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Long-Term Capital Movements

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Abstract

International financial integration allows countries to become net creditors or net debtors with respect to the rest of the world. In this paper, we show that a small set of fundamentals—shifts in relative output levels, the stock of public debt and demographic factors—can do much to explain the evolution of net foreign asset positions. In addition, we highlight the role that "external wealth" plays in determining the behaviour of the trade balance, and we provide some evidence that a portfolio balance effect exists: real interest rate differentials are inversely related to net foreign asset positions.

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Contents Page

I. INTRODUCTION

The global integration of capital markets has been one of the biggest stories in the world economy in recent decades. International asset trade offers several potential benefits. Countries can share risks via international portfolio diversification; the efficient allocation of capital to the most productive locations is promoted; and consumption can be smoothed across time periods in response to shifts in macroeconomic fundamentals. While risk sharing may be largely accomplished through gross international asset trade, net capital flows will typically be required for the latter two functions.

With respect to net asset trade, the empirical literature initiated by Feldstein and Horioka (1980) has focused on the evolution of current accounts across countries and through time, highlighting the degree of co-movement between national saving and domestic investment. Another branch of the literature has investigated whether net capital flows respond appropriately to cyclical macroeconomic shocks, most prominently in the literature that has tested "present value" models of the current account (see Obstfeld and Rogoff, 1996).

In this paper, we instead turn our attention to the *stocks* of external assets and liabilities, studying the long-term factors driving the evolution of countries' net external positions. Our interest in this subject, which has received much less attention in the literature, is based on a number of considerations. First, international macroeconomic theory suggests that a host of long-term fundamentals can lead to countries becoming persistent international net creditors or international net debtors. Such long-term factors can be missed if emphasis is exclusively placed on current account imbalances, even using long spans of data: for instance, a country may run persistent current account deficits but still be reducing its external liabilities relative to GDP. Second, if long-term factors are important in determining net foreign asset positions, short-term flows cannot be properly understood unless the constraints imposed by long-run equilibrium conditions are explicitly taken into account. For example, the implications of a country's current account deficit depend on whether it is moving the country toward or away from its target long-run net foreign asset position.

Why then has little attention been devoted to studying such longer-run issues? Paucity of data on foreign asset and liability stocks has been a traditional barrier to research on net foreign asset positions. Only a few countries have published reliable estimates of accumulated stocks, whereas current account data have been much more widely available. In Lane and Milesi-Ferretti (1999), we have employed a uniform methodology to generate estimates of foreign asset and liability positions for a large number of industrial and developing economies over the past three decades. This data set enables us to analyze the behavior of net foreign asset positions in a more comprehensive manner than in the efforts of previous researchers.

We address three questions about net foreign asset positions. First, we try to explain their behavior, across countries and over time, investigating why some countries are net creditors and others net debtors, and why some creditors turn into debtors, such as the United States, and vice-versa, like Singapore. Identifying the long-term macroeconomic forces underlying the endogenous determination of net foreign asset positions provides insight into the role played by international financial integration in allowing countries to de-link national production and consumption.

Second, we identify two mechanisms that link trade balances to net foreign asset positions. One key channel is that changes in the target long-run net foreign asset position are an important force driving the current account. The other is that, for a given desired net foreign asset position, a country that enjoys high returns on its foreign assets and pays out low returns on its foreign liabilities can afford to run a smaller trade surplus (or larger trade deficit). In this way, we highlight the role of a state variable (the net foreign asset position) in determining the dynamics of the trade balance.

Third, we explore the relation between net foreign asset positions and the real interest rate differential. This is an old question in the portfolio balance literature: do debtor countries pay a risk premium? The traditional literature attempted to link currency return differentials to outstanding relative stocks of national monies but much less research has been directed at linking differences in real interest rates across countries to long-run net foreign asset positions (Frankel and Rose, 1995).

The structure of the rest of the paper is as follows: in Section II, we briefly discuss the broad properties of our data set of foreign assets and liabilities. The determination of long-run net foreign asset positions is investigated in Section III. Section IV models the short-run dynamics of the net foreign asset position and the behavior of the trade balance. We turn in Section V to the relation between the net foreign asset position and the real interest rate differential. Conclusions and directions for future research are offered in Section VI.

II. International Balance Sheets: Stylized Facts

A. Methodology

A country's net external position is the sum of net claims of domestic residents on nonresidents. In line with the way in which transactions are recorded in balance of payments statistics, we classify external assets and liabilities into three main categories: foreign direct investment (FDI), portfolio equity (EQ), and debt instruments (DEBT). Foreign exchange reserves (FX) belong in this last category, although we keep them separate in the overall accounting. Hence we define net foreign assets (NFA) as follows

$$NFA_{it} = FDIA_{it} + EQA_{it} + DEBTA_{it} + FX_{it} - FDIL_{it} - EQL_{it} - DEBTL_{it} \qquad (1)$$

where the letter A indicates assets and the letter L liabilities. The FDI category reflects a "lasting interest" of an entity resident in one economy in an enterprise resident in another economy (IMF, 1993). This includes greenfield investment as well as equity participation giving a controlling stake (typically set at above 10 percent), while remaining equity purchases are classified under portfolio equity investment.[2] The debt category includes trade credits, bank loans, and portfolio bond instruments.

For most industrial countries, estimates of stocks of external assets and liabilities are published by national authorities and collected by the IMF and the OECD, but coverage starts for most countries only in the early eighties. The corresponding measure of net foreign assets is called the International Investment Position (*IIP*). For developing economies, however, comprehensive stock data are generally available only for external debt and foreign exchange reserves; *IIP* availability is limited, especially along the time series dimension. In addition, the methodologies used to estimate the various stocks of equation (1) often differ across countries (for example, book or market value for equity and FDI) making cross-country comparisons more difficult.

In order to overcome the limitations in existing data, we have constructed data on external assets and liabilities for 66 industrial and developing economies, covering the period 1970–98. We discuss in detail the methodology we use for estimating net external positions in Lane and Milesi-Ferretti (1999). Broadly speaking, we rely on stock data, when available, supplemented by cumulative flows data, with appropriate valuation adjustments. The latter are particularly important given the increased role played by portfolio equity and FDI flows during the past decade.

The use of flow data can be better understood by considering the fundamental balance of payments identity, which states that the current account, net financial flows and changes in foreign exchange reserves sum to zero, with a term capturing "net errors and omissions" acting as the balancing item.[3] Financial flows can be divided between FDI, portfolio equity and debt flows, plus a term capturing capital account transfers, which include debt forgiveness operations and other transactions that do not give rise to a corresponding asset or liability. The evolution of net claims on the rest of the world is dictated by the flows of new net claims—which equal the current account balance net of capital transfers TR_t^k —and by capital gains and losses KG on existing claims

$$\Delta NFA_{it} = CA_{it} + TR_{it}^k + KG_{it} \tag{2}$$

Our first measure of net foreign assets, *CUMCA*, is available for all countries and is obtained by cumulating current account balances, net of capital transfers, with appropriate adjustments designed to take into account valuation effects, debt reduction and debt forgiveness and other

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[2] This implies that in certain cases the distinction between these two categories can de facto be blurred, but the issue cannot be clarified further in the absence of detailed disaggregated data.

[3] We assume that errors and omissions reflect changes in the debt assets held by country residents abroad, in line with the capital flight literature. See Lane and Milesi-Ferretti (1999) for a discussion of this issue.

terms subsumed in *KG*. For example, we adjust the outstanding stock of equity assets and liabilities so as to reflect variations in the U.S. dollar value of stock market indices, and the stocks of inward and outward FDI to reflect changes in the cross-country prices of capital goods. A comparison with existing data on stocks of external assets and liabilities provides a satisfactory robustness check on our methodology.

For developing economies, we also construct a second measure, *CUMFL*, that is obtained as the sum of stocks of the various external assets and liabilities, calculated as adjusted cumulative capital flows or, as is the case for external debt and foreign exchange reserves, as direct stock measures. As is explained in detail in Lane and Milesi-Ferretti (1999), our *CUMCA* measure implicitly considers estimates of cumulative unrecorded capital flows as assets held by the country residents abroad. Instead, *CUMFL* includes unrecorded capital outflows only to the degree that they are reflected in net errors and omissions, and hence a lower fraction of unrecorded external capital holdings than *CUMCA*.[4] We use these measures to supplement the existing *IIP* data.

Before turning to the presentation of the data, it is important to point out that the measurement of international current and capital transactions faces severe problems, in particular under-recording of exports/capital outflows, reflected in the existence of a measured "world current account deficit" (over US$70 billion in 1998). These problems are unavoidably reflected in our data, which makes use of official sources; even though we try to account to the extent possible for unrecorded capital outflows, external assets are as a whole underreported.

B. Net Foreign Assets: Broad Trends

The distribution of countries between large and small creditors and debtors in 1975, 1986 and 1997 is depicted in Figure 1.[5] In industrial countries as a whole the dispersion of net external

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[4] For developing countries, the CUMCA measure determines the stock of debt assets residually, after subtracting from the estimated net external position the net FDI and equity positions and the difference between reserves and external debt. To understand the difference with CUMFL, consider, for example, the case of a country with a trade deficit entirely financed by a flow of new debt liabilities (and errors and omissions equal to zero). Assume, as has often been the case in developing countries during periods of capital flight, that the change in the stock of external debt (measured by World Bank data) exceeds the recorded debt inflow in the balance of payments. Cumulating the current account (as in CUMCA) implies that the change in the net external position is equal to the recorded flow of new debt, and thus implicitly assumes that the difference between the change in the stock of debt and the flow is offset by an accumulation of debt assets of the country abroad. If debt assets are instead estimated directly as cumulative flows (as is the case for CUMFL), the change in the net external position corresponds to the increase in the stock of external debt.

[5] We focus here just on the overall net foreign asset position. See Lane and Milesi-Ferretti (2000b) for a discussion of the composition of the "external capital structure."

positions has increased during the past 25 years, with an increase in the number of relatively large debtors, especially between 1975 and 1986, and in the number of creditors with assets above 10 percent of GDP. For developing economies, there is a large increase in the number of countries with "large" external liabilities (over 40 percent of GDP) between the 1970s and the 1980s, in the aftermath of the debt crisis. More generally, a pattern of increased dispersion in net external positions is also visible, and is especially strong between the 1970s and the 1980s.

Figure 2 plots different net foreign asset measures as ratio of GDP for a selection of industrial countries for the period 1970–98. We graph both our estimate *CUMCA* and the direct estimate of net foreign assets (*IIP*) when available.[6] Only a few countries have remained creditors throughout the past three decades (Germany, Japan, Netherlands, and Switzerland); the rest of the group is almost evenly split between persistent debtors and "switchers." Among the latter, a well-known case is the United States.

Figure 3 plots net foreign asset measures for some of the developing nations in our sample, highlighting a number of interesting facts. First, the dynamics of external positions in the countries most affected by the debt crisis is similar, with a sharp worsening during the early 1980s and an improvement later in the decade. Second, net external liabilities measured with *CUMFL* are significantly larger than *CUMCA* in several countries (Argentina, Brazil, Mexico, and Indonesia), reflecting unrecorded capital outflows. The third is the effect of the currency collapse due to the Asian crisis on external liabilities in Indonesia and to a lesser degree in Thailand. Finally, the improvement of Singapore's net external position over time is remarkable.[7]

III. The Determinants of Net Foreign Asset Positions

We propose a parsimonious reduced-form model of the net foreign asset position

$$b_{it} = \sigma' Z_{it} + \varepsilon_{it}; \qquad Z_{it} = [YC_{it}, GDEBT_{it}, DEM_{it}] \qquad (3)$$

where b_{it} is country i's ratio of net foreign assets to GDP in year t, YC_{it} is its output per capita, $GDEBT_{it}$ is its level of public debt and DEM_{it} is a set of demographic variables. As the discussion in the next subsection makes clear, we have followed the main themes developed in the theoretical literature in selecting these variables as the primary determinants

[6] In Lane and Milesi-Ferretti (1999) we explain the most relevant differences between these two measures.

[7] Taiwan province of China shows a similar, albeit less dramatic trend among the economies in our sample.

of net foreign asset positions.[8] It is important to take note that all variables should be interpreted as measured relative to global values, since common movements in output per capita, demographic trends and government debt should not affect net foreign assets but rather will operate via global variables such as the world real interest rate.

A. Theoretical Channels

Relative output per capita can affect net foreign asset positions through several channels. First, if the domestic marginal product of capital decreases as an economy grows richer, domestic investment will fall and home investors will seek out overseas accumulation opportunities. Second, an increase in domestic income may lead to a rise in the domestic savings rate. This result is most clearly generated in models with habit formation in consumption preferences: as an economy grows, consumption will lag behind output (see, for instance, Carroll, Overland and Weil, 2000). An alternative explanation has been suggested by Rebelo (1992): under Geary-Stone preferences, the savings rate will also be increasing in income levels, since the marginal utility of extra consumption sharply diminishes once basic consumption needs are satisfied. We note that, even if the increase in the savings rate is temporary, there may be a permanent improvement in the net foreign asset position. A positive relation between relative output per capita and the net foreign asset position is also captured in the traditional "stages of the balance of payments" hypothesis (see Halevi, 1971; and Fischer and Frenkel, 1974).

Although these factors point to a positive relation between relative output per capita and the net foreign asset position, an effect operating in the opposite direction may be at work in developing economies operating under credit constraints. In models in which an improvement in net worth or cash flow relaxes financial constraints, an increase in production may allow greater recourse to foreign credit, possibly implying a negative relation between net external assets and relative output at least over some interval.

The second variable we consider is the stock of public debt. In a world that exhibits departures from Ricardian equivalence, higher levels of public debt may be associated with a decline in the external position. For instance, in the Blanchard-Yaari finite-horizon model, an increase in public debt is not fully offset by an increase in private asset accumulation since public debt is perceived as net wealth by current generations, who will bear only part of the tax burden implied by its higher stock (Blanchard, 1985, Faruqee and Laxton, 2000). Third, demographic factors are also potentially important determinants of the net foreign assets. For instance, countries with an ageing population can prepare for an increase in the ratio of

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[8] Since we have a limited number of time series observations, we are constrained in the number of determinants that we can include in our empirical work. As is detailed in subsection 3a, there are myriad channels by which these variables can potentially affect net foreign asset positions and a number of theoretical contributions highlight some of these individual mechanisms. Building an integrative general equilibrium model that would nest the various hypotheses is beyond the scope of this paper and our empirical specification will inevitably not be able to discriminate between all competing theories.

retirees to workers by accumulating overseas assets to supplement domestic income streams. Domestic investment in these countries will also be curtailed as the marginal product of capital is diminished by a reduction in the growth of (or a decline in) the working-age population and the labor force.

At the other end of the population distribution, a society with a high youth dependency ratio may require heavy investment in social infrastructure (education, housing). A high youth dependency ratio may also reduce the savings rate, as households with children attempt to smooth consumption. Accordingly, we may expect to see a decline in net foreign assets in countries experiencing a rise in the youth dependency ratio (see also Taylor, 1994, Obstfeld and Rogoff, 1996, Higgins, 1998).

