

What is Net Foreign Asset?

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- Value of assets that a country owns abroad
 - Value of domestic assets owned by foreigners
-
- Net foreign assets

What is Net Foreign Asset?

$$\begin{array}{r} \text{Initial position of net foreign assets} \\ + \text{ Net capital gains on net foreign assets} \\ + \text{ Cumulative current account balances} \\ \hline \text{Net foreign assets} \end{array}$$

As of Year 2007

USD trillions	Assets	Liabilities	Net foreign assets
Australia	.9	1.5	-.6
Japan	5.4	3.2	2.2

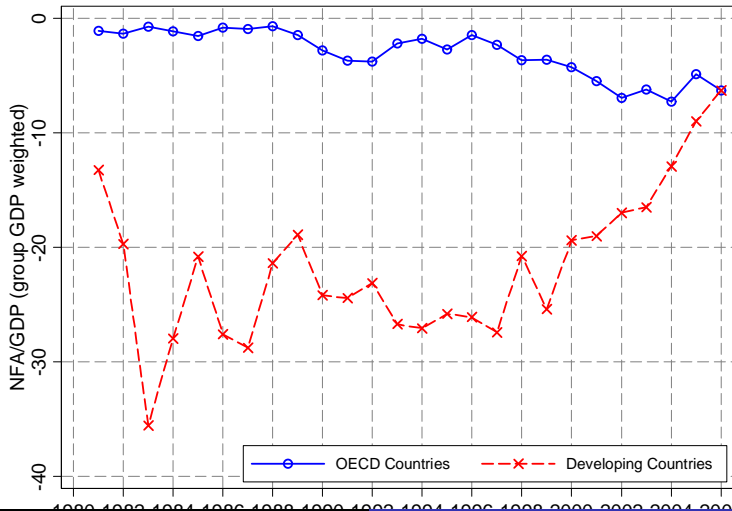
Per Capita or Per GDP?

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Normalized Net Foreign Assets of Japan as of 2007

	Position	Annual Growth Rate 1998-2007
Per Capita (USD)	17, 153	8.09%
Per GDP	.49	2.63%

Rising NFA/GDP of Developing Countries



Who Should Be Lending?

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According to the standard Neoclassical growth model with labor and capital as the only inputs:

High Capital/Labor

- low marginal product of capital

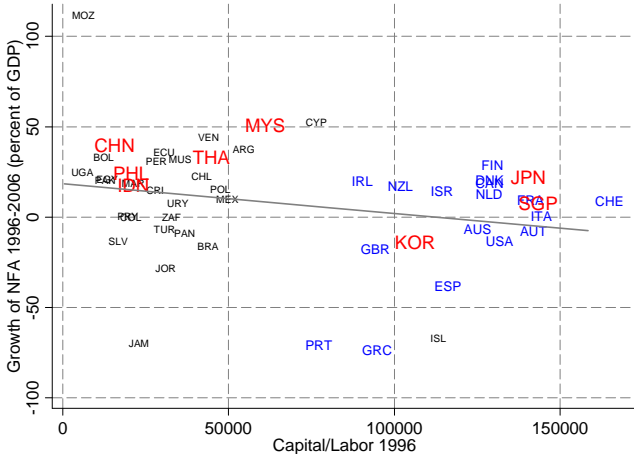


Low Capital/Labor

- high marginal product of capital

Who Have Been Lending?

Low $\frac{\text{Capital}}{\text{Labor}}$ Economies!



Some guidelines from previous research

Negative net foreign asset not an independent source of instability
[Henderson&Rogoff J.I.E.82]

Long-run feedbacks between net foreign asset and domestic
absorption
[Masson et al. J.I.M.F.94]

Significant increase of equity liabilities and reserves accumulation
in emerging markets
[Lane&Milesi-Ferretti J.I.E.07]

Variables of Interests

Consequences

- Consumption/GDP
- Real exchange rate
- Real interest rate

Global factors

- Real
- Financial

How net foreign assets affect these macroeconomic dynamics?

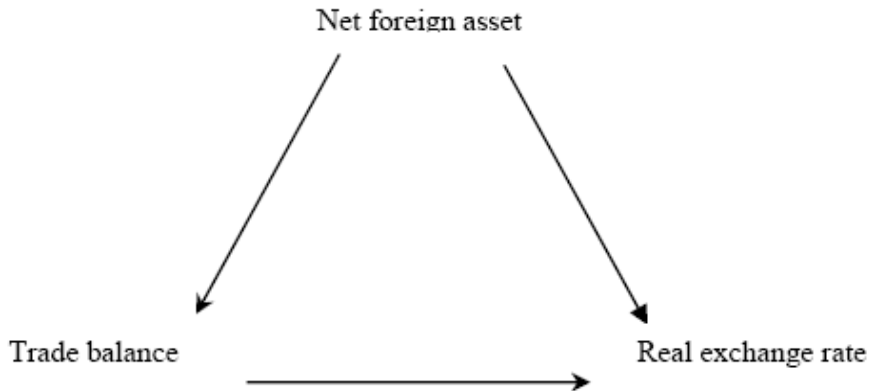
How Should We Treat Net Foreign Assets

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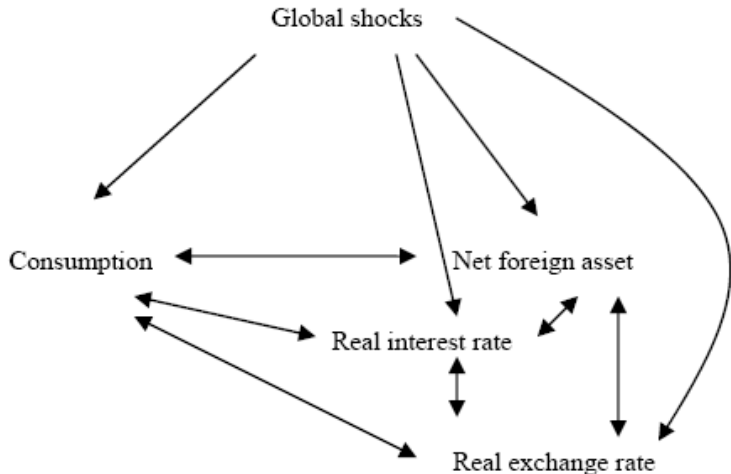
Exogenous?

