Exchange Rates and the Trade Balance: Korean Experience 1970 to 1996

Peter Wilson [1]

The purpose of this paper is to examine the relationship between the real trade balance and the real exchange rate for bilateral trade in merchandise goods between Korea and both the USA and Japan on a quarterly basis over the period 1970 to 1996 using the partial reduced form model of Rose and Yellen (1989) derived from the two-country imperfect substitutes model. In line with recent work using a similar methodology, our findings suggest that when account is taken of the non-stationarity of the underlying data, the real exchange rate does not have a significant impact on the real bilateral trade balance with respect to the USA or Japan. Only when we ran the estimating equations in logs of levels using ordinary least squares did we find a significant relationship for Korean trade with the USA, supporting previous work by Han-Min Hsing and Savvides (1996). As far as the *J*-curve is concerned, we find no persuasive evidence of a *J*-curve effect at work. It is, however, possible that 'small country' effects are at work, whereby a tendency to price exports in foreign rather than domestic currency generates a rise in the domestic currency value of exports during the currency contract period which masks the initial rise in import values associated with *J*-curve behaviour, but there was no evidence that imports subsequently fell as the lag length increased, which would be required to support a strict interpretation of the *J*-curve.

Keywords: Trade balance, Exchange rate, *J*-curve

JEL Classification: F14, F31

*Associate Professor, Economics Department, National University of Singapore, Kent Ridge Crescent, Singapore 119260, Republic of Singapore, (Tel) +65-8743997, (Fax) +65-2344985, (E-mail) ecspeter@nus.edu.sg.
[**Seoul Journal of Economics** 2000, Vol. 13, No. 2]

I. Introduction

Although it is part of the folklore of economics, transmitted to generations of students, that a real currency depreciation tends to improve the real trade balance (or current account) in the long-run but that the response of the trade balance to a change in the real exchange rate follows a *J* tilted to the right, recent empirical work utilizing the non-structural partial reduced form approach of Rose and Yellen (1989), which models the real trade balance directly as a function of the real exchange rate and real home and foreign output variables, has found very little evidence of a reliable long run relationship between the real trade balance and the real exchange rate and no evidence at all for *J*-curve effects for bilateral trade flows between countries or in aggregate. See, for example, Rose and Yellen (1989) for the USA with respect to her other G7 partners and in aggregate; Rose (1991) for five OECD countries in aggregate and monthly; and Rose (1990) for 30 developing countries annually and 19 quarterly.

A key feature of these studies, compared to earlier work, is the application of a time-series econometric methodology which tests for unit roots and cointegration. Typically, unit roots are detected but no cointegration, so estimation proceeds with first differenced data. A variety of estimating techniques are used, including non-parametric estimation and simultaneous equation methods. The application of a batch of robustness tests has also generally failed to reverse these negative results.[1]

This debate is particularly relevant to Korea since one of the most important issues in policy discussions has been whether exchange rate policy since 1980 has been designed to stabilize the current account balance of payments to ensure sustained growth and export competitiveness, and whether such policy has generally been effective, despite changes in the foreign exchange regime, at least until the implementation of the more flexible market average

[1]A rare exception is Han-Min Hsing and Savvides (1996) who found some evidence of a *J*-curve for bilateral quarterly trade between Korea and the USA when a polynomial distributed Almon lag structure was imposed on the exchange rate coefficients with the model estimated in level form, even though pre-testing confirmed the presence of unit roots in the data. However, when a less restricted distributed lag structure is imposed and the data is differenced.

exchange rate (MAR) system in the 1990s.[2]

The purpose of this paper is to examine the relationship between the real trade balance and the real exchange rate for bilateral trade in merchandise goods for Korea to the USA and Japan on a quarterly basis over the period 1970 to 1996 using the partial reduced form model of Rose and Yellen (1989). The advantage of the bilateral approach is that it avoids the asymmetric response of trade flows to exchange rate changes across countries. Two specific questions are addressed:

1) Is the real exchange rate a significant determinant of the real bilateral trade balance?
2) Does the *J*-curve exist?

We begin in Sections II and III with some background on the relationship between trade and exchange rates for small open economies such as Korea, and also discuss the *J*-curve phenomenon. This is followed in Sections IV and V by the specification of a partial reduced form model and its transformation into an estimating equation. Preliminary tests are carried out to detect unit roots in the data and evidence of cointegrating relationships between the variables, and the estimating equation is then suitably transformed into a difference plus error correction formulation to convert the unit root variables into stationary processes. Estimation is carried out using instrumental variables to cater for possible simultaneity between the current values of the left and right hand side variables, especially between the real trade balance and the real exchange rate. Our empirical results are presented in Section VI where we also carry out some robustness checks. Our key findings are then summarized in the conclusion.

II. The Elasticities Approach and the '*J*' Curve Phenomenon

The rationale behind the *J*-curve is rooted in the 'elasticities' approach to balance of payments adjustment which focuses on the magnitude of the supply and demand price elasticities of exports and imports as depicted in the Bickerdike-Robinson-Metzler (BRM) imperfect substitutes model with the familiar Marshall-Lerner condi-

[2]For a good discussion of the evolution of exchange rate policy in South Korea and the effectiveness of central bank intervention, see Rhee and Song (1998).

tion as a special case.[3] The improvement of the trade balance in the long run is fundamental to the stabilization policies of the International Monetary Fund (IMF), including those enacted in the wake of the recent financial crises in Asia, even if devaluation/ depreciation is not in itself to be regarded as a panacea for restoring external competitiveness and the window of opportunity it opens may be short-lived.

The *J*-curve phenomenon has also been invoked to explain the persistence of the United States trade deficit following the fall in the US dollar from its peak in 1985. See, for example, Krugman and Baldwin (1987) and Krugman (1989). According to this perspective, whilst the US import and export price elasticities of demand are clearly significant and satisfy the Marshall-Lerner condition in the longer term (although they are not very far above unity), the substantial lags in the adjustment of both prices and quantities to exchange rate changes are seen as important contributing factors in the sluggish response of the US deficit.[4]

The related 'pass-through' literature was also stimulated by the apparent resilience of the trade balances of the major industrial countries to changes in their exchange rates and the fact that this could not be explained by 'elasticity pessimism'. The focus of the pass-through approach (see the survey by Menon (1995)) is on the complex relationships between exchange rate changes and the prices of internationally traded goods and the extent to which exchange rate changes are ultimately reflected in the destination currency prices of traded goods. Low pass-through would make it possible for trade flows to stay relatively insensitive to currency changes even if export and import demand is highly elastic over the short and long run. The presence of lags in the transmission of exchange rate changes to prices, together with subsequent lags in

[3]See, for example Goldstein and Khan (1985) and Argy (1994).

[4]The rapid improvement in the Mexican trade balance with the USA following the sharp depreciation of the peso against the dollar in December 1994 is also cited as another case of successful balance of payments adjustment. The absence of any obvious *J*-curve complications is explained by Krugman and Obsfeld (1997, pp. 470-1) in terms of the massive size of the devaluation, the financial crisis which accompanied the devaluation leaving no doubt that the change was permanent, so exporters and importers adjusted rapidly, the improvement in the trade balance brought about by a cut in domestic spending, and prior trade liberalization which made import and export volumes more sensitive to relative price changes.

the quantity response to these price changes, as suggested in the mainstream *J*-curve literature, could thus significantly impede overall balance of payments adjustment.

