The Impact of Canadian Pork Imports on New South Wales Pigmeat Prices

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1. Introduction

In September 1989 the Australian Government announced an in-principle decision to lift the existing ban on importation of unprocessed pigmeat, specifically for Canadian product. The decision was confirmed in July 1990, the formal protocols were signed soon after and imports from Canada began arriving in August 1990. In the first year, import levels were generally minor. However from July 1991 there was a sustained increase in volumes, so that the total for 1991/92 was over 4000 tonnes compared with about 1000 tonnes for the preceding year (APC 1998a). This increase in imports coincided with a dramatic fall in farm prices for pigs in early 1992 (APC 1998a).

Through the rural press and industry publications, the pig industry had been a vocal critic of the decision to allow in Canadian imports on the grounds of possible disease risk and that Canadian producers were heavily subsidised. The large fall in farm prices in early 1992 heightened this concern and the Australian Pork Corporation was instructed to prepare and submit a countervailing duty case. On receival of the case the Australian Customs Service initiated a dumping and subsidy inquiry in August 1992 and reported in November 1992. The finding was that frozen pork imports from Canada had not caused and did not threaten to cause, material injury to the Australian pig industry (ACS 1992). On appeal, this negative finding was upheld by the Anti-Dumping Authority (ADA 1993), and also by a subsequent appeal to the Federal Court. Another period of high import levels and low prices in early 1995 and a rally of pig producers in Canberra led to an Industry Commission inquiry into pigmeat imports (IC 1995), while a similar set of circumstances in late 1997 and early 1998 led to the current inquiry.

While there have been some coincidental opposing movements in import volumes and domestic pig prices, and theory would predict that there may be a causal relationship, there have been few formal attempts (ABARE 1989, Scott 1990, King 1993, ABARE 1995, Griffith 1995), particularly recently, to evaluate whether these changes in pig prices are caused by imports or whether they are due to other factors in the pig market or the broader meat market. The objective of this study is to test whether or not there exists a statistically significant causal relationship between the level of imports of Canadian pork into Australia and the level of prices in the New South Wales pigmeat market. It updates evidence prepared for the 1995 IC inquiry.

2. Methods of Analysis

To test the causal relationship between Canadian pork imports and New South Wales pigmeat prices the notion of causality developed by Granger (1969) is used. Causality is defined as follows: "variable x is said to cause variable y if current values of y can better be predicted by using past values of x, than by not doing so, given that all other relevant information including past values of y, is used in both cases" (Granger 1969, p 426). If both x causes y and y causes x, the variables have a simultaneous causal relationship; if neither x causes y nor y causes x, they are independent; and if x was to cause y, but the converse was not true, then causality can be inferred where x is the leader and y is the follower. The opposite conclusion would hold for y causing x.

Considerable controversy surrounds the causality literature and the various methodological and philosophical critiques associated with different aspects of causality tests (see Zellner 1979). As well, there are a number of causality tests available based on time series methods (cross correlations and transfer functions - see Pierce (1977)) as well as regression methods. In this study only regression methods are used.

2.1 The Granger Model

The procedure outlined in Granger's original (1969) paper on causality is one of the methods used in this study. The procedure contains two regression equations of the form (Granger 1980):

(1) $Y_t = \Sigma a_i Y_{t-i} + \Sigma b_i X_{t-i} + eZ_t + C_y + u1_t$

(2) $X_t = \Sigma c_i X_{t-i} + \Sigma d_i Y_{t-i} + fZ_t + C_x + u2_t$

where i = the chosen lag structure, t = current time period, C = constant term, Y = NSW pigmeat prices, X = Canadian pork imports, Y_{t-i}= lagged prices, X_{t-i} = lagged imports, Z = variables reflecting "other relevant information" and $u1_t$ and $u2_t$ are the random errors. The coefficients a, b, c, d, e, f are to be estimated. Since all RHS variables are predetermined, these equations may be efficiently estimated by OLS. Seasonal dummy variables need to added if monthly or quarterly data are used.

Equation (1) is estimated with and without the $\Sigma b_i X_{t-i}$ terms. If the coefficients b_i as a group are not significantly different from zero, then past values of X have no effect on the prediction of Y and therefore X does not cause Y. In the reverse regression, equation (2) is estimated with and without the $\Sigma d_i Y_{t-i}$ terms. If the coefficients d_i as a group are not significantly different from zero, then past values of Y have no effect on the prediction of X and therefore Y does not cause X.

The null hypothesis, that past values of X (in equation (1) for example) have coefficients as a group insignificantly different from zero, is tested via the F test:

$$F = \frac{(\text{rest.ESS} - \text{unrest.ESS})/(n)}{(\text{unrest.ESS})/(N - m)}$$

where unrest.ESS is the error sums of squares from the regression with the lagged terms (the unrestricted model), rest.ESS is the error sums of squares from the regression without the lagged terms (those coefficients are restricted to be zero), n is the number of coefficients on the lagged terms, m is the number of coefficients after the restrictions are imposed, and N is the number of observations. If the calculated F value is greater than the critical value at the chosen significance level for the relevant degrees of freedom, the null hypothesis that the coefficients on the lagged terms are zero, is rejected.

An alternate test, the Likelihood Ratio (LR) test is also used. This is a more general procedure for testing nested hypotheses when both the restricted and unrestricted models have been estimated by maximum likelihood methods. The test is based on computing values of the maximised log-likelihood function for both models. If the unrestricted maximum is close to the restricted maximum, the restrictions should be favoured. If the difference is substantial, the restrictions should be rejected. The LR test statistic is given by

$$g = 2(L_U - L_R)$$

where L_U and L_R are values of the maximised log-likelihood functions for the unrestricted and restricted models, respectively.

Under H_O that the restrictions are true, g has an approximate χ^2 distribution with degrees of freedom equal to the number of restrictions. The restrictions that the coefficients on the lagged terms are zero, are rejected if g is greater than the critical χ^2 value at the chosen significance level.

2.2 The Sims Model

Causality tests using Sim's (1972) procedure are also used in this study. Sims suggests prefiltering each series (using a common prefilter) to remove autocorrelation. This is usually necessary because, unlike the Granger equations, there are no lagged dependent variables in the Sim's models. Both series are then regressed on past and future values of the other transformed series. The following two regression equations specify Sim's procedure:

(3) $Y_t = \Sigma a_i X_{t-i} + \Sigma b_i X_{t+i} + eZ_t + C_y + v1_t$

(4) $X_t = \Sigma c_i Y_{t-i} + \Sigma d_i Y_{t+i} + fZ_t + C_x + v2_t$

where the symbols are as defined above except for the lead variables (subscripts t+1) which indicate future values, and the different error terms. Both equations are estimated with and without the lead variables and the F and LR tests are calculated. In equation (3), according to Sim's procedure, X causes Y in Granger's sense if the lead coefficients b_i are not significantly different from zero, but the lead coefficients d_i in equation (4) are significant. In the same way, using equation (4), Y causes X if the lead coefficients d_i are not significantly different from zero, but the lead coefficients b_i in equation (3) are significant.

The choice of which method to use is not clear. The weight of published evidence is to prefer the Granger test. Nakhaeizadeh (1987) states that, in general, Granger's procedure is more adequate than Sims' procedure and Feige and Pearce (1979) are cited for showing that the results of Sims' causality tests are very sensitive to the applied pre-filter. Geweke, Meese and Dent (1983), quoted by Jones (1989), also recommend the use of the Granger direct test over the Sims test, based on the findings of their Monte Carlo study of alternative tests for predictive relationships between time series variables. Mookerjee (1987) has found the direct test of Granger causality most efficient. However because many of these assessments are data specific, the two methods are compared and contrasted in this study.

2.3 Causality in VAR Models

The way that causality tests are implemented in the Granger and Sims models outlined above implies pairwise causality. That is, while other relevent market information is allowed to help explain variation in the dependent variable, this is not usually done in a formal manner and interest is primarily in the causal effect of one variable on another. Thus it is a partial test. Vector Autoregressive (VAR) models have been increasingly used in recent years to overcome this problem. A VAR model is the unconstrained reduced form of a dynamic simultaneous equations model of a market or industry (Sims 1980). It expresses a vector of endogenous variables as linear functions of their own and each other's lagged values. Current and lagged exogenous variables may also be included in the system. Again, since all RHS variables are predetermined, and the same list of RHS variables appears in all equations, this set of equations can be efficiently estimated by OLS. The following is an example of one equation from a VAR model:

$$(5)\ Y_{1t} = \Sigma a_i Y_{1t-i} + \Sigma b_i Y_{2t-i} + \Sigma c_i Y_{3t-i} + \ldots + \Sigma d_i Z_{t-i} + C_{y1} + u_{1t}$$

where Y_1, Y_2, Y_3 etc are endogenous variables in the underlying structural market model, and the "causal" variable of interest (X in the Granger and Sims's models) may be either one of the endogenous Y variables or one of the exogenous Z variables. Standard F tests from comparing unrestricted and restricted versions of (5) are used to assess whether there is a statistically significant causal relationship in this market (Griffiths et al 1993, Enders 1995). Because of the way that the interactions between all relevant variables are included in this model, it is a more complete test of causality than the pairwise tests given by the Granger and Sim's models.

3. Data Definitions and Sources

IMPGAU: imports of pigmeat into Australia, all categories, all sources, tonnes, July 1989 to April 1998, collected by ABS, provided by APC (1998a,b).
IMPGCN: imports of pigmeat into Australia, fresh, chilled and frozen, from Canada, tonnes, July 1990 to April 1998, provided by APC (1998a,b).
VMPGAU: imports of pigmeat into Australia, all categories, all sources, $'000, July 1989 to April 1998, provided by APC (1998a,b).
VMPGCN: imports of pigmeat into Australia, fresh, chilled and frozen, from Canada, $'000, July 1990 to April 1998, provided by APC (1998a,b).
PMPGAU: import unit value of pigmeat into Australia, all categories, all sources, cents/kg, April 1989 to April 1998, calculated.
PMPGCN: import unit value of pigmeat into Australia, fresh, chilled and frozen, from Canada, cents/kg, July 1990 to April 1996, calculated.