However, the impact of demographic factors on the net foreign asset position is not just a function of the youth and old-age dependency ratios but also of the age structure of the working-age population (Mundell, 1991). For instance, a relatively young workforce may be associated with relatively low saving and high investment whereas an older workforce may be associated with a rise in the net foreign asset position, as the saving for retirement motive kicks in and domestic investment falls. For this reason, we will employ the entire age distribution in our empirical work.

Finally, some authors have recently modeled the determination of net foreign asset positions in a stylized mean-variance portfolio framework, with the demand and supply for domestic and foreign assets being determined by risk and return characteristics and by the profiles of investors (see Calderón, Loayza and Servén, 2000; Kraay, Loayza, Servén and Ventura, 2000; and Edwards, 2001). As the preceding discussion has highlighted, our fundamentals—output per capita, public debt and demography—potentially affect these factors in complex ways. Among the channels not already discussed, output per capita and years-to-retirement may plausibly affect the degree of risk aversion. However, the relation between risk aversion and the net foreign asset position depends on whether the "safe" asset is domestic or foreign, which is typically a model-specific choice.

B. Previous Empirical Work

Masson, Kremers, and Horne (1994) are one of the very limited numbers of studies focusing on the evolution of net foreign assets.[9] In their country studies of the United States, Japan and Germany over the period 1960–85, they relate net foreign asset positions to the overall dependency ratio and the level of government debt, but do not include the level of income per capita.[10] They find evidence of a long-run relation between these variables, and highlight

[9] Halevi (1971) and Roldós (1996) provide some empirical evidence on the "stages of the balance of payments" hypothesis.

[10] In a study of OECD countries, Bayoumi and Gagnon (1996) also control for fiscal and demographic effects but their primary focus is on the effects of inflation on net foreign asset positions.

the role of feedback mechanisms working through absorption in the adjustment process towards the long-run equilibrium. Calderón, Loayza and Servén (2000) relate the evolution of net foreign assets to composite measures of risk and return; they find support for their specification, particularly for countries with low barriers to international capital movements.

Taylor (1994), Higgins (1998), and Herbertsson and Zoega (1999) have provided some evidence that demographic factors are an important driving force of medium-term current account behavior. Herbertsson and Zoega (1999) focus in particular on the link between population age structure and public and private saving behavior: they highlight how countries with high youth dependency ratios tend to have larger current account deficits.[11] Employing a demographic specification similar to ours, Taylor (1994) and Higgins (1998) show that the demographic structure is quantitatively important in explaining medium-term current account behavior.

C. Empirical Analysis

Our empirical analysis of the long-run behavior of net foreign assets uses data for 66 countries spanning the period 1970–98. Throughout our empirical work, we split the sample between "industrial" and "developing" economies.[12] The industrial countries consist of long-standing members of the OECD, which approximately corresponds to the most-developed set of countries at the start of the sample period. We allow for potentially different relations between our fundamentals and net foreign asset positions for the two groups, as well as for differences in data quality. For instance, we have already noted that the output per capita may exert different effects in both groups and the difference in life expectancy and in retirement patterns means that demographic effects plausibly will also differ across the two samples. Furthermore, differences in the pervasiveness of liquidity constraints and other sources of violation from Ricardian equivalence may induce differences in the relation between net foreign assets and public debt in the two groups.

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[11] However, Chinn and Prasad (2000) find instead only weak evidence of a systematic impact of dependency ratios on current account balances in a wide sample of industrial and developing countries.

[12] "Industrial" countries include the United States, United Kingdom, Austria, Belgium-Luxembourg, Denmark, France, Germany, Italy, Netherlands, Norway, Sweden, Switzerland, Canada, Japan, Finland, Greece, Iceland, Ireland, Portugal, Spain, Australia, and New Zealand. "Developing" economies are Turkey, South Africa, Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Mexico, Panama, Paraguay, Peru, Uruguay, Venezuela, Jamaica, Trinidad and Tobago, Israel, Jordan, Kuwait, Oman, Saudi Arabia, Syrian Republic, Egypt, Sri Lanka, Taiwan province of China, India, Indonesia, Korea, Malaysia, Pakistan, Philippines, Singapore, Thailand, Algeria, Botswana, Côte d'Ivoire, Mauritius, Morocco, Zimbabwe, Tunisia, and China.

We use the following variables: net foreign assets as a ratio of GDP (*CUMCA* and *CUMFL* measures, as well as the *IIP* measure for robustness checks), GDP per capita in 1995 U.S. dollars (in log form), the stock of public debt as a ratio of GDP, and the shares of population under 14, over 65, and between 15 and 64 (in five-year cohorts).[13]

Public debt is defined as the sum of external public debt, net of foreign exchange reserves, and gross domestic public debt.[14] For industrial countries, the main source of data for public debt is the OECD (general government definition); for developing economies, the data have been constructed using the World Bank's Global Development Finance, the IMF's Government Financial Statistics and national sources. Unfortunately the definition of government for developing economies is not homogeneous—it can refer to central government, general government or nonfinancial public sector. When data availability was not a constraint, we have used the broadest definition of government. A data Appendix detailing sources and definitions for the debt data is available from the authors.

Finally, population shares were constructed using the United Nations' Demographic Yearbook (Historical Supplement 1948–97), supplemented by data from Herbertsson and Zoega (1999).[15]

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[13] Ideally, we would like to measure net foreign assets relative to a country's total wealth but this would require data on land values, natural resources, human capital, and the value of domestic assets. In any event, it is plausible that GDP may serve as a reasonable proxy for wealth.

[14] We would of course prefer to use net domestic public debt, but data availability for such a measure is much more limited. Since we focus on time series behavior, and given the strong co-movement between the two measures for those countries for which they are both available, we are confident that this choice still allows us to capture the right long-run relation. As we will discuss later, obstacles are more serious when undertaking cross-sectional analysis because of cross-country differences in the definitions of "government."

[15] We thank these authors for kindly sharing their data.

Bivariate relations

As a precursor to the multivariate econometric work, we begin in Figures 6–8 by showing the bivariate relations between net foreign asset positions on the one side and output per capita, public debt and demographic structure on the other. In these graphs, the data are measured in terms of average changes between the 1980–89 and 1990–98, capturing the medium- or long-term movement in country positions.[16] In each figure, Panels A and B contain observations from the industrial and developing economies, respectively.

Panel A of Figure 4 shows a quite striking positive bivariate relation between growth in output per capita and improvement in the net foreign asset position among the industrial nations. A significant positive relation between output per capita and the net foreign asset position is also evident in the developing country sample in Panel B of Figure 6. However, the slope is flatter and the overall fit is much weaker. We will return to the difference in slopes between the industrial and developing samples when interpreting the results of the regression analysis below.

Figure 5 plots the change in the net foreign asset position against the change in the public debt to GDP ratio. For both industrial and developing economies, we observe an inverse bivariate relation: growth in public debt tends to be associated with a decline in the net foreign asset position.

We turn to the impact of demographic structure in Figure 6. This figure charts the correlation between the change in the net foreign asset position and the change in the population shares in each age cohort (0–14, 15–19, … , 60–64, 65+). For the industrial countries, we see that an increase in the youth dependency ratio is associated with a decline in the net foreign asset position, as is an increase in the 30–49 age groups (albeit these correlations are weaker). There is a "twin peaks" effect here: increases in both the 15–29 and 50–64 age groups are associated with an improvement in net foreign assets. For the developing economies, the impact of demographic structure is more uniform: an increase in the 15–29 population share is associated with a decline in the net foreign asset position, whereas the 30–49 population share exerts a positive effect.

Although these scatter diagrams provide some suggestive evidence, the interpretation of bivariate relations of course should not be pushed too far. For instance, there is a strong correlation in the data between demographic structure and output per capita, both along the time series and the cross-sectional dimension, which could explain the co-movements of one of these variables with net foreign assets. To uncover whether all of these variables play a simultaneous role in the dynamics of net foreign assets, we next turn to panel regressions for formal multivariate regression analysis.

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[16] This "cross-section in first differences" is essentially a country fixed-effects specification, picking up intra-country time variation. We get similar graphs if we also employ data from the 1970s but the more recent period offers more complete data and may better capture behavior under integrated capital markets.

Panel fixed-effects regression analysis

Since we are interested in the role played by shifts in our fundamentals in explaining the dynamic evolution of net foreign asset positions, we focus on a fixed-effects panel specification in this subsection (we consider the cross-section evidence in the next subsection). The country fixed effects also have the merit of soaking up unobserved variables that may lead to permanent differences in measured net foreign asset positions across countries.[17] To control for common global movements, in particular of world GDP per capita, demographics and public debt, we also include time dummies in all the regressions.

As a precursor to the regression analysis, we explored the univariate time series properties of the data. We tested for nonstationarity in our series for net foreign assets, demographic variables, government debt and log GDP per capita using the NPT1.1 econometric package (see Chiang and Kao, 2000). The tests were performed separately on the industrial and the developing country samples, using the panel unit root test of Hadri (2000) (allowing for fixed effects and no time trend). For all series in the four samples, the test rejects the null hypothesis of stationarity.[18] In light of the evidence on the presence of unit roots, we subsequently tested for panel cointegration among our variables using tests suggested by Kao (1999) and Pedroni (1999). Both are residual-based tests for which the null hypothesis is lack of cointegration (nonstationarity of residuals). These test statistics are reported in Table 1 and strongly suggest the existence of a cointegrating relation among net foreign assets and our fundamentals.

Having ascertained that the variables display a common trend, we follow Stock and Watson (1993) and estimate their long-run relation using a dynamic ordinary least squares (DOLS [-1,1]) specification.[19] We report estimates for the 1970–98 and 1980–98 intervals. The data set is more complete for the post-1980s period and, in addition, this latter period may better reflect an environment of open capital accounts.[20]

With respect to the specification, we want to allow the entire age structure to influence the net foreign asset position but do not wish to estimate independent parameters for our 12 age cohorts. We therefore follow Higgins (1998) by restricting the coefficients on the population

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[17] This may capture both country-specific determinants of net foreign asset positions and permanent measurement errors in our estimates of national net foreign asset positions.

[18] Other panel unit root tests gave broadly similar results. The unit root test results are available from the authors.

[19] A DOLS [-2,2] specification gave similar results. Only leads and lags of output growth and changes in public debt are included (including changes in demographic variables makes no difference). Standard errors are corrected for heteroskedasticity.

[20] In future work, we plan to explicitly look at measures of capital account liberalization.

share variables to lie along a cubic polynomial, so that only three composite demographic variables need actually be entered into the regression specification (see the Appendix for details).

Tables 2 and 3 report the results of the panel estimation (with fixed country and time effects) for the industrial and developing country samples, respectively. For the industrial country sample, we use both our measure of net foreign asset positions (*CUMCA*) and, for robustness, a measure that replaces *CUMCA* by official international investment position data where it is available for most of the sample period (*CUMCA+IIP*). For developing economies, we employ the two alternative measures of the net foreign asset position (*CUMCA* and *CUMFL*) described in Section 2. We also report results when Singapore is excluded from the sample, since it is an extreme observation with respect to its net foreign asset position, and its role as banking center complicates considerably the construction of accurate net foreign asset measures (indeed, *CUMFL* is not available). Finally, in each case, we also report results for balanced samples.

For the industrial country sample, Table 2 shows a consistently strong positive influence of output per capita on the net foreign asset position. The stable point coefficient of about 0.9 means that a 10 percent improvement in a country's relative output per capita is associated with a 9 percentage point improvement in its ratio of net foreign assets to GDP. This result provides supporting evidence of those theories outlined in Section 3a that predict a positive co-movement between output per capita and net foreign assets.

If we consider the 1970–98 interval, the results for public debt and demographic structure are also quite strong. In line with our theoretical prior, net foreign assets are negatively related to the size of the government debt. The statistically significant -0.125 point estimate implies that the net foreign asset to GDP ratio falls by 6 percentage points in a country that experiences a 40 percentage point increase in its public debt to GDP ratio (relative to the world average), indicating that government debt is largely domestically absorbed.

The relation between net foreign assets and demographic structure also accords with the thrust of the theoretical literature: a decline in the net foreign asset occurs if there is an increase in the population shares of younger age cohorts, whereas the net foreign asset position responds positively to an increase in the share of workers nearing retirement, with a maximum effect for the 50–54 age group. It is also interesting to note that the over-65 age group exerts a negative effect, consistent with the running down of net foreign assets.

However, as is evident from columns (2) and (4) in Table 2, the significance of the public debt and demographic results is lost if we just look at the more recent 1980–98 period. With regard to public debt, the weakening of the conditional correlation is due to just one country, Australia, where public debt exhibits a strong *positive* co-movement with net foreign assets. If Australia is excluded from the sample, the coefficient on public debt rises to -0.12 and is strongly statistically significant. Results for the balanced sample are similar to those for the 1970-98 periods for the full sample.[21]

We next turn to the results for the developing country sample. First, across columns (1)–(6), we observe a negative relation between output per capita and the net foreign asset position: as a developing country becomes relatively richer, it typically sees an increase in its net external liabilities. The contrast with the result for the industrial country sample is quite striking, although the negative coefficient is typically small and is insignificant in column (2). As was noted in Section 3.1, a negative association between output per capita and net foreign assets is consistent with the relaxation of binding credit constraints on developing economies.[22] Second, Table 3 shows a very strong inverse relation between public debt and the net foreign asset position. A point estimate in the range [-0.67, -0.86] implies that a 20-percentage point increase in government debt is associated with a [13.4, 17.2] percentage point decline in net foreign assets. This high "pass-through" from net government liabilities to net external liabilities is also consistent with pervasive credit constraints in developing economies, since credit market imperfections are understood to be a primary source of deviations from Ricardian Equivalence (Bernheim, 1987).[23]

With respect to the impact of demographic structure on the net foreign asset positions of developing economies, the evidence in Table 3 shows a pattern similar to that for industrial countries: an increase in the population share of younger age groups is associated with a decline in the net foreign asset position. A comparison of the α coefficients between the industrial and developing economies also shows a greater sensitivity of the net foreign asset position to age structure in the latter group. However, the significance of these demographic

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[21] Belgium-Luxembourg, Denmark, Finland, Greece, Norway, and Portugal were dropped to obtain a balanced sample.

[22] Results clearly suggest that the relation between output per capita and net foreign assets over the entire sample of industrial and developing countries, is nonmonotonic. To some extent, we capture a nonlinear relation by splitting the sample between industrial and developing countries. We also tried to capture nonlinearities within the developing country sample by positing the existence of a threshold level of income (varying the choice of threshold), as well as by splitting the developing country sample into richer and poorer countries based on initial or average income. However, no strong evidence of nonlinearity emerges from the analysis—the relation with income per capita remains weak statistically and economically.

