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TRINITY COLLEGE DUBLIN AND CEPR, AND INTERNATIONAL MONETARY FUND AND CEPR

Long-Term Capital Movements

1. *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 location 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 comovement between national saving and domestic investment. Another branch of the literature has investigated whether net capital flows respond appropriately to cyclical macroeconomic shocks, most promi-

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nently 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 towards 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 (2001a), we have employed a uniform methodology to generate estimates of foreign-asset and -liability positions for a large number of industrial and developing countries over the past three decades. This dataset 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, like 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 delink national production and consumption.

Second, we identify two mechanisms that link trade balances to net foreign-asset (NFA) positions. One key channel is that changes in the target long-run NFA position are an important force driving the current account. The other is that, for a given desired NFA 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 NFA position) in determining the dynamics of the trade balance.

Third, we explore the relation between NFA 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 money, 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 2, we briefly discuss the broad properties of our dataset of foreign assets and liabilities. The determination of long-run NFA positions is investigated in Section 3. Section 4 models the short-run dynamics of the NFA position and the behavior of the trade balance. We turn in Section 5 to the relation between the NFA position and the real-interest-rate differential. Conclusions and directions for future research are offered in Section 6.

2. *International Balance Sheets: Stylized Facts*

2.1 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 as follows:

$$\mathrm{NFA}_{it} = \mathrm{FDIA}_{it} + \mathrm{EQA}_{it} + \mathrm{DEBTA}_{it} + \mathrm{FX}_{it} - \mathrm{FDIL}_{it} - \mathrm{EQL}_{it} - \mathrm{DEBTL}_{it}, \quad (1)$$

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%), while remaining equity purchases are classified under portfolio equity investment.[1] The debt category includes trade credits, bank loans, and portfolio bond instruments.

1. This implies that in certain cases the distinction between these two categories can in fact be blurred, but the issue cannot be clarified further in the absence of detailed disaggregated data.

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 NFA is called the *international investment position* (IIP). For developing countries, 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 countries, covering the period 1970–1998. We discuss in detail the methodology we use for estimating net external positions in Lane and Milesi-Ferretti (2001a). 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.[2] 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 NFA, 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 terms subsumed in KG. For example, we adjust the outstanding stock of equity

2. 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 (2001a) for a discussion of this issue.

assets and liabilities so as to reflect variations in the U.S.$ 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 countries, 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 (2001a), our CUMCA measure implicitly considers estimates of cumulative unrecorded capital flows as assets held by the country residents abroad. CUMFL instead 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.[3] 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 underrecording of exports and capital outflows, reflected in the existence of a measured "world current account deficit" (over U.S.$70 billion in 1998). These problems are unavoidably reflected in our data, which make use of official sources; even though we try to take account of unrecorded capital outflows to the extent possible, external assets are as a whole underreported.

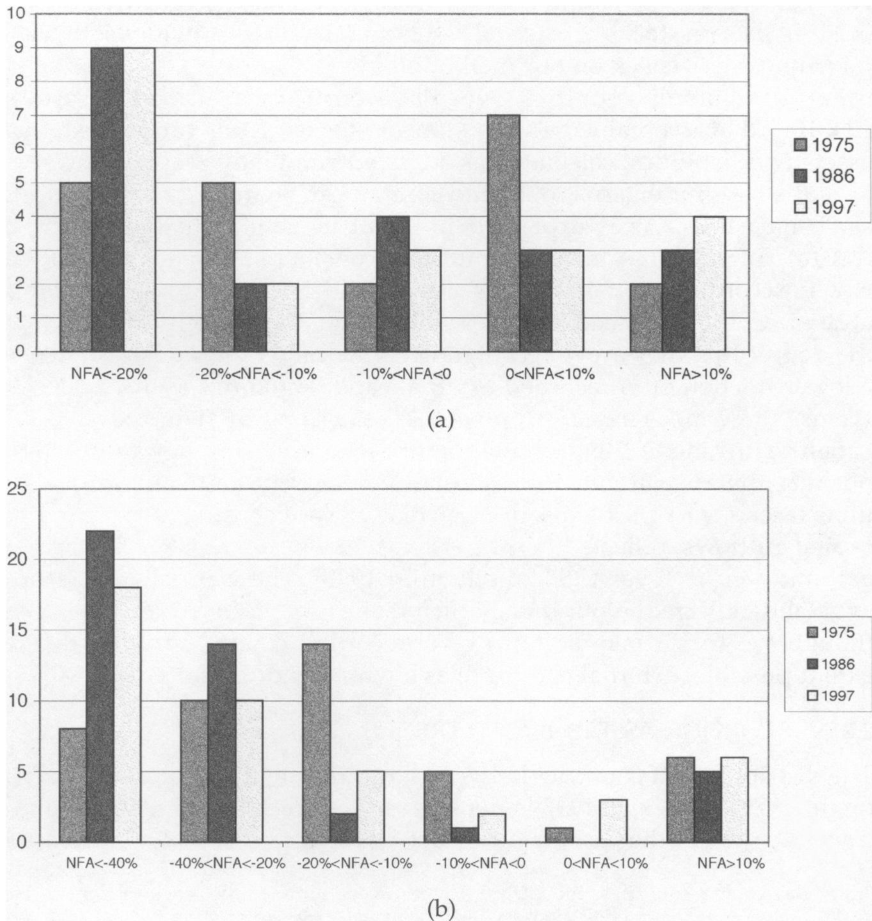
2.2 NET FOREIGN ASSETS: BROAD TRENDS

The distribution of countries between large and small creditors and debtors in 1975, 1986, and 1997 is depicted in Figure 1.[4] In industrial countries as a whole the dispersion of net external positions has increased

3. 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.

4. We focus here just on the overall NFA position. See Lane and Milesi-Ferretti (2001b) for a discussion of the composition of the external capital structure.

Figure 1 DISTRIBUTION OF NET FOREIGN-ASSET POSITIONS: (a) INDUSTRIAL COUNTRIES; (b) DEVELOPING COUNTRIES



Plot of the number of countries with net foreign-asset position in the given range on the given year.

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% of GDP. For developing countries, there is a large increase in the number of countries with *large* external liabilities (over 40% 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 in the 1970s and the 1980s.

Figure 2 plots different NFA measures as a fraction of GDP for a selection of industrial countries for the period 1970–1998. We graph both our estimate CUMCA and the direct estimate of NFA (IIP) when available.[5] Only a few countries have remained creditors throughout the past three decades (Germany, Japan, the Netherlands, and Switzerland); the rest of the group is almost evenly split between persistent debtors and switchers. Among the latter, the best-known case is the United States.

Figure 3 plots NFA 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 with 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.[6]

3. *The Determinants of Net Foreign-Asset Positions*

We propose a parsimonious reduced-form model of the NFA position:

$$b_{it} = \sigma' Z_{it} + \varepsilon_{it}, \qquad Z_{it} = [\mathrm{YC}_{it}, \mathrm{GDEBT}_{it}, \mathrm{DEM}_{it}], \tag{3}$$

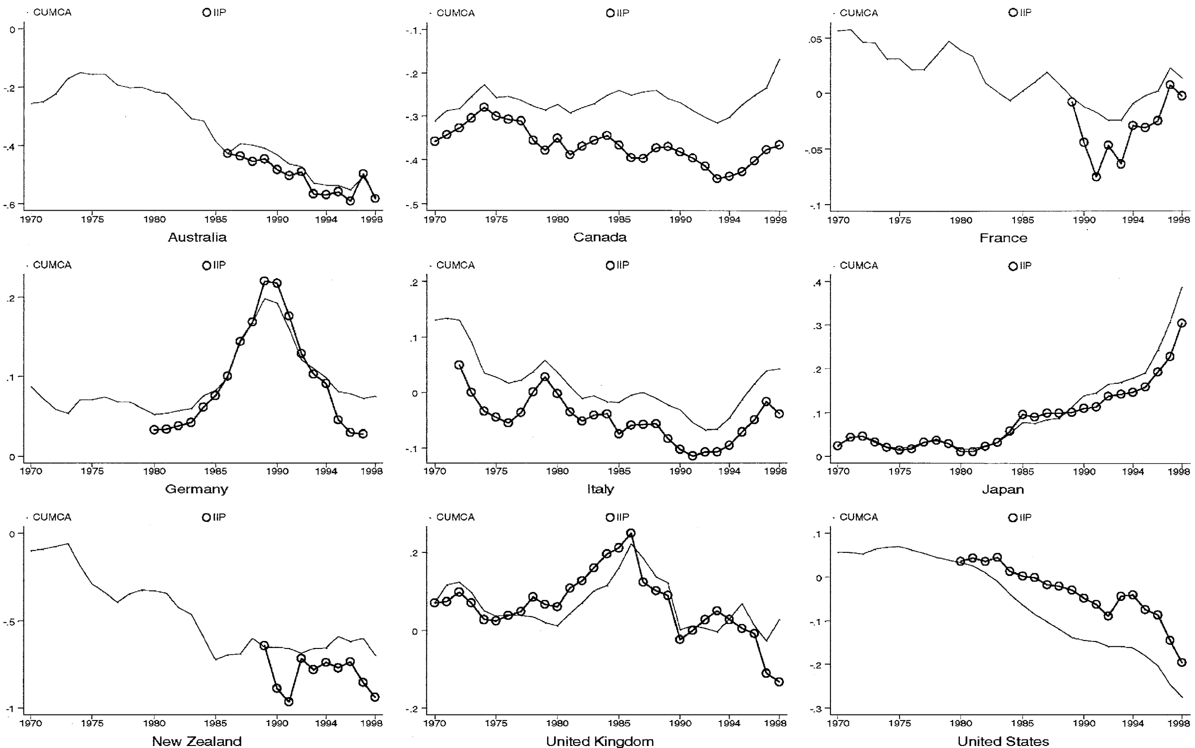
where b_{it} is country i's ratio of NFA to GDP in year t, YC_{it} is its output per capita, GDEBT_{it} is its level of public debt, and DEM_{it} is a set of demographic variables. As the discussion in the next subsection makes clear, we have followed the main themes developed in the theoretical literature in selecting these variables as the primary determinants of NFA positions.[7] 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

5. In Lane and Milesi-Ferretti (2001a) we explain the most relevant differences between these two measures.

6. Taiwan shows a similar, albeit less dramatic, trend among the economies in our sample.

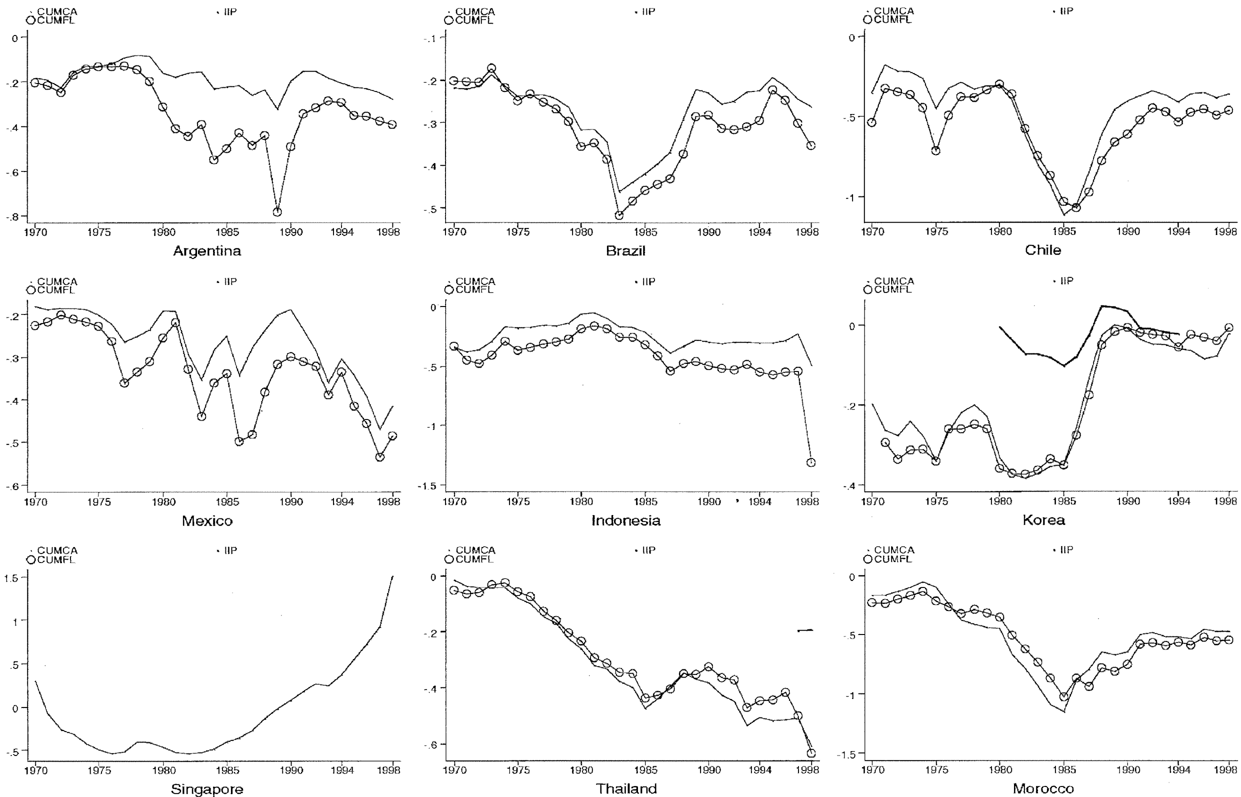
7. Since we have a limited number of time-series observations, we are constrained in the number of determinants that we can include in our empirical work. As detailed in Section 3.1, these variables can affect NFA positions through several channels as highlighted by a number of theoretical contributions. 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.

