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.*

Australian Journal of Agricultural Economics, Vol. 28, No. 1 (April 1984), pp. 33-43.

THE EEC SHEEPMEAT MARKET AND VOLUNTARY EXPORT RESTRAINT AGREEMENTS

NICOLA BLYTH
Australian Meat and Live-stock Corporation, Sydney, NSW 2000

Voluntary export restraint agreements are an increasingly common measure used to restrict international trade in particular commodities. They have been applied to the EEC sheepmeat market since 1980 as part of the Common Agricultural Policy. In this paper, theoretical implications of voluntary export restraints are analysed and compared with alternative trade barriers, such as variable levies. The effects of the various trade barriers which the EEC could impose on sheepmeat imports are quantified using an econometric model of the world sheepmeat market. From the exporters' viewpoint, voluntary export restraints are shown to be the least harmful form of providing protection against imports into the EEC.

An increasingly common form of quantitative trade barrier utilised in commodity markets is the voluntary export restraint agreement whereby foreign governments are asked to limit exports to a given quantity. Voluntary export restraints have been in force in the EEC sheepmeat market since 1980, under the sheepmeat regime of the Common Agricultural Policy (Blyth 1980). These were fixed for 1980-84 at an annual level of 245 kt for New Zealand, 17.5 kt for Australia and smaller amounts for other minor exporters, giving a total of around 325 kt. An *ad valorem* tariff of 10 per cent also operates.

In this paper two aspects of voluntary export restraints are discussed. First, the theoretical implications of applying voluntary export restraints compared with other forms of trade barrier are summarised. Second, some of the effects on the world sheepmeat market of the imposition of voluntary export restraints by the EEC are quantified using an econometric model.

Recently, several forms of protection that are more restrictive than the current system have been proposed for sheepmeat by the EEC. The proposals include a minimum price or variable levy system, and a reduction in imports under the current voluntary export restraints agreement. A variable levy system is analysed in this paper, and compared with the voluntary export restraints in terms of the resultant degree of market disruption.

Theoretical Implications of Voluntary Export Restraints

The theoretical implications of various forms of protection have been well documented but literature pertaining specifically to voluntary export restraints is limited. Notable contributions have been made by Grubel (1977), Takacs (1978) and Allen, Dodge and Schmitz (1983), the last in relation to the US beef market.

Although voluntary export restraints, quotas and tariffs are all restrictions on trade, a voluntary export restraint differs from both quotas and tariffs in several respects. First, while the import quota and tariff are ap-

Copyright 1984 The Australian Agricultural Economics Society.
C

plied by the importing country and restrict the quantity demanded for a good on the world market, a voluntary export restraint is implemented under duress by the exporting country and restricts the quantity supplied to a particular market. Voluntary export restraints tend, therefore, to be more restrictive than either tariffs or quotas in many cases (Murray, Schmidt and Walker 1978).

Second, both an import quota and a tariff normally apply to imports from all sources, while voluntary export restraints are negotiated with, and imposed upon, only the most important exporting countries. Some suppliers may be left out of the agreements because they are minor participants in the market, or because they refuse to limit their exports. Exports of sheepmeat from such countries continue to enter the EEC under the sheepmeat regime, although they are restrained by an *ad valorem* tariff of 20 per cent and constitute less than two per cent of EEC sheepmeat imports.

Another important effect of voluntary export restraints is that foreign producers are able to sell their goods at the importing country's protected market price and thus acquire revenue on the restricted quantity above that which they would have earned in the absence of voluntary export restraints. For importing countries, therefore, voluntary export restraints are more costly than tariffs or normal import quotas, since they produce identical welfare losses and other effects, but in addition they lead to a loss of tariff revenue or income to quota holders (Caves and Jones 1977).

Discussion in most of the literature is centred around the absolute, static effects of imposing voluntary export restraints. A further important aspect of any policy is its dynamic long-run impact on price stability. The effect of import policies on world market price stability is an important issue for exporters of a product whose supply tends to be variable, as their incomes can fluctuate considerably. This aspect is well developed in recent literature, for example, Bale and Lutz (1979) and Zwart and Meilke (1979). The major effects are summarised in Table 1.

