A RE-EXAMINATION OF THE DETERMINANTS OF AUSTRALIA'S IMPORTS

Jacqueline Dwyer and Christopher Kent

ABSTRACT

The trend rise in import penetration in Australia has renewed interest in the determinants of import volumes. In this paper, an attempt is made to explain the growth in Australia's imports in terms of the increased openness of the economy. Openness is proxied by the effective rate of protection. It is found that whilst reductions in protection do not help explain the growth in aggregate imports, they do explain a substantial share of the growth in imports of consumption and intermediate goods. This is said to reflect the impact of reductions in protection on both the demand for imports and the domestic supply of import substitutes.

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1. INTRODUCTION

The equilibrium quantity of imports is primarily a function of economic activity and the price of imports relative to other goods. Of these, economic activity is most often found to be the principal determinant of import volumes.[1] Certainly, in the past, a general direct relationship between changes in import volumes and economic activity has been evident in Australia. Consequently, there was a widely held expectation that the recent recession would curtail imports by more than in fact occurred, facilitating a significant improvement in the current account deficit. Instead, despite subdued economic activity, there remains a trend rise in the rate of import penetration. The prospect that imports may accelerate as the nation's economic recovery consolidates has, in some quarters, raised concern about further possible increases in the current account deficit. This concern warrants a re-examination of the determinants of the volume of imports - in particular, those factors *other* than income and relative prices that influence the import decision. One such factor central to this paper is the effect of increased openness of the Australian economy.

It might be expected that the growth in import penetration is related to the process of international integration. Over the last decade there has been a substantial increase in the openness of the Australian economy as tariff (and non-tariff) protection has been reduced. Reflecting this, the absolute value of trade as a share of national income has risen and intra-industry trade has expanded. Such increased openness is likely to impact upon both the demand for imports and the supply of domestically produced import substitutes. Thus the focus of this paper is the determinants of *excess* demand for importables.

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[1] Horton and Wilkinson (1989) and Wilkinson (1992) show that, for Australia, there have been episodes in which relative prices were the principal determinant of import volumes. Generally, however, it is shown that economic activity is the principal determinant of import volumes. See, for example, Leamer and Stern (1970), Magee (1975), Murray and Ginman (1976), Goldstein, Khan and Officer (1980), Thursby and Thursby (1984).

The main purpose of the paper is to estimate Australia's excess demand for importables. The approach draws on that of Wilkinson (1992). However, in this exercise, an attempt will be made to identify structural changes in the market for importables that might arise from the dismantling of protection. Furthermore, the extent to which the effect of such changes is evident in the market for aggregate imports compared with the component classes of imports (consumption, capital and intermediate goods) will also be considered. It is hypothesised that the inclusion of a term for protection will prove a significant explanator of excess demand for imports, in particular those of consumer goods, as these imports have been subjected to the greatest reductions in protection.

The paper is organised as follows. In Section 2, the behaviour of imports is shown in relation to economic activity, relative prices and openness of the Australian economy. In Section 3, the conceptual framework for the analysis of imports is developed. In Section 4, the data required for estimation are described. The estimation procedure and results are presented in Section 5 and, finally, the results and their implications are discussed.

2.   TRENDS IN IMPORT PENETRATION

The relationship between economic activity and imports is shown in Figure 1, where the annual change in real gross national expenditure (GNE) is compared with that of the volume of endogenous imports.[2] It is apparent that there is a positive correlation between real GNE and imports. In fact, typically, the change in the volume of imports is more than proportional to that in GNE. This is evident in each cycle of economic activity. The recession of 1982/83 was associated with a sharp fall in the growth of imports. Similarly, the recent recession has been associated with a fall in import growth. However, this fall has been less pronounced than that of 1982/83. Furthermore, in contrast to previous episodes, import growth has since recovered ahead of economic activity.

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[2] Endogenous imports are those that exclude "lumpy items" such as fuel, aircraft and defence equipment. These items do not typically respond to changes in domestic demand. For the purpose of this paper, imports of computers have also been excluded.

Figure 1: Endogenous Imports and Economic Activity

(year-ended percentage change)
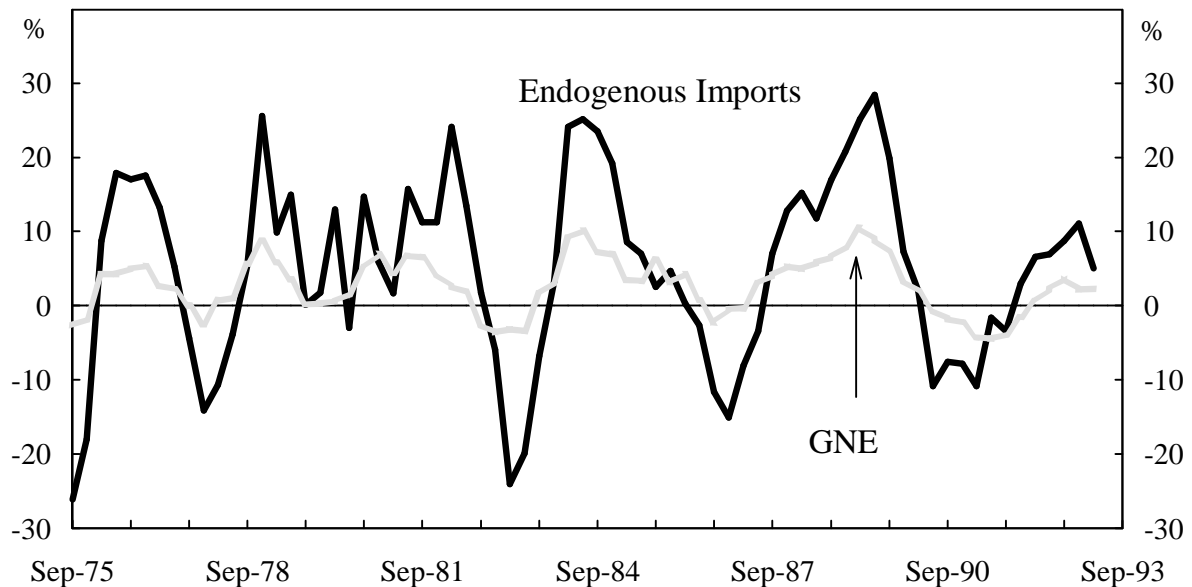
The relationship between relative prices and imports is shown in Figure 2. Here, the annual change in the volume of endogenous imports is compared with that of the relative price of imports (measured as the deflator for endogenous imports relative to the deflator for GNE).[3] A negative correlation between the series is evident for most of the period shown. The sharp increases in import prices between 1984 and 1986 corresponded to a fall in the volume of imports, whilst the fall in import prices in the late 1980s corresponded to a surge in import growth.[4] Recently, however, a positive correlation between the series has emerged: a rise in the relative price of imports has coincided with a recovery of import volumes.

