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Australian demand for imports in the 1980s

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A demand function is specified for imports. An attempt is made to model the effect of capacity constraints on the demand for imports, reflecting the insight that at times of high demand in the economy, demand for imports increases independant of prices and income. The model is estimated using quarterly data for the period 1977(3)-1988(2) for total merchandise imports and for three categories of imports: consumer, capital and intermediate goods. The results from the disaggregated equations suggest that aggregate imports are not very sensitive to prices and that there are substantial lags involved: preferred price elasticities estimates are around 0.7 for consumer good imports, 1.4 for capital goods, and zero for intermediate goods, the latter representing around 50 per cent of total Australian merchandise imports. These results imply a price elasticity for aggregate merchandise imports of around 0.7. The high price elasticity of imports of capital goods is surprising in view of the limited range of Australian capital goods industries producing substitutes. This result is consistent with earlier research and can possibly be explained by an income or 'scale' effect; that is, because capital good imports make up such a large proportion of total investment in plant and equipment in Australia, a depreciation may result in a decline in total investment which significantly reduces the demand for imported capital goods. Imports are found to be fairly income elastic, with capacity constraints having a significant positive effect on demand for all categories of imports. Some policy implications of these results are discussed.

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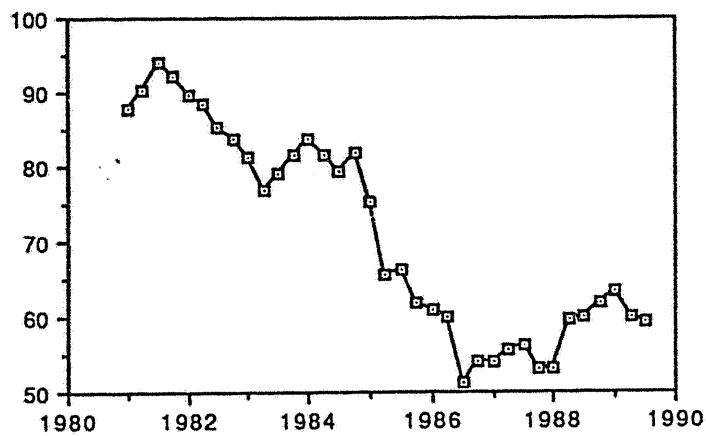
Background

After the recession of the early 1980s, the economy began to record strong growth from 1983 onwards. This was in part due to the ending of the drought which had afflicted the agricultural sector, but seems mainly attributable to the mild fiscal stimulus provided by the outgoing Fraser government in 1982-83, and continued by the Hawke government until 1985. Employment growth was strong, and inflation was falling.

But this picture was to change markedly after 1985. In February 1985 the Trade weighted exchange rate index (TWI) depreciated by around 20 per cent. The currency weakened throughout 1985, with a further sharp depreciation of around 15 per cent occurring in mid-1986 (see Figure 1.1). These events focussed attention on the weakness of Australia's external position - in particular, the historically high current account deficit, and high levels of external debt (Figure 1.2). The resolution of these problems has been the overiding consideration in the formulation of economic policy until the present.

Figure 1.1: *Movements in the Trade Weighted Index of the Australian Exchange Rate (1970:2 = 100)*

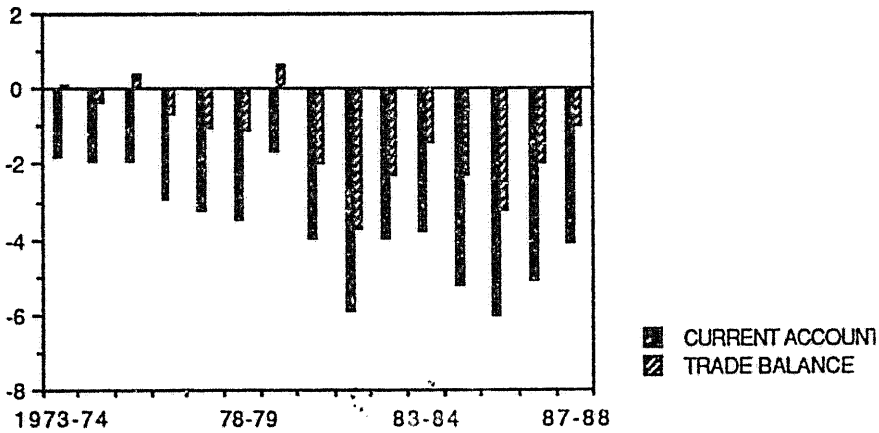


(*Source*: ABS 1989e)

It is evident from the Statements accompanying the 1985-86 Commonwealth Budget (Treasury 1985) that the government was optimistic about the ability of the depreciation to solve the current account problem that had emerged in that year. The important thing noted was to make sure the price increases arising from the depreciation did not flow on to costs. If this was done it was asserted that 'the depreciation could still be having a favourable impact on activity

beyond 1985-86' (Treasury 1985, p. 62). Imports were predicted to decline 'notwithstanding the continued growth in domestic demand that is forecast, including the import intensive plant and equipment investment' (Treasury 1985, p. 73). Fiscal, wages and monetary policy had been tightened slightly throughout 1985, though it is clear that it was thought that the bulk of adjustment would occur as a result of the depreciation.

Figure 1.2: *The Performance of the Current Account and Trade Balances of Australia 1973-1988 (as a percentage of GDP)*



(*Source* : Treasury 1988, p. 24)

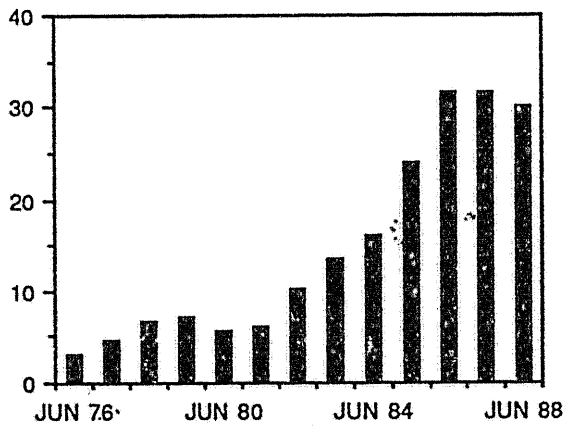
The terms of trade deteriorated more than was expected by policy makers during the course of the 1985-86 financial year (Treasury 1986). The government implemented increasingly restrictive monetary and fiscal policies throughout 1986 in an effort to produce the desired fall in imports. Real wages fell, as they were discounted for the inflationary effects of the depreciation, and this further reduced demand for imports. No doubt these restrictive policies were a response to the escalating seriousness of the current account problems. However, the efficacy of the depreciation in inducing the necessary adjustment was the subject of increasing debate.

