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IMPORT PROTECTION, CAPITAL FLOWS, AND REAL EXCHANGE RATE DYNAMICS

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This paper focuses on the effect of import protection on the response of the real exchange rate to capital flows. The central hypothesis is that barriers to imports blunt the expenditure and production shifting effects of changes in relative prices, and hence the ability of the real exchange rate to equilibrate the economy in response to international capital flows. Employing a cross-section approach, the study focuses on three broadly similar countries but with very different levels of protection: Argentina, Australia, and Canada. The empirical results are consistent with the central hypothesis.

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I. Introduction

This paper poses a connection between the level of protection of domestic

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industry and the impact of international capital flows on the real exchange rate. The central proposition, one sketched out in an earlier paper by Sjaastad (1991), is that protection renders expenditure and production shifting between traded and home (i.e., nontraded) goods less responsive to relative prices, and hence increases the variance of the real exchange rate relative to that of capital flows; this occurs because protection reduces the volume of trade and, perhaps, the margins of substitution between traded and home goods as well. The result is that the real exchange rate reacts more strongly to capital flows in highly protected economies than in those with liberal commercial policies.

While it is obvious that import protection generates an import-competing sector unable to cope with foreign competition, it also has been found that an important manifestation of high protection is a retardation of industrialized exports (Miranda, 1986) and, consequently, an inordinate dependence on natural-resource-based export activities such as agriculture and mining. These industries are often slow in their ability to expand and contract, at least in the short run. In addition, as tariff structures are rarely uniform, imports become concentrated in low-tariff items which, in highly protected economies, tend to be capital goods, raw materials, and intermediate goods essential to the functioning of the protected industrial sector. This pattern of trade exacerbates the difficulty of adjusting to international capital flows; moreover, if the real exchange rate is rendered inflexible upwards by rigidity of both wages and the exchange rate, the necessary adjustments come about in quantities rather than prices, leading to the classic "stop-go" economy.

This paper sets out to test these ideas. In particular, we attempt to identify the effect of protection on the response of the real exchange rate to international capital flows, the central hypothesis being that, other things equal, protection leads to greater variability of the real exchange rate.

The remainder of the paper is organized as follows. Section II presents a selective review of the existing literature, and Section III develops a simple model that highlights the impact of protection on the behavior of the real exchange rate. The empirical methodology and results are presented in Section IV, in which estimates of the elasticity of the real exchange rate with respect to capital flows are found to be strongly affected by notional levels of protection. Policy implications are briefly discussed in the final section.

II. A Selective Survey of Existing Literature

The role of the real exchange rate in macroeconomic adjustment has become prominent in recent research on open economies such as that of Edwards (1988). It is typically argued that stable real exchange rates at appropriate levels send the correct signals to economic agents and facilitate smooth adjustment of the balance of payments, thereby ensuring macroeconomic stability and increased welfare; as Mussa (1982) has pointed out, however, the variance of purchasing power parity (PPP) real exchange rates, defined as ep^*/p, where e is the nominal exchange rate and p and p^* are the domestic and foreign price levels, respectively, has increased sharply since fixed parities among the major currencies were abandoned in 1973. It also is frequently argued that persistent deviations from PPP are often due to misguided government policies that influence the allocation of spending between traded and home goods and services.

A. The Salter Effect

Since Salter's seminal 1959 paper, it is widely accepted that real exchange rates respond to international capital flows, which have accelerated in recent years, particularly so in the developing countries over the past decade. The response of the real exchange rate to capital flows, however, appears to differ across regions. Sachs (1981) analyzed the linkage between real exchange rates and the current accounts in OECD countries and found that over the 1970s many of the deficit countries experienced real exchange rate appreciation, while surplus countries (which included Japan and the United States) showed real depreciation. Schadler (1994) finds that capital flows into Thailand, Spain, Mexico, Egypt, Colombia and Chile during the late 1980s and early 1990s lead to real appreciations, while the IMF (1991), Calvo et al. (1993), and Khan and Reinhart (1995) find that, on average, the Latin American countries experienced larger real appreciations than did the Asian countries.

One prominent explanation for these differences is that the two regions do not attract the same kind of capital; direct foreign investment was more important in Asia than in Latin America. Companies investing in a new plant are likely to import the necessary equipment to run it; as the capital inflows are used to pay for those imports, the real exchange rate is unaffected. Others argue that the Asian economies channel foreign capital into investment, whereas Latin Americans tend to spend it on consumption. A third argument is that Latin American central banks have been less successful in sterilizing capital inflows by open market operations; the efficacy of sterilization is, however, open to question as at best it is effective only in the short run. It is the purpose of this paper to provide a fourth explanation for these differences; namely, that the greater is the degree of openness of an economy, the weaker will be the response of the real exchange rate to capital flows.

B. Liberalization and the Real Exchange Rate: The Sequencing Issue

The behavior of the real exchange rate is highly relevant to the design of liberalization policies and their effect on the balance of payments; Khan and Zahler (1983) provide a systematic analysis of the short run effects of liberalization on both the current and capital accounts. Central to that issue is the proper sequencing of the liberalization of trade and capital movements; in this context, the "Southern Cone" syndrome is relevant. That syndrome refers to the Argentine, Chilean, and Uruguayan liberalization cum stabilization policies in the late 1970s and early 1980s. While in full pursuit of ambitious liberalization programs, all three countries adopted exchange-rate-based stabilization plans involving minute, pre-announced, and diminishing rates of devaluation of their currencies against the U.S. dollar – the infamous tablitas. This policy mix succeeded only partially in reducing inflation (partly because the dollar itself was rapidly depreciating until mid-1980), but did result in large capital inflows in response to sustained interest rate differentials.