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[3] Note that published price deflators for imports record import prices over the docks and, as such, are not the final price faced by the purchasers of imports.

[4] A detailed discussion of this episode can be found in Horton and Wilkinson (1989) and Wilkinson (1992).

Figure 2: Endogenous Imports and their Relative Price
(year-ended percentage change)
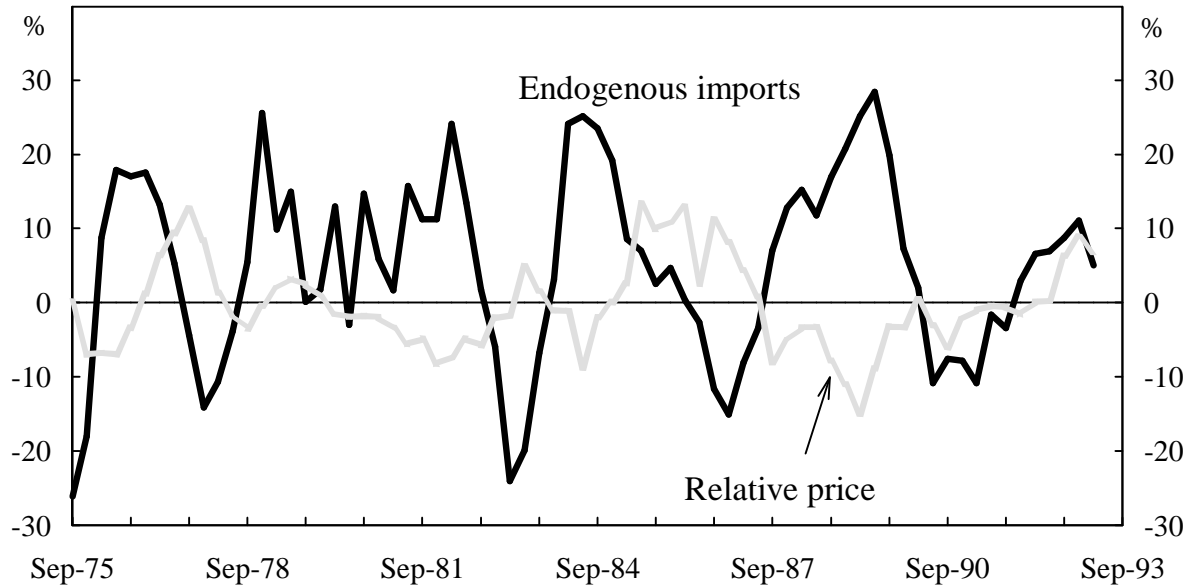
A comparison of Figures 1 and 2 reveals that the recent history of import growth has some interesting properties. In 1990/91, whilst the economy was in recession, the relative price of imports was quite low. Such low relative prices in this period may have offset, to some extent, the downward pressure on import volumes associated with weak activity. More recently, the relative price of imports has increased, but this price increase is now coincident with the emergence of economic recovery. These offsetting influences make less clear the driving force for the recent growth in imports. What is clear, however, is that import penetration has increased.

As shown in Figure 3, the constant price value of imports as a share of GNE has exhibited a trend rise. Whilst there are cyclical movements around this trend, it appears that there has been a general "ratchetting up" of import penetration. This may reflect an underlying structural change in the market for importables. Such change may be related to the increased openness of the Australian economy.

Figure 3: Import Penetration Ratio
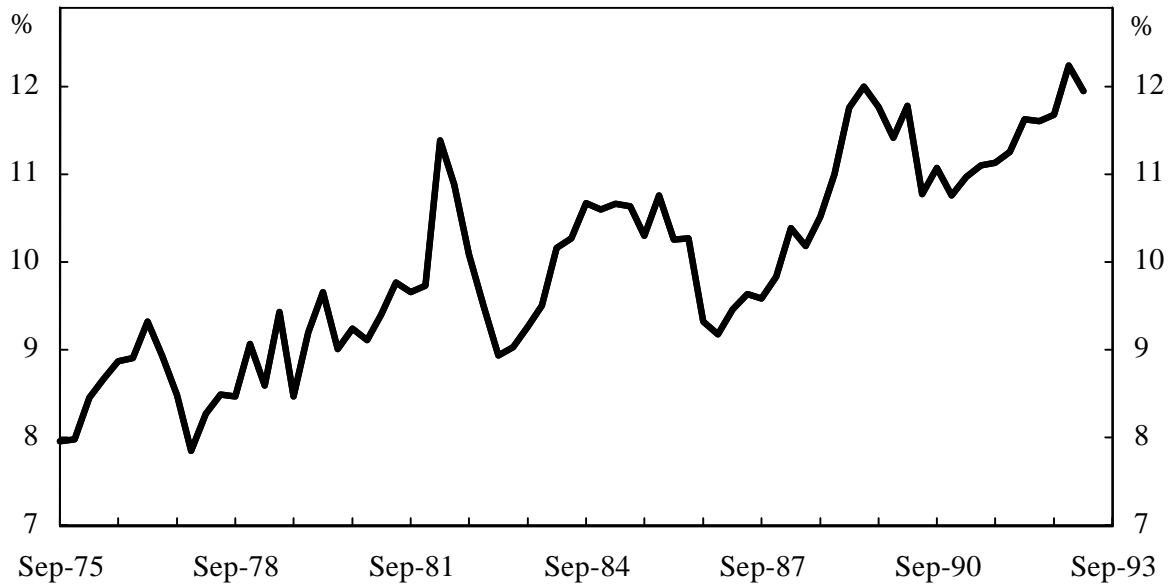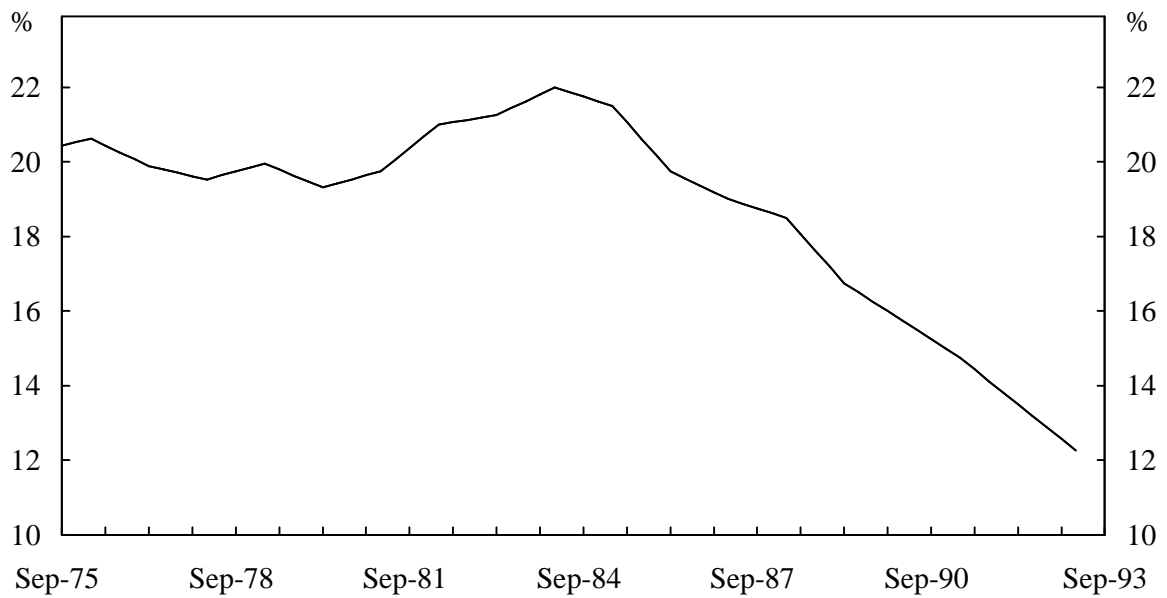(endogenous imports to GNE, 1989/90 prices)