Prior to the non-structural partial reduced form approach of Rose and Yellen (1989), by and large, the empirical evidence amassed over the last three decades has supported the 'elasticity optimists' but also the existence of significant *J*-curve effects. Testing mostly revolved around variants of the two-country imperfect substitutes model to obtain the necessary estimates of the price elasticities using structural demand functions. See, for example, the survey by Goldstein and Khan (1985), Noland (1989) on Japan, and Bahmani-Oskooee (1985) for Greece, India, Korea and Thailand.

The *J*-curve describes the lag with which a real currency depreciation improves the real trade balance and can be rationalized in terms of a currency contract effect and/or insufficiently high short-run price elasticities of export and import demand which results in a sluggish response of trade values to changes in relative prices brought about by currency changes. The currency contract effect arises if import and export orders reflect decisions made in advance of the depreciation at the old exchange rate. If imports are invoiced in foreign currency and exports in domestic currency, prices will be sticky in sellers' currency so there will be an increase in the value of pre-contracted imports measured in domestic output terms, but the domestic value of exports remains unchanged. Only in the longer run when new contracts are signed will the volume of home imports fall and home exports rise sufficiently to improve the trade balance so that the effect of the depreciation is cumulatively positive.

The theoretical basis of the *J*-curve effect is the classical elasticities approach which is a partial equilibrium micro-oriented analysis focusing on the effects on import and export values of changes in relative prices brought about by changes in currencies, disregarding macro effects on variables such as wages, prices and economic activity (or implicitly assumes these effects to be neutralized by policy).[5]

Although there is no *a priori* reason why a currency devaluation/depreciation should have any particular effect on the trade balance,

[5]The partial equilibrium nature of the elasticities approach is discussed in Rose and Yellen (1989, p. 56) and Dornbusch (1975).

a set of necessary and sufficient conditions for an improvement can be derived from the two-country imperfect substitutes model (imports and exports are imperfect substitutes for domestic goods) in the form of the generalized Bickerdike-Robinson-Metzler (BRM) solution in which the outcome depends primarily on the relative elasticities of the demand and supply for imports and exports.[6] The real trade balance B will improve when the real exchange rate q, defined as the nominal exchange rate (domestic currency price of foreign exchange) multiplied by the ratio of an index of the prices of foreign produced goods to an index of the prices of domestically produced goods, increases if:

$$\frac{dB}{dq}=Dm^{*}\times rpx\frac{(1+Es)\times Ed^{*}}{Ed^{*}+Es}-q\times Dm\times rpx^{*}\frac{(1-Ed)\times Es^{*}}{Ed+Es^{*}}>0. \quad (1)$$

Where Dm (Dm^{*}) is the quantity of imports demanded by domestic (foreign) residents, rpx (rpx^{*}) is the relative price of exportables at home (and abroad), Ed (Ed^{*}) are the absolute price elasticities of demand for home (and foreign), and Es (Es^{*}) are the corresponding price elasticities of supply.

The sign of (1) is indeterminate but if trade is initially balanced ($B=0$) and Es and Es^{*} are infinite then this reduces to the familiar Marshall-Lerner condition that a real depreciation improves B so long as the sum of absolute Ed and Ed^{*} exceed unity.

The assumption of infinite supply elasticities implies that the foreign price of imports and the domestic price of exports are fixed. In this sense, the *J*-curve is plausible for advanced developed countries which invoice predominantly in sellers' currency, but is less so for more open economies such as Korea, which are more likely to be price-takers in international markets (cannot influence the foreign price of their imports since they are negligible buyers in foreign markets, but can sell any volume of exports abroad at a given foreign price) so changes in the real exchange rate have no perceptible effects on world prices and thus on the foreign currency prices of their exports and imports. Hence, if both imports and exports are predominantly invoiced in foreign currencies such as the US dollar the value of both rise during the currency contract period. In this case, both the foreign demand and supply elastic-

[6]See, for example, Argy (1994, Ch. 12).

ities will be infinite so the price of imports and exports in foreign currency will be constant. The condition for a depreciation to improve B becomes:

$$Es+Ed\frac{Dm\times q\times rpx^{*}}{Dm^{*}\times rpx}>\frac{Dm\times q\times rpx^{*}-Dm^{*}\times rpx}{Dm^{*}\times rpx}. \qquad (1)'$$

If there is trade balance initially:

$$Es+Ed>0.$$

In other words, the outcome of a currency depreciation is always positive for the trade balance, so there is no J-curve. The worst case scenario here is when both the elasticity of demand for imports and the elasticity of supply of exports are zero so $Ed=Es=0$, but even in this case the trade balance remains unchanged. This implies that the J-curve effect cannot occur for a small open economy that is initially in trade equilibrium.

If, however, there is a trade deficit (for example, Korea with respect to Japan) and the short-run supply and demand elasticities in the home country are sufficiently low, (1)′ will not hold and a J-curve effect may be observed.[7] Note that if there is a trade surplus (1)′ holds regardless of the values of the elasticities. In some cases such as Korean trade with the US, the bilateral trade balance has switched over time, so either outcome could be plausible.

Thus, whether the BRM condition holds in the long-run, so $dB/dq>0$, and 'perverse' J-curve effects are present in the short-run due to currency contract effects or low trade elasticities are ultimately empirical questions which can be tested with an appropriate model and econometric procedure. We shall also analyse export and import data separately to see if the failure to detect a J-curve in the short-run can be attributed to the small country assumption.

[7]The intuitive reason is that if $Es=Ed=0$, a 10 percent devaluation will increase the import bill in domestic currency by 10 percent and export receipts will also rise by the same amount. Since imports exceed exports initially, the absolute deficit increases. This may, however, be partly or more than offset by some import response and some export response.

III. The Trade Balance and Real Exchange Rate for Small Open Economies

Until March 1980 the won was pegged to the US$ according to a single currency peg (SCP) system established in 1964. Under this system, the Korean Government set the lower limit of the won exchange rate against the US$, but inflationary pressures caused by expansionary domestic monetary and fiscal policies, together with the two oil shocks, forced the authorities to devalue the won four times, the last one being in June 1980. The benefits of stability against the US$ were thus secured at the expense of frequent misalignments. In March 1980, therefore, the regime was changed to the multiple currency basket peg (MCBP) system, whereby the won per US$ rate was determined by a formula based on an IMF SDR basket (with the weights revised every five years) and an unpublished independent basket. The composition of the independent basket and relative weights between the two baskets were never disclosed so this allowed the Bank of Korea a substantial amount of discretion in the management of the currency, but at the same time there was political pressure from the USA to allow for a more market-based system, especially when Korea's trade surplus with the USA increased in the 1980s. Four consecutive years of current account surpluses between 1986 and 1989 provided the Korean authorities with an opportunity to liberalize the regime and in 1990 they introduced the current market average exchange rate (MAR) system. Under this regime the exchange rate of the won against the US$ is now determined by market forces in the interbank foreign exchange market (the Seoul Foreign Exchange Market) with the Bank of Korea confined to being one of the market participants. A band imposed to prevent excessive volatility in intra-day rates was successively widened and has rarely acted as a constraint on the movement of the exchange rate.

