1990. The strong Canadian dollar, with respect to its US counterpart, is the only reason why record prices have not been achieved (Alberta Agriculture, April 1990, p. 16). Alberta Agriculture suggests that the current price rally has been driven by demand as well as tight supplies in the US. Prices peaked in early June, but short supplies are expected to keep producer prices above 1989 levels for the remainder of the year. Prices received by Canadian producers tend to drop in December due to a seasonally low demand (Alberta Agriculture, July 1990, p. 16).

Predictions about trade are important from an Australian perspective. While uncertainty exists over the volume of exports to the US in the near future, Japan is expected to continue to be a major importer in 1991 (Agriculture Canada, March 1990, p. 34). However, figures for 1990 so far indicate that exports to Japan are down on 1989 levels (Alberta Agriculture, July 1990, p. 21). This year Canada opened up a new market in the USSR, with exports of 10 000 t to that country. Eastern Europe is a likely outlet for more Canadian exports over the next two to five years. Poland, Romania, Yugoslavia and Bulgaria are all described by Alberta Agriculture (April 1990) as potential customers.

3.5 Summary of Canadian Pig Industry

The Canadian pig industry is a large net exporter of both pigmeat products and live pigs. The US decisions to lower the countervailing duties on Canadian pigs and pork products are likely to be the major influences on Canada's production and exports to the US. In the short term, it may be expected that exports to the US will increase. This could mean that export supplies for other destinations are reduced. In addition, the opening of new

markets in Eastern Europe will be influential in shaping the Canadian pig industry well into the 1990s. There may also be an increase in Canada's production of pigmeat, in the medium run, to take advantage of these export opportunities.

Recent high prices should lead to increased production over the next two years. Live pigs and pigmeat products should continue to be major export earners.

4 THE INCENTIVES TO TRADE

4.1 Introduction

This section aims to assess whether it is economically feasible for Canada to export unprocessed pigmeat to Australia. This involves an analysis of a number of variables including the Canadian export price, Australian wholesale price, Australia's exchange rate with both Canada and the US, shipping costs, Australian and Canadian production levels and government policy. Changes in these variables are difficult to predict with any degree of accuracy. Therefore, questions will be asked along the lines of a 'what if...' basis rather than on the basis of formal forecasts, although 'most likely' combinations are highlighted. Several assumptions have been made in order to correct for data deficiencies, and these are outlined at appropriate times.

4.2 Outline of Variables

4.2.1 Canadian export price

Primary data on Canadian export prices were unavailable at the time of writing. Therefore, two estimates were used as a basis for a 'Free On Board' (FOB) price. The first of these was based on Agriculture Canada's 1989 figures for fresh and frozen pork exports by volume and value. This gave a 1989 export value of C\$2.30/kg. The second estimate was based on the volume and value of Canadian pork exported to New Zealand (NZ) in 1989 (in \$NZ Cost, Insurance and Freight [CIF]). This value was converted to Australian dollars and then back to Canadian dollars using exchange rates for the end of June, 1989 (Reserve Bank of Australia Bulletin, December 1989). The value was found to be C\$2.43.

4.2.2 Australian wholesale price

The Australian wholesale price was taken from Nielsen Marketing Research (1989 and 1990) published in The Australian Meat Industry Bulletin. The price was an Australian national average rather than a specific cut price. The 1989 annual average estimate was \$2.79/kg. For 1990 estimates, the figure was the May national average of \$2.69/kg.

4.2.3 Exchange rates

Exchange rates between Australia and Canada, Australia and the US and Canada and the US were all taken from The Reserve Bank of Australia Bulletin for December 1989 and July 1990.

4.2.4 Transport costs

Transport costs are calculated in US currency. The values given were for an 18 tonne refrigerated container. Transport costs include the flat rate per container, Canadian wharfage, currency adjustment factor, bunker surcharge, terminal receiving charge, protective service charge and Australian wharfage charge. Transport from dockside to the wholesaler's distribution centre was considered to be negligible in terms of a per kilogram cost.

Estimates for 1990, in \$A/kg, were based on an end of June 1990 Australia/US exchange rate with currency adjustment and bunker surcharge costs from September 1990 (Shipping company representative [Name withheld by request], pers. comm., 1990). Per container costs were cheaper from the west coast (Vancouver) than the east coast (Toronto, Montreal). When converted to a per kilogram cost it was found that east coast transport was A\$0.31 compared to a west coast cost of A\$0.30/kg. It would seem that Vancouver is the most

likely outlet for potential Canadian pork exports to Australia. Thus, the west coast transport rate has been used in the analysis. For the first two simulations below, the rate used was an early 1990 value. It has been suggested that the average annual increase in transport costs is approximately 10 per cent (Shipping company representative [Name withheld by request], pers. comm., 1990). However, the AMLC (Market Notes, 1989, 1990) suggests that refrigerated transport costs for beef have decreased since the middle of 1989. It would be expected that refrigerated transport costs for pork are fairly similar, so the sensitivity analysis below has allowed for both increases and decreases in transport costs.

4.2.5 Australian production levels

Details about the level of production in Australia are available in section 2. The industry is expected to maintain its balance, with production covering domestic demands and leaving small quantities available for export. Saleyard and retail prices are expected to rise by around 4 per cent per year over 1990 to 1992.

4.2.6 Canadian production levels

Details about the Canadian industry are available in section 3. Alberta Agriculture (July 1990) expect a gradual increase in production and a gradual decrease in price for the remainder of 1990 and early 1991.

4.2.7 Government policy

Changes in government policy, rather than directly influencing feasibility, may have an indirect influence on trade in pigmeat between Australia and Canada. Three areas that may influence trade are;

i) There is a possibility that AQIS may change the quarantine regulations on imports of uncooked pigmeat. As far as Australian pig producers are concerned, the TGE issue is not resolved and further representations on this issue seem likely. It is possible, though highly unlikely, that the import ban could be reinstated, meaning no uncooked pigmeat would be allowed into Australia. Another possible scenario is that AQIS could ask for tighter inspection rules with importers being levied for the extra cost. This could make importing the Canadian product more expensive.

ii) The Canadian government may, in the future, decide to lower assistance levels to the agricultural sector because of budgetary considerations. This may cause a reduction in supply (possibly forcing some Canadian pig producers out of the industry) thus reducing the availability of export meat. It may also raise the FOB price at which export shipments are offered for sale.

iii) The outcome of the US countervailing duty case is expected to have an influence on Canadian production and exports in future years. More exports to the US are likely and less supplies would then be available for other export markets such as Australia.

4.3 Analysis of Incentives to Trade

An analysis of the economic feasibility of trade between Canada and Australia was undertaken using a spreadsheet model. The format used was to take a Canadian export price, convert this to Australian dollars and then add a per kilogram transport cost. The result was an estimate of a landed price in Sydney which could be compared to Australian wholesale prices. By subtracting the landed price from the Australian price, a differential was obtained. A negative number indicated that the trade was not feasible (Figure 4.1). Two simulations were undertaken for 1989 data using the two estimated Canadian FOB prices separately. The results are summarised below and in Figure 4.1.

Simulation 1

The Canadian export price was taken to be C\$2.30/kg. Exchange rates from the end of June 1989 were used (C\$0.904, US\$0.76). It would have been desirable to use average exchange rates for the 1989 calendar year.

$$\begin{aligned}
 & \text{Canada FOB price} \times \text{Exchange Rate} & = & \text{Canada FOB price in A\$} \\
 (\text{Transport Cost}/18\text{t} \times \text{ER} + \text{Australian Wharfage}) \div 18000 & = & \text{Transport Cost/ kg in A\$} \\
 & \text{Canada FOB in A\$} + \text{Transport cost} & = & \text{Landed price} \\
 & \text{Australian Wholesale - Landed Price} & = & \text{Price differential}
 \end{aligned}$$

If value of price differential is negative then trade is not feasible.

Estimates of Trade Feasibility (\$/kg)

1st estimate

1989 ave Canada FOB	End June 1989 exchange rate	Can FOB A\$	West Coast Transport Cost (US\$ total/18t)	Exchange Rate (US\$/A\$)	Transport Cost (A\$/kg) dock)	Total cost (A\$ Syd)	Aust. w/sale	Price diff.
2.30	0.904	2.55	3925.69	0.76	0.30	2.84	2.79	-0.05

2nd estimate

1989 ave Canada FOB	End June 1989 exchange rate	Can FOB A\$	West Coast Transport Cost (US\$ total/18t)	Exchange Rate (US\$/A\$)	Transport Cost (A\$/kg) dock)	Total cost (A\$ Syd)	Aust. w/sale	Price diff.
2.43	0.904	2.69	3925.69	0.76	0.30	2.99	2.79	-0.20

Figure 4.1: Analysis of Incentives to Trade

Unfortunately, these data were unavailable at the time of writing. However, the variations in exchange rates over the whole year were taken into account when setting the exchange rate ranges in the sensitivity analysis below. With an Australian national average wholesale price of \$2.79/kg and a freight cost of \$0.30/kg, the price differential was found to be -\$0.05/kg.