Figure 4: Effective Rate of Protection

The openness of the Australian economy is represented in this paper by changes in the effective rate of protection.[5] In 1973, there was a 25 per cent across-the board reduction in tariffs. The rate of protection then plateaued for a period, subsequently rising in the early 1980s. However, since its local peak in 1984, the effective rate of protection has fallen by almost half (see Figure 4). This represents an important structural change in the market for importables.

Reductions in protection can be expected to affect the *demand* for imports, both directly and indirectly. A fall in protection increases the demand for imports directly by lowering their landed price. However, the effect of tariff changes on the landed price of imports is found, most often, to be relatively small - at least in the short run. Typically, it is swamped by the effect of exchange rate movements so that, in the short run, both the landed and free on board prices of imports move similarly.[6] In the long run, though, one might expect the effect of tariff reductions to generate a more discernible change in the landed price of imports. Reductions in protection may, as well, have important indirect effects on import demand. A credible commitment to the dismantling of protection will influence the behaviour of economic agents. As they come to recognise that the process is irreversible, they may adapt to this change so that, at a given level of output or relative price, they may demand more imports than would otherwise have been the case.

Reductions in protection will, however, also affect the domestic *supply* of import substitutes. A fall in the rate of protection increases the price of import substitutes relative to imports, reducing demand for the domestically produced good. Then, if producers recognise that the dismantling of protection will not be reversed, so that demand for import substitutes will be permanently lower, it can be expected that a corresponding reduction in the supply of such goods will occur. Using input-output data for selected years, Dwyer (1992) has shown that the share of gross domestic

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[5] Measured by the Industry Commission's effective rate of assistance. An effective rate of assistance measures the percentage change by which all forms of assistance raise an industry's value added per unit of output. That is, it accounts for the fact that tariff and non-tariff protection is also applied to inputs to production. Plunkett, Wilson and Argy (1992) describe the construction of the series.

[6] This appears to have always been the case in Australia. See Gregory and Martin (1976) for a discussion of this with respect to the 25 per cent tariff reduction of 1973. They show that even with this massive tariff reduction, exchange rate effects dominated movements in the final price of imports.

product (GDP) attributable to import-competing industries has fallen since the early 1980s. A proxy for the supply of domestically produced substitutes is considered here.[7] As shown in Figure 5, throughout the 1980s, such supply has fallen both absolutely and as a share of GDP.[8] The fall appears to have been accelerated during the two major recessions. However, if one abstracts from these recessions, it also appears that the trend decline in the supply of import substitutes has become significantly greater since the early 1980s, as the economy has become more open.

Figure 5: Supply of Import Substitutes
(domestic supply of import substitutes as a share of GDP, 1989/90 prices)
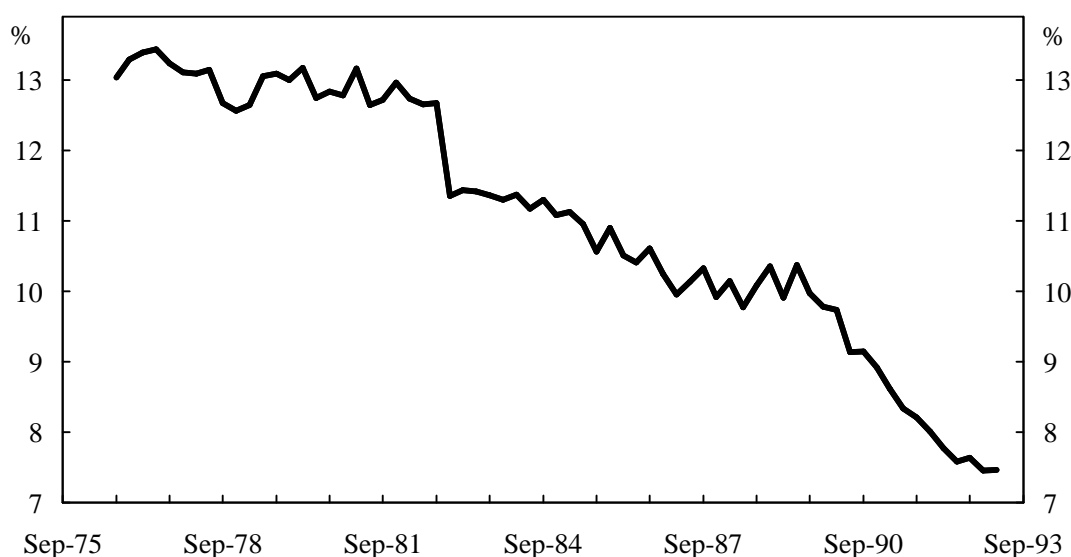
This result has an important implication. Comment on the growth in import penetration has typically been couched in terms of the impact of international

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[7] Industries are defined as import competing according to the ratio of the volume of imports to the volume of domestic sales reported in Kent and Scott (1991). The constant price GDP of these import-competing industries *less exports* is then expressed as a share of GDP for the economy as a whole. This approach yields results broadly consistent with those found by Dwyer (1992), using disaggregated data for selected years in which input-output data are available. For further discussion see Appendix 1.