Figures 1 and 2 plot the real bilateral exchange rate between the Korean won and the US dollar, and the won and the Japanese yen, respectively, together with the equivalent real bilateral trade balances. A rise in the real exchange rate is interpreted here as a real depreciation, and *vice versa*. These variables are defined in Appendix as q and B and the scale is constructed to match means and

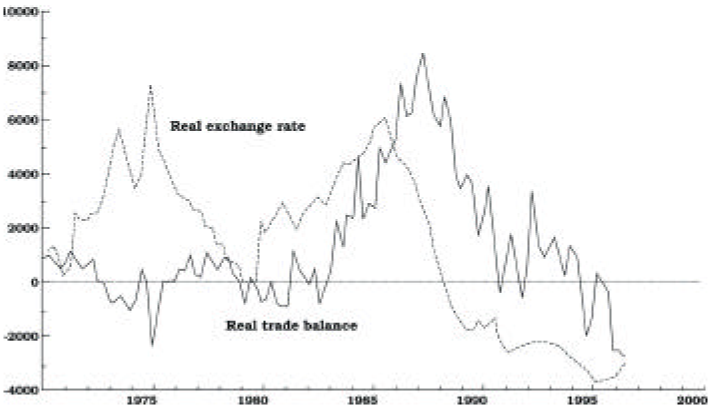

FIGURE 1

KOREAN BILATERAL REAL TRADE BALANCE
AND REAL EXCHANGE RATE WITH THE USA

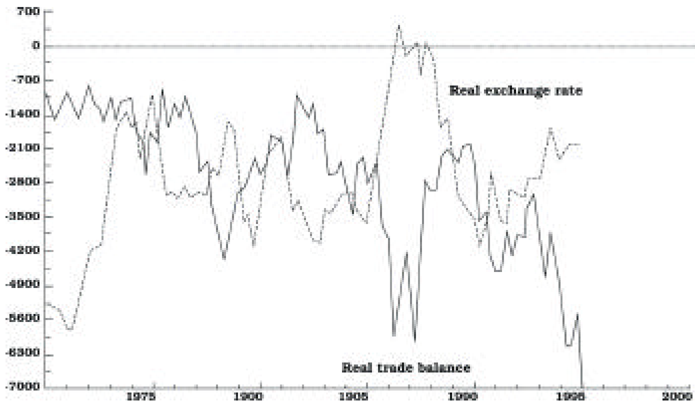

FIGURE 2

KOREAN BILATERAL REAL TRADE BALANCE
AND REAL EXCHANGE RATE WITH JAPAN

Table 1

Korean Exchange Rates and the Trade Balance 1970 to 1996

	1970-79	1980-89	1990-96
	Annual average percentage change		
Trade with the USA			
Nominal exchange rate	4.93	3.55	3.07
Real exchange rate	-0.46	-0.83	-1.12
Real merchandise exports	12.94	15.16	0.48
Trade with Japan			
Nominal exchange rate	9.66	9.24	10.97
Real exchange rate	2.22	1.37	3.08
Real merchandise exports	25.88	13.98	0.85

	Correlation with real exchange rate 1970-96 (in changes)
Trade with the USA	
Real exports	-0.02
Real trade balance	-0.15
Trade with Japan	
Real exports	0.22
Real trade balance	-0.14

Note: The exchange rate variables are defined as the nominal or real cost of a US dollar or Japanese yen measured in home country currency. All real variables are based on 1990=100.

Source: Appendix

ranges. Table 1 presents some corresponding summary descriptive statistics for the key trade and exchange rate variables.

The real exchange rate of the won against the US$ has appreciated over all three periods in terms of annual average percentage changes but there have been large swings in this rate, with periods of depreciation in the mid-1970s and in the first half of the 1980s, and periods of appreciation in the latter part of the 1970s and 1980s and between 1991 and 1995. The yen rate, on the other hand has tended to depreciate on average over the three periods, particularly in the second half of the 1970s and 1980s but has also exhibited sharp appreciations between 1981 and 1982 and 1989 and 1990.

The real trade balance has also been more volatile with respect to the USA than with Japan. For the USA there were deficits in the mid-1970s and in the first half of the 1980s and in the 1990s, but a surplus in the second part of the 1980s, largely due to the 'three blessings' of low oil prices, low world interest rates and low values of the US$ against the yen. The bilateral trade balance with Japan, however, was negative over the whole period, particularly from the mid-1980s onwards, a reflection of Korea's strong dependence on imports of capital goods and intermediate inputs, much of which were subsequently processed into exports. Annual average export growth was always positive over the three periods but less spectacular than for competitors such as Malaysia and Singapore in the 1990s as the older 'tiger' faced increasing competition from other emerging economies.

The simple correlation coefficients relating changes in exports and changes in the real trade balance to changes in real bilateral exchange rates are, however, either negative or weakly positive. The absence of strong positive coefficients linking real exports and the real trade balance to the real exchange rate is not uncommon in the exchange rate literature. Meese and Rogoff (1988), for example, found it very difficult to identify variables which exhibit a stable correlation with exchange rates. We test this relationship between the real exchange rate and the real trade balance more formally below by deriving a partial reduced form equation from the generalized elasticities approach.

IV. Model Specification

Our starting point is the two-country imperfect substitutes model[8] which assumes that imports and exports are imperfect substitutes for domestic goods. On the demand side we have the following Marshallian functions derived from the utility maximizing consumer using aggregated data and classifying the price variables into one category—the price of imports at home and abroad:

$$Dm = Dm(y,\ rpm) = a_1 y - a_2 rpm,$$
$$Dm^* = Dm^*(y^*,\ rpm^*) = a_1^* y^* - a_2^* rpm^*. \qquad (2)$$

[8]See, for example Goldstein and Khan (1985, pp. 1044-50) and Argy (1994, Ch. 12).

The quantity of imports demanded by domestic (foreign) residents depends positively on real domestic (foreign) income in domestic (foreign) output terms and negatively on the relative price of imported goods. For the home country this is *rpm* or the domestic price of imports measured in home currency (rpm^* is the corresponding relative price of imports abroad):

$$rpm = e \times \frac{px^*}{p} = e \times \frac{p^*}{p} \times \frac{px^*}{p^*} = q \times rpx^*, \tag{3}$$

where px^* is the foreign currency price of foreign exportables, e is the nominal exchange rate (the domestic currency price of foreign exchange), and p is an index of the prices of domestically produced goods.[9] So rpx^* is the relative price of exportables abroad (the foreign currency price of foreign exports, px^*, divided by an index of the prices of foreign produced goods, p^*), converted by the real exchange rate: $q = e \times p^*/p$.

Analogously, the relative price of imports abroad rpm^* is given by:

$$rpm^* = \frac{rpx}{q}, \tag{4}$$

where *rpx* is the price of exportables in domestic currency *px* divided by the domestic price level. On the supply side the quantity supplied of exportables depends positively on the relative price of exportables in each country:[10]

$$\begin{aligned} Sx &= Sx(rpx) = b_1 rpx, \\ Sx^* &= Sx^*(rpx^*) = b_1{}^* rpx^*. \end{aligned} \tag{5}$$

[9]There seems to be little consistency in the choice of deflators for home and foreign nominal magnitudes. Rose (1991) uses the consumer price index (CPI) for both, Rose and Yellen (1989) use the GNP deflator, and Han-Min Hsing and Savvides (1996) use the CPI for home but a wholesale price index (WPI) for foreign. To compare our findings for Korea with the latter study, we also used the CPI for home and WPI for foreign (see Appendix).