Simulation 2

This simulation used the second estimate of C\$2.43/kg for the Canadian export price. Holding exchange rates and transport costs constant, it was found that the price differential was -\$0.20/kg.

Therefore, based on 1989 data, there is no economic incentive for trade in unprocessed pork between Australia and Canada.

Next, a sensitivity analysis was carried out by incorporating 'best guess' values for recent months into the spreadsheet to allow two variables to be changed while holding two variables constant. The 'best guess' values were taken to be C\$2.36 for the Canadian FOB price (being the average of the two estimates above); \$2.69 for the Australian wholesale price (being the May 1990 national average); an exchange rate of A\$1.00 = C\$0.9216 (being the exchange rate at the end of June 1990); and a transport cost of \$0.30/kg (being the west coast transport cost with Australian wharfage charges included). The results are summarised below and in Tables 1.1, 1.2 and 1.3 in Appendix 1.

Simulation 3

For this case, the exchange rate and transport cost were held constant at the 'best guess' values, with the Canadian FOB and Australian wholesale price being varied. The results show that trade becomes more feasible with a higher Australian wholesale price and/or a lower Canadian FOB price. For example, with the given exchange rate and transport cost, if the Australian wholesale price is greater than \$3.00/kg, then any Canadian FOB price under C\$2.49/kg would make the trade feasible. If the Australian price is \$2.70/kg, then the Canadian price would have to be under C\$2.20/kg for the trade to become viable.

Simulation 4

This simulation held the Australian wholesale price and exchange rate constant at the 'best guess' values while varying the Canadian FOB price and the transport cost. It was found that low values of the Canadian FOB price would make the trade feasible when combined with low transport costs. For example, with the given Australian wholesale price and exchange rate, if the Canadian FOB price was C\$2.20/kg, then any transport cost below \$0.30/kg would make the trade feasible. Similarly, if the transport cost were to fall to \$0.25/kg, then Canadian prices below C\$2.29/kg would make the trade economically feasible.

Simulation 5

The fifth simulation involved holding the transport cost and Australian wholesale price at the 'best guess' values while varying the Canadian FOB price with the exchange rate. It was found that a strong Australian dollar, with respect to the Canadian dollar, would be needed with a low Canadian price before imports of pigmeat would become viable. For example, an exchange rate of A\$1.00 = C\$0.85 or greater would make the trade viable for Canadian prices under C\$2.30/kg.

Simulation 6

This simulation varied the exchange rate against the Australian wholesale price. Transport costs and the Canadian FOB price were held constant at their respective 'best guess' values. The results indicate that a strong dollar and a high Australian price combination would make importing Canadian pigmeat viable. For example, an Australian price greater than \$2.80/kg combined with an exchange rate higher than C\$0.945 would make the trade economically feasible.

Simulation 7

This simulation held the Australian wholesale and Canadian FOB prices constant at 'best guess' values while changing the transport cost and exchange rates. It was found that very high exchange rates would need to be operating with low transport costs before the imports would become feasible. For example, with Australian and Canadian prices at \$2.69 and C\$7.11 per kilogram respectively, an exchange rate of A\$1.00 = C\$0.975 would only allow trade to be feasible if the transport cost was below \$0.27/kg.

Simulation 8

This final simulation involved varying the Australian wholesale price with respect to the transport cost. The Canadian FOB price and exchange rate were held at the 'best guess' values. The results here suggest that high Australian prices and low transport costs are necessary before trade becomes viable. For example, any Australian price above \$2.85/kg makes trade economically feasible if transport costs are below \$0.29/kg.

4.4 Summary of Feasibility

These simulations do not provide all the answers to the economic feasibility of trade in pigmeat between Australia and Canada. However, they do provide the background for some important conclusions.

The exchange rate between Australia and Canada is only one major influence on potential trade between the two countries. The prices, both wholesale in Australia and FOB in Canada, are also very influential. The transport cost is of less importance simply because large changes are required to the per container cost before this has a significant influence at a per kilogram level. Similarly, the exchange rate between Australia and the US is also less important. For example the Australian dollar would have to strengthen from US\$0.78 to US\$0.83 to lower the transport cost from \$0.30/kg to \$0.28/kg. However, the US dollar may provide indirect effects on the feasibility of trade through its influence on both the Australian and Canadian economies. That is, the Canadian dollar is generally fairly stable with respect to the US dollar while the Australian dollar tends to be more unstable.

To summarise the results, imports of unprocessed Canadian pigmeat are more likely to occur:

- a) The lower the Canadian FOB price for pigmeat;
- b) The higher the Australian wholesale price of pork;
- c) The stronger the Australian dollar with respect to both the Canadian and US dollars; and
- d) The lower the cost of refrigerated transport between Canada and Australia.

The 'best guess' values of these variables were C\$2.36 for the Canadian FOB price, \$2.69 for the Australian national average wholesale price, A\$1 = C\$0.9216 for the exchange rate and \$0.30/kg for the transport cost. At these 'best guess' values, the price differential was found to be -0.17 (A\$). This value implies that the trade is economically infeasible.

5 ESTIMATED ECONOMIC EFFECTS OF CANADIAN IMPORTS

5.1 Introduction

This section aims to outline the economic effects of varying hypothesised levels of imports of unprocessed Canadian pigmeat on the Australian pig industry. An econometric model of the Australian industry is used to show the aggregate effects on key industry variables (production, demand, farm and retail prices and industry revenues).

5.2 Expectations About Quantity

The results reported in section 4 showed that, at the 'best guess' values, trade in unprocessed pigmeat between Australia and Canada was not economically feasible. However, some expectations can be formed about the likely level of exports that would come into Australia if economic conditions changed and the trade was considered feasible.

5.2.1 Canadian exports to New Zealand

Data on Canadian pork exports to New Zealand are available from 1983 to 1989. The volume has ranged from a high of 1556.8 t in 1984 to a low of 190.7 t in 1988. Some 771.8 t of Canadian pork were imported in 1989. New Zealand pork consumption has been fairly stable, averaging 48.394 kt from 1984 to 1989 (Walter Moore, NZ Ministry of Agriculture and Fisheries, pers. comm., 1990). As a percentage of pork consumption in New Zealand, 771.8 t represents approximately 1.6 per cent and 1556.8 t represents approximately 3.2 per cent.

As Australia also exports pork to New Zealand, it would indicate that the New Zealand market is at least as profitable as the domestic market. Thus, Canadian exports to Australia of up to 2 per cent of domestic consumption may not be unreasonable. Based on 1989 consumption levels, this would mean imports of approximately 6.075 kt.

5.2.2 Available export supply from Canada

The two major markets for Canadian pork exports are the US and Japan. In 1989, exports supplied to other markets totalled 15 kt out of a possible 228 kt. This proportion may continue with the decision, by the US, to drop the countervailing duty on Canadian exports to that country. Other markets in Eastern Europe may also provide an outlet for Canadian exports. This has been demonstrated by recent exports of 10 kt to the USSR. Based on this information, it would be unlikely that more than 5 kt would be available for export to Australia.

5.2.3 Other factors

The current "Gulf crisis" lifted the value of the Australian dollar with respect to both the US and Canadian dollars although the currency has again depreciated recently. A strong \$A because of such factors is likely to improve the feasibility of trade and open the way for some larger quantities to be exported to Australia in the short term.

Given the above information, it was decided to use 500 t, 1000 t, 5000 t and 10 000 t per year as the hypothesised import quantities into Australia in the simulation analysis.

5.3 Specification of the Model

The quarterly econometric model of the Australian pig industry used here is an updated but unpublished version of the model initially developed by Griffith and Gellatly (1982). The simulation format used was an historical one rather than a forecasting one. That is, the model provides solution values based on what would have happened in the past if imports of Canadian pigmeat had been allowed. Real prices (base 1966) rather than nominal prices are used in the model.

Griffith and Gellatly (1982) considered the economic relationships in the pig industry in four components. These are identified as inventory relationships, production, demand and price formation. Figure 5.1 shows the interactions within and between the blocks over time. The individual equations in the model are reported in Appendix 2.

