ABSTRACT

By exploiting the information in a panel data set, this paper is able to construct more powerful tests of various hypotheses on the determinants of real exchange rates than would be possible with single-country time-series data. Focusing on annual data for 20 industrial countries from 1973 through 1995, there are three major results. First, the evidence for a stationary real exchange rate is stronger when the exchange rate is defined in terms of wholesale prices than consumer prices, presumably because of the greater tradability of wholesale commodities. Second, the half-life of shocks to the real exchange rate is between two and three years. Third, there is a significant and robust relationship between real exchange rates and net foreign assets.

Net Foreign Assets and Equilibrium Exchange Rates: Panel Evidence

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Introduction and Summary

This paper exploits a panel of annual data for 20 countries from 1960 through 1995 to examine the relationships between real exchange rates and a number of variables that have been proposed in the literature on exchange rate determination. These variables are the level of net foreign assets, the ratio of consumer prices to wholesale prices, the level of real per capita income, and the share of government consumption in total output. The panel cointegration approach used in this paper estimates long-run equilibrium relationships while controlling for simultaneity and feedback from the exchange rate to the explanatory variables.

Real per capita income does not have any statistically significant relationship with the real exchange rate either in the short run or in the long run. Government consumption also does not have any long-run relationship with the real exchange rate, but the future change in government spending does have a robust short-run effect. When government consumption is expected to increase in the following year,

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the real exchange rate appreciates temporarily. The CPI-WPI ratio is strongly correlated with the real exchange rate defined in terms of CPIs, but it has only a weak long-run correlation with the WPI real exchange rate. This finding supports the view that CPIs contain a significant component of nontradable goods and services prices that are not arbitraged by international trade. The level of net foreign assets is significantly and robustly correlated with the real exchange rate, both in the short run and the long run.

Focusing on the relationship between the WPI real exchange rate and net foreign assets, the estimates indicate that the half-life of real exchange rate disequilibria is about two and one-half years. For most countries in the sample, net foreign assets are essentially constant, and the real exchange fluctuates widely with no trend. For a few countries, net foreign assets have a pronounced trend. It is primarily for these countries that the real exchange rate appears to drift over time.

Literature Review

Following the econometric methodology of Levin and Lin (1992), a number of researchers recently have tested for stationarity of the real exchange rate using panel data, including Frankel and Rose (1996), Papell (forthcoming), and Wei and Parsley (1995). These studies typically claim to reject the hypothesis of a unit root in the real exchange rate using the greater power of panel data. However, O'Connell (1996) shows that the standard practice of defining all exchange rates relative to a single country can distort the size of the test, and that correcting for this effect weakens the evidence against a unit root. This paper extends the panel framework to control for the O'Connell critique and to consider cointegration between the real exchange rate and other variables.

The literature on the determinants of the real exchange rate is too voluminous for an exhaustive review, especially as Froot and Rogoff (1995) and Rogoff (1996) provide up-to-date surveys. Dornbusch and Fischer (1980), Hooper and Morton (1982), and Gavin (1991) present theoretical treatments of the relationship between net foreign assets and the exchange rate that form the basis for this study. Hooper and Morton develop a model in which exogenous shocks to trade flows create a long-run positive correlation between net foreign assets and the real exchange rate (defined as the price of home goods relative to foreign goods). In a more complete theoretical model, Gavin shows that exogenous shocks to wealth create a positive correlation between net foreign assets and the real exchange rate when the Marshall-Lerner condition is satisfied.[2] Hooper and Morton (1982), Faruqee (1995), and Obstfeld and Rogoff (1995) present empirical results confirming a positive correlation between net foreign assets and the real exchange rate.

In a more general framework, both net foreign assets and the real exchange rate should be viewed as endogenous variables that influence each other and are determined simultaneously. The papers cited above focus on the effects of exogenous

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[2]The same shocks create a negative correlation when the Marshall-Lerner condition does not hold. The Marshall-Lerner condition is that the price elasticity of demand for tradables should be sufficiently high that a real depreciation leads to an increase in the trade balance. Nearly all econometric estimates of trade elasticities satisfy this condition, at least in the long run. See Marquez (1990).

shocks that affect net foreign assets directly. The transmission to the real exchange rate is based on the conclusion that in equilibrium, a country with negative net foreign assets must have a trade surplus to finance the stream of interest and dividend payments. The mechanism to generate this trade surplus is a real exchange rate depreciation. Similarly, countries with positive net foreign assets must have trade deficits in equilibrium. Thus, a shock to net foreign assets has a long-run effect on the real exchange rate as long as goods produced in different countries are not perfect substitutes.

While shocks to the real exchange rate have a well-defined short-run effect on net foreign assets, their long-run effect is ambiguous. Such shocks have no effect on net foreign assets unless they affect a country's saving rate permanently. In some simple models of trade and asset accumulation, exchange rate shocks have no long-run effect on net foreign assets, and net foreign asset shocks do have a long-run effect on the real exchange rate.

It is important to recognize that exchange rate dynamics may be the mechanism by which shocks to desired net foreign assets are equilibrated. Thus, an increase in desired net foreign assets may cause an immediate depreciation of the exchange rate in order to generate a trade surplus, followed by a long-run real appreciation of the exchange rate above its initial level once the desired net foreign asset stock is achieved.

Balassa (1964) and Samuelson (1964) argued that technological progress is biased toward the production of tradables, and that countries experiencing rapid technological progress should exhibit a rising real exchange rate in terms of price indexes that include nontradables, such as the CPI. A direct test of the Balassa-Samuelson hypothesis would require data on productivity over time, which are difficult to obtain for many countries. As a proxy, this paper uses real per capita GNP. Chinn and Johnston (1996) and Mark and Choi (1995) find evidence for a positive correlation between productivity or per capita income and the CPI real exchange rate using a subset of the countries examined in this paper.