By the early 1980s all three Southern Cone countries had experienced substantial real appreciations, and all were confronting severe balance of payments crises as well as deep recession. Fernandez (1985) argued that capital inflows played a fundamental role in the short run dynamics of the Argentine real exchange rate, an argument that has been echoed by Corbo (1985) in the Chilean context and by Hanson and De Mello (1985) for the Uruguayan case. It is noteworthy, however, that despite the similarity of their exchange rate policies, real appreciations were far larger in Argentina and Uruguay than in Chile, which may be in part due to commercial policy; as Bruno (1985) pointed out, an important contrast between Chile, on the one hand, and Argentina and Uruguay on the other, was the high and growing degree of openness of the Chilean economy.[1]

The Southern Cone experiences have been widely analyzed by Bruno (1985), Harberger (1982), McKinnon (1982), and Sjaastad (1983), among others and, while that literature offers significant lessons for economic policy, little systematic analysis has established a precise link between the degree of openness of the economy and the quantitative response of the real exchange rate to international capital movements – the central theme of this paper. Although many might agree with McKinnon (1982) on the danger of removing capital controls in the face of heavy protection, as well as with Bruno's (1985) argument that "one important lesson (from the Southern Cone) for the sequencing of markets would seem to be placing the current account far ahead of the capital account in terms of timing" (p. 868), a definitive analytical underpinning for these views is not evident. Some believe that, because asset prices can adjust instantaneously while prices of goods and services adjust gradually, the real exchange rate impacts more quickly and strongly on the capital account than the current account. Others, such as Frenkel (1983) in his two-horse carriage analogy, argue that the capital account adjusts more rapidly than does the current account. Unfortunately, this proposition is not a scientific one as it cannot be refuted empirically; since current account deficits, as measured, are identical with capital account surpluses (apart from errors and omissions), it is impossible to observe any difference in speeds of adjustment of the two accounts.

The contribution of this study to the sequencing issue lies in the evidence that protection magnifies the reaction of real exchange rates to capital flows with the implication that unless prices, wages, and/or the exchange rate are highly flexible, free movement of capital in the face of heavy protection may be a recipe for macroeconomic instability. This argument should not be interpreted as support of capital controls, but rather as a rationale for the view

[1] According to Fernandez (1985), from 1978 to 1981 the Argentine real exchange rate fell by 34 per cent, and De Mello et al. (1985) calculate the decline in Uruguay at nearly 46 per cent, whereas Galvez and Tybout (1985) estimate the Chilean real appreciation to have been only 20 per cent in the same period.

that the dismantling of those controls be held in abeyance until trade liberalization is largely complete.

III. Capital Flows and the Real Exchange Rate

This section presents a skeletal model that illuminates the link between real exchange rates and capital flows, and also examines the ways in which import protection can exacerbate the variability of the real exchange rate. In view of the evidence that PPP real exchange rates are subject to substantial measurement error (Sjaastad 1998a, 1998b), the real exchange rate in this study is defined as a price index for internationally-traded goods relative to an index for nontraded (or home) goods rather than the PPP version thereof.

A. A Model of the Home-Goods Sector

The relationship between capital flows and the real exchange rate is based on equilibrium in the market for home goods. The economy has three types of goods and services: importables, exportables, and home goods, whose price indices are p_M, p_X, and p_H, respectively. Under an exchange rate rule, p_H is endogenous, and with a money supply rule, p_M and p_X are endogenous; in both cases, the endogenous price(s) induces the requisite expenditure and production shifting to accommodate a capital flow. The supply of home goods, depends upon the three prices and gross domestic product (GDP), designated by g. The demand for home goods, is a function of the same three prices, GDP corrected for the terms of trade, designated by y, and capital flows, indicated by k; $k > 0$ implies a capital inflow. The actual capital-flow variable is $k_g = k/g$.

Letting upper-case letters be the natural logarithms of lower-case letters, a local log-linear version of the model can be written as follows:

(1)

where $\varepsilon_{H,i} =$ / and $\eta_{H,i} =$ / for $i = H, M, X$; since the effect of the terms of trade on income is captured by Y, the $\eta_{H,i}$ elasticities involve only substitution effects. As both and are homogeneous of degree zero in the three prices, $\varepsilon_{H,H} + \varepsilon_{H,M} + \varepsilon_{H,X} = 0$, and $\eta_{H,H} + \eta_{H,M} + \eta_{H,X} = 0$. The parameter $\eta_{H,Y} =$ / $mps_{H,y} / aps_H$ is the ratio of marginal and average propensities to spend on home goods. As the parameter $\eta_{H,k}$ is the elasticity of with respect to $1 + k_g$, the ratio of expenditure to GDP, we have $\eta_{H,k} =$ / / $mps_{H,k}$ / in which $mps_{H,k} =$ and note that $\eta_{H,k}$ and $\eta_{H,Y}$ are not necessarily identical.

