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SOME POPULAR MISCONCEPTIONS ABOUT SMALL COUNTRY PASS-THROUGH

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ABSTRACT

In the theoretical pass-through literature at present it is predicted that a small open economy will exhibit complete pass-through. The objective of this paper is to show that this is a popular misconception, and this aim is fulfilled by presenting four different scenarios which are able to explain incomplete small country pass-through. The first scenario supposes that domestic producers of import substitutes are imperfectly competitive when grouped together, the second assumes that foreign exporters use imported inputs, the third examines a case in which there exists other 'large' countries demanding or supplying the traded good, and the fourth assumes a mixed currency denomination of trade contracts. The theoretical contention of incomplete small country import pass-through is examined in the context of the results of over 50 empirical pass-through studies.

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I. INTRODUCTION

In the theoretical import pass-through literature at present it is predicted that a small open economy will exhibit complete import pass-through. This implies that if the home currency depreciates by 10 per cent then import prices will rise by 10 per cent in the long run. This standard conclusion was first proposed in the purchasing power parity literature, and confirmed later when Magee (1973) produced the seminal article introducing pass-through. This paper is designed to show that the standard view is not an exhaustive description of pass-through. We demonstrate that complete pass-through is just one scenario among many by examining four different mechanisms which are able to explain the incomplete result even though the importing country is small.

Section II describes how the proponents of complete small country pass-through obtain their result. Section III informs us about the reasons why this standard result does not exhaust the permissible outcomes, and describes four scenarios which produce incomplete pass-through. Section IV presents an exhaustive list of the empirical estimates of long run pass-through, while the final section concludes the paper.

II. THE STANDARD PASS-THROUGH PREDICTIONS

In this and the following section we examine the *standard* partial equilibrium, comparative static effects of exchange rate adjustments on import prices. This relationship between the exchange rate and import prices is referred to as the extent of pass-through. The pass-through outcomes outlined in this section are considered to be *standard* as they are the indisputable predictions of the (published) theoretical pass-through studies which currently exist in the literature.

The comparative statics of this and later sections are undertaken for a particular industry which is open to (unrestricted) trade opportunities. This will give us insight into factors which not only explain pass-through at the industry level, but, generalising further, will also provide information about an economy's aggregate pass-through.

Suppose we have a situation in which a tradable good (m) is produced in a single nation F (for foreign), and this good is sold to consumers in both F and country D (for domestic). Let us set up the following simple market setting for good m, (suppressing exogenous determinants of demand and supply):

$$(1)\ Q^s = Q^s(P_F) \text{ — market supply}$$

$$(2)\ Q^d = Q^d(P_D, P_F) \text{ — market demand,}$$

where Q^s is the quantity supplied to market by foreign suppliers, P_F is the foreign currency price received by foreign suppliers, and Q^d is the market demand for m which is a function of the D-currency and F-currency price of m, (P_D and P_F respectively).

We assume a competitive world m-industry for expositional simplicity.[1] The market supply function is, therefore, the horizontal summation of the marginal cost functions of price-taking firms in country F. The market demand function is the aggregation of the marshallian demand curves derived from the utility maximisation problems of consumers in F and D.[2] The

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1 This assumption is necessary if we are to suppress the complications associated with inter-firm rivalry which is relevant for describing pass-through at the firm level, a lower level of aggregation, but not for a general exposition at the industry level. In addition, it avoids the unnecessary burden of endogenising the currency denomination of trade contracts which, if introduced here, would mask the issues of most concern in this paper. For further insight into these issues, however, consult Mann (1989) or Webber (1993).

2 A more specific case of the market demand function is the

utility functions of such consumers are assumed to be strictly quasi-concave, with interior solutions, so that each consumer's demand function represents a unique solution, and that solution maximises utility. Market demand is a function of both the D-currency and F-currency price of m since both D and F consumers pay for m in their respective currencies. We assume m to be a normal good, that is, $\partial Q^d / \partial P_i < 0$ (for i = D and F).

Assume that contracts describing trade in m are denominated in F's currency.[3] It follows that the domestic currency price of m is given by:

$$(3)\ P_D = E_F.P_F,$$

where E_F is the bilateral exchange rate between D and F. Totally differentiating the market equilibrium condition gives:

$$(4)\ (\partial Q^s / \partial P_F)dP_F = (\partial Q^d / \partial P_D)dP_D.$$

From (3) the differential dP_D is given by:

$$(5)\ dP_D = E_F.dP_F + dE_F.P_F.$$

Combining (4) and (5) and re-arranging for $(dP_D/dE_F).(E_F/P_D)$

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horizontal summation of the demand curves of consumers in D and F; $Q_D^d(P_D) + Q_F^d(P_F)$. The problem with using such a demand specification, is that it is not useful in describing how far a shock to the domestic exchange rate shifts the market demand curve when the home country is large, compared to when it is small. In addition, it is unable to explain situations in which the foreign firms practise price discrmination, and it fails to accomodate for scenarios in which one consumer's utility is a function of the consumption choices of others, for instance, in the case of Veblen, bandwagon, and snob effects.