Much of the policy debate has concerned the existence and strength of the 'J-curve' effect - that is, that the trade balance will worsen in the short run, as the depreciation changes only the prices of imports and exports, with the volume response coming later. The Australian experience gives some support to this contention. The trade balance worsened in 1985 due to both an increase in the value of imports and a decrease in the value of exports. This, in combination with the greater Australian dollar loan repayments resulting from the depreciation,

caused the increase in the current account deficit in 1984-85 and 1985-86 (see Figure 1.2). However, export volumes, especially from the manufacturing and service sectors, increased in 1986 (OECD 1988).

The existence of a J-curve on the import side of the trade balance is less certain. This is because the reduction in import volumes that occurred from 1985 to 1987 (see Figure 1.4) is a not only a result of the depreciation - the contraction in demand in that year (national income registered negative growth in 1986) would have contributed to this result. What is clear is that the reduction in import volumes was less than expected by the government and most commentators (OECD 1988, p. 36; Treasury 1988, pp. 38-42).

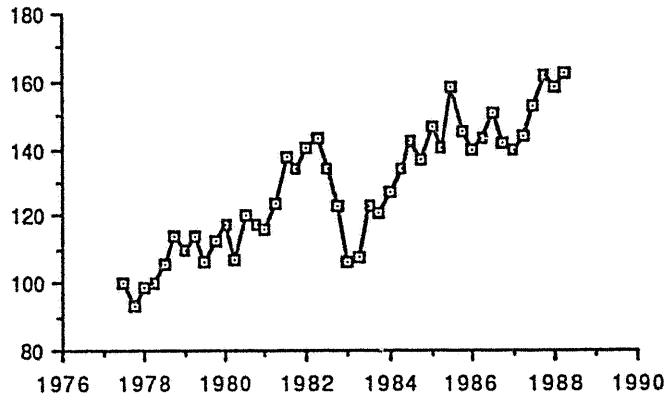
Figure 1.3: *External Debt as a Percentage of GDP*



(*Source*: Treasury 1988, p. 24)

While the trade balance, and, as a consequence, the current account, improved in late 1986, this was due mainly to commodity prices stabilising. The large improvement in the trade balance and current account in 1987-88 was largely due to increases in world commodity prices, although volumes of non-rural exports have continued to increase modestly as well. But the weakness of Australia's current external position lies in the strong growth in import volumes that has occurred since mid-1987 (see Figure 1.4), amounting to a 9.9 per cent increase for 1987-88 and a 25.5 per cent increase in 1988-89. This has coincided with a strongly growing economy, and an appreciating Australian dollar (the TWI increased 20 per cent between September 1986 and March 1989 before declining 6 per cent by September 1989).

Figure 1.4: *Index of the Volume of Imports (1977:3 = 100)*



(*Source*: ABS 1989a, 1989b)

It is clear from the above discussion that an accurate idea of the determinants of the demand for imports is important for the conduct of macroeconomic policy at present. A number of studies on import demand in Australia have been carried out. Some earlier studies, such as Norton et al. (1970) and Caton and Higgins (1974), found no evidence of a non zero price elasticity for imports. Many later studies concluded that imports had a price elasticity of around negative one. These studies include those by Gregory and Martin (1976), Lipp and Bailey (1982), and research towards the Treasury NIF model such as Johnston (1979). The optimism expressed at the time of the depreciation may have been based, in part, on results such as these.

Brain and Manning (1987, pp. 19-20) suggest two reasons why imports may be less responsive to prices than these studies would suggest. First, 'an increasing proportion of imports (including semi-finished components) is complementary, rather than competitive with, Australian production.' Second, some of the industry plans that have been introduced in certain import-competing industries have increased the role of quotas as a protective instrument, and thus reduced the price responsiveness of the imports concerned. Also, the Treasury (1988, pp. 38-42) notes that there has been 'a shift in the composition of demand towards goods and services with a high import content', with emphasis being placed on the fast growth in computer-related equipment. This would have the effect of making imports less price elastic (Brain and Manning 1987, p. 29).

To judge whether these ideas are correct there is a need to derive some elasticity estimates using recent data. That is the first aim of this paper. A second aim of this paper is to provide

some estimates of price and income elasticities for three categories of imports - consumer, capital and intermediate goods - as these categories could be expected to behave quite differently. The paper concludes with some remarks about the implications of these findings for interpreting recent Australian economic experience and the formulation of policies to deal with the current problems.

A Model of the Demand for Imports

The model used in this paper to estimate import demand is as follows:

(1) $$M_{di} = f(P_{mi}/P_{di}, A_i, C_i)$$

where:

M_i = quantity of imports in category *i* ;

P_{mi} = the price of imports in category *i* ;

P_{di} = price of domestically produced goods and services that are substitutes for imports in category *i* ;

A_i = the activity variable relevant for goods and services of category *i* ;

C_i = the variable capturing the effect of the economic cycles, for category *i* ; and

An equation of this form will be estimated for total mechandise imports as has been the case in many previous studies (Norton et al. 1970, Johnston 1979). However, previous studies have also shown that various categories of imports behave quite differently. In this study equation (1) will be estimated for three categories of imports: consumer, capital and intermediate goods. Out of all the potential categorisations for which data is available, this one groups goods that are related in a behavioural sense.