PAPGNW: dressed carcase price of GH2, 60-70kg pigs, NSW markets, cents/kg, January 1988 to August 1998, collected by NSW Meat Industry Authority, provided by AMLC (1996) and MIA staff.
PWPGNW1: dressed carcase price for baconer class pigs, delivered to Sydney retail shops, cents/kg, January 1988 to January 1998, collected by Neilsons, provided by MATFA (1998) and AMLC staff. Prices for beef (BEEFMAT) and lamb (LAMBMAT) wholesale prices defined in a similar manner are also available from this source. They are used in some sensitivity analyses.
PWPGNW4: wholesale price for legs, May 1993 to June 1998, provided by PC.
PRLENW: retail price of pork legs, Sydney retail outlets, cents/kg, January 1988 to January 1998, collected by Neilsons, provided by MATFA (1998) and AMLC staff.
PRLONW: retail price of pork mid loin chops, Sydney retail outlets, cents/kg, January 1988 to January 1998, collected by Neilsons, provided by MATFA (1998) and AMLC staff.

PRRUNW: retail price of beef rump steak, Sydney retail outlets, cents/kg, January 1988 to January 1998, collected by Neilsons, provided by MATFA (1998) and AMLC staff. Retail prices for other beef cuts such as sirloin (SLOINMAT), topside (TOPSMAT), chuck (CHUCKMAT), blade (BLADEMAT) and mince (MINCEMAT), defined in a similar manner, are also available from this source. They are used in some sensitivity analyses. A weighted average price of all these beef cuts

was also calculated and used in sensitivity analyses.
PRLLNW: retail price of lamb leg, Sydney retail outlets, cents/kg, January 1988 to January 1998, collected by Neilsons, provided by MATFA (1998) and AMLC staff.
PDPGNW: production of pigmeat in NSW, tonnes carcase weight, January 1988 to June 1998, collected by ABS, provided by AMLC (1996) and APC (1998b).
PAPGAU: dressed carcase price of GH2, 60-70kg pigs, weighted average of all state markets, cents/kg, January 1988 to August 1998, collected by ABARE and provided by ABARE staff.

Summary statistics for the above data set and correlations between the variables are reported in Appendix Tables 1 and 2. It should be noted that the Neilson wholesale and retail price data have not been published by MATFA since January 1998.

4. Specification Choices

In using the procedures outlined above, and with an understanding of the data available, a number of technical issues in implementation arise. It is necessary to choose the appropriate lag length, the appropriate prefilter and the functional form of the regression models.

4.1 Lag Lengths

A prominent issue regarding tests of causality is the determination of the appropriate finite lag length that ensures white noise residuals, to satisfy Granger causality assumptions. Because causal inferences are sensitive to the choice of lag length (Thornton and Batten 1985, Nakhaeizedah 1987), attention must be given to the manner in which the lag length is set.

There are three main approaches to specification of lag lengths of the dependent and independent variables for the distributed lag models which serve as a basis for the causality tests; the ad hoc, rule of thumb and statistical search criteria. The ad hoc approach involves arbitrary lag specification, usually based on knowledge of the market. The rule of thumb approach (Geweke 1978) advocates the lag length of the independent variable to be less than the lag length of the dependent variable in order to retain power of the test. The last alternative is statistical search criteria such as Akaike's final prediction error (Hall 1997).

Jones (1989) used both statistical and non statistical lag length determination procedures to allow a comparison of their relative performance in correctly assessing causality. The relative performance of these approaches was tested using a global search of the lag space of the distributed lag models. That study found one of the ad hoc procedures performed better than any of the three statistical methods in correctly identifying causality when it exists. This is in contrast to the study by Thornton and Batten (1985) in which the ad hoc procedure performed worse than the FPE. Therefore there does not seem to be a superior procedure as previous results could be data specific (Thornton and Batten 1985).

The ad hoc approach is used here, with the use of lags (1,1), (3,3), (6,6) and (9,9). The six month lag structure would seem to be near the upper bound of possible causal influences but the nine month lag is included because of some of the outcomes of the stationarity tests as outlined below.

4.2 Prefilters

Granger’s definitions assume all time series to be jointly covariance stationary; that is, the mean and covariance are not functions of time. However most time series are non stationary. Monthly commodity prices, in particular, have trend components because of inflation, storage costs, and other carrying charges (Grant et al. 1983). In order to make the Granger concept of causality operational, Sims and various other authors introduced prefilters. Prefilters involve transforming the variables of a series to stationarity before the series is analysed.

There is the view that filtering to produce variables that are covariance stationary is not always necessary. Zellner (1979, p35) states “in terms of stationary variables, one can employ autocorrelation functions, cross correlation functions, etc. However if it makes economic sense to formulate a law or model in terms of non stationary variables, it is not necessary to filter variables in order to estimate parameters values and to predict from such estimated models”. Zellner (1979) also suggests that the effects of filtering, whether by differencing or by use of more general filters, can be drastic enough in some circumstances to justify Friedman’s phrase ‘throwing the baby out with the bath’. In other words deterministic deseasonalising/detrending procedures can possibly take too much out of the series as suggested by Pierce (1977). Filtering is not a neutral procedure that necessarily produces satisfactory results. As such, filtering can therefore produce a quandary about what is ‘too much’ or ‘too little’.

Differencing is often an appropriate filtering method for an analysis of agricultural prices, as their autocorrelation functions typically die out quickly and differencing removes most of the autocorrelation and non stationary influences. In this study a formal investigation of the stationarity properties of the various series is conducted, with the full results reported in Appendix Tables 3 and 4. An excerpt from these tables is shown below in Table 1. Three alternate test statistics and associated probabilities of not rejecting the null hypothesis of unit roots (or non-stationarity) are given for the raw and first-differenced forms of two crucial variables - the farm price (PAPGNW) and the wholesale price (PWPGNW) (see data descriptions in Section 3). The three test statistics are the augmented Dickey-Fuller, the Phillips-Perron, and the Weighted Symmetric. According to the TSP manual (Hall 1997), the last is the most reliable. If the relevent probability value is greater than 0.05, a unit root is implied and a stationarity correction is warranted. For the wholesale price, the raw data imply a unit root by all tests and the first differenced data imply stationarity. Most of the series examined follow this pattern. However for the farm price, the test statistics for the raw data are mixed, with two implying stationarity and one not, while the first-differenced data all imply stationarity. A couple of other series follow this pattern. In the interests of consistency, all series are first differenced. All subsequently imply stationarity.

The other columns in this table indicate the number of lag values of the lagged dependent variable of the augmented Dickey-Fuller model deemed by the program to be the optimum to generate serially uncorrelated residuals. Most of these optimum lag values are less than six, but there are several, like for PAPGNW above, which range up to ten. This information was used to place an upper boundary on the choice of lags in the causality regressions.

Table 1: Example Stationarity Test Results, 1990:7 - 1998:1

Variable/	Raw Data			Differenced Data		
Test	TestStat	P-value	Num.lags	TestStat	P-value	Num. lags

PAPGNW						
Wtd.Sym.	-4.106	0.003	3.00000	-4.537	0.0009	7.000
Dickey-F	-3.913	0.012	3.00000	-4.406	0.002	7.000
Phillips	-19.092	0.085	3.00000	-36.759	0.002	7.000
PWPGNW						
Wtd.Sym.	-2.648	0.210	2.00000	-6.099	0.79D-06	2.000
Dickey-F	-2.447	0.354	2.00000	-4.642	0.0007	3.000
Phillips	-17.744	0.110	2.00000	-102.02	4.06D-10	2.000

4.3 Functional Forms

The functional form of the regression equations used can also affect the significance of the results of causality tests. The linear form is mostly used although Bessler and Kling (1984), Freebairn (1984) and Mookerjee (1987) all favoured the use of logs. This analysis used both the linear function and the logarithmic function for comparison. However there were no differences in the test results between the linear and log first differences, and only the linear results are reported.

4.4 "All Other Relevant Information"

One of the assumptions underlying the Granger causality test is that "all other relevant information, including past values, is used in both cases". When the causality test is between two or more variables of the same type, eg Australian and United States wheat prices (Sneikers and Wong 1987, Thompson et al 1994) or Canadian and United States wheat prices (Spriggs et al 1982), there is an argument that the same exogenous information would affect both prices equally and there would be little gained from explicitly including other variables. However, when the potential causal relationship is between variables of different types, eg Canadian pork exports to Australia and NSW prices, then other variables need to be explicitly included in the regressions. Because of the nature of the expected relationship, other variables were sought to help explain movements in domestic pig prices. The two variables chosen were pigmeat production levels in NSW, as a supply effect, and the retail price of beef and the retail price of lamb, as demand effects.

Finally, Bessler and Kling (1984, p338) stated that “a more revealing causal analysis can be carried out by examining the forecasting ability present (or lacking) in a (proposed) causal relationship”. This form of causal testing is not undertaken in this analysis because of the relatively small number of data points available since Canadian pigmeat imports were allowed.

5. Results of the Granger and Sims Regressions

5.1 Initial Considerations

Granger regressions like equations (1) and (2) and Sims regressions like equations (3) and (4) were estimated using the TSP Version 4.4 econometric package (Hall et al 1997) for the full sample period available, 1990:8-1998:1. Initial runs of some of the models were done to check the autocorrelation aspect of the procedures. As expected from the discussion in section 2.2, the

Durbin h statistic on the Granger OLS equations were almost all acceptable while the estimated rho value for the Sims AR1 corrected equations were almost all significant. Thus all Granger equations were estimated by OLS while all Sims equations were estimated with an autocorrelation correction. An example of a typical one of these regressions is reported in Appendix Table A5. Note that the seasonal dummies are all significant, the "other information" variables have the expected signs, and the lagged import variables have mostly negative coefficients.

The results of applying the appropriate F and LR tests for all the appropriate combinations are reported in the top half of Appendix Tables A6-A9. One such table, for the relationship between farm price and Canadian import volume, is included as Table 2 below.