A local solution for P_H is the following:

$$P_H = constant + [\omega P_M + (1 - \omega) P_X] - \theta^* \ln(1 + k_g) - \gamma^* \ln(1 + TT) \tag{2}$$

in which $\omega = (\varepsilon_{H,M} - \eta_{H,M})/(\eta_{H,H} - \varepsilon_{H,H})$ is the "shift" parameter in the theory of the incidence of protection (see Sjaastad, 1980), $\theta^* = \eta_{H,k} / (\eta_{H,H} - \varepsilon_{H,H}) < 0$, and $\gamma^* = \varepsilon_{H,g} / (\eta_{H,H} - \varepsilon_{H,H})$. Since changes in y and g have similar effects on and those variables (and their parameters) were combined into a terms-of-trade variable TT, whose definition can be found in the Data Appendix.

From equation (2), $\omega = fP_H / fP_M = (fP_H / fP_T)(fP_T / fP_M)$, where P_T is a traded-goods price index. But the homogeneity postulate requires that $fP_H / fP_T = 1$, so it follows that P_T can satisfy that postulate if and only if $fP_T / fP_M = \omega$, a requirement that is met by defining P_T as $\omega P_M + (1 - \omega) P_X$. As the real exchange rate is defined (in natural logs) as $RER = P_T - P_H$, equation (2) is an implicit relationship between capital flows and the real exchange rate.[2] The explicit relationship can be written as:

$$RER = constant + \theta^* \ln(1 + k_g) - \gamma^* \ln(1 + TT) \tag{3}$$

where θ^* and γ^* are the elasticities of the real exchange rate with respect to the expenditure-output ratio and the income effects associated with changes

[2] With $PT = \omega P_M + (1 - \omega) P_X$, it follows that $fRER / fP_M = \omega - fP_H / fP_M = 0$ and $fRER / fP_X = (1 - \omega) - fP_H / fP_X = 0$, so the real exchange rate as defined in the text is invariant with respect to changes in P_M and P_X brought about by protectionist measures that do not involve first-order income effects. That property is not shared by PPP real exchange rates.

in the terms of trade, respectively. The effect of import protection on the magnitude of the parameter θ^* obviously is the focal point of the analysis.

B. Some Consequences of Protection

Import protection affects the magnitude of θ^* via a scale effect and perhaps also through a substitution effect. The scale effect arises because a protection-induced decline in the volume of trade magnifies the proportionate response of imports and exports to capital flows. When imports and exports are twenty-five to thirty per cent of GDP, a capital inflow of five percent of GDP can be accommodated with a relatively small increase in imports and/or a small reduction in exports. But when import protection has reduced the volume of imports and exports to, say, seven per cent of GDP, the required adjustments are relatively much larger. The scale effect is analogous to one of the sources of the recent external debt service problem in Argentina. While many commentators have pointed out that the Argentine external debt was not unduly large relative to her GDP, the fact that intense import protection in that country has severely contracted the volume of Argentine international trade with the result that, during 2001, interest payments on her external debt were equal to approximately fifty per cent of her export revenue.

Concerning the substitution effect, it is evident from casual observation that countries pursuing liberal trade policies have substantial domestic production of a rather broad set of importables and quite highly diversified exports, the outputs of which can readily expand or contract in response to changes in the real exchange rate. But the picture is very different in countries engaged in intense import substitution. In the first place, those countries typically adopt bi-modal tariff structures; protection granted to targeted industries usually is prohibitive (so the goods produced by those industries are no longer imported) while nontargeted imports face rather low tariffs.[3] As the number of targeted goods increases, the composition of imports undergoes a radical change; imports become concentrated in capital goods, raw materials, and intermediate goods, products that lack domestic substitutes

[3] For example, in 1975 the average tariff in Uruguay (a highly protectionist country) was 117 per cent, but tariff revenue was only ten per cent of the value of imports.

and which are used in roughly fixed proportions with value added in the protected industrial sector. In the limit, prohibitive tariffs are so pervasive that no domestically-produced goods are imported and no imported goods are produced domestically; in that case, any substitution between imports and home goods becomes limited to the final demand for the output of the protected industrial sector, thereby greatly weakening the expenditure and production-shifting effects induced by changes in the real exchange rate.

A similar phenomenon occurs in the export sector. Import protection is shifted onto the export sector in the form of an implicit export tax, the shifting being effected via increased costs (particularly wages) relative to output prices in the export sector (Sjaastad, 1980, Clements and Sjaastad, 1984). As protection grows, the implicit tax also increases and those export-oriented activities employing internally-mobile resources are the most vulnerable and the first to succumb (Miranda, 1986). When protection becomes intense, the only exports to survive are those in which sector-specific inputs (typically natural resources) account for a large part of total cost; those inputs have no alternative but to absorb the implicit tax. Sector-specific inputs are typically found in agriculture and mining, where supply elasticities are known to be low, at least in the short run. In many small countries (e.g., Chile and Australia), domestic demand for mineral products is minuscule relative to production, so the degree of substitution in consumption between those products and home goods is very small; in the case of agriculture, that substitution effect is limited as the demand for food products is price inelastic. Thus trade barriers also diminish substitution possibilities between home goods and exportables.