A partial test of the Balassa-Samuelson hypothesis is to examine the impact of the CPI-WPI ratio on the CPI real exchange rate to confirm whether movements in the tradables-nontradables price ratio plays a significant role in real exchange rate movements. Rogoff (1996) shows that the WPI real exchange rate between Japan and the United States has exhibited a much smaller drift over time than the CPI real exchange rate.

Froot and Rogoff (1991) and DeGregorio, Giovannini, and Wolf (1994) find evidence of a temporary effect of government spending on the CPI real exchange rate. They argue that higher government spending tends to appreciate the real exchange rate because it falls more heavily on nontraded goods. Rogoff (1992) argues that the long-run effects of government spending are much smaller than the short-run effects. Nevertheless, Chinn and Johnston (1996) claim that the ratio of real government consumption to real GDP does have a long-run effect on the real CPI exchange rate.

The Data

The dataset is an annual panel with observations for 20 industrial countries from 1960 through 1995.[3] The basic regressions were run over the floating-rate period beginning in 1973. The series were obtained from the *International Financial Statistics* database maintained by the International Monetary Fund.[4] For the basic regressions, all exchange rates were defined vis-a-vis Germany, and the German data were dropped from the regressions.[5] The data mnemonics and definitions are presented in Table 1. Net foreign assets are scaled by trade flows because equilibrium is achieved through the operation of the real exchange rate on the trade sector of the economy.

Univariate Analysis

Figures 1-6 plot the data starting in 1970. Most of the real exchange rate series exhibit large swings around a slowly drifting or constant mean. For the WPI real exchange rate, the primary exceptions are those of Germany's immediate neighbors--

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[3]Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, the Netherlands, New Zealand, Norway, Spain, Sweden, Switzerland, the United Kingdom, and the United States. Due to missing observations for certain series the sample begins in 1980 for Germany, and it ends in 1992 for Finland and 1994 for Belgium, Germany, Italy, and Greece.

[4]Finnish net factor income was obtained from OECD *Annual National Accounts.* Belgian and French wholesale prices were obtained from national sources.

[5]Frenkel (1981) was the first to note that the evidence for purchasing power parity is weaker when using dollar exchange rates, a finding confirmed by Edison, Gagnon, and Melick (forthcoming). As discussed below, use of the United States as the partner country has only a small effect on the results of this paper.

Table 1 Data Definitions	
REC	Log real exchange rate using CPIs (increase = appreciation)
REW	Log real exchange rate using WPIs (increase = appreciation)
NFA	Net foreign assets (calculated by cumulating exports plus net factor income minus imports since 1960) divided by exports plus imports of goods and services
CWR	Log ratio of CPI to WPI
YPC	Log real GNP per capita
GOV	Ratio of government consumption to nominal GDP

Austria, Denmark, the Netherlands, and Switzerland--which are characterized by much smaller movements and very little drift. A downward drift is noticeable for Australia, Canada, and the United States. An upward drift is apparent for Japan.

NFA drifts upward in Japan and Switzerland, and downward in Australia, New Zealand, and the United States, with little trend in the remaining countries. CWR drifts upward in most countries. YPC exhibits a pronounced upward trend in every country. Finally, GOV has either a small upward trend or no trend in every country.

Table 2 presents the results of panel unit root tests for each variable. The tests were conducted by regressing the first difference of the variable on its lagged level, lagged first differences of the variable, and a full set of country and year dummy variables, as shown in equation (1). Four lagged differences were included in the initial regressions and the lag length was truncated sequentially by dropping coefficients that were not significant at the 10 percent level.[6] In most cases only one lagged difference was retained, but in all cases the adjustment coefficient was completely insensitive to the choice of lag length and the test statistic was only moderately affected.

$$\Delta REx_{it} = \rho REx_{it-1} + \sum_{k=1}^{4} \beta_k \Delta REx_{it-k} + \alpha_i + \tau_t \tag{1}$$

$$i = 19 \textit{ industrial countries} \qquad t = 1973, \ldots, 1995$$

Levin and Lin (1992) show that estimation of country-specific intercepts biases the adjustment coefficient, ρ, and the associated test statistic downward. They provide a table of adjusted critical values from Monte Carlo simulations of different sample sizes which is the basis for the significance levels in Table 2. O'Connell (1996) points out that the definition of all exchange rates in terms of a common country can lead to a cross-country correlation in the residual that also tends to bias the test statistic downward. By estimating a complete set of time effects, the regression is able to control for the common influence of the omitted country, Germany.

Both real exchange rates appear to be stationary.[7] The real exchange rate using WPIs exhibits stronger mean reversion than that using CPIs, which may reflect the greater tradability of the components of the WPI. There is weak evidence of mean reversion of the CPI-WPI ratio and the government consumption ratio. There is no

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[6]I also tested for the significance of a full set of country-specific dynamic coefficients. I found them to be significant only for YPC and GOV, and their inclusion had no material effect on the unit root test statistics for YPC and GOV.

[7]Using exchange rates vis-a-vis the United States leads to nearly identical results.

evidence of mean reversion in net foreign assets and real per capita incomes.

Table 2 Panel Unit Root Tests (Equation (1))		
Variable	Adjustment Coefficient	Test Statistic
REC	-.25	-8.0***
REW	-.32	-8.8***
NFA	-.01	-1.3
CWR	-.14	-6.6*
YPC	-.08	-4.0
GOV	-.19	-6.4
***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.		

Further evidence on the time-series properties of these data can be derived by analyzing the estimated time effects from the panel data regressions. These time effects capture the movements common to all countries over time, and they may themselves contain unit roots. To perform the analysis, I combined the time-effect coefficients sequentially to create a new data vector for each variable listed in Table 2. I then conducted augmented Dickey-Fuller tests with one lagged difference on these data vectors. The tests revealed that the estimated time effects are stationary at the 5 percent level for all variables except YPC.