Table 2: F and LR Tests of the Relationship Between Canadian Pigmeat Import Volumes and NSW Farm Level Baconer Prices, 1990:8 - 1998:1

PAPGNW		9,9		6,6		3,3		1,1	
IMPGCN		PAPGNW	IMPGCN	PAPGNW	IMPGCN	PAPGNW	IMPGCN	PAPGNW	IMPGCN
GRANGER	F1	0.72	1.58	0.85	1.45	1.49	1.18	1.26	2.75
	LR1	8.24	17.21**	6.24	10.44	5.24	4.18	1.47	3.18*
SIMS	F2	1.29	0.94	1.04	1.01	1.79	0.97	0.64	3.38*
	LR2	14.71*	10.94	7.12	7.53	6.33*	3.47	0.75	3.91**

For F1, 5% critical values are F(9,70)=2.02; F(6,76)=2.21; F(3,81)=2.72; and F(1,86)=3.95 for 9, 6, 3 and 1 lags respectively.
For F2, 5% critical values are F(9,61)=2.04; F(6,70)=2.23; F(3,79)=2.72; and F(1,85)=3.95.
For F1, 10% critical values are F(9,70)=1.73; F(6,76)=1.85; F(3,81)=2.16; and F(1,86)=2.77.
For F2, 10% critical values are F(9,61)=1.74; F(6,70)=1.86; F(3,79)=2.16; and F(1,85)=2.77.
For all of the LR values, 5% critical values are $\chi^2(9)=16.92$; $\chi^2(6)=12.59$; $\chi^2(3)=7.81$; and $\chi^2(1)=3.84$.
For all of the LR values, 10% critical values are $\chi^2(9)=14.68$; $\chi^2(6)=10.64$; $\chi^2(3)=6.25$; and $\chi^2(1)=2.71$.

In interpreting the table, the two series analysed (**PAPGNW** and **IMPGCN**) are noted in the heading along with the three chosen lag structures for the causal relationship **(9,9), (6,6), (3,3)** and **(1,1**). Down the left column of the table are the two methods (**GRANGER** or **SIMS**). The next column shows which test statistic is calculated for each type of equation (**F** or **LR**). The values in the body of the table are the calculated F and LR statistics. Under the table are given the critical values for the test statistics at the 5% level and 10% level for the various degrees of freedom relevant for each equation. Where a test statistic is significant at 5%, it is denoted by **, and at 10% by *.

To recap, the first F value in any pair across any Granger row is a test of whether the coefficients b_i in equation (1) as a group are significantly different from zero. If the calculated F value is less than the critical value, then past values of imports have no effect on the prediction of prices and therefore imports do not "cause" prices. The second F value in the pair is a test of whether the coefficients d_i in equation (2) as a group are significantly different from zero. If the calculated F value is les than the critical F value, then past values of prices have no effect on the prediction of imports and therefore prices do not "cause" imports. **So if the first F is significant and the second is not, imports "cause" prices.** If the second F is significant and the first is not, prices "cause" imports. If neither F statistic is significant, there is no causal relationship either way, and if both F values are significant, there is simultaneous causality or a feedback relationship.

The first F value in any pair across any Sims row is a test of whether the lead coefficients b_i in equation (3) as a group are significantly different from zero. If the calculated F value is less than the critical value, then future values of imports have no effect on the prediction of prices, therefore prices do not "cause" imports. In the same way, the second F value in any pair across any S row is a test of whether the lead coefficients d_i in equation (4) as a group are significantly different from zero. If the calculated F value is less than the critical value, then future values of prices have no effect on the prediction of imports, therefore imports do not "cause" prices. Again, four combinations of causal relationships are possible. **If the second F is significant and the first is not, imports "cause" prices.**

A similar interpretation may be placed on the LR values.

5.2 Impacts of Canadian Pork Imports on New South Wales Pigmeat Prices, 1990-1998

The first set of regressions examine four possible causal relationships involving Canadian pigmeat imports and NSW farm price, wholesale price and two retail prices (Appendix Tables A6-A9). Recall these are for the full data set. A surprising result, given the extensive media indications to the contrary, is that very few of the F or LR values reported in these tables are significant at even the 10% level. There are no significant relationships in either of the retail price sets of equations; some evidence of a simultaneous relationship at longer lags in the wholesale price equations, or of imports “causing” wholesale price changes; some evidence of prices “causing” imports at longer lags in the farm price regressions; and mixed evidence of both types of causal relationship at very short lags in the farm price regressions.

Certainly there is no consistent evidence about the causal relationship between the level of Canadian imports of pigmeat and farm, wholesale or retail prices in NSW. If there is a pattern at all, it is that wholesale prices and Canadian imports may be jointly determined over longer lag periods, that none of the price impact at wholesale is transmitted to the retail pork market, and that NSW prices of pigs are only causally effected by import volumes in the very short run as extra supplies come up against very inelastic demand and supply schedules. There is no consistent pattern of the Granger or Sims method producing results different to the other, however it is evident that there are many more significant LR values than F values. If only F values were considered, a conclusion of no causal relationships at all would be made. The weak evidence of simultaneity suggests redoing the analysis in a VAR framework, and this is done in Section 6.

The above conclusions are quite different to the evidence found during the 1995 inquiry, where it was only the retail leg price which showed a consistent causal effect from import volumes. This difference in results raises an issue of time period. Industry has been pointing out that during the first few years after imports were allowed, import quantities fluctuated markedly with extended periods of low imports and several dramatic peaks. Also, because of this variability, domestic market participants may have been uncertain about future import volumes and may have consciously bid down domestic prices. However in recent years, while there have been large and rapid increases in import volumes, imports have been much more stable, and market participants may well be more accepting of the presence of imports and less uncertain about their influences on domestic prices. Thus, imports are much more likely to have caused price and/or quantity adjustments in the domestic market in more recent years. The analysis is thus redone for a more recent sample period, 1993-1998, which omits the "settling-in" period of the impact of imports.

5.3 Impacts of Canadian Pork Imports on New South Wales Pigmeat Prices, 1993-1998

Data summary statistics and correlation coefficients for the raw data over the shorter time period are reported in Appendix Tables A10-A11. Unit root tests are also redone for this period and the results are reported in Appendix Tables A12-A13. Similar conclusions regarding the need for differencing were reached as for the full sample.

The results of estimating the Granger and Sims models over the shorter sample period are reported in the bottom half of Appendix Tables A6-A9. Note that for degrees of freedom reasons, the maximum lag length had to be restricted to 6 months. Here, there is no evidence of any causal relationships in the wholesale market, but quite strong evidence of prices causing imports at longer lags at the farm and retail levels, with some evidence of joint relationships at the farm level in particular. While the results for the wholesale and retail tests indicate a worrying sensitivity to sample period selection, the notion of joint determination of prices and import volumes over the longer term, remains.

5.4 Sensitivity to Data Choices

All the results so far are in terms of Canadian import volumes and New South Wales prices. It may be that these choices of dependent and independent variables may be influencing the results. Before moving on to the VAR models, some data sensitivity tests are undertaken.

In Appendix Table A14, the measure of wholesale price used is a wholesale leg price provided by the PC. A joint relationship between imports and this price is observed at longer lags, with some indication also of prices causing imports. This is a similar result to those in Appendix Table A7.

Finally, in Appendix Table A15, Canadian import unit values are used instead of volumes together with the NSW farm price. Little change is seen from the results in Appendix Table A6.

Various other combinations of measures of the exogenous "influencing" variables were tested, including different measures of beef retail prices and using wholesale instead of retail beef and lamb prices, but little differences in the test results were noticed. These results are not reported here.

6. VAR Results

As suggested in the pairwise causality tests reported above, it seems that in the longer term at least there is some evidence of simultaneous determination of prices in the domestic market and import volumes. A better way of assessing the impact of imports in this situation is to use a VAR type of model. Thus a VAR system containing NSW farm, wholesale and retail prices, NSW pigmeat production and Canadian imports is estimated over the two sample periods employed previously. Then the system is re-estimated excluding the import variable and the relevent summary statistics used to calculate F tests of the restrictions that imports have no effect in the system. For consistency with the pairwise causality tests, the VAR equations are estimated in first differences and lags are set to 6. The results of these tests are reported in Table 3.

Over the full sample period, only NSW pigmeat production is shown to have been statistically effected by Canadian pigmeat imports. And contrary to expectations, this has not necessarily been a negative effect. Impulse response functions generated from a one period, one unit increase in imports show a net positive effect on production over a 12 month adjustment period, although there are some months showing a negative effect. Impulse response functions for all prices and production are reported in Table 4. It is interesting to note that the net effects of imports on prices are negative in all cases, but not significant in a statistical sense.

Over the shorter, more recent sample period, most prices are negatively effected by Canadian pigmeat imports and production is positively effected, but only NSW pigmeat production and NSW retail price are shown to be statistically effected. The impulse response functions for these shocks are given in the bottom half of Table 4.

As an alternative, a new procedure for undertaking causality testing in a VAR framework developed by Rambaldi and Doran (1996) is also used to examine the possible impact of imports. This procedure does not require stationarity transformations of the data as long as an additional lag length is allowed for each level of integation, and that the VAR system is estimated in a SUR framework. Thus for lag lengths of 6, variables lagged up to 7 need to be included in the equations if the variables are first difference stationary. The results of implementing these tests are reported in Table 5.

Over the full sample period, none of the test statistics were significant. Thus imports were not significant in explaining NSW farm, wholesale and retail prices and NSW pigmeat production, either singly or jointly. Over the shorter sample period, imports were found to significantly influence variations in NSW wholesale and retail prices singly, and all prices and production jointly.

Table 3: F Tests of the Impact of Imports from a VAR in First Differences

(a)1991:3 - 1998:1

Dependent Variable	Without Imports		With Imports		F Statistic
	SSR	Adj. R2	SSR	Adj. R2	
DPAPGNW	2849.30	.356	2487.41	.347	1.07
DPWPGNW	2921.44	.432	2554.96	.422	1.05
DPRLENW	153494	.215	144529	.141	0.49
DPDPGNW	14945300	.745	11432700	.773	2.25*

5% critical value is F(6,44)=2.30; 10% critical value is F(6,44)=2.00.