[8] It might be argued that Australia would experience a secular decline in import substitutes as the economy becomes more developed and increases the share of non-tradeables in both production and consumption. However, the extent of the decline shown here exceeds that which can be explained by such secular change.

integration on import *demand*.[9]   And yet, it is evident in Figure 5 that greater openness has been accompanied by a fall in the supply of import replacements. Supply side influences may, therefore, be important determinants of the import decision.

We commence with the testable proposition that international integration has been accompanied by a structural change in the market for importables, impacting upon both the demand and the supply side. The framework for our analysis is outlined below.

3.   THE CONCEPTUAL FRAMEWORK

The equilibrium quantity of imports is the product of interaction between demand and supply in the market for importables. Demand can be satisfied from two sources: the foreign supply of imports or the domestic supply of substitutes. However, the determinants of supply are more complex than those of demand (Leamer and Stern 1970). Difficulties with respect to the identification of supply functions for importables have tended to be overcome by assuming that there is an infinite elasticity of supply, so that the equilibrium quantity of imports can be related solely to changes in demand (Murray and Ginman 1976, p.75). Certainly, there is likely to be infinite elasticity of the foreign supply of imports. This will not be the case for the domestic supply of substitutes. Thus, to the extent that the domestic supply of importables is relevant, import demand functions are, in effect, excess demand functions. Hereafter, import demand functions will be considered in that sense.

In the traditional model of import demand, import volumes are a function of real income and the price of importables relative to that of domestically produced goods:

$$M = \left(\frac{P_m}{P_y}, \frac{y}{P_y} \right) \tag{1}$$

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9   In fact, as noted by Phillips (1989), this comment is often couched in terms of the "immorality" of demand for imports.

where: M is the volume of imports; P_m is the price of imports; P_y is the price of domestically produced goods; and y is domestic money income.

This traditional import demand function is, however, the most restricted model presented in the literature. It distinguishes only between the prices of imports and those of *all* domestically produced goods. Purchasers, in fact, allocate their budgets between imports and various classes of domestically produced goods. Domestically produced goods comprise those which are exportable, importable and non-traded. The prices of each type of good can, therefore, be incorporated into an import demand model of Hall, Jankovic and Pitchford (1989).[10] Furthermore, the import decision is also influenced by supply side conditions. Thus the traditional import demand function has been adapted to include additional prices and a supply side term. Typically, a term for capacity utilisation is included, although other supply side factors can be considered.[11] Central to this paper is a measure of openness. Assuming that the import function is homogeneous of degree zero with respect to income and prices, it can be normalised by any one of these prices. Normalising by the price of non-traded goods yields:

$$M = \left(\frac{P_m}{P_n}, \frac{P_x}{P_n}, \frac{y}{P_n}, z \right)$$

(2)

where: there is a single price of importables; P_x is the domestic price of exportables; P_n is the price of non-traded goods; and z is a supply side condition.[12]

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[10] This approach assumes that there is *no* separability in consumption. Separability in consumption occurs when consumers allocate their expenditure first between traded and non-traded goods and then between imports and domestically produced import substitutes so that import demand is independent of the price of non-traded goods. For a detailed discussion of this issue see Goldstein et al. (1980).

[11] Reduced spare capacity may encourage consumers to switch from domestic to foreign sources of supply, thereby increasing the demand for imports. See Leamer and Stern (1970) and Gregory (1971) for an early discussion and, more recently, Wilkinson (1992).

[12] Use of a single price of importables does, however, carry with it the assumption that imports and import replacements are perfect substitutes with perfect price flexibility (Arndt 1979). If the assumption of the law of one price for importables were relaxed, functions for import demand could also include the domestic price of import substitutes.

This approach follows the analysis (Hall et al. 1989). Applications of it by Horton and Wilkinson (1989) and Wilkinson (1992) have made a valuable contribution to the Australian empirical literature by establishing a role for relative domestic prices in the determination of import demand.

The choice between equation (2) and any restricted version of it is ultimately an empirical question. The approach adopted in this paper is as follows. First, the traditional import demand function will be estimated. Then, additional terms will be included as arguments in the function. In particular, inclusion of a term for protection is expected to help explain import behaviour. The following sections describe the data required for estimation and the estimation technique to be adopted.

4.   DATA

The data used in the estimation of import demand are listed below with a brief comment on their features. All data are quarterly and expressed as natural logarithms. Where data are in index or constant price form, 1989/90=100. Where seasonal patterns are evident, seasonally adjusted data have been used. Further details and sources are given in Appendix 1.

M   real endogenous imports, excluding computers.

PM   ratio of the implicit price deflator for endogenous imports (excluding computers) to the GNE deflator.

PML   the ratio of the landed price of imports to the GNE deflator.

PX   ratio of the domestic price of exports to the GNE deflator.

GNE   real GNE

Z   effective rate of protection

Import volumes are represented by real endogenous imports, excluding computers. Computers have been excluded because the rapid pace of advance in computer technology has posed problems for measurement of their constant price value (Meade 1991; McCarthy 1989). In essence, the dramatic rise in power of computers in recent years has been equated with a fall in the unit price of such

power. In consequence, while the *value* of computer imports as a share of GDP has risen little since the mid 1980s, the *volume* has risen significantly. Since estimates of import demand are sensitive to changes in the reported volume of computer imports, computers have been excluded.[13]

There are a variety of published price series for imports. That used here is an implicit price deflator for endogenous imports (excluding computers). It records import prices "free on board" - that is, over the docks - and excludes tariffs. A proxy for the landed price of imports is also constructed by multiplying the implicit price deflator by the average rate of duty paid. Ideally, a landed price would also include the scarcity premium that arises from import quotas, transport costs and all other charges that account for the difference between prices over the docks and those that face purchasers.[14] Given that such information is generally unavailable, it is common practice to assume that such changes have not been significant over the period or are, at least, less significant than the changes in tariffs (Gregory and Martin 1976; Athukorala and Menon 1988).