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-o- cumulative capital flows (CUMFL).

affect NFA positions, but rather will operate via global variables such as the world real interest rate.

3.1 THEORETICAL CHANNELS

Relative output per capita can affect NFA 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 NFA position. A positive relation between relative output per capita and the NFA 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 NFA position, an effect operating in the opposite direction may be at work in developing countries 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 aging population can prepare for an increase in the ratio of retirees to workers by accumulating overseas assets to supplement domestic income streams. Domestic investment in these countries will also be curtailed as the marginal prod-

uct 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 NFA in countries experiencing a rise in the youth dependency ratio (see also Taylor, 1994; Taylor and Williamson (1994); Obstfeld and Rogoff, 1996; Higgins, 1998).

However, the impact of demographic factors on the NFA 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 NFA 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 NFA 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; 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 NFA position depends on whether the "safe" asset is domestic or foreign, which is typically a model-specific choice.

3.2 PREVIOUS EMPIRICAL WORK

Masson, Kremers, and Horne (1994) is one of the very limited number of studies focusing on the evolution of NFA.[8] In their country studies of the United States, Japan, and Germany over the period 1960–1985, they relate NFA positions to the overall dependency ratio and the level of government debt, but do not include the level of income per capita.[9]

8. Halevi (1971) and Roldós (1996) provide some empirical evidence on the stages-of-the-balance-of-payments hypothesis.

9. 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 NFA positions.

They find evidence of a long-run relation between these variables, and highlight the role of feedback mechanisms working through absorption in the adjustment towards the long-run equilibrium. Calderón, Loayza, and Servén (2000) relate the evolution of NFA 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.[10] 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.

3.3 EMPIRICAL ANALYSIS

Our empirical analysis of the long-run behavior of NFA uses data for 66 countries spanning the period 1970–1998. Throughout our empirical work, we split the sample between *industrial* and *developing* countries.[11] The industrial countries consist of long-standing members of the OECD, which approximately correspond to the most-developed set of countries at the start of the sample period. We allow for potentially different relations between our fundamentals and NFA 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 the two 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 con-

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

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

straints and other sources of violation of Ricardian equivalence may induce differences in the relation between net foreign assets and public debt in the two groups.

We use the following variables: NFA 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 fraction of GDP, and the shares of population under 14, over 65, and between 15 and 64 (in 5-year cohorts).[12]

Public debt is defined as the sum of external public debt, net of foreign-exchange reserves, and gross domestic public debt.[13] For industrial countries, the main source of data for public debt is the OECD (general government definition); for developing countries, 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 countries is not homogeneous—it can refer to central government, general government, or the 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 (2000) *Demographic Yearbook* (Historical Supplement 1948–1997), supplemented by data from Herbertsson and Zoega (1999).[14]

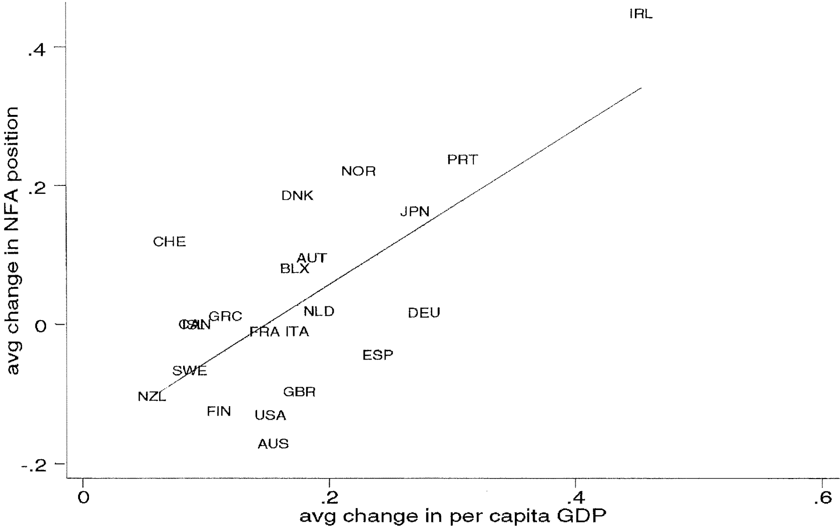
3.3.1 Bivariate Relations As a precursor to the multivariate econometric work, we begin in Figures 4–6 by showing the bivariate relations between net foreign-asset positions on the one side and output per capita, public debt, and demographic structure on the other. In these graphs, the data are measured in terms of average changes between 1980–1989 and 1990–1998, capturing the medium- or long-term movement in country

12. 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.

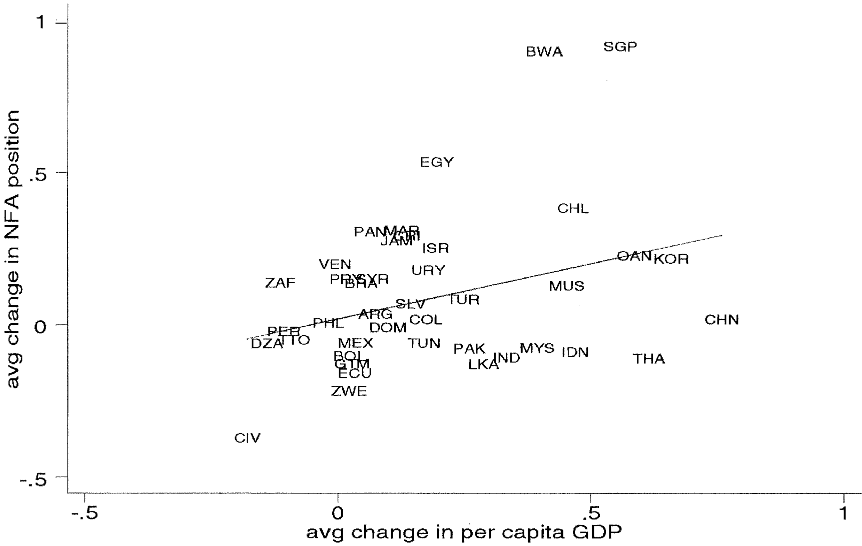
13. We would of course prefer to use net domestic public debt, but data availability for such a measure is much more limited. Since we focus on time-series behavior, and given the strong comovement between the two measures for those countries for which they are both available, we are confident that this 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."

14. We thank these authors for kindly sharing their data.

Figure 4 NET FOREIGN ASSETS AND GDP PER CAPITA (AVERAGE CHANGE, 1990–1998 OVER 1980–1989): (a) INDUSTRIAL COUNTRIES; (b) DEVELOPING COUNTRIES

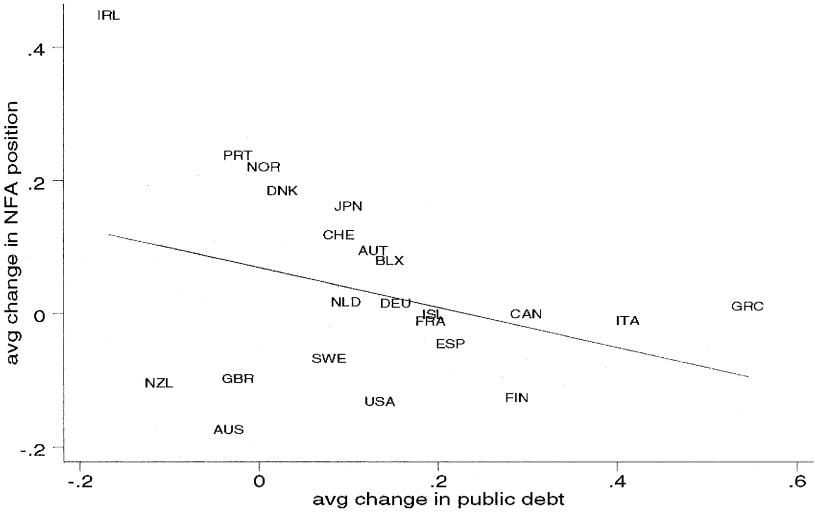


(a)

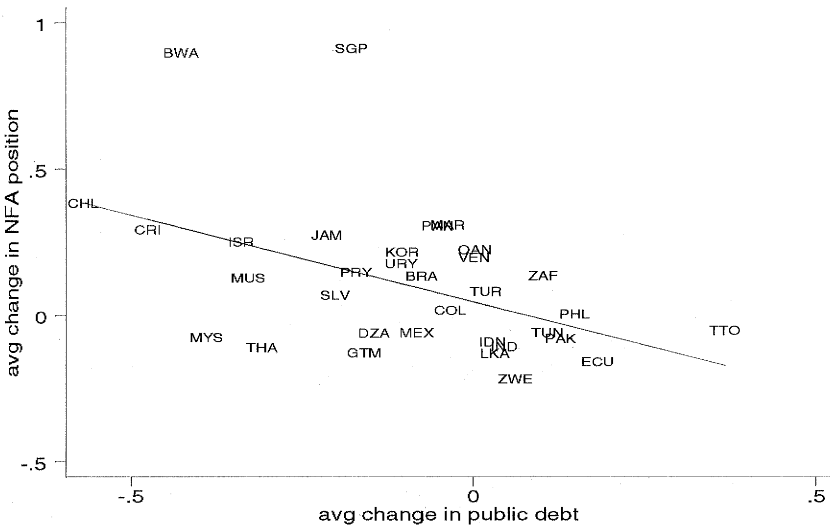


(b)

Figure 5 NET FOREIGN ASSETS AND PUBLIC DEBT (AVERAGE CHANGE, 1990–1998 OVER 1980–1989): (a) INDUSTRIAL COUNTRIES; (b) DEVELOPING COUNTRIES

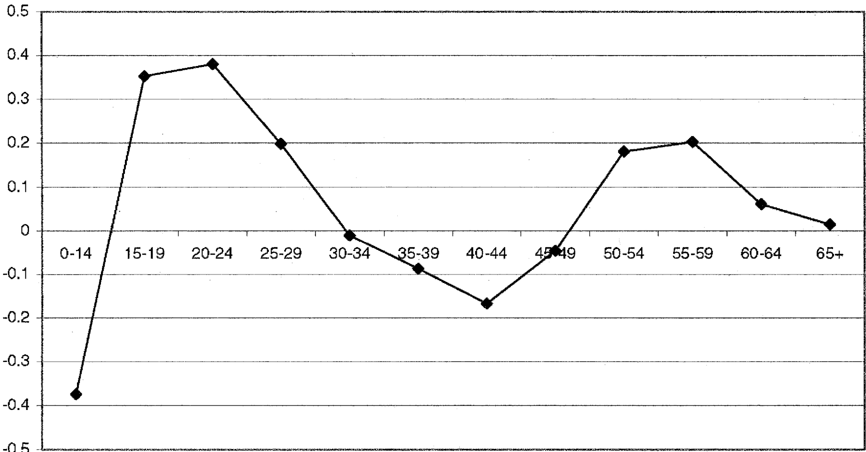


(a)

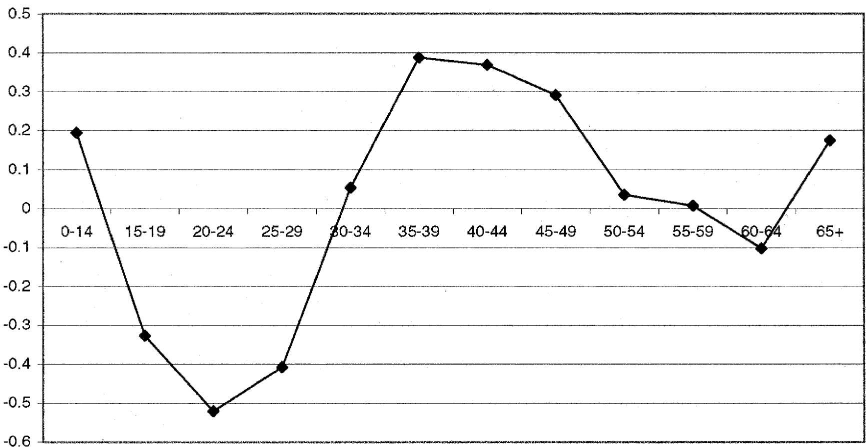


(b)

Figure 6 IMPACT OF CHANGE IN DEMOGRAPHICS ON CHANGE IN NET FOREIGN ASSETS. (AVERAGE CHANGE, 1990–1998 OVER 1980–1989): (a) INDUSTRIAL COUNTRIES; (b) DEVELOPING COUNTRIES



(a)



(b)

positions.[15] In each figure, panels (a) and (b) contain observations from the industrial and developing countries respectively.