5.4 Inclusion of Imports into the Model

Imports of pigmeat were not included as a variable in the original model because of their very small historical proportions of total output and disposition. The simplest way to include the effects of imports into the model

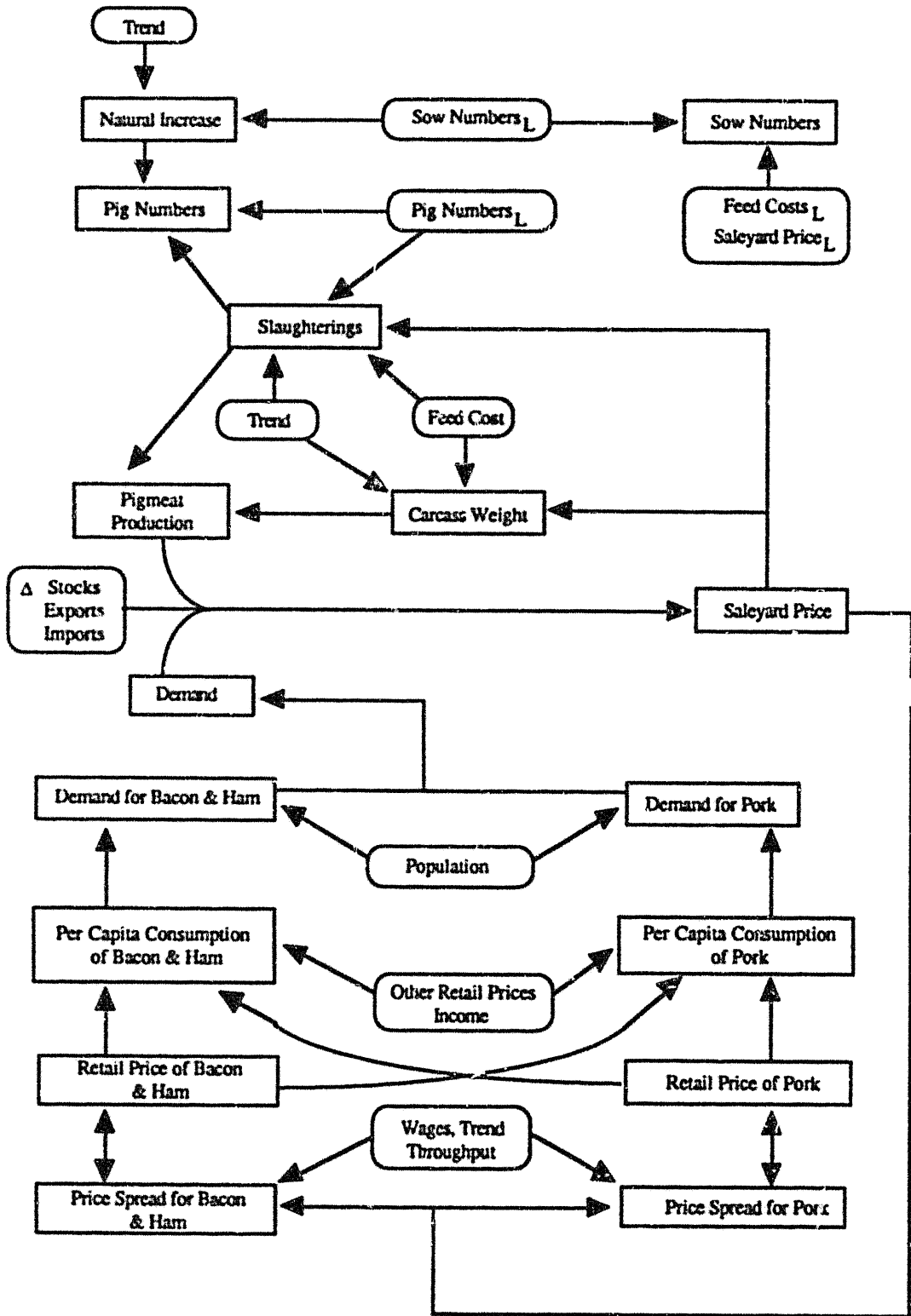


Figure 5.1: Economic Relationships in the Australian Pig Industry

was to add imports into exports to give net exports. This led to a change in the supply/demand identity for production of pigmeat as noted above (Equation 5.5).

5.5 Simulation of the Model

The model was simulated over the 21 year period 1967:2 to 1987:3. Five simulations in all were run, using a base model with no imports, and the four hypothesised levels of imports. Unfortunately, the model could only be simulated statically rather than dynamically. This may tend to bias the results towards a non-rejection of the null hypothesis. The validation performance of the model, with respect to saleyard price, is shown in Figure 5.2.

The decision criterion employed is t-tests to test for significant differences in the means of selected variables with and without imports. The tests were carried out on the means over the entire sample period and on means for ten quarter samples. It was hoped that testing over ten quarter samples would show if the economic impacts of importing Canadian pigmeat were more pronounced in the early stages of the trade. The 10 per cent level of significance was chosen to allow for the static nature of the model. Testing for significant differences in the variance of these variables was disregarded because imports were included as equal amounts per quarter over the entire sample period. Thus, significant changes in the variability of prices, for example, were not expected.

5.6 Analysis of Results

Five variables were tested to show the economic effects of importing Canadian pigmeat. These were the per capita consumption of pork (CNPK), the total demand for pork (PKDM), the retail price of pork (PRKAU), the saleyard price of pigs (PAPGAU) and the pig industry total revenue (TR). Imports of pigmeat could be expected to have impacts on other variables, such as slaughterings and sow numbers. However, the five variables chosen were considered to be the best indicators of economic impact.

It was expected that, as the level of imports increased, per capita and total consumption would increase while retail and saleyard prices would decrease. The simulation results indicate that this has occurred. The effect on industry revenues is unclear, depending on the interaction of output and price.

Changes in means for the entire sample period were considered insignificant if the calculated t values (t_{calc}) were less than the table value (t_{table}) in absolute terms. Both one and two tail tests were carried out to allow for positive or negative changes in the respective variables. The calculated t values, with the general formulae, are given in Table 5.2. It can be seen that the per capita consumption of pork with imports is not significantly different from the mean of per capita consumption without imports at the 10 per cent level of significance. Similarly, the total demand for pork is not significantly different even with imports of 10 000 t annually. The simulation results show a fall in both retail and saleyard prices. However, the t tests suggest that the difference between both the mean retail price and the mean saleyard price are not statistically different for any of the hypothesised levels of imports. The industry total revenue was the only variable tested that showed a significant difference with imports of 10 000 t. The pattern of saleyard price solution values over time, with and without imports, is shown in Figure 5.3.

The same procedure was used for ten quarter samples. It was thought that imports may have a greater impact in the early stages, with less impact later on as the market adjusted to regular import quantities each quarter. However the results showed that there were no significant differences between the means of any of the variables, with and without imports.