3 The currency which is used to denominate trade contracts is not important in evaluating the degree of pass-through in the large country case, but as we will show later, it is important when the importing country is small.

yields the degree of good m (bilateral) import pass-through between D and F (∂_F):

$$(6)\ \delta_F = [\epsilon_{sF} - \epsilon_{dF}]/[\epsilon_{sF} - \epsilon_{dF} - \epsilon_{dD}],$$

where $E_{dF} \equiv (\partial Q^d/\partial P_F).(P_F/Q)$ is the direct price elasticity of market demand with respect to the F-currency price, $E_{dD} \equiv (\partial Q^d/\partial P_D).(P_D/Q)$ is the direct price elasticity of market demand with respect to the D-currency price, and $E_{sF} \equiv (\partial Q^s/\partial P_F).(P_F/Q)$ is the price elasticity of country F's supply. The intuition associated with this large country result follows.

A depreciation in the domestic currency against the currency of F, that is, an increase in E_F, increases the domestic currency price of *m* (P_D) for a given foreign currency price, forcing the demand curve for m to shift down and to the left in P_F/Q space. The direction and magnitude of the change (if any) in the foreign currency market price, P_F, depends on the slope of the supply curve. If the supply curve is upward sloping, that is, the industry for m is an increasing cost industry, P_F falls at a slower rate than the depreciation, causing pass-through to be partial, ($\delta_F \in (0,1)$). Pass-through is complete, ($\delta_F = 1$), when the m-industry is characterised by constant marginal costs, in which case the supply curve is infinitely elastic, and hence P_F is fixed. A perfectly inelastic supply curve, in which case production is fixed, implies zero pass-through, ($\delta_F = 0$), since P_F declines at the same rate as the exchange rate depreciation. In the case of a downward sloping supply curve, which describes a decreasing cost industry, the degree of pass-through is perverse. The type of perverse pass-through depends on the relative slopes of the demand and supply curves. If the supply curve is steeper than the demand curve, then perverse pass-through occurs in the form $\delta_F \in [-\infty,0)$. This implies that P_F falls to a greater extent than the depreciation in D's currency against F's, thus causing the

domestic currency price to decline. If the demand curve is steeper than the supply curve, then P_F rises in response to a depreciation in E_F, implying perverse pass-through of the form $\partial_F \in (1,+\infty]$. In this case the domestic currency price rises at a faster rate than the currency depreciation.

Out of the above results the standard outcome for a large importing country is partial pass-through, implying that when the home currency depreciates part is absorbed by foreign exporters and part by domestic importers. The extent of the depreciation paid by exporters and importers depends on the elasticities of demand and supply, which is the standard 'depreciation incidence' conclusion. In contrast, let us now examine the limiting case of a small importing country. Such a country is characterised by an inability to significantly affect market demand by altering its consumption decisions.[4] More formally, this implies that the limit of (6) as $\epsilon_{dD} \rightarrow 0$ is $\delta_F = 1$, that is, a small country exhibits complete pass-through. This implies that a shock to the domestic exchange rate is completely passed-through into the home country's import prices. This follows from the fact that an adjustment in the domestic exchange rate alters domestic consumers demand only, which in turn has negligible effect on market demand and thus the foreign currency price. This result is independent of the shape of the industry supply curve and is the standard prediction of the current stock of theoretical pass-

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4 The currency denomination of trade contracts in this standard model now becomes important. If importing consumers pay in F's currency, then the literature predicts that D's pass-through will be complete, but if D pays in its own currency then pass-through will be zero. The currency denomination of trade contracts literature has provided substantial evidence showing that in the case of a large economy exporting to a small economy, the currency which is used to denominate trade contracts is that of the exporting country. See Grassman (1973), Magee (1973), Baron (1978), Bilson, (1983), Cornell (1980), and Reagan and Stulz (1989).

through models.

We show in the following section four scenarios which invalidate this standard small country result.

III. WHY SMALL COUNTRY PASS-THROUGH MAY NOT BE UNITY

Case 1. Producers of Import Substitutes

Suppose in the importing country (D) there exists competitive producers of a substitute for the import, and when grouped together, these producers are able to make enough of the good to affect the world market price by altering their output decisions.[5] We maintain the assumption that D is small. In this case the market supply curve has a foreign (Q_F^s) and a domestic (Q_D^s) component, with the domestic supply curve being the horizontal summation of the marginal cost functions of the domestic firms. The new equilibrium condition is:

$$(7)\ Q_F^s(P_F) + Q_D^s(P_D) = Q^d(P_D, P_F).$$

Totally differentiating and re-arranging (7) gives the following expression for import pass-through:

$$(8)\ \delta_F = [\epsilon_{sF} - \epsilon_{dF}]/[\epsilon_{sF} - \epsilon_{dF} - \epsilon_{dD} + \epsilon_{sD}],$$

where ϵ_{sD} (> 0 in the standard case) is the price elasticity of domestic supply. Clearly, this pass-through expression deviates from the (standard) unity case in the limit as $D_{dD} \rightarrow 0$, (implying

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5 In this case, country D is not small in the ordinary sense. Only demand is small. This may be justified by supposing that the small country allocates much of its resources to the production of a few goods, including good m, which it produces with a strong comparative advantage, thus enabling some price-making behaviour on the supply side.

a small country on the demand side), if the price elasticity of domestic supply differs from zero.