Imports here are modelled as imperfect substitutes for domestic tradable goods. It is assumed that the supply of imports is infinitely elastic. The allocation choices of an economy are modelled as a multi-stage process (Goldstein and Kahn 1984, p. 19). In the case where demand for consumer good imports is being modelled this is a two stage process. In the first stage consumers allocate expenditure between tradables (that is, imports and their domestic substitutes) and nontradables. Demand for consumer good imports is determined in the second stage of this process as a function of the relative prices of imports and domestic tradables and final consumption expenditure. Thus, demand for imports is assumed to be independent of the price of non-tradables. This assumption is supported by research on import demand in other industrial countries (Goldstein and Kahn 1984, p. 1063). Where imports are inputs into the

production process (ie, intermediate or capital goods), these are a function of their own price relative to the price of their domestic substitutes and a relevant activity variable. Here an assumption is being made that the inputs are combined with other inputs into production in fixed proportions (Goldstein et al. 1980, note 9). Thus the prices of other factors of production do not enter as arguments in this equation. In the case where intermediate goods are being modelled the activity variable is total output. In the capital goods equation the activity variable becomes total investment expenditure. The price and activity measures used in this study are described in detail in Appendix 1.

A variable measuring the state of the economic cycle appears in most studies of import demand. In the words of Leamer and Stern (1970, p. 14), this 'represents an ammendment to the traditional theory of demand insofar as it gives cognizance to the idea that queues as well as prices may be used to allocate goods among consumers'. Gregory (1971, p. 31), in a paper in which he estimates an import demand equation for the United States, incorporates this idea into neoclassical demand theory using a concept of 'effective price'. This amounts to defining price in the traditional model as a 'vector possessing many dimensions'. Other elements in the vector may include such things as quoted waiting time and trade credit terms. Gregory (1971) hypothesises that firms are reluctant to increase prices in the face of an increase in demand pressure. Instead they will first alter stocks, then elements of the effective price vector, production levels, and finally actual price. This order of responses is the result of firms attempts to minimise costs in an environment of monopolistic competition. The decision whether to buy from local or foreign producers will be based on considerations of relative *effective prices*. Thus Alaouze (1977, p. 4), following Gregory (1971), says 'when the level of demand approaches and exceeds the productive capacity of the economy, import demand increases independantly of prices'. Conversly, at times of low demand, firms will decrease the effective price of their goods, and this will cause imports to decrease independent of price changes.

Gregory and Marsden (1979, p 35) suggest that different categories of imports will react differently to movements in the business cycle. Gregory (1971) mentions a number of 'disequilibrium' responses to increases and decreases in demand pressure. This means that the variable measuring cyclical fluctuations is probably recording a number of effects resulting from changes in demand. For goods for which there is domestic competition it will measure effective price. For inputs into the production process the same variable will measure the derived demand resulting from the disequilibrium stocking and production responses of domestic firms. Increases in demand for imported capital goods in these times could be a result of firms wishing to expand capacity, rather than the 'effective price' effect.

In the earlier Australian studies, including Norton et al. (1970), Gregory and Martin (1976), Kumar and Ironmonger (1970) and Talbot (1971), a variable based on a ratio of the number of job vacancies to the 'number of people unemployed', or some variant of this, was included in models of import demand. Later studies, all emanating from research into the Treasury NIF model, use a different variable as a proxy for representing the business cycle. Presumably the experience of the 1970s caused any variable to do with unemployment rates to fall into disfavour. Instead Johnston (1979), Lipp and Bailey (1982), and Simes (1988) use a variable with the self-explanatory nomenclature of 'detrended stocks to sales ratio'. When this ratio is low the business cycle is at a 'high', and import demand is higher (all other things being equal). The variable 'overtime hours per head' has been introduced into the latest Treasury model, that is NIF88, as 'a proxy for the extent to which domestic (demand) may be met by readily adjusting domestic production' (Simes 1988, p. 29). This latter variable has been used in the present paper.

The correct specification of lags is of obvious importance given their prominence in the J-curve debate. For each category of imports for which equation (1) is estimated, a number of alternative lag structures will be compared. The inclusion of a lagged dependent variable is commonly included in import demand specifications. This model embodies the Koyck stock adjustment model, that is the hypothesis that a change in independant variables will imply a new long-run equilibrium value for the dependent variable, but that adjustment to this value will occur gradually. It is important to note what the implications of this model are. First, the adjustment lag on each variable is constrained to be equal. Secondly, the adjustment is hypothesised to proceed as a geometric decay through time. These are probably not reasonable restrictions to make.

Combining the lagged dependent variable with lagged independent variables gets around the first restriction. This occurs because the coefficients on the independant variables are able to take on different values, allowing for the possibility of average lag lengths being different for each variable. This is an improvement as there are no *a priori* grounds for believing the lags of each variable will be the same.

An Almon type lag is more flexible than either of these alternatives. Specific distributed polynomial lag structures can be introduced on each variable. For instance, it allows one to model an adjustment to a price change that consists of a slow build up and then decline. For imports, with long lags in order and delivery, this may be a more accurate model of the lag response than the declining geometric lag response implicit in the Koyck adjustment model. A prominant problem is that to apply the procedure it must be assumed that both the lag length and the order of the polynomial of the lag are known. In practice, this is usually derived after a

degree of pretesting, resulting in the generation of estimators with an unknown distribution (Judge et al. 1982, p. 743).

When investigating alternative lag structures a degree of experimentation is inevitable because there is no firm theoretical basis on which to make a hypothesis which can be tested. If this experimentation occurs then it is important to be aware of the full range of elasticity estimates derived in this process so that any conclusions made on the magnitude of these elasticities are not dependent on essentially arbitrary changes in specification. In this study the lagged dependent variable will be included and this will be compared to distributed polynomials of various lengths and orders.

Econometric Results

In this section some of the equations estimated are presented. Equations for each category of imports will be discussed separately. These results will then be compared to those of other studies, with some general conclusions being drawn. For each equation quarterly data is used. The period over which each equation is estimated is 1977(3) to 1988(2). The data sources and methods of construction are outlined in Appendix 1. The variable names are outlined in Appendix 2.