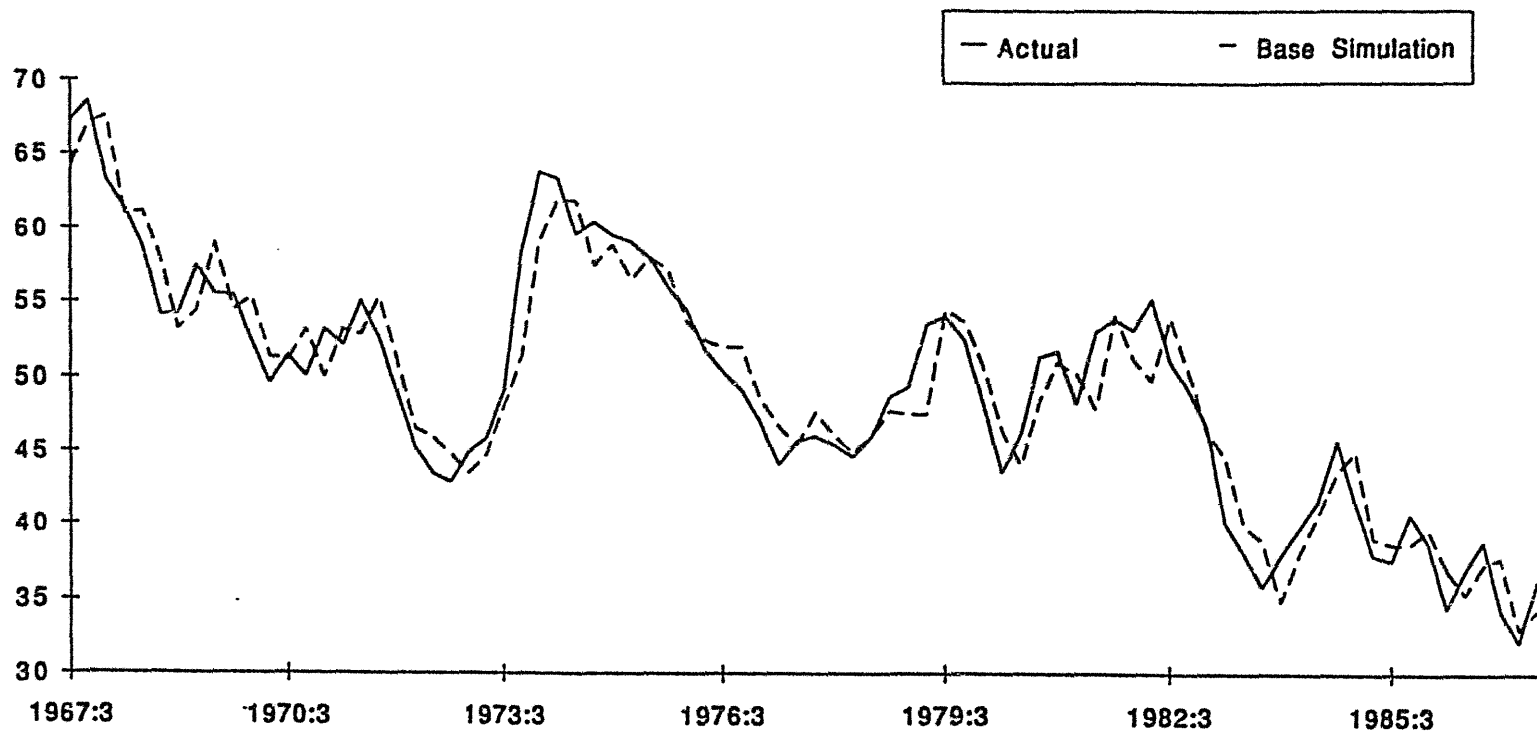


Figure 5.2: Model Validation - Saleyard Price of Pigs

Table 5.2

Testing for Significant Difference between Means With and Without Imports of Canadian Pigmeat

Testing for Significant Difference between Means over 1967:2 to 1987:3

$$H_0 : \mu_1 = \mu_2 \text{ or } \mu_1 - \mu_2 = 0$$

$$H_a : \mu_1 - \mu_2 \neq 0$$

Eg - X1 = TRS

X2 = TRS WITH IMPORTS

$$t_{\text{calc}} = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{(s_1^2/n_1 + s_2^2/n_2)^{0.5}}$$

Reject H_0 if $|t_{\text{calc}}| > t_{\text{tables}}$

Import Quantity	CNPKS	PKDMS	PRPKAUS	PAPGAUS	TRS
10000t	-0.765	-0.108	0.795	0.563	-1.991
5000t	-0.015	-0.054	0.398	0.281	-1.007
1000t	-0.008	-0.011	0.079	0.056	-0.203
500t	-0.004	-0.005	0.040	0.028	-0.102

t-tables (162, 0.90) = 1.645 or 1.282 at 2 tail 10% and 1 tail 10% respectively.

Testing for Significant Difference between Means for Ten Quarter Samples

Eq - X1 = PAPGAUS

X2 = PAPGAUS WITH IMPORTS

$$t_{\text{calc}} = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{\left(\frac{S_1^2(n_1 - 1) + S_2^2(n_2 - 1)}{n_1 + n_2 - 2} \right)^{0.5}}$$

Reject H_0 if $|t_{\text{calc}}| > t_{\text{tables}}$

	CNPKS	PKDMS	PRPKAUS	PAPGAUS
to 1969:3	-0.033	-0.028	0.290	0.152
to 1972:1	-0.029	-0.031	0.720	0.408
to 1974:3	-0.021	-0.022	0.122	0.100
to 1977:1	-0.025	-0.027	0.541	0.210
to 1979:3	-0.031	-0.033	0.164	0.252
to 1982:1	-0.026	-0.027	0.149	0.213
to 1984:3	-0.021	-0.020	0.180	0.104
to 1987:1	-0.021	-0.027	0.254	0.215

t-tables (18, 0.90) = 1.33 or 1.734 at 2 tail 10% and 1 tail 10% respectively.

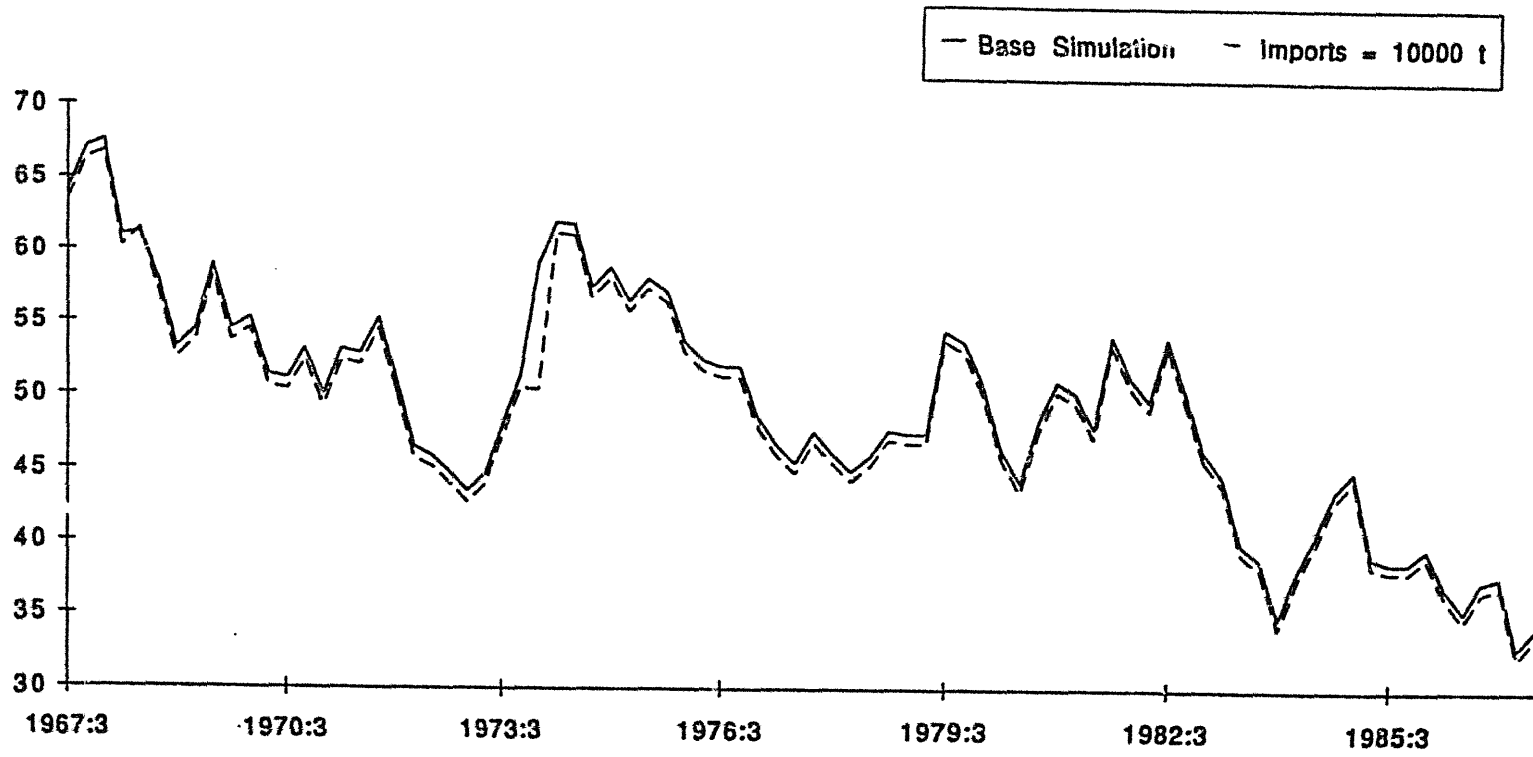


Figure 5.3: Saleyard Price of Pigs With and Without Imports

5.7 Summary of Results

On the basis of the statistical analysis, it was decided that the null hypothesis should not be rejected. There will be no significant economic effects on the Australian pig industry as a result of the importation of the hypothesised quantities of Canadian pigmeat (assuming there is no TGE impact).