[10]Note this assumes perfect competition although Rose and Yellen (1989, p. 55) refer to the argument that many models of imperfect competition in supply also lead to the reduced form equation derived in this model.

Relative prices equilibrate supply and demand at home and abroad so:

$$Dm = Sx^*;\ Dm^* = Sx. \tag{6}$$

The real trade balance B, measured in terms of units of home output, is by definition the nominal value of exports minus imports in domestic currency deflated by the domestic price level:

$$B = rpx \times Dm^* - q \times rpx^* \times Dm. \tag{7}$$

B can now be expressed as a partial reduced form equation which depends only on q, y and y^* by solving structural equations (2) to (6) for the relative price ratios and quantities of domestic exports and imports and substituting these into (7):[11]

$$B = \frac{b_1(a_1^*)^2(y^*)^2q^2}{(a_2^* + b_1 \times q)^2} - \frac{b_1^*(a_1)^2(y)^2q}{(b_1^* + a_2 \times q)^2}, \tag{8}$$

which can be simplified to:

$$B = B(q,\ y,\ y^*). \tag{9}$$

We are interested here in whether a real depreciation will improve B if y and y^* are held constant, and whether the sign is negative in the short-run but positive in the long-run, thus producing the J-curve effect. In (8), B will improve if y^* increases or y falls but the effect of q given by dB/dq is ambiguous.[12]

[11]See Rose and Yellen (1989). The advantage of the partial reduced form approach is that it is easier than obtaining the structural form (volume and pass-through) parameters by estimating a set of structural supply and demand equations for exports and imports. Since the focus here is on the effects on the net trade balance, it is simpler to get the estimates directly from (9) and then test for the restriction of homogeneity of degree zero in p, p^* and e using one equation.

[12]The partial equilibrium nature of the model arises from the fact that the question being asked is whether a real depreciation improves B given that y and y^* are held constant. A full general equilibrium analysis would

According to the BRM condition above dB/dq will be positive if:

$$\frac{dB}{dq}=Dm^{*}\times rpx\frac{(1+Es)\times Ed^{*}}{Ed^{*}+Es}-q\times Dm\times rpx^{*}\frac{(1-Ed)\times Es^{*}}{Ed+Es^{*}}>0. \quad (10)$$

The special cases discussed in Section II above can then be derived from (10) by making appropriate assumptions about the trade balance and the magnitude of the elasticities Ed (Ed^*) and Es (Es^*).

V. The Econometric Model

In this section we formulate an empirical model to generate estimates of the coefficients of the contemporaneous and lagged values of q as a direct measure of dB/dq in (9) above.

We begin by specifying a log-linear[13] dynamic approximation to equation (9), and form a general autoregressive distributed lag (ADL) model for the real trade balance B_t conditional on the real exchange rate q, real income in domestic output terms y, and real income in foreign output terms y^*. Since the trade balance can take on both positive and negative values it was left in non-log form and a constant is added to allow for deterministic drift. Full details of the data sources and construction of the variables are relegated to Appendix.

$$B_t=\alpha_0+\sum\alpha_{1j}B_{t-j}+\sum\beta_{0i}q_{t-i}+\sum\beta_{1j}y_{t-j}+\sum\beta_{2j}y^{*}{}_{t-j}+\varepsilon_t, \quad (9)'$$

where $i=0$ to r with current and $r=8$ lags of q,
$j=0$ to s with current and $s=4$ lags on B, y and y^*,
ε_t=a well-behaved random error term, and
α_0=a constant term.

A priori we expect $\beta_1<0$ due to the inverse relationship between real domestic output and the real trade balance, and $\beta_2>0$ as an increase in foreign output improves B. The key parameter is β_0

require q, y, y^* all to be endogenous.

[13]There is no particular reason to take logs of the right hand side variables, but since this has been the practice in previous work, it is done here for comparison.

which represents the cumulative impact of the real exchange rate on the real trade balance. Since q is defined in terms of the domestic currency price of the foreign currency, a positive change in q implies a real depreciation of the home currency. Consequently, $\beta_0 > 0$ would satisfy the 'generalized Marshall-Lerner condition' and a *J*-curve effect would be verified only if there are initially negative values of β_0 followed by positive values.

The exact dynamic structure of (9) is unknown but we initially included lags for q of eight quarters to cover a two year span for the *J*-curve effects to work themselves out, but only four quarters for B, y and y^* since the responses here are expected to be quicker. This is still somewhat arbitrary, but is necessary to retain sufficient degrees of freedom in our estimation. Variations in lag length are tested below under the robustness checks.

As a preliminary step, all the variables in (9)′ were tested for the presence of unit roots, and cointegration tests were carried out to see if those variables that are individually integrated are jointly cointegrated. Table 2 lists the results of the unit roots tests on B, q, y and y^*, together with details of the exact test procedure used. A significant test statistic implies stationarity. In line with previous studies, there appears to be a strong indication of unit roots in the variables.

Given the presence of unit root, non-stationarity raises the possibility of cointegration. Table 3 reports the results of the Engle-Granger and Johansen (1988) cointegration tests.[14] These tests suggest no evidence of cointegrating relationships among the variables at the optimum lag based on the minimization of the Akaike Information Criterion. Thus, again in line with previous studies, there is little evidence for the existence of a stable linear steady-state relationship between the levels of the real trade balance, the real exchange rate, and real domestic and foreign output for Korea over this period.

The presence of unit roots implies that the estimation of (9)′ in level form would be inappropriate. Although there is no evidence of cointegration, to err on the side of caution, (9)′ was transformed into a difference plus error-correction model to convert the unit root variables into stationary processes with lags to capture the

[14]The maximum eigenvalue test was not available in the COINT routine in *TSP version 4.3*.

TABLE 2

TESTING FOR UNIT ROOTS

Variable	Test statistic	Trade with the USA	Trade with Japan
Real trade balance (B)	ADF	-1.39(0.86)	-2.10(0.54)
	WS	-1.83(0.76)	-2.55(0.26)
	PP(z)	-8.04(0.58)	-20.08(0.70)
Real exchange rate (q)	ADF	-2.17(0.51)	-3.33(0.06)
	WS	-1.43(0.90)	-2.68(0.19)
	PP(z)	-5.63(0.77)	-12.09(0.31)
Real domestic output (y)	ADF	-1.99(0.60)	-1.94(0.63)
	WS	-2.18(0.52)	-0.34(0.99)
	PP(z)	-8.36(0.55)	-3.54(0.91)
Real foreign output (y^*)	ADF	-1.42(0.85)	-2.52(0.32)
	WS	-0.85(0.98)	-0.70(0.99)
	PP(z)	-5.19(0.81)	-8.16(0.57)

Note: All variables except B are in logs. The tests are carried out over the period 1970(1) to 1996(2) for the USA and 1970(1) to 1995(1) for Japan, include a constant and a time trend and are augmented up to a maximum of 10 lags. The choice of optimum lag for the ADF and WS tests was decided on the basis of minimizing the Akaike Information Criterion. For the PP(z) test the optimal lag for the ADF test is used. The probability values are in brackets with a * indicating significance at the 5 percent level, and a ** at the 1 percent level. The test statistics and critical values are from the COINT procedure in *TSP version 4.3*. ADF is the augmented Dickey-Fuller (tau) test with critical values based on MacKinnon (1994). WS is the augmented Weighted Symmetric (tau) test based on Pantula *et al.* (1994), and PP(z) is the Phillips-Perron (1988) variation of the Dickey-Fuller (z) test with critical values from MacKinnon (1994).

short-run dynamics and error correction mechanism to allow for the possibility of a long-run steady state.