Total Merchandise Imports

Selected results for equations describing the demand for total merchandise imports are presented in Table 7.1. The price elasticities are close to unity. The income elasticities are 0.96 in equation I, and 0.90 in equation II. The variable measuring the 'effective price' (ie, hours overtime) is significant in all equations. Equation II is the preferred equation for predictive purposes. The homogeneity restriction was tested for equation II and was accepted at the five per cent significance level.

Other equations were estimated in the course of pre-testing and the results of these are described here briefly. Almost all the experimentation carried out concerned a search for 'sensible' lag structures. If the activity variable (Y) was given a polynomial lag structure, the magnitude of the lag coefficients invariably increased over time, which does not make sense. Second order polynomial lags were experimented with. In each of these equations the lag structure was not satisfactory - that is, the coefficients switched signs, or, in the case of relative prices, the lag structure was concave downwards. The price elasticities ranged between -.9 and -1.2, except for two equations where there was an order two, eight quarter polynomial lag on

Table 7.1: *Coefficients from equations for Total Merchandise Imports*[a]

Variables	Equations I	Equations II
Log TM_{t-1}		.38
		(3.5)
$\sum b_i$ Log $RELP_{T,t-i}$	-1.02	-.59
		(-3.27)
b_0	-.25	
	(-4.10)	
b_1	-.21	
	(-4.33)	
b_2	-.18	
	(-4.51)	
b_3	-.15	
	(-4.37)	
b_4	-.11	
	(-3.52)	
b_5	-.08	
	(-2.19)	
b_6	-.05	
	(-1.02)	
b_7	-.01	
	(-.21)	
b_8	.02	
	(.34)	
Order	1	
Log Y	.96	.56
	(8.12)	(3.48)
ROT	.55	.40
	(5.05)	(4.26)
Constant	-6.80	-3.92
	(-5.76)	(-2.82)
R^2 adjusted	.90	.91
Durbins[b]	1.10	-.31

a. The dependent variable is the log of the volume of total merchandise imports, *t* statistics are in brackets. Variable names are contained in appendix 4. All variables except hours overtime (ROT) are logged. In all the equations three seasonal dummies were included to account for seasonality. The coefficients and *t* statistics for these variables are not presented in the table, though in all cases there was significant seasonality. The variable names are contained in the appendix in the end of this chapter.

b. When a lagged dependent variable is included in the equation this is Durbins h statistic, otherwise the figure quoted is the Durbin Watson statistic.

the price variable. Here the price elasticity estimates were -1.44 and -1.88. These equations also yielded low income elasticities (.88 and .83), indicating that the presence of collinearity in the data used for the price and activity variables was the possible source of these aberrant estimates. In all other equations the income elasticity was very close to unity. The hours overtime variable was significant in all equations.

Consumer Good Imports

The results from these equations were highly unstable, as can be seen in the sample of results presented in Table 7.2. The coefficient on the price variable was insignificant in equations which included a short response lag (for example, with polynomial lag structure (first or second order) of under three quarters, or a geometric lag - which, in effect, imposes a short lag - such as that in equation I in Table 7.2). However, when the lags were lengthened there was evidence of a significant price response, though in most cases the total price elasticity was less than one (see equations II and III in Table 7.2). When a polynomial lag was specified on the activity variable (PFC) the lag coefficients switched signs, as it did even when the minimum lag of one quarter is specified, as in equation III. Because of the highly unstable nature of the results no equation would be preferred for the purposes of prediction; however, it is felt that the estimates derived from equation II are the most useful as indicative guides to the magnitudes of the price and income elasticities.

The results of other equations estimated are described here briefly. Any second order polynomial lags on the price variable yielded lag structures that were concave downwards. The total price elasticity estimates ranged from zero (ie, insignificant) to -1 24. The activity elasticity estimates ranged from .9 to 1.91. The high income elasticity estimates occurred only in equations where the price elasticity was low, and vica versa. This means collinearity is probably present. The effective price proxy is not always significant.

Capital Good Imports

A sample of the estimates of equations for the demand for capital good imports are presented in Table 7.3. As in the case of consumer good imports, the coefficient on the price variable was insignificant when a short lag was specified. However, when a longer lag was specified (as in the equations in Table 7.3), the coefficient was significant and greater than one. The results concerning the cyclical effect are ambiguous - it is significant in equations I but insignificant in equation II at the 5 per cent significance level. For predictive purposes equation I in Table 7.3 is preferred.

Table 7.2: *Coefficients in the Equations for Consumer Goods*[a]

Variables	Equations I	II	III
Log M_{t-1}	.49		
	(3.27)		
$\sum b_i$ Log $RELP_{C,t-i}$	-.18	-.79	-.44
	(-1.39)		
b_0		.03	.06
		(.72)	(.86)
b_1		.002	.02
		(.07)	(.42)
b_2		-.03	-.02
		(-1.09)	(-.71)
b_3		-.06	-.06
		(-2.76)	(-2.45)
b_4		-.09	-.10
		(-3.71)	(-2.53)
b_5		-.12	-.15
		(-3.72)	(-2.30
b_6		-.15	-.19
		(-3.51)	(-2.15)
b_7		-.18	
		(-3.32)	
b_8		-.21	
		(-3.17)	
Order		1	1
$\sum \partial_i$ Log PFC_{t-i}	.90	1.2	1.53
	(2.8)	(5.39)	
∂_0			2.79
			(1.98)
∂_1			-1.26
			(-.92)
ROT	.14	.52	.35
	(1.35)	(3.72)	(2.59)
Constant	-8.11	-10.25	-13.45
	(-2.75)	(-4.72)	(-6.84)
R^2 adjusted	.91	.91	.89
Durbin[b]	.87	1.08	1.13

a. The dependent variable is the log of the volume of total merchandise imports, *t* statistics are in brackets. Variable names are contained in appendix 4. All variables except hours overtime(ROT) are logged. In all the equations three seasonal dummies were included to account for seasonality The coefficients and *t* statistics for these variables are not presented in the table, though in all cases there was significant seasonality. The variable names are contained in the appendix in the end of this chapter.

b. When a lagged dependent variable is included in the equation this is Durbins h statistic, otherwise the figure quoted is the Durbin Watson statistic.