The intuition associated with this result is as follows. Suppose there is a depreciation in the domestic currency unit. This induces domestic consumers to demand less of *m* and domestic suppliers to supply more. The reduction in import demand has little impact on the market for *m* since the importing country is small, however, the increase in domestic supply forces a reduction in the foreign currency price as it causes the market supply curve to shift out and to the right in P_F/Q space. In the standard case, the exchange rate increases to a greater extent than P_F falls causing partial pass-through.

Case 2. Foreign Producers Employ Imported Inputs

Suppose now we return to the simple setting of no domestic supply of m. Let us assume that foreign producers use imported inputs in the production of m. In addition, assume that these producers pay for the inputs in a neutral currency (say, country J's currency). In this case the exchange rate of J enters the new market supply function (exogenously), and the equilibrium condition becomes:

$$(9)\ Q_F^s(P_F, E_J) = Q^d(P_D, P_F),$$

where E_J is the bilateral exchange rate between F and J, with an increase in E_J implying that F's currency is weaker against J's. In order to obtain a pass-through result for D which differs from unity in the limit, we require E_J to adjust at the same time as the domestic/foreign exchange rate, E_F. Is this possible? The answer is yes, since if we suppose, for instance, that D's exchange rate depreciates against F's and is unchanged against J's, then three-way exchange rate arbitrage implies that F's currency is stronger against that of country J. That is, an increase in E_F coincides with

a reduction in E_J.

The effect of an appreciation in E_J is a reduction in the F-currency cost of imported inputs. This in turn induces them to produce more of m, shifting the market supply curve to the right, causing a reduction in P_F. Analytically, pass-through between D and F in this case is defined as:

$$(10)\ \delta_F = [\epsilon_{sF} - \epsilon_{dF} + \epsilon_{sE}]/[\epsilon_{sF} - \epsilon_{dF} - \epsilon_{dD}],$$

where ϵ_{SE} (<0) is the elasticity of foreign supply with respect to an adjustment in J's exchange rate. Clearly, as long as this elasticity is non-zero then pass-through will be incomplete even as $\epsilon_{dD} \rightarrow 0$, contradicting the standard unity prediction.

Case 3. Another Supplying Country, or Another Demanding Country

1. The Market Price is Denominated in F's Currency

Suppose there exists some country U in which are firms who produce an identical version of m to that produced by firms in F. Assume suppliers in both F and U do not require imported inputs. We also assume that firms in U sell there good in the world market (to D and F) and receive in return price P_F (note this is denominated in F's currency). Each firm in U are assumed to be price-takers when taken individually, however, when grouped together are able to influence the world market price of m by varying their supply decisions. The market equilibrium condition becomes:

$$(11)\ Q^s_F(P_F) + Q^s_U(P_U) = Q^d(P_D, P_F),$$

where Q^s_U is the quantity supplied to market by producers in U, which is based on a supply function given by the horizontal summation of the marginal cost functions of the *m*-producing

firms in U, $P_U \equiv P_F.E_U$, and E_U is the U-currency price of a unit of F-currency. In the context of exports from country F to domestic country D, pass-through will not necessarily be complete when $\epsilon_{dD} \rightarrow 0$ due to changes in the U-country's supply of m. The extent of pass-through is given by:

$$(12)\ \delta_F = [\epsilon_{sF} - \epsilon_{dF}]/[\epsilon_{sF} - \epsilon_{dF} - \epsilon_{dD} + \epsilon_{sU}],$$

where ϵ_{sU} (> 0) is the U-country's price elasticity of supply. The intuition associated with this case is as follows. Analogous to the discussion in case 2 above, a depreciation in D's currency against F's may coincide with an appreciation in F's currency against U's. This causes the price received by U's producers to increase, which in turn induces them to produce more. The market responds to the greater supply by reducing P_F. Consumers in country D feel the relief of the lower price of m even though they are not directly involved in the cause of the price reduction. The result is, under standard assumptions, import pass-through between countries F and D which is less than unity.

A similar intuition coincides with a situation in which consumers of U import m from F. If U-consumers pay for F's product in the currency of F, it follows that a depreciation in U's currency against F's will reduce U-consumers demand for F's good. If U-consumers, when joined together, are able to affect the market price by changing their consumption decisions, then the exchange rate adjustment causes a significant reduction in market demand, $(\delta Q^d/\delta P_U \neq 0)$, and a decline in the market price of good m. This decline in the market price is also felt by price-takers in small country D, thus the extent of pass-through between D and F is at most partial.