(a) 1993:1 - 1998:1

Dependent Variable	Without Imports		With Imports		F Statistic
	SSR	Adj. R2	SSR	Adj. R2	
DPAPGNW	1730.46	.211	1278.74	.183	1.30
DPWPGNW	1464.61	.402	1307.88	.252	0.43
DPRLENW	59687.3	.447	37626	.512	2.15*
DPDPGNW	8130360	.738	5102290	.770	2.18*

5% critical value is F(6,22)=2.55; 10% critical value is F(6,22)=2.06.

Table 4: Impulse Response Functions of Endogenous Variables to a Shock in Imports

(a) 1991:2 - 1998:1

Lag	DPAPGNW	DPWPGNW	DPRLENW	DPDPGNW
1	0.000	0.000	0.000	0.000
2	-0.011	0.004	0.010	0.190
3	-0.005	-0.002	-0.021	0.546
4	-0.001	-0.009	-0.061	0.126
5	-0.009	0.000	-0.032	-0.771
6	0.006	0.001	-0.014	0.573
7	-0.004	-0.016	0.035	-1.086
8	-0.001	0.002	0.054	0.735
9	0.002	0.005	0.001	0.653
10	0.001	-0.008	-0.010	-0.456
11	-0.002	0.001	0.025	0.078
12	-0.002	0.000	-0.014	-0.275
Sum	-0.026	-0.010	-0.027	0.313

(b) 1993:5 - 1998:1

Lag	DPAPGNW	DPWPGNW	DPRLENW	DPDPGNW
1	0.000	0.000	0.000	0.000
2	-0.008	0.007	-0.112	0.614
3	-0.004	0.014	0.050	0.080
4	-0.020	-0.018	0.094	1.018
5	0.000	0.006	0.006	-1.089
6	0.010	0.009	-0.072	3.117
7	-0.026	-0.015	0.081	-3.844
8	-0.001	-0.009	0.051	2.004
9	0.004	0.007	-0.120	-0.117
10	-0.004	-0.008	0.033	-0.601
11	0.007	-0.007	-0.009	0.227
12	-0.008	-0.012	0.002	-0.726
Sum	-0.050	-0.032	0.004	0.683

Table 5: F and $\chi 2$ Tests of the Impact of Imports Using the Rambaldi and Doran VAR Model

(a) 1990:9 - 1998:1

Test	Sum of Coefficients	Test Statistic	Probability
IMPGCN in PAPGNW Eqn.	-0.0405	t= -0.89	0.373
IMPGCN in PWPGNW Eqn.	0.0059	t= 1.07	0.286
IMPGCN in PRLENW Eqn.	-0.0018	t= -0.05	0.963
IMPGCN in PDPGNW Eqn.	-0.2402	t= -0.63	0.531
IMPGCN in all Eqns.		$\chi 2$= 2.635	0.621

(a) 1993:1 - 1998:1

Test	Sum of Coefficients	Test Statistic	Probability
IMPGCN in PAPGNW Eqn.	0.0278	t= 0.73	0.464
IMPGCN in PWPGNW Eqn.	0.0199	t= 2.51	0.012
IMPGCN in PRLENW Eqn.	-0.0873	t= -2.12	0.034
IMPGCN in PDPGNW Eqn.	-0.1808	t= -0.37	0.708
IMPGCN in all Eqns.		$\chi 2$= 27.46	0.000

7. Conclusions

With so many options covered in the analysis, it could have been difficult to come to some conclusion about what may be the preferred results.

Fortunately, the results are basically consistent when viewed over the full period since Canadian imports have been allowed into Australia. It is evident that Canadian imports of pigmeat have no consistent causal effect on farm, wholesale or retail pigmeat prices in NSW. The pairwise Granger and Sims causality tests suggest that farm prices cause imports over longer lag periods; that imports may have some causal effect on wholesale prices over longer lag periods if the Sims results are used, but that this effect is a joint one if the Granger results are used; and that there is no effect on retail prices. Neither of the two VAR analyses suggest any causal influence of imports on domestic prices. Note also that many of the estimated significant test statistics are only significant at the 10% level. In terms of differences if any across methods, the Granger model and the F test have tended to provide less evidence of causality flowing from imports to domestic prices. In fact if the Granger model was chosen as suggested in the literature and the standard F test of restrictions was the only test employed, there would be no evidence of any impact by imports on domestic prices.

However, when only the most recent six years data are examined, a wider range of causal impacts are found. The pairwise Granger tests suggest some joint relationships between farm price, import volumes and import values at longer lag lengths, but for all other prices the causation is from domestic prices to import volumes. The pairwise Sims tests also suggest some joint relationships betwen farm and wholesale prices and import volumes and unit values, but in addition there is evidence of imports causing farm price changes and retail price changes. The more general VAR models confirm a significant effect of imports on retail prices but there is no evidence for a significant effect on farm prices. The evidence on wholesale price and production are mixed in the VAR models.

If a position had to be taken, it would be to favour the more general VAR model results which take account of the simultaneous causal relationships shown in the pairwise Granger and Sims model results. In this case, the evidence is that retail leg prices and maybe wholesale prices have been significantly influenced by Canadian imports over the past 6 years. Other prices may have been influenced by imports in recent months, but the data are not available in sufficient quantities to allow that to be shown in the statistical analyses.

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Table A1: Data Summary Statistics: Raw Data: 1990:8-1998:1

Number of Observations: 90

	Mean	Std Dev	Minimum	Maximum
PAPGAU1	214.68556	20.75041	161.20000	261.00000
PAPGNW	218.20056	21.01814	179.25000	270.00000
PDPGNW	7980.00000	801.80496	6075.00000	10139.00000
PWPGNW1	295.76667	22.03473	256.00000	346.00000
PRLENW	634.42222	119.71018	380.00000	803.00000
PRLONW	775.14444	34.23697	728.00000	844.00000
PBEEFMAT	821.69033	23.35983	771.00000	870.00000
BEEFMAT	251.18713	19.64430	208.00000	282.29666
LAMBMAT	235.20427	37.66348	164.42308	325.00000
PRRUNWT	1186.61111	46.22051	1082.00000	1264.00000
SLOINMAT	1057.92222	50.40287	982.00000	1189.00000
TOPSMAT	931.88889	20.53289	892.00000	989.99994
CHUCKMAT	670.87778	27.21319	627.00000	875.00000
BLADEMAT	791.96666	23.65313	734.00000	839.99994
MINCEMAT	632.27778	30.24805	546.00000	681.00000
PRLLNW	585.08333	60.89811	483.00000	695.00000
DUM1	0.088889	0.28618	0.00000	1.00000
DUM6	0.077778	0.26932	0.00000	1.00000
DUM12	0.088889	0.28618	0.00000	1.00000
IMPGAU	427.16955	303.47910	17.79000	1419.58997
IMPGCN	326.10111	274.38119	1.48000	1116.29004
IMPGCN(-1	322.50978	276.52623	0.00000	1116.29004
IMPGCN(-2	315.51222	276.63166	0.00000	1116.29004
IMPGCN(-3	305.35711	271.13698	0.00000	1116.29004
VMPGAU	1738.78913	1266.30076	73.27400	5895.58008
VMPGCN	1261.41567	1119.61077	6.35000	4533.00000
PMPGAU	408.34616	48.86454	320.54736	556.31146
PMPGCN	383.89686	53.23512	158.53764	531.34351

Table A2: Correlation Matrix: Raw Data: 1990:8-1998:1

	PAPGAU1	PAPGNW	PDPGNW	PWPGNW1	PRLENW
PAPGAU1	1.00000				
PAPGNW	0.91183	1.0000			
PDPGNW	-0.31133	-0.31650	1.00000		
PWPGNW1	0.55622	0.62781	-0.29999	1.00000	
PRLENW	0.51683	0.39755	-0.18743	0.55262	1.00000
PRLONW	0.43719	0.46752	-0.25034	0.82601	0.67147
PBEEFMAT	0.22419	0.21911	0.039991	0.38649	0.45543
BEEFMAT	-0.41046	-0.45849	0.36859	-0.67814	-0.52166
LAMBMAT	0.49856	0.50442	-0.15534	0.66957	0.62298
PRRUNWT	0.35534	0.39940	0.016964	0.50366	0.49556
SLOINMAT	0.21659	0.18843	-0.061996	0.48660	0.54967
TOPSMAT	-0.095901	-0.098166	0.11295	0.091158	0.15477
CHUCKMAT	0.014534	0.024223	0.22848	-0.060347	-0.17801
BLADEMAT	0.13716	0.070013	0.13099	0.00026525	0.23344
MINCEMAT	0.26419	0.27117	-0.089761	0.45031	0.56490
PRLLNW	0.46236	0.42352	-0.079706	0.66490	0.73428
DUM1	0.072497	0.11189	-0.44291	0.17438	-0.031938
DUM6	-0.21553	-0.20525	0.32369	-0.070748	-0.065677
DUM12	0.18470	0.22257	0.25027	0.18507	-0.054076
IMPGAU	0.26492	0.29883	-0.18203	0.56612	0.49315
IMPGCN	0.26497	0.30663	-0.13285	0.60399	0.50022
IMPGCN(-1	0.18276	0.26816	-0.071346	0.59681	0.44667
IMPGCN(-2	0.14163	0.22843	-0.098482	0.58763	0.40548
IMPGCN(-3	0.13087	0.21122	-0.21390	0.58004	0.39071
VMPGAU	0.30099	0.33380	-0.22025	0.54354	0.47093
VMPGCN	0.31340	0.34636	-0.16775	0.62828	0.51817
PMPGAU	0.14587	0.13124	-0.17067	-0.14477	-0.071203
PMPGCN	0.24833	0.19031	-0.052833	0.18214	0.19227