A further problem is that we cannot assume all regressors are valid conditioning variables. Simultaneity is possible between B and current values of all the right hand side variables, especially between B and q. There is also the possibility of measurement errors. Accordingly, the instrumental variables procedure in PcGive (see Doornik and Hendry 1994b, p. 383) was used to obtain consistent estimates by including all exogenous regressors in the estimated equation together with additional instruments for both

TABLE 3

ENGLE-GRANGER AND JOHANSEN COINTEGRATION TESTS

Engle-Granger:		
	Test statistic	
	Trade with the USA	Trade with Japan
Real trade balance (*B*)	-2.07(0.94)	-3.02(0.59)
Real exchange rate (*q*)	-2.45(0.84)	-3.59(0.29)
Real domestic output (*y*)	-2.29(0.89)	-2.23(0.90)
Real foreign output (y^*)	-4.23(0.08)	-2.98(0.61)
Johansen trace tests:		
	Probability values (Optimal lag=10)	
	Trade with the USA	Trade with Japan
H_0: $r=0$	0.49	0.59
H_0: $r<=1$	0.74	0.78
H_0: $r<=2$	0.65	0.81
H_0: $r<=3$	0.63	0.62

Note: All variables except *B* are in logs. The tests are carried out over the period 1970(1) to 1996(2) for the USA and 1970(1) to 1995(1) for Japan, include a constant and a time trend and are augmented up to a maximum of 10 lags. For brevity only the optimum lag is reproduced here. The choice of optimum lag was decided on the basis of minimizing the Akaike Information Criterion. The probability values are in brackets with a * indicating significance at the 5 percent level, and a ** at the 1 percent level. For the Engle-Granger procedure the test statistic is the Engle-Granger (tau) from the COINT procedure in *TSP version 4.3*, with critical values from MacKinnon (1994). The trace tests are from the COINT procedure in *TSP version 4.3* and include a finite sample correction. Critical values are from Osterwald-Lenum (1992).

home and foreign countries. It is not an easy task to find reliable instruments for the contemporaneous values of y, y^* and q, so the choice was largely based on data availability over a long period of time and previous studies, including Rose and Yellen (1989), and Han-Min Hsing and Savvides (1996).[15] For Korea, these additional instruments included foreign exchange reserves, money supply, government expenditures, inward foreign direct investment, domestic

[15]Although trade models suggest the use of interest rates and money supplies as valid instruments for the real exchange rate, it has not been easy in practice to establish this empirically. See Meese and Rogoff (1988).

investment and the current account balance of payments. The domestic interest rate was omitted since this has been a controlled policy variable during most of the 1970s and 1980s (Lindner 1992). For the USA and Japan, instruments include money supply, foreign exchange reserves, government spending, short-term interest rates, domestic investment and the balance of payments current account. All instruments except the interest rate are in real terms, and all are in log form except for home and foreign real current account and real foreign direct investment. Initially, the contemporaneous values of the instruments were included together with two lags. More details of the construction of these instruments are given in Appendix.

Equation (9)″ below is the transformed version of (9)′ in difference plus error-correction form in which the first difference of the real trade balance is determined by current and lagged values of the first differences of the logs of the real exchange rate and real domestic and foreign income. No restrictions are imposed by this transformation. Δ signifies a first difference operator:[16]

$$\Delta B_t = \alpha_0 + \sum_{j=1}^{3} \alpha_{1j} \Delta B_{t-j} + \sum_{i=0}^{7} \beta_{0i} \Delta q_{t-i} + \sum_{j=0}^{3} \beta_{1j} \Delta y_{t-j} + \sum_{j=0}^{3} \beta_{2j} \Delta y^*_{t-j} + \delta_1 B_{t-1} + \delta_2 q_{t-1} + \delta_3 y_{t-1} + \delta_4 y^*_{t-1} + \varepsilon_t. \qquad (9)''$$

VI. Results and Robustness Checks

Equation (9)″ was estimated for both US and Japanese bilateral trade with Korea using quarterly data from 1972(1) to 1996(1) for the former and from 1972(1) to 1994(4) for the latter. The results are presented in Table 4. Of particular interest are the signs and statistical significance of the lag coefficients $\sum \beta_{0i}$ which measure the cumulative impact of the 'exogenous' change in the real

[16]Quite a wide range of estimating techniques have been used in previous studies. Instrumental variables were chosen largely to enable a comparison with the detailed work on Korea by Han-Min Hsing and Savvides (1996). The addition of error-correction terms was, with hindsight, probably superfluous given the absence of cointegrating relationships, but is unlikely to make much difference in terms of efficiency loss compared to a simple first difference model, as in Rose and Yellen (1989) and Han-Min Hsing and Savvides (1996).

TABLE 4

SIGNIFICANCE TESTS FOR THE EXCHANGE RATE AND OUTPUT COEFFICIENTS

	(9)″	Levels	1975 Start	1980 Start	3SLS
Trade with the USA [1972(1) to 1996(1)]					
$\sum \beta_{0i}$	18.40	59.00	-83.80	-86.90	-290.85
F	0.55	4.41**	0.28	0.18	0.63
$\sum \beta_{1j}$	-135	10.70	-37.10	-115	30.30
F	1.33	1.93	0.49	0.58	0.16
$\sum \beta_{2j}$	242	-15.20	196	91.30	303
F	2.29	2.99*	1.17	0.37	1.48
SE	819	788	852	986	572
DW	1.75	1.71	1.71	1.69	-
Chi-sq $\beta=0$	86.59**	-	84.30**	57.06**	-
Sargan Chi-sq	44.39**	-	44.56**	37.00*	-
AR 1-5 (5)	10.54	12.06*	10.66	8.12	87.96**
Normality chi	1.28	9.13	1.37	0.46	0.42
Wald Chi-sq	33.34**	13.98**	36.00**	26.54**	-
Trade with Japan [1972(1) to 1994(4)]					
$\sum \beta_{0i}$	-73.80	940	-81.00	-152	-355
F	1.13	1.54	1.44	1.36	3.95**
$\sum \beta_{1j}$	-85.70	17.20	90.60	-72.10	-111
F	0.73	1.52	0.68	0.26	0.78
$\sum \beta_{2j}$	85.90	-10.50	14.90	-2.04	206
F	1.30	1.97	0.27	0.74	1.26
SE	627	615	639	677	478
DW	1.96	1.93	1.91	2.01	-
Chi-sq $\beta=0$	29.14	-	31.57	32.08	-
Sargan Chi-sq	48.46**	-	44.87**	40.15**	-
AR 1-5 (5)	6.65	9.13	5.15	2.02	86.33**
Normality chi	3.66	1.39	3.78	2.89	3.29
Wald Chi-sq	7.57	24.27**	7.55	3.10	-

Note: The F test is used to test the significance of each variable under the null that the sum of the lag coefficients=0. A * indicates significance at the 5 percent probability level, and a ** at the one percent level. SE is the standard error of the regression, DW is the Durbin-Watson statistic for first-order autocorrelation. Chi-sq $\beta=0$ is a chi-squared test that all the coefficients except the intercept are zero. Sargan uses a chi-squared test (Sargan 1964) for the validity of the instrumental variables with the null that the model is correctly specified and the instruments are valid. AR is the Lagrange multiplier test for *r*th order autocorrelation, distributed as chi-sq (*r*) under the null that the errors are white noise. The test is for lags 1 to 5. Normality chi is a chi-squared test for the normality of the residuals. Wald is a test that all the long-run coefficients except the constant are zero.

exchange rate q on the real trade balance B.