The results of other equations estimated in the course of experimentation are described briefly as follows. In all the equations with longer lag structures, the coefficient on the price variable was significant and greater than one. These range from -1.2 to -1.95, with the higher results appearing in the same equations as the lower activity elasticity estimates (as in equation I). These range from .9 to 1.23. Second order lags performed badly (for example, see equation II in Table 7.3), as well as some of the first order lags, with problems similar to those discussed in the cases of the other import groupings. It is worth noting that the equations with 'sensible' lag structures are the ones that also yield the higher price elasticity estimates (-1.63, in equation I, to -1.95). The coefficient of the ROT variable, while insignificant in the equations incorporating a shorter lag (including a geometric lag), was sometimes significant in these equations where a longer lag was specified (as in equations I and II in Table 7.3).

Compared with the equations for the other classes of imports, the capital goods equations incorporating polynomial lags exhibited less autocorrelation, possibly meaning that the specification was better. However, the adjusted R squared was, in general, lower than those of equations in other categories of imports.

Intermediate Good Imports

A sample of the estimates of equations for the demand for intermediate good imports are presented in Table 7.4. In equation I the coefficient on the price variable was insignificant. The implied income elasticity in equation I is .44. There is evidence of a response to economic cycles, independent of income, in each of the equations. As mentioned in the previous section the positive response of intermediate imports to changes in the pressure of demand may not be due to a rise in the effective price. Rather, it may be due to inventory dynamics.

When longer lags were specified in equation II there was some evidence of a price response, but the estimated total price elasticity is positive and small. This may be a result of the same fickleness that seems inherent in polynomial lags, as has been evident in the demand equations for other categories of imports. However there is a reasonable explanation for this. Most goods in this category are not competitive with domestic production in Australia. In fact, these goods are *complementary* with Australian production. Thus, to the extent that a depreciation is expansionary (and this depends on the increase in net exports that occurs), it will cause an increase in demand for intermediate imports. Hamilton (1988, pp. 2-4) has suggested that a depreciation has mildly expansionary effects up to ten quarters after it occurs. In view of the uncertainty surrounding this result, equation I is preferred for the purposes of prediction.

Table 7.3: *The Coefficients in the Capital Goods Equations*[a]

Variables	Equations I	Equations II
$\sum b_i$ Log $RELP_{K,t-i}$	-1.64	-1.37
b_0	-.19	-.26
	(-1.66)	(-1.03)
b_1	-.19	-.17
	(-1.92)	(-1.43)
b_2	-.19	-.10
	(-2.23)	(-1.35)
b_3	-.18	-.07
	(-2.55)	(-.63)
b_4	-.18	-.06
	(-2.77)	(-.48)
b_5	-.18	-.08
	(-2.73)	(-.75)
b_6	-.18	-.13
	-2.45)	(-1.85)
b_7	-.17	-.20
	(-2.08)	(-1.76)
b_8	-.17	-.30
	(-1.74)	(-1.2)
$\sum \partial_i$ Log IPE_{t-i}	1.0	1.23
∂_0	.31	.85
	(2.27)	(2.58)
∂_1	.26	.40
	(2.57)	(.99)
∂_2	.20	-.02
	(3.20)	(-.06)
∂_3	.15	
	(4.91)	
∂_4	.09	
	(3.19)	
∂_5	.03	
	(.54)	
∂_6	-.02	
	(-.24)	
Order	1	2
ROT	.86	.49
	(2.45)	(1.73)
Constant	-6.69	-8.03
	(-4.83)	(-6.15)
R^2 adjusted	.81	.84
Durbins[b]	1.53	1.79

Footnotes as for Tables 7.1 and 7.2

Discussion of Results

A major inconsistency in the findings is that the aggregate price and activity elasticities derived from the disaggregated import elasticities are different from those yielded by the aggregate equations. Using the method outlined in Magee (1975, pp. 235-39), and the elasticity estimates from the 'preferred equations' of each import category, the aggregate price and activity elasticity estimates derived from the disaggregated results are -.71 and .81 respectively. This is to be compared with the price and activity elasticity estimates from the preferred total imports equation of -.95 and .90 respectively. It is important to note that price elasticities are likely to be biased towards unity when an inaccurate import price measure is used to deflate the import value series to produce import volumes, and to calculate the relative price variable (Goldstein and Kahn 1984, p. 1055). The extent of this bias is unknown, but it is likely to be present.

Looking at the disaggregated results more closely, no evidence was found that indicates that consumer goods imports have a high price elasticitiy. One other study (Lipp and Bailey 1982) has found consumer goods to be responsive to price changes. However, Brain and Manning (1987) suggest that industry policies in a number of industries have had the effect of reducing the price elasticity of imports of a significant proportion of consumer goods.

The finding that capital goods imports exhibit the most elastic price response is also consistent with an earlier estimate (Lipp and Bailey 1982). These authors were surprised by this result, and tended to play down its significance by explaining its occurrence in terms of collinearity in the data set. The fact that a similar magnitude has been obtained over a different period of estimation increases the confidence that can be placed in this unexpected result. One possible explanation for this is as follows. When the price of an input changes this has two analytically separate effects on the demand for that input - a substitution effect, as consumers switch consumption to the cheaper product, and an expansion effect, as producers do not buy the same amount of all inputs because the price change has altered the total costs of that producer. In the case of Australian imports of capital goods one would expect the substitution effect to be weak. This is because of the small size of the Australian capital goods industry and the fact that firms are reluctant to switch suppliers due to highly heterogenous nature of capital goods - non-price factors are important determinants of the demand of specific firms. This has been found to be the case in Australia in a survey conducted by the Bureau of Industry Economics (Riethmuller et al. 1986). However, because imported capital goods make up such a large proportion of total investment in plant and equipment (around 40 per cent), it is likely that increases in the prices of foreign capital goods will have a significant (negative) expansion