Most protective measures restrict transmission of fluctuations from the world market to the protected market, but to varying degrees. *Ad valorem* tariffs, for example, allow prices on the domestic market to vary proportionately with world prices. This results in higher absolute price fluctuations on domestic markets than without the policy and hence, in

TABLE 1

The Effects of Trade Policies on Price Instability

Trade policy of importer	Degree of price instability in comparison with instability under free trade	
	World market	Importing country
Ad valorem tariff	Smaller	Larger
Variable levy	Larger	Smaller
Fixed quota	Larger	Generally larger
Voluntary export restraint	Larger	Generally larger

Source: Adapted from Bale and Lutz (1979).

an absorption of some of the world price fluctuation. Import quotas and voluntary export restraints allow a 'one-sided' dampening effect as, in the event of an import supply shortfall, neither will be effective. In the event of a surplus, however, the degree of instability of the world price is increased over the free trade case, as none of the variation can be transmitted to the restricted market. Variable levies generally ensure that none of the world price fluctuation is transmitted to the domestic market. Even though variable levies can theoretically have a one-sided dampening effect if world prices rise above the protected domestic market price, this rarely occurs because the world price is usually below the price in the importing country.

In general, exporters and producers outside the restricted market gain most benefit, in terms of stability of export receipts, from policies (such as an *ad valorem* tariff) which allow markets to absorb fluctuations in world supply without amplifying world market price changes. In the following section some of the absolute effects of protection are quantified. It is not possible to quantify the stability effects of policies at this stage, although some qualitative indications are given.

Often the reasons for the imposition of a certain type of trade barrier are more political than economic. For example, voluntary export restraints may appear more liberal and acceptable to exporting countries than the setting of quantity limits by the importer. Tariffs, whilst they are direct revenue earners, are obvious sources of protection. However, it is not easy to measure the tariff-equivalent of quantitative restrictions even though, in effect, the overall protection given to a sector may be much greater. For example, Sampson and Yeats (1977) estimated the effective protection of sheepmeat in the EEC to be 119 per cent, despite the nominal tariff rate at the time of 20 per cent. Although a particular type of barrier may give the greatest benefit to the importing country, it may not be feasible under GATT rules to replace existing, more liberal barriers. Even with respect to EEC agricultural trade, compensatory concessions generally have to be made when new or tighter controls are introduced.

Policy Analysis

In order to assess the effects of voluntary export restraints and other protectionist policies on international trade in sheepmeat, an existing model of the world sheepmeat market was utilised. The model accounts for domestic production, consumption and trade in the major trading countries or regions and the world pricing mechanism. Although it is a relatively large model in terms of international coverage, the structure has been kept simple by estimating derived functions which incorporate transport costs, other charges and policy responses implicitly, and indicate the responsiveness of domestic supply and demand to changes in the world price. The supply and demand functions, in this case, are derived with respect to the Smithfield (UK) price which is taken to be a representative 'world' price.

The Appendix contains the estimates of the functions and a description of the variables and regions included in the model. The model was estimated using ordinary least squares regression and annual data from 1960-80. The results were generally consistent with a priori expectations,

though there were some anomalies in price responses on the supply side. A dynamic *ex post* simulation indicated that the model was a satisfactory representation of market conditions. A summary of these results is given in the Appendix. (Full results are presented in Blyth 1982.)

The model was used to simulate market conditions over the 1981-90 period to provide a base forecast for comparison. Various trade barriers were then imposed on imports into the EEC in three further simulation runs, and the results assessed against the base forecast. One point which emerged from the results of the base forecast simulation was that continuation by the EEC of the voluntary export restraints at 1980 levels would not result in them being binding on exporters, given the import demand levels for the EEC and the export supply levels projected.

If the voluntary export restraints were to be renegotiated, they would need to be set 35-40 per cent below 1980-84 levels to become binding. Moreover, given the long-run decline in EEC imports projected in the base forecast, restraints would have to be negotiated on an annual, diminishing scale.

Three policy scenarios were simulated. Under the first (Policy I), EEC imports were restrained to 220 kt. Under the second (Policy II), the voluntary export restraints were reduced by diminishing quantities, commencing at 50 per cent of the base forecast levels. The third, a variable import levy (Policy III), was provided for comparison and is discussed more fully below. The results are summarised in Table 2.