Although the cumulative effects of q on B are 'correctly' signed for trade with the USA, indicating that a real depreciation improves the trade balance eventually, the sign is 'perverse' for trade with Japan. Moreover, the F-test of the significance of the real exchange rate under the null that the sum of the lag coefficients is zero is not rejected for both the USA and Japan. Thus, as with previous studies, including Rose and Yellen (1989), Rose (1990) and Han-Min Hsing and Savvides (1996) which use similar models and econometric methodology, we are unable to reject the null that current and lagged values of the first difference of the real exchange rate are jointly insignificant determinants of the real trade balance at the 5 percent significance level. Both Korea's real income and foreign income were correctly signed but were insignificant in terms of their cumulative impact on the real trade balance.

As far as *J*-curve effects are concerned, inspection of the signs and significance of the individual current and lagged values of q (Table 5) for the USA indicate negative values in earlier quarters followed by positive values later as the lag length increases, which together with a positive sign on the cumulative values for the USA would be consistent with *J*-curve behaviour, but none of the individual coefficients are statistically significant and neither is the cumulative sum. For Japan only the last quarter is positive, while none of the coefficients are significant and the cumulative sum of the lags is inconsistent with the *J*-curve. Increasing the lag length here simply generates insignificant coefficients cycling between positive and negative.

In order to check the robustness of our results to changes in the estimation procedure or model composition, a number of additional estimates were produced. Initial checks centered on varying the combinations of instruments and lag lengths on the explanatory variables. For reasons of brevity, these are not presented here. The results were robust to these changes. We also changed the starting date of the regressions to 1975 and the second quarter of 1980 to allow for the changes in the foreign exchange regime discussed in Section III above, in the first case to omit the turbulent last years of the adjustable peg system, and in the second to test for the change of foreign exchange regime with the introduction of the MCBP system. The results (Table 4) are similar but the coefficient signs for the USA (Table 5) are now inconsistent with a *J*-curve effect.

TABLE 5

SIGNS AND SIGNIFICANCE OF THE REAL EXCHANGE RATE COEFFICIENTS

	(9)"	Levels	1975 Start	1980 Start	3SLS
Korea-USA					
Lag 0	-18.81 (0.24)	-5111 (1.22)	28.06 (0.33)	5.83 (0.05)	-38.05 (0.73)
1	-44.18 (0.93)	6329 (1.04)	-48.87 (0.72)	-82.32 (0.88)	-5.16 (0.09)
2	-15.71 (0.38)	3514 (0.61)	-40.51 (0.70)	-12.75 (0.17)	-68.08 (1.34)
3	-3.71 (0.09)	-1084 (0.19)	-26.02 (0.49)	33.84 (0.45)	-12.77 (0.29)
4	12.36 (0.29)	3070 (0.58)	1.62 (0.03)	-11.67 (0.16)	-80.74 (1.79)
5	24.40 (0.65)	1809 (0.37)	-8.79 (0.19)	-43.29 (0.62)	-15.99 (0.38)
6	14.21 (0.40)	-113 (0.02)	-15.45 (0.36)	24.71 (0.36)	-51.39 (1.40)
7	49.89 (1.34)	3926 (0.81)	26.30 (0.57)	-1.22 (0.02)	-18.67 (0.50)
8	-	-6437 (1.90)	-	-	-
$\sum\beta_{0i}$	18	59	-84	-87	-291
F	0.55	4.41**	0.28	0.18	0.16
Korea-Japan					
Lag 0	-5.48 (0.24)	-2935 (1.80)	-8.81 (0.36)	-41.72 (1.35)	-54.19 (2.23)*
1	-26.94 (1.63)	1569 (0.69)	-40.47 (1.99)*	-31.42 (1.10)	-61.55 (2.46)*
2	-18.89 (1.25)	433 (0.19)	-23.06 (1.32)	-40.17 (1.56)	-67.31 (2.35)*
3	-9.38 (0.58)	1122 (0.51)	-10.95 (0.62)	-23.37 (0.94)	-60.22 (2.89)**
4	-11.28 (0.71)	-446 (0.19)	-11.41 (0.63)	-8.44 (0.33)	-73.42 (3.31)**
5	-12.59 (0.80)	11.57 (0.01)	-6.24 (0.35)	-17.69 (0.72)	-2.72 (0.13)
6	-7.47 (0.48)	478 (0.21)	-1.75 (0.10)	-13.56 (0.58)	-38.46 (2.03)*
7	18.2 (1.12)	2844 (1.25)	21.65 (1.19)	24.52 (1.04)	2.26 (0.12)
8	-	-2137 (1.39)	-	-	-
$\sum\beta_{0i}$	-74	940	-81	-152	-355
F	1.13	1.54	1.44	1.36	3.95**

Note: The t values are in brackets beneath each coefficient. The F test is used to test the significance of each variable under the null that the sum of the lag coefficients=0. A * indicates significance at the 5 percent probability level, and a ** at the one percent level.

A third exercise involved running the equation in logs of levels using ordinary least squares. Although this is strictly inappropriate here given the evidence of non-stationarity in the underlying time-series, this was done for comparison with previous studies which use a structural approach and found evidence to support *J*-curves, such as Krugman and Baldwin (1987) and Noland (1989). Rose and Yellen (1989) also found some evidence of a significant effect of q on B when they reestimated their partial reduced form model in level form but found *J*-curve effects only for US trade with Germany and France. Han-Min Hsing and Savvides (1996) found some cases of a significant long-run effect of q on B for Korean and Taiwanese trade with the USA, Japan and the rest of the world using the data in level form, but with one exception, Korea's bilateral trade with the USA, the individual coefficients were insignificant and the *J*-curve phenomenon was not observed at all. In our case, we also found a significant long run positive relationship between q and B for Korean trade with the USA (Table 4), but no obvious *J*-curve pattern (Table 5). The contemporaneous value for q was negative followed by positive signs, but further negative signs appear and none of the individual coefficients are significant.

Our three final robustness checks centered on testing for the validity of the assumption of zero homogeneity of the trade balance with respect to the components of the real exchange rate, 'third country' and 'small country' effects.

As far as the zero homogeneity restriction is concerned, we re-estimated the model allowing for both short-run and long-run non-homogeneity of the real exchange rate by including separately $\Delta \log (p^*/p)$ and $\Delta \log e$, where e is the domestic currency price of foreign exchange and p^*/p is the price differential from $q=e(p^*/p)$. *A priori*, a rise in e and p^*/p should be associated with an improvement in B. As with Rose and Yellen (1989), we found the data to be consistent with the homogeneity assumption that the current and lagged values of both price differentials and the nominal exchange rate (in logged differences) are jointly insignificant in the trade balance equation.