Real GNE is nominated as the appropriate activity variable as it represents domestic demand for goods.[15] In practice, however, the explanatory power afforded to

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[13] Bullock, Grenville and Heenan (1993).

[14] An attempt is also made to account for tariffs *and* the scarcity premium that arises from import quotas by using the Industry Commission's nominal rates of protection for each of the twelve major industry categories in the manufacturing division. However, as discussed by Phillips (1989), there are difficulties associated with the use of nominal rates of protection for this purpose. In compiling measures of nominal protection the Commission uses weights proportional to unassisted output values, rather than import shares. Given this limitation, landed prices derived from the nominal rate of protection are not reported in this paper. Results are, however, broadly consistent with those generated by inclusion of tariffs only and are available from the authors.

[15] GDP would be an appropriate measure of activity if imports are primarily intermediate goods, the use of which is a function of domestic output rather spending (Horton and Wilkinson 1989, p.6). Intermediate goods in 1991/92 accounted for about 50 per cent of Australia's total real endogenous imports. Given this share, it is common for either type of activity variable to be used.

activity is altered little by the choice of activity variable (Horton and Wilkinson 1989; Wilkinson 1992).[16]

Activity and price variables are also decomposed into the components that correspond to consumption, capital and intermediate imports. Given that imports are not a homogeneous bundle of goods, this facilitates an examination of the extent to which the behaviour of aggregate imports is driven by a given component class.

Finally, a measure of openness was required. A popular measure of openness is the ratio of imports to GDP.[17] However, use of such a measure would introduce endogeneity into a function for import demand: it is the very thing that we want to explain. Consequently, we measure openness by changes in protection and use the effective rate of assistance calculated by the Industry Commission. A decline in the effective rate of assistance is interpreted as an increase in openness.

5.   ESTIMATION OF DEMAND FOR IMPORTS

Valid estimation requires that account be taken of the time series properties of the data to be employed. All data to be used in the estimation of import demand are non-stationary.[18] An approach to deal with non-stationary data that has been employed by recent contributors to the empirical literature on import demand combines the concepts of cointegration and error correction.[19] In this paper, the cointegrating relationship between import volumes and its explanators is tested and estimated using the Phillips and Hansen (1990) fully modified OLS estimator. The estimation period is from the September quarter 1974 to the March quarter 1993.

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[16] Although, it may affect the elasticities of the nominated relative price terms in an import demand function.

[17] See, for example, Romer (1991). With respect to discussion of Australia's increased openness, see Bullock et al. (1993).

[18] The time series properties of the data are reported in Appendix 2.

[19] Refer to Hall et al. (1989), Horton and Wilkinson (1989), Wilkinson (1992) and Bewley and Orden (1991).

5.1   Aggregate Imports

We commence with estimation of the traditional import demand function for aggregate imports, estimated in log levels, where import demand is a function of economic activity and the relative price of importables:

$$M_t = a + bGNE_t + lPM_t \tag{3}$$

Results from the P-H estimator confirm the existence of a cointegrating relationship (see Appendix 3). The long-run elasticity estimates are shown in Table 1, with the model denoted by the equation number.

The result is standard: the volume of imports is directly related to economic activity and inversely related to price. The sizes of the coefficients fall within the bounds of those reported in many other Australian studies.[20]

Table 1: Long-Run Elasticities for Aggregate Import Models
(September quarter 1974 to March quarter 1993)

Model	Activity	Relative Prices	Protection
Traditional model:			
without tariff adjustment (3)	1.55	-0.42	..
	(0.05)	(0.13)	
Protection models:	1.50	-0.41	
with landed import prices (4)	(0.06)	(0.13)	..
with effective protection term (5)	1.57	-0.41	-0.04
	(0.07)	(0.13)	(0.49)

Note: Standard errors are shown in parentheses.

However, recently there has re-emerged a debate about the appropriate size of the income elasticity for imports.[21] In theoretical literature it is often claimed that, in the long run, the income elasticity should be unity. Formally, this assertion is based

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[20] See Macfarlane (1979), Horton and Wilkinson (1989), Hall et al. (1989) and Bullock et al. (1993) for a discussion of elasticities.

[21] The early debate is most often associated with Houthakker and Magee (1969) who demonstrated the potential importance of high income elasticities with respect to secular trade imbalances. For a review of the recent debate see Blecker (1992).

on assumptions of long-run steady state growth and the homothetic demand of identical consumers (Magee 1975). The intuition behind this assertion is that while the income elasticity may exceed unity in the short to medium term due changes in patterns of production or consumption, the effect of these changes will be dissipated so that, in the long run, there is a stable relationship between income and imports.[22] Subscribers to this theory would argue that the size of the income elasticity generated by the traditional model is too high and is the result of misspecification. Certainly, such concern is expressed by Bullock et al. (1993) with respect to reported income elasticities for Australia.[23]

In essence, the income elasticity generated by the traditional model tells us that the growth in import penetration we have observed is primarily attributable to the growth in income. However, the omission of relevant explanators will bias the income elasticity. Therefore, we approach the issue of possible mispecification by considering factors other than income.

First, we consider the use of additional relative prices. This approach is in keeping with the tradition of emphasising the role of price elasticities in the determination of trade volumes (Houthakker and Magee 1969, p.111). However, additional relative price terms do not emerge as being statistically significant (see Appendix 3). Instead, we attribute possible misspecification of the traditional import demand equation to the failure to account for changes in protection. Thus we move from the benchmark traditional model to one that includes protection.

There are two main ways in which protection can be included. The landed price of imports can be considered, with the effect of tariffs subsumed into the relative price term so that:

$$M_t = a + bGNE_t + lPML_t \tag{4}$$

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[22] However, convincing arguments can also be made that the income elasticity may exceed unity if an allowance is made for, say, the "desire for variety" at higher levels of income. Krugman (1989) offers a detailed discussion of factors determining income elasticities for imports.

[23] It may also be the case that the estimation periods in the various Australian studies do not permit identification of the true long-run relationship. However, the *systematic* tendency for traditional models to generate high income elasticities suggests that the problem is one of misspecification.

Alternatively, a measure of the effective rate of protection can be included as a separate argument so that:

$$M_t = a + bGNE_t + l\,PM_t + qZ_t \qquad (5)$$

Inclusion of the effective rate of protection as a separate argument is designed to capture factors *in addition to* the direct effect of changes in protection on the relative price of imports. That is, its purpose is to capture the indirect effects of the lowering of protection on import volumes, such as may be associated with changed conditions of domestic supply of importables.[24]

The results from these two approaches are also shown in Table 1. Note, that neither approach yields discernible evidence of a tariff effect. There is no clear fall in the income elasticity: in both cases, at the 5 per cent level, the income elasticity is not significantly different from that in the traditional model. There is no significant change in the price elasticities and the protection term, when included separately, is insignificant.