Multivariate Analysis

In light of the evidence of the previous section that real exchange rates are stationary, it may seem unlikely that there exist significant correlations between real exchange rates and the remaining variables in the dataset, which appear to be nonstationary, or, at most, borderline stationary. However, it is important to recognize that the maintained assumption of the panel unit root test is that either all series are stationary or all series have unit roots. Recall that the plots of the data revealed that real exchange rates exhibit drifts in certain countries, but not in other countries. The pattern of drifts over time also varied across countries for the other variables, raising the possibility that some of the other variables may be able to explain the apparent long-run movements of the real exchange rates of certain countries.

The approach taken here is purely empirical. The goal is to search for a long-run correlation between the real exchange rate and any or all of the explanatory variables. No attempt is made to identify a theoretical structural relationship. However, significant evidence of a long-run correlation, or cointegrating vector, may be taken as evidence on the types of shocks and transmission channels that are important in the data.

In a truly long sample, one could simply regress the real exchange rate on the explanatory variables. However, in the relatively short sample available, dynamic adjustments to shocks, and feedback from the exchange rate to some of the explanatory variables, may lead to biased estimates of the long-run correlations. Moreover, the adjustment dynamics and feedback effects may be of interest in themselves. Phillips and Loretan (1991) provide a methodology for dealing with these issues in short samples.

As shown in equation (2), the regressions of the previous section are augmented to include the other four variables. The term in parentheses is the long-run cointegrating relationship between the real exchange rate and the explanatory variables. The error-correction coefficient, ρ, captures the long-run adjustment speed to deviations from equilibrium. In order to control for short-run dynamics and feedback effects from the real exchange rates to the independent variables, I included backward and forward differences of the independent variables as well as lagged differences of the real exchange rate. Additional lags of the explanatory variables were not significant, presumably reflecting the fact that exchange rates respond quickly to economic news. Finally, the regressions include a full set of country and time effects.

$$\begin{aligned} \Delta REx_{it} = {} & \rho\left(REx_{it-1} - \gamma_1 NFA_{it-1} - \delta_1 CWR_{it-1} - \theta_1 YPC_{it-1} - \lambda_1 GOV_{it-1}\right) \\ & + \gamma_2 \Delta NFA_{it+1} + \gamma_3 \Delta NFA_{it} + \delta_2 \Delta CWR_{it+1} + \delta_3 \Delta CWR_{it} \\ & + \theta_2 \Delta YPC_{it+1} + \theta_3 \Delta YPC_{it} + \lambda_2 \Delta GOV_{it+1} + \lambda_3 \Delta GOV_{it} \\ & + \textstyle\sum_{k=1}^{4} \beta_k \Delta REx_{it-k} + \alpha_i + \tau_t \end{aligned} \tag{2}$$

$$i = 19 \textit{ industrial countries} \qquad t = 1973, \ldots, 1994$$

In order to obtain a parsimonious and robust specification, I performed sequential tests on the estimates of equation (2). First, I tested the lagged differences of the real exchange rates. The second, third, and fourth lags were never individually or jointly significant at the 10 percent level, so they were dropped from the regression. Next I tested the significance of the independent variables.[8] For each variable I tested the joint significance of the lagged level, forward difference, and backward difference. YPC was never significant at the 10 percent level. GOV was

[8]According to Levin and Lin (1992), if one accepts the hypothesis of cointegration (based on the estimated error-correction coefficient, ρ, and its standard error) the coefficients on the levels of the explanatory variables have standard distributions.

significant at the 5 percent level for REC and the 10 percent level for REW. NFA and CWR were always significant at the 1 percent level. After dropping YPC from the regressions, further tests revealed that only the forward difference of GOV was significant. The lagged level and backward difference of GOV were dropped. The results are presented in Table 3.

According to the first column of Table 3, a future increase in government spending of 1 percent of GDP causes an immediate increase in the real exchange rate of 0.87 percent. While it is possible that this correlation arises because shocks to the exchange rate affect future government spending, a more plausible interpretation is that the political process makes fiscal policy highly forecastable. Thus, forward-looking exchange markets can price in the effect of future government spending. As discussed above, government spending has no significant long-run effect on either REC or REW.

Changes in the CPI-WPI ratio show up one-for-one in the CPI real exchange rate (REC) immediately (from the coefficient on ΔCWR_{it}), but in the long run only about two-thirds of these changes are reflected in the CPI real exchange rate (from the coefficient on CWR_{it-1}). These estimates are consistent with those from the REW equation: changes in the CPI-WPI ratio have no immediate effect on the WPI real exchange rate, but they tend to reduce the WPI real exchange rate in the long run. If international arbitrage equates the prices of the components of WPIs and not the components of CPIs, one would expect to observe a long-run coefficient on CWR of 1 in the REC equation and 0 in the REW equation. On the other hand, if CPIs are arbitraged and WPIs are not, one would expect to observe a coefficient on CWR of 0 in the REC equation and -1 in the REW equation. These estimates imply that arbitrage works better for the components of WPIs, but that a weighted average of WPIs and CPIs is more stable than either index alone. The positive coefficient on future changes in the CPI-WPI ratio reflects the feedback of the exchange rate onto domestic prices. Exchange rate appreciations tend to reduce WPIs more than CPIs, thereby increasing CWR in the following period.