[23] In most of the developing countries in our sample, public debt was primarily contracted internationally, given the shallowness of domestic financial markets.

effects is weakened when Singapore is excluded from the sample.[24] Finally, results for the balanced sample in column (7) are quite similar to those for the full sample, although the magnitude of the public debt effect falls somewhat to -0.50.[25]

We turn now to examining how well our panel specification, which imposes equality of all slope coefficients within our two country groups, can match the dynamics of net foreign assets at the individual country level. For this purpose, Figures 7 and 8 plot actual and fitted long-run values of net foreign assets for selected industrial and developing economies.[26] For the richer countries, the graphs suggest that our specification matches the time-series behavior of net foreign assets quite well in small open economies, but does not do as well for Germany, the United Kingdom, and the United States. For the latter country, public debt has been declining and growth has been strong in the late 1990s, and both factors would lead us to expect an improvement in net foreign assets. Instead, the level of U.S. net external liabilities has increased substantially during this period.[27] A similar diverging pattern between actual and fitted values occurs in the late nineties for Japan, for exactly the symmetric reason—faltering GDP growth and rapidly increasing public debt would lead us to expect, ceteris paribus, a worsening in the net foreign asset position, while Japan's improved throughout the period.[28]

For developing economies, the overall fit shown in Figure 8 is very good, with very few exceptions. One is Venezuela, which has severe measurement problems for its net foreign asset position because of the size of unrecorded assets held abroad. The divergence for Malaysia's actual and fitted values in the 1990s is due to the same factors at work in the United States: our model predicts that fast growth and a declining public debt should be associated with falling external liabilities.

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[24] Singapore has undergone a dramatic demographic transition, with a rapid ageing of the population. Of course, this may precisely represent very good evidence regarding the effect of demography on net foreign assets, since Singapore has also been rapidly accumulating external assets in recent years.

[25] The balanced sample for developing countries excludes Algeria, Argentina, Bolivia, Botswana, Brazil, Chile, Cote d'Ivoire, Dominican Republic, Paraguay, Peru, Trinidad and Tobago, Turkey, and Zimbabwe.

[26] Graphs for all other countries are available from the authors. The fitted values are generated from fixed-effects panel OLS regressions: coefficient estimates are very similar to those obtained from the DOLS specification.

[27] See Obstfeld and Rogoff (2000) on the sustainability of the U.S. external position.

[28] In part, these patterns can be linked to the increased degree of equity diversification across countries: for example, the strong performance of U.S. equity markets during the 1990s and the weak performance of Japanese markets implied capital gains for foreign holders of U.S. equities and losses for foreign holders of Japanese equities.

In summary, the data suggest that foreign asset positions in industrial countries exhibit a strong co-movement with relative output per capita, while their quantitative link with public debt is relatively weak. Conversely, public debt is very strongly correlated with the dynamics of net external liabilities in developing economies, while the relation with income per capita along the time series dimension is weak or negative. In addition, in both samples, the demographic variables generally play an important role in determining net foreign asset positions. Our simple econometric specification captures long-run trends in net foreign assets very well for developing economies and small open industrial countries, but is less successful in explaining the behavior of net foreign assets in larger countries.

Cross-sectional evidence

The panel data analysis presented in the previous subsection has focused on the evolution of net foreign assets within countries. In this subsection, we investigate the cross-sectional relation between net foreign assets and their determinants, focusing on the 1990s. Table 4 presents results of cross-sectional regressions of net foreign assets on log output per capita, public debt and demographic variables, where all variables are averages during the period 1990–98.[29]

Relative output per capita is the only significant variable in explaining the cross-sectional variation in net foreign asset positions across industrial countries. As in the time series dimension, richer countries have larger net foreign asset positions, although the cross-section point estimate is 40–50 percent smaller in magnitude. Neither public debt nor demography is helpful in explaining the 1990s cross-section for industrial countries.

Our fundamentals are more successful in explaining cross-country differences in net external positions among developing economies. In contrast to the time series result, we find a positive association between output per capita and net foreign assets in the cross-section, although the point estimate is typically small and not significant in column (6). Similar to the time series evidence, the cross-sectional effect of public debt is negative and significant: developing economies with larger public debts also have larger net external liabilities. Columns (4)–(6) also suggest a significant impact of the demographic structure on the cross-section distribution of net foreign asset positions among developing economies, with a pattern that is qualitatively similar to that found in the time series data.

The differences in the coefficients on income between the industrial and developing sample, both in the time series and in the cross-section, suggest that the underlying relation between net foreign assets and output per capita is nonlinear. We report results using a quadratic cross-sectional relation between output per capita and net foreign assets for developing

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[29] Results are virtually unchanged if we focus on a single year, given that these variables move only slowly year to year.

economies in column (7).[30] The specification does pick up a nonmonotonicity but the turning point is at a low threshold (US$1,170): only 8 out of the 38 countries are in the region in which the cross-sectional relation between output per capita and net foreign assets is slightly negative.[31]

IV. The Dynamics of Net Foreign Assets and the Trade Balance

In the previous section, we focused on the long-run behavior of net foreign assets, arguing that it can be characterized as a cointegrating relation $b_{it} = \sigma' Z_{it} + \varepsilon_{it}$. In this section, we shift our attention to the "adjustment mechanism"—namely, the role played by our long-run model in shaping the short-run dynamics of net foreign assets, as well as the implications these dynamics have for the trade balance.

A. The ECM Representation

Since the underlying long-run relation is a cointegration equation, we can obtain the "desired" change in net foreign assets $\hat{\Delta} b_{it}$ as the fitted values from estimating an error correction mechanism representation

$$\Delta b_{it} = \beta' \Delta Z_{it} + \eta \Delta b_{it-1} - \lambda (b_{it-1} - \sigma' Z_{it-1}) + \nu_{it} \qquad (4)$$

In order to keep the model specification as parsimonious as possible we impose equality of all slope coefficients among the industrial and among the developing country samples in estimating this error-correction specification.

Table 5 reports the estimated error-correction coefficient λ and the overall fit of equation (4) for the different country groups and samples. The specification of the regression also includes the lagged change in the dependent variable and contemporary changes in all explanatory variables (coefficients not reported). Results show that deviations of net foreign assets from their long-run trend tend to be quite persistent, with a half-life of five–six years, and that the speed of adjustment is quite similar in industrial and developing economies. Given the restrictive specification of the short-run dynamics, the fit of the regressions is remarkably good, especially so for developing economies.

It is useful to ask how well this simple specification accounts for the dynamics of net foreign assets at the individual country level. For this purpose, Table 6 reports the country-by-country bivariate correlations between actual and fitted values for changes in net foreign

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[30] A similar specification for the whole sample gives statistically weaker results, with an estimated "turning point" below output per capita of US$1,000. It makes little difference to the results if Singapore is included or CUMCA is used as the net foreign asset measure.

[31] Caution should be exercised in interpreting these cross-sectional results, because our sample excludes low-income countries that are typically highly indebted.

assets for the period 1970–98. For industrial countries, the model does poorly in explaining the short-run dynamics of the net foreign asset position for most of the "large" economies—Japan, United Kingdom, and United States—while it tracks the smaller open economies, such as Ireland, Portugal, and the Scandinavian countries, quite nicely.[32] For developing economies, the model performs remarkably well across the board, explaining a substantial fraction of year-to-year changes in net foreign assets, with very few exceptions.

B. Implications For The Trade Balance

The factors driving the net foreign asset position influence the behavior of the trade balance via two channels. First, changes in the desired net foreign asset position require shifts in the trade balance. Second, for a given desired net foreign asset position, there is an inverse relation between the investment returns on the outstanding stock of net foreign assets and the trade balance.

In an accounting sense, changes in the net foreign asset position reflect trade imbalances, investment income payments and receipts and capital gains and losses. Formally,

$$B_{it} - B_{it-1} = TB_{it} + TR_{it}^{c} + TR_{it}^{k} + i_{it}B_{it-1} + KG_{it} \quad (5)$$

where TB_{it} is the balance of trade in goods and services, TR_{it}^{c} (TR_{it}^{k}) are net current (capital) transfers, $i_{it}B_{it-1}$ is investment income and KG_t is the capital gain/loss on outstanding net external assets. The current account is given by the sum of TB_{it}, TR_{it}^{c} and investment income $i_{it}\,B_{it-1}$.[33] Dividing both sides of equation (5) by GDP measured in U.S. dollars, adding together investment income and capital gains, and re-arranging terms, we obtain

$$\Delta b_{it} = tb_{it}^{*} + tr_{it}^{k} + \frac{(i_{it} + kg_{it})}{1+\gamma_{it}} b_{it-1} - \frac{\gamma_{it}}{1+\gamma_{it}} b_{it-1} \quad (6)$$

where tb_{it}^{*} is the ratio to GDP of the balance of goods, services, and current transfers; $i_{it} + kg_{it}$ is the nominal rate of return on outstanding net foreign assets (nominal yield i_{it} plus capital gains/losses); and γ is the rate of change of GDP measured in current dollars. Note that $1+\gamma = (1+g)(1+\varepsilon)(1+\pi^{*})$, where g is the real GDP growth rate, ε is the rate of real

[32] One reason why the model may not fully capture the dynamics of the net foreign asset position for the former group of countries is that these are financial centers and high levels of gross international asset trade mean that the impact of volatile revaluation effects on the net foreign asset position is likely to be especially important.

[33] The expression $i_{it}\,B_{it-1}$ for investment income implicitly assumes that the dollar yield on external assets and liabilities is the same. We discuss below the implications of this assumption.

exchange rate appreciation of the home country's currency vis-à-vis the U.S. dollar and π^* is U.S. inflation.

In turn, we can re-arrange equation (6) to relate the "transfer-corrected" trade balance to our estimate of the change in the net foreign asset position, given in equation (4)

$$tb_{it}^{*} + tr_{it}^{k} = \Delta b_{it} - \frac{r_{it} - g_{it} - \varepsilon_{it}}{(1+g_{it})(1+\varepsilon_{it})} b_{t-1} + v_{it} = \Delta b_{it} - \psi_{it} + v_{it} \qquad (7)$$

where r_{it} is the real rate of return on net foreign assets, measured in U.S. dollars.[34] The "transfer-corrected" trade balance is related to three factors. The first term on the RHS of this equation reflects the change in the net foreign asset position that is required for convergence to its long-run fundamental value, as captured by the ECM representation in Section 4.1; the second term ($-\Psi_{it}$) is the combined effect of overall returns, output growth, and real exchange rate changes, interacted with the past net foreign asset position; and the third term is the component of the change in net foreign assets that is not explained by the dynamics of long-run fundamentals. Consider for example a debtor country for which the rate of return on its net liabilities is higher than its growth rate. In this case if the "fundamental" net foreign asset position does not change, the country will need to run a trade surplus equal to Ψ_{it}.
In Figure 9 we show the distribution of adjusted returns Ψ_{it} and the trade balance tb_{it}^{*} among industrial and developing economies for the periods 1980–89 and 1990–98.[35] The low growth and real depreciation associated with the debt crisis are reflected in the high number of less developed countries with large negative adjusted returns during the 1980s, a number that declines in the 1990s. Among industrial countries one observes an increase in the

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[34] In the presence of differences in rates of return between external assets and liabilities the RHS would also include the term $(r_{it}^{L} - r_{it}^{A})b_{it-1}^{L}$ where $r_{it}^{L} - r_{it}^{A}$ is the rate of return differential between liabilities and assets and b_{it-1}^{L} is the stock of gross liabilities. We implicitly include this term in the adjusted returns Ψ_{it}.

[35] The construction of the "adjusted returns" term ψ_{it} is complicated by the measurement problems associated with capital gains and losses briefly discussed in Section 2. For industrial countries, the series for KG_{it} includes the difference between the change in the outstanding stock and the flow for portfolio equity investment assets and liabilities, foreign direct investment assets and liabilities, and foreign exchange reserves. These differences are particularly significant for portfolio equity assets and liabilities, especially during the 1990s, because of the fluctuations in market values generated by stock markets trends and volatility. Our data do not allow us to estimate capital gains and losses on the debt portfolio of industrial countries. For developing countries, the series on capital gains and losses includes one additional item—the impact of cross-currency fluctuations on the outstanding stock of gross external debt (data that are reported in the World Bank's Global Development Finance database).

number of countries with large negative adjusted returns during the 1990s, and correspondingly in the countries running large trade surpluses. The increase in rates of return generated by the capital gains on equity holdings during the 1990s are one factor behind this development. Figure 9 also highlights that there is more dispersion in the trade balance among developing than among industrial countries.

Figure 10 presents scatter diagrams illustrating the cross-sectional relation between the adjusted returns term and the trade balance for the industrial and developing economies for the period 1980–98. The Figures also show a line with a negative slope of 45 degrees that corresponds, for a given level of adjusted returns, to the trade balance that would keep the net foreign asset position constant (in the absence of capital transfers such as debt forgiveness). In both samples there is a strong negative relationship between adjusted returns and trade balance. Some observations are noteworthy. First, the United States' adjusted returns term is positive, a reflection of the positive rate of return differential between its external assets and liabilities. This implies that a trade deficit of 0.5 percent of GDP over the past two decades would have been consistent with an unchanged net foreign asset position. In fact the trade deficit has been much larger, in connection with the deterioration of the U.S. net external position. Second, Singapore's spectacular increase in its net foreign assets, even given its large positive adjusted-returns term, has required large trade surpluses.

In summary, the results in this section show that the long-run fundamentals driving the net foreign asset positions can also explain an important fraction of short-run changes in countries' external wealth, and that the behavior of the trade balance is tightly related to the dynamics of the net foreign asset position. The extent to which changes in the underlying fundamentals of the net external position and correction in any drift from the long-run equilibrium relation are reflected in the trade balance depends on the "adjusted" returns on the outstanding net foreign asset position.

V. Net Foreign Assets and Real Interest Differentials

Rates of return on assets and liabilities play a crucial role in determining the dynamic behavior of net foreign assets, and are likely to be influenced by their level and composition. For instance, a home bias in asset demand and/or an upward-sloping supply of international funds means that interest rates may be linked to net foreign asset positions: debtor countries should experience higher interest rates than creditor countries. Applications of this "portfolio balance" approach have typically related currency returns to shifts in relative asset supplies in different currencies (e.g., a model of dollar interest rates versus yen interest rates) but the model should hold more generally as a framework for thinking about country risk (Frankel and Rose, 1995).

In this spirit, the real interest rate differential can be written as

$$r_{it} - r_{wt} = \delta_{it} - E_t[\Delta RER_{t+1}] \qquad (8)$$

where δ_{it} is the country risk premium and the second term on the right hand side is (minus) the expected rate of real exchange rate appreciation.

If the rate of real appreciation is zero in a steady state, then the long-run real interest differential just depends on the steady-state country risk premium

$$r_{it} - r_{wt} = \delta_{it} = -\delta\, bx_{it} \qquad \delta > 0 \qquad (9)$$

where we model the country risk premium as inversely (and linearly) related to the ratio of net foreign assets to exports bx_{it}.[36]

A. Empirical Results

We confine attention to the industrial country sample. Nominal interest rates are yields on government bonds, the same employed by Obstfeld and Rogoff (2000, 2001).[37] We measure the real interest rate as the December nominal interest rate in year t minus the actual inflation rate in year t+1. We report the panel fixed-effects results in Table 9, where the DOLS estimator is again employed. In panel A, we include all countries and the time dummies soak up the "world real interest rate" that is common to all countries; in panel B, we employ the real interest differential vis-à-vis the United States. The actual ratio of net foreign assets to exports in employed as a regressor in columns (1)–(4), whereas we use the fitted values generated in Section 3.3.2 in columns (5)–(8).[38] The results in columns (1)–(2) and (5)–(6) are for the 1970–98 period; and for 1980–98 in columns (3)–(4) and (7)–(8). We also enter the stock of public debt and the rate of real exchange rate appreciation in alternate specifications.[39] In line with the portfolio balance literature, the former is intended to control for variation in the supply of alternative assets; the latter is to proxy for expected changes in the real exchange rate.