6 IMPACT OF IMPORTS ON INDIVIDUAL PRODUCERS

6.1 Introduction

The purpose of this section is to examine the effects of the various hypothesised levels of imports on the profitability of a representative pig enterprise. This is done by estimating the percentage change in the saleyard price received by producers as a result of imports. As the results above have suggested that the saleyard price is not significantly different with imports or without imports, it was decided to use the difference between the mean saleyard price with no imports and the mean saleyard price with imports of 10 000 t. The percentage change in price is then applied to a representative farm's gross margin budget to see the effects on this farm's annual profit.

6.2 The Gross Margin Budget

The budget used was developed by Greg Roesse from NSW Agriculture and Fisheries (Leeton). The major assumptions behind the budget are available if required. It is based on a 100 piggery producing 1690 weaners per year.

The analysis was based on decreasing the value of sales of all stock by a given percentage. It was assumed that the value of sow and boar replacements would decrease by the same amount. This assumption was expected to make the scenario with imports appear to be worse than what would likely happen in the actual market situation. It would be expected that a decrease in the value of growers would lead to a greater decrease in the value of replacements, because farmers would be expected to retain fewer gilts and require fewer sows as replacements for their breeding herd. All variable costs were held constant as they would not be expected to change with small changes in the value of output.

6.3 Results of Analysis

Table 6.1 contains the representative farmer's annual profit statement. The first column shows the existing, or 'no imports', situation. The second column shows the situation with imports of 10 000 t per year. The largest difference between mean saleyard prices with and without these imports was found to be 1.62 per cent. The effect on the representative farm is to reduce the enterprise gross margin by approximately 4 per cent, the cash operating surplus by approximately 4.7 per cent and the return to capital and management by approximately 5 per cent.

The third column has been included to show the effects if the saleyard price of pigs were to decrease by 5 per cent. Clearly this would have a much greater impact on the enterprise profit. The return to capital and management is decreased by almost 16 per cent.

6.4 Summary

Imports of Canadian pigmeat, under the assumptions used, would be expected to have a minimal impact on the representative farm's annual profit. This is consistent with the minimal impact evidenced on aggregated prices in the simulation analysis.

7 CONCLUSIONS

7.1 Limitations of the Analyses

Limitations of the study can be found in both section 4 and 5. Section 4 discussed the incentives to trade. It was found that, at the time of writing, trade in pigmeat between Canada and Australia was not economically feasible. However, a report in "The Land" (13 September, 1990) suggests that

Table 6.1
Representative Farm's Annual Profit Statement

Income-Livestock Sales	Existing	With Can. Imports = 10000t Decreased Value by 1.62%	Percentage change from existing	Decreased value by 5%	Percentage change from existing
	\$	\$	%	\$	%
Value of grower sales	202647	199364		192515	
Value of gilt sales	10800	10625		10260	
Value of boar sales	3500	3443		3325	
Value of backfatter sales	5025	4944		4474	
Miscellaneous	0	0		0	
LESS Purchases					
Cost of replacement sows	7440	7319		7068	
Cost of replacement boars	1950	1918		1853	
Miscellaneous	0	0		0	
GROSS RETURNS: (A)	212582	209138		201953	
Less variable costs					
Feed	103904	103904		103904	
Water	1400	1400		1400	
Health	2000	2000		2000	
Electricity	2000	2000		2000	
Cartage	6395	6395		6395	
Commission	7769	7769		7769	
Repairs and Maintenance	1500	1500		1500	
Casual labour	1500	1500		1500	
Sundries	500	500		500	
TOTAL VARIABLE COSTS: (B)	126968	126968		126968	
ENTERPRISE GROSS MARGIN: (A)-(B)=(C)	85614	82170	-4.0	74985	-12.4
Less Cash Overhead Costs					
Loan repayments	0	0		0	
Perm. hired labour	10000	10000		10000	
Subs; telephone	1200	1200		1200	
Rates; insur; account	1200	1200		1200	
TOTAL CASH OVERHEAD COSTS: (D)	12400	12400		12400	
CASH OPERATING SURPLUS: (C)-(D)=(E)	73214	69770	-4.7	62585	-14.5
Less non-cash overhead costs					
Owners labour	5000	5000		5000	
Machinery depreciation	0	0		0	
Housing depreciation	0	0		0	
Opportunity cost	0	0		0	
TOTAL NON-CASH OVERHEAD COSTS: (F)	5000	5000		5000	
RETURN to CAPITAL and MANAGEMENT: (E)-(F)=(G)	68214	64770	-5.0	57585	-15.6
GROSS MARGIN per SOW	856.14	821.70	-4.0	749.85	-12.4
BREAK EVEN PRICE: (cents/kg D.W.)	1.39	1.39		1.39	
OPERATING PROFIT per SOW	682.14	647.70	-5.0	575.85	-15.6

imports of about 180 t are due for delivery in Sydney and Tasmania. Several reasons can be outlined that explain why these imports are taking place despite the results obtained above.

First, the Australian dollar has appreciated significantly, with respect to both Canadian and US currencies, since the end of June, 1990. "The Weekend Australian" (29 September, p. 49) puts the Australian dollar at C\$0.958 and US\$0.827. However, by the analysis in Section 4, the price differential would still be -0.06 \$/kg so the trade is still not economically viable.

Second, it may be possible that an importing firm is bringing in Canadian pork at a loss just to test out the Australian market reaction to the Canadian product.

Third, the analysis did not take into account the price difference between primals. That is, it is expected that mainly leg meat would come into Australia because the rest of the Canadian carcass is considered too fat for Australian consumers (The Land, September 1990, p. 19). The leg cut is particularly expensive in Australia (R. Sewell, pers. comm., September 1990). Thus, if the Canadian price for leg cuts is significantly cheaper, the trade may be economically feasible. These data were unavailable at the time of writing.

Finally, the pork prices used in the analysis were estimated as Canadian and Australian national averages. As well as disregarding the differences between primals, the prices used did not take into account regional differences in both Australia and Canada. It may also be said that the prices reported in AMLC and similar publications may be significantly different from those negotiated by individual importers and exporters.

In Section 5, the model used was run in a static format. This means that the model is limited because it is unable to show the full supply response effects of the changes in prices, especially over the longer term. Another limitation is the fact that imports were specified to enter the Australian market as equal quantities each quarter over the entire sample period. It may be found, in the real situation, that a relatively large quantity could come into Australia in one quarter with no imports in the next quarter. This would be expected to have a more disruptive influence on the Australian pig industry, possibly leading to lower and more variable prices received by producers.

7.2 Conclusions

As shown in Section 4, the important variables in determining the feasibility of trade are the exchange rates between Australia and Canada, the Canadian FOB price of pork, the Australian wholesale price of pork and the cost of refrigerated transport between Canada and Australia. Although there are some limitations to this analysis, trade in pigmeat between Canada and Australia was found to be economically infeasible. Thus, the level of imports is likely to remain low.

Should imports enter the Australian market, processors may be perceived to benefit from slightly lower saleyard prices. Consumers would be unlikely to see much benefit from this, although the model has indicated that retail prices will fall marginally. Producers would suffer small losses, increasing as the level of imports increases.

The results of this research suggest that lifting the import restriction on Canadian pork carcasses will have a limited impact on the Australian pig industry.

7.3 Suggestions for Further Research

All of the limitations, outlined above, form possible areas for further research. In particular, data could be updated to include the price differences between the primals for both Canada and Australia as well as some more accurate Canadian export prices.

Another obvious area for further research would be to upgrade the model to run on a dynamic basis, thus allowing the full supply effects of the changing prices to be shown.

Aside from improvements to the work already carried out, another important area for further research lies in the disease risk aspect. In particular, an analysis of the risk of TGE entering Australia through the imported pigmeat could be coupled to an economic analysis to show the possible effects on producers if an outbreak of TGE occurred.