2. The Market Price is Denominated in U's Currency

Now, suppose F-consumers of U's product pay in the currency of

U. In this case, an appreciation in F's currency against U's causes an increase in the demand for U's product, shifting the market demand curve to the right implying a higher world price (under standard circumstances). This in turn implies a perverse pass-through result (in excess of unity) for country D, as the D-currency price of imports rises to a greater extent than the depreciation in E_J.[6]

The analytical confirmation of the above intuition is given as follows. The equilibrium condition for this new scenario is:

$$(13)\ Q^d(P_D, P_F \equiv P_U/E_U) = Q^s_F(P_F) + Q^s_U(P_U).$$

Totally differentiating and re-arranging gives the following expression for D-country pass-through:

$$(14)\ \delta_F = [\epsilon_{dF} - \epsilon_{sF} - 2\epsilon_{sU}]/[\epsilon_{dF} - \epsilon_{sF} - \epsilon_{sU} + \epsilon_{dD}],$$

which is in excess of unity as $\epsilon_{dD} \rightarrow 0$ since $\epsilon_{dF} < 0$, and ϵ_{sF}, $\epsilon_{sU} > 0$ are the signs expected under standard circumstances.

Case 4. Mixed Currency Denomination Of Contracts

Let us now suppose once again that D imports good *m* from both F and U, but now D pays for imports from U in U's currency and imports from F in F's currency. Thus, D finances its imports of good m in a mixture of currencies. We assume that the U-currency price, P_U, and the F-currency price, P_F, paid by country D, are fixed, which implies that changes in the D-currency price of m are due to pure valuation effects only, rather than a combination of

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6 Not only is pass-through in excess of unity a theoretical possibility, but it will be shown in the forthcoming tables that empirically it is not uncommon.

A similar scenario occurs if F-suppliers of *m* are paid in U's currency, in which case the market supply curve shifts to the left.

valuation and foreign price effects.[7] In this case country D's good *m* import price index is given by:

$$(15)\ P_D = \gamma_U.P_U.E_{U^*} + \gamma_F.P_F.E_F,$$

where P_D is the domestic currency price of m imports, γ_i is D's import share based on imports from country *i*, where, for instance, $\gamma_U \equiv Q_U/(Q_U+Q_F)$, and E_{U^*} is the bilateral exchange rate between countries D and U.[8] Typically, import price indexes are fixed weight, thus γ_U and γ_F are invariant with respect to exchange rate changes.

Let us now assume that D's currency depreciates against F's currency only, that is, $dE_F > 0$. In this case, exchange rate pass-through becomes:

$$(16)\ \delta_m \equiv [dP_D/dE_F].[E^*/P_D] = \gamma_F.P_F[\gamma_U E_{U^*} + \gamma_F E_F]/[\gamma_U P_U E_{U^*} + \gamma_F P_F E_F],$$

where $E^* \equiv [\gamma_U E_{U^*} + \gamma_F E_F]$ is country D's import share weighted exchange rate for good *m*.

From (16) it is clear that import pass-through is not necessarily complete. Indeed, D's pass-through is unambiguously complete only in the case where all contracts are denominated in country F's exchange rate, that is, $\gamma_F = 1$ and $\gamma_U = 0$. Thus, D's

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7 By valuation effect we refer to the change in P_D as a result of a change in the exchange rate only. For instance, for $P_D = P_F.E_F$, if P_F is fixed, $dP_D = P_F.dE_F$, where $P_F.dE_F$ is the valuation effect. If, in addition, P_F changes then the added pressure for P_D to change is referred to as the foreign price effect (or market adjustment effect). In the example above this is equal to $E_F.dP_F$.

For a more thorough discussion of this point see Webber (1993: Ch.2).

8 An alternative to such volume import share weights is value import share weights. For example, U's value import share weight would be $\gamma_U = V_U/(V_U+V_F)$, where V_i is the value of D's imports from country *i*.

import pass-through is incomplete by virtue of the fact that import contracts are denominated in a mixture of currencies. The intuition associated with this case is as follows. A depreciation in D's currency against F's causes an increase in the D-currency price of m imports for a given F-currency export price, P_F. However, the relationship between the increase in E_F and P_D is not proportionate by virtue of the fact that P_D now comprises of two weighted D-currency price terms, one of which does not respond to the exchange rate adjustment. Thus, the response by P_D to E_F is now governed by the weight γ_F, which is less than unity, hence the rate of change in P_D is less than the rate of change in E_F implying incomplete pass-through.