Standard theory says that changes in protection will alter relative prices and, thereby, import demand. The fact that the effects of protection are not channelled through the landed price term in equation (4) is, perhaps, surprising. However, as discussed in Section 2, the impact of changes in protection on the landed prices of imports is typically found to be small, because the bulk of any movement in such relative prices is most often explained by exchange rate fluctuations.[25] More interesting is the fact that in equation (5), the effective rate of protection - the term for openness - proved to be insignificant. Certainly, *a priori* reasoning would

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[24] The term for the effective rate of protection will also be capturing indirect demand effects to the extent that purchasers of imports respond to factors other than income and relative prices as protection is dismantled. In the framework adopted in this paper, it is not possible to distinguish between indirect demand and supply side effects. However, given the evidence of a structural change in the supply of import-competing goods presented in Section 2, our prior is that supply side effects will dominate.

[25] Even though a cointegration framework is designed to identify long-run relationships, it may be that, during the period of estimation, exchange rate fluctuations have been sufficiently large to obscure the impact of tariff reductions on the landed price of imports. In consequence, the choice of landed prices compared with those free on board makes little difference statistically when attempting to measure import demand.

suggest that a regime shift in protection *must* impact upon import volumes. The question then arises, why is this not evident in the specification adopted here?

Magee (1975) acknowledges the difficulties of explaining import volumes for product areas in which imports have domestic substitutes. He shows analytically that import penetration will increase when the domestic demand elasticity for importables exceeds the domestic supply elasticity, or when shifts in demand for importables exceed those of supply. He argues that these rules of pure theory can be used to explain the "frustrating empirical problem" of identifying excess demand for importables.

Magee's rules can be applied to demonstrate the apparent failure of changes in protection to explain aggregate import demand. For instance, adjustments of the domestic supply of importables to the dismantling of protection may be more gradual than changes in demand, making the influence of falls in protection difficult to establish statistically. Against the backdrop of secular change in the supply of import substitutes, there are big swings in the demand for imports that are associated with changes in activity and relative prices. In a statistical sense, the information contained in such swings in demand tends to dominate that afforded by the underlying structural changes in conditions of supply.[26]

Furthermore, imports are not a homogeneous bundle of goods. A model for aggregate imports may mask important differences in the effect of falling protection on the market for some categories of imports. In particular, it might be expected that the market for consumption imports has been most affected by lower protection whilst that for capital imports has been least affected.[27] It is proposed that a disaggregated approach will permit the influence of supply side effects of changes in protection to be identified. These possibilities are explored in the following section.

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[26] And, indeed, underlying changes in demand for imports that are independent of activity and relative prices.

[27] Generally, finished goods, for which there are domestic substitutes, have had the highest rates of protection and have experienced greater relative cuts in protection since 1984. Capital imports, on the other hand, have few domestically produced substitutes and typically have been afforded lower levels of protection (see Industry Commission, *Annual Report*, various years).

5.2   A Disaggregated Approach

We re-estimate equation (5) for imports of consumption, capital and intermediate goods. We use the prices that correspond to each class of import. However, we maintain the use of an aggregate measure of economic activity.[28] We argue that, in an excess demand formulation, when the activity variable is "finely tuned" to correspond to a particular class of imports, its behaviour accords too closely with that of the dependent variable and, thereby, inhibits the identification of more gradual supply side change, such as may be associated with falls in protection.

The results obtained from the re-estimation of equation (5) with disaggregated data accord with priors better than the results obtained from the other models, including models which employ the "finely tuned" disaggregated activity variables. A comparison of all models is provided in Appendix 3. A summary of results from the preferred model is presented in Table 2 for each class of import. They reveal some important differences in the response of components classes of imports to changes in activity, relative prices and protection.

Table 2: Long-Run Elasticities for Disaggregated Import Models
(September quarter 1979 to March quarter 1993)

Model	Activity	Relative Prices	Protection
Protection model:			
with effective protection term (5)			
consumption	1.48	-0.78	-1.59
	(0.11)	(0.10)	(0.54)
intermediate	1.22	0.00	-1.32
	(0.12)	(0.15)	(0.59)
capital	2.04	-0.72	3.02
	(0.27)	(0.24)	(1.15)

Note: Standard errors are shown in parentheses.

[28] Similarly, Phillips (1989) uses a general measure of activity when estimating disaggregated models of import demand. Alternatively, for each class of imports, Athukorala and Menon (1988) nominate a corresponding expenditure class.

For imports of *consumption* goods, the term for protection has the expected sign, is significant and its inclusion is associated with a reduction in the income elasticity. Whilst the income elasticity is significantly lower, it nonetheless remains quite high. This class of import is more likely to have a higher income elasticity than others as it fits well the "desire for variety" hypothesis. Use of disaggregated data also reveals that the relative price elasticity for consumption goods is significantly higher than for the models of aggregate imports in Table 1. This is consistent with the responsiveness of consumption decisions generally to changes in price, given the availability of substitutes.

For imports of *intermediate* goods, the term for protection also has the expected sign and is significant. Again, its inclusion is associated with a reduction in the income elasticity. In fact, the income elasticity for intermediate goods is notably lower than that for aggregate imports. Furthermore, in this case, the price elasticity is insignificantly different from zero.[29] This suggests that the decision to import an intermediate good (for which there are few domestic substitutes) will be related primarily to economic activity and not to relative prices. In fact, the lack of response of intermediate imports to changes in relative prices is a key factor explaining the size of the relative price elasticity for aggregate imports.[30]

It is of concern that for imports of *capital* goods the protection term is significant and of the wrong sign. Furthermore, its inclusion increases the income elasticity. Because capital imports have few domestic substitutes and have been subjected to generally lower levels of protection, it may be expected that changes in protection are less significant for capital than other classes of import. Nonetheless, a positive coefficient is perverse.

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[29] Observing that, in the above estimation, no role exists for the price of intermediate imports relative to that for non-traded goods, we also allow for separability in consumption. We consider that producers may allocate their expenditure on intermediate imports according to the price of such goods relative to the price of domestic substitutes. Even in this case, no role for relative prices is found. Whilst this is not to say that there is no role for relative prices, there is no statistical indication that it influences the demand for intermediate imports. See Bullock et al. (1993) for a discussion about why such price elasticities may be low.