Figure 4a shows a quite striking positive bivariate relation between growth in output per capita and improvement in the NFA position among the industrial nations. A significant positive relation between output per capita and the NFA position is also evident in the developing-country sample in Figure 4b. 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 NFA position against the change in the ratio of public debt to GDP. For both industrial and developing countries, 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 effect of demographic structure in Figure 6. This figure charts the correlation between the change in the NFA 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 countries, the effect of demographic structure is more uniform: an increase in the 15–29 population share is associated with a decline in the NFA 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 along the cross-sectional dimension, which could explain the comovements 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.

3.3.2 Panel Fixed-Effects Regression Analysis Since we are interested in the role played by shifts in our fundamentals in explaining the dynamic

15. 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.

evolution of NFA positions, we focus on a fixed-effects panel specification in this sub-subsection (we consider the cross-section evidence in the next sub-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.[16] 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.[17] 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.[18] We report estimates for the 1970–1998 and 1980–1998 intervals. The dataset is more complete for the post-1980s period, and in addition this latter period may better reflect an environment of open capital accounts.[19]

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 twelve age cohorts. We therefore follow Higgins (1998) by restricting the coefficients on the population 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).

16. 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.
17. Other panel unit-root tests gave broadly similar results. The unit-root test results are available from the authors.
18. 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 heteroscedasticity.
19. In future work, we plan to look explicitly at measures of capital-account liberalization.

Table 1 KAO (1999) AND PEDRONI (1999) COINTEGRATION TESTS

	(1) Industrial 1970–98	*(2) Industrial 1980–98*	*(3) Developing 1970–98*	*(4) 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.

Tables 2 and 3 reports 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 they are available for most of the sample period (CUMCA + IIP). For developing countries, 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% 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 for those theories outlined in Section 3.1 that predict a positive comovement between output per capita and net foreign assets.

If we consider the 1970–1998 interval, the results for public debt and

Table 2 DETERMINANTS OF NET FOREIGN ASSETS, INDUSTRIAL COUNTRIES: PANEL DOLS REGRESSIONS WITH FIXED TIME AND COUNTRY EFFECTS

	(1) CUMCA 1970–98	*(2) CUMCA 1980–98*	*(3) CUMCA+IIP 1970–98*	*(4) CUMCA+IIP 1980–98*	*(5) CUMCA Balanced 1972–97*
Log GDP per capita	0.91	0.91	0.9	0.89	0.94
	(12.63)**	(7.26)**	(12.55)**	(6.71)**	(11.66)**
Public debt	−0.125	−0.05	−0.124	−0.07	−0.18
	(3.1)**	(0.9)	(3.01)**	(1.1)	(4.54)**
χ^2(demog)	30.1	2.3	22.1	4.2	43.6
	(0.00)**	(0.51)	(0.00)**	(0.24)	(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(Popul. < 15)	−1.47	−0.81	−1.24	−1.2	−2.26
α(Popul. > 64)	−0.66	−0.59	−1.29	−0.44	−0.05
α_{max}	1.41	0.46	1.24	0.63	1.24
	(50–54)	(35–39)	(50–54)	(30–34)	50–54)
α_{min}	−1.49	−0.81	−1.29	−1.2	−2.26
	(15–19)	(0–14)	(15–19)	(0–14)	(0–14)

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 NFA minus gold. In regression (3) the dependent variable is the IIP estimate of NFA for Belgium, Canada, Italy, Japan, and the 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, the Netherlands, Spain, Sweden, Switzerland, the United Kingdom, and the United States, and CUMCA for the remaining countries. For definition of α, see Appendix.

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 ratio of net foreign assets to GDP falls by 6 percentage points in a country that experiences a 40-percentage-point increase in its ratio of public debt to GDP (relative to the world average), indicating that government debt is largely absorbed domestically.

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

Table 3 DETERMINANTS OF NET FOREIGN ASSETS, DEVELOPING COUNTRIES: PANEL DOLS REGRESSIONS WITH FIXED TIME AND COUNTRY EFFECTS

	(1) CUMCA 1970–98 All	(2) CUMCA 1980–98 All	(3) CUMCA 1970–98 No Sing.	(4) CUMCA 1980–98 No Sing.	(5) CUMFL 1970–98 No Sing.	(6) CUMFL 1980–98 No Sing.	(7) CUMCA 1977–97 Balanced
Log GDP per capita	−0.21	−0.08	−0.29	−0.2	−0.31	−0.25	−0.26
	(4.59)**	(1.05)	(6.76)**	(2.98)**	(6.8)**	(3.6)**	(3.55)**
Public debt	−0.67	−0.67	−0.73	−0.71	−0.86	−0.86	−0.50
	(14.03)**	(13.3)**	(16.8)**	(14.6)**	(21.4)**	(19.6)**	(8.87)**
χ^2(demog)	28.7	21.2	5.5	4.6	12.7	6.4	38.7
	(0.00)**	(0.00)**	(.14)	(.20)	(.01)**	(.10)	(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(Popul. < 15)	−1.01	−0.38	−0.49	−0.78	−0.9	−1.11	−1.17
α(Popul. > 64)	−0.522	0.158	2.05	2.47	4.33	4.6	0.55
α_{max}	3.92	3.54	2.05	2.47	4.33	4.6	5.66
	(50–54)	(55–59)	(65+)	(65+)	(65+)	(65+)	(55–59)
α_{min}	−3.92	−3.54	−1.19	−1.1	−1.18	−1.14	−5.67
	(20–24)	(20–24)	(25–29)	(20–24)	(45–49)	(35–39)	(20–24)

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. Regression (3)–(6) exclude Singapore from the sample. For definition of α, see Appendix.

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 1980–1998 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* comovement 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 1970–1998 period for the full sample.[20]

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 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 NFA is consistent with the relaxation of binding credit constraints on developing countries.[21]

Second, Table 3 shows a very strong inverse relation between public debt and the NFA 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 NFA. This high pass through from net government liabilities to net external liabilities is also consistent with pervasive credit constraints in developing countries, since credit-market imperfections are understood to be a primary source of deviations from Ricardian equivalence (Bernheim, 1987).[22]

With respect to the effect of demographic structure on the net foreign-asset positions of developing countries, the evidence in Table 3 shows a

20. Belgium–Luxembourg, Denmark, Finland, Greece, Norway, and Portugal were dropped to obtain a balanced sample.

21. 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.

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

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 countries also shows a greater sensitivity of the net foreign-asset position to age structure in the latter group. However, the significance of these demographic effects is weakened when Singapore is excluded from the sample.[23] 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.[24]

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 countries.[25]

For the richer countries, the graphs suggest that our specification matches the time-series behavior of NFA quite well in small open economies, but does not do as well for Germany, the United Kingdom, and the United States. For the last 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 NFA. Instead, the level of U.S. net external liabilities has increased substantially during this period.[26] 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 NFA position, whereas Japan's improved throughout the period.[27]

For developing countries, the overall fit shown in Figure 8 is very good, with very few exceptions. One is Venezuela, which has severe

23. Singapore has undergone a dramatic demographic transition, with a rapid aging of the population. Of course, this may in fact 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.
24. The balanced sample for developing countries excludes Algeria, Argentina, Bolivia, Botswana, Brazil, Chile, Côte d'Ivoire, the Dominican Republic, Paraguay, Peru, Trinidad and Tobago, Turkey, and Zimbabwe.
25. Graphs for all other countries are available from the authors. The fitted values are generated from fixed-effects panel OLS regressions: the coefficient estimates are very similar to those obtained from the DOLS specification.
26. See Obstfeld and Rogoff (2000) on the sustainability of the U.S. external position.
27. 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.

Figure 7 ACTUAL AND FITTED VALUES, NET FOREIGN ASSETS, SELECTED INDUSTRIAL COUNTRIES

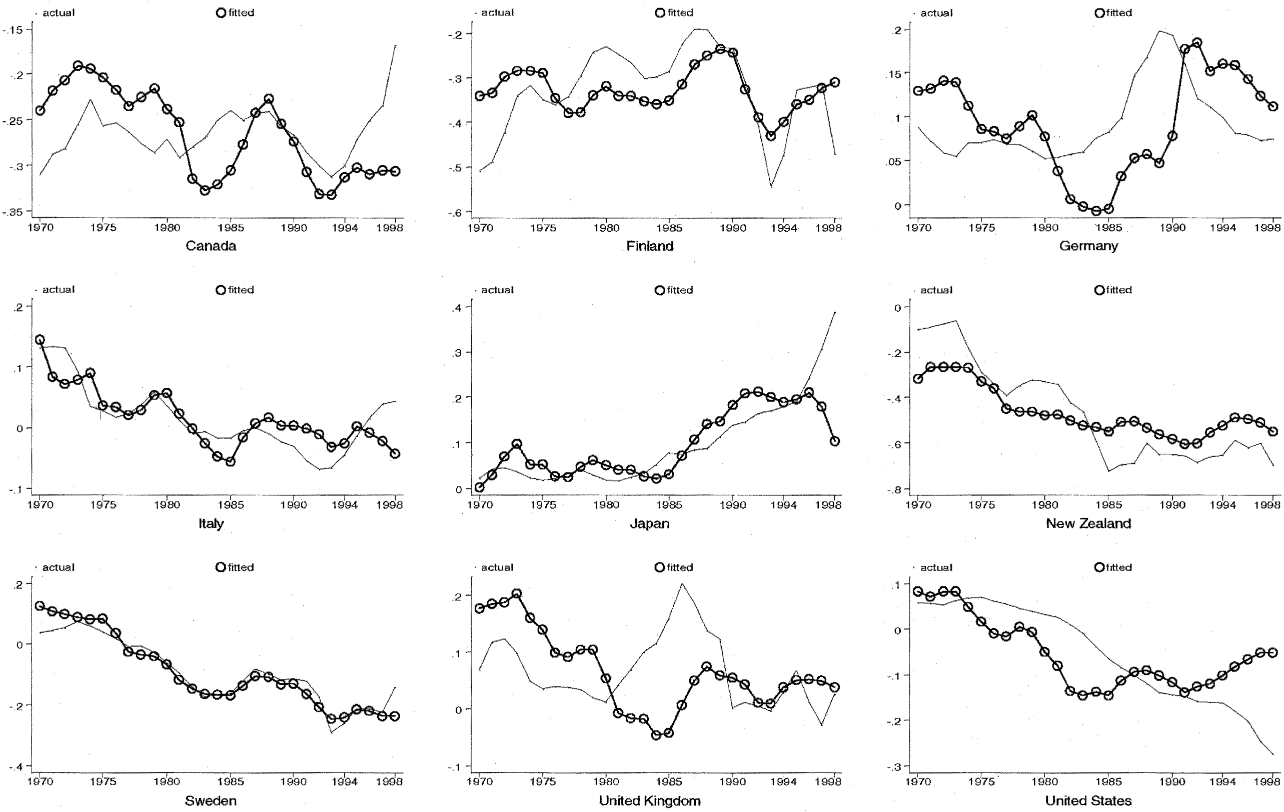
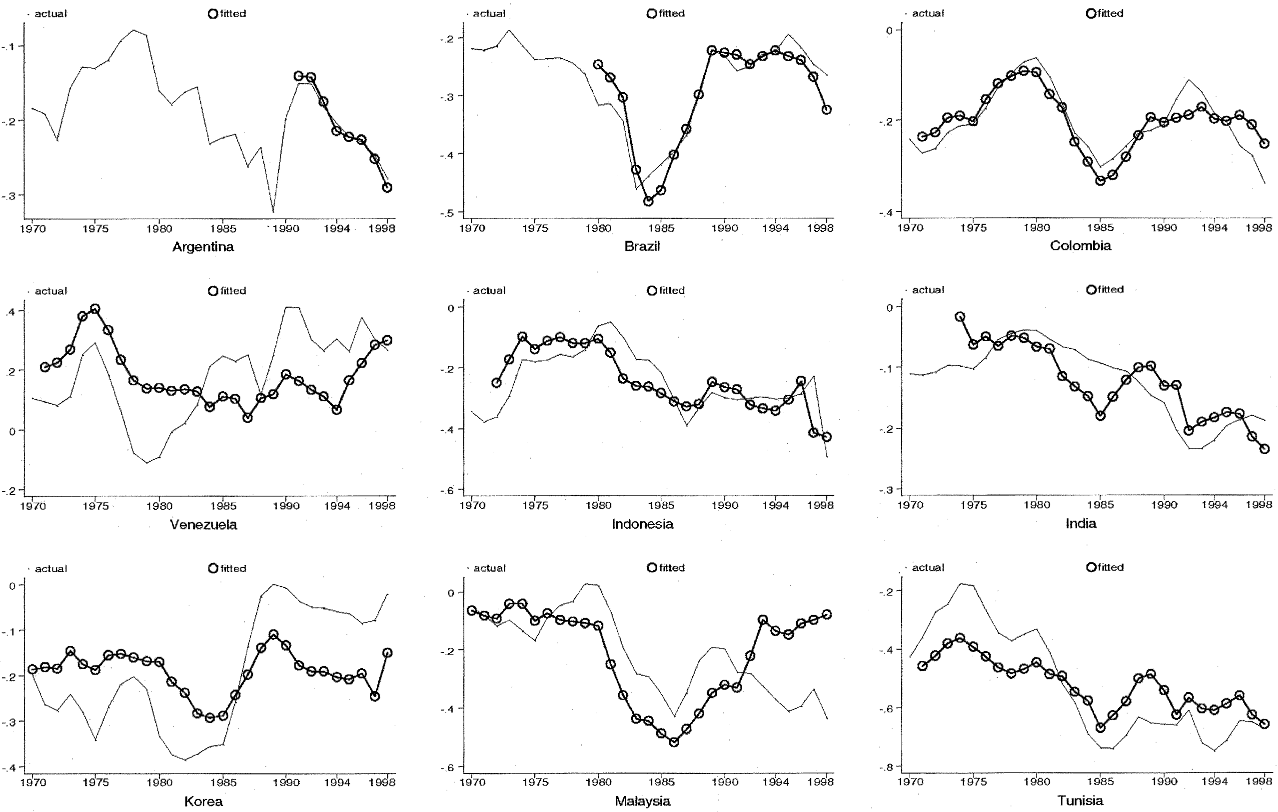