Across columns (1)–(8), the results show clear evidence of a portfolio balance effect in the determination of real interest differentials: for instance, according to the point estimate in

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[36] We use exports rather than GDP as the denominator to better capture the capacity of the economy to make overseas payments. The choice of denominator makes little practical difference for the results.

[37] Iceland is excluded from the sample. We thank these authors and Jay Shambaugh for generous assistance with these data.

[38] In Section 3.3.2, we regressed the ratio of net foreign assets to GDP on output per capita, the stock of public debt, and demographic variables. We multiply the fitted values from this regression by the ratio of GDP to exports.

[39] In line with the method for measuring expected inflation, the actual rate of real exchange rate appreciation in year t+1 proxies for the expected rate of real appreciation in year t+1. In panel A, we use a multivariate CPI-based real exchange rate series; in panel B, it is the bilateral CPI-based real exchange rate vis-à-vis the United States.

column (1) of panel B, a 20 percentage point improvement in the ratio of net foreign assets to exports position is associated with an 50 basis point reduction in the real interest rate differential. The effect is also significant for the 1980–98 period and the estimated point coefficient typically larger for the more recent period. These findings are little affected by inclusion of the stock of public debt and the rate of real exchange rate appreciation. Even stronger results are obtained when the net foreign asset position is instrumented by the level of GDP per capita, public debt and demographic variables in columns (5)–(8), suggesting that the relation is not being generated by reverse causality running from the real interest differential on the net foreign asset position.

Figure 10 provides a scatter plot of average net foreign assets and real interest rates over the period 1990–98, documenting a negative relation between these variables. Table 10 reports cross-section regression results for the same period. In the cross-section, net foreign assets again have a significant effect on the real interest rate differential across all specifications. For instance, the point estimate of -1.07 in column (1) of panel B indicates that, all else equal, a country with an average net foreign asset to exports ratio that is 50 percentage points above the sample mean enjoys a real interest rate that is 53.5 basis points below the average real interest rate differential vis-à-vis the United States. We note also that the stock of public debt typically has a marginally significant positive impact on the real interest differential rate (at the 10 percent level) but real exchange rate appreciation has no impact in the cross-sectional specification.

The results in this section provide some suggestive evidence that net foreign asset positions matter in determining real interest rate differentials, in line with the spirit of the portfolio balance literature.[40] In future work, it would be instructive to experiment with different asset classes and maturities, and explore alternative techniques for calculating expected inflation and the expected rate of real appreciation. Moreover, it would be interesting to distinguish between different components of the net foreign asset position (e.g., is it just net external debt that matters? / do portfolio equity liabilities and FDI liabilities have different effects?) and to investigate the interaction between net foreign asset positions and other risk factors in determining real interest rate differentials.

VI. Conclusions

Our primary goal in this paper has been to demonstrate the fruitfulness of studying the behavior of a key state variable in international macroeconomics: namely, the net foreign asset position. We have shown that persistent fundamentals—output per capita, public debt,

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[40] Bayoumi and Gagnon (1996) predict that a country's net foreign asset position should be negatively correlated with its (after-tax) real interest rate. In this case, our estimate of the portfolio balance effect will be understated if a high real interest rate endogenously improves the net foreign asset position. We further note that inflation and real interest rates are negatively correlated in the time series dimension of our data set but positively correlated in the cross-section.

and demographic variables—have a major influence on the direction of international asset trade. Moreover, we have examined the role played by the desired and actual net foreign asset position in determining the trade balance, the former since trade balances are typically required to accomplish changes in the target net foreign asset position, the latter due to the role played by investment returns on outstanding foreign assets and liabilities. Finally, we have presented evidence that the net foreign asset position is also important in determining international asset prices, exerting a negative influence on real interest rate differentials.

Given the space limitations, there are many interesting questions concerning foreign asset and liability positions that we cannot address in this paper. In other work, we have shown that net foreign asset positions exert an important influence on the long-run behavior of real exchange rates (Lane and Milesi-Ferretti, 2000a) and made an initial exploration of the determinants of the structure of the "international balance sheet" between debt, portfolio equity, and foreign direct investment (Lane and Milesi-Ferretti, 2000b). Among the important issues that we must defer to future research is the role played by the level and composition of the external balance sheet in determining the probability of a financial crisis, and an exploration of the factors driving differences in cross-countries rates of return on external assets and liabilities.

Table 1. Kao (1999) and Pedroni (1999) Cointegration Tests

	(1)	(2)	(3)	(4)
	Industrial 1970–98	Industrial 1980–98	Developing 1970–98	Developing 1980–98
Kao (1999) DF ρ* test	10.89	10.42	-15.65	11.62
	(0.00)	(0.00)	(0.00)	(0.000)
Kao (1999) ADF stat, 1 lag	-4.24	-4.48	-4.73	-4.17
	(0.00)	(0.00)	(0.00)	(0.00)
Kao (1999)ADF stat, 2 lags	-4.36	-4.52	-4.29	-4.61
	(0.00)	(0.00)	(0.00)	(0.00)
Pedroni (1999) t stat for $\hat{\rho}_{NT}$	-333.6	-237.1	-472.4	-315.2
	(0.00)	(0.00)	(0.00)	(0.00)

Note: Cointegration tests are performed on the vector including NFA, log GDP per capita, public debt and the three composite demographic variables. The table reports the value of the statistic, with p-values in parenthesis. The null hypothesis in all tests is lack of cointegration. DF (ADF) stands for (augmented) Dickey-Fuller.

Table 2. Determinants of Net Foreign Assets, Industrial Countries
Panel DOLS Regressions with Fixed Time and Country Effects

	(1)	(2)	(3)	(4)	(5)
	CUMCA 1970–98	CUMCA 1980–98	CUMCA+IIP 1970–98	CUMCA+IIP 1980–98	CUMCA Balanced 1972–97
Log GDP per capita	0.91 (12.63)**	0.91 (7.26)**	0.9 (12.55)**	0.89 (6.71)**	0.94 (11.66)**
Public Debt	-0.125 (3.1)**	-0.05 (0.9)	-0.124 (3.01)**	-0.07 (1.1)	-0.18 (4.54)**
χ^2 **(Demog.)**	30.1 (0.00)**	2.3 (0.51)	22.1 (0.00)**	4.2 (0.24)	43.6 (0.00)**
Adjusted R^2	0.89	0.91	0.89	0.93	0.9
Observations	516	389	516	382	390
Countries	22	22	22	22	15
α **(POP<15)**	-1.47	-0.81	-1.24	-1.2	-2.26
α **(POP>64)**	-0.66	-0.59	-1.29	-0.44	-0.05
α **max**	1.41 (50–54)	0.46 (35–39)	1.24 (50–54)	0.63 (30–34)	1.24 (50–54)
α **min**	-1.49 (15–19)	-0.81 (0–14)	-1.29 (15–19)	-1.2 (0–14)	-2.26 (0–14)

Note: Dynamic ordinary least squares, t-statistics in parentheses (p-value for the χ^2 **(Demog)** statistic). * (**) indicates statistical significance at the 5% (1%) confidence level. In regressions (1) and (2) the dependent variable is *CUMCA* for all countries except Belgium, for which it is the IIP estimate of net foreign assets minus gold. In regression (3) the dependent variable is the IIP estimate of NFA for Belgium, Canada, Italy, Japan, and United Kingdom, and *CUMCA* for all other countries. In regression (4) it is the IIP estimate of NFA for Austria, Belgium, Canada, Finland, Germany, Italy, Japan, Netherlands, Spain, Sweden, Switzerland, United Kingdom, and United States, and *CUMCA* for the remaining countries.

Table 3. Determinants of Net Foreign Assets, Developing Countries
Panel DOLS Regressions with Fixed Time and Country Effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	CUMCA 1970-98 All	CUMCA 1980-98 All	CUMCA 1970-98 No Sing.	CUMCA 1980-98 No Sing.	CUMFL 1970-98 No Sing.	CUMFL 1980-98 No Sing.	CUMCA 1977-97 Balanced
Log GDP per capita	-0.21 (4.59)**	-0.08 (1.05)	-0.29 (6.76)**	-0.2 (2.98)**	-0.31 (6.8)**	-0.25 (3.6)**	-0.26 (3.55)**
Public Debt	-0.67 (14.03)**	-0.67 (13.3)**	-0.73 (16.8)**	-0.71 (14.6)**	-0.86 (21.4)**	-0.86 (19.6)**	-0.50 (8.87)**
χ^2 **(Demog.)**	28.7 (0.00)**	21.2 (0.00)**	5.5 (.14)	4.6 (.20)	12.7 (.01)**	6.4 (.10)	38.7 (0.00)**
Adjusted R^2	0.83	0.87	0.85	0.88	0.89	0.91	0.89
Observations	779	590	753	572	728	566	416
Countries	39	39	38	38	38	38	16
α **(POP<15)**	-1.01	-0.38	-0.49	-0.78	-0.9	-1.11	-1.17
α **(POP>64)**	-0.522	0.158	2.05	2.47	4.33	4.6	0.55
α **max**	3.92 (50–54)	3.54 (55–59)	2.05 (65+)	2.47 (65+)	4.33 (65+)	4.6 (65+)	5.66 (55–59)
α **min**	-3.92 (20–24)	-3.54 (20–24)	-1.19 (25–29)	-1.1 (20–24)	-1.18 (45–49)	-1.14 (35–39)	-5.67 (20–24)

Note: Dynamic ordinary least squares, t-statistics in parentheses (p-value for the χ^2 **(Demog)** statistic). * (**) indicates statistical significance at the 5% (1%) confidence level. In regressions (1)–(4) the dependent variable is *CUMCA*, in regressions (5) and (6) it is *CUMFL*. Regressions (3)–(6) exclude Singapore from the sample.

Table 4. Net Foreign Assets: Cross-Sectional Regressions

	(1) CUMCA 1990–98 Industrial	(2) CUMCA+IIP 1990–98 Industrial	(3) CUMCA 1990–98 Dev	(4) CUMCA 1990–98 Dev, no Sing	(5) CUMFL 1990–98 Dev, no Sing	(6) CUMFL 1990–98 Dev, no Sing
Log GDP per capita	0.45 (3.58)**	0.54 (2.92)**	0.18 (2.32)**	0.17 (2.0)**	0.15 (1.6)	-1.87 (2.93)**
Log GDP per capita squared						0.13 (3.26)**
Public Debt	0.10 (0.7)	-0.11 (0.35)	-0.44 (4.52)**	-0.45 (4.47)**	-0.65 (5.18)**	-0.71 (6.55)**
χ^2 **(Demog.)**	3.05 (0.38)	2.21 (0.53)	35.3 (0.00)**	33.6 (0.00)**	36.7 (0.00)**	1.35 (0.28)
Adjusted R^2	0.45	0.33	0.62	0.57	0.63	0.69
Countries	22	22	39	38	38	38
α **(POP<15)**	-1.2	394.2	-489.2	-442.3	-276.9	-2.25
α **(POP>64)**	-0.44	-1314.6	1527.8	1389.0	921.8	-0.04
α **max**	0.62 (30–34)	424.3 (15–19)	1527.8 (65+)	1389.0 (65+)	921.8 (65+)	1.24 (50–54)
α **min**	-1.2 (0–14)	-1314.6 (65+)	-511.9 (20–24)	-464.0 (20–24)	-298.1 (35–39)	-2.25 (0.14)

Note: Ordinary least squares, heteroskedasticity-corrected t-statistics in parentheses (p-value for the χ^2 **(Demog.)** statistic). * (**) indicates statistical significance at the 5% (1%) confidence level. In regressions (1) the dependent variable is *CUMCA* for all countries except Belgium, for which it is the IIP estimate of net forcign assets minus gold. In regression (2) the dependent variable is the IIP estimate of NFA for Austria, Belgium, Canada, Finland, Germany, Italy, Japan, Netherlands, Spain, Sweden, Switzerland, United Kingdom, and United States, and *CUMCA* for the remaining countries. Regressions (3)–(6) refer to the developing country sample, in regressions (3) and (4), the dependent variable is *CUMCA,* in regression (5) it is *CUMFL.* Regressions (4)–(5) exclude Singapore.

Table 5. Changes in Net Foreign Assets: Speed of Adjustment
Panel Regressions, Error-Correction Specification

A. Industrial Countries

	(1) CUMCA 1970–98	(2) CUMCA 1980–98	(3) CUMCA+IIP 1970–98	(4) CUMCA+IIP 1980–98
Error Correct.	-0.11 (4.11)**	-0.17 (4.59)**	-0.12 (4.23)**	-0.14 (3.34)**
Adjusted R^2	0.28	0.30	0.27	0.13
Observations	539	393	537	374
Countries	22	22	22	22

Note: Ordinary least squares, t-statistics in parentheses (p-value for the χ^2 (Demog.) statistic). * (**) indicates statistical significance at the 5% (1%) confidence level. Regressions also include the lagged first difference in *CUMCA*, contemporaneous first differences in the other variables belonging to the *Z* vector and country and time dummies. In regressions (1) and (2) the dependent variable is the change in *CUMCA* for all countries except Belgium, for which it is the change in the IIP estimate of net foreign assets minus gold. In regression (3) the dependent variable is the change in the IIP estimate of NFA for Belgium, Canada, Italy, Japan, and United Kingdom, and the change in *CUMCA* for all other countries. In regression (4) it is the change in the IIP estimate of NFA for Austria, Belgium, Canada, Finland, Germany, Italy, Japan, Netherlands, Spain, Sweden, Switzerland, United Kingdom, and United States, and the change in *CUMCA* for the remaining countries.

B. Developing Countries

	(1) CUMCA All 1970–98	(2) CUMCA All 1980–98	(3) CUMCA No Sing 1970–98	(4) CUMCA No Sing 1980–98	(5) CUMFL No Sing 1970–98	(6) CUMFL No Sing 1980–98
Error Correct.	-0.06 (2.36)*	-0.11 (2.96)**	-0.10 (4.99)**	-0.16 (5.05)**	-0.10 (4.53)**	-0.15 (4.66)**
Adjusted R^2	0.44	0.45	0.48	0.50	0.54	0.56
Observations	849	612	822	594	786	585
Countries	39	39	38	38	38	38

Note: Ordinary least squares, t-statistics in parentheses (p-value for the χ^2 (Demog.) statistic). * (**) indicates statistical significance at the 5% (1%) confidence level. In regressions (1)–(4) the dependent variable is the change in *CUMCA,* in regressions (5)–(6) it is the change in *CUMFL.* Regressions also include the lagged first difference in the dependent variable, contemporaneous first differences in the other variables belonging to the *Z* vector and country and time dummies. Regressions (3)–(6) exclude Singapore from the sample.