Table 7.4: *The coefficients of the Intermediate Goods equations*[a]

Variables	Equations I	Equations II
Log IM_{t-1}	.34	
	(2.91)	
Σbi Log $RELP_{I,t-i}$	-.29	.29
	(-1.56)	
b_0		-.13
		(-1.87)
b_1		-.09
		(-1.61)
b_2		-.05
		(-1.13)
b_3		-.01
		(-.24)
b_4		.03
		(1.07)
b_5		.07
		(2.04)
b_6		.11
		(2.45)
b_7		.15
		(2.58)
b_8		.19
		(2.63)
Log Y_I	.29	.78
	(2.06)	(5.38)
ROT	.50	.52
	(4.61)	(4.72)
Constant	-1.39	-5.52
	(-1.09)	(-3.72)
R^2 adjusted	.87	.84
Durbins[b]	-.15	1.35

a. The dependent variable is the log of the volume of total merchandise imports, *t* statistics are in brackets. Variable names are contained in appendix 4. All variables except hours overtime(ROT) are logged. In all the equations three seasonal dummies were included to account for seasonality. The coefficients and *t* statistics for these variables are not presented in the table, though in all cases there was significant seasonality. The variable names are contained in the appendix in the end of this chapter.

b. When a lagged dependent variable is included in the equation this is Durbins h statistic, otherwise the figure quoted is the Durbin Watson statistic.

effect, resulting in a fall in the purchase of all capital goods. The high price elasticity may reflect this effect.

The finding that imports that are inputs to production are not price elastic is consistent with those presented in earlier studies (Gregory and Marsden 1979; Gregory and Martin 1976; Lipp and Bailey 1982).

The activity elasticities estimated in this study are generally lower than those in past studies - the income elasticity of total imports is estimated as less than unity in both the preferred total imports equation and when the component activity elasticities for the three categories of imports are aggregated. This is unexpected given Australia's experience of a rising import penetration ratio in recent years. The collinearity between the activity and price measures noted above for some equations may contribute to the explanation of this unusual result. This could mean that the price elasticities are overstated and that the income elasticities understated.

A finding consistent with earlier studies is that imports respond strongly to cyclical factors.

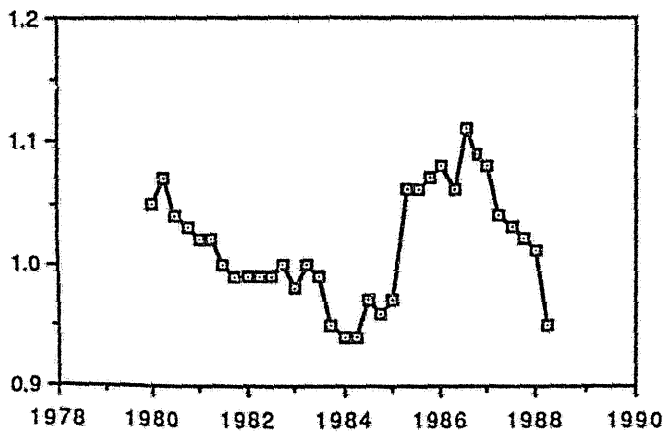
The estimates of the income and price elasticities presented in this paper are tentative as they are not based on a fully rigorous model. Among other things, this would include a system of equations enabling the demand for imports to be estimated simultaneously with the supply of importables produced domestically. A demand model incorporating the effective price concept in a rigorous manner, such as that estimated by Gregory (1971) for the United States economy, would be preferable; however statistics are not available in Australia to allow this type of model to be estimated.

Conclusions

Recent Australian Experience

It would seem that the major determinant of import behaviour in recent years has been the level of activity in the economy (Gittins 1988b). Rising income increases the demand for imports as they are, in general, normal goods. However, the main effect of income fluctuations on the demand for imports is due to the 'disequilibrium' responses of firms to short term changes in demand. If firms are reluctant to change prices, then changes in the level of demand in the economy will be met, possibly for quite some time, by changes in elements of the 'effective price', stocking levels and production. These effects feed through to the demand for imports independent of changes in relative prices and, to some extent, income. Thus, much of the decline in imports in 1985-86, and their subsequent strong recovery in 1987-88 and 1988-89, results from these factors. It is worth noting that the relative prices of imported goods to domestic substitutes have returned to the levels that existed prior to the depreciations of the mid-1980s (see Figure 8.1). While the price response of imports is probably weak, nevertheless, this decline in relative prices has contributed to the rising import volumes in 1987-88 and 1988-89 (see Figure 1.4).

Figure 8.1: *Movements in the Relative Prices of Total Merchandise Imports and Their Domestic Substitutes (1981:3=100)*

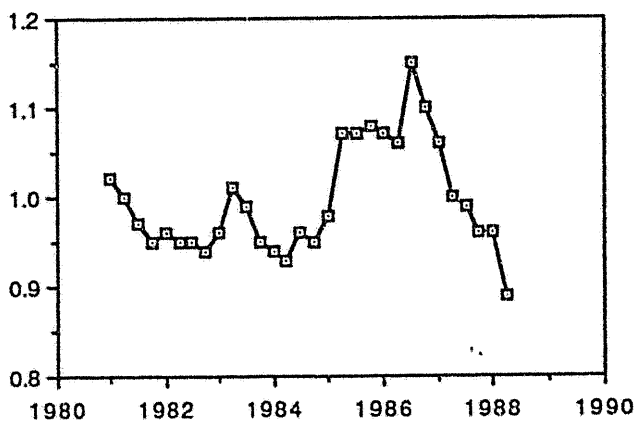


(*Source*: ABS 1989a; 1989b)

The depreciation did not affect imports as much as was expected for the following reasons. First, on the basis of the empirical work presented in this study, the price elasticity of demand for imports is probably lower than was previously thought. Second, the full price effects of the depreciation were not passed through due to imperfect competition in the tradables sector. There is survey evidence that some importers did not pass through the full price rise attributable to the exchange rate movements so as to maintain their market share (Riethmuller et al. 1986). Also, the fact that many inputs into production are only available from overseas sources means that much of the depreciation will result in increased costs, and, as a result, increased domestic prices. Third, the increase in imports of computer equipment may account for some of the higher import volumes - though it can be seen from the graph in Treasury (1988, p. 40) that the big increase in imports in this category occurred just *prior* to the depreciation in 1985. Still, the rise in computer related imports since then would have slightly attenuated the fall in imports resulting from the depreciations of 1985 and 1986, and accounted for a small part of the rise in the 1987-88. In sum, while there is evidence of a delayed response of imports to a change in prices, it appears that the J-curve effect is weaker than was thought at the time of the depreciations.