[30] Magee (1975) discusses the ways in which a price elasticity for aggregate imports can be subject to error when the elasticities of the component classes of imports vary through time. Menon (1993) examines this issue further and shows that the aggregate price elasticity is a function of the disaggregated price elasticity for each class of import (*i*), *i*'s share of total imports and the variation in the price of *i* relative to the price of total imports.

However, a role for protection that accords with our priors has been found for consumption and intermediate imports which, together, account for about 80 per cent of the nation's total endogenous imports. An important question is the extent to which reductions in protection have contributed to the growth in these classes of import. We focus on the impact of the fall in protection since its local peak in the March quarter 1984. Our preferred model is used to generate a long-run equilibrium volume of imports. An experiment is then conducted to predict the change in import volumes that would have occurred if the level of protection had remained fixed, with all other things changing. That is, we present the counterfactual.[31] The difference between this counterfactual level of import volumes and its true long-run equilibrium level permits identification of the contribution of the fall in protection to the growth in imports.[32] The results are summarised in Table 3 for each class of import.[33]

Table 3: Contribution of Reduced Protection to Import Growth
(March quarter 1984 to March quarter 1993)

Import Class	Consumption	Intermediate
Estimated long-run growth	47.1	46.4
Percentage point contributions:		
Activity	41.2	33.7
Relative prices	-11.6	0.0
Protection	18.2	14.7

[31] See Horton and Wilkinson (1989) for a similar approach. It should be noted, however, that this approach abstracts from the effect that reductions in protection have had on GNE and relative prices over the period.

[32] As the model is non-linear in levels, percentage point contributions of each explanator do not sum to the estimated long-run growth.

[33] Alternatively, one might ask what would have happened if tariffs had changed, all other things being constant? This approach has less intuitive appeal given that the other variables by their very nature change, whereas tariffs are set by policy. However, when this alternative approach is adopted, it produces estimates of the contribution of falling protection to import volumes that are only marginally lower than those presented in Table 3.

These results indicate that of the 47 per cent increase in consumption imports since the March quarter 1984, about 18 percentage points (or two fifths) are attributable to reductions in protection. The impact of falling protection has been less pronounced for intermediate imports, but is nonetheless substantial, with about 15 percentage points (or one third) of the increase due to falls in protection. Given that these categories, when combined, represent the bulk of the nation's imports, it is apparent that the dismantling of protection has been a major contributor to import growth. In fact, reductions in protection have been the largest contributor *other than income* to the growth in non-capital import volumes.

6. CONCLUSION

The trend rise in import penetration in Australia has renewed interest in the determinants of import volumes. In this paper, an attempt has been made to explain the growth in Australia's imports in terms of the increased openness of the economy. A traditional import demand function was augmented with a term for the effective rate of assistance, with the latter as a proxy for openness. Whilst this term did not help explain the growth in aggregate imports, it did prove to be a significant explanator of consumption and intermediate imports which account for the bulk of the nation's total imports. In fact, it was shown that a substantial share of the growth in these imports can be explained by the reduction in protection. This result was attributed to the effect that changes in protection have on both the demand for imports and the supply of domestic substitutes. In particular, evidence was presented that the dismantling of protection has been accompanied by a fall in the supply of domestic substitutes so that supply side constraints may have influenced the import decision.

Identifying a role for protection as a possible supply side factor has been useful in several respects. First, it has demonstrated that changes in the equilibrium volume of imports may not always result from a shift in demand. Instead, a formulation that permits identification of the long-run determinants of both the demand and supply of importables may be a more appropriate vehicle for explaining import behaviour.

Second, it has been shown that the inclusion of a term for protection markedly reduces the income elasticity of demand for consumption and intermediate imports. This result lends support to the view that high income elasticities for imports have

been "confounded" by supply side factors (Krugman 1989). It suggests that although economic activity remains the principal determinant of import volumes, the strength of this link may be less pronounced than commonly thought. This has important practical implications for our understanding of the relationship between import volumes and the business cycle and, indeed, the extent to which structural trade imbalances may arise as national income increases over time.

Finally, finding a role for protection satisfies the intuition that increased openness must explain at least some of the growth in import volumes since the local peak in protection in 1984. In fact, since then, reductions in protection have emerged as the most important factor other than income that explains the growth in non-capital import volumes. This result provides a useful insight into the reasons for continued growth in import penetration, especially in the current environment of subdued economic activity. It supports the conventional wisdom that the process of international integration has been accompanied by greater specialisation in trade and production.

APPENDIX 1: DATA

Unless otherwise mentioned, all data series are quarterly, from 1974:3 to 1993:1, seasonally adjusted and based in 1989/90 prices where relevant.

(a) Import Volumes

Endogenous imports, consumption imports, capital imports and "other" imports, where the last category is taken to represent intermediate goods. Data for the three broad economic classifications of imports are only available from September 1979. Source: ABS Catalogue No. 5302.0.

Computer imports. Data are unpublished ABS and non-seasonally adjusted. Computer equipment imports (SITC 752) are included in capital imports, while computer parts imports (SITC 75997) are in "other" imports. Source: ABS, unpublished.

(b) Activity Variables

Real GNE, GDP, private consumption, gross non-farm production and non-farm stocks. GNE and GDP are income-based estimates. Source: ABS Catalogue No. 5206.0.

(c) Relative Prices

Implicit price deflators for total endogenous imports, consumption imports, capital imports, "other" imports and GNE. Source: ABS Catalogue No. 5206.0.

Prices of Materials Used in Manufacturing (Home Produced Series). Source: ABS Catalogue No. 6411.0.

Price of domestically produced import substitutes. Source Dwyer (1992).

(d) Trade Data

Customs duty receipts (monthly). Source: Department of Finance, Commonwealth Financial Transactions.

Effective rate of assistance to manufacturing derived by splicing shorter-run series published by the Australian Industry Commission. Source: Plunkett, Wilson and Argy (1992).

Nominal rate of protection proxied by re-weighting the nominal rate of assistance for each of the 12 two digit ASIC categories of the manufacturing division according to import shares, with the latter derived from SITC data. Source: Industry Commission, *Annual Report: 1991/92*.