REFERENCES

- ABARE (June 1990 and earlier issues), 'Pig and poultry meats', Agriculture and Resources Quarterly, 2(2), p. 119.
- _____ (1989), Estimated Trade Effects of Removal of Ban on Pigmeat Imports from Canada, Unpublished report, Canberra.
- Australian Bureau of Statistics (1988), Imports, Australia, Annual Summary Tables, Catalogue no. 5426.0, Canberra.
- _____ 1990a, Livestock and Livestock Products, Australia, 1988-89, Catalogue no. 7221.0, Canberra.
- _____ (1990b), Agricultural Industries, Structure of Operating Units, Australia, 31 March, 1989, Catalogue no. 7102.0, Canberra.
- _____ (1990c), Production of Food, Drink, Tobacco and Stock and Poultry Food, Australia, Catalogue no. 8359.0, Canberra.
- Agriculture Canada (1990 and earlier issues), Market Commentary, Market Outlook and Analysis Division of the Policy Branch, Ottawa.
- Alberta Agriculture (1990 and earlier issues), Livestock Situation and Outlook, Market Analysis Branch, Alberta.
- Anon (1990a and earlier issues), 'Government says ban must go', The Pig Farmer, 24(7), 2-4.
- Anon (1990b), 'Summary: Exchange Rates', The Weekend Australian, 29 September, p. 49.
- Australian Meat and Livestock Corporation (1990 and earlier issues), Market Notes: Livestock and Meat, No. 765, Sydney.
- Australian Pig Industry Delegation (1990), 'Transmissible Gastro Enteritis: A Report based on the findings of the Australian Pig Industry Delegation', Unpublished report, Canberra.
- Bennett, C. (1982), 'The changing Australian pig industry', Quarterly Review of the Rural Economy, 4(4), 313-320.
- Doran, H.E. and Guise, J.W.B. (1984), Single Equation Methods in Econometrics: Applied Regression Analysis, University of New England, Armidale.
- Doti, J.L. and Adibi, E. (1988), Econometric Analysis: An Applications Approach, Prentice Hall, New Jersey.
- Gill, R.A. and Griffith, G.R. (1987), Market Structure of the Australian Pig Industry, Division of Marketing and Economic Services, NSW Department of Agriculture, Research Workpaper No. 11/87.
- Graham, V. and Rowlett, M. (1990), 'First Canadian pork shipment next week', The Land, 13 September, p. 19.

- Griffith, G.R. (1985), The Specification, Estimation and Validation of a Quarterly Econometric Model of the N.S.W. Pig Industry: Further Progress, Division of Marketing and Economic Services, NSW Department of Agriculture, Research Workpaper No. 3/85.
- _____ and Gallatiy, C. (1982), The Development and Testing of a Quarterly Econometric Model of the Australian Pig Industry, Division of Marketing and Economics, New South Wales Department of Agriculture, Miscellaneous Bulletin No. 36.
- _____, Green, W. and Vere, D.T. (1988), Studies in the Australian Prime Lamb Market, 7. CER and the impacts of potential increases in New Zealand lamb imports, Division of Marketing and Economic Services, New South Wales Department of Agriculture, Research Workpaper 1988.
- Meat and Allied Trades Federation of Australia (1990 and earlier issues), The Australian Meat Industry Bulletin, 13(6), p. 54.
- Pindyck, R.S. and Rubinfeld, D.L. (1981), Econometric Models and Econometric Forecasts, 2nd Ed., McGraw Hill, Sydney.
- Ryan-Clark, F. (1990), 'How Canada cracked the Australian pork market', Australian Rural Times, August 9 - August 15, p. 26.
- Reserve Bank of Australia (1990 and earlier issues), Reserve Bank of Australia Bulletin, Reserve Bank, Sydney, S48-S49.
- Ribic, K., McGrath, M., Strong, A. and Griffith, G.R. (1990), A Statistical Handbook for the NSW and Australian Pig Industries: 1970 to 1988, NSW Agriculture and Fisheries Division of Rural and Resource Economics, Rural and Resource Economics Report No. 12.
- Røese, G. (1990), 'Assessing a change in production', Unpublished report, N.S.W. Agriculture and Fisheries, Leeton.
- Scott, B.S. (1990), Some Economic Effects on the Australian Pig Industry of Removing Import Restrictions on Unprocessed Canadian Pork, Unpublished B.Ag.Ec. Dissertation, University of New England, Armidale.
- Van Kooten, G.C., Spriggs, J. and Schmitz, A., 1989, The Impact of Canadian Commodity Stabilisation Programs on Risk Reduction and the Supply of Agricultural Commodities, Agriculture Canada, Policy Branch, Working Paper 2/89.

Appendix 1

Table 1.1

Estimates of Trade Feasibility: Simulations 3 and 4

Variables:		Best Guesses:							
Canada FOB CS	(Can)	C\$2.36/kg							
Aust w/sale AS	(Aus)	A\$2.69							
Aust/Can ER	(ER)	A\$1=C\$0.9216							
Trans cost AS/kg	(TC)	A\$0.30/kg							
3rd Simulation		Constants ER, TC							
		Changing: Can; Aus							
		Canada FOB CS							
	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60
Aust w/sale AS									
2.50	-0.19	-0.24	-0.30	-0.35	-0.40	-0.46	-0.51	-0.57	-0.62
2.55	-0.14	-0.19	-0.25	-0.30	-0.35	-0.41	-0.46	-0.52	-0.57
2.60	-0.09	-0.14	-0.20	-0.25	-0.30	-0.36	-0.41	-0.47	-0.52
2.65	-0.04	-0.09	-0.15	-0.20	-0.25	-0.31	-0.36	-0.42	-0.47
2.70	0.01	-0.04	-0.10	-0.15	-0.20	-0.26	-0.31	-0.37	-0.42
2.75	0.06	0.01	-0.05	-0.10	-0.15	-0.21	-0.26	-0.32	-0.37
2.80	0.11	0.06	0.00	-0.05	-0.10	-0.16	-0.21	-0.27	-0.32
2.85	0.16	0.11	0.05	0.00	-0.05	-0.11	-0.16	-0.22	-0.27
2.90	0.21	0.16	0.10	0.05	0.00	-0.06	-0.11	-0.17	-0.22
2.95	0.26	0.21	0.15	0.10	0.05	0.01	-0.06	-0.12	-0.17
3.00	0.31	0.26	0.20	0.15	0.10	0.04	0.01	-0.07	-0.12
3.05	0.36	0.31	0.25	0.20	0.15	0.09	0.04	0.02	-0.07
4th Simulation		Constants Aus; ER							
		Changing: Can; TC							
		Canada FOB CS							
	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60
Trans cost									
0.35	-0.05	-0.0	-0.16	-0.21	-0.26	-0.32	-0.37	-0.43	-0.48
0.34	-0.04	-0.09	-0.15	-0.20	-0.25	-0.31	-0.36	-0.42	-0.47
0.33	-0.03	-0.08	-0.14	-0.19	-0.24	-0.30	-0.35	-0.41	-0.46
0.32	-0.02	-0.07	-0.13	-0.18	-0.23	-0.29	-0.34	-0.40	-0.45
0.31	-0.01	-0.06	-0.12	-0.17	-0.22	-0.28	-0.33	-0.39	-0.44
0.30	0.00	-0.05	-0.11	-0.16	-0.21	-0.27	-0.32	-0.38	-0.43
0.29	0.01	-0.04	-0.10	-0.15	-0.20	-0.26	-0.31	-0.37	-0.42
0.28	0.02	-0.03	-0.09	-0.14	-0.19	-0.25	-0.30	-0.36	-0.41
0.27	0.03	-0.02	-0.08	-0.13	-0.18	-0.24	-0.29	-0.35	-0.40
0.26	0.04	-0.01	-0.07	-0.12	-0.17	-0.23	-0.28	-0.34	-0.39
0.25	0.05	0.00	-0.06	-0.11	-0.16	-0.22	-0.27	-0.33	-0.38
0.24	0.06	0.01	-0.05	-0.10	-0.15	-0.21	-0.26	-0.32	-0.37
0.23	0.07	0.02	-0.04	-0.09	-0.14	-0.20	-0.25	-0.31	-0.36
0.22	0.08	0.03	-0.03	-0.08	-0.13	-0.19	-0.24	-0.30	-0.35
0.21	0.09	0.04	-0.02	-0.07	-0.12	-0.18	-0.23	-0.29	-0.34
0.20	0.10	0.05	-0.01	-0.06	-0.11	-0.17	-0.22	-0.28	-0.33