Figure 8 ACTUAL AND FITTED VALUES, NET FOREIGN ASSETS, SELECTED DEVELOPING COUNTRIES



measurement problems for its NFA 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.

In summary, the data suggest that foreign-asset positions in industrial countries exhibit a strong comovement 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 countries, 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 NFA positions. Our simple econometric specification captures long-run trends in NFA very well for developing countries and small open industrial economies, but is less successful in explaining the behavior of NFA in larger countries.

3.3.3 Cross-Sectional Evidence The panel data analysis presented in the previous sub-subsection has focused on the evolution of net foreign assets within countries. In this sub-subsection, we investigate the cross-sectional relation between NFA 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 1990–1998.[28]

Relative output per capita is the only significant variable in explaining the cross-sectional variation in NFA positions across industrial countries. As in the time-series dimension, richer countries have larger NFA positions, although the cross-section point estimate is 40–50% 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 countries. In contrast to the time-series result, we find a positive association between output per capita and NFA 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 countries with larger public debts also have larger net external liabilities. Columns (4)–(6) also suggest a signifi-

28. The results are virtually unchanged if we focus on a single year, because these variables move only slowly from year to year.

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	0.54	0.18	0.17	0.15	−1.87
	(3.58)**	(2.92)**	(2.32)**	(2.0)**	(1.6)	(2.93)**
Log GDP per capita squared						0.13
						(3.26)**
Public debt	0.10	−0.11	−0.44	−0.45	−0.65	−0.71
	(0.7)	(0.35)	(4.52)**	(4.47)**	(5.18)**	(6.55)**
χ^2(demog)	3.05	2.21	35.3	33.6	36.7	1.35
	(0.38)	(0.53)	(0.00)**	(0.00)**	(0.00)**	(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(Popul. < 15)	−1.2	394.2	−489.2	−442.3	−276.9	−2.25
α(Popul. > 64)	−0.44	−1314.6	1527.8	1389.0	921.8	−0.04
α_{max}	0.62	424.3	1527.8	1389.0	921.8	1.24
	(30–34)	(15–19)	(65+)	(65+)	(65+)	(50–54)
α_{min}	−1.2	−1314.6	−511.9	−464.0	−298.1	−2.25
	(0–14)	(65+)	(20–24)	(20–24)	(35–39)	(0.14)

Ordinary least squares, heteroscedasticity-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 foreign assets minus gold. In regression (2) the dependent variable is the IIP estimate of NFA for Austria, Belgium, Canada, Finland, Germany, Italy, Japan, the Netherlands, Spain, Sweden, Switzerland, the United Kingdom, and the 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) and (5) exclude Singapore. For definition of α, see Appendix.

cant effect of the demographic structure on the cross-section distribution of NFA positions among developing countries, 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 NFA and output per capita is nonlinear. We report results using a quadratic cross-sectional relation between output per capita and NFA for developing countries in column (7).[29] The specification does pick up a nonmonotonicity, but the turning point is at a low threshold ($1170); only 8 out of the 38 countries are in the region in which the cross-sectional relation between output per capita and NFA is slightly negative.[30]

4. *The Dynamics of Net Foreign Assets and the Trade Balance*

In the previous section, we focused on the long-run behavior of NFA, 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 NFA, as well as the implications these dynamics have for the trade balance.

4.1 THE ECM REPRESENTATION

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

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

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

29. A similar specification for the whole sample gives statistically weaker results, with an estimated turning point below output per capita of U.S.$1000. It makes little difference to the results if Singapore is included or CUMCA is used as the NFA measure.

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

Table 5 CHANGES IN NET FOREIGN ASSETS: SPEED OF ADJUSTMENT: PANEL REGRESSIONS, ERROR-CORRECTION SPECIFICATION

(a) *Industrial Countries*[a]

	(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

(b) *Developing Countries*[b]

	(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

Ordinary least squares, *t*-statistics in parentheses [*p*-value for the χ^2(demog) statistic]. * (**) indicates statistical significance at the 5% (1%) confidence level.

[a]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 NFA minus gold. In regression (3) the dependent variable is the change in the IIP estimate of NFA for Belgium, Canada, Italy, Japan, and the 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, the United States, and the change in CUMCA for the remaining countries.

[b]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.

dependent variable and contemporary changes in all explanatory variables (coefficients not reported). Results show that deviations of NFA from their long-run trend tend to be quite persistent, with a half-life of 5–6 years, and that the speed of adjustment is quite similar in industrial and developing countries. Given the restrictive specification of the short-

run dynamics, the fit of the regressions is remarkably good, especially so for developing countries.

It is useful to ask how well this simple specification accounts for the dynamics of NFA 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 NFA for the period 1970–1998. For industrial countries, the model does poorly in explaining the short-run dynamics of the NFA position for most of the large economies—Japan, the United Kingdom, and the United States—while it tracks the smaller open economies, such as Ireland, Portugal, and the Scandinavian countries, quite nicely.[31] For developing countries, the model performs remarkably well across the board, explaining a substantial fraction of year-to-year changes in NFA, with very few exceptions.

4.2 IMPLICATIONS FOR THE TRADE BALANCE

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

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

$$B_{it} - B_{it-1} = \mathrm{TB}_{it} + \mathrm{TR}^{c}_{it} + \mathrm{TR}^{k}_{it} + i_{it}B_{it-1} + \mathrm{KG}_{it}, \tag{5}$$

where TB_{it} is the balance of trade in goods and services, TR^{c}_{it} (TR^{k}_{it}) are net current (capital) transfers, $i_{it}B_{it-1}$ is investment income, and KG_{it} is the capital gain/loss on outstanding net external assets. The current account is given by the sum of TB_{it}, TR^{c}_{it}, and the investment income $i_{it}B_{it-1}$.[32] Dividing both sides of equation (5) by GDP measured in U.S. dollars, adding together investment income and capital gains, and rearranging terms, we obtain

$$\Delta b_{it} = \mathrm{tb}^{*}_{it} + \mathrm{tr}^{k}_{it} + \frac{i_{it} + \mathrm{kg}_{it}}{1 + \gamma_{it}} b_{it-1} - \frac{\gamma_{it}}{1 + \gamma_{it}} b_{it-1}, \tag{6}$$

31. One reason why the model may not fully capture the dynamics of the NFA 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 NFA position is likely to be especially important.

32. 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.

Table 6 CORRELATION BETWEEN ACTUAL AND FITTED CHANGE IN NET FOREIGN ASSETS[a]

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	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

[a]Correlation coefficient between actual and fitted values of changes in the ratio of NFA to GDP. Regressions for the period 1970–1998 corresponding to column (1) in Table 5a for industrial countries, and column (5) in Table 5b for developing countries.

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-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 rearrange equation (6) to relate the *transfer-corrected* trade balance to our estimate of the change in the NFA position, given in equation (4):

$$tb^*_{it} + tr^k_{it} = \widehat{\Delta b_{it}} = -\frac{r_{it} - g_{it} - \varepsilon_{it}}{(1 + g_{it})(1 + \varepsilon_{it})} b_{t-1} + \nu_{it} = \widehat{\Delta b_{it}} - \Psi_{it} + \nu_{it}, \qquad (7)$$

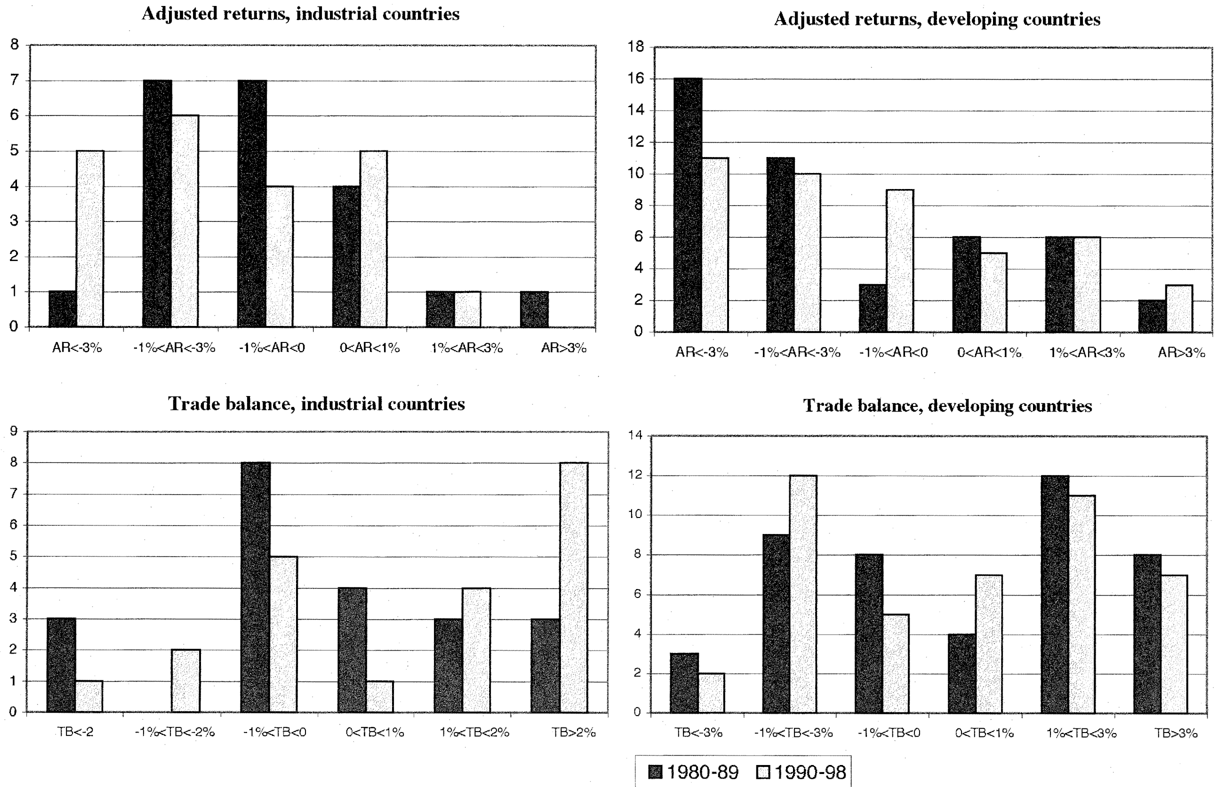
where r_{it} is the real rate of return on net foreign assets, measured in U.S. dollars.[33] The transfer-corrected trade balance is related to three factors. The first term on the RHS on this equation reflects the change in the net foreign-asset position that is required for convergence to its long-run 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 NFA position; and the third term is the component of the change in NFA that is not explained by the dynamics of its 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 NFA 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 countries for the periods 1980–1989 and 1990–1998.[34] The low growth and real depreciation

33. In the presence of differences in rates of return between external assets and liabilities, the RHS would also include the term $(r^L_{it} - r^A_{it})b^L_{it-1}$, where $r^L_{it} - r^A_{it}$ is the rate of return differential between liabilities and assets, and b^L_{it-1} is the stock of gross liabilities. We implicitly include this term in the adjusted returns Ψ_{it}.