The third country effect arises because, although the model in Section IV above is a two-country model, the empirical analysis uses bilateral data *i.e.* a multicountry world. If, for example, Korea maintains a fixed peg against the US$ and the dollar, in turn, depreciates substantially against the yen, Korean exporters may redirect sales from the US to the Japanese market, so exports to the US fall even though there has been no change in the Korea-US real exchange rate.[17] There is no doubt that the won rate against non-US$ currencies has been subject to substantial shocks and that changes in the yen-US$ rate, in particular, have significantly affected the volatility of the won-US$ rate during periods of substantial depreciation or appreciation. From the end of June 1995 to the end of the year, the yen depreciated by 18.1 percent against the US$ forcing the won up by 16.4 percent against the yen (Rhee and Song 1998).

To allow for this possible effect, we included changes in both the US and Japanese bilateral real exchange rates and associated lags in a joint estimation of (9)″ for both countries using Three Stage Least Squares (3SLS).[18] The results are presented in Tables 4 and 5. For both the US and Japanese real bilateral trade balances the cumulative impact of changes in the real exchange rate are negative, contrary to a prior expectations, and in the Japanese case the cumulative effect is significant. This is confirmed by inspection of the lag pattern of the exchange rate coefficients in Table 5, which are overwhelmingly negative and in some cases individually significant, The cumulative third country bilateral exchange rates (not shown) were also insignificant and wrongly signed in both cases.

The initially negative response of the trade balance to changes in the exchange rate according to the *J*-curve hypothesis stems essentially from movements in the value of imports rather than in exports. An increase in the value of imports is expected since these are denominated in foreign currency, but in so far as exports are denominated in domestic currency, a depreciation leaves the value of exports in domestic currency unchanged. In the small country case, on the other hand, both exports and imports are denominated in foreign currency and would increase in value, measured in domestic currency, during the currency contract period. Hence the

[17] I am grateful to an anonymous referee for raising this issue.

[18] Under the MCBP system, the exchange rate of the won per US dollar was determined by a formula which incorporated a SDR basket determined by the IMF and an undisclosed independent basket. The weights in the SDR basket in 1986 for the US dollar and yen were 42 and 15 percent, respectively, and independent estimates suggest over 90 percent weight for these two currencies in the independent basket (Rhee and Song 1998).

TABLE 6

THE SMALL COUNTRY CASE

	Trade with the USA [1972(1) to 1996(1)]		Trade with Japan [1972(1) to 1994(4)]	
	Exports	Imports	Exports	Imports
$\Sigma\beta_{0i}$	1.83	0.91	2.86	1.82
F	4.08**	2.41*	2.14*	1.63
$\Sigma\beta_{1j}$	-	1.52	-	4.94
F	-	0.97	-	6.74**
$\Sigma\beta_{2j}$	3.20	-	6.03	-
F	7.34**	-	9.71**	-
SE	7.61	12.14	10.22	8.45
DW	1.58	2.11	1.50	1.51
Chi-sq β=0	125**	61.58**	96.96**	119**
Sargan Chi-sq	55.29**	35.49*	57.53**	38.62*
AR 1-5 (5)	22.50**	14.11*	22.42**	20.46**
Normality chi	2.04	5.04	2.60	6.39*
Wald Chi-sq	64.19**	21.79**	135**	84.62**
Lag 0	0.78	0.12	0.19	0.60
	(1.31)	(0.10)	(0.52)	(1.85)
1	-0.10	1.45	0.06	0.37
	(0.27)	(2.37)*	(0.19)	(1.59)
2	-0.37	-0.16	0.47	0.28
	(1.01)	(0.27)	(1.55)	(1.31)
3	-0.33	-1.27	0.83	0.35
	(0.85)	(2.02)*	(2.79)**	(1.62)
4	-0.27	-0.21	0.33	0.13
	(0.70)	(0.39)	(1.28)	(0.64)
5	0.27	0.17	0.14	-0.01
	(0.78)	(0.31)	(0.55)	(0.05)
6	0.82	0.82	0.34	0.08
	(2.48)*	(1.56)	(1.41)	(0.07)
7	1.03	-0.02	0.52	0.02
	(3.09)**	(0.03)	(1.97)	(0.09)

Note: The F test is used to test the significance of each variable under the null that the sum of the lag coefficients=0. A * indicates significance at the 5 percent probability level, and a ** at the one percent level. SE is the standard error of the regression. DW is the Durbin-Watson statistic for first-order autocorrelation. Chi-sq β=0 is a chi-squared test that all the coefficients except the intercept are zero. Sargan uses a chi-squared test (Sargan 1964) for the validity of the instrumental variables with the null that the model is correctly specified and the instruments are valid. AR is the Lagrange multiplier test for rth order autocorrelation, distributed as chi-sq (r) under the null that the errors are white noise. The test is for lags 1 to 5. Normality chi is a chi-squared test for the normality of the residuals. Wald is a test that all the long-run coefficients except the constant are zero.

need to treat exports and imports as separate regressors and test whether exports increase in the short-run and this is part of the reason we fail to find a *J*-curve is because the country is small.

Accordingly, we re-ran equation (9)″ with the log of real exports regressed on q and y^* and the log of real imports regressed on q and y. The estimates and associated lag coefficients are listed in Table 6. For both the USA and Japan, exports appear to be positively related to the real exchange rate in the short and long run, which is consistent with the small country assumption. Imports also increase with q in the short run, which is consistent with a *J*-curve being masked by the rise in exports. But the strict interpretation of the *J*-curve requires imports to fall over time. For the USA, however, positive coefficients persist at later lags and the cumulative relationship is positive and significant. For Japan, the cumulative impact is not significant but it is positive and all coefficients except one are positive in sign. All the income variables are cumulatively significant except in the US import equation.

VII. Conclusion

The purpose of this paper has been to examine the relationship between the real trade balance and the real exchange rate for bilateral trade in merchandise goods between Korea and both the USA and Japan over the period 1970 to 1996 using the partial reduced form model of Rose and Yellen (1989), derived from the two-country imperfect substitutes model. In line with recent work using a similar methodology, our findings suggest that when account is taken of the non-stationarity of the underlying data, the real exchange rate does not have a significant impact on the real bilateral trade balance with respect to the USA or Japan. The economic interpretation of this is that there appears to be no relationship between the real trade balance and changes in relative prices brought about by changes in real exchange rates and thus no discernable impact on bilateral trade flows. Only when we ran the estimating equations in logs of levels using ordinary least squares did we find a significant relationship between the real exchange rate and the real bilateral trade balance for Korean trade with the USA, supporting previous work by Han-Min Hsing and Savvides (1996).

As far as the *J*-curve is concerned, we can find no persuasive evidence of a *J*-curve effect at work for bilateral trade relations between Korea and the USA and Japan. It is, however, possible that 'small country' effects are at work, suggesting that a tendency to price exports in foreign rather than domestic currency generates a rise in the domestic currency value of exports which masks the initial rise in import values associated with *J*-curve behaviour, but there was no evidence that imports subsequently fell as the lag length increased, which would be required to support a strict interpretation of the *J*-curve.