Appendix 1

Table 1.2

Estimates of Trade Feasibility: Simulations 5 and 6

Variables:		Best Guesses:							
Canada FOB CS	[Can]	CS\$2.36/kg							
Aust w/sale AS	[Aws]	AS\$2.69							
Aust/Can ER	[ER]	AS1=CS0.9216							
Trans cost AS/kg	[TC]	AS0.30/kg							
5th Simulation		Constants Aws; TC Changing: Can; ER							
	Canada FOB CS								
	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60
A/C ER									
0.890	-0.08	-0.14	-0.19	-0.25	-0.31	-0.36	-0.42	-0.48	-0.53
0.895	-0.07	-0.12	-0.18	-0.24	-0.29	-0.35	-0.40	-0.46	-0.52
0.900	-0.05	-0.11	-0.17	-0.22	-0.28	-0.33	-0.39	-0.44	-0.50
0.905	-0.04	-0.10	-0.15	-0.21	-0.26	-0.32	-0.37	-0.43	-0.48
0.910	-0.03	-0.08	-0.14	-0.19	-0.25	-0.30	-0.36	-0.41	-0.47
0.915	-0.01	-0.07	-0.12	-0.18	-0.23	-0.29	-0.34	-0.40	-0.45
0.920	0.00	-0.06	-0.11	-0.16	-0.22	-0.27	-0.33	-0.38	-0.44
0.925	0.01	-0.04	-0.10	-0.15	-0.20	-0.26	-0.31	-0.37	-0.42
0.930	0.02	-0.03	-0.08	-0.14	-0.19	-0.24	-0.30	-0.35	-0.41
0.935	0.04	-0.02	-0.07	-0.12	-0.18	-0.23	-0.28	-0.34	-0.39
0.940	0.05	0.00	-0.06	-0.11	-0.16	-0.22	-0.27	-0.32	-0.38
0.945	0.06	0.01	-0.04	-0.10	-0.15	-0.20	-0.26	-0.31	-0.36
0.945	0.07	0.02	-0.03	-0.08	-0.14	-0.19	-0.24	-0.29	-0.35
0.955	0.09	0.03	-0.02	-0.07	-0.12	-0.18	-0.23	-0.28	-0.33
0.960	0.10	0.05	-0.01	-0.06	-0.11	-0.16	-0.21	-0.27	-0.32
0.965	0.11	0.06	0.01	-0.05	-0.10	-0.15	-0.20	-0.25	-0.30
6th Simulation		Constants TC; Can Changing: ER; Aws							
	Aust w/sale AS								
	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95
A/C ER									
0.890	-0.40	-0.34	-0.30	-0.25	-0.20	-0.15	-0.10	-0.05	0.00
0.895	-0.39	-0.34	-0.29	-0.24	-0.19	-0.14	-0.09	-0.04	0.01
0.900	-0.37	-0.32	-0.27	-0.22	-0.17	-0.12	-0.07	-0.02	0.03
0.905	-0.36	-0.31	-0.26	-0.21	-0.16	-0.11	-0.06	-0.01	0.04
0.910	-0.34	-0.29	-0.24	-0.19	-0.14	-0.09	-0.04	-0.01	0.06
0.915	-0.33	-0.28	-0.23	-0.18	-0.13	-0.08	-0.03	0.02	0.07
0.920	-0.32	-0.27	-0.22	-0.17	-0.12	-0.07	-0.02	0.03	0.08
0.925	-0.30	-0.25	-0.20	-0.15	-0.10	-0.05	0.00	0.05	0.10
0.930	-0.29	-0.24	-0.19	-0.14	-0.09	-0.04	0.01	0.06	0.11
0.935	-0.27	-0.22	-0.17	-0.12	-0.07	-0.02	0.03	0.08	0.13
0.940	-0.26	-0.21	-0.16	-0.11	-0.06	-0.01	0.04	0.09	0.14
0.945	-0.25	-0.20	-0.15	-0.10	-0.05	0.00	0.05	0.10	0.15
0.950	-0.23	-0.18	-0.13	-0.08	-0.03	0.02	0.07	0.12	0.17
0.955	-0.22	-0.17	-0.12	-0.07	-0.02	0.03	0.08	0.13	0.18
0.960	-0.21	-0.16	-0.11	-0.06	-0.01	0.04	0.09	0.14	0.19
0.965	-0.20	-0.15	-0.10	-0.05	0.00	0.05	0.10	0.15	0.20

Appendix 1

Table 1.3

Estimates of Trade Feasibility: Simulations 7 and 8

Variables:		Best Guesses:							
Canada FOB C\$	[Can]	C\$2.36/kg							
Aust w/sale A\$	[Aws]	A\$2.69							
Aust/Can ER	[ER]	A\$1=C\$0.9216							
Trans cost A\$/kg	[TC]	A\$0.30/kg							
7th Simulation	Constants	Aws; Can							
	Changing:	TC; ER							
	Transport cost A\$/kg								
	0.35	0.34	0.33	0.32	0.31	0.30	0.29	0.28	0.27
A/C ER									
0.890	-0.31	-0.30	-0.29	-0.28	-0.27	-0.26	-0.25	-0.24	-0.23
0.895	-0.30	-0.29	-0.28	-0.27	-0.26	-0.25	-0.24	-0.23	-0.22
0.900	-0.28	-0.27	-0.26	-0.25	-0.24	-0.23	-0.22	-0.21	-0.20
0.905	-0.27	-0.26	-0.25	-0.24	-0.23	-0.22	-0.21	-0.20	-0.19
0.910	-0.25	-0.24	-0.23	-0.22	-0.21	-0.20	-0.19	-0.18	-0.17
0.915	-0.24	-0.23	-0.22	-0.21	-0.20	-0.19	-0.18	-0.17	-0.16
0.920	-0.23	-0.22	-0.21	-0.20	-0.19	-0.18	-0.17	-0.16	-0.15
0.925	-0.21	-0.20	-0.19	-0.18	-0.17	-0.16	-0.15	-0.14	-0.13
0.930	-0.20	-0.19	-0.18	-0.17	-0.16	-0.15	-0.14	-0.13	-0.12
0.935	-0.18	-0.17	-0.16	-0.15	-0.14	-0.13	-0.12	-0.11	-0.10
0.940	-0.17	-0.16	-0.15	-0.14	-0.13	-0.12	-0.11	-0.10	-0.09
0.945	-0.16	-0.15	-0.14	-0.13	-0.12	-0.11	-0.10	-0.09	-0.08
0.950	-0.14	-0.13	-0.12	-0.11	-0.10	-0.09	-0.08	-0.07	-0.06
0.955	-0.13	-0.12	-0.11	-0.10	-0.09	-0.08	-0.07	-0.06	-0.05
0.960	-0.12	-0.11	-0.10	-0.09	-0.08	-0.07	-0.06	-0.05	-0.04
0.965	-0.11	-0.10	-0.09	-0.08	-0.07	-0.06	-0.05	-0.04	-0.03
0.970	-0.09	-0.08	-0.07	-0.06	-0.05	-0.04	-0.03	-0.02	-0.01
0.975	-0.08	-0.07	-0.06	-0.05	-0.04	-0.03	-0.02	-0.01	0.00
0.980	-0.07	-0.06	-0.05	-0.04	-0.03	-0.02	-0.01	0.00	0.01
0.985	-0.06	-0.05	-0.04	-0.03	-0.02	-0.01	0.00	0.01	0.02
0.990	-0.04	-0.03	-0.02	-0.01	0.00	0.01	0.02	0.03	0.04
0.995	-0.03	-0.02	-0.01	0.00	0.01	0.02	0.03	0.04	0.05
1.000	-0.02	-0.01	0.00	0.01	0.02	0.03	0.04	0.05	0.06
8th Simulation	Constants	ER; Can							
	Changing:	TC; Aws							
	Transport cost A\$/kg								
	0.35	0.34	0.33	0.32	0.31	0.30	0.29	0.28	0.27
Aust w/sale A\$									
2.50	-0.41	-0.40	-0.39	-0.38	-0.37	-0.36	-0.35	-0.34	-0.33
2.55	-0.36	-0.35	-0.34	-0.33	-0.32	-0.31	-0.30	-0.29	-0.28
2.60	-0.31	-0.30	-0.29	-0.28	-0.27	-0.26	-0.25	-0.24	-0.23
2.65	-0.26	-0.25	-0.24	-0.23	-0.22	-0.21	-0.20	-0.19	-0.18
2.70	-0.21	-0.20	-0.19	-0.18	-0.17	-0.16	-0.15	-0.14	-0.13
2.75	-0.16	-0.15	-0.14	-0.13	-0.12	-0.11	-0.10	-0.09	-0.08
2.80	-0.11	-0.10	-0.09	-0.08	-0.07	-0.06	-0.05	-0.04	-0.03
2.85	-0.06	-0.05	-0.04	-0.03	-0.02	-0.01	0.00	0.01	0.02
2.90	-0.01	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07
2.95	0.04	0.05	0.06	0.07	0.08	0.09	0.10	0.11	0.12
3.00	0.09	0.10	0.11	0.12	0.13	0.14	0.15	0.16	0.17

Appendix 2

Inventory block

The inventory block consists of one identity for total pig numbers and two equations explaining sow numbers and natural increase. Data definitions are given in the accompanying Table.