Under the first policy the simulated world price is depressed by 1.8 per cent due to imports into the EEC falling by 7.4 per cent on average over the 1981-90 period. This is a US$62/t decline over the mean base forecast world price. There is a US$61/t decline in 1985 and an US$83/t decline in 1990 (imports are considerably lower in the later period). The lower world price stimulates demand for imports in other countries, partially offsetting the reduction in sales to the EEC, so total world imports fall by only 1 per cent, or 11 kt, below the base level. New Zealand exports therefore fall by only 0.5 per cent, or by an average of 2 kt below the

TABLE 2

Comparison Among Import Policies for Sheepmeat in the EEC

Variable	Mean base level[a] (1981-90)	Mean percentage change over base level		
		Policy I	Policy II	Policy III
World price	$2825/t	−1.8	−12.6	−9.7
EEC (10) imports	236kt	−7.4	−50.0	−48.8
World trade	938kt	−1.0	−6.6	−5.3
New Zealand exports	377kt	−0.5	−3.9	−3.4
Australian exports	506kt	−1.6	−7.7	−8.1
EEC (10) production	707kt	+0.9	+4.2	+4.1
EEC (10) consumption	944kt	−1.1	−8.4	−8.2
EEC price	$2825/t	+8.0	+58.0	+56.1
New Zealand total revenue	$1065m	+1.1	−5.3	−12.8
Australian total revenue	$1429m	−3.3	−19.4	−17.1

[a]All prices in 1980 US dollars.

base level. Most of the impact of the fall in world demand is felt in Australia and in the marginal exporting countries.

However, the effect on New Zealand's revenue from sheepmeat exports is not entirely clear. Prices obtained in world markets are reduced and total exports decline, but exporters could benefit from obtaining higher prices for sales within the EEC. Whilst it is not possible to calculate the exact change in New Zealand's revenue, an estimate can be made on the basis of the following. If approximately 30 per cent of New Zealand's exports over the simulation period is sold in the EEC at the higher EEC price, with the remainder sold at the world price, then New Zealand's revenue could increase by about 1 per cent above the base level. (This approximation takes no account of the simultaneous and dynamic effects of increased revenue.) Australian revenue would decline by about 3 per cent, as shipments to the EEC would continue to be at low levels anyway.

Under the second policy scenario of highly restrictive voluntary export restraints, the results are similar, but more extreme. The world price would fall 12.6 per cent below the base level and EEC prices would be about 70 per cent higher than world prices. Even though higher prices would be obtained for sales in the EEC, the reduced level of sales to the EEC and lower world prices combine to yield revenue to New Zealand which is approximately 5 per cent below the base forecast. If similar restrictions were made using quotas instead of voluntary export restraints and if import licences were administered by the EEC, New Zealand's revenue could fall by about 16 per cent as none of the economic rent associated with a quota would accrue to New Zealand. In addition, imposition of such restrictions by the EEC would certainly amplify instability in the world market price.

An alternative means for the EEC to maintain internal prices in the face of low world prices is through the use of a variable levy. Another simulation (Policy III) was run to assess the effects of imposing a variable levy at the level of the EEC guide price levels proposed by the EEC Commission. The guide price levels used for the UK were those calculated by Volans (1981). These levels gradually increase over a transition period to 1984-85 and harmonise with the basic price thereafter.

Applying these rates results in changes generally only marginally different from those reported under Policy II (Table 2). The major difference is that revenue for countries exporting to the EEC declines further than it would with a restrictive voluntary export restraint, as exporters are unable to benefit from the higher EEC prices. In New Zealand's case, this would represent 12.8 per cent lower revenue than in the base simulation. The main beneficiaries of a variable levy, with EEC prices at approximately double the world price, would be EEC producers (supply in the EEC would be 4 per cent greater than forecast in the base simulation) and the European Guarantee and Guidance Fund (responsible for administering border taxes and duties) which would collect an average annual sum of US$290m. Thus, if the EEC wishes to maintain its internal price by reducing imports, and to maximise revenue, it could apply a system of variable levies. Correspondingly, exporters would sustain the greatest loss in revenue under this system. Moreover, as discussed earlier, variable levies cause any price instability on the world market to be amplified, to the detriment of exporters.

Discussion

Under normal market conditions, any form of trade barrier which the EEC imposes, would depress imports into the EEC and, hence, the foreign price. Comparison of different forms of barriers, such as quotas, tariffs and variable levies (Blyth 1982) indicates that the measures which offer least restriction to exporters appear to be an *ad valorem* tariff, or the equivalent voluntary export restraint, if any restriction is to be applied. Considering the stability effects though, the variance of the expected (mean) benefit to exporters would be smaller over time with a tariff than a voluntary export restraint, but the voluntary export restraint allows exporters to minimise revenue losses.