Appendix: Data Sources and Manipulation

Most of the data is from the International Monetary Fund *International Financial Statistics* (*IFS*) from the first quarter of 1970 to the fourth quarter of 1996 and was extracted via *Dbank Release 97.1* online at the National University of Singapore, or from CD-Rom in the Central Library at the University of Warwick. The exact *IFS* series selected is indicated below in brackets after each variable. All real variables are based on 1990=100. The statistical and econometric work was carried out using Doornik and Hendry's (1994a,b) *PcFiml* (*8.0*) and *PcGive* (*8.0*), and *Time Series Processor* (*TSP*) *version 4.3* (see Hall 1995).

Real trade balance B:
Monthly bilateral imports and exports to the USA and Japan in US dollars were taken from the OECD, *Monthly Statistics of Foreign Trade*, Paris: OECD, and were converted into quarterly figures and into domestic currency using the market exchange rate (*IFS*, rf) and deflated by the Korean consumer price index (*IFS*, 64). The real trade balance measured in real home currency units was then calculated as the export series minus the import series.

The real bilateral exchange rate q:

The bilateral nominal exchange rate (*IFS*, rf) for Korea with respect to the US dollar was converted into a real exchange rate by multiplying the nominal rate by the ratio of the US price level to the domestic price level. The domestic price level was the consumer price index (*IFS*, 64) and the foreign price level was proxied by the wholesale price index (*IFS*, 63). An equivalent procedure was used to generate the real rate against the yen after computing the home currency value of the yen from the ratio of the home currency rate against the US dollar (*IFS*, rf) to the yen rate against the US dollar (*IFS*, rf).

Real income y, y^*:
The US or Japanese index of real industrial production (*IFS*, 66c) was used to give real foreign income in foreign output terms. Korean income in domestic output terms was analogously defined.

Instrumental variables:
Korean data used for the instruments was extracted for foreign exchange reserves (*IFS*, 11d), the money supply (*IFS*, 34), the current account (*IFS*, *77ad*) and government expenditure (*IFS*, 82), and were converted into real terms using the consumer price index (*IFS*, 64) as the deflator. Korean real foreign direct investment (*IFS*, *77BAD*) and real domestic investment (*IFS*, *93E*) were also available. For the USA and Japan, equivalent instruments were compiled for the real money supply, real reserves, real government consumption (proxied by *IFS*, 82 or *IFS*, 82 plus 83). Three additional instruments were available for the two foreign countries with a long enough series: the real current account (*IFS*, 77ad deflated by 64), real domestic investment (*IFS*, 93e deflated by 64) and nominal interest rates (*IFS*, 60b). All variables were logged except the current account and real foreign direct investment which can assume both positive and negative values.

(*Received May, 2000; Revised July, 2000*)

References

Abeysinghe, T., and Yeok, Tan Lin. "Exchange Rate Appreciation and Export Competitiveness: The Case of Singapore." *Applied Economics* 30 (No. 1 1998): 51-5.

Argy, V. *International Macroeconomics: Theory and Policy.* New York: Routledge, 1994.

Bahmani-Oskooee, M. "Devaluation and the J-curve: Some Evidence from LDCs." *The Review of Economics and Statistics* 67 (No. 3 1985): 500-4.

Doornik, Jurgen A., and Hendry, David F. *PcFiml 8.0: Interactive Econometric Modelling of Dynamic Systems*. Oxford: University of Oxford Institute of Economics and Statistics, 1994a.

__________. *PcGive 8.0: An Interactive Econometric Modelling System.* Oxford: University of Oxford Institute of Economics and Statistics, 1994b.

Dornbusch, R. "Exchange Rates and Fiscal Policy in a Popular Model of International Trade." *American Economic Review* 68 (Part 1 1975): 859-71.

Goldstein, M., and Khan, M. S. "Income and Price Effects in Foreign Trade." In R. W. Jones and P. B. Kenen (eds.), *Handbook of International Economics*. Amsterdam: North Holland, 1985: 1041-105.

Hall, B. *Time-Series Processor Version 4.3*. Palo Alto, CA: TSP International, 1995.

Han-Min Hsing and Savvides, Andreas. "Does a J-Curve Exist for Korea and Taiwan?" *Open Economies Review* 7 (No. 2 1996): 127-45.

Johansen, S. "Statistical Analysis of Cointegration Vectors." *Journal of Economic Dynamics and Control* 12 (June-Sept. 1988): 231-54.

Krugman, P. "The J-curve, the Fire Sale, and the Hard Landing." *The American Economic Review* 79 (No. 2 1989): 31-5.

Krugman, P., and Baldwin, R. E. "The Persistence of the US Trade Deficit." *Brookings Papers on Economic Activity* (1987): 1-43.

Krugman, P., and Obsfeld, Maurice. *International Economics*. Reading, Mass: Addison-Wesley, 1997.

Lindner, D. "Foreign Exchange Policy, Monetary Policy, and Capital Market Liberalisation in Korea." International Finance

Discussion Paper No. 435. Board of Governors of the Federal Reserve System, 1992.

MacKinnon, James G. "Approximate Asymptotic Distribution Functions for Unit-Root and Cointegration Tests." *Journal of Business and Economic Statistics* (No. 2 1994): 167-76.

Meese, R. A., and Rogoff, K. "Was It Real?" *Journal of Finance* 43 (No. 4 1988): 933-48.

Menon, Jayant. "Exchange Rate Pass-Through." *Journal of Economic Surveys* 9 (No. 2 1995): 197-231.

Noland, Marcus. "Japanese Trade Elasticities and the J-Curve." *The Review of Economics and Statistics* 71 (No. 1 1989): 175-9.

Osterwald-Lenum, Michael. "Practitioners' Corner: A Note with Quintiles for the Asymptotic Distribution of the Maximum Likelihood Cointegration Rank Test Statistic." *Oxford Bulletin of Economics and Statistics* (No. 3 1992): 461-71.

Pantula, Sastry G., Gonzalez-Farias, Graciela, and Fuller, Wayne A. "A Comparison of Unit-Root Test Criteria." *Journal of Business and Economic Statistics* (No. 4 1994): 449-59.

Phillips, P. C. B., and Perron, Pierre. "Testing for a Unit Root in Time-Series Regression." *Biometrika* 75 (June 1988): 335-46.

Rhee, Yeongseop, and Song, Chi-Young. "Exchange Rate Policy and the Effectiveness of Intervention." In S. Collignon, Jean Pisani-Ferry and Yung Chul Park (eds.), *Exchange Rate Policies in Emerging Asian Countries*. London: Routledge, 1998.

Rose, Andrew K. "Exchange Rates and the Trade Balance." *Economics Letters* 34 (No. 2 1990): 271-5.

__________. "The Role of Exchange Rates in a Popular Model of International Trade: Does the Marshall-Lerner Condition Hold?" *Journal of International Economics* 30 (No. 3 1991): 301-16.

Rose, Andrew K., and Yellen, Janet L. "Is There a J-Curve?" *Journal of Monetary Economics* 24 (No. 1 1989): 53-68.

Sargan, J, D. (1964) "Wages and Prices in the United Kingdom: A Study in Econometric Methodology." Reprinted in D. F. Hendry and K. F. Wallis (eds.), *Econometrics and Quantitative Economics*. Oxford: Basil Blackwell, 1994.

Tongzon, Jose L., and Menon, Jayant. "Exchange Rates and Export Pricing in a Small Open NIC: The Singaporean Experience." *The Singapore Economic Review* 38 (No. 2 1995): 201-11.