An interesting implication of the findings presented earlier is that the large increase in the price of imported capital goods was possibly a significant contributing factor to the weak investment performance of the Australian economy in recent years, and that the recent fall in the prices of imported capital goods relative to domestically produced capital goods (see Figure 8.1) has encouraged the investment recovery since 1987.

Figure 8.2: *Movements in the Relative Prices of Imported and Domestic Capital Goods 1981-88 (1981:1=1.0)*



(*Source*: ABS 1989a; 1989b)

Policy Implications

Reducing demand for imports has been a major secondary objective of Australian macroeconomic policy since 1986 (this being effected to achieve the objective of external balance). Whether this should be a policy objective is the subject of some controversy (Aspromorgous 1989, Pitchford 1989). However, if it is accepted that the high current account deficit of recent years is in some sense unsustainable, then the empirical results presented in this paper give some support to macroeconomic policies aimed at containing domestic demand. On the import side of the trade balance at least, this policy is likely to be more effective in reducing demand for imports in times of high capacity utilisation than policies that are aimed at altering relative prices (eg, exchange rate or tariff policy).

One of the main restrictive instruments the government has relied upon has been a tight monetary policy. This is one of the reasons the exchange rate has appreciated in recent years. This appreciation will produce a response in import volumes, though, as outlined above, this may not be all that significant in a time of booming demand. However, other components of Australia's trade, such as tradable services and exports, have responded significantly to the increase in competitiveness resulting from the depreciation (Treasury 1988, p. 42). This is especially true of services associated with tourism, and the export of non-metal manufactures. This strong response appears to have been curtailed by the appreciation that occurred between mid-1986 and early 1989. The deterioration in the trade balance resulting from these factors has to be weighed against the improvement that results from the drop in domestic demand induced by restrictive monetary policy.

Appendix 1: Sources and Construction of Data

Import Volumes

Import volumes are obtained by deflating import value data by import prices. The derivation of the price series is outlined below. Import value data are constructed for a number of different import classifications in ABS (1989a). Two of these, the Australian Import Commodity Classification (AICC) and the Australian Standard Industrial Classification (ASIC), group imports mainly according to the materials that make up the product. As such they are of less use in demand studies. In this study imports are disaggregated according to Broad Economic Categories (BECs). This classification allows imports to be grouped according to their enduse - that is, whether they are capital, intermediate, or consumer goods.

These categories were constructed from the BEC as follows. The numbers in parentheses are the internationally accepted BEC number (see United Nations, 1986).

Capital Goods

Capital Goods (except transport equipment)	(41)
Transport equipment, industrial	(521)

Consumer Goods

Food and beverages, primary, mainly for household consumption	(112)
Food and beverages, processed, mainly for household consumption	(122)
Fuels and lubricants, processed, motor spirit (50 per cent)	(321)
Passenger motor cars	(51)
Transport equipment, non-industrial	(522)
Consumer goods, durable	(61)
Consumer goods, semi-durable	(62)
Consumer goods, non-durable	(63)

Intermediate Goods

Food and beverages, primary, mainly for industry	(111)
Food and beverages, processed, mainly for industry	(121)
Industrial supplies, primary	(21)
Industrial supplies, processed	(22)
Fuels and lubricants, primary,	(31)

Fuels and lubricants, processed, motor spirit (50 per cent)	(321)
Fuels and lubricants, processed, other	(322)
Capital goods, parts and accessories	(42)
Transport equipment, parts and accessories	(53)

For the purposes of comparison with the results of Lipp and Bailey (1982), which is important as it is the only previous study with which the results of this study can be compared, there are slight differences in the composition of these categories. Lipp and Bailey (1982) include categories 522 and 53 in their end use category 'investment goods' which otherwise is identical with the end use category 'capital goods' used in this study. They exclude the BEC 3 from their end use category 'other goods', as well as including BECs 111 and 121 in their 'consumer goods' category. Otherwise their category 'other goods' is equivalent to the category 'intermediate goods' used in this study.

While this classification is more satisfactory than the alternatives for the purposes of this project, it still has some important limitations. Some BECs include goods that could be classified in more than one of the end use categories specified above. The United Nations (1986) recommends that when making up end use categories, the BEC 'passenger vehicles' (51) should be allocated partly to 'consumer goods' and partly to 'capital goods', while the BEC 'motor spirit' should be allocated partly to 'intermediate goods' and partly to 'consumer goods'. As can be seen in the above classification, the BEC 'motor spirit' has been split, with half going to 'intermediate goods' and half to 'consumer goods', while the whole of the BEC 'passenger motor cars' was allocated to the end use categories 'consumer goods'. This arbitrary split was originally done to harmonise these end use categories with those for which the ABS has constructed price indexes (ABS 1988c), though, as it turned out, this publication was not used in this study. In the case of the BEC 'passenger motor cars' this less satisfactory classification is a significant drawback, as this BEC would be equivalent to around 10-15 per cent of the total value of the 'consumer goods' or 'capital goods' end use categories. The level of imports of motor spirit is insignificant in the case of Australia.

There are also problems with the makeup of the BECs. The case of personal computer technology illustrates these limitations. Imports of monitors and central processing units are classed as 'capital goods (except transport equipment)' (51), whereas keyboards and printers are recorded as 'parts and accessories' (52) which is included in the end use category 'intermediate goods'. Also, some computers are used as consumer goods. However, little can be done about these inaccuracies except to note them.