Table 3 Multivariate Results (Equation (2))

	ΔREC_{it}	ΔREW_{it}
E.C. (ρ)	-.34*** (.04)	-.34*** (.04)
NFA_{it-1}	.11*** (.03)	.10*** (.03)
CWR_{it-1}	.66*** (.16)	-.26* (.16)
ΔNFA_{it+1}	-.15*** (.05)	-.14*** (.05)
ΔNFA_{it}	.24*** (.05)	.24*** (.05)
ΔCWR_{it+1}	.34*** (.11)	.33*** (.11)
ΔCWR_{it}	1.14*** (.11)	.16 (.10)
ΔGOV_{it+1}	.87** (.35)	.84** (.35)
ΔREx_{it-1}	.13*** (.04)	.19*** (.05)
R^2	.66	.59
std. error	.046	.045
No. Obs.	414	414

***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

Turning to the effect of NFA, Table 3 displays a significant positive correlation between the real exchange rate and the level of net foreign assets. When net foreign assets increase by an amount equal to total exports plus imports ($\Delta NFA=1$) the real exchange rate appreciates by 24 percent in the short run and 10-11 percent in the long run. The short-run effect is much larger because the exchange rate is a forward-looking variable and current account balances are very persistent. Thus, a small increase in the growth rate of NFA tends to lead to a large permanent increase in the level of NFA. The negative coefficient on future changes in NFA reflects the equilibrating nature of the system, as an appreciating exchange rate puts downward pressure on the future growth rate of NFA. To put these estimates in perspective, the United States' current account balance in 1994 was equal to about 10 percent of exports plus imports of goods and services. A permanent decrease in NFA of this magnitude would be expected to depreciate the real exchange rate by 1 percent in the long run.

As in the previous section, an augmented Dickey-Fuller test strongly rejects the hypothesis of a unit root in the estimated time effects of both regressions presented in Table 3. Figure 7 plots the time effects from the REW regression. The horizontal line represents the mean value of the estimated time effects.[9]

Robustness

Table 4 compares the basic results for the WPI real exchange rate with five alternative specifications to provide evidence on the robustness of the estimated relationship between net foreign assets and the real exchange rate. The first column reprints the estimates from the last column of Table 2. The short-run dynamic coefficients on CWR and GOV are omitted. The second column presents estimates of

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[9]The inclusion of a full set of country dummies necessitates a zero restriction on one of the time effects, in this case the 1994 dummy was dropped.

Table 4 Alternative Specifications

	Basic Model	Basic Model 1962-94	NFI proxy for NFA	Country-Specific Trends	Country-Specific Dynamics	U.S. as Reference Country
E.C. (ρ)	-.34*** (.04)	-.23*** (.03)	-.35*** (.04)	-.54*** (.05)	-.40*** (.04)	-.35*** (.04)
NFA_{it-1}	.10** (.03)	.14*** (.04)	1.22*** (.45)	.11** (.05)	.09*** (.03)	.08** (.03)
CWR_{it-1}	-.26* (.16)	-.17 (.11)	-.16 (.16)	.25 (.17)	-.23 (.14)	-.27* (.15)
ΔNFA_{it+1}	-.14*** (.05)	-.12*** (.04)	.11 (.31)	-.15*** (.06)	n.a.	-.15*** (.05)
ΔNFA_{it}	.24*** (.05)	.19*** (.04)	-.35 (.32)	.17** (.05)	n.a.	.25*** (.05)
ΔREW_{it-1}	.19*** (.05)	.18*** (.04)	.20*** (.05)	.25*** (.05)	n.a.	.18*** (.05)
R^2	.59	.50	.57	.65	.69	.80
No. Obs.	414	593	411	414	414	406

***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

the basic specification over the entire sample from 1962 through 1993. Not surprisingly--given the switch from fixed to floating exchange rates--there is evidence of a structural break in the adjustment speed coefficient, but one can still reject noncointegration at the 1 percent level. (It is because of this structural break that most of the regressions focus on the floating-rate period only.) Using the entire sample, the long-run estimated effect of NFA on REW is even greater and more significant than in the floating rate subsample.

The second alternative examines the effect of measurement error in net foreign assets. NFA is calculated by cumulating the own-currency current account balances over time.[10] The lack of an initial benchmark value has no effect on the estimated coefficient since there is a complete set of country-specific intercepts in the regression. However, the calculation of NFA ignores valuation effects on the gross stocks of foreign assets and liabilities due to movements in exchange rates, equity prices, and land prices. In addition, there are large errors and omissions in the international current accounts data. The third column presents estimates using the ratio of net factor income to total trade (NFI) as an alternative measure of NFA. In theory, NFI should be equal to a market rate of return times the level of NFA. If the rate of return were around 5 to 10 percent, one would expect the coefficient on NFI to be around 10 to 20 times larger than that on NFA. As shown in Table 4, the estimated coefficient on NFI is 12 times larger than that on NFA, implying an average rate of return of 8 percent. The short-run impact of changes in NFI appear quite different from those of NFA. This difference probably reflects the tendency for foreign assets to be denominated in foreign currencies and foreign liabilities to be denominated in domestic currency. Periods of exchange-rate appreciation are thus associated with declining net factor income, as the domestic-currency value of earnings on foreign assets declines relative to payments on foreign liabilities.

[10]As the sum of net factor income and exports minus imports of goods and services, NFA differs from a cumulated current account balance slightly due to the omission of unilateral transfers.

The next two alternatives consider different econometric specifications. The fourth column displays the effect of including country-specific time trends in the regression. The specification with time trends yields a somewhat faster estimated adjustment speed and a positive, but insignificant, long-run effect of CWR on REW. The estimated long-run effect of NFA is essentially unaffected. The fifth column displays the effect of estimating separate coefficients for each country on the lagged difference of the exchange rate and the forward and backward differences of net foreign assets. Despite the profligate parameterization of this specification, the coefficient on the level of NFA is nearly identical to its value in the basic specification.

Finally, the last column presents the estimates of the basic specification when all exchange rates are defined relative to the United States. In this regression the U.S. data are dropped and the German data are included. The results are very similar to those of the first column.

Interpretation of Results

The statistical results of the previous three sections suggest a paradox: Real exchange rates are stationary; net foreign assets are nonstationary; yet there is a long-run correlation between real exchange rates and net foreign assets. The solution to this paradox is apparent in Figure 8.