	PRLONW	PBEEFMAT	BEEFMAT	LAMBMAT	PRRUNWT
PRLONW	1.00000				
PBEEFMAT	0.50946	1.00000			
BEEFMAT	-0.71249	-0.014353	1.0000		
LAMBMAT	0.75145	0.70833	-0.45402	1.00000	
PRRUNWT	0.52775	0.86195	-0.10710	0.71273	1.00000
SLOINMAT	0.62282	0.84114	-0.23205	0.67014	0.69493
TOPSMAT	0.22201	0.72231	0.20134	0.30559	0.55382
CHUCKMAT	-0.081649	0.51327	0.42253	0.089452	0.33006
BLADEMAT	0.0089275	0.73820	0.42227	0.38418	0.66835
MINCEMAT	0.64592	0.76802	-0.35304	0.75713	0.65301
PRLLNW	0.79768	0.77022	-0.40792	0.90090	0.77946
DUM1	0.066335	-0.042628	-0.0086917	-0.079486	0.062104
DUM6	-0.017073	0.058628	0.012582	0.060489	0.046685
DUM12	0.041106	-0.043368	0.0026978	-0.097609	-0.069986
IMPGAU	0.74901	0.18888	-0.66043	0.41510	0.22548
IMPGCN	0.78043	0.23948	-0.64981	0.47902	0.30338
IMPGCN(-1	0.77538	0.21490	-0.64141	0.45453	0.24703
IMPGCN(-2	0.73811	0.22951	-0.63167	0.43463	0.27888
IMPGCN(-3	0.70719	0.20957	-0.60924	0.44364	0.28727
VMPGAU	0.72652	0.16236	-0.65424	0.38927	0.18462
VMPGCN	0.80584	0.25692	-0.67085	0.50495	0.30339
PMPGAU	-0.11834	-0.21217	0.030229	-0.19992	-0.31041
PMPGCN	0.19168	0.081181	-0.10600	0.16936	-0.023687

	SLOINMAT	TOPSMAT	CHUCKMAT	BLADEMAT	MINCEMAT
SLOINMAT	1.0000				
TOPSMAT	0.51028	1.00000			
CHUCKMAT	0.24171	0.49092	1.00000		
BLADEMAT	0.50791	0.52117	0.45784	1.0000	
MINCEMAT	0.61418	0.42151	0.045319	0.38240	1.00000
PRLLNW	0.76124	0.42378	0.11045	0.42364	0.75823
DUM1	-0.029895	0.047591	-0.099583	-0.0045371	-0.075573
DUM6	0.087361	0.044249	0.022774	0.065672	0.000076625
DUM12	-0.053653	-0.062358	0.15002	-0.10745	-0.058699
IMPGAU	0.38675	-0.059306	-0.19356	-0.24650	0.37701
IMPGCN	0.42728	-0.041625	-0.19143	-0.19396	0.41471
IMPGCN(-1	0.41752	-0.075169	-0.21513	-0.21807	0.41886
IMPGCN(-2	0.39028	-0.0043823	-0.16760	-0.19897	0.40336
IMPGCN(-3	0.34334	0.033400	-0.30637	-0.18324	0.45375

VMPGAU	0.35387	-0.082885	-0.18599	-0.26529	0.36000
VMPGCN	0.43983	-0.030085	-0.17490	-0.19571	0.43816
PMPGAU	-0.21001	-0.15949	0.0087988	-0.17180	-0.15181
PMPGCN	0.10600	0.035483	0.10291	0.015254	0.058064

	PRLLNW	DUM1	DUM6	DUM12	IMPGAU
PRLLNW	1.0000				
DUM1	-0.065546	1.00000			
DUM6	0.037964	-0.090709	1.0000		
DUM12	-0.054586	-0.097561	-0.090709	1.00000	
IMPGAU	0.48232	-0.11747	-0.10947	-0.11746	1.0000
IMPGCN	0.52806	-0.11831	-0.085492	-0.10188	0.96898
IMPGCN(-1	0.52055	-0.097006	0.041412	0.11816	0.74689
IMPGCN(-2	0.51052	0.12606	-0.0075113	0.19380	0.61967
IMPGCN(-3	0.51653	0.20949	0.0014587	0.061045	0.53349
VMPGAU	0.44648	-0.12618	-0.12903	-0.11482	0.98741
VMPGCN	0.54846	-0.12816	-0.083015	-0.091991	0.96568
PMPGAU	-0.23596	-0.060619	-0.20855	0.021818	-0.037787
PMPGCN	0.16952	-0.24382	0.00078927	0.10512	0.10935

	IMPGCN	IMPGCN(-1)	IMPGCN(-2)	IMPGCN(-3)	VMPGAU
IMPGCN	1.00000				
IMPGCN(-1	0.77275	1.00000			
IMPGCN(-2	0.65475	0.78171	1.00000		
IMPGCN(-3	0.56103	0.67802	0.78398	1.00000	
VMPGAU	0.93838	0.71813	0.57641	0.50189	1.0000
VMPGCN	0.99035	0.77049	0.63509	0.55332	0.95174
PMPGAU	-0.15206	-0.15857	-0.18235	-0.19316	0.097017
PMPGCN	0.065934	0.060796	-0.080958	-0.013320	0.17952

	VMPGCN	PMPGAU	PMPGCN
VMPGCN	1.0000		
PMPGAU	-0.075640	1.00000	
PMPGCN	0.15915	0.47493	1.0000

Table A3: Unit Root Tests: Raw Data: 1990:7-1998:1

Test	TestStat	P-value	Num.lags
Unit root tests for PAPGAU1			
Wtd.Sym.	-3.69349	0.011552	3.00000
Dickey-F	-3.52800	0.036489	3.00000
Phillips	-16.44575	0.14136	3.00000
Unit root tests for PAPGNW			
Wtd.Sym.	-4.10641	0.0033903	3.00000
Dickey-F	-3.91303	0.011642	3.00000
Phillips	-19.09172	0.084538	3.00000
Unit root tests for PWPGNW1			
Wtd.Sym.	-2.64771	0.21022	2.00000
Dickey-F	-2.44886	0.35398	2.00000
Phillips	-17.74447	0.11010	2.00000
Unit root tests for PDPGNW			
Wtd.Sym.	-1.88464	0.72254	10.00000
Dickey-F	-2.46963	0.34331	10.00000
Phillips	-96.76656	1.44343D-09	10.00000
Unit root tests for IMPGCN			
Wtd.Sym.	-3.71591	0.010811	2.00000
Dickey-F	-3.54171	0.035136	2.00000
Phillips	-37.00570	0.0018706	2.00000
Unit root tests for IMPGCN			
Wtd.Sym.	-3.82081	0.0079244	2.00000
Dickey-F	-3.63358	0.027121	2.00000
Phillips	-33.46745	0.0040977	2.00000
Unit root tests for PMPGAU			
Wtd.Sym.	-3.97498	0.0050132	3.00000
Dickey-F	-3.82238	0.015462	3.00000
Phillips	-38.74539	0.0012672	3.00000
Unit root tests for PMPGCN			
Wtd.Sym.	-3.95036	0.0053941	2.00000
Dickey-F	-3.79739	0.016693	2.00000
Phillips	-72.76774	4.57385D-07	2.00000
Unit root tests for PRRUNW			
Wtd.Sym.	-0.77291	0.98634	8.00000
Dickey-F	0.51083	0.99687	8.00000
Phillips	-19.03153	0.085550	8.00000
Unit root tests for PRLLNW			
Wtd.Sym.	-1.82524	0.75670	6.00000
Dickey-F	-2.23303	0.47128	6.00000
Phillips	-16.61499	0.13687	6.00000
Unit root tests for PRLONW			
Wtd.Sym.	-1.94841	0.68276	2.00000
Dickey-F	-2.34118	0.41132	4.00000
Phillips	-11.66883	0.33398	4.00000

Unit root tests for PRLENW

Wtd.Sym.	-1.61545	0.85342	5.00000
Dickey-F	-2.75145	0.21534	3.00000
Phillips	-21.03196	0.057344	3.00000

Unit root tests for PBEEFMAT

Wtd.Sym.	-2.64572	0.21120	2.00000
Dickey-F	-2.34127	0.41127	2.00000
Phillips	-22.85400	0.039542	2.00000

Unit root tests for BEEFMAT

Wtd.Sym.	-1.73814	0.80139	3.00000
Dickey-F	-1.47035	0.83906	2.00000
Phillips	-5.80280	0.76096	2.00000

Unit root tests for LAMBMAT

Wtd.Sym.	-2.87671	0.11836	2.00000
Dickey-F	-3.24972	0.074943	2.00000
Phillips	-20.15167	0.068458	2.00000

Unit root tests for SLOINMAT

Wtd.Sym.	-3.80012	0.0084257	5.00000
Dickey-F	-3.59456	0.030309	5.00000
Phillips	-34.56519	0.0032168	5.00000

Unit root tests for TOPSMAT

Wtd.Sym.	-2.58787	0.24145	4.00000
Dickey-F	-2.33499	0.41470	4.00000
Phillips	-27.02663	0.016516	4.00000

Table A4: Unit Root Tests: Differenced Data: 1990:8-1998:1

Test	TestStat	P-value	Num.lags
Unit root tests for DPAPGAU			
Wtd.Sym.	-4.28863	0.0019693	7.00000
Dickey-F	-4.16617	0.0050330	7.00000
Phillips	-48.14040	0.00014922	7.00000
Unit root tests for DPAPGNW			
Wtd.Sym.	-4.53701	0.00093834	7.00000
Dickey-F	-4.40602	0.0021418	7.00000
Phillips	-36.75918	0.0019764	7.00000
Unit root tests for DPWPGN1			
Wtd.Sym.	-6.09984	8.79292D-06	2.00000
Dickey-F	-4.64294	0.00087295	3.00000
Phillips	-102.02428	4.06081D-10	3.00000
Unit root tests for DPDPGNW			
Wtd.Sym.	-7.24671	2.85396D-07	10.00000
Dickey-F	-7.31681	2.68378D-09	10.00000
Phillips	-99.22259	7.98331D-10	10.00000
Unit root tests for DIMPGAU			
Wtd.Sym.	-5.09920	0.00017496	5.00000
Dickey-F	-5.08203	0.00014548	5.00000
Phillips	-82.00184	5.02922D-08	5.00000
Unit root tests for DIMPGCN			
Wtd.Sym.	-4.89977	0.00031750	4.00000
Dickey-F	-4.74733	0.00057852	4.00000
Phillips	-91.93296	4.62523D-09	4.00000
Unit root tests for DPMPGAU			
Wtd.Sym.	-6.19155	6.68488D-06	4.00000
Dickey-F	-5.34614	0.000046059	5.00000
Phillips	-70.28065	8.26862D-07	5.00000
Unit root tests for DPMPGCN			
Wtd.Sym.	-4.01733	0.0044199	6.00000
Dickey-F	-5.40575	0.000035288	5.00000
Phillips	-107.16075	1.17503D-10	5.00000
Unit root tests for DPRRUNW			
Wtd.Sym.	-4.05718	0.0039256	7.00000
Dickey-F	-3.84524	0.014406	7.00000
Phillips	-86.59748	1.66900D-08	7.00000
Unit root tests for DPRLLNW			
Wtd.Sym.	-4.60190	0.00077304	5.00000
Dickey-F	-4.55501	0.0012253	5.00000
Phillips	-100.29629	6.16164D-10	5.00000
Unit root tests for DPRLONW			
Wtd.Sym.	-4.78414	0.00044852	3.00000
Dickey-F	-4.62950	0.00091981	3.00000
Phillips	-82.42632	4.54253D-08	3.00000