The nature of the scale and substitution effects can be illustrated further in the context of our model; one way involves transforming the denominator of the coefficient θ^*, $\eta_{H,H} - \varepsilon_{H,H}$, into cross elasticities. Differentiating the identity with respect to p_H, where m and x are the quantities of imports and exports, respectively, and holding k, p_M, and p_X constant results in: Setting this expression can be written in elasticity form as:

$$\eta_{H,H} - \varepsilon_{H,H} = \varepsilon_{X,H}\alpha_X - \eta_{M,H}\alpha_M \tag{4}$$

in which $\varepsilon_{X, H} = fX / fP_H < 0$ and $\eta_{M, H} = fM / fP_H > 0$ are the cross elasticities of export supply and import demand with respect to p_H, $\alpha_X = (xp_X) / (q_H p_H)$, and $\alpha_M = (mp_M) / (q_H p_H)$ are the ratios of exports and imports to expenditure on nontraded goods. Combining equation (4) with the definition of θ^* results in an alternative expression for that parameter:

$$\theta^* = \eta_{H, K} / (\varepsilon_{X, H} \alpha_X - \eta_{M, H} \alpha_M) \qquad (5)$$

The scale effect associated with import protection is quite evident as that protection diminishes both α_X and α_M, thereby increasing the magnitude of θ^*.[4] The substitution effect associated with import protection would be reflected in a smaller magnitude of the cross elasticities $\eta_{M, H}$ and $\varepsilon_{X, H}$. The strength of the substitution effect, however, is ambiguous. In the case of imports, for example, $\eta_{M, H} = (fm / fP_H) / m$, and import protection has a negative effect on both fm / fP_H and m. Accordingly, the nature of the effect on $\varepsilon_{X, H}$ and $\eta_{M, H}$ can be established only on the basis of empirical evidence. It is important to note that even if import protection were to have no effect on either $\varepsilon_{X, H}$ or $\eta_{M, H}$, it still can have a profound effect on $\eta_{H, H}$ and $\varepsilon_{H, H}$.

A second way to illustrate the scale and substitution effects is to derive the direct and indirect effects of a capital flow on the volume of imports. Holding p_M, p_X, GDP, and the terms of trade constant we have:

(6)

where $mps_{M, k}$ is the marginal propensity to spend on importables with respect to a capital inflow and $aps_M = (mp_M) / (g + k)$ is the import ratio. As was pointed out above, while import protection has an ambiguous effect on the

[4] Exports decline because import protection involves an implicit tax on exports; for evidence on that issue, see Sjaastad (1980), Clements and Sjaastad (1984).

elasticity $\eta_{M, H}$, it clearly reduces the import ratio, aps_M, and probably $mps_{M, k}$ as well, which reduces the right hand side of equation (6). While import protection may affect the magnitude of $d(mp_M) / dk$, the direction of that effect is unclear. Accordingly, there is a strong presumption that import protection must increase the magnitude of θ^* to offset the decline it induces in the magnitudes of both aps_M and $mps_{M, k}$.

IV. Empirical Methodology and Results

To test the central hypothesis of this paper one might specify θ^* as a function of a protection-level variable and estimate that relationship with time series data; that approach, however, is unpromising as efforts to quantity protection have met with meager success. The average (or median) tariff can be meaningless, as tariffs in highly protectionist countries tend to be either prohibitively high or quite low.[5] The ratio of tariff revenue to imports cannot distinguish between low and high levels of protection; moreover, neither measure can detect non-tariff barriers. In view of these difficulties, it was decided to determine if the magnitude of θ^* differs systematically across three small, broadly similar countries, Argentina, Australia, and Canada, all of which have abundant natural resource endowments but very different commercial policies. Canadian markets have been very open to international trade in recent decades while Australia reputedly has been one of the most protectionist of the OECD club. Argentina's aggressive protection of her industrial sector is legendary; indeed, the uniform tariff equivalent of the Argentine tariff structure in the in the decade of the 1970s has been estimated at 98 per cent.[6]

The summary data for the three countries in Table 1 indicate that the degree of "openness" (the ratio of exports plus imports to GDP) during 1978-92 is

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[5] Due to bi-modal tariff schedules, tariff revenue is often a very small fraction of the average (or median) tariff rate. As was noted earlier, in 1975 when Uruguay was a highly protectionist country, her average tariff was 117 per cent, but tariff revenue was only about ten per cent of imports.

[6] The uniform tariff equivalent is the uniform tariff that would result in the same volume of trade as does the actual tariff structure. The estimate of the uniform tariff equivalent for Argentina is from Sjaastad (1981).

Table 1. Summary Statistics for Three Small Economies: Period Averages, 1978-92

Country	Population (millions)	Real GDP (billions, 1985 U.S. dollars)	Openess (%)
Argentina	30.3	168.1	14.90
Australia	15.6	216.2	34.07
Canada	25.0	394.2	52.25

Source: Penn World Tables and World Bank STARS database.

highest for Canada and lowest for Argentina. Canada out traded Argentina by three and half times and Australia did so by more than two times. As Canada's GDP was more than twice that of Argentina, this ranking conflicts with the idea that trade is more important for a small economy than a larger one. While factors other than protection affect a country's trading activity, there can no doubt that at least part of the large but perverse differences in the trade volumes of these three countries arises from vastly differing degrees of import protection.

A. An Indirect Test

The first test of the proposition that import protection increases the magnitude of θ^* was an indirect one based on the response of imports to capital flows described in the previous section. To test that proposition, a discrete version of equation (6) was specified as follows:

$$\Delta(mp_M / g)_t = constant + \beta \Delta k_{g,t} + u_t \tag{7}$$

in which β corresponds to $d(mp_M) / dk$.