34. 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-market 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).

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.

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

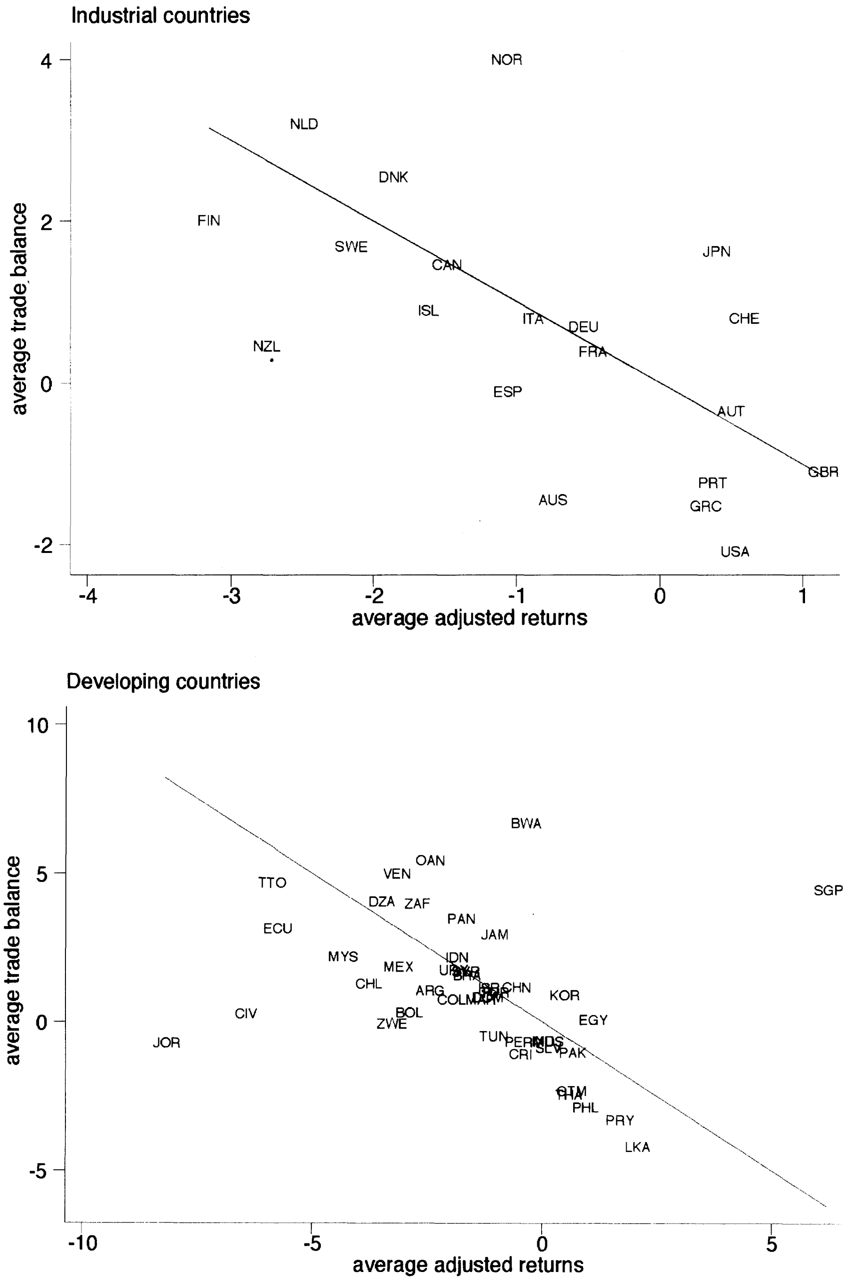
Figure 10 presents scatter diagrams illustrating the cross-sectional relation between the adjusted-returns term and the trade balance for the industrial and developing countries for the period 1980–1998. The graphs also show a line with a negative slope of 45 degrees that corresponds, for a given level of adjusted returns, to the trade balance that would keep the NFA 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's 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% of GDP over the past 2 decades would have been consistent with an unchanged NFA 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 NFA, 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 NFA 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 NFA 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 NFA position.

5. *Net Foreign Assets and Real Interest Differentials*

Rates of return on assets and liabilities play a crucial role in determining the dynamic behavior of NFA 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 NFA positions: debtor countries should experi-

Figure 10 ADJUSTED RETURNS AND THE TRADE BALANCE



ence 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 vs. 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

$$r_{it} - r_{wt} = \delta_{it} - E_t[\Delta \text{RER}_{t+1}] \tag{8}$$

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

$$r_{it} - r_{wt} = \delta_{it} = -\delta \, \text{bx}_{it}, \qquad \delta > 0, \tag{9}$$

where we model the country risk premium as inversely (and linearly) related to the ratio of NFA to exports, bx_{it}.[35]

5.1 EMPIRICAL RESULTS

We confine attention to the industrial-country sample. Nominal interest rates are yields on government bonds, the same ones employed by Obstfeld and Rogoff (2000, 2001).[36] 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 7, 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 (a), we employ the real interest differential vis-à-vis the U.S. The actual ratio of NFA to exports is employed as a regressor in columns (1)–(4), whereas in columns (5)–(8) we use the fitted values generated in Section 3.3.2.[37] The results in columns (1)–(2) and (5)–(6) are for 1970–1998; those in columns (3)–(4) and (7)–(8), for 1980–1998. We also enter the stock of public debt and the rate of real exchange-rate

35. 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.
36. Iceland is excluded from the sample. We thank those authors and Jay Shambaugh for generous assistance with these data.
37. In Section 3.3.2, we regressed the ratio of NFA 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.

appreciation in alternative specifications.[38] 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 column (1) of panel (b), a 20-percentage-point improvement in the ratio of NFA to exports is associated with a 50-basis-point reduction in the real interest-rate differential. The effect is also significant for the 1980–1998 period, and the estimated point coefficient is 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 NFA 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 NFA position.

Figure 11 provides a scatterplot of average net foreign assets and real interest rates over the period 1990–1998, documenting a negative relation between these variables. Table 8 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 NFA-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 U.S. We note also that the stock of public debt typically has a marginally significant positive effect on the real interest-rate differential (at the 10% level), but real exchange-rate appreciation has no effect in the cross-sectional specification.

The results in this section provide some suggestive evidence that NFA positions matter in determining real interest-rate differentials, in the spirit of the portfolio-balance literautre.[39] In future work, it would be

38. 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), the bilateral CPI-based real exchange rate vis-à-vis the U.S.

39. Bayoumi and Gagnon (1996) predict that a country's NFA 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 NFA position. We further note that inflation and real interest rates are negatively correlated in the time-series dimension of our dataset but positively correlated in the cross section.

Table 7 REAL INTEREST RATES AND REAL INTEREST DIFFERENTIALS: PANEL DOLS REGRESSIONS WITH FIXED TIME AND COUNTRY EFFECTS

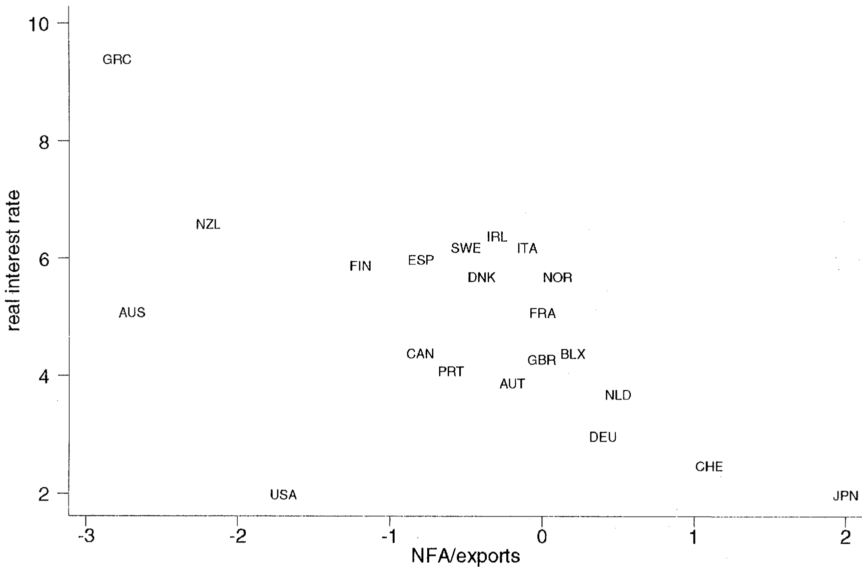
	(1) *1970–98*	*(2)* *1970–98*	*(3)* *1980–98*	*(4)* *1980–98*	*(5)* *1970–98*	*(6)* *1970–98*	*(7)* *1980–98*	*(8)* *1980–98*
				(a) *Real Interest Rate*				
NFA/exports	−1.06	−0.83	−1.36	−0.91	−1.5	−1.63	−2.87	−2.81
	(2.6)*	(2.0)*	(2.48)*	(1.66)	(2.45)*	(2.94)**	(4.48)**	(4.65)**
Public debt		3.82		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*

NFA/exports	−2.54 (5.41)**	−2.44 (5.5)**	−2.73 (4.3)**	−2.22 (4.58)**	−2.57 (4.03)**	−2.77 (4.27)**	−3.19 (4.83)**	−3.24 (5.52)**
Public debt		3.18 (1.76)		7.79 (4.82)**		2.23 (1.51)		3.18 (1.67)
D(RER)		−0.04 (2.15)*		−0.014 (.78)		0.012 (.54)		0.015 (.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

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

Figure 11 REAL INTEREST RATES AND NET FOREIGN ASSETS



Average data, 1990–1998.

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 NFA 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 NFA positions and other risk factors in determining real interest-rate differentials.

6. *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, 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 NFA position in determining the trade balance—the former because trade balances are typically required to accomplish changes in the target NFA position, the latter due to the role played by

Table 8 REAL INTEREST RATES AND REAL INTEREST DIFFERENTIAL: CROSS-SECTION EVIDENCE (AVERAGE, 1990–98)

	(1)	(2)	(3)	(4)
	(a) *Real Interest Rate*			
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*			
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

Sample is industrial countries, except Iceland. 1990–1998 averaged data. In panel (a), the dependent variable is the real interest rate; in panel (b) the real interest differential vis-à-vis the U.S. In regressions (1)–(2), CUMCA is employed as the measure of NFA; in regressions (3)–(4) it is based on the fitted value from regression of NFA on GDP per capita, public debt, and demographic variables. In regressions (2) and (4), the multivariate real exchange rate is employed in panel (a), and the bivariate real exchange rate vis-à-vis the U.S. in panel (b). * (**) indicates statistical significance at the 5% (1%) confidence level.

investment returns on outstanding foreign assets and liabilities. Finally, we have presented evidence that the NFA 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 NFA positions exert an important influence on the long-run behavior of real exchange rates (Lane and Milesi-Ferretti, 2000) 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, 2001b). 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.

Appendix

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 $\Sigma_{j=1}^{12}\alpha_j p_{jt}$, where p_{jt} is the population share of cohort j in period t and $\Sigma_{j=1}^{12}\alpha_j = 0$. 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

$$\gamma_0 = -\gamma_1 \frac{1}{J}\sum_{j=1}^{12} j - \gamma_2 \frac{1}{J}\sum_{j=1}^{12} j^2 - \gamma_3 \frac{1}{J}\sum_{j=1}^{12} j^3.$$

In turn, we can estimate γ_1, γ_2, γ_3 by introducing the age variables into the estimated equation in the following way:

$$\gamma_1 \, \mathrm{DEM}_{1t} + \gamma_2 \, \mathrm{DEM}_{2t} + \gamma_3 \, \mathrm{DEM}_{3t},$$

where

$$\mathrm{DEM}_{1t} = \sum_{j=1}^{12} j p_{jt} - \frac{1}{J}\sum_{j=1}^{12} j \sum_{j=1}^{12} p_{jt},$$

$$\mathrm{DEM}_{2t} = \sum_{j=1}^{12} j^2 p_{jt} - \frac{1}{J}\sum_{j=1}^{12} j^2 \sum_{j=1}^{12} p_{jt},$$

$$\mathrm{DEM}_{3t} = \sum_{j=1}^{12} j^3 p_{jt} - \frac{1}{J}\sum_{j=1}^{12} j^3 \sum_{j=1}^{12} p_{jt}.$$

Finally, we can easily recover the implicit α_j once we know γ_0, γ_1, γ_2, γ_3.

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Comment

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1. *Overview of the Paper*

This paper is part of an ambitious project by Lane and Milesi-Ferretti attempting to measure, explain, and explore various aspects of international balance sheets. The first paper in the series, "The External Wealth of Nations," documents the compilation of an exciting new dataset on net foreign-asset positions for a sample of 66 industrial and developing

countries from 1970 through 1998. This paper uses this dataset to answer three straightforward questions. First, what determines a country's NFA position? Second, how do changes in a country's net foreign-asset position affect its trade balance? Third and finally, how does a country's NFA position affect its domestic interest rate?