If the existing system of protection were removed (that is, if the tariff rate were zero, and assuming voluntary export restraints were not binding), exporters would gain extra revenue from increased sales and a rise in the world price of an average 1.8 per cent or US$62/t, as the increase in EEC imports would more than offset the decline in exports to other markets (Blyth 1982). In several of the years since voluntary export restraints were negotiated, they were not binding due to the high levels negotiated, poor prices in the EEC and the fortuitous development of the Middle East market. The voluntary export restraint, therefore, presents more of a psychological than a physical barrier to exporters, discouraging them from 'dumping' on the UK market. Exporters require a more co-ordinated marketing policy in the EEC to avoid further restrictions being imposed in future and to maximise returns from current sales.

It has been shown that if the voluntary export restraint were to be reduced to approximately half the level of 'normal' imports, or if a variable levy system were introduced, then the effects on the rest of the world market, especially on exporters, could be major. Blyth (1982) has shown that the current level and type of tariff protection (that is a 10 per cent *ad valorem* tariff and a non-binding voluntary export restraint) does, in fact, maximise welfare (that is, national income) in the EEC. Admittedly, it is doubtful whether there is a conscious economic rationale behind the setting of protection levels in the EEC, but there is evidence to support the hypothesis that the EEC's nominal import tariff on sheepmeat is close to the optimum level. A rough estimate of the optimum tariff was made for the periods 1961-70 and 1971-75 and the years 1961 and 1980. Using supply and demand elasticities of 0.26 and −0.30, respectively, and the relevant production and consumption to import ratio weights, the optimum tariff was around 18 per cent for the earlier period, when EEC imports were sizeable. For the more recent period, the optimum tariff was around 9 per cent in line with the decline in imports. Comparable results were obtained by Grennes and Johnson (1980) with respect to the EEC wheat trade.

Thus, the tariff reduction in 1980 also seems to have been consistent with the decline in imports into the EEC, and ensured that welfare in the EEC was maximised. However, the more restrictive trade barriers recently proposed by the EEC appear to be aimed at maintaining producer protection whilst reducing budget support, at the expense of EEC consumers and third country exporters. The increased protection measures are unlikely to result in a net welfare gain for the EEC, nor are they

strictly permissible under GATT, but are likely to be introduced regardless, for socio-political reasons.

References

Allen, R., Dodge, C. and Schmitz, A. (1983), 'Voluntary export restraints as protection policy', *American Journal of Agricultural Economics* 65(2), 291-6.

Bale, M. D. and Lutz, E. (1979), 'The effects of trade intervention and international price instability', *American Journal of Agricultural Economics* 61(3), 512-6.

Blyth, N. (1980), *The EEC Sheepmeat Regime: Arrangements and Implications*, Discussion Paper No. 51, Agricultural Economics Research Unit, Lincoln College, New Zealand.

—— 1982, *The World Sheepmeat Market: An Econometric Model*, Research Report No. 138, Agricultural Economics Research Unit, Lincoln College, New Zealand.

Caves, R. E. and Jones, R. W. (1977), *World Trade and Payments*, Little, Brown and Co., Boston.

Grennes, T. and Johnson, P. R. (1980), 'Import tariffs and price formation in the world wheat market: comment', *American Journal of Agricultural Economics* 62(4), 819-22.

Grubel, G. H. (1977), *International Economics*, Richard Irwin, Illinois.

Murray, T., Schmidt, W. and Walker, I. (1978), 'Alternative forms of protection against market disruption', *Kyklos* 31(4), 624-37.

Sampson, G. P. and Yeats, A. J. (1977), 'An evaluation of the common agricultural policy as a barrier facing agricultural exports to the EEC', *American Journal of Agricultural Economics* 59(1), 99-106.

Takacs, W. E. (1978), 'The non-equivalence of tariffs, import quotas and voluntary export restraints', *Journal of International Economics* 8(3), 565-73.

Volans, K. (1981), *EEC Sheepmeat Regime—The Agreed Proposal*, Technical Note, East of Scotland Agricultural College.

Zwart, A. C. and Meilke, K. D. (1979), 'The influence of domestic pricing policies and buffer stocks on price stability in the wheat industry', *American Journal of Agricultural Economics* 61(3), 434-47.