Now, let us assume that both E_F and E_{U^*} adjust. If we suppose that D's currency depreciates against both F's currency and U's currency, assuming $|dE_F| = |dE_{U^*}| \equiv dE$, then pass-through becomes:

$$(17)\ \delta_m = [\gamma_U P_U + \gamma_F P_F][\gamma_U E_{U^*} + \gamma_F P_F]/[\gamma_U P_U E_{U^*} + \gamma_F P_F E_F].$$

This pass-through result differs from the complete case for $\gamma_F \in (0,1)$ when $E_F \neq E_{U^*}$. The intuition associated with this case is as follows. If D's currency depreciates against both F's and U's currency, then complete pass-through will occur only when the D-currency price of imports from both U and F increase in the same proportion. The D-currency price of U imports is $P_U.E_{U^*}$ and of F imports is $P_F.E_F$, thus, since P_F and P_U are fixed, it follows that the rate of growth in $P_F.E_F$ is dE_F/E_F and of $P_U.E_{U^*}$ is dE_{U^*}/E_{U^*}. For complete pass-through we need $dE_{U^*}/E_{U^*} = dE_F/E_F$, but since $E_{U^*} \neq E_F$ it follows that the growth rates are not equal. This implies that the D-country's good m import pass-through is incomplete.

Pass-through (17) is also complete when contracts are denominated in one currency only, that is, $\gamma_U = 1$ or $\gamma_U = 1$, since the rate of change in the D-currency price index equals the rate of

change in the currency which is denominating trade contracts.[9]

If we examine both cases above more generally in the context of n (> 2) importing countries, then pass-through for $dE_i \neq 0$, $dE_j = 0\ \forall\ i \neq j$ becomes:

$$(18)\ \delta_m = \left\{[\Sigma_{j=1}^{n}\ \gamma_j E_j]\gamma_i P_i\right\} / \left\{\Sigma_{j=1}^{n}\ \gamma_j P_j E_j\right\},$$

which generally implies incomplete small country pass-through for country D for analogous reasons to (16) above. This result clearly equals unity, implying complete pass-through, when all contracts are denominated in the currency of the *i*th country ($\forall$ i=1,...,n).

For completeness, in the context of an equal-magnitude depreciation in D's currency against the currencies of all *n* countries, pass-through becomes:

$$(19)\ \delta_m = \left\{\Sigma_{j=1}^{n}\ \gamma_j E_j\right\}\left\{\Sigma_{j=1}^{n}\ \gamma_j P_j\right\} / \left\{\Sigma_{j=1}^{n}\ \gamma_j P_j E_j\right\},$$

which differs from unity due to analogous reasons to pass-through (17), with pass-through complete only when $E_1=E_2=.....=E_n$, or when any γ_i ($\forall$ i=1...*n*) equals unity, implying import contracts are denominated in just one currency.

In a comparison of (18) and (19) it is evident that, analogous to the relationship between (16) and (17), pass-through (19) exceeds (18) since it is affected by a greater number of exchange rates, each causing the D-currency import price index to increase. One of the general implications of this point is that small country

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9 If D's currency depreciates against F's currency but is stronger against U's currency, then the addition term in the first square bracket of (17) becomes a subtraction term.

It is clear in a comparison of (16) and (17) that pass-through (17) exceeds (16). This follows from the fact that (17) includes two bilateral exchange rates increasing (dE_{U^*} and $dE_F > 0$) while (16) includes just one ($dE_F > 0$), with both exchange rate changes increasing the domestic currency import price index.

pass-through associated with a good which is imported from many countries is likely to be higher than that for a good imported from fewer countries, ceteris paribus. This follows from the fact that the latter pass-through estimate is typically affected by movements in fewer bilateral exchange rates. This is only true if the importing country's currency moves in the same direction against the majority of its competitors currencies, and the home country pays for its imports in the currency of the exporter.

IV. IMPORT PASS-THROUGH ESTIMATES

In this section, we review the long run import pass-through results of empirical studies in the literature. This will enable us to provide evidence confirming or rejecting the point advanced in section III that small country pass-through is not necessarily complete. We will also be in a position to evaluate whether small country pass-through is significantly different to large country pass-through, which is a point of contention in section II. As an aside from the theoretical discussion, we also establish the effect on pass-through estimates of different degrees of aggregation and estimation technique.

Empirical studies of import pass-through generally differ in three aspects of their investigation: (i) the size of the countries they analyse, (ii) the estimation techniques employed, and (iii) the degree of aggregation. The tables below present a summary of this information for a selection of studies, while the appendix contains a more extensive briefing of the estimation techniques employed by the various studies.

In the presentation of the import pass-through estimates to follow, we assume that countries with populations less than 27 million in 1991 are considered relatively small.[10] This includes

10 This is obviously a rather crude way of distinquishing between 'large' and 'small' countries. The basic premise of this method is

Australia, Austria, Belgium, Botswana, Canada, Switzerland, Taiwan, Sweden, the Netherlands, and certain small LDCs. The remaining countries investigated by pass-through studies, the US, Japan, Korea, Germany, Italy, the UK, France, Indonesia and the Philippines are considered large economies for the purpose of this paper. Most studies employ quarterly data, with exceptions noted. Studies which do not report diagnostics are highlighted.