The solid lines are log WPI real exchange rates (REW), demeaned by country. The cross symbols represent the long-run effect of the ratio of net foreign assets to total trade (NFA) and the CPI-WPI ratio (CWR) on REW from the basic regression, also demeaned by country. The cross symbols are estimates of the long-run equilibrium real exchange rate. In every country, the variance of the real exchange rate exceeds the variance of the equilibrium exchange rate. In many countries, the equilibrium real exchange rate is essentially a constant, reflecting the stability of NFA and the very small effect of CWR. For these countries, the real exchange rate is stationary. Since these countries dominate the sample, the panel unit root test is able to reject the hypothesis that all real exchange rates contain a unit root.

However, for several countries--notably Australia, Japan, New Zealand, Switzerland, and the United States--NFA does have a visible trend. These countries provide the evidence in favor of a long-run effect of NFA on REW.[11] To take two important examples: Between 1973 and 1994 NFA fell from .53 to -.45 in the United States, implying a permanent real exchange rate depreciation of nearly 10 percent. During the same period in Japan, NFA rose from .29 to 2.0, implying a permanent real appreciation of roughly 17 percent. Thus, movements in net foreign assets can explain a cumulative drift of 27 percent in the U.S.-Japanese real exchange rate over the past 20 years, which is nearly two-thirds of the total movement in the real bilateral exchange rate over this period.

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[11]When these countries are excluded from the regression, the long-run coefficient on NFA is greatly reduced but the new estimate is only about one standard deviation lower than the original estimate. The remaining coefficients are affected only slightly.

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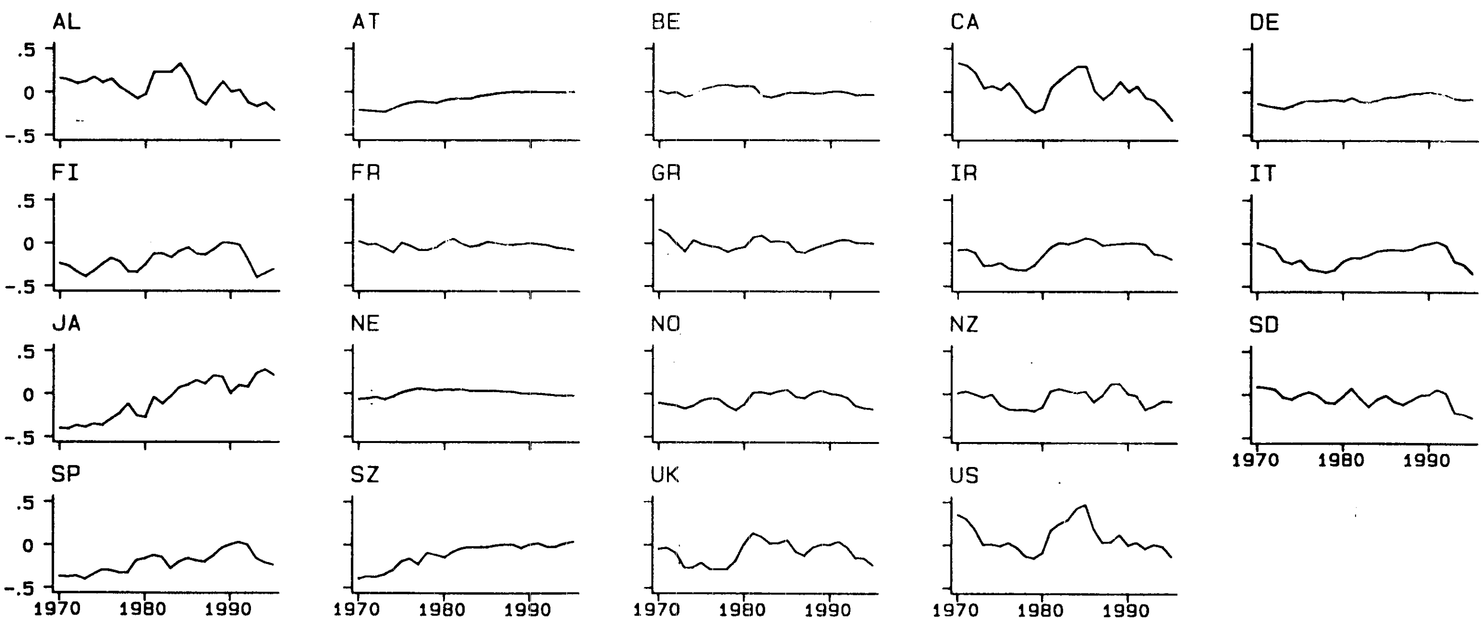

Figure 1
Log CPI Real Exchange Rate (1990=0)