APPENDIX

The estimates of the production, consumption and trade equations for the model are given below, with definitions of the variables. Values in parentheses beneath the estimated coefficients are *t*-statistics.

Variable Definitions for the Model

VARIABLE NAME	DEFINITION AND SOURCE
Pw	World price of sheepmeat; Smithfield (UK) price for imported, PM grade, New Zealand lamb, US$/t.
Pi	*Pw* converted to real national currency, in region *i*.
Si	Quantity of sheepmeat produced in region *i*, kt carcase weight per annum.
Ci	Quantity of sheepmeat consumed in region *i*, kt carcase weight per annum.
PCi	Per person consumption in region *i*, calculated from *Ci/Ni*.
Xi	Quantity of sheepmeat exported from region *i*, kt carcase weight equivalent basis.
Mi	Quantity of sheepmeat imported by region *i*, kt per annum.
Ni	Population in region *i*, millions at mid-year.
Yi	Income per person in region *i*, real domestic currency. Calculated from (US$*GNP*ERi*)/(*Ni*CPIi*).
ERi	Exchange rate in region *i*; domestic currency/US$.
T	Trend variable (1960 = 1, 1980 = 21).
CPIi	Consumer price index in region *i* (1970 = 100).
CPIW	World all commodity price index (1970 = 100).
DPW	*Pw/CPIW*
DUK	UK supply and demand; the dummy variable reflects the UK's accession to the EEC (1960-73 = 0, 1974-80 = 1).
DI	Iranian supply and demand; the dummy variable incorporates the effect of the revolution (1960-78 = 0, 1979-80 = 1).
DAR	Argentina; the dummy variable represents the military takeover of government (1960-71 = 0, 1972-80 = 1).
DG	Greece; the dummy variable represents the change to civilian government (1960-73 = 0, 1974-80 = 1).
PWL	World wool price; Australian greasy at wholesale, US$/100 kg.
PB	World beef price; average export unit value, US$/t.
WPB	*PB/CPIW*
PBAR	(*PB*ERAR*)/*CPIAR*
PWLAR	(*PWL*ERAR*)/*CPIAR*
RAU	Australian weather index; a seasonal index measuring rainfall and sheep performance factors, as a percentage of the normal.
PBAU	Australian beef price, real Ac/kg, retail.
PBRLYC	Canadian barley price; Feed No. 1, in store, Thunder Bay, real Can$/t.
PBC	Canadian beef price, calculated from *PBUS* converted to real Can$.
PBEC	EEC beef price, calculated from *PBUK* converted to real ECU.
PBJ	Japanese beef price, medium quality, at wholesale, Tokyo, real yen/kg.
PPJ	Japanese pork price, medium quality, at wholesale, Tokyo, real yen/kg.
PWLNZ	New Zealand wool price; average auction price for greasy wool, real NZc/kg.
PBNZ	New Zealand beef price; average mid-month schedule for P.1 Steer, real NZc/kg.
SMD	New Zealand weather index; the relative soil moisture deficit index of the number of days of no grass growth per year.
PRBNZ	New Zealand beef price, real NZc/kg.
PRPUK	UK retail pork price, annual national average, real p/lb.
PRBUK	UK retail beef price, annual national average, real p/lb.
PRCUK	UK retail poultry price, annual national average, uncooked broiler, real p/lb.
PBUK	UK wholesale beef price; Smithfield, top quotation for English longsides, £/t.
PWBUK	*PBUK/CPIUK*
PWLUK	UK wool price; guaranteed price to producer, real p/lb.
PBUS	US beef price; wholesale steer beef carcases, 500-600 lb, Chicago, real US$/100 lb.
WRNY	World annual per person national income, average of market economies, US$, deflated by *CPIW*.

The regions are defined as follows: Argentina = AR, Australia = AU, Canada = C, Eastern Europe = EE, EEC (8) = EC, Greece = G, Iran = I, Japan = J, New Zealand = NZ, United Kingdom = UK, United States = US, USSR = R, Rest-of-World = RW, Total World = W.

