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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."

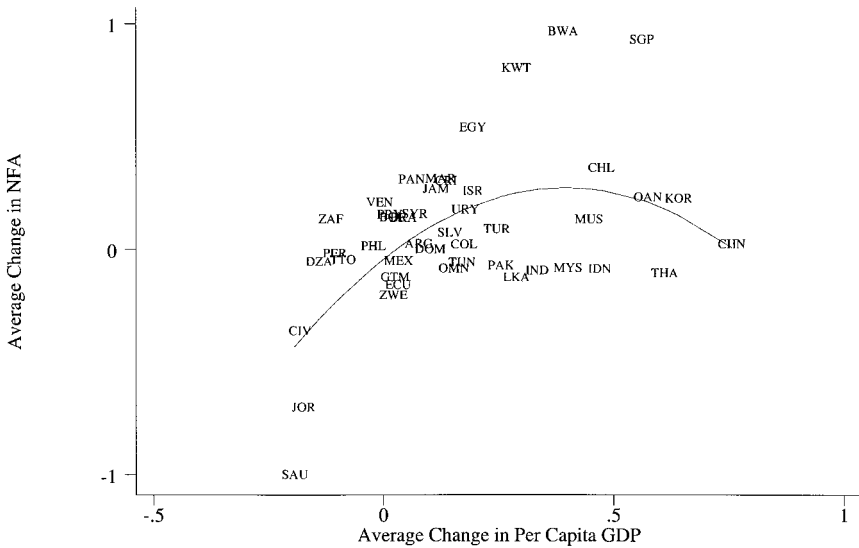
Each of these channels linking a country's output and net foreign-asset position could counteract each other, and the relative strength of each of the channels could vary with a country's income level. For example, the second channel, based on credit constraints, is more likely to occur in developing 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.<sup>1</sup> 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.

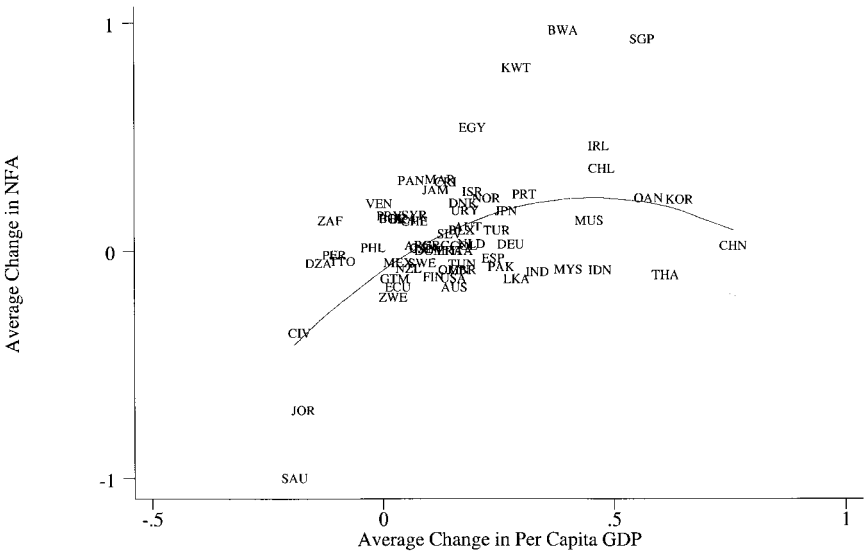
This series of results suggests that the underlying relationship linking changes in NFA positions and GDP per capita is not linear. A simple extension to the panel estimates—just adding a squared term—appears to significantly improve the specification. In the current version of the paper, the authors 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

	<i>Developing countries</i>		<i>Full sample</i>	
	(1)	(2)	(3)	(4)
Constant	-0.05 (-0.80)	-0.05 (-0.86)	-0.06 (-1.46)	-0.09 (-2.07)
Log GDP per capita	0.62 (3.15)	1.62 (4.30)	0.66 (4.09)	1.41 (4.68)
Log GDP per capita <sup>2</sup>		-2.04 (-3.01)		-1.55 (-2.89)
No. of countries	45	45	67	67
Adjusted R <sup>2</sup>	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



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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:

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

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

$$NFA_{it} = GDEBT_{it} + DEM_{it} + YC_{it}, \quad (2)$$

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.<sup>2</sup> 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.<sup>3</sup> 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

	<i>Industrial countries</i>		<i>Developing countries</i>	
	(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 <sup>2</sup>	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.

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#### 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.<sup>4</sup> 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.

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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-