Unfortunately, BEC data are only available from ABS publications for the period from 1977(3) - 1988(2). Earlier data were compiled by the ABS but have since been misplaced. The other classifications have been collected for a longer period, but it was judged better to use the BEC data because it is more appropriate for research into the determinants of demand.

The BEC data used were on a recorded trade basis, whereas balance of payments basis data have been generally used in past studies. There are minor differences between the two in such matters as the timing of the transactions (see Lipp and Bailey 1982, p. 33 for details). The reason that data on a balance of payments basis have been used is that the aggregate 'endogenous imports' is only compiled on this basis (Lipp and Bailey (1982) and Talbot (1971) used internal ABS sources to derive disaggregated endogenous imports data). The ABS publishes endogenous imports data broken down into three end use categories similar to those used in this study. However, these are only available after 1979, meaning the degrees of freedom in estimation would be restricted prohibitively if this data were used.

A category roughly similar to 'endogenous goods can be constructed from the recorded trade basis data by leaving out the BEC 'goods not elsewhere specified' (7) from 'total merchandise imports'. This BEC contains mainly defence equipment and thus it includes a significant proportion of 'exogenous imports'. An additional advantage of using recorded trade basis data is that petroleum imports can be included (they are excluded from the data compiled on a balance of payments basis).

Import Prices

Implicit price deflators were derived from the current and constant price import data contained in ABS (1989b). For the total merchandise imports equation the implicit price deflator was derived directly from the 'total imports' current and constant price data. No constant price BEC data are published, though, with more resources and time than is available to this author, these could be compiled from unpublished ABS sources. Price indexes that relate directly to the end use categories compiled above are published quarterly in ABS (1988c). Unfortunately, this has only been published since 1981(3). Disaggregated current and constant price data are compiled for AICC divisions only and thus they do not correspond directly to the end use categories used in this study.

The data available were used to produce current and constant price data for categories roughly comparable to the end use categories outlined above. Implicit price deflators were then derived. The end use were constructed from the AICC categories in the following proportions:

Capital goods

55 per cent of 'Machinery and transport equipment'

Consumer goods

All of 'Food and beverages'

All of 'Other imports'

15 per cent of 'Machinery and transport equipment'

Intermediate goods

All of 'Fuels'

All of 'Basic materials'

All of 'Chemicals'

All of 'Metals and metal manufactures'

All of 'Textiles, fabrics, etc.

30 per cent of 'Machinery and transport equipment'

The proportions above were decided upon after roughly cross classifying the component 3 digit AICC groups with the BECs (see ABS 1982).

Domestic Prices

Domestic prices are constructed using ABS indexes for various categories of manufacturing industries. Again these categories do not match the categories of imports exactly.

Total imports

Quarterly data were derived by a simple average of the monthly 'All manufacturing industry index', published in ABS (1988d). This is a more accurate domestic price measure than the GDP deflator used in many studies, as only the price movements of domestic tradables is included.

Capital goods

A price measure was derived from a simple monthly average of the subdivisions indexes in ABS (1988d). These are selected subdivisions from the ASIC, and as such do not correspond exactly with the end use categories compiled above. The capital goods domestic price index was constructed using the following weightings:

33 per cent for the 'Transport equipment' index (ASIC 32)

66 per cent for the 'Other industrial machinery and equipment and household appliances' index (ASIC 33)

Intermediate goods

This price index is constructed using the same method as for 'capital goods' above. The weightings used are:

50 per cent for the 'Chemicals, petroleum and coal products' index (ASIC 27)
10 per cent for the 'Wood, wood products and furniture' index (ASIC 25)
30 per cent for the 'Other industrial machinery and equipment and household appliances' index (ASIC 33)
10 per cent for the 'Fabricated metal products' index (ASIC 31)

As in the case of the derivation of the end use category import price deflators, the proportions above were decided upon after roughly cross classifying the component 3 digit ASIC groups with the BEC divisions (see ABS 1982).

Consumer goods

The price measure used for domestic consumer good substitutes was the same as that used for the total merchandise imports equation in this study. That is the 'all manufacturing industry index' (ABS 1989d). The reason this was used is that it is a net index. This means that goods are only included if they leave the manufacturing sector. Thus, it will roughly approximate an index of those goods entering into consumption. This price series was compared graphically with a more conventional domestic price measure - the price index of the national accounts aggregate 'private final consumption expenditure' (ABS 1988e). It was found that these two measures move very closely.

Activity Variables

Total imports

The activity variable used in the total merchandise imports equation was 'Gross non-farm product at market (1984-85) prices', ABS (1988e). An income variable modified to exclude those parts of national income not spent on the tradables sector, such as that used in Johnston (1979), Simes (1988) or Caton and Higgins (1974), would have been preferable. However, time constraints precluded the use of a more sophisticated measure.

Consumer goods

The activity variable used in the 'consumer goods' equation was 'private fixed consumption expenditure at 1984-85 prices', ABS (1988e).

Capital goods

'Private gross fixed capital expenditure on plant and equipment at 1984-85 prices' is used as the activity variable for the capital goods equation. The series can be obtained from ABS (1988e). 'Private gross fixed capital expenditure on other building and construction' was not included because it contains a high proportion of nontradables.

Intermediate goods

The activity variable used for this equation was the same as that used for the total merchandise equation. A better measure would be one such as manufacturing sales, but time constraints prevented this series being obtained.

Measures of the Effect of Economic Cycles

Hours overtime per employee is used in each equation to represent the effect of economic cycles on the demand for each category of imports. This series was obtained from ABS (1988e).

APPENDIX 2 -List of Variable Names

The variable names are as follows:

TM = the volume of total merchandise imports,
CM = the volume of consumer good imports,
KM = the volume of capital good imports,
IM = the volume of intermediate good imports,
RELP = relative prices, that is the ratio of the price of imports to the price of domestic substitutes,
Y = Gross National Non-farm Product,
IPE = Investment in Plant and Equipment,
PFC = Private Final Consumption Expenditure,
ROT = hours overtime per employee,

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