As θ^* is posited to be a function of the degree of import protection, the quarterly data samples for the three countries had to be chosen to reflect periods during which their commercial policies were quite stable. In the Argentine case, the sample begins with 1978:1 and ends with 1992:4, after which there was an attempt at trade liberalization in that country. In the case of Canada, the sample starts with 1971:1 and ends with 1994:3, prior to the implementation of NAFTA. For Australia, the sample period is 1977:3 to 1994:3. When estimates were made simultaneously for the three countries, the common sample period is that of Argentina. For details, see the Data Appendix.

Equation (7) was estimated simultaneously using quarterly data for the three countries by the RATS nonlinear system routine using White's (1980) robust standard error estimator (NSYS-ROB). As θ^* is posited to be a function both the relative volume of trade and its composition, the period was limited to 1978:1 to 1992:4 to avoid significant changes in commercial policy in any of the countries involved. The overall level of protection in those countries was quite stable from the middle to late 1970s to the early 1990s, but commercial policy in both Argentina and Australia became somewhat more liberal in the course of the 1990s. Descriptions and sources of the data appear in the Data Appendix.

The estimates of β in equation (7), summarized in panel A, Table 2, range from 0.44 to 0.51 and all three are highly significant.[7] While the largest estimate is for Canada, the estimates are not significantly different from one another as none of the equality restrictions, reported in panel B, Table 2, are rejected. When those restrictions are imposed, the estimate of β, reported in panel C, Table 2, is 0.46 with a t statistic of 11.82. These results could obtain only if the magnitude of the Argentine θ^* far exceeds that of both Australia and Canada.

These results can be used to illustrate the magnitude of the scale effect. From the definition of β, we can write $\theta^* = (mps_{M,k} - \beta) / (aps_M\, \eta_{M,H})$. Assuming that $mps_{M,k} = aps_M$, $\beta = 0.5$, and $\eta_{M,H} = 1$, then $\theta^* = 1 - 1/(2\, aps_M)$. If $aps_M = 1/3$, then $\theta^* = -0.5$; however, if the import ratio has been reduced to 1/12 by import protection (as in the case of Argentina), the magnitude of θ^* increases dramatically to -5.0**.**

B. Individual Country Estimates of Real Exchange Rate Elasticities

The second test of the effect of import protection on real exchange rate behavior involved estimation of equation (3). For this test, a proxy for the

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[7] In making the estimates of β, serial correlation in the residuals was reduced by allowing one lag on the dependent variable. The estimates reported in Table 2 are of the long run values of β.

Table 2. Simultaneous NSYS-ROB Estimates of Equation (7): Argentina, Australia and Canada, 1978:1-92:4

A. Unrestricted Estimates of β

Parameter	Estimate	t-statistic	P-value
β_{ARG}	0.4396	6.5959	0.0000
β_{AUS}	0.4495	5.2078	0.0000
β_{CAN}	0.5134	5.0455	0.0000

B. Chi-Square Equality Tests on Unrestricted Estimates of β

Restrictions	χ^2 Statistic	P-value
$\beta_{ARG} = \beta_{AUS}$	0.0062	0.9370
$\beta_{ARG} = \beta_{CAN}$	0.3726	0.5416
$\beta_{AUS} = \beta_{CAN}$	0.1787	0.6725
All three	0.3776	0.8279

C. Restricted Estimate of β

Parameter	Estimate	t-statistic	P-value
β	0.4567	11.8155	0.0000

D. Summary Statistics (Restricted Estimates)*

Country	R^2	SEE	D-W	Ljung-Box test	
				$Q_{(6)}$	P-value
Argentina	0.7268	0.0077	2.1703	1.6952	0.9455
Australia	0.6811	0.0067	1.9439	6.6733	0.3521
Canada	0.6198	0.0069	1.8541	5.5223	0.4788

Note: * The coefficients of determination were adjusted for degrees of freedom.

real exchange rate was developed, one that one that avoids the difficulties in constructing a home-goods price index, P_H. In short, that price index was replaced with the overall price level, $P = aps_H P_H + (1 - aps_H)P_i$. The resulting proxy for the real exchange rate, $RERP = P_T - P = aps_H RER$, differs from the real thing only by the factor of proportionality aps_H. With this alteration, equation (3) becomes:

$$RERP_t = constant + \theta \ln (1 + k_{g,\,t}) + \gamma \ln(1 + TT_t) + \upsilon_t \tag{8}$$

in which $\theta = asp_H\, \theta^*$ *and* $\gamma = asp_H\, \gamma^*$.

B.1. Sims Causality Tests

While the maintained hypothesis is that international capital flows "cause" the real exchange rate, it can be argued that a change in the real exchange can by itself induce an international capital flow. A spontaneous shift in demand away from traded towards nontraded goods, for example would increase the relative price of nontraded goods and might generate a current account surplus and hence a capital outflow, at least in the short run. Therefore, prior to estimating equation (8), the Sims procedure was used to test for causality.

The real exchange rate proxy, *RERP*, and the capital flow variable, $1 + k_g$, were pre-filtered to eliminate serial correlation. Six leads and lags on the independent variables were permitted in all cases, and the causality test was based on the joint significance of the leads.

The results of the Sims tests appear in Table 3. From panel A it is evident that the hypothesis that capital flows "cause" real exchange rates is not rejected for any country. Panel B, however, indicates that the reverse causality is rejected in every country.