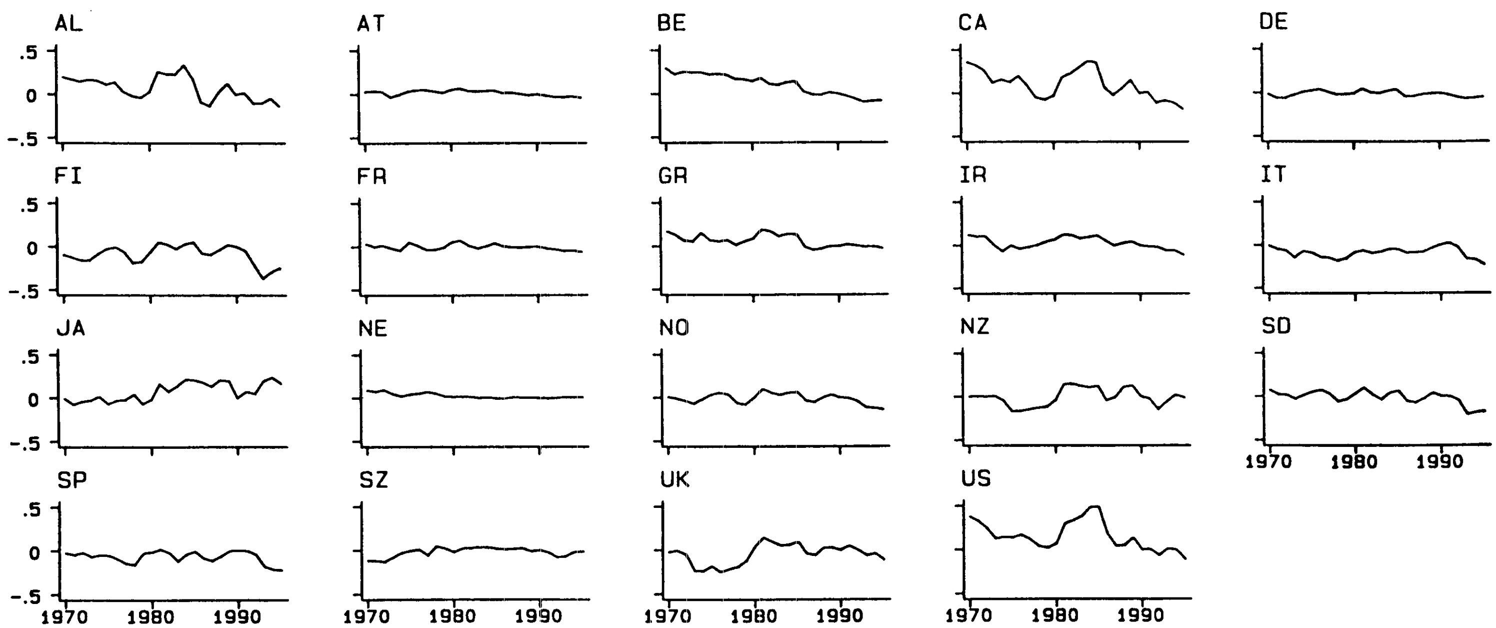

Figure 2
Log WPI Real Exchange Rate (1990=0)