Table 6. Correlation Between Actual and Fitted Change in Net Foreign Assets

Industrial countries	*Observ.*	*Correlation*	*Devel. countries*	*Observ.*	*Correlation*
Australia	24	0.07	Algeria	8	0.49
Austria	27	0.80	Argentina	7	0.90
Belgium	16	0.40	Bolivia	4	0.95
Canada	27	0.17	Botswana	19	0.67
Denmark	18	0.74	Brazil	18	0.79
Finland	27	0.71	Chile	10	0.76
France	21	0.55	Colombia	27	0.81
Germany	27	0.40	Costa Rica	27	0.88
Greece	26	0.68	Côte D'Ivoire	8	0.94
Iceland	18	0.83	Dominic. Rep.	5	0.82
Ireland	27	0.79	Ecuador	27	0.88
Italy	27	0.69	El Salvador	27	0.60
Japan	27	0.10	Guatemala	24	0.32
Netherlands	27	-0.31	India	24	0.42
New Zealand	27	0.58	Indonesia	26	0.50
Norway	27	0.62	Israel	27	0.72
Portugal	25	0.81	Jamaica	27	0.80
Spain	22	0.46	Jordan	23	0.77
Sweden	27	0.72	Korea	27	0.77
Switzerland	18	-0.35	Malaysia	27	0.56
United Kingdom	27	0.19	Mauritius	26	0.81
United States	27	0.01	Mexico	24	0.17
			Morocco	27	0.92
			Pakistan	26	0.85
			Panama	27	0.21
			Paraguay	22	0.77
			Peru	8	0.80
			Philippines	27	0.60
			South Africa	27	0.62
			Sri Lanka	25	0.78
			Taiwan prov. of Ch.	23	0.71
			Thailand	27	0.44
			Trinidad&T.	21	0.75
			Tunisia	27	0.76
			Turkey	22	0.48
			Uruguay	24	0.87
			Venezuela	27	0.34
			Zimbabwe	20	0.63

Note: Correlation coefficient between actual and fitted values of changes in the ratio of net foreign assets to GDP. Regressions for the period 1970–98 corresponding to column (1) in Table (5), panel A for industrial countries and column (5) in Table 5, panel B for developing countries.

Table 7. Real Interest Rates and Real Interest Differentials
Panel DOLS Regressions with Fixed Time and Country Effects

A. Real Interest Rate

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	RDIF 1970-98	RDIF 1970-98	RDIF 1980-98	RDIF 1980-98	RDIF 1970-98	RDIF 1970-98	RDIF 1980-98	RDIF 1980-98
NFA/exports	-1.06	-0.83	-1.36	-0.91	-1.5	-1.63	-2.87	-2.81
	(2.6)*	(2.0)*	(2.48)*	(1.66)	(2.45)*	(2.94)**	(4.48)**	(4.65)**
Public debt		3.82		7.1		2.98		3.56
		(2.1)*		(3.4)**		(2.03)*		(1.91)*
D(RER)		0.03		0.04		0.02		2.64
		(1.2)		(1.74)		(.9)		(1.23)
Adjusted R^2	0.5	0.56	0.36	0.39	0.54	0.59	0.43	0.46
Countries	21	21	21	21	21	21	21	21
Observations	462	410	362	336	442	410	358	336

B. Real Interest Differential

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	RDIF 1970-98	RDIF 1970-98	RDIF 1980-98	RDIF 1980-98	RDIF 1970-98	RDIF 1970-98	RDIF 1980-98	RDIF 1980-98
NFA/exports	-2.54	-2.44	-2.73	-2.22	-2.57	-2.77	-3.19	-3.24
	(5.41)**	(5.5)**	(4.3)**	(4.58)**	(4.03)**	(4.27)**	(4.83)**	(5.52)**
Public debt		3.18		7.79		2.23		3.18
		(1.76)		(4.82)**		(1.51)		(1.67)
D(RER)		-0.04		-0.014		0.012		0.015
		(2.15)*		(.78)		(.54)		(.66)
Adjusted R^2	0.58	0.59	0.6	0.64	0.6	0.59	0.63	0.67
Countries	21	21	21	21	21	21	21	21
Observations	423	403	344	338	416	386	340	319

Note: Sample is Industrial Countries, with exception of Iceland. In panel A, dependent variable is the real interest rate; in panel B, dependent variable is real interest differential vis-à-vis the United States. In regressions (1)–(4), CUMCA is employed as measure of NFA; in regressions (5)–(8), it is based on fitted value from regression of NFA on GDP per capita, public debt and demographic variables. In regressions (2), 4), (6), and (8), multivariate real exchange rate is employed in panel A and bivariate real exchange rate vis-à-vis the United States in panel B.
* (**) indicates statistical significance at the 5% (1%) confidence level.

Table 8. Real Interest Rates And Real Interest Differentials: Cross-Section Evidence

A. Real Interest Rate

	(1)	(2)	(3)	(4)
	RINT 1990–98	RINT 1990–98	RINT 1990–98	RINT 1990–98
NFA/exports	-0.88	-0.88	-1.2	-1.18
	(2.6)*	(2.68)*	(5.39)**	(5.28)**
Public debt		1.57		1.31
		(1.55)		(1.67)
D(RER)		-0.19		-0.19
		(0.9)		(1.1)
Adjusted R^2	0.31	0.35	0.49	0.52
Countries	21	21	21	21

B. Real Interest Differential

	(1)	(2)	(3)	(4)
	RDIF 1990–98	RDIF 1990–98	RDIF 1990–98	RDIF 1990–98
NFA/exports	-1.07	-1.07	-1.27	-1.26
	(3.62)**	(4.12)**	(6.61)**	(8.21)**
Public debt		1.72		1.33
		(1.8)		(1.7)
D(RER)		-0.08		-0.1
		(.43)		(.72)
Adjusted R^2	0.54	0.59	0.65	0.68
Countries	20	20	20	20

Note: Sample is Industrial Countries, with exception of Iceland. 1990-98 averaged data. In panel A, dependent variable is the real interest rate; in panel B, dependent variable is real interest differential vis-à-vis the United States. In regressions (1)–(2), CUMCA is employed as measure of NFA; in regressions (3)–(4) it is based on fitted value from regression of NFA on GDP per capita, public debt and demographic variables. In regressions (2) and (4), multivariate real exchange rate is employed in panel A and bivariate real exchange rate vis-à-vis the United States in panel B. * (**) indicates statistical significance at the 5% (1%) confidence level.

Figure 1A. Distribution of Net Foreign Asset Positions, Industrial Economies

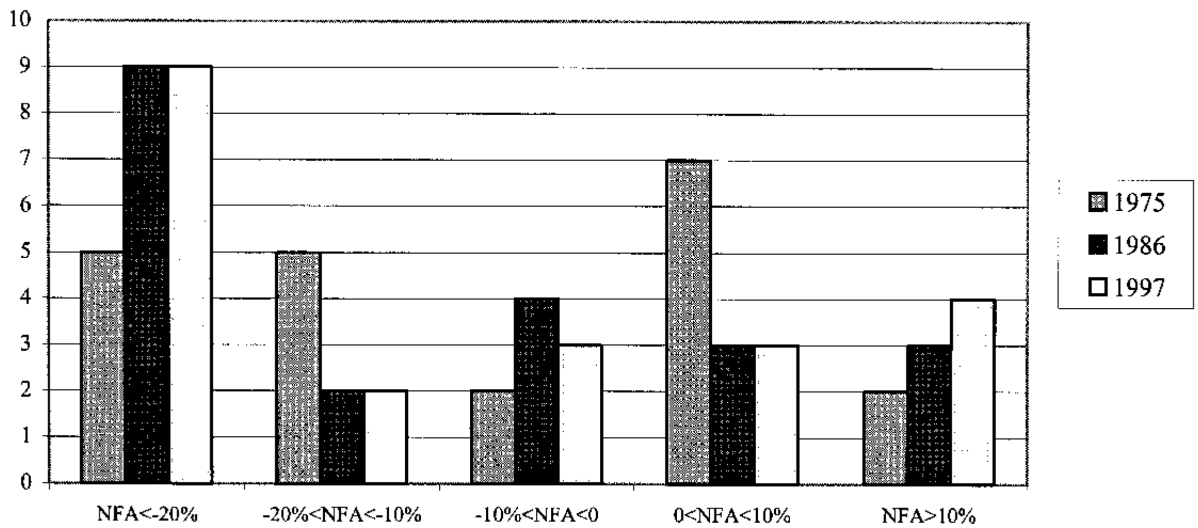
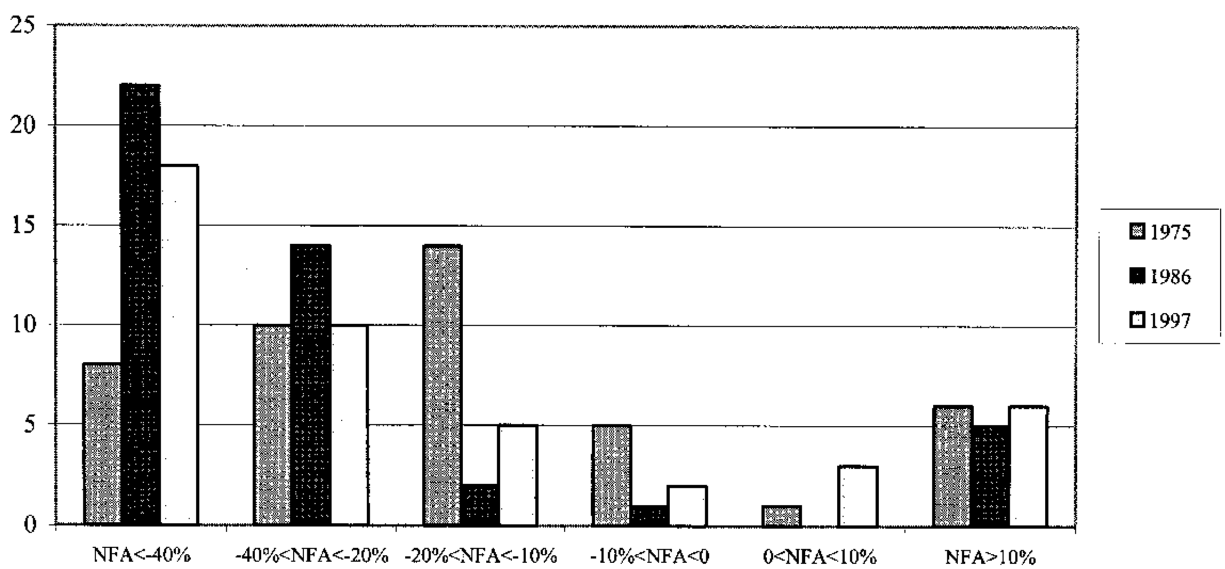
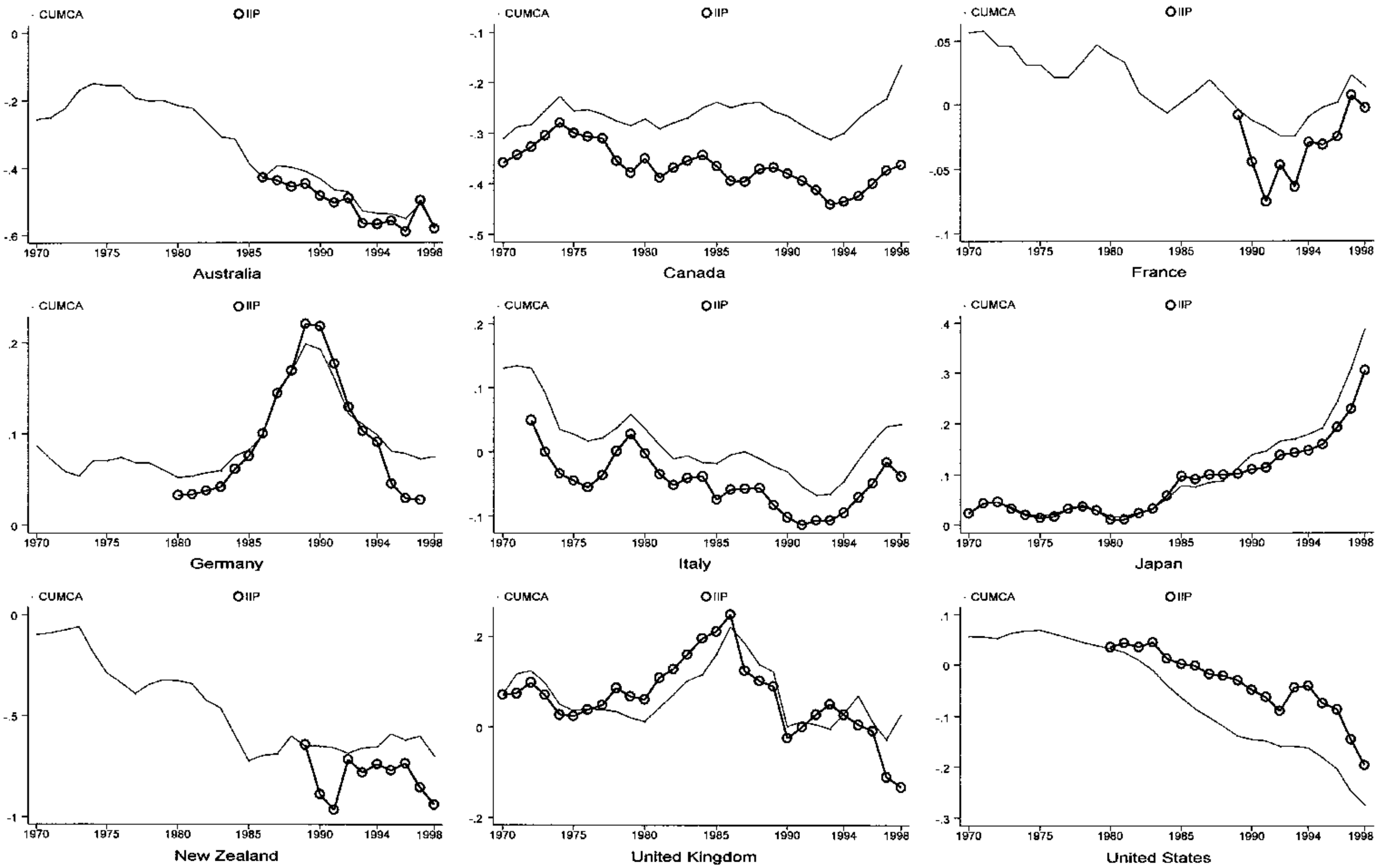