Table 1 presents the long-run import pass-through estimates for the small countries mentioned above. The average pass-through is taken for studies which examine pass-through at the disaggregate (industry) level. Disaggregated studies are denoted by D and aggregate studies by A, while estimation techniques are numbered 1 through to 6 consistent with the labelling practice used in the appendix.

In the small country results, we find that pass-through is complete in only three (14.3 per cent of) cases; for Botswana, Sweden and Austria; 38 per cent indicate pass-through between 75 per cent and 100 per cent, and 57 per cent of studies show pass-through between 0 per cent and 75 per cent. Clearly, this is strong evidence supporting the position that small country import pass-through is not necessarily complete, which is consistent with the theoretical evidence presented in section III. Indeed, the results in Table 1 indicate that small country pass-through is 74 per cent on average, which is 26 per cent less than the predictions of the theoretical studies which form the status quo.

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that countries with relatively small populations will exhibit insignificant import demand due to the fact that they have fewer consumers. One of the notable controversial countries included in the small country category is Canada, however, as we will show, if we were to include Canada in the large country group this would further support the theoretical evidence presented in section III.

Table 1. Small Importing Country Results

Paper	Long-Run Pass-Through	Importing Country	Estim-ation Technique	Aggreg-ation
BIE (1986)	0.75[a]	AUSTRALIA	1	D
BIE (1987)	0.96[a]	AUSTRALIA	1	D
	0.73[a]	TAIWAN	1	D
CLARK LEITH (1990)	1.00[b]	BOTSWANA	1	A
MENON (1992a)	0.73	AUSTRALIA	1	D
MENON (1992b)	0.80	AUSTRALIA	1	D
MORENO (1989)	0.74	TAIWAN	1	A
PHILLIPS (1989)	0.97[a]	AUSTRALIA	1	A
WEBBER (1989)	0.87	AUSTRALIA	1	A
KHOSLA & TERANISHI (1989)	0.96	SWEDEN	1	A
	0.22[c]	LDCs	1	A
WEBBER (1993)	0.11	AUSTRALIA	1	D
SPITAELLER (1980)	0.66	NETHERLANDS	1	A
	0.78[c]	LDCs	3	A
MARQUEZ (1991)	0.70	CANADA	4	A
KREINEN (1977)	0.90	CANADA	5	A
	0.90	BELGIUM	5	A
	1.00	AUSTRIA	5	A
	1.00	SWITZERLAND	5	A
BIE (1986)	0.22	AUSTRALIA	6	D
BIE (1987)	0.62	AUSTRALIA	6	D

a Insufficient diagnostics are provided in order to evaluate the appropriateness of the specification or the diagnostics reveal severe misspecification problems.

b Monthly data is used in these cases.

c This represents the average pass-through associated with a select group of small less developed countries.

One of the interesting features of the results is that the (8) studies which estimate pass-through at the industry level report

much smaller pass-through, equal to 63 per cent on average, than the (13) studies of pass-through at the aggregate level, which is on average 85 per cent. Perhaps a reason for this phenomena is that at the aggregate level there are a greater number of exporting countries, and thus more import contracts written-up in foreign currency. This implies that there are more bilateral exchange rates acting to influence pass-through at the aggregate level. Following from the pass-through information in equations (17) and (18), in which case (18) exceeds (17) since there is wider exchange rate volatility, then it follows in principle that this is one possible reason for aggregate pass-through exceeding disaggregate pass-through.

Another possible reason for the differential in pass-through caused by different levels of aggregation is that pass-through at the aggregate level not only depends on relative price elasticities, but, in addition, is affected by macroeconomic factors such as domestic and foreign capacity constraints, and the timing and expected magnitude of shocks to money and goods markets. Pass-through at the aggregate level is also influenced by (general equilibrium) feedback effects within and between industries. For instance, an exchange rate depreciation may increase import prices in an initial impact, but this may in turn increase factor costs and thus the price of import substitutes, hence increasing the demand for importables, again causing import prices to rise once more. If such feedback effects are not relevant in affecting pass-through at the industry level, then pass-through in aggregate will tend to be higher.[11] There is insufficient evidence to determine whether small country pass-through estimates are sensitive to estimation technique.

Table 2 presents analogous information for the pass-through

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11 For a more extensive discussion of the macroeconomic determinants of pass-through, see Dohner (1984), Aizenman (1989), Murphy (1989), Klein (1990), and Webber (1993: Ch.3).