(e) Supply of Import-Competing Goods

Defined as manufacturing GDP of each traded industry less its exports. Calculated from 1976:3 to 1993:1 as total manufacturing GDP less that of non-traded manufacturing industries (wood, wood products and furniture, non-metallic mineral products and fabricated metal products) less exports of all other industries (other metals, machinery, transport equipment, other manufactures, cork and wood products, furniture, non-metallic mineral manufactures and metals manufactures).

Other metals, machinery, transport equipment and other manufactures are Balance of Payments categories. The remaining industries are, respectively, the SITC categories 63, 82, 66, 69.

Source: ABS Catalogue No. 5206.0 Table 19; ABS Catalogue No. 5302.0 Table 14; ABS unpublished data; ABS Exports by SITC.

APPENDIX 2: TIME SERIES PROPERTIES OF THE DATA

Each of the series used in estimating the excess demand for imports was tested for non-stationarity using the Augmented Dickey Fuller (ADF) test (Said and Fuller 1984). The null hypothesis is the existence of non-stationarity.

Four lags of the differenced series were included in the ADF test. Lagrange multiplier tests were conducted to test for first, and joint first to fourth order autocorrelation. The test statistic was taken from the specification of the ADF test which was free from autocorrelation and had the smallest number of lags.

The results reported in Table A2.1 are for the tests in which a constant is included. For the Z_t test, five lags of the covariance were included.

In Table A2.1, the results of stationarity testing of both the log level and log difference of the series are reported. All series posses one unit root, with the exception of the effective rate of assistance which, for the period of estimation, may have two unit roots. However, this variable is not determined by a stochastic process; it is set by policy and movements in it can be interpreted as a shift in the constant in each period in which it exhibits change. Its time series properties do not compromise the cointegrating relationship observed between imports and its explanators.

The critical values are taken from Fuller (1976):

- -3.51 at the 1 per cent level;

- -2.89 at the 5 per cent level; and

- -2.58 at the 10 per cent level.

With the exception of the effective rate of assistance, the null hypothesis of non-stationarity is accepted at the 10 per cent level for log levels and rejected at the 5 per cent level for first differences. (In fact, non-stationarity of first differences is rejected at the 1 per cent level for most series.)

Table A2.1: Results of Unit Root Tests

Imports:	Order	ADF	Z_t
Aggregate*	level	-1.35	-0.51
	1st difference	-5.39	-7.43
Consumption	level	-1.24	-1.32
	1st difference	-6.58	-6.72
Intermediate	level	-1.39	-1.38
	1st difference	-6.95	-7.17
Capital	level	-2.28	-2.50
	1st difference	-3.15	-6.77
Relative Price of Imports:			
Aggregate*	level	-1.72	-2.06
	1st difference	-7.77	-7.93
Aggregate Landed*	level	-1.36	2.39
	1st difference	-7.78	-7.95
Consumption	level	-1.58	-1.90
	1st difference	-7.64	-7.84
Intermediate	level	-1.25	-1.32
	1st difference	-6.52	-6.63
Capital	level	-2.30	-1.97
	1st difference	-3.23	-6.96
Activity:			
Real GNE*	level	-0.40	-0.48
	1st difference	-7.44	-7.57
Protection:			
Effective rate of assistance*	level	0.38	2.32
	1st difference	-2.10	-2.15

Note: Series denoted by * are tested for stationarity during the period from the September quarter 1974 to the March quarter 1993. All other series are tested during the period from the September quarter 1979 to the March quarter 1993.

APPENDIX 3: RESULTS

Results are based on the P-H estimates of the long-run equilibrium. (For the sake of brevity, long-run constants are not reported.) The existence of cointegration was tested by examining the significance of the error correcting terms in the P-H error correction model (ECM). Kremers, Ericsson and Dolado (1992) demonstrate that this is a more powerful test for cointegration than direct tests based on the residuals of the cointegrating relationship. Standard errors of the ECM were corrected for hetroscedasticity and autocorrelation where necessary. Further details of these estimates are available from the authors on request.

Table A3.1: Results
(September quarter 1974 to March quarter 1993, unless otherwise indicated)

Import Component	Activity	Relative Price	Protection	Coefficient on LR Error
Endogenous total	1.55 GNE (0.05)	-0.42 PM (0.13)		-0.44 (0.17)
Endogenous total	1.50 GNE (0.06)	-0.41 PML (0.13)		-0.43 (0.13)
Endogenous total	1.57 GNE (0.07)	-0.41 PM (0.13)	-0.04 Z (0.49)	-0.43 (0.12)
Endogenous total *	1.62 GNE (0.06)	-0.37 PM (0.09) 0.71 PX (0.22) -0.75 PS (0.37)		-0.69 (0.22)
Endogenous total *	1.49 GNE (0.06)	-0.38 PM (0.11) 0.33 PS (0.23)		-0.73 (0.18)

cont.

Import Component	Activity	Relative Price	Protection	Coefficient on LR Error
Consumption **	1.71 GNE (0.08)	-0.82 PM^c (0.12)		-0.91 (0.31)
Consumption **	1.48 GNE (0.11)	-0.78 PM^c (0.10)	-1.59 Z (0.54)	-0.71 (0.13)
Consumption **	1.74 PC (0.09)	-0.70 PM^c (0.14)		-0.67 (0.15)
Consumption **	1.70 PC (0.17)	-0.70 PM^c (0.14)	-0.21 Z (0.83)	-0.70 (0.13)
Intermediate **	1.41 GNE (0.09)	-0.04 PM^i (0.17)		-0.53 (0.22)
Intermediate **	1.22 GNE (0.15)	0.00 PM^i (0.15)	-1.32 Z (0.59)	-0.83 (0.30)
Intermediate **	1.49 GNFP (0.12)	-0.18 PM^i (0.12)		-0.58 (0.24)
Intermediate **	1.41 GNFP (0.20)	-0.17 PM^i (0.12)	-0.38 Z (0.79)	-0.55 (0.17)
Capital **	1.44 GNE (0.27)	-0.75 PM^k (0.33)		-0.46 (0.11)
Capital **	2.04 GNE (0.28)	-0.72 PM^k (0.25)	3.02 Z (1.15)	-0.46 (0.18)

Note: Standard errors are shown in parentheses. Equations denoted by * are estimated from the September quarter 1974 to the June quarter 1992. Equations denoted by ** are estimated from the September quarter 1979 to the March quarter 1993. Superscripts $^{c, i, k}$ denote the component implicit price deflators for the imports of consumption, intermediate and capital goods; PS is the price of import substitutes; PC is private consumption spending; and GNFP is gross non-farm product.

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