Figure 1B. Distribution of Net Foreign Asset Positions, Developing Economies



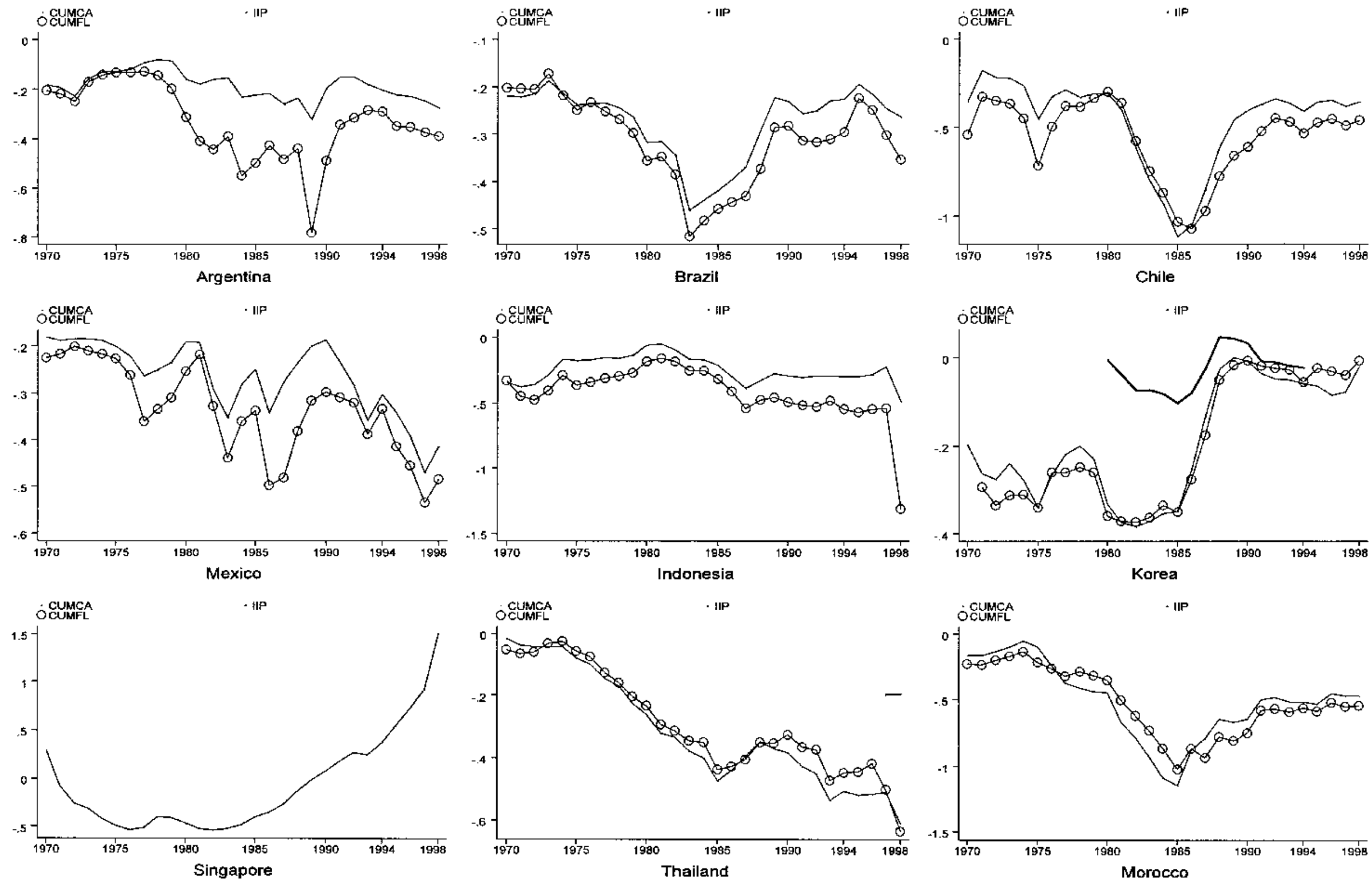
Note: Number of countries with net foreign asset position in the given range on the specific year on the vertical axis.

Figure 2. Net Foreign Assets, Industrial Countries



International investment position (*IPNFA*)
Adjusted cumulative current account (*CUMCA*)

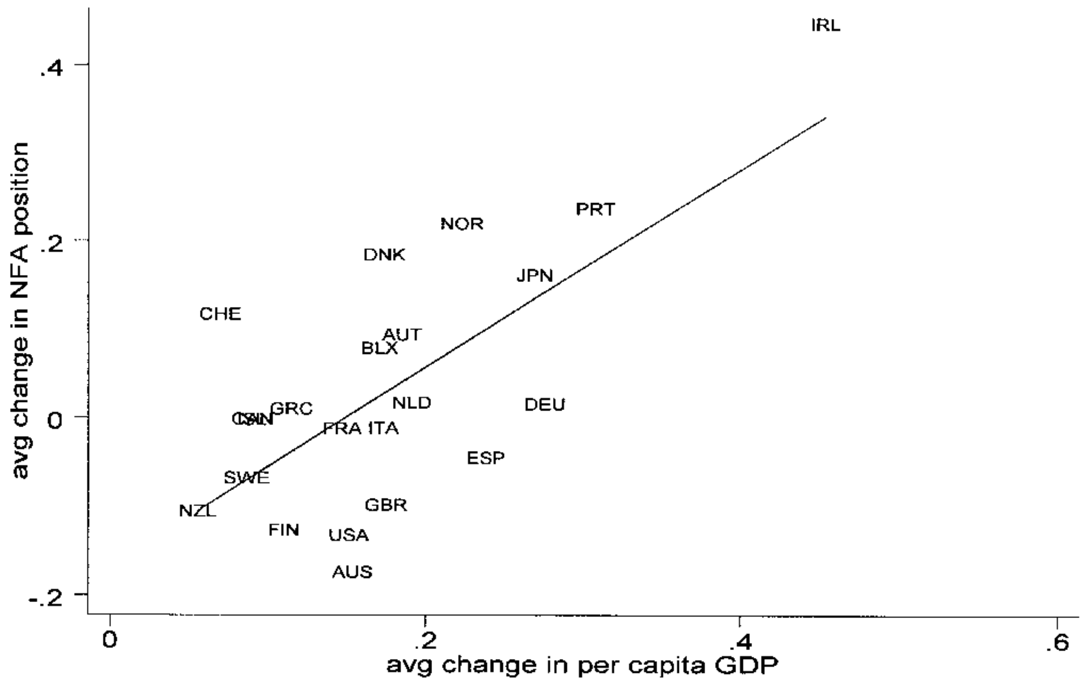
Figure 3. Net Foreign Assets, Developing Countries



——— International investment position (*IPNFA*)
——— Cumulative current account (*CUMCA*)
–o–o– Cumulative capital flows (*CUMFL*)

Figure 4. Net Foreign Assets and GDP Per Capita
(Average Change, 1990-98 over 1980-89)

A. Industrial Economies



B. Developing Economies

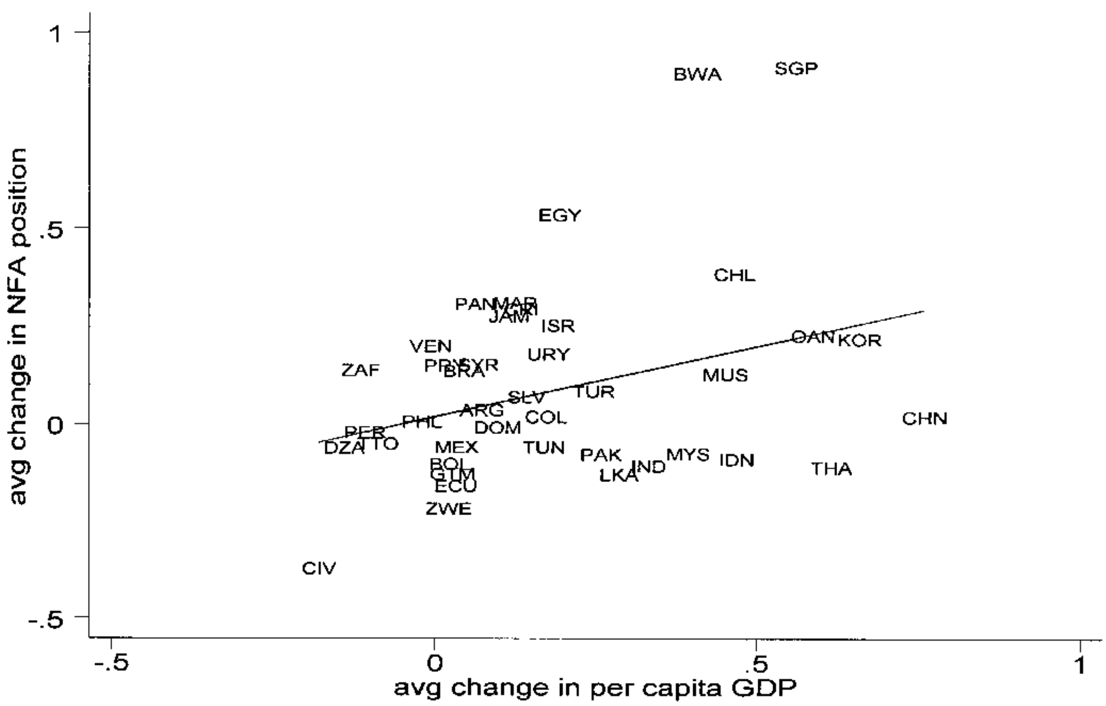
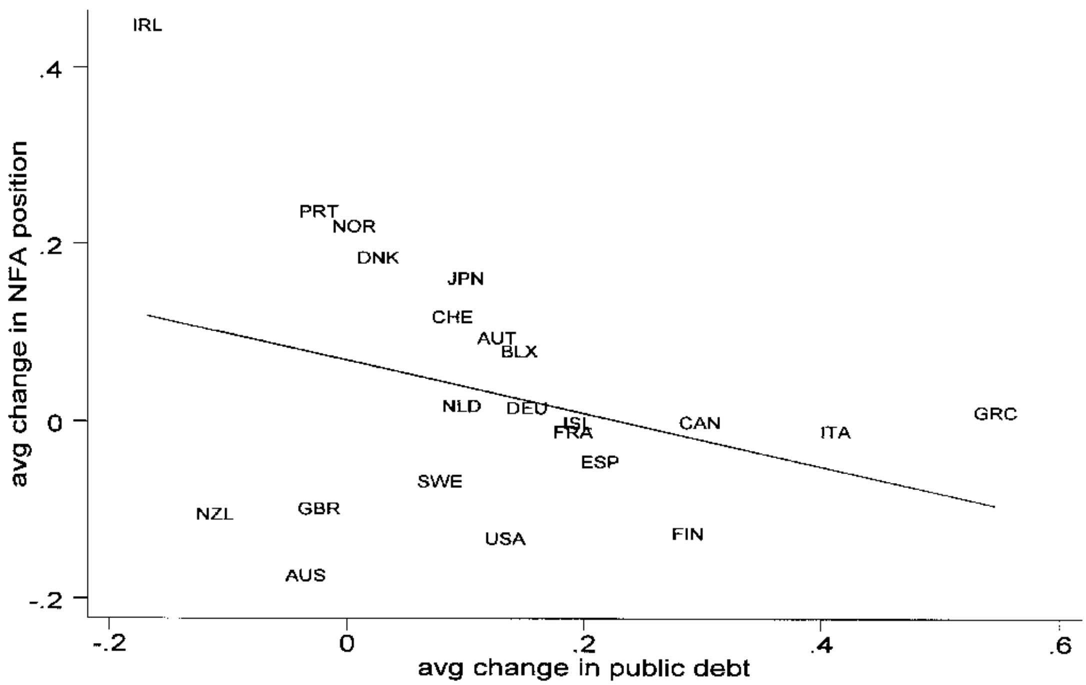


Figure 5. Net Foreign Assets and Public Debt
(Average Change, 1990-98 over 1980-89)

A. Industrial Economies



B. Developing Economies

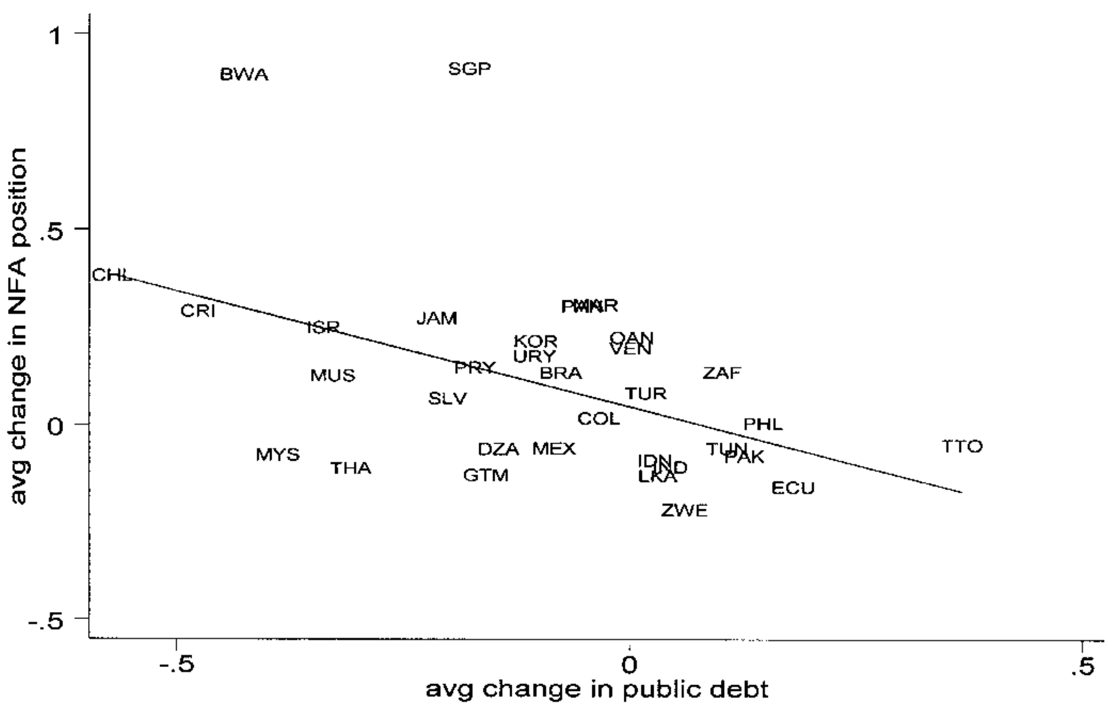
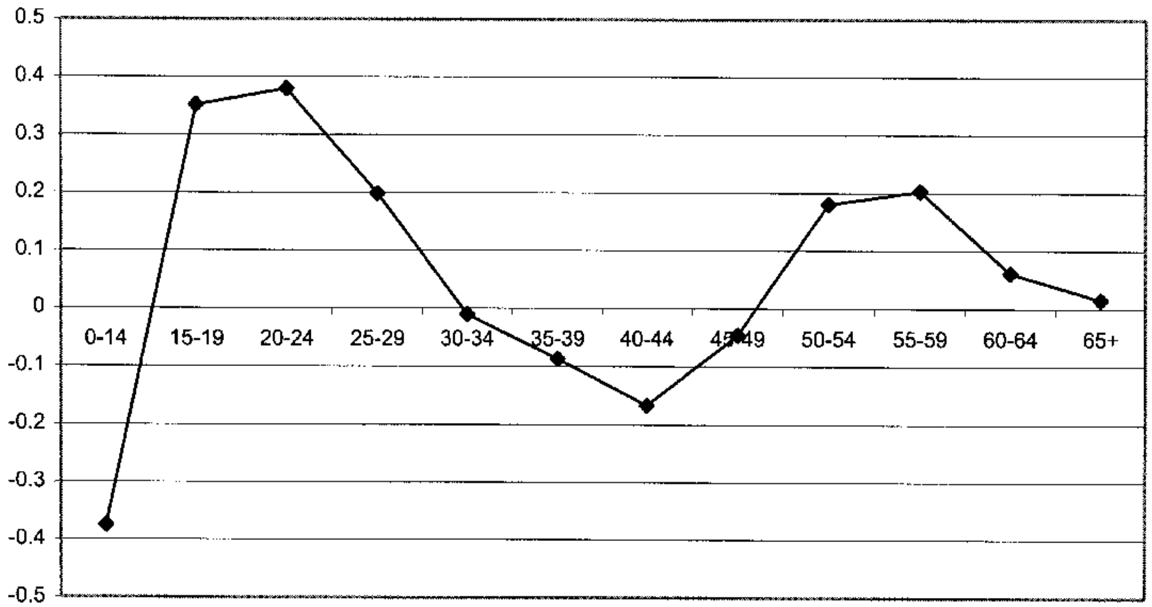