The paper presents an extensive series of graphs and empirical tests aimed at answering these three questions. Most of the results are highly significant, economically important, and in agreement with the predictions of standard open-economy macro models. For example, results for the first question suggest that in industrial countries, changes in NFA positions are positively correlated with changes in output per capita. In developing countries, changes in net foreign-asset positions are negatively correlated with changes in output per capita and negatively correlated with changes in public debt. In both groups of countries, NFA positions are highly correlated with demographics. The results for the second question show that countries' net foreign-asset positions are negatively correlated with their trade balance. Finally, results for the third question indicate that countries' NFA positions are negatively correlated with their real interest rates.

The authors should be applauded for this paper. They examine important questions that are far from resolved in the open-economy macro literature. In their empirical tests, they are careful to use panel estimation to control for any time-invariant omitted variables, as well as the appropriate time-series techniques to adjust for cointegration. Despite their extremely parsimonious specifications, the graphs of actual and fitted values suggest that their models have a high degree of explanatory power for most countries in the sample. Perhaps most noteworthy, the dataset compiled for this paper was a substantial undertaking (which is understated in the paper) and will undoubtedly form the basis of a numerous studies examining topics related to net foreign assets.

I do, however, have several concerns with the paper's analysis. To correspond to the trio of questions examined in the paper, the remainder of my comments will focus on three of the most problematic issues: nonlinearity, omitted variables, and endogeneity. The comments will conclude with an overall evaluation of the paper.

2. *Nonlinearity and Income Divisions*

My first set of concerns with the paper is that many of the relationships being tested with linear regressions are nonlinear. This problem arises in each of the three sets of tests, but to make the point clearly, I will focus on one specific nonlinearity: the relationship between a country's GDP per capita and its NFA position. In the theoretical discussion in Section

3.1, the paper points out several ways in which output per capita can affect net foreign-asset positions. For example, "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." On the other hand, in credit-constrained countries, "an increase in production may allow greater recourse to foreign credit, possibly implying a negative relation between net external assets and relative output per capita, at least over some interval."

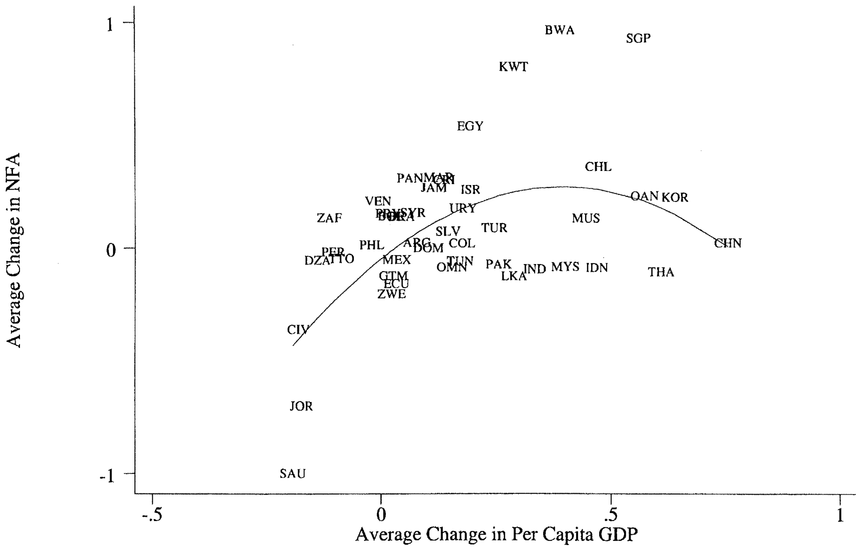
Each of these channels linking a country's output and net foreign-asset position could counteract each other, and the relative strength of each of the channels could vary with a country's income level. For example, the second channel, based on credit constraints, is more likely to occur in developing countries. In order to adjust for this nonlinear relationship between output and net foreign assets, the authors divide their sample into two groups of countries: industrial and developing. They define industrial countries as "long-standing members of the OECD, which approximately corresponds to the most-developed set of countries at the start of the sample period."

The empirical results for the two groups of countries suggest that this relationship between output and net foreign assets is in fact nonlinear and driven by the two theoretical channels discussed above. The relationship between changes in output per capita and changes in net foreign assets is positive and highly significant in industrial countries, and negative and highly significant in developing countries. But is there any reason to believe that this rough division between "long-standing members of the OECD" and nonmembers accurately captures the true form of the relationship? Each group of countries is extremely diverse. For example, "industrial" countries include the U.S. and Switzerland as well as Greece and Portugal. "Developing" countries include Paraguay and Zimbabwe as well as Singapore and Israel. It is hard to believe the relationship between income and net foreign assets is the same for these diverse members of each country group.

A simple extension to one of the figures in the paper shows that these differences within each group of countries in the relationship between income and net foreign assets can be important and significantly affect estimates. Figure 1 graphs the average change in a country's NFA position between 1980–1989 and 1990–1998 vs. the average change in its GDP per capita over the same two periods for developing countries. This is the analysis performed in Figure 4(b) of the paper.[1] Then, to calculate

1. Figure 4(b) drops several observations from the sample because those countries do not have sufficient data to include in the subsequent regression analysis. I include the full sample, with no significant effect on the results.

Figure 1 DEVELOPING COUNTRIES



the fitted line for the graph, I estimate the linear specification used in the paper and also add a squared term for GDP per capita. Regression results are reported in columns (1) and (2) of Table 1. The nonlinear specification outperforms the linear regression, and the squared term is highly significant. In Figure 1, the fitted regression line including the nonlinear term is clearly a better fit for the data than a straight line.

Next, instead of focusing on just developing countries, I repeat this analysis for the entire sample of countries. Figure 2 graphs the relationship between average changes in NFA positions and average changes in GDP per capita for industrial and developing countries. Columns (3) and (4) in Table 1 report regression estimates for the linear regression and with the additional squared term, respectively. Once again, the nonlinear specification outperforms the linear specification, and Figure 2 suggests that the nonlinear fitted line is a much better description of the data.

This series of results suggests that the underlying relationship linking changes in NFA positions and GDP per capita is not linear. A simple extension to the panel estimates—just adding a squared term—appears to significantly improve the specification. In the current version of the paper, the authors perform a similar extension to their cross-section estimates [adding a squared term for GDP per capita in column (6) of

Table 1 EVIDENCE OF NONLINEARITY IN THE RELATIONSHIP BETWEEN INCOME PER CAPITA AND NET FOREIGN ASSETS

	Developing countries		*Full sample*	
	(1)	*(2)*	*(3)*	*(4)*
Constant	−0.05	−0.05	−0.06	−0.09
	(−0.80)	(−0.86)	(−1.46)	(−2.07)
Log GDP per capita	0.62	1.62	0.66	1.41
	(3.15)	(4.30)	(4.09)	(4.68)
Log GDP per capita^2		−2.04		−1.55
		(−3.01)		(−2.89)
No. of countries	45	45	67	67
Adjusted R^2	0.17	0.30	0.19	0.27

Note: t-statistics are in parentheses. Variables calculated as average changes between 1980–1989 and 1990–1998 (to correspond to Figure 4 in the paper). See Figures 1 and 2 of this comment for corresponding data points and fitted regression line.

Figure 2 ALL COUNTRIES

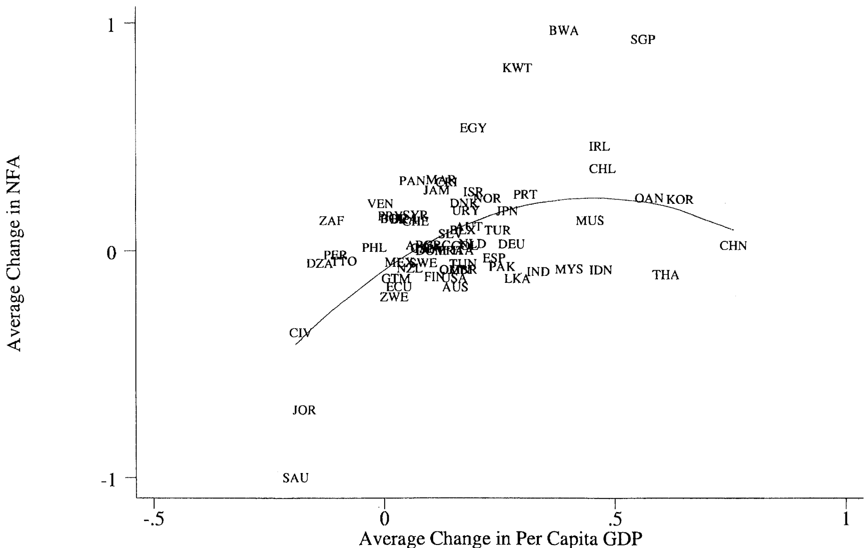


Table 4]. The nonlinear term is highly significant, and including this term substantially affects other coefficient estimates. This combination of results suggests that the rough division between industrial and developing countries used in the paper will not accurately capture the relationship between income levels and NFA positions. Instead of using these two rough groups, the paper should try to better specify the underlying, nonlinear relationship between these variables. At the very least, it should include a squared term in the base specification. As shown in the simple tests in Table 1, even the simple extension of including a squared term for income levels can significantly affect coefficient estimates.

3. *Omitted Variables: Investment, at Least*

A second concern that I have with this paper is omitted variables. The specifications estimated to answer each of the three motivating questions are extremely parsimonious. For example, the first series of regressions, predicting determinants of a country's NFA position, include only six control variables: income per capita, public debt, and three demographic variables. The second series of regressions, predicting a country's trade balance, include two sets of explanatory variables: a lagged measure of the trade balance and then a set of controls for investment returns. The third series of regressions, predicting real interest-rate differentials, includes at most three controls: NFA, public debt, and the real exchange rate.

In all three cases, there are numerous variables that are not included in the regression but could affect the dependent variable and be highly correlated with one or more explanatory variables. As a result, coefficient estimates could be biased. The paper takes an important step toward adjusting for omitted-variables bias by using panel estimation and controlling for any time-invariant country-specific effects. Panel estimation does not, however, control for any omitted variables that vary over time, which is particularly problematic in this paper, since the time periods are fairly long (generally 28 or 18 years). To make this point about the necessity to include additional controls and sensitivity tests in the regression analysis, I will focus on one omitted variable: domestic investment. This is only one example of several omitted variables that could significantly affect the regression results.

Domestic investment is one variable that should be included in estimates predicting a country's NFA position (the first series of tests in the paper). To see the importance of this variable, it is useful to examine the standard balance-of-payments accounting equation used in introductory macroeconomics textbooks:

$$\underbrace{X_{it} - M_{it}}_{\text{trade surplus}} = \underbrace{(\text{TA}_{it} - G_{it} - \text{TR}_{it})}_{\text{govt. budget surplus}} + S_{it} - I_{it}, \tag{1}$$

where X is exports, M is imports, TA is government tax revenue, G is government spending on goods and services, TR is government transfer payments, S is private savings, and I is domestic investment. The model used to estimate a country's NFA position in the paper is

$$\text{NFA}_{it} = \text{GDEBT}_{it} + \text{DEM}_{it} + \text{YC}_{it}, \tag{2}$$

where NFA is the ratio of net foreign assets to GDP, YC is output per capita, GDEBT is the stock of public debt, and DEM is a set of demographic variables. When equation (2) is estimated in changes (as in the panel specification), it is directly comparable to equation (1). Changes in NFA in equation (2) are highly correlated with the trade surplus in equation (2) (as explored in detail in the second series of tests in the paper.) Changes in GDEBT in equation (2) are equivalent to the government budget surplus in equation (1). Changes in DEM are included to capture how changes in the demographic composition of the population affect the savings rate [as written in equation (1)]. Investment, however [the final term in equation (1)], is not included in equation (2). Instead, the paper includes output per capita.

It is well documented that investment is highly volatile over time within a given country. Therefore, it is unlikely that the country fixed effects control for movements in this variable. Moreover, investment is undoubtedly correlated with output per capita. Therefore, do estimates of the relationship between output per capita and NFA in equation (2) capture the relationship between these two variables? Or is the coefficient on output per capita actually capturing the effect of investment? Or is the relationship between investment and GDP biasing the coefficient estimates on GDP?

To analyze these questions more formally, Table 2 reports the univariate correlations between NFA (measured by CUMCA), income per capita, and investment as a share of GDP for industrial and developing countries.[2] These univariate correlations suggest that NFA are positively correlated with GDP per capita in both industrial and developing countries. This is in contrast to the multivariate panel regression results, where NFA are positively correlated with GDP per capita in industrial countries, but negatively correlated in developing countries. The univariate correlation

2. Correlations are calculated across countries and years. Investment as a share of GDP is taken from World Bank (2000). *World Development Indicators on CD-ROM*, Washington, DC: World Bank.