Unit root tests for DPRLENW

Wtd.Sym.	-4.03113	0.0042420	7.00000
Dickey-F	-3.82717	0.015235	7.00000
Phillips	-54.82657	0.000031640	7.00000

Unit root tests for DPBEEFMAT

Wtd.Sym.	-3.82936	0.0077261	9.00000
Dickey-F	-3.63522	0.026994	9.00000
Phillips	-62.50032	5.22391D-06	9.00000

Unit root tests for DBEEFMAT

Wtd.Sym.	-5.95068	0.000013733	2.00000
Dickey-F	-6.60029	1.10917D-07	2.00000
Phillips	-106.75356	1.29646D-10	2.00000

Unit root tests for DLAMBMAT

Wtd.Sym.	-5.89470	0.000016234	2.00000
Dickey-F	-5.98577	2.35328D-06	2.00000
Phillips	-95.92610	1.76759D-09	2.00000

Unit root tests for DSLMAT

Wtd.Sym.	-5.24451	0.00011333	7.00000
Dickey-F	-4.41739	0.0020540	9.00000
Phillips	-53.11405	0.000047159	9.00000

Unit root tests for DTOPSMAT

Wtd.Sym.	-6.77524	1.16799D-06	3.00000
Dickey-F	-6.59026	1.16730D-07	3.00000
Phillips	-76.38269	1.93033D-07	3.00000

Table A5: Example of a Granger Regression

Dependent variable: DPWPGNW
Current sample: 1990:2 to 1998:1
Number of observations: 96
Mean of dep. var. = .375000
Std. dev. of dep. var. = 10.6526
Sum of squared residuals = 5476.00
Variance of residuals = 79.3622
Std. error of regression = 8.90855
R-squared = .492046
Adjusted R-squared = .300643
LM het. test = 10.7106 [.001]
Durbin-Watson = 2.09542 [.001,1.00]
Durbin’s h alt. = -1.89067 [.059]
Jarque-Bera test = 27.6424 [.000]
Ramsey’s RESET2 = 10.5235 [.002]
F (zero slopes) = 2.57074 [.001]
Schwarz B.I.C. = 5.32750
Log likelihood = -330.320

Variable	Estimated Coefficient	Standard Error	t-statistic	P-value
C	19.3770	3.64095	5.32198	[.000]
DPWPGNW(-1)	-.392196	.120586	-3.25241	[.002]
DPWPGNW(-2)	-.061306	.129506	-.473382	[.637]
DPWPGNW(-3)	.206733	.126583	1.63318	[.107]
DPWPGNW(-4)	.253433	.128654	1.96988	[.053]
DPWPGNW(-5)	.070744	.132856	.532486	[.596]
DPWPGNW(-6)	.074496	.125034	.595808	[.553]
DPDPGNW	-.534337E-03	.122399E-02	-.436552	[.664]
DPRRUNW	.092472	.053451	1.73003	[.088]
DPRLLNW	.020344	.069150	.294195	[.769]
DUM1	-12.9220	6.43933	-2.00673	[.049]
DUM2	-29.3704	6.06841	-4.83988	[.000]
DUM3	-25.2893	5.95703	-4.24528	[.000]
DUM4	-27.5615	6.10052	-4.51790	[.000]
DUM5	-21.9537	5.94569	-3.69238	[.000]
DUM6	-25.8268	5.89327	-4.38242	[.000]
DUM7	-18.3100	5.14965	-3.55559	[.001]
DUM8	-14.9243	5.05442	-2.95272	[.004]
DUM9	-17.5623	4.82655	-3.63869	[.001]
DUM10	-15.2512	4.88683	-3.12087	[.003]
DUM11	-17.2765	5.04849	-3.42212	[.001]
DIMPGCN(-1)	.698469E-02	.749913E-02	.931401	[.355]
DIMPGCN(-2)	-.010886	.757064E-02	-1.43792	[.155]
DIMPGCN(-3)	-.839255E-02	.758950E-02	-1.10581	[.273]
DIMPGCN(-4)	-.914161E-02	.766088E-02	-1.19328	[.237]
DIMPGCN(-5)	-.732515E-02	.763796E-02	-.959045	[.341]
DIMPGCN(-6)	-.014026	.726613E-02	-1.93035	[.058]

Table A6: F and LR Tests of the Relationship Between Canadian Pigmeat Import Volumes and NSW Farm Level Baconer Prices.

(a) 1990:8 - 1998:1

PAPGNW		9,9		6,6		3,3		1,1	
IMPGCN		PAPGNW	IMPGCN	PAPGNW	IMPGCN	PAPGNW	IMPGCN	PAPGNW	IMPGCN
GRANGER	F1	0.72	1.58	0.85	1.45	1.49	1.18	1.26	2.75
	LR1	8.24	17.21**	6.24	10.44	5.24	4.18	1.47	3.18*
SIMS	F2	1.29	0.94	1.04	1.01	1.79	0.97	0.64	3.38*
	LR2	14.71*	10.94	7.12	7.53	6.33*	3.47	0.75	3.91**

(b) 1993:5 - 1998:1

PAPGNW		6,6		3,3		1,1	
IMPGCN		PAPGNW	IMPGCN	PAPGNW	IMPGCN	PAPGNW	IMPGCN
GRANGER	F3	1.42	1.35	1.15	1.13	0.94	4.56**
	LR3	12.79**	12.16*	4.94	4.86	1.30	6.01**
SIMS	F4	0.47	2.04*	1.05	1.00	0.00	1.89
	LR4	5.06	18.74**	4.68	4.48	0.00	2.60

For F1, 5% critical values are F(9,70)=2.02; F(6,76)=2.21; F(3,81)=2.72; and F(1,86)=3.95 for 9, 6, 3 and 1 lags respectively.
For F2, 5% critical values are F(9,61)=2.04; F(6,70)=2.23; F(3,79)=2.72; and F(1,85)=3.95.
For F3, 5% critical values are F(6,28)=2.45; F(3,34)=2.88; and F(1,38)=4.10.
For F4, 5% critical values are F(6,22)=2.55; F(3,31)=2.91; and F(1,37)=4.10.
For all of the LR values, 5% critical values are $\chi^2(9)=16.92$; $\chi^2(6)=12.59$; $\chi^2(3)=7.81$; and $\chi^2(1)=3.84$ for 9, 6, 3 and 1 lags respectively.
** denotes significant at the 5% level.

For F1, 10% critical values are F(9,70)=1.73; F(6,76)=1.85; F(3,81)=2.16; and F(1,86)=2.77 for 9, 6, 3 and 1 lags respectively.
For F2, 10% critical values are F(9,61)=1.74; F(6,70)=1.86; F(3,79)=2.16; and F(1,85)=2.77.
For F3, 10% critical values are F(6,28)=2.00; F(3,34)=2.33; and F(1,38)=2.84.
For F4, 10% critical values are F(6,22)=2.06; F(3,31)=2.28; and F(1,37)=2.85.
For all of the LR values, 10% critical values are $\chi^2(9)=14.68$; $\chi^2(6)=10.64$; $\chi^2(3)=6.25$; and $\chi^2(1)=2.71$ for 9, 6, 3 and 1 lags respectively.
* denotes significant at the 10% level.

Table A7: F and LR Tests of the Relationship Between Canadian Pigmeat Import Volumes and NSW Wholesale Baconer Carcase Prices.

(a) 1990:8 - 1998:1

PWPGNW1		9,9		6,6		3,3		1,1	
IMPGCN		PWPGNW 1	IMPGCN	PWPGNW 1	IMPGCN	PWPGNW 1	IMPGCN	PWPGNW 1	IMPGCN
GRANGER	F1	1.47	1.56	1.50	1.73	0.99	0.67	1.21	1.28
	LR1	16.10*	17.00**	10.71*	12.31*	3.51	2.41	1.45	1.49
SIMS	F2	1.35	0.96	0.84	0.82	0.37	0.33	0.64	0.24
	LR2	15.92*	11.13	6.25	6.11	1.30	1.19	0.74	0.27

(b) 1993:5 - 1998:1

PWGNW1		6,6		3,3		1,1	
IMPGCN		PWGNW1	IMPGCN	PWGNW1	IMPGCN	PWGNW1	IMPGCN
GRANGER	F3	0.24	0.72	0.33	0.16	0.44	1.41
	LR3	2.38	6.86	1.47	0.70	0.61	1.93
SIMS	F4	0.75	0.93	0.18	0.55	0.18	0.59
	LR4	7.90	8.48	0.80	2.44	0.23	0.80

Table A8: F and LR Tests of the Relationship Between Canadian Pigmeat Import Volumes and NSW Retail Pork Leg Prices.