Figure 6. Impact of Change in Demographics on Change in Net Foreign Assets.
(Average Change, 1990-98 over 1980-89)

A. Industrial Economies



B. Developing Economies

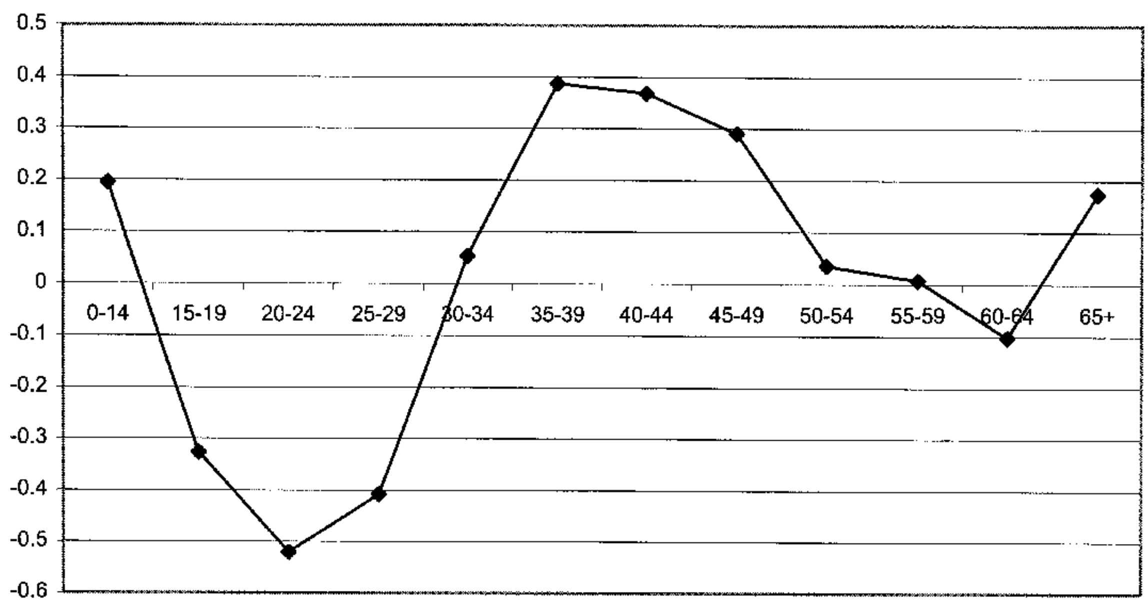


Figure 7. Actual and Fitted Values, Net Foreign Assets, Selected Industrial Economies

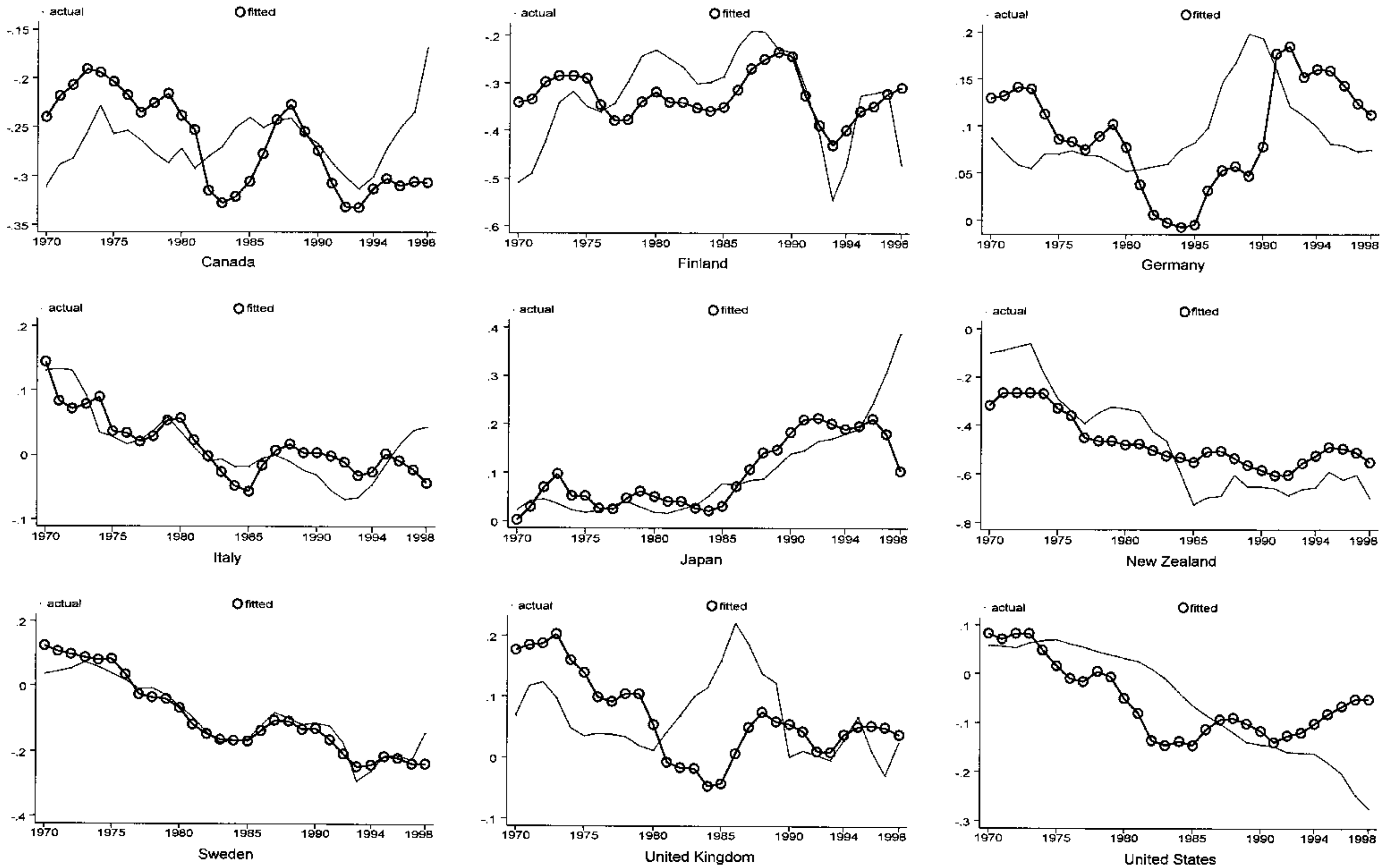


Figure 8. Actual and Fitted Values, Net Foreign Assets, Selected Developing Economies

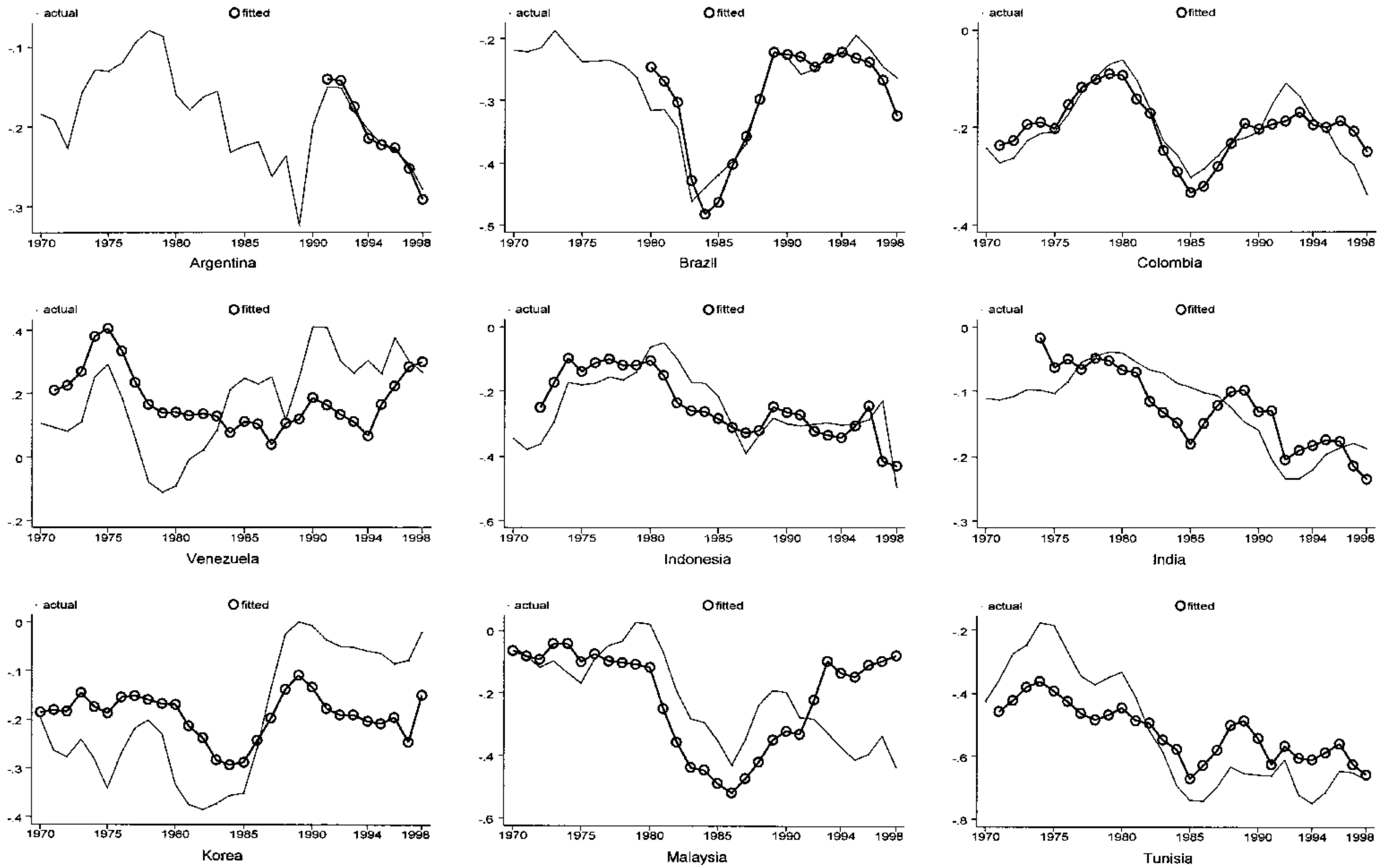
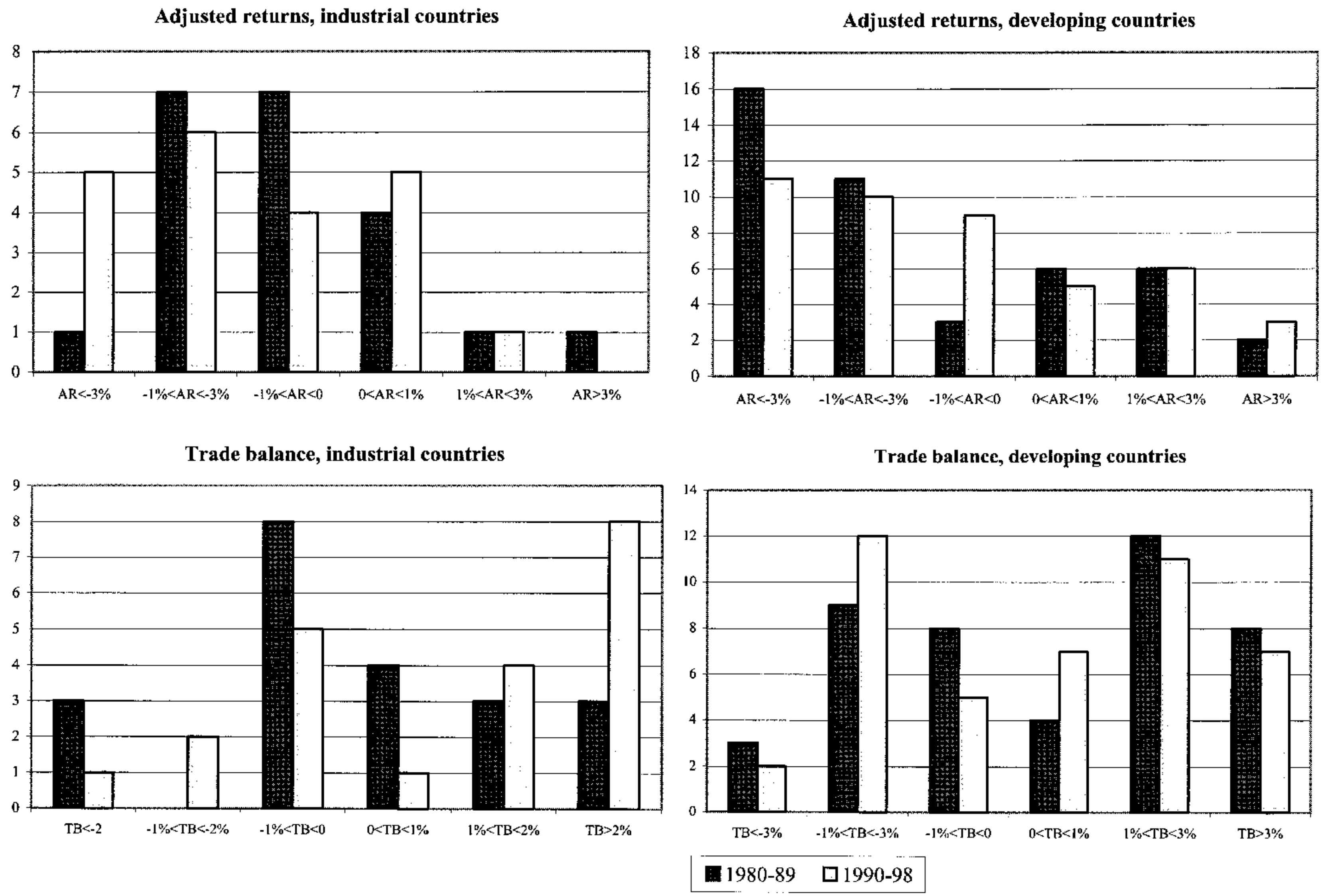


Figure 9. Trade Balance and Adjusted Returns: Cross-Country Dispersion, 1980s and 1990s



Note: Number of countries with adjusted returns and trade balance (ratios of GDP), averaged over the corresponding time period, within the given range.