B.2. Preliminary Estimates of Equation (8)

Since the real exchange rate may respond to capital flows and the terms of trade with lags, equation (8) was parameterized as follows:

$$A(L)RERP_t = constant + \Theta(L)\ln(1 + k_{g,t}) + \Gamma(L)\ln(1 + TT_t) + \nu_t \qquad (9)$$

where $A(L) =$ is a polynomial of degree M in positive powers of the lag operator L, and likewise for $\Theta(L)$, whose degree is N, and $\Gamma(L)$. The final effect on *RERP* of a permanent shock to k_g is defined as $\theta = \Theta(1)/A(1)$.

Table 3. **Sims Causality Tests: Argentina, Australia, and Canada**

A. Tests if Capital Flows Cause Real Exchange Rates

Country	$\chi^2_{(6)}$ Statistic	P-value
Argentina	27.9734	0.0001
Australia	17.9843	0.0063
Canada	26.9296	0.0001

B. Tests if Real Exchange Rates Cause Capital Flows

Country	$\chi^2_{(6)}$ Statistic	P-value
Argentina	3.8841	0.6924
Australia	10.7189	0.0975
Canada	9.7558	0.1353

Preliminary OLS estimates of equation (9), with lags added until the sums of the polynomial coefficients stabilized, indicated that the joint restriction $A(1) = \Theta(1) = 0$ could not be rejected for any of the three countries; as a result, $\Theta(1)/A(1)$, the estimator of θ, is indeterminate. To deal with that problem, $A(L)$ was replaced with the identity $A(L) = (1 - L)\tilde{A}(L) + L^M A(1)$, and similarly for $\Theta(L)$; the degrees of the new polynomials $\tilde{A}(L)$ and $\Theta(L)$ are M-1 and N-1, and the k^{th} coefficient of $\tilde{A}(L)$, for example, is With $A(1)$ and $\Theta(1)$ restricted to zero, equation (9) becomes:

(10)

and the estimator of θ now is

In the preliminary tests, the restriction $A(L) = (1 - L)$ also could not be rejected for any of the three countries, which implies $\tilde{A}(L) = 1$ and $\theta =$ But since = = where is of degree N - 2, the final version of equation (8) is the following:

(11)

Estimates of θ based on equation (11), with lagged variables as instruments, were made for each country by OLS using Hansen's (1982) generalized method of moments (OLS-GMM).[8] As will be seen, the differences in the estimates of the θ*'s are* very substantial and consistent with the results reported in Table 2.

Argentina

The joint restrictions $A(1) = \Theta(1) = 1$ are not rejected (see panel A, Table 4); with those restrictions imposed, the OLS-GMM estimate of θ is -6.19 (see panel B, Table 4). That estimate is significant at the 0.00 per cent level, and is striking in economic terms: during the sample period a capital inflow of five per cent of Argentine GDP would inflate her CPI relative to traded-goods prices by more than thirty per cent!

Australia

The estimates for Australia were made in the same way as for Argentina, and are summarized in Table 4. With the zero-sum restrictions imposed on $A(1)$ and $\Theta(1)$, the standard error of estimate is only 2.2 per cent, and the OLS-GMM direct estimate of θ, -2.10, is significant at the 0.00 per cent level and is about one-third the magnitude of the corresponding estimate for Argentina.

[8] In none of the three cases were the estimates of θ sensitive to variations of plus and minus 0.2 in the value of ω used to construct P_T.

Table 4. OLS-GMM Estimates of Real Exchange Rate Elasticities (Equation 11)

A. Chi-Square Tests on Joint Restrictions

Country	Restrictions	$\chi^2_{(2)}$ Statistic	P-value
Argentina	A(1) = Θ(1) = 0	1.3909	0.4988
Australia	A(1) = Θ(1) = 0	0.5887	0.7450
Canada	A(1) = Θ(1) = 0	0.7548	0.6857

B. Restricted Elasticity Estimates

Country	Parameter	Estimate	t-statistic	P-value
Argentina	Θ	-6.1914	-20.7895	0.0000
Australia	Θ	-2.0996	-7.7314	0.0000
Canada	Θ	-0.6605	-2.7427	0.0061

C. Summary Statistics*

Country	R^2	SEE	D-W	Ljung-Box test	
				$Q_{(8)}$	P-value
Argentina	0.8737	0.1205	1.8688	5.6328	0.6883
Australia	0.9670	0.0219	1.5905	5.4219	0.7117
Canada	0.9679	0.0280	2.0873	6.3998	0.6025

Note: * The coefficients of determination were calculated on the basis of the variance of *RERP* and adjusted for degrees of freedom.

Canada

In the Canadian case the estimate of θ was made in the same way as for Argentina and Australia and the results appear in Table 4. With the $A(1)$ and $\Theta(1)$ zero-sum restrictions imposed, the estimate of θ is very small (one third that of Australia and about one tenth that of Argentina) but is significant at less than the one per cent level. Due to Canada's liberal commercial policy, capital flows are accommodated with very modest adjustments to her real exchange rate.[9]

B.3. Simultaneous Cross-Country Estimates

To test the significance of the differences in the estimates, the *θ's* were estimated simultaneously for all three countries by NSYS-ROB; the results appear in Table 5. The estimates for Australia and Canada differ somewhat from those reported in Table 4, but in view of the standard errors; the two sets of estimates are not inconsistent. While the estimate of θ for Canada is positive, it does not differ significantly from the estimate reported in Table 4. Tests on cross-country equality restrictions on the θ parameter are summarized in panel B, Table 5; all restrictions can be rejected at well below the one per cent level, which lends further support to the central hypothesis of this study.