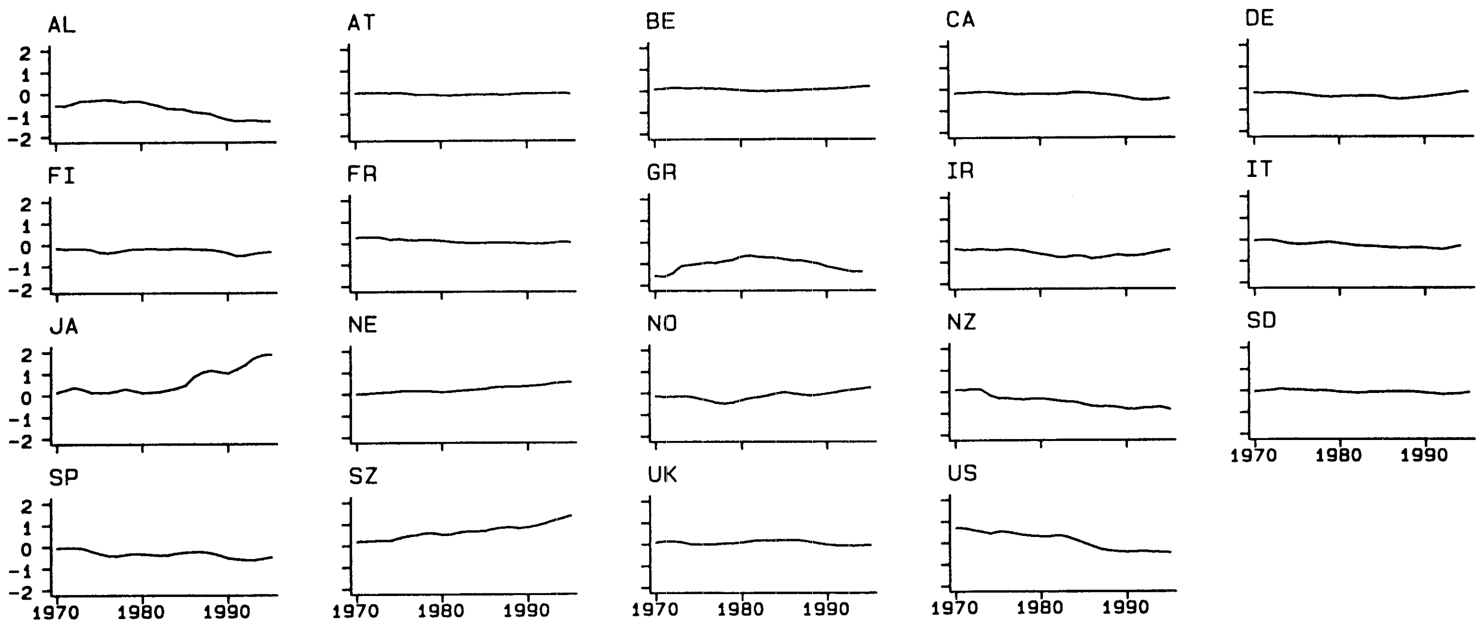

Figure 3
Net Foreign Assets to Total Trade

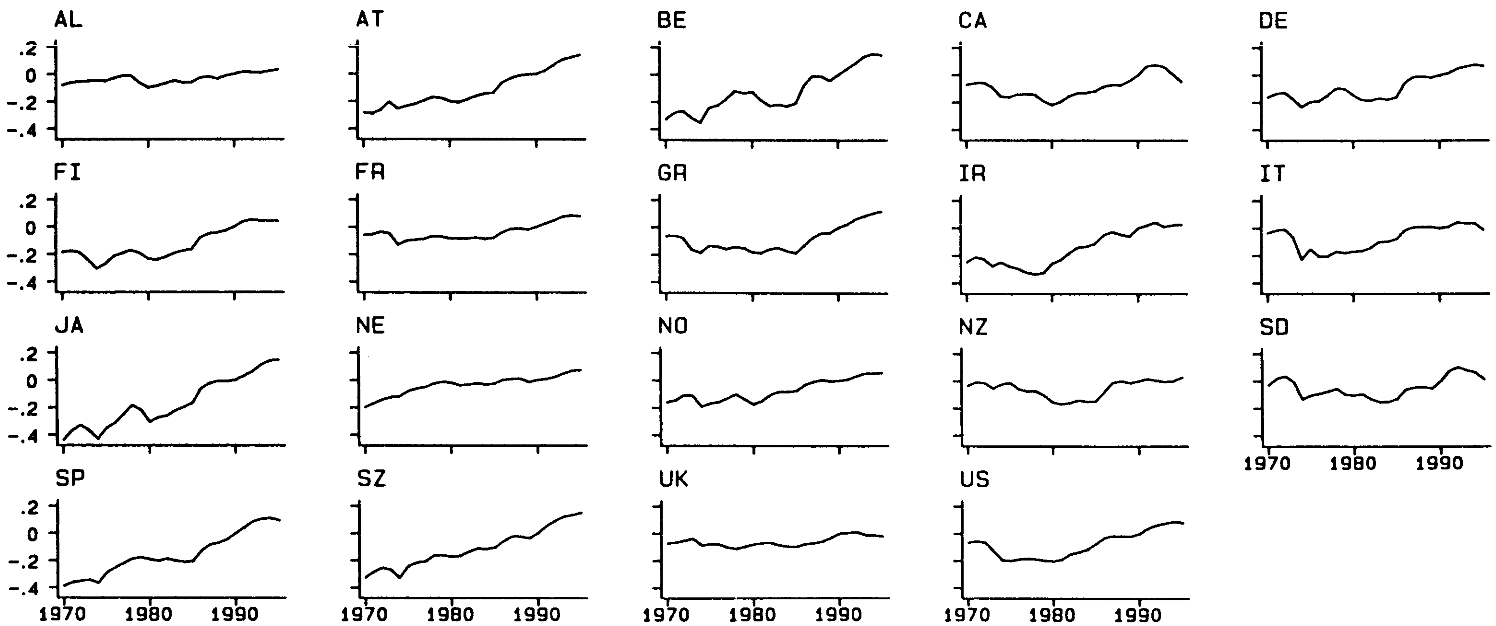

Figure 4
Log CPI-WPI Ratio (1990=0)

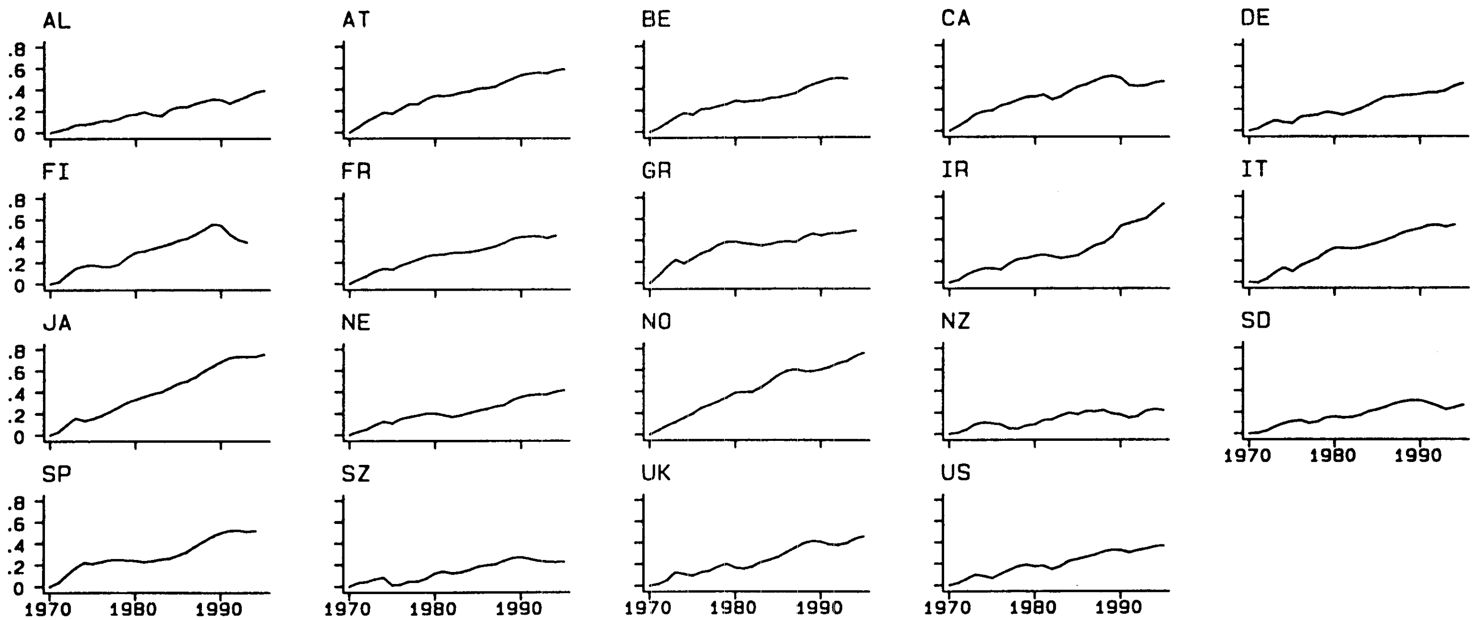

Figure 5
Log Real Per Capita Income (1970=0)