Table 2 UNIVARIATE CORRELATIONS

(a) *Industrial countries: 1970–1998*

	NFA (CUMCA)	*GDP per capita*	*Investment /GDP*
NFA (CUMCA)	1.00	0.45	0.04
GDP per capita		1.00	−0.17
Investment/GDP			1.00

(b) *Developing countries: 1970–1998*

	NFA (CUMCA)	*GDP per capita*	*Investment /GDP*
NFA (CUMCA)	1.00	0.37	−0.04
GDP per capita		1.00	0.07
Investment/GDP			1.00

estimates also show that NFA are positively correlated with investment in industrial countries and negatively correlated in developing countries. Moreover, GDP per capita is negatively correlated with investment in industrial countries and positively correlated in developing countries.

Although it is impossible to predict how omitting investment will bias the coefficient on GDP per capita in the multivariate context of equation (2), the correlations in Table 2 allow us to predict the bias in a univariate context. The correlations suggest that omitting investment will generate a negative bias in estimates of the effect of GDP on NFA in both industrial and developing countries. Moreover, if these univariate correlations are strong enough and outweigh any counteracting multivariate correlations, that will also be the effect of the omitted-variable bias in the multivariate context.

Table 3 tests these implications. It reports fixed-effects estimates of equation (2) with and without a control for investment for both industrial and developing countries.[3] The results agree with the predictions from the univariate correlation analysis. Excluding investment from the model generates a downward bias on the coefficient estimates for GDP per capita. In industrial countries, the effect of the bias is small. In developing countries, however, the effect of the bias is significant and the coefficient on GDP per capita becomes insignificant, while the coefficient on investment is negative and highly significant. This suggests that

3. These estimates are similar to those reported in column (1) of Tables 2 and 3 in the paper. The only differences between these estimates and those in the paper (to the best of my knowledge) are: (1) these estimates are fixed effects and do not control for cointegration as done in the paper; (2) this sample size is slightly larger than that in the paper.

Table 3 REGRESSION RESULTS: IMPACT OF OMITTING INVESTMENT FROM PREDICTIONS OF NET FOREIGN ASSETS

	Industrial countries		*Developing countries*	
	(1)	*(2)*	*(3)*	*(4)*
Log GDP per capita	0.87 (14.73)	0.93 (15.02)	−0.19 (−4.57)	−0.04 (−0.88)
Public debt /GDP	−0.13 (−4.10)	−0.17 (−5.20)	−0.63 (−19.27)	−0.63 (−19.84)
Investment /GDP		−0.47 (−2.97)		−1.16 (−8.49)
No. of observations	577	535	907	872
No. of countries	22	22	39	38
Within R^2	0.46	0.51	0.47	0.54

Note: t-statistics are in parentheses. Dependent variable is CUMCA. Estimates are fixed effects for the full sample from 1970–1998. Period dummies and demographic variables are included in the regressions but are not reported.

when investment is omitted from the equation, estimates of the effect of GDP per capita on NFA in developing countries may be biased and actually be capturing the relationship between investment and NFA.

This section has presented theoretical and empirical evidence that omitting one variable from one regression could significantly bias coefficient estimates. Domestic investment in the regressions predicting NFA, however, is only one of a number of potentially important omitted variables. Others are capital-account liberalization, increased trade flows, changes in expected growth rates or returns, income inequality, inflation, and exchange-rate movements. Each of these variables has changed significantly for many countries in the sample over the long periods under consideration and therefore will not be captured in the country effects in the panel estimation. Granted, there are limited degrees of freedom in many of the regressions estimated in the paper, but given the potentially serious biases from excluding these important variables, the paper should carefully address what other variables are omitted and how they might affect the results. Moreover, the paper should add an extensive series of sensitivity tests to see if including any of these variables in the base specification significantly affects results. The *NBER Macroeconomics Annual* is the ideal forum to perform this sort of detailed robustness analysis and explore a wide variety of potential interactions between variables.

4. *Endogeneity: What is Actually Driving What?*

The third major concern that I have with this paper is endogeneity. The paper carefully explains why each of the independent variables could affect the dependent variables in each of the three sets of regressions. There are equally valid reasons, however, why each of the dependent variables could in turn affect many of the explanatory variables. In several parts of the paper, the language suggests that the authors are aware of this problem. For example, when interpreting coefficient estimates, they write that a movement in one variable "is associated with" or "is correlated with" a movement in another variable, instead of saying that a movement in one variable "causes" a movement in the other. In other cases, however, the terminology is less careful and the language interprets coefficient estimates as showing causality. Moreover, the central purposes motivating the paper are not to understand correlations, but rather to better understand what causes changes in a country's NFA position and what are the effects of changes in NFA positions on other variables, such as the trade balance and interest-rate differentials. Therefore, in order to answer the key questions motivating the paper, the authors should address potential endogeneity issues in more detail. This section discusses two specific examples in detail and then provides suggestions for dealing with endogeneity.

One of the clearest examples of endogeneity is in the final series of tests in the paper: how a country's NFA position affects its interest-rate differential (versus the global interest rate or the U.S. interest rate.) The paper estimates a straightforward regression of the interest-rate differential on NFA, using both panel and cross-country estimation for two different periods. In alternative specifications, there are also controls for movements in the country's real exchange rate and stock of public debt. Estimates of the coefficient on net foreign assets are negative and usually highly significant. The paper interprets this as "some suggestive evidence that NFA positions matter in determining real interest-rate differentials. . ." But, do movements in NFA positions drive movements in the interest-rate differential, or vice versa? Japan is a clear example. Japan has significantly lowered its interest rate since 1990 (from 5.20 in 1990 to 0.01 in 1998) in an attempt to spur domestic growth.[4] During this period, Japan has consistently run a large capital-account surplus, and its NFA position has increased substantially. (The CUMCA variable rose from 0.14 in 1990 to 0.39 in 1998.) Did the change in Japan's NFA position drive the fall in interest rates? Or did the fall in interest rates drive the change in Japan's NFA position? The specification in the paper as-

4. Based on the real-interest-rate data used in the paper.

sumes the former, while I would argue that the latter channel is more important.

In addition to this model predicting interest-rate differentials, each of the central regressions in the paper could also have problems with endogeneity. For example, in the set of regressions predicting a country's NFA position, two of the explanatory variables are income per capita and public debt. But when a country borrows more from abroad (generating a negative NFA position), couldn't these additional resources spur output growth—especially in a country that was previously liquidity-constrained? And if the borrowing from abroad is largely lending to the government, couldn't this decline in NFA (i.e., increased borrowing from abroad) allow the government to increase its level of public debt? For example, in the last 5 years of the dataset, Argentina's NFA (as measured by CUMCA) fell from −18.2% in 1993 to −27.8% in 1998. Over the same period, Argentina's public debt increased from 23.8% to 28.4% of GDP. Did the changes in Argentina's public debt cause the changes in its NFA position, or vice versa?

Each of these examples suggests that endogeneity could affect regression estimates. The authors should directly address these issues rather than using terms such as "associated with" or "correlated with" when interpreting results. In the theoretical motivation for each set of regressions, they should carefully discuss any channels that could generate feedback from the dependent to the explanatory variables. In the regression estimates, they should attempt to instrument for the variables which are most likely to suffer from serious endogeneity problems. Granted, finding desirable instruments is always difficult in a panel framework, but at the very least the authors should try using lagged values of each of the relevant variables as instruments.

5. *Conclusions and Overall Assessment*

When I read and assess an empirical paper, I frequently think of it in terms of a four-tiered pyramid. At the base of the pyramid is the paper's motivation. Without a relevant question or interesting issue, a paper has no foundation and will have minimal impact. The second tier on the pyramid is the dataset. Although no dataset is perfect, it is impossible to address certain issues without critical pieces of information of an acceptable quality. The third and fourth tiers of the pyramid are the model and estimation methodology. The model should capture the key relationships between the relevant variables, and the estimation methodology should yield unbiased and efficient estimates. Few empirical papers satisfactorily achieve all four of these levels.

The paper by Lane and Milesi-Ferretti performs well as assessed in terms of this empirical-paper pyramid. The paper clearly satisfies the first criterion: it is built on a strong base. It asks a number of important questions about the determinants of countries' net foreign-asset positions and how changes in these asset positions affect key macroeconomic variables. The paper also performs extremely well on the second tier of the pyramid. It uses an exciting new dataset, undoubtedly compiled with a tremendous amount of effort by the authors, on NFA positions. The paper is weaker, however, on the third and fourth tiers of the pyramid. The models used as the basis for estimation may miss important relationships between key variables. Although cointegration is an excellent start, the estimation methodology may overlook substantial problems. In particular, my comments have focused on three potential problems with the model and estimation: nonlinearity, omitted variables, and endogeneity. To be fair, however, much of the empirical work in macroeconomics does not satisfactorily address these three issues.

Therefore, although my comments have focused on several potential weaknesses with the paper, the paper's accomplishments and valuable contributions are worth reiterating. This paper uses a first-rate new dataset to investigate several important issues relating to international balance sheets. Many of these issues were previously unresolved in the literature, largely due to unsatisfactory data. In terms of the empirical-paper pyramid, the paper satisfies the two most important criteria to form the basis of an important paper—interesting and unresolved questions combined with excellent data. The paper's results will undoubtedly inspire future work investigating a number of these relationships in more detail. The dataset has promising possibilities for future research. I look forward to seeing the next installment by these authors in their series of papers exploring international balance sheets.

Comment

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In 1985, U.S. statistics showed that the net international investment position of the United States had turned negative for the first time since World War I. In 1989, it again turned negative for the first time since World War I. How is that possible? In the meantime, a revision had raised the valuation of U.S. assets overseas, by recognizing, for example, increased prices of capital assets acquired in the distant past. This revi-

sion was large enough to restore America's net creditor status, though only temporarily.[1] The magnitude of this revision is one indicator of how large the measurement errors in these data are, or at least how bad they have been in the past, which in turn is one reason why they have been so little used. The worldwide discrepancy is another tangible illustration of the problem.

That said, I am persuaded that this line of research by Lane and Milesi-Ferretti is a very useful one. In part this is because of the high marginal product of research in an area where few others have explored. But it is also because the authors have been able to put together data for more countries than were available in the early 1980s. And the variation in the data is sufficiently great that measurement error need not necessarily prevent us from learning anything by examining them.

Overall, the results are much better than I would have predicted. There is little modeling as such. Instead, they offer a variety of theoretical reasons for thinking that income per capita, public debt, and demographics should each have effects on the net foreign-asset position, and these tend to be borne out in the empirical results. In the case of industrialized countries, income per capita has a strong positive effect on the asset position, supporting the idea that countries become creditors as they grow rich. (This certainly fits the experience of the Netherlands and the United Kingdom in their heydays, the United States until the 1980s, and Japan. The United States in recent years is a conspicuous outlier.)

Public debt seems to have a negative effect on the investment position, as hypothesized. This effect is even stronger among developing countries than among industrialized countries. The authors explain the discrepancy by the argument that credit constraints are pervasive in developing countries. But I would have thought that credit constraints for these countries are even worse internationally (capital controls, default risk, recurrent crises, absence of international bankruptcy court)—that they would find it even harder to finance budget deficits out of foreign borrowing than out of domestic borrowing. I consider this result to be a bit paradoxical, but it is the same paradox found in the Feldstein–Horioka literature: the saving retention coefficient is even higher for industrialized countries than for developing countries, which seems inconsistent with the higher capital mobility that we expect for industrial-

1. The U.S. data system tends to collect better data on capital flowing in than on capital flowing out. No comprehensive survey of U.S. residents' holdings of foreign securities had been conducted since World War II, until one was conducted in 1994 (Kester et al., 1995). (Measured U.S. net indebtedness is $1.474 trillion as of end 1999, and still climbing rapidly.)

ized countries.[2] The big question that this research should try to answer is analogous to the one addressed by the earlier Feldstein–Horioka literature: Are net international investment positions as large as we would expect from neoclassical theory and perfect capital mobility, and if not, why not?

The claim is made that economic theory has stronger predictions about the long-run relationships among asset stocks than about short-run relationships among flows. By way of elaboration, the point is made that theory predicts that the stock of foreign assets should depend negatively on the stock of government debt, but that the relationship between the current-account deficit and the budget deficit depends entirely on the origin of the shocks.[3] I think the point is to look at low-frequency relationships, not at long-term capital, whether stock or flow. Perhaps the title of the paper should be Long-Term Movements of Capital, rather than Long-Term Capital Movements.

The third finding is that demographics matter as well, with the young population reducing the asset position and the peak-earning fifties age cohort adding to it.[4]

Next come estimates with dynamic adjustment. The authors estimate the half-life at five years, and describe this behavior of the investment position as quite persistent. I would have expected slower adjustment, if anything, and am surprised it is not *more* persistent. I suspect that if adjustment were solely by current-account surpluses and deficits, the half-life might be longer than five years, and that the estimates are picking up variation in exchange rates and asset prices.