C. Further Tests on the Argentine Case

In April 1991 Argentina drastically reformed both her exchange rate and monetary régimes. The peso was fixed against the U.S. dollar and became convertible, thereby eliminating all capital controls. Nonetheless, peso interest rates converged only slowly to dollar rates, which resulted in a large capital

[9] Referring back to the discussion in Section III.B, the point estimates of θ indicate that the substitution effect may also influence the impact of import protection on the behavior of the real exchange rate. Given the elasticities in equation (5), the magnitude of θ^* varies inversely with the "openness" ratio. That inverse for Argentina is 3.51 times that of Canada whereas the estimate of θ_{ARG} is 9.37 times θ_{CAN}, and the inverse for Australia is 1.53 times that of Canada, while the estimate of θ_{AUS} is 3.18 times θ_{CAN}, which appears to leave considerable room for the influence of the substitution effect. But as $\theta_i / \theta_j = (aps_{H,i} / aps_{H,j})$ the ratios θ_i / θ_j and may not be identical, so the differences between the ratios of the inverses of the openness ratios and θ_i / θ_j ratios may be due to the possibility that protection increases the average propensity to spend on home goods. But as the Argentine propensity can hardly be triple that of Canada, nor can the Australian propensity be double that of Canada, import protection must reduce the scope forsubstitution between home and traded goods.

Table 5. Simultaneous NSYS-ROB Real Exchange Rate Elasticity Estimates (Equation 11): Argentina, Australia and Canada, 1978:1-92:4

A. Simultaneous Elasticity Estimates

Parameter	Estimate	t-statistic	P-value
θ_{ARG}	-6.1183	-3.8694	0.0001
θ_{AUS}	-1.7389	-2.5620	0.0104
θ_{CAN}	0.3634	0.6211	0.5346

B. Chi-Square Equality Tests on Elasticities

Restrictions	χ^2 Statistic	P-value
$\theta_{ARG} = \theta_{AUS}$	7.9587	0.0048
$\theta_{ARG} = \theta_{CAN}$	11.6239	0.0007
$\theta_{AUS} = \theta_{CAN}$	7.1551	0.0075
All three	12.1893	0.0023

C. Summary Statistics*

Country	R^2	SEE	D-W	Ljung-Box test	
				$Q_{(8)}$	P-value
Argentina	0.9018	0.1056	1.8736	4.7711	0.7817
Australia	0.9582	0.0198	1.6281	4.8060	0.7781
Canada	0.9941	0.0119	1.4767	9.6346	0.2916

Note: * See note in Table 4.

inflow, much of which is thought to be repatriation of foreign assets — the “Miami” dollars — by Argentine residents. The inflation moderated sharply but did not cease; from 1991:1 to 1993:1, consumer prices rose by 66 per cent, while the wholesale price index, which is heavily weighted with traded goods, rose by only 18 per cent. The Argentine post-reform inflation, which often has been attributed to inertia, clearly was concentrated in the home goods and services sector. Due to these developments, the Argentine case merits further analysis.

The degree to which the Argentine inflation following the régime change was due to large capital inflows was examined by analyzing the residuals (corrected to have a zero mean) of the OLS-GMM estimate of equation (11). Those residuals were regressed on dummy variables defined for each quarter of the 1990:1-92:4 period; the dummy variables were set to unity for the quarter in question and zero for all others, and their coefficients (which are the exact residuals for the quarters in question) and standard errors were estimated by OLS with a separate run for each quarter. The results, which appear in Table 6, indicate that the model performs even better after the régime change than before; the average residual was 11.67 per cent in the five quarters preceding the régime change versus 3.93 per cent for the seven quarters

Table 6. Real Exchange Rate Equation Residuals: Argentina, 1990:1-92:4*

Final quarter	k_g (%)	Residual	Standard error	t-statistic	P-value
1990:1	-3.85	-0.1892	0.1082	-1.7491	0.0860
1990:2	-6.25	-0.2160	0.1072	-2.0144	0.0490
1990:3	-2.62	-0.0455	0.1110	-0.4099	0.6835
1990:4	0.33	-0.1058	0.1103	-0.9597	0.3415
1991:1	-2.81	-0.0268	0.1111	-0.2415	0.8101
1991:2	-0.96	0.0149	0.1112	0.1340	0.8939
1991:3	3.01	0.0655	0.1108	0.5912	0.5568
1991:4	4.71	0.1315	0.1097	1.1984	0.2360
1992:1	2.92	-0.0191	0.1112	-0.1722	0.8640
1992:2	5.18	0.0063	0.1112	0.0565	0.9551
1992:3	5.38	-0.0197	0.1112	-0.1771	0.8601
1992:4	5.06	0.0180	0.1112	0.1619	0.8720

Note: * Based on the estimate of equation 11 for Argentina, summarized in Table 4.

beginning with 1991:2. Moreover, after the change in régime, only one residual exceeded ten per cent and none were significantly different from zero. Indeed, in 1992, despite a capital inflow of nearly five per cent of GDP, the residuals were very small. Finally, while it might appear that negative forecast errors are associated with capital outflows, that association is very weak, as only one of the twelve residuals is significant at the five per cent level. These results support the position that the Argentine post-reform inflation resulted from capital inflows rather than sheer inertia.