Figure 10. Adjusted Returns and the Trade Balance

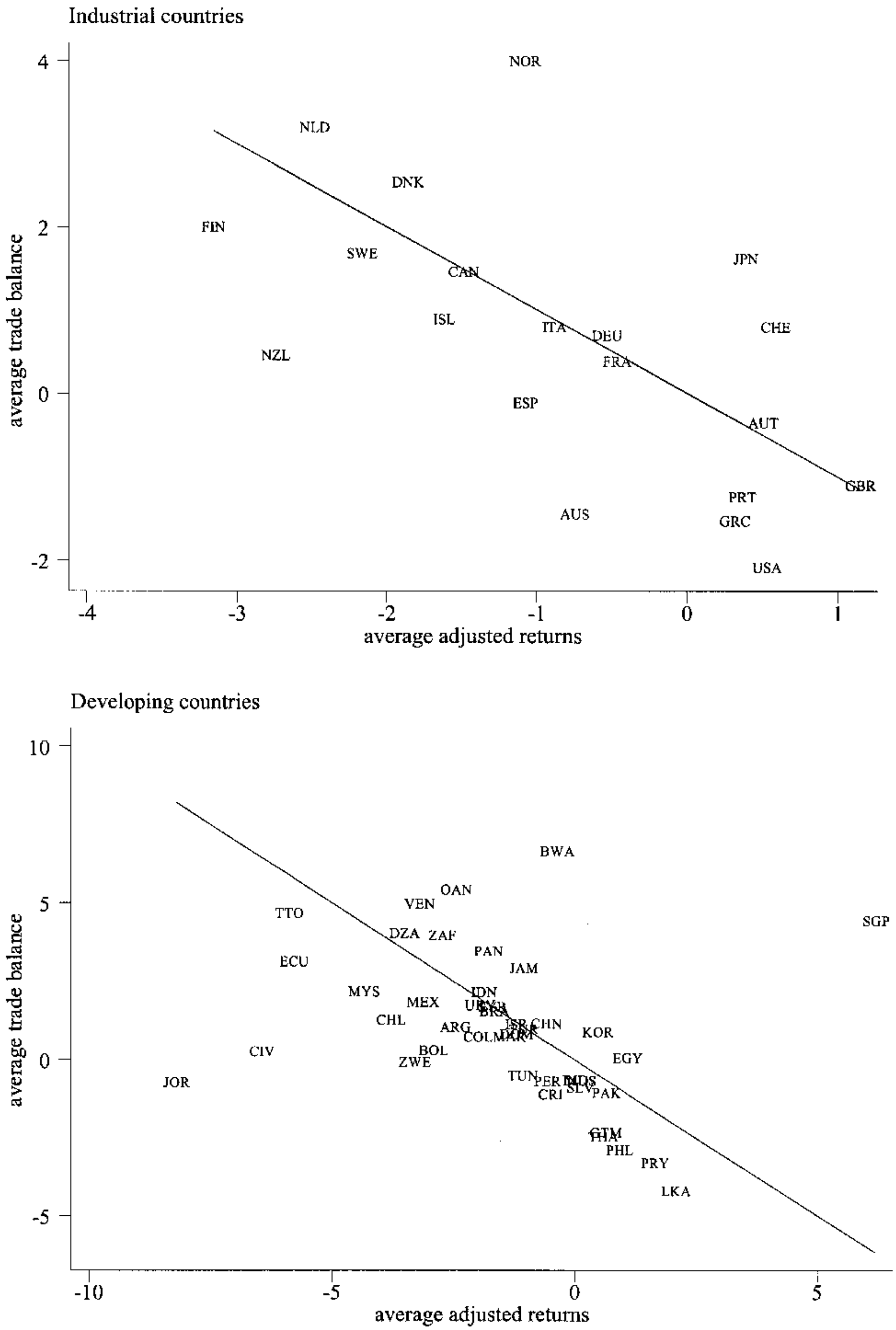
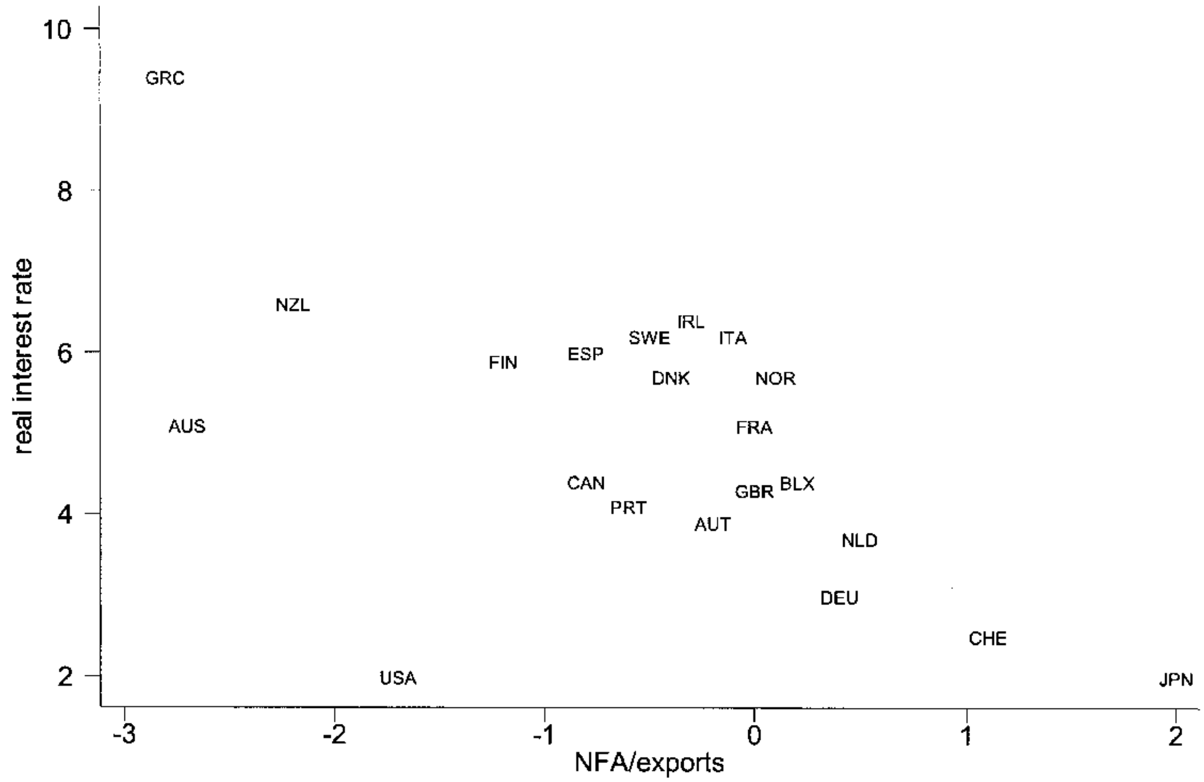


Figure 11. Real Interest Rates and Net Foreign Assets



Average Data, 1990–98.

Parameterization of Demographic Structure

Our demographic specification follows Fair and Dominguez (1991) and Higgins (1998). We divide the population into $J = 12$ age cohorts and the age variables enter the net foreign assets equation as $\sum_{j=1}^{12} \alpha_j p_{jt}$ where p_{jt} is the population share of cohort j in period t and $\sum_{j=1}^{12} \alpha_j = 0$. We make the restriction that the coefficients lie along a cubic polynomial

$$\alpha_j = \gamma_0 + \gamma_1 j + \gamma_2 j^2 + \gamma_3 j^3$$

The zero-sum restriction on the coefficients implies that

$$\gamma_0 = -\gamma_1 (1/J)\sum_{j=1}^{12} j - \gamma_2 (1/J)\sum_{j=1}^{12} j^2 - \gamma_3 (1/J)\sum_{j=1}^{12} j^3$$

In turn, we can estimate $\gamma_1, \gamma_2, \gamma_3$ by introducing the age variables into the estimated equation in the following way

$$\gamma_1 DEM_{1t} + \gamma_2 DEM_{2t} + \gamma_3 DEM_{3t}$$

where

$$DEM_{1t} = \sum_{j=1}^{12} j p_{jt} - (1/J)\sum_{j=1}^{12} j \sum_{j=1}^{12} p_{jt}$$

$$DEM_{2t} = \sum_{j=1}^{12} j^2 p_{jt} - (1/J)\sum_{j=1}^{12} j^2 \sum_{j=1}^{12} p_{jt}$$

$$DEM_{3t} = \sum_{j=1}^{12} j^3 p_{jt} - (1/J)\sum_{j=1}^{12} j^3 \sum_{j=1}^{12} p_{jt}$$

Finally, we can easily recover the implicit α_j once we know $\gamma_0, \gamma_1, \gamma_2, \gamma_3$.

References

Bayoumi, T. and J. Gagnon, 1996, "Taxation and Inflation: A New Explanation for Capital Flows," *Journal of Monetary Economics*, Vol. 38, pp. 303–30.

Bernheim, B.D., 1987, "Ricardian Equivalence: An Evaluation of Theory and Evidence," *NBER Macroeconomics Annual*, Vol. 2, pp. 263–303.

Blanchard, O., 1985, "Debts, Deficits and Finite Horizons," *Journal of Political Economy*, Vol. 93, pp. 223–47.

Calderón, C., N. Loayza and L. Servén, 2000, "External Sustainability: A Stock-Flow Perspective," World Bank Policy Research Working Paper: No 2281 (January).

Carroll, C., J. Overland and D. Weil, 2000, "Saving and Growth with Habit Formation," *American Economic Review*, Vol. 90, pp. 341–55.

Chiang, M. and C. Kao, 2000, "Nonstationary Panel Time Series Using NPT 1.1: A User Guide," Syracuse University, Mimeo.

Chinn, M. and E. Prasad, 2000, "Medium-Term Determinants of Current Accounts in Industrial and Developing Countries: An Empirical Exploration," IMF Working Paper No. 00/46 (March).

Edwards, S., 2001, "Does the Current Account Matter?," NBER Working Paper No. 8275.

Fair, R. and K. Dominguez, 1991, "Effects of the Changing U.S. Demographic Structure on Macroeconomic Equations," *American Economic Review*, Vol. 81, pp. 1276–94.

Faruqee, H. and D. Laxton, 2000, "Life Cycles, Dynasties, Saving: Implications for Small, Open Economies," IMF Working Paper No. 00/126 (July).

Feldstein, M. and C. Horioka, 1980, "Domestic Savings and International Capital Flows," *Economic Journal*, Vol. 90, pp. 314–29.

Fischer, S. and J. Frenkel, 1974, "Economic Growth and The Stages of The Balance of Payments," in *Trade, Stability and Macroeconomics*, ed. by G. Horwich and P. Samuelson (New York: Academic Press), pp. 503–21.

Frankel, J. and A. Rose, 1995, "Empirical Research on Nominal Exchange Rates," in *Handbook of International Economics,* Vol. 3., ed. by G. Grossman and K. Rogoff (Amsterdam: North-Holland).

Hadri, K., 2000, "Testing for Stationary in Heterogeneous Panel Data," *Econometrics Journal*, Vol. 3, pp. 148–61.

Halevi, N., 1971, "An Empirical Test of The Balance of Payments Stages Hypothesis," *Journal of International Economics*, Vol. 1, pp. 102–18.

Herbertsson, T. and G. Zoega, 1999, "Trade Surpluses and Life-Cycle Saving Behavior," *Economics Letters*, Vol. 65, pp. 227–37.

Higgins, M., 1998, "Demography, National Savings and International Capital Flows," *International Economic Review*, Vol. 39, pp. 343–69.

International Monetary Fund, 1993, *Balance of Payments Manual*, Vol. 5, (Washington, DC: IMF).

———, *Balance of Payments Statistics*, (various issues).

———, *International Financial Statistics*, (various issues).

Kao, C., 1999, "Spurious Regression and Residual-Based Tests for Cointegration in Panel Data," *Journal of Econometrics*, Vol. 90, pp. 1–44.

Kraay, A., N. Loayza, L. Servén and J. Ventura, 2000, "Country Portfolios," NBER Working Paper No. 7795.

Lane, P.R. and G.M. Milesi-Ferretti, 1999, "The External Wealth of Nations," Centre for Economic Policy Research Discussion Paper No. 2231, Forthcoming in *Journal of International Economics*.

———, 2000a, "The Transfer Problem Revisited: Net Foreign Assets and Long-Run Real Exchange Rates," Centre for Economic Policy Research Disc. Paper No. 2511.

———, 2000b, "External Capital Structure: Theory and Evidence," Centre for Economic Policy Research Discussion Paper No. 2583.

Masson, P., J. Kremers and J. Horne, 1994, "Net Foreign Assets and International Adjustment: The United States, Japan and Germany," *Journal of International Money and Finance*, Vol.13, pp. 27–40.

Mundell, R.A., 1991, "The Great Exchange Rate Controversy: Trade Balances and the International Monetary System," in *International Adjustment and Financing: The Lessons of 1985–1991*, ed. by F. Bergsten (Washington: Institute for International Economics).

Obstfeld, M. and K. Rogoff, 1996, *Foundations of International Macroeconomics*, (Cambridge, MA: The MIT Press).

———, 2000, "Perspectives on OECD Economic Integration: Implications for U.S. Current Account Adjustment," in *Global Economic Integration: Opportunities and Challenges*, Proceedings of a Symposium Sponsored by the Federal Reserve Bank of Kansas City.

———, 2001, "The Six Major Puzzles in International Macroeconomics: Is There a Common Cause?," *NBER Macroeconomics Annual*, Vol. 15, pp. 339–90.

———, A.M. Taylor, 2000, "Real Interest Equalization and Real Interest Parity over the Long Run: A Reconsideration," UC-Berkeley and UC-Davis, Mimeo.

Pedroni, P., 1999, "Critical Values for Cointegration Tests in Heterogeneous Panels with Multiple Regressors," *Oxford Bulletin of Economics and Statistics*, Vol. 61, pp. 653–678.

Rebelo, S., 1992, "Growth in Open Economies," *Carnegie-Rochester Series on Public Policy*, Vol. 36, pp. 5–46.

Roldós, J., 1996, "Human Capital, Borrowing Constraints and The Stages of The Balance of Payments," International Monetary Fund (February), Mimeo.

Stock, J.H. and M.W. Watson, 1993, "A Simple Estimator of Cointegrated Vectors in Higher Order Integrated Systems," *Econometrica*, Vol. 61, pp. 783–820.

Taylor, A.M., 1994, "Domestic Savings and International Capital Flows Reconsidered," NBER Working Paper No. 4892.

United Nations, 2000, "Demographic Yearbook: Historical Supplement 1948–97," CD-ROM.

World Bank, *Global Development Finance*, (various issues).

———*World Development Indicators*, (various issues).