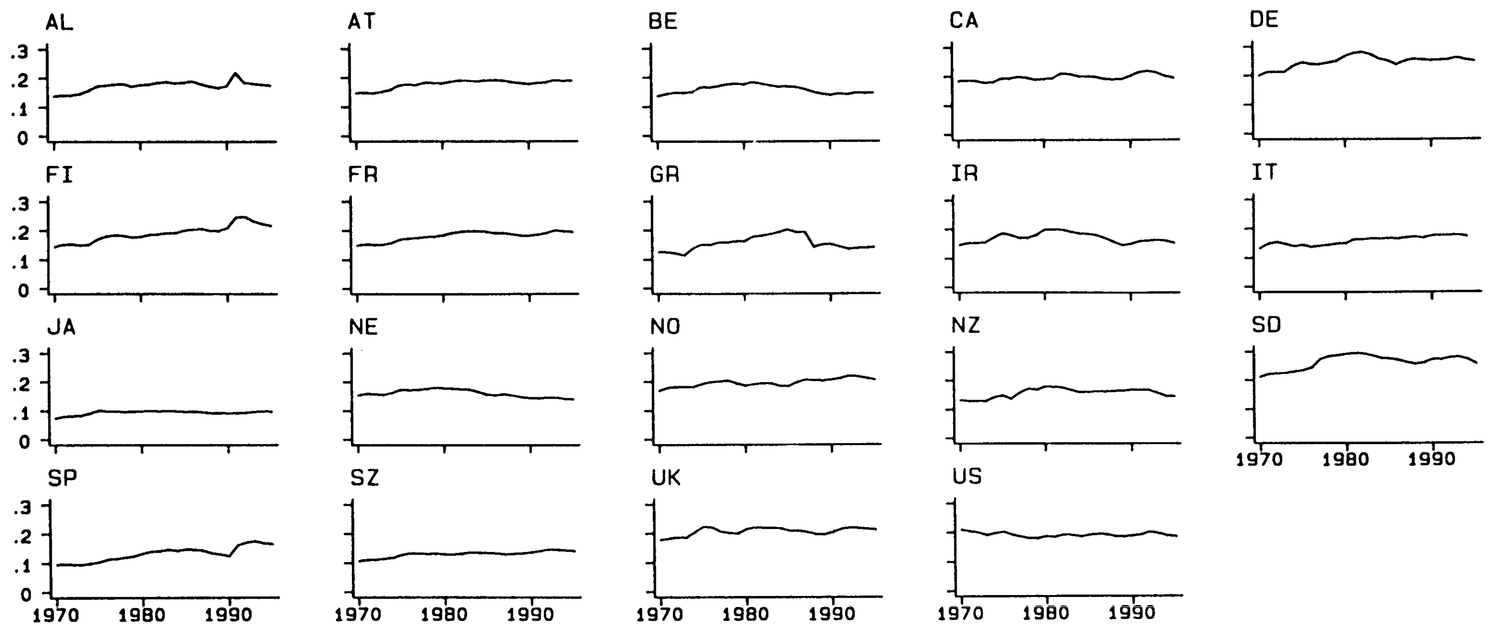

Figure 6
Government Share of GDP

Figure 7
Estimated Time Effects

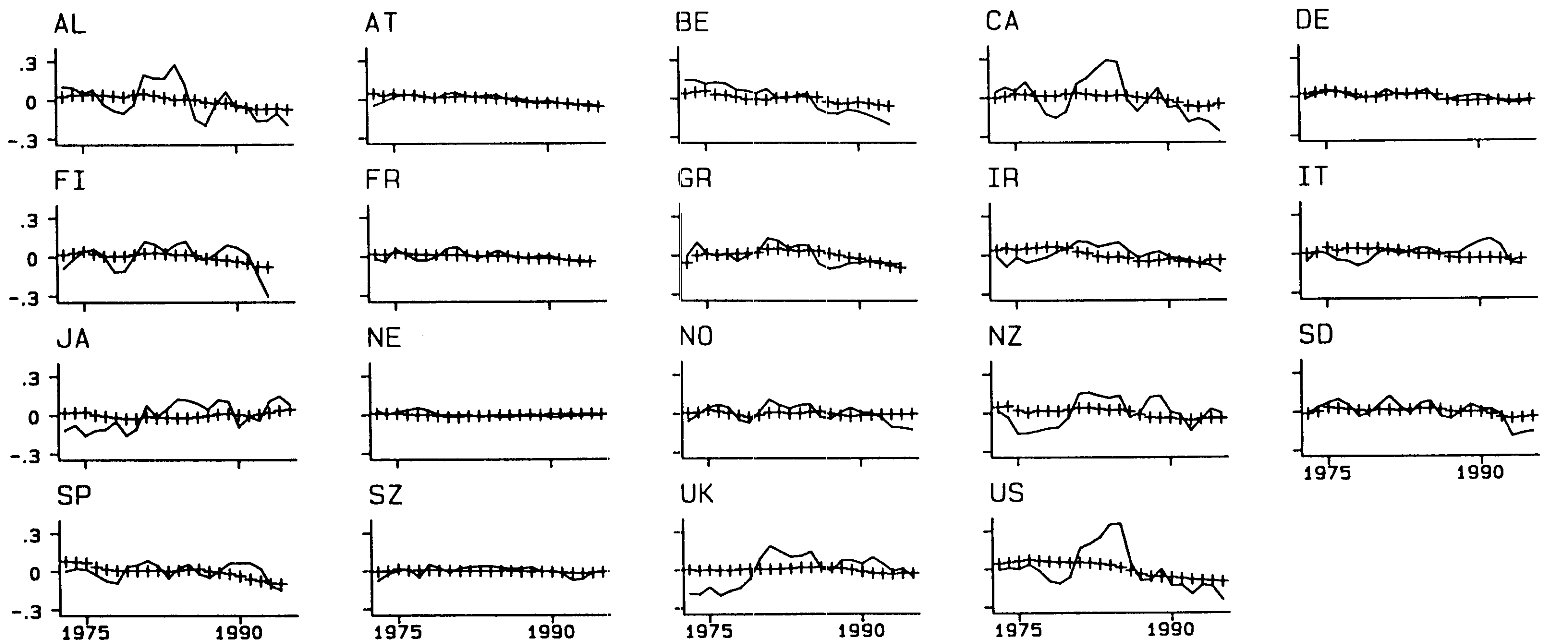

Figure 8
Equilibrium Real Exchange Rates, Demeaned

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Joseph E. Gagnon