IV. Summary and Conclusions

This paper has analyzed the impact of import protection on the reaction of the real exchange rate to international capital flows. The maintained hypothesis is that import protection reduces the quantitative response of demand and production to changes in the real exchange rate. The empirical results strongly support that hypothesis. The evidence from three small countries, Argentina, Australia, and Canada, indicates that during the period from the late 1970s to the early 1990s the response of the real exchange rate to capital flows was extremely large for Argentina (highly protectionist by any standard), quite substantial for Australia (highly protectionist by OECD standards) but negligible for Canada (a relatively free trading country). Indeed, the point estimates reported in Table 4 indicate that a capital inflow of five per cent of GDP would increase the Argentine price level relative to the price of traded goods by 31 per cent, versus ten cent in Australia and only three per cent in Canada. Moreover, the responses in all three countries differed significantly at less than the one per cent level.

When neither the exchange rate nor the nominal wage is flexible, capital flows can result in severe macroeconomic instability; the Argentine situation of 1995-96 is a case in point. Owing to the Mexican crisis of late 1994, the capital flow into Argentina reversed but, as the Argentine exchange rate was fixed and the labor market exhibited little downward flexibility in nominal wages, the real exchange rate mechanism could not come into play and the result was a singular increase in unemployment.These results also provide an insight into the issue of the sequencing of liberalization in developing countries that was discussed in Section I. Eliminating capital controls prior to liberalizing trade will sooner or later lead to capital flows, and since protection magnifies the response of the real exchange rate to capital flows, those flows will require large adjustments in the relative price of home goods and wages. Although it is hard to make a convincing case that capital movements are inherently bad, the results of this study indicate that when a country imposes heavy restrictions on current account transactions, it will do well to impose restrictions on capital account transactions as well, a proposition that conforms to the general theory of the second best. Although relaxing restrictions on international flows of both capital and goods is widely viewed as desirable, this study suggests that capital controls should not be dismantled until the commercial account has been substantially opened.

Data Appendix

All data were quarterly for periods ranging from the 1970s to the early 1990s. Augmented Dickey-Fuller unit-root tests (not reported but available upon request) on the relevant variables for all three countries (with a trend for variables when in level form) showed that, with four lags, unit roots were rejected for all variables at the three per cent level and, when the variables were first differenced, unit roots were rejected for all variables at the one per cent level for all lags.

In all cases k_g was defined as a fraction of GDP. As a GDP deflator was unavailable for Argentina, the proxy for the real exchange rate was defined on the consumer price index, p_C, in all cases. The P_T variable was defined as a weighted average of P_M and P_X using the ω parameter as defined earlier.

The exact form of the final term in equation (2), which was represented by $\gamma^* \ln(1 + TT_t)$, is $(\eta_{H,Y} Y_t - \varepsilon_{H,G} G_t) / (\varepsilon_{H,H} - \eta_{H,H})$. By definition, $y_t = g_t(1 + TT_t)$, where TT_t is a first approximation of the terms-of-trade income effect as a fraction of real GDP and defined as TT_t … in which a * superscript indicates that the variable has been deflated by p_c. In the case of exports,

and similarly for imports, so

Combining $Y_t = G_t + \ln(1 + TT_t)$ with the numerator of the exact form of the final term in equation (2) yields $\eta_{H,Y} Y_t - \varepsilon_{H,G} G_t = (\eta_{H,Y} - \varepsilon_{H,G}) G_t + \eta_{H,Y} \ln(1 + TT_t)$.

As variations in y and g have similar effects on and respectively, the elasticities $\eta_{H, Y}$ and $\varepsilon_{H, G}$ are both positive and similar in magnitude, the term $(\eta_{H, Y} - \varepsilon_{H, G})G_t$ was ignored and hence $\gamma^* = \eta_{H, Y} / (\varepsilon_{H, H} - \eta_{H, H})$.

Argentina

Most Argentine data are from the FIEL database. The export and import price variables are the wholesale price index for agricultural products, which are Argentina's main export, and the wholesale import price index, respectively. The value of ω, 0.48, for constructing P_T is from Sjaastad (1981). Because of problems with the Argentine balance of payments data, net factor payments abroad were excluded from the capital-flow measure in the Argentine case. Those payments were excluded because, during the period in question, Argentina had a large (gross) external debt, but her private-sector foreign assets were smaller but of a similar order of magnitude. While service of the largely official external debt does appear in the service account of the Argentine balance of payments, it is widely believed that the earnings on privately-held foreign assets do not because those earnings were largely unrepatriated, and no imputation was made to the balance of payments for those earnings. Since the factor service account of the Argentine balance of payments grossly overstates actual net service of external debt during the sample period, capital flows in the Argentine case were defined as the deficit in merchandise and non-factor service trade.

Australia and Canada

Australian and Canadian data are from TIME SERIES DATA EXPRESS (EconData Pty Ltd of Australia). Import and export prices indices are identified in the database as IMPIPI and EXPIPI, respectively. For both countries, the capital flow variable was defined as the deficit in the goods and services account of their balance of payments as a fraction of GDP. The values of ω, 0.60 for Australia and 0.76 for Canada, for constructing the traded-goods price indices were obtained from a study reported in Sjaastad (1998b).

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