(a) 1990:8 - 1998:1

PRLENW		9,9		6,6		3,3		1,1	
IMPGCN		PRLENW	IMPGCN	PRLENW	IMPGCN	PRLENW	IMPGCN	PRLENW	IMPGCN
GRANGER	F1	0.95	0.60	0.95	0.51	1.02	0.81	0.00	0.08
	LR1	10.72	5.99	6.92	3.76	3.61	2.89	0.00	0.09
SIMS	F2	0.52	0.42	0.38	0.36	0.31	0.46	0.07	0.00
	LR2	6.20	5.02	2.91	2.73	1.14	1.67	0.07	0.00

(b) 1993:5 - 1998:1

PRLENW		6,6		3,3		1,1	
IMPGCN		PRLENW	IMPGCN	PRLENW	IMPGCN	PRLENW	IMPGCN
GRANGER	F3	0.70	3.06**	0.21	2.78*	0.52	0.03
	LR3	6.70	24.18**	0.96	11.18**	0.72	0.03
SIMS	F4	2.49*	0.68	2.92**	0.23	1.18	1.80
	LR4	21.72**	7.44	11.98**	1.03	1.64	2.43

Table A9: F and LR Tests of the Relationship Between Canadian Pigmeat Import Volumes and NSW Retail Pork Loin Chop Prices.

(a) 1990:8 - 1998:1

PRLONW		9,9		6,6		3,3		1,1	
IMPGCN		PRLONW	IMPGCN	PRLONW	IMPGCN	PRLONW	IMPGCN	PRLONW	IMPGCN
GRANGER	F1	0.35	0.81	0.29	0.88	0.60	0.93	1.26	1.12
	LR1	4.07	9.23	2.20	6.41	2.14	3.32	1.46	1.31
SIMS	F2	0.58	0.59	0.49	0.45	0.37	0.45	0.25	1.74
	LR2	6.97	6.94	3.70	3.31	1.33	1.60	0.30	1.99

(b) 1993:5 - 1998:1

PRLONW		6,6		3,3		1,1	
IMPGCN		PRLONW	IMPGCN	PRLONW	IMPGCN	PRLONW	IMPGCN
GRANGER	F3	0.47	1.41	0.34	2.40*	0.14	5.78**
	LR3	4.61	12.64**	1.49	9.80**	0.19	7.50**
SIMS	F4	1.39	4.52**	0.43	4.58**	0.44	2.12
	LR4	12.64**	33.20**	1.91	17.27**	0.64	2.82*

Table A10: Data Summary Statistics: Raw Data: 1993:5 to 1998:1

Number of Observations: 57

	Mean	Std Dev	Minimum	Maximum
PAPGAU1	219.39474	21.79050	181.60001	261.00000
PAPGNW	222.79386	23.18998	187.25000	270.00000
PDPGNW	8006.73684	853.93970	6250.00000	10139.00000
PWPGNW1	304.42105	21.76658	260.00000	346.00000
PWPGNW4	304.00000	27.03239	260.00000	360.00000
PRLENW	675.65789	120.09669	380.00000	803.00000
PRLONW	791.52632	32.94590	742.00000	844.00000
PBEEFMAT	836.10754	14.08266	806.97998	870.00000
BEEFMAT	249.39394	23.74752	208.00000	282.29666
LAMBMAT	256.54723	28.36073	208.99998	325.00000
PRRUNWT	1214.56140	29.90044	1136.00000	1264.00000
SLOINMAT	1085.28070	41.44305	1008.00000	1189.00000
TOPSMAT	941.40351	18.89052	903.00000	989.99994
CHUCKMAT	676.08772	32.70773	627.00000	875.00000
BLADEMAT	801.35087	22.48768	734.00000	839.99994
MINCEMAT	648.19298	14.39176	618.00000	670.00000
PRLLNW	623.59649	40.18389	532.00000	695.00000
DUM1	0.087719	0.28540	0.00000	1.00000
DUM6	0.087719	0.28540	0.00000	1.00000
DUM12	0.087719	0.28540	0.00000	1.00000
IMPGAU	499.20930	332.12422	82.88000	1419.58997
IMPGCN	403.36228	299.41715	47.10000	1116.29004
IMPGCN(-1	399.36719	302.01354	47.10000	1116.29004
IMPGCN(-2	390.79684	302.28946	47.10000	1116.29004
IMPGCN(-3	377.88386	295.17948	47.10000	1116.29004
VMPGAU	2010.38643	1403.15015	294.76099	5895.58008
VMPGCN	1589.27137	1243.53788	168.21100	4533.00000
PMPGAU	399.70702	39.39298	320.54736	479.53271
PMPGCN	388.43966	38.32946	290.31781	499.36649

Table A11: Correlation Matrix: Raw Data: 1993:5-1998:1

	PAPGAU1	PAPGNW	PDPGNW	PWPGNW1	PWPGNW4
PAPGAU1	1.00000				
PAPGNW	0.95503	1.00000			
PDPGNW	-0.37930	-0.41673	1.00000		
PWPGNW1	0.54598	0.63736	-0.46597	1.00000	
PWPGNW4	0.67647	0.69608	-0.21408	0.37681	1.00000
PRLENW	0.40793	0.32780	-0.22434	0.48631	0.0053354
PRLONW	0.38112	0.40945	-0.43060	0.80693	0.22056
PBEEFMAT	-0.017392	-0.023410	0.10287	-0.040693	-0.13268
BEEFMAT	-0.50067	-0.52054	0.49880	-0.83168	-0.26383
LAMBMAT	0.54082	0.55201	-0.32149	0.65766	0.16358
PRRUNWT	0.33584	0.33016	-0.000068244	0.19468	-0.050681
SLOINMAT	0.026989	-0.017718	-0.12911	0.15679	-0.056569
TOPSMAT	-0.43476	-0.37097	0.15440	-0.34359	-0.26580
CHUCKMAT	-0.10413	-0.053314	0.28999	-0.23794	0.030396
BLADEMAT	-0.088663	-0.14588	0.27621	-0.43302	-0.20830
MINCEMAT	0.28764	0.24379	-0.27972	0.54886	-0.032038
PRLLNW	0.42318	0.39522	-0.21742	0.61443	-0.040999
DUM1	0.048889	0.096674	-0.45250	0.19229	0.046292
DUM6	-0.21442	-0.19634	0.31157	-0.086538	-0.22220
DUM12	0.21256	0.22591	0.24797	0.17217	0.43514
IMPGAU	0.28172	0.28046	-0.29296	0.55881	0.14715
IMPGCN	0.31117	0.30110	-0.26347	0.56217	0.15336
IMPGCN(-1	0.25994	0.28567	-0.20649	0.57758	0.22260
IMPGCN(-2	0.20708	0.24616	-0.22332	0.61022	0.19512
IMPGCN(-3	0.18174	0.21318	-0.34666	0.61859	0.10448
VMPGAU	0.30538	0.30772	-0.32505	0.55584	0.19933
VMPGCN	0.32910	0.32388	-0.30089	0.58475	0.17688
PMPGAU	0.11613	0.14879	-0.13544	0.058897	0.44436
PMPGCN	0.17292	0.21146	-0.13058	0.32781	0.23615

	PRLENW	PRLONW	PBEEFMAT	BEEFMAT	LAMBMAT
PRLENW	1.00000				
PRLONW	0.61849	1.00000			
PBEEFMAT	0.14510	-0.040223	1.00000		
BEEFMAT	-0.64163	-0.87425	0.16556	1.00000	
LAMBMAT	0.53396	0.60217	0.093763	-0.67765	1.0000
PRRUNWT	0.38215	0.018638	0.61160	-0.011044	0.25650
SLOINMAT	0.41704	0.31334	0.72600	-0.24300	0.28464
TOPSMAT	-0.27407	-0.30759	0.52057	0.42706	-0.40730
CHUCKMAT	-0.41925	-0.33621	0.63322	0.47957	-0.20397
BLADEMAT	-0.13384	-0.56966	0.61873	0.61925	-0.20122
MINCEMAT	0.73791	0.72559	0.12193	-0.73970	0.57781
PRLLNW	0.77976	0.68433	0.27915	-0.63011	0.79175
DUM1	-0.095491	0.10515	-0.077209	-0.034550	-0.098526
DUM6	-0.071786	-0.088560	0.084959	0.019015	0.063713
DUM12	-0.092365	0.11085	0.018582	-0.039706	-0.10294
IMPGAU	0.56264	0.80343	-0.083580	-0.72560	0.44303
IMPGCN	0.56663	0.80073	-0.085228	-0.71285	0.46715
IMPGCN(-1	0.52647	0.81611	-0.13898	-0.70686	0.42357
IMPGCN(-2	0.47541	0.78360	-0.12058	-0.67647	0.38527
IMPGCN(-3	0.47420	0.75484	-0.20750	-0.65945	0.37795
VMPGAU	0.52751	0.78915	-0.094957	-0.71648	0.42653
VMPGCN	0.55320	0.81450	-0.078789	-0.72872	0.47503
PMPGAU	-0.11654	0.054841	-0.097946	-0.038644	-0.064398
PMPGCN	0.10739	0.32405	0.11232	-0.24872	0.19813

	PRRUNWT	SLOINMAT	TOPSMAT	CHUCKMAT	BLADEMAT
PRRUNWT	1.0000				
SLOINMAT	0.28981	1.0000			
TOPSMAT	0.15160	0.14171	1.00000		
CHUCKMAT	0.25450	0.096255	0.46609	1.00000	
BLADEMAT	0.58158	0.22917	0.32964	0.42764	1.0000
MINCEMAT	0.083817	0.45089	-0.24949	-0.41767	-0.39312
PRLLNW	0.44020	0.47122	-0.28068	-0.23078	-0.10560

DUM1	0.042255	-0.051941	0.13574	-0.12518	-0.0076636
DUM6	0.067366	0.059781	0.076122	0.0068128	0.042419
DUM12	-0.056095	-0.060999	0.039688	0.25932	-0.14678
IMPGAU	-0.055249	0.29644	-0.38504	-0.31795	-0.56341
IMPGCN	-0.011139	0.27712	-0.41450	-0.32877	-0.52162
IMPGCN(-1	-0.10343	0.25508	-0.42506	-0.35079	-0.54858
IMPGCN(-2	-0.085053	0.23649	-0.34704	-0.29375	-0.50141
IMPGCN(-3	-0.041549	0.16500	-0.30104	-0.46085	-0.50130
VMPGAU	-0.088095	0.27995	-0.37972	-0.30211	-0.56965
VMPGCN	-0.029010	0.27863	-0.39408	-0.31636	-0.53712
PMPGAU	-0.30754	-0.045376	0.033079	0.071561	-0.18494
PMPGCN	-0.099293	0.11880	0.081924	0.084019	-0.18509