DEMAND EQUATIONS

$$PCAR = 7.03 - 0.27\text{E-}05PAR - 0.25\text{E-}03YAR + 0.21\text{E-}03PBAR - 1.85DAR$$
(6.14) (2.03) (0.79) (1.54) (5.17)
$R^2 = 0.92$ $DW = 1.75$ $F_{(4,16)} = 47.24$

$$PCAU = 35.74 - 0.25\text{E-}01PAU + 0.38\text{E-}02YAU + 0.18PBAU - 1.48T$$
(1.85) (2.38) (0.54) (2.44) (2.43)
$R^2 = 0.89$ $DW = 1.78$ $F_{(4,16)} = 32.76$

$$PCC = 2.71 - 0.17\text{E-}02PC + 1.11\text{E-}02YC + 0.25\text{E-}02PBC - 0.13T$$
(0.87) (2.07) (1.63) (2.35) (1.66)
$R^2 = 0.60$ $DW = 2.04$ $F_{(4,16)} = 6.12$

$$PCEC = 0.94 - 0.76\text{E-}04PEC + 0.17\text{E-}04YEC - 0.62\text{E-}04PBEC + 0.40\text{E-}01T$$
(7.08) (0.64) (0.20) (0.50) (7.58)
$R^2 = 0.93$ $DW = 1.13$ $F_{(4,16)} = 57.08$

$$PCG = 12.10 - 0.92\text{E-}04PG + 0.85\text{E-}04YG - 3.90DG + 0.24T$$
(6.60) (0.96) (0.51) (4.45) (0.76)
$R^2 = 0.75$ $DW = 1.09$ $F_{(4,16)} = 12.11$

$$PCI = 7.62 - 0.42\text{E-}04PI + 0.75\text{E-}04YI - 2.61DI.$$
(3.98) (1.17) (8.73) (2.81)
$R^2 = 0.86$ $DW = 1.79$ $F_{(3,17)} = 34.82$

$$PCJ = -0.56 - 0.31\text{E-}05PJ + 0.15\text{E-}02YJ + 0.25\text{E-}02PPJ + 0.24\text{E-}03PBJ$$
(0.68) (2.01) (2.57) (2.98) (0.55)
$R^2 = 0.77$ $DW = 1.30$ $F_{(4,16)} = 13.69$

$$PCNZ = 75.83 - 0.97\text{E-}02PNZ - 0.21\text{E-}01YNZ + 0.15PRBNZ.$$
(4.32) (0.34) (1.97) (0.93)
$R^2 = 0.50$ $DW = 1.20$ $F_{(3,17)} = 5.60$

$$PCUK = 12.09 - 0.43\text{E-}02PUK + 0.10\text{E-}01YUK - 0.74\text{E-}01PRBUK +$$
(2.55) (1.48) (1.23) (1.20)
$$0.44\text{E-}01PRPUK - 0.17PRCUK - 0.50T$$
(0.42) (2.99) (3.47)
$R^2 = 0.97$ $DW = 2.43$ $F_{(6,14)} = 92.77$

$$PCUS = 1.77 - 0.27\text{E-}03PUS + 0.27\text{E-}04YUS + 0.64\text{E-}03PBUS - 0.82\text{E-}01T$$
(5.86) (1.47) (0.49) (3.11) (12.34)
$R^2 = 0.98$ $DW = 1.79$ $F_{(4,16)} = 222.10$

TRADE EQUATIONS

$$MR = 30.51 - 0.87\text{E-}01DPW + 6.34T$$
(0.43) (0.82) (4.66)
$R^2 = 0.62$ $DW = 1.20$ $F_{(2,18)} = 14.70$

$$XEE = -16.00 + 0.17\text{E-}01DPW + 1.20T$$
(1.49) (1.08) (5.77)
$R^2 = 0.79$ $DW = 0.56$ $F_{(2,18)} = 35.54$

$$MRW = 78.87 + 0.588MRW_{-1} + 0.89\text{E-}01DPW - 0.87\text{E-}01WPB + 0.14WRNY + 3.88T$$
(0.73) (2.55) (0.59) (1.47) (1.13) (0.94)
$R^2 = 0.87$ $DW = 2.01$ $F_{(5,14)} = 19.30$

$$XRW = -27.62 + 0.45XRW_{-1} + 0.53\text{E-}01DPW + 2.65T$$
(1.04) (2.15) (1.27) (2.24)
$R^2 = 0.93$ $DW = 1.61$ $F_{(3,16)} = 68.44$