$$\begin{aligned}
 (1) \quad \text{INTPAU} &= \text{INTPAU}(-1) + \text{NIQ} - \text{SLPGAU} \\
 (2) \quad \text{INSOWAU} &= 84.423 + 0.80 \cdot \text{INSOWAU}(-1) + 5.98 \cdot \text{DUMWQ}(-4) \\
 &\quad (1.68) \quad (5.64) \qquad (1.50) \\
 &\quad + 0.41 \cdot \text{PAPGAU}(-2) - 0.70 \cdot \text{PFFDAU}(-2) \\
 &\quad (2.21) \qquad (2.9)
 \end{aligned}$$

adjusted R^2 [R^2] = 0.75

Standard error of the regression [SER] = 5.06

rho = 0.80 (t=4.77)

DH = n.a.

$$\begin{aligned}
 (3) \quad \text{NIQ} &= 397.22 + 1.39 \cdot \text{INSOWAU}(-1) + 0.10\text{E-}01 \cdot \text{T2SOW} \\
 &\quad (3.39) \quad (3.79) \qquad (5.13) \\
 &\quad - 130.62 \cdot \text{DUMQ1} - 48.50 \cdot \text{DUMQ2} - 26.22 \cdot \text{DUMQ3} \\
 &\quad (14.26) \quad (-4.60) \quad (-2.87) \\
 R^2 &= 0.77 \quad \text{SER} = 42.38 \quad \text{DW stat} = 2.18 \quad \text{rho} = 0.74 (t=9.93)
 \end{aligned}$$

Production block

The production block has an equation for average carcass weight and a price dependent slaughterings equation. Two identities are included for slaughterings and production of pigmeat.

$$\begin{aligned}
 (4) \quad \text{SLPGAU} &= \text{PDPGAU} / \text{AVSLWT} \\
 (5) \quad \text{PDPGAU} &= \text{CONS} + \text{NEXPGAU} + \text{INPGAU} \\
 (6) \quad \text{PAPGAU} &= 36.02 - 0.15\text{E-}01 \cdot \text{SLPGAU} + 0.21 \cdot \text{PFFDAU} \\
 &\quad (1.60) \quad (-1.79) \qquad (1.90) \\
 &\quad 0.44 \cdot \text{PAPGAU}(-1) - 3.11 \cdot \text{DUMQ1} - 2.66 \cdot \text{DUMQ2} \\
 &\quad (1.55) \qquad (-2.78) \qquad (-3.50) \\
 &\quad - 0.79\text{E-}01 \cdot \text{T2} \\
 &\quad (-1.15) \\
 R^2 &= 0.65 \quad \text{SER} = 2.50 \quad \text{rho} = 0.58 (t=2.20)
 \end{aligned}$$

$$\begin{aligned}
(7) \quad \text{AVSLWT} &= 0.14\text{E-}01 + 0.68*\text{AVSLWT}(-1) - 0.45\text{E-}03*\text{D7273} \\
&\quad (3.63) \quad (8.50) \quad (-1.46) \\
&+ 0.18\text{E-}02*\text{DUMQ1} + 0.18\text{E-}02*\text{DUMQ2} + \\
&\quad (6.95) \quad (7.54) \\
&0.14\text{E-}02*\text{DUMQ3} + 0.48\text{E-}04*\text{T2} \\
&\quad (6.07) \quad (3.98) \\
R^2 &= 0.96 \quad \text{SER} = 0.76\text{E-}01 \quad \text{DH} = -2.38
\end{aligned}$$

Demand block

The demand block consists of two equations to explain per capita consumption of pork and per capita consumption of bacon and ham. Two identities in the demand block represent total demand for pork and total demand for bacon and ham.

$$\begin{aligned}
(8) \quad \text{PKDM} &= \text{CNP}K * \text{POP}NAU \\
(9) \quad \text{DM}BHAU &= \text{DC}BHAU * \text{POP}NAU \\
(10) \quad \text{CNP}K &= 0.97 - 0.35\text{E-}02*\text{PR}PKAU + 0.74\text{E-}03*\text{PR}BFAU \\
&\quad (2.22) (-1.99) \quad (0.71) \\
&- 0.92\text{E-}03*\text{Y}PCAU + 0.15*\text{DUM}Q1 + 0.33*\text{DUM}Q2 \\
&\quad (-2.52) \quad (2.35) \quad (4.91) \\
&+ 0.24*\text{DUM}Q3 + 0.81*\text{CNP}K(-1) \\
&\quad (4.69) \quad (13.19) \\
R^2 &= 0.86 \quad \text{SER} = 0.15 \quad \text{DH stat} = -1.33 \\
(11) \quad \text{DC}BHAU &= 0.23 + 0.41\text{E-}04*\text{PR}BANW + 0.15\text{E-}02*\text{PR}LBAU \\
&\quad (0.97) (0.46\text{E-}01) \quad (0.99) \\
&+ 0.49\text{E-}03*\text{Y}PCAU + 0.93*\text{DC}BHAU(1) - \\
&\quad (1.16) \quad (19.58) \\
&1.00*\text{DUM}Q1 - 0.40*\text{DUM}Q2 - 0.44*\text{DUM}Q3 \\
&\quad (-13.90) \quad (-6.77) \quad (-8.99) \\
R^2 &= 0.95 \quad \text{SEE} = 0.14 \quad \text{DH stat} = 0.23
\end{aligned}$$

Price block

The price block also contains two equations and two identities. The equations explain the price spread, or margin, for pork and bacon and ham respectively. The two identities represent the retail price for pork and the retail price for bacon.

$$\begin{aligned}
(12) \quad \text{PR}PKAU &= \text{PAP}GAU + \text{MPP} \\
(13) \quad \text{PR}BANW &= \text{PAP}GAU + \text{MM}BHAU
\end{aligned}$$

(14) $MPP = 8.77 - 0.24 \cdot P\text{APGAU} + 0.23 \cdot P\text{APGAU}(-1) +$
 (1.20) (-2.38) (2.22)
 $0.20 \cdot W\text{AGEAU} + 0.76E-01 \cdot P\text{RBFAU} +$
 (2.12) (2.81)
 $0.88E-01 \cdot T2 - 0.29 \cdot P\text{DPGAU} + 0.76 \cdot M\text{PP}(-1)$
 (3.13) (-3.46) (13.93)

$R^2 = 0.87$ $SER = 2.39$ $DH \text{ stat} = 2.26$

(15) $MM\text{HAU} = -46.97 - 0.38 \cdot P\text{APGAU} + 0.61 \cdot P\text{APGAU}(-1)$
 (-3.16) (-1.57) (2.53)
 $+ 0.66 \cdot W\text{AGEAU} + 0.11 \cdot P\text{RBFAU} +$
 (3.73) (2.18)
 $0.89 \cdot M\text{MBHAU}(-1)$
 (21.69)

$R^2 = 0.89$ $SEE = 6.08$ $DH \text{ stat} = -1.42$

Table A.2

Data Definitions

Definitions : Endogenous Variables

INTPAU	Total number of pigs at the end of each quarter, '000 head.
INSOWAU	Number of breeding sows at the end of each quarter, '000 head.
NIQ	Natural increase in pig herd, '000 head.
SLPGAU	Slaughterings of pigs, '000 head.
PAPGAU	Saleyard price of pigs, 64-68 kg, c/kg dcw.
PDPGAU	Production of pigmeat, kt.
MPP	Price spread for pork, c/kg.
MMBHAU	Price spread for bacon and ham, c/kg.
PRPKAU	Retail price of pork, c/kg.
AVSLWT	Average carcass weight, kg.
CNPK	Per capita consumption of pork, kg/head.
PKDM	Total demand for pork, kt.
DMBHAU	Total demand for bacon and ham, kt.
DCBHAU	Per capita consumption of bacon and ham, kg/head.
PRBANW	Retail price of bacon, N.S.W., c/kg.

Definitons : Exogenous Variables

PFFDAU	Feed cost, \$/t.
DUMWQ	Dummy variable for the impact of wheat quotas, 1 in 1969(2) to 1972(2), 0 otherwise.
PRBFAU	Retail price of beef, c/kg.
PRLBAU	Retail price of lamb, c/kg.
DUMQi	Seasonal dummy variable, 1 in quarter i, 0 otherwise.
INPGAU	Change in stocks of pigmeat, kt.
NEXPGAU	Net exports of pigmeat, kt.
T2	Time trend.
T2SOW	Time trend * INSOWAU (-1).
YPCAU	Per capita household disposable income, \$.
POPNAU	Population, million.
WAGEAU	Wages in the meat processing sector, \$/week.
D7273	Dummy variable for the 1972-73 period, 1 in 1972(1) to 1973(4), 0 otherwise.