	MINCEMAT	PRLLNW	DUM1	DUM6	DUM12
MINCEMAT	1.00000				
PRLLNW	0.75291	1.00000			
DUM1	-0.095493	-0.059141	1.00000		
DUM6	0.056670	0.032726	-0.096154	1.00000	
DUM12	-0.091146	-0.065369	-0.096154	-0.096154	1.00000
IMPGAU	0.65922	0.53789	-0.15845	-0.15796	-0.10598
IMPGCN	0.65426	0.54896	-0.17263	-0.15345	-0.098629
IMPGCN(-1	0.62490	0.54286	-0.093643	-0.049776	0.12109
IMPGCN(-2	0.51855	0.52920	0.12985	-0.072347	0.31669
IMPGCN(-3	0.51990	0.52560	0.33800	-0.030559	0.12280
VMPGAU	0.63253	0.49643	-0.16206	-0.17660	-0.10049
VMPGCN	0.66068	0.54037	-0.16783	-0.15195	-0.095508
PMPGAU	-0.10881	-0.19469	-0.12342	-0.31566	0.044790
PMPGCN	0.22289	0.12991	-0.042908	-0.050177	0.027606

	IMPGAU	IMPGCN	IMPGCN(-1)	IMPGCN(-2)	IMPGCN(-3)
IMPGAU	1.00000				
IMPGCN	0.98429	1.00000			
IMPGCN(-1	0.77802	0.75664	1.00000		
IMPGCN(-2	0.64307	0.62966	0.76823	1.0000	
IMPGCN(-3	0.54751	0.52851	0.66022	0.77162	1.0000
VMPGAU	0.99098	0.97046	0.76667	0.61007	0.52696
VMPGCN	0.98042	0.99362	0.75396	0.60648	0.51783
PMPGAU	0.11679	0.075500	0.054823	-0.018700	-0.044502
PMPGCN	0.20475	0.19913	0.15392	0.058749	0.041317

	VMPGAU	VMPGCN	PMPGAU	PMPGCN
VMPGAU	1.00000			
VMPGCN	0.97879	1.00000		
PMPGAU	0.22563	0.14313	1.0000	
PMPGCN	0.27140	0.28166	0.60574	1.0000

Table A12: Unit Root Tests: Raw Data: 1993:5-1998:1

	TestStat	P-value	Num.lags
Unit root tests for PAPGAU			
Wtd.Sym.	-2.84499	0.12862	3.00000
Dickey-F	-2.55348	0.30176	3.00000
Phillips	-9.83948	0.44702	3.00000
Unit root tests for PAPGNW			
Wtd.Sym.	-2.88973	0.11436	3.00000
Dickey-F	-2.61833	0.27153	3.00000
Phillips	-9.24538	0.48889	3.00000
Unit root tests for PWPGNW1			
Wtd.Sym.	-2.00777	0.64316	3.00000
Dickey-F	-1.82733	0.69143	3.00000
Phillips	-10.58398	0.39808	3.00000
Unit root tests for PDPGNW			
Wtd.Sym.	-1.83851	0.74932	10.00000
Dickey-F	-1.86946	0.67034	10.00000
Phillips	-46.56441	0.00021442	10.00000
Unit root tests for IMPGAU			
Wtd.Sym.	-3.67812	0.012088	2.00000
Dickey-F	-2.78150	0.20382	3.00000
Phillips	-24.83945	0.026191	3.00000
Unit root tests for IMPGCN			
Wtd.Sym.	-3.66739	0.012477	2.00000
Dickey-F	-3.45925	0.043961	2.00000
Phillips	-27.16878	0.016025	2.00000
Unit root tests for PMPGAU			
Wtd.Sym.	-3.17348	0.052398	3.00000
Dickey-F	-2.44606	0.35543	4.00000
Phillips	-23.04056	0.038052	4.00000
Unit root tests for PMPGCN			
Wtd.Sym.	-3.02151	0.080111	3.00000
Dickey-F	-3.21127	0.082179	2.00000
Phillips	-31.66281	0.0060846	2.00000
Unit root tests for PRRUNW			
Wtd.Sym.	-1.31399	0.93479	6.00000
Dickey-F	-0.69938	0.97319	6.00000
Phillips	-8.52363	0.54284	6.00000
Unit root tests for PRLLNW			
Wtd.Sym.	-2.25796	0.46041	6.00000
Dickey-F	-1.92931	0.63935	6.00000
Phillips	-11.68790	0.33293	6.00000
Unit root tests for PRLONW			
Wtd.Sym.	-2.03367	0.62520	2.00000
Dickey-F	-3.14981	0.094875	6.00000
Phillips	-10.04986	0.43278	6.00000

Unit root tests for PRLENW

Wtd.Sym.	-2.28109	0.44329	4.00000
Dickey-F	-1.79208	0.70857	4.00000
Phillips	-18.53762	0.094295	4.00000

Unit root tests for SLOINMAT

Wtd.Sym.	-3.14249	0.057193	7.00000
Dickey-F	-3.37256	0.055163	7.00000
Phillips	-17.79123	0.10910	7.00000

Unit root tests for TOPSMAT

Wtd.Sym.	-3.48391	0.021397	3.00000
Dickey-F	-3.67237	0.024243	3.00000
Phillips	-23.21366	0.036717	3.00000

Unit root tests for PWPGNW4

Wtd.Sym.	-3.19374	0.049472	5.00000
Dickey-F	-3.41344	0.049618	5.00000
Phillips	-15.16922	0.17981	5.00000

Table A13: Unit Root Tests: Differenced Data: 1993:5-1998:1

	TestStat	P-value	Num.lags
Unit root tests for DPAPGAU			
Wtd.Sym.	-4.04443	0.0040774	2.00000
Dickey-F	-3.82417	0.015376	2.00000
Phillips	-32.02328	0.0056241	2.00000
Unit root tests for DPAPGNW			
Wtd.Sym.	-3.83044	0.0077014	2.00000
Dickey-F	-3.63568	0.026958	2.00000
Phillips	-28.43041	0.012241	2.00000
Unit root tests for DPWPGN1			
Wtd.Sym.	-4.59761	0.00078301	2.00000
Dickey-F	-3.41292	0.049686	3.00000
Phillips	-68.01151	1.41764D-06	3.00000
Unit root tests for DPDPGNW			
Wtd.Sym.	-5.63701	0.000035067	10.00000
Dickey-F	-6.36980	3.55346D-07	10.00000
Phillips	-62.14260	5.68383D-06	10.00000
Unit root tests for DIMPGAU			
Wtd.Sym.	-3.84171	0.0074481	5.00000
Dickey-F	-4.16408	0.0050694	10.00000
Phillips	-44.71751	0.00032734	10.00000
Unit root tests for DIMPGCN			
Wtd.Sym.	-3.54026	0.018140	4.00000
Dickey-F	-4.13368	0.0056257	10.00000
Phillips	-50.57382	0.000085052	10.00000
Unit root tests for DPMPGAU			
Wtd.Sym.	-5.35835	0.000080647	5.00000
Dickey-F	-5.11640	0.00012562	4.00000
Phillips	-46.11520	0.00023770	4.00000
Unit root tests for DPMPGCN			
Wtd.Sym.	-2.93317	0.10185	6.00000
Dickey-F	-4.56986	0.0011577	5.00000
Phillips	-44.99885	0.00030695	5.00000
Unit root tests for DPRRUNW			
Wtd.Sym.	-4.15251	0.0029551	5.00000
Dickey-F	-4.11850	0.0059239	5.00000
Phillips	-35.77160	0.0024622	5.00000
Unit root tests for DPRLLNW			
Wtd.Sym.	-3.64716	0.013245	5.00000
Dickey-F	-3.59304	0.030439	5.00000
Phillips	-48.53473	0.00013625	5.00000
Unit root tests for DPRLONW			
Wtd.Sym.	-3.11364	0.062024	3.00000
Dickey-F	-3.17084	0.090371	5.00000
Phillips	-51.77130	0.000064432	5.00000

Unit root tests for DPRLENW

Wtd.Sym.	-4.52022	0.00098658	6.00000
Dickey-F	-5.40141	0.000035981	3.00000
Phillips	-30.91886	0.0071544	3.00000

Unit root tests for DSLMAT

Wtd.Sym.	-4.67796	0.00061594	5.00000
Dickey-F	-3.24571	0.075671	9.00000
Phillips	-29.81561	0.0090862	9.00000

Unit root tests for DTOPSMAT

Wtd.Sym.	-5.31982	0.000090491	3.00000
Dickey-F	-5.14740	0.00010996	3.00000
Phillips	-43.88874	0.00039553	3.00000

Unit root tests for DPWPGN4

Wtd.Sym.	-3.97611	0.0049965	8.00000
Dickey-F	-3.91606	0.011530	8.00000
Phillips	-22.85172	0.039561	8.00000

Table A14: F and LR Tests of the Relationship Between Canadian Pigmeat Import Volumes and NSW Wholesale Leg Prices.

(b) 1993:5 - 1998:1

PWPGNW4		6,6		3,3		1,1	
IMPGCN		PWPGNW 4	IMPGCN	PWPGNW 4	IMPGCN	PWPGNW 4	IMPGCN
GRANGER	F3	0.49	3.43**	0.60	0.78	0.00	1.29
	LR3	4.84	26.46**	2.63	3.40	0.01	1.76
SIMS	F4	1.92	1.88	1.08	0.31	0.90	0.03
	LR4	17.92**	16.78**	4.85	1.42	1.26	0.04

Table A15: F and LR Tests of the Relationship Between Canadian Pigmeat Import Unit Values and NSW Farm Level Baconer Prices.

(b) 1993:5 - 1998:1

PAPGNW		6,6		3,3		1,1	
PMPGCN		PAPGNW	PMPGCN	PAPGNW	PMPGCN	PAPGNW	PMPGCN
GRANGER	F3	1.61	2.29*	0.62	0.34	0.31	0.10
	LR3	14.23**	19.19**	2.73	1.53	0.42	0.14
SIMS	F4	2.27*	2.71**	0.16	1.73	0.12	0.00
	LR4	20.55**	22.19**	0.73	7.48*	0.16	0.00