In the dynamic estimates, and the panel estimates, the results work less well for the United States, Japan, Germany, and the United Kingdom. Could this be because these are the countries that borrow primarily in their own currency? A key question is whether we should be thinking of the kind of portfolio balance model where investors diversify across currencies of denomination, or the kind where they diversify across countries of issuance. Among other questions that turn on this

2. See, e.g., Dooley, Frankel, and Mathieson (1987).

3. The latter point is certainly true. In the 1980s the U.S. current account grew worse when the budget deficit widened, because the origin was fiscal expansion, whereas in the 1990s the current account grew worse when the budget improved, because both were responding to a New Economy investment boom. But is the situation really so different with stocks rather than flows? Mightn't theory predict that the sign of the correlation between the stock of foreign assets and the stock of government debt would reverse, if the driving force were a New Economy boom that raised the return to capital?

4. The paper mentions that "the over-65 age group exerts a negative effect, consistent with the running down of NFA." In the case of those who have newly retired, I would expect a positive effect on the level of assets. Only for the very old, those who have lived longer than expected, might one look for a negative effect.

decision, if it is a matter of currency risk rather than country (default risk), it may be necessary to express foreign holdings relative to total portfolio (wealth) rather than relative to income or exports as the authors do throughout.

I see several remaining puzzles and priorities for future research:

1. The relationship between income and investment position appears to have an inverted-U shape. This follows from the finding that the relationship is positive for one income range and negative for another. If so, the relationship would be analogous to the original Kuznets curve, which said that income inequality gets worse at early stages of industrialization, and then starts to get better when income passes a turning point, and to the so-called environmental Kuznets curve, which says that the same pattern holds for pollution. We observe that high debt brings with it vulnerability to financial crisis. Perhaps all three variables—inequality, pollution, and debt—are unpleasant side effects of growth that people are willing to put up with at early stages when maximizing GDP is the overriding goal, but which they can afford to reduce when they get richer. The authors indeed find some evidence of the U-shaped relationship between income and investment in cross-section data. The puzzle is that they do not find it in time-series data.
2. As the authors say, future research should attempt to distinguish among different components of the net investment position, breaking out FDI, equities, and long-term debt from short-term debt—though it might be necessary at the same time to break out gross assets from gross liabilities. I think we have decided, in the aftermath of the financial crises of the 1990s, that the composition of net capital flows is as important as the total magnitude.
3. I would suggest trying a more sophisticated approach to measuring the rate-of-return variable.

A lot can be said on this last problem.

The authors decompose the expected return differential into two components—a real interest differential and expected real appreciation:

$$i_{i(t)} - i_{w(t)} - E_t\,\Delta s_{t+1} = (i_{i(t)} - E_t\,\Delta p_{i(t+1)}) - (i_{w(t)} - E_t\,\Delta p_{w(t+1)})$$
$$-(E_t\,\Delta s_{t+1} - E_t\,\Delta p_{t(t+1)} + E_t\,\Delta p_{w(t+1)}).$$

Since the latter component is generally insignificant in their results, they are in effect saying that expected return differentials are determined by

differences in real interest rates. I am not sure if this will give the right answer in general. Interest rates (real as well as nominal) in Japan, for example, have been below those in the U.S. for most of the postwar period, yet this difference has been approximately offset—perhaps more than offset, depending on the measure—by the upward trend in the value of the yen (which in real terms averaged 3% a year). Because yen appreciation was such a strong trend, Japanese bonds paid more than American bonds despite their low interest rate. In other words, real appreciation of the yen may have been large enough to change the sign of the difference in expected returns.[5]

At the one-year horizon, there is good reason for thinking that speculators expect the real exchange rate to regress gradually toward purchasing power parity (PPP), at least among the dollar and major European currencies. (Forget the yen.) Actually, there are two reasons for thinking so. First, survey data suggest that expectations of market participants are formed in this way. Second, studies of PPP suggest that the actual real-exchange-rate process has an autoregressive component, and rational expectations implies that investors' expectations would in turn be formed in this way.

Let me make a pitch for inverting the equation—running it with rates of return on the left-hand side and asset position on the right. Write the demand for domestic assets as a linear function of the expected return differential:

$$x_{(t)} = \alpha + \beta E_t \left[r_{i(t+1)} - r_{w(t+1)}\right].$$

Then invert:

$$r_{i(t+1)} - r_{w(t+1)} = -\beta^{-1} \alpha + \beta^{-1} x_{(t)} + \varepsilon_{t+1}.$$

1. The logic is that measurement errors in the rates of return (ε) are large.
2. If the rates of return are measured as ex post returns, then there is a theoretical argument for believing that these large measurement errors—which are investors' ex post prediction errors—are uncor-

5. Frankel (1991, Section 8.2). When Japan removed its capital controls after 1979, the net flow was out rather than in. So perhaps the real interest differentials are giving us the right answer. (This would be easier to understand if we were talking about flows. The low real interest rate in Japan signals an excess of national saving relative to real investment, and the high real interest rate in the United States signals the reverse; the discrepancy in each country is the net capital flow.)

related with the ex ante asset quantity variable. That theoretical reason is, of course, rational expectations. Let us accept the standard rational-expectations methodology for present purposes.

3. This specification readily lends itself to intuitive interpretation as the answer to the question: "If I increase my international indebtedness by one percentage point, by how much do I drive up the interest rate I have to pay?"
4. If one wants to test the null hypothesis of perfect capital mobility, it is much easier to test $\beta^{-1} = 0$ than it is to test $\beta = \infty$.
5. You can have fun imposing the constraint that β is determined by optimal portfolio diversification, which can give you the constraint that the coefficient matrix is proportional to the variance of the error term ε *in the same equation.* Going to the multidimensional case is optional, where β^{-1} is a matrix, proportional to the variance–covariance matrix of ε:

$$\beta^{-1} = \rho E(\varepsilon\varepsilon').$$

Lane and Milesi-Ferretti do invert the equation in Section 5, to the extent of putting the ex post real interest differential on the left-hand side. I might understand proceeding in this manner if the logic were that we are talking about assets other than bonds here (e.g., FDI), so that some broad measure of real return to equity is what matters. That gets into the other point about decomposing the aggregate investment position into FDI vs. bonds etc. But let us stay with the idea of one aggregate asset. If that one asset were short-term default-free bills, then the only source of uncertainty would be in the exchange rate, for those countries able to borrow in their own currency:

$$r_{i(t+1)} - r_{w(t+1)} \equiv i_{i(t)} - i_{w(t)} - E_t\, \Delta s_{t+1}.$$

This case is particularly simple, and allows one to model and measure the first and second moments with some precision. But it requires also getting data on the stocks of domestic and foreign assets that are outstanding and that thus have to be held by someone, not just net domestic debt to foreigners. Indeed, the net international indebtedness variable, which is the focus of this paper, does not enter into the asset supplies at all. Rather, to get net indebtedness to matter, it has to come in as a determinant of demand rather than supply, assuming a home bias in asset demands. Such a home bias is easy to derive from the optimal diversification framework, by the way, because residents of each country

consume more of their own goods, and so each views the other's currency as somewhat risky.[6]

I am not recommending that Lane and Milesi-Ferretti go down this route. Their unique contribution is working with the data on the net foreign-investment position. Their title and introduction state explicitly that their motivation is to shift the emphasis from short-term flows to long.[7] Long-term loans and bonds, equities, and FDI are as important as short-term bonds. As their graphs show, equities and FDI grew rapidly among emerging markets in the 1990s. In these markets, default risk has been as important as exchange risk. So the authors need not focus on short-term interest rates and exchange rates in measuring expected returns. And they need not get sidetracked cumulating government bond supplies in each country.

Even at the stage where the authors continue to aggregate all asset categories together, I would like to propose trying an alternative approach for measuring the aggregate rate of return: the *net investment income* line of the balance of payments, expressed relative to the net international investment position.

There are certainly problems with this strategy. Even if the data are measured accurately, a serious problem arises if investment income and the investment position are of opposite signs, as they were for the United States from 1989 until mid-1998. There is no cure for this problem except to do the disaggregation. In addition, there are serious errors in the measurement of investment income. They are probably a leading source of both the world current-account discrepancy ("horizontal") and the statistical discrepancy in the U.S. balance of payments ("vertical"). Nevertheless, these errors are quite on a par with those in the measurement of the net international-investment position itself, and it seems appropriate to study these two important but neglected series together.

The advantage is that you then can avoid deciding what kind of asset you are thinking about, and also can throw the questions of how to

6. In the framework of mean–variance optimization with nonstochastic goods prices, the home bias in asset preferences is equal to the home bias in consumption preferences, times a factor equal to 1 minus the reciprocal of the coefficient of relative risk aversion. (See, e.g., Frankel, 1994, p. 11.)

7. They describe the Feldstein–Horioka literature as focusing on short-term capital flows. But in fact Feldstein and Horioka gave as motivation for their paper the observation that the existing interest-rate parity literature focused on short-term capital mobility, and their goal was to address long-term capital mobility. In my view the distinction between short-term and long is misplaced here. Lane and Milesi-Ferretti want to talk about net stocks of assets, whereas the earlier literature they have in mind talks about flows. Perhaps a (second) change of title is in order: it should be something like Long-Term Patterns in International Investment. And similarly, the contribution of Feldstein and Horioka was not to shift attention from short term to long, but rather from prices to quantities.

measure the real interest rates and expected changes in the real exchange rate out the window and estimate an equation like (2) above. You can even impose the constraint that β^{-1} is proportional to the variance of ε.

I look forward to future installments of this work, whether along the lines of my suggestion or not.

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Discussion

Philip Lane responded to Kristin Forbes by saying that the possibility of a nonlinear relationship between net foreign assets and income was not addressed in the time series because of the difficulty of incorporating nonlinearities in a cointegration framework. In particular, in this case the relationship might have more than one turning point. Lane explained that they did not put savings and investment directly into their regressions because they wanted a parsimonious model, and demography and income could affect net foreign assets through many channels, including savings and investment. He agreed with Jeff Frankel that the issue of net investment income relative to net foreign-asset position is as yet unexplored. He said that, in practice, the composition of net foreign assets is important for this relationship.

Mark Gertler said that, leaving aside credit market imperfections, the basic neoclassical model suggests that a country's future investment opportunities should determine its net foreign-asset position. Ideally, the researcher would like to have a measure of Tobin's q by country. He noted that the investment–capital ratio could be a proxy for Tobin's q under certain conditions, which could explain why the investment–

capital ratio worked so well in the regressions presented by Kristin Forbes. Rick Mishkin agreed, suggesting that the return to capital relative to the pool of domestic savings is the first-order factor to investigate as a determinant of net foreign-asset positions. David Romer also agreed with Gertler and Mishkin that fundamentals were of first-order importance and should be taken into account more explicitly.

Charles Engel was skeptical of the possibility of estimating long-run equilibrium relationships based on the 30 years of data collected by the authors. First, he thought convergence would be slow, and second, there could be structural breaks in the estimated relationship. He would have preferred to see the authors examine short-run relationships using their data. He was also worried by the fact that the estimated model appeared to work well for small countries, but not for the United States, Japan, and Germany. He was not happy with the use of net foreign assets relative to GDP, instead of wealth. In a stock-market boom, this measure makes the United States look risky, even though most of U.S. stock is held by Americans. He would have preferred to see a better measure of countries' ability to pay off their debts.

Jaume Ventura raised the issue of the direction of causality in the relationship between interest-rate differentials and net foreign-asset positions. The authors assumed that rate differentials were high because of risk premia. But from a portfolio-balance perspective, causality could run in the opposite direction. Lane responded that the interest rates in question were interest rates on bonds, so, given arbitrage, the differential should be determined by expected exchange-rate changes and risk premia alone.

Greg Mankiw said the data set collected by the authors would be very useful. He would have liked to see correlations between net foreign assets and the right-hand-side variables used in growth theory. This would give some idea of the theories one should look at in trying to explain net foreign-asset positions. In response, Ventura said he had run regressions where net foreign assets relative to wealth (rather than GDP) were the dependent variable, with standard variables from growth regressions on the right-hand side. In these regressions, he noted, wealth explained most of the variation in net foreign assets. The other variables, such as human capital and political institutions, came in with the right sign, but explained little of the variation in net foreign-asset positions.

Michael Klein was curious about what happened to net foreign assets in the runup to crises. Are changes in net foreign assets generally transitory or persistent around crises?

Lane agreed that in theory fundamentals matter, and countries with high marginal products of capital should see capital inflows. But he said

that in practice, things were not so simple, as political-economy considerations were also very important.

Gian Maria Milesi-Ferretti also defended the use of income per capita rather than investment opportunities as a determinant of net foreign-asset positions. In standard open-economy models the two are correlated, so this is appropriate. On breaks in the data, he felt that researchers should not give up estimating long-run relationships on this account; instead, they should investigate whether breakpoints are systematically related to certain variables.