SUPPLY EQUATIONS

$$SAR = 18.55 + 0.85SAR_{-1} - 0.46\text{E-}07PAR_{-2} - 0.46\text{E-}02PBAR_{-2} + 0.40\text{E-}01PWLAR_{-2} - 0.23T$$
(0.40) (4.44) (0.01) (0.65) (0.77) (0.15)
$R^2 = 0.77$ $DW = 1.65$ $F_{(5,13)} = 8.91$

$$SAU = 531.44 + 0.46SAU_{-1} - 0.89\text{E-}01PAU_{-2} + 1.47PBAU_{-2} - 0.98PWL_{-2} - 1.55RAU - 4.69T$$
(0.90) (1.35) (0.19) (0.65) (0.86) (0.97) (0.93)
$R^2 = 0.57$ $DW = 1.49$ $F_{(6,12)} = 2.64$

$$SC = -5.99 + 0.66SC_{-1} - 0.29\text{E-}02PC_{-2} + 0.85\text{E-}02PBC_{-2} + 0.18\text{E-}01PBRLYC$$
(1.67) (6.59) (1.28) (2.81) (1.45)
$R^2 = 0.91$ $DW = 2.22$ $F_{(4,14)} = 36.47$

$$SEC = 74.42 + 0.63SEC_{-1} - 0.13\text{E-}02PEC_{-1} + 2.09T$$
(1.71) (2.69) (1.11) (1.68)
$R^2 = 0.96$ $DW = 1.86$ $F_{(3,15)} = 138.62$

$$SG = 2.86 + 0.77SG_{-1} + 0.67\text{E-}03PG_{-1} + 0.45T$$
(0.31) (6.36) (1.98) (1.52)
$R^2 = 0.95$ $DW = 1.05$ $F_{(3,16)} = 107.68$

$$SI = 15.22 + 0.77SI_{-1} + 4.27T - 57.30DI_{-1}$$
(0.88) (5.23) (2.02) (2.13)
$R^2 = 0.94$ $DW = 1.50$ $F_{(3,16)} = 84.54$

$$SNZ = -20.70 + 1.03SNZ_{-1} + 0.46\text{E-}03PNZ_{-2} - 0.21PBNZ_{-2} + 0.41PWLNZ_{-2} - 0.58SMD$$
(0.81) (2.77) (0.01) (0.22) (0.68) (0.92)
$R^2 = 0.65$ $DW = 1.92$ $F_{(5,13)} = 4.91$

$$SUK = 35.33 + 0.39SUK_{-1} - 0.98\text{E-}01PUK_{-2} + 0.18PWBUK_{-2} + 135.28PWLUK_{-2} + 20.85DUK$$
(0.30) (1.08) (0.34) (0.71) (1.09) (0.83)
$R^2 = 0.26$ $DW = 1.39$ $F_{(5,13)} = 0.94$

$$SUS = 14.12 + 0.97SUS_{-1} - 0.15\text{E-}02PUS_{-2} - 0.15\text{E-}01PBUS_{-2}$$
(0.35) (15.07) (0.08) (0.43)
$R^2 = 0.98$ $DW = 1.46$ $F_{(3,15)} = 215.69$

TABLE 3

Summary of Goodness-of-Fit Statistics for Each Endogenous Variable 1960-80: Dynamic Simulation

Variable	Mean absolute relative error	Theil's U1[a]	Variable	Mean absolute relative error	Theil's U1
	per cent			per cent	
SAR	8.83	0.06	*PCUS*	3.68	0.02
SAU	10.86	0.07	*XAR*	37.32	0.21
SC	9.21	0.05	*XAU*	16.06	0.10
SEC	2.02	0.01	*XNZ*	6.05	0.03
SG	5.20	0.02	*XEE*	35.21	0.15
SI	8.27	0.05	*XRW*	11.56	0.06
SNZ	3.51	0.02	*MC*	20.16	0.12
SUK	4.85	0.03	*MEC*	17.73	0.09
SUS	3.70	0.02	*MG*	23.22	0.12
PCAR	6.01	0.03	*MI*	68.33	0.31
PCAU	8.39	0.05	*MJ*	12.71	0.07
PCC	14.41	0.08	*MR*	43.34	0.23
PCEC	2.77	0.01	*MUK*	6.50	0.04
PCG	4.42	0.02	*MUS*	28.79	0.16
PCI	7.03	0.04	*MRW*	15.14	0.08
PCJ	13.04	0.07	*MW*	6.16	0.04
PCNZ	10.47	0.07	*PW*	6.77	0.03
PCUK	2.15	0.01			

[a] Theil's U1 statistic has a value of zero when the simulated value equals the actual value.