Table 2. Large Importing Country Results

Paper	Long-Run Pass-Through	Importing Country	Estim-ation Technique	Aggreg-ation
ALTERMAN (1991)	0.49	US	1	D
ATHUKORALA (1991)	0.75	KOREA	1	D
CITRIN (1989)	1.00	US	1	A
FEENSTRA (1989)	0.83	US	1	D
FEINBURG (1986)	0.24	GERMANY	1	D
HELKIE & HOOPER (1988)	0.90[a]	US	1	A
HOOPER & MANN (1989)	0.68	US	1	A
KHOSLA				
& TERANISHI (1989)	0.87	US	1	A
	0.92	JAPAN	1	A
	0.27	PHILLIPINES	1	A
	0.17	INDONESIA	1	A
KHOSLA (1991)	0.43	JAPAN	1	D
KRUGMAN				
& BALDWIN (1987)	1.07	US	1	A
MANN (1989)	0.20	US	1	D
MASTROPASQUO				
& VONA (1988)	0.24[b]	US	1	A
MEADE (1991)	0.85	US	1	A
MOFFET (1989)	0.50	US	1	A
SPITAELLER (1980)	0.83	FRANCE	1	A
	0.73	GERMANY	1	A
	0.93	UK	1	A
	0.71	US	1	A
WOO (1984)	0.56	US	1	A
	0.60	US	2	A
ATHUKORALA				
& MENON (1993)	0.34	JAPAN	2	D

Paper	Long-Run Pass-Through	Importing Country	Estim-ation Technique	Aggreg-ation
FROOT				
& KLEMPERER (1989)	0.06[a]	US	3	A
OHNO (1989)	0.67[a]	US	4	A
	0.84[a]	JAPAN	4	A
MARQUEZ (1991)	0.83	GERMANY	4	A
	0.48	JAPAN	4	A
	0.23	UK	4	A
KREINEN (1977)	0.43	US	5	A
	0.60	GERMANY	5	A
	0.80	JAPAN	5	A
SHWARTZ & PEREZ (1974)	0.75	US	6	A

a Insufficient diagnostics are provided in order to evaluate the appropriateness of the specification or the diagnostics reveal severe misspecification problems.

b Monthly data is used in these cases.

c This represents the average pass-through associated with a select group of less developed countries.

studies of large economies. In only two (6 per cent) of cases is pass-through complete (or in excess of unity); 26 per cent of studies report pass-through in excess of 75 per cent but less than 100 per cent, 24 per cent indicate pass-through between 50 per cent and 75 per cent, and 38 per cent of observations find pass-through which is 50 per cent or less. Large country pass-through is found to be 61 per cent on average, which is 13 per cent less than the average small country pass-through. This average result confirms the predictions of section II, where it is shown that; (i) the standard large importing country result is partial pass-through, $\delta_F \in (0,1)$, and (ii) the large country has a greater

influence on import prices compared to small countries, thus allowing lower pass-through. Analogous to the small country results, we find that pass-through at the disaggregate level, equal to 47 per cent on average, (over 7 studies), is much lower than the average pass-through of 65 per cent found at the aggregate level (for 27 studies).

As an aside from the theoretical discussion, pooling of the small and large country pass-through estimates together reveals an average pass-through of 54 per cent. The (40) studies which analyse aggregate pass-through estimate that on average 71 per cent of exchange rate changes are passed-through to home currency prices, while disaggregate studies estimate a far lower pass-through elasticity of 54 per cent. The pooled estimates also reveal that the regression results (41 studies) estimate pass-through to be 67 per cent on average, whereas the control country approach (8 studies) estimates average pass-through to be much higher at 80 per cent. There is an insufficient number of studies involved with using the remaining 3 techniques to warrant a full comparison, however, the evidence does show tentatively that regression-type estimates, including single equation and system estimates, report lower pass-through than do other types of estimates, including survey and control country methods.

One of the possible reasons for the sensitivity of pass-through to estimation technique is that the regression method estimates pass-through using an import share-weighted exchange rate regressor, consisting of the weighted sum of a number of bilateral exchange rates. Alternatively, the control country estimates use only a single bilateral exchange rate in each pass-through estimate. Section III, case 4 indicated that in evaluating small country pass-through, by incorrectly using a single bilateral exchange rate rather than a weighted sum leads us to wrongly conclude that pass-through is complete. Table 1 shows that pass-through is 95 per cent on average for the control country

technique, which supports the view that perhaps this technique is overestimating the true pass-through by neglecting information on the movements in other important bilateral exchange rates. This overestimate tends to bias upward the non-regression estimates of pass-through in both the small and large country results.

In summary, the most important finding in our empirical results is that there is a wide dispersion of long run pass-through estimates, however, there is strong evidence to support the claim that small country pass-through is typically incomplete, both at the aggregate and disaggregate levels.

V. CONCLUSION

This paper has shown that proponents of the complete small country pass-through prediction are not entirely correct. It is indicated that this incorrect prediction will occur in theory if; (i) there exists domestic producers of import substitutes, which, when grouped together, are able to influence the world price of the tradable good, (ii) foreign producers import inputs into production and do not pay for those inputs in their own currency, (iii) a third large country exists which engages in overseas trade, or (iv) the home country imports from a number of countries, each employing their own currency in selling to the home market. The theoretical propositions are supported empirically by virtue of the fact that 85 per cent of studies reveal incomplete small country pass-through, with average pass-through equal to 74 per cent. This is only 13 per cent more than the 61 per cent average pass-through obtained in the studies of large countries, implying that pass-through in small economies is not overwhelmingly different to the incomplete pass-through witnessed in large economies. It was also shown tentatively that long run estimates of pass-through are sensitive to the level of aggregation employed by the studies, in addition to the estimation technique used.

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APPENDIX

A BRIEF SUMMARY OF ESTIMATION TECHNIQUES

Technique 1. Single Equation, Exogenous Exchange Rate

Generally, this class of specifications involves estimation of a single equation, employing domestic currency import or export prices as the dependent variable, and contemporaneous and lagged exogenous exchange rate terms as the independent variables. The models are differentiated by the additional regressors employed, which are determined by the hypothesis the investigator is testing, and the modelling of dynamics. The group of additional regressors typically includes foreign and domestic factor prices or costs, capacity utilisation (or some proxy thereof), and a measure of the volatility of the exchange rate.

Technique 2. Endogenous Exchange Rate And Costs

This class of empirical import pass-through studies relies on the work of Woo (1984), and Athukorala and Menon (1993). Generally, the Woo specification involves regressing the domestic currency price of imports on the domestic and foreign unit labour costs in manufacturing, and the foreign price of domestic currency. All of the regressors are deemed to be endogenous, consequently IV estimation is employed. The importing country is the US and the timeframe is 1975:2 to 1984:1.

Athukorala and Menon (1993) investigate export pass-through for disaggregated Japanese exports over the quarterly period 1980.1 to 1990.4. A two equation model is estimated which endogenises export prices and an index of Japanese production

costs. The exchange rate term employed in the analysis is exogenous, and is constructed as the currency-contract-weighted exchange rate.

Technique 3. Expected Exchange Rate Model

This empirical model is featured in Froot and Klemperer (1989). It postulates that the current period domestic currency price of imports depends on the contemporaneous exchange rate, and the expected future exchange rate. This allows the model to differentiate between expected temporary and permanent exchange rate changes.

Two proxies are employed for the expected exchange rate term. The first is survey data on the perceived direction of the exchange rate twelve months into the future, and the second involves the nominal interest differential between the domestic and foreign economy. The importing country is the US, and the timeframe involves pooled annual data over the period 1981 to 1986 for sixty-five industries.

Technique 4. Full Information System Estimates

There exists two papers in the literature using full information system estimates in order to analyse pass-through empirically; Ohno (1989), and Marquez (1991).

Ohno's specification is based on a system consisting of four structural equations which describe the export and domestic prices employed by a domestic and foreign country. The aggregate price level in each equation is explained by prices lagged one period, income, material prices, and the exchange rate. The home and foreign countries employed by Ohno are the US and Japan, and the timeframe is 1977:4 to 1983:3. Industry-specific estimates of import pass-through are provided, and these are

obtained through application of the iterative 3SLS.

Marquez (1991) uses the FIML estimator to estimate a system of four dynamic equations describing the US trade account. The four endogenous variables are aggregate export and import prices and volumes. The exchange rate, real income, and absorption are the exogenous variables employed. A system of equations is set up for the US's trade with each of the following countries; Canada, Germany, Japan, the United Kingdom, other industrial countries, OPEC, and non-OPEC developing countries. The quarterly timeframe employed is 1973:1 to 1984:4. Marquez uses expected forecasts errors to determine the reliability of pass-through estimates.

Technique 5. Control Country Approach

This approach is a result of work conducted by Kreinen (1977). The estimates are obtained in the context of the 1971 Smithsonian Agreement which involved a realignment of all major currencies.The most effective way of explaining this method is through the use of a hypothetical scenario. Suppose we use the US as an example, and examine the effects of the 1971 dollar devaluation on the dollar price of US imports. The control country method attempts to isolate the effects of the exchange rate adjustment on US import prices by identifying the factors, independent of the exchange rate, which caused the prices to change, and subtract this from the total price change. A 'control country' is employed in order to identify the 'other factors' causing US import prices to change.

The data Kreinen employs relates to exchange rate changes between 1970 and 1972. Eight countries are used in order to investigate import pass-through. They include the US, the Federal Republic of Germany, Japan, Canada, Belgium, Italy, Switzerland and Austria. Different control countries are utilised for each of

the above countries. In addition, a number of control countries are employed for each country in order to examine the sensitivity of import pass-through estimates to the use of different control countries.

Technique 6. Survey Data

Pass-through results are derived from survey evidence found in responses to questionaires and personal interviews. In Australia over the late 1970's and 1980's, the Bureau of industry economics conducted a survey of 83 importers and 109 import using and import competing manufacturers. Shwartz and Perez (1974) analysed survey data (collected in 1972) for US imports from France, Belgium, Italy, Japan and West Germany.

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