Endogenous?

Taking NFA/GDP as Exogenous



Taking NFA/GDP as Endogenous



Data

Original

- 128 countries
- 1980-2006



Sample

- 48 countries
- > 10 years per country
- Unbalanced panel
- OECD, G7, Developing countries, ASEAN+China, Japan, S. Korea

G7 and ASEAN+3

	<u>Net foreign assets</u> GDP	<u>Consumption</u> GDP	Real exchange rate	Real interest rate
G7				
1982-1989	1.9	78.7	97.3	6.0
1990-1999	-.3	78.5	97.5	5.7
2000-2006	-3.8	73.8	98.2	3.4
ASEAN+China, Japan, S. Korea				
1982-1989	-.2	68.0	72.1	3.9
1990-1999	7.3	67.7	89.9	3.9
2000-2006	19.6	63.9	91.0	3.3

Between Variables, Strong Correlations Across Countries

	<u>Net foreign assets</u> GDP	<u>Consumption</u> GDP	Real exchange
<u>Consumption</u> GDP	.66		
Real exchange	.61	.97	
Real interest	.53	.97	.93

Between Countries, Strong Correlations in ASEAN+3

	<u>Net foreign assets</u> GDP	<u>Consumption</u> GDP	Real exchange	Real interest
OECD	-.04	.08	.09	.24
G7	-.12	.05	-.07	.15
Developing	.08	.02	.15	.11
ASEAN+3	.23	.01	.24	.16

Empirical Specification

Macroeconomic Dynamics

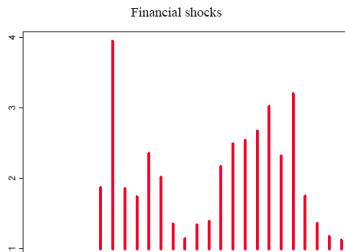
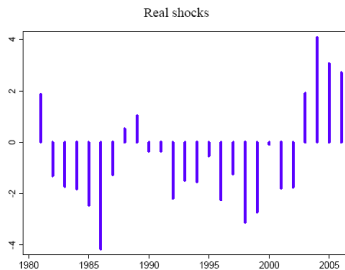
- Net foreign assets/GDP
- Consumption/GDP
- Real exchange rate
- Real interest rate



Global Shocks

- Real: Global dry cargo freight rates [Kilian AER, forthcoming]
- Financial: Implied volatility of SP500 [Ang et al. J.F.06]

Global Real and Financial Shocks



Cross Correlation of Shocks

Real \Leftrightarrow Financial

year	-4	-2	0	2	4
correlation	.48	.13	-.41	-.20	-.22

Stationarity Tests

Maddala-Wu panel unit-root test (p-value)

	X_t	ΔX_t
Net foreign assets/GDP	.3463	.0000
Consumption/GDP	.0009	.0000
Real exchange rates	.0000	.0006
Real interest rates	.0000	.0000

Phillips-Perron unit-root test (p-value)

	X_t	ΔX_t
Global shocks		
Real	.2220	.0001
Financial	.1859	.0000

Baseline Specification

$$\begin{bmatrix} \Delta \frac{\text{Net foreign assets}}{\text{GDP}} \\ \frac{\text{Consumption}}{\text{GDP}} \\ \text{Real exchange} \\ \text{Real interest} \end{bmatrix} = Y$$

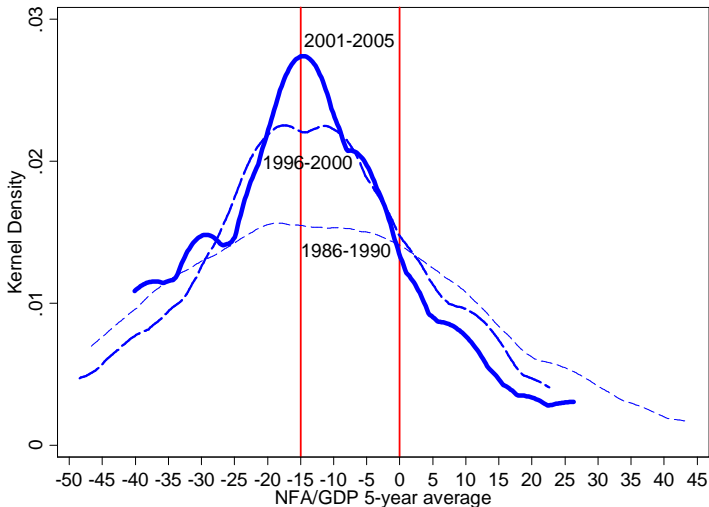
$$Y_{j,t} = Y'_{j,t-1}\beta + \Phi + \varepsilon_{j,t}$$

$\Phi \equiv$ a set of country fixed effects

Baseline Estimation: 48 countries, no shocks

on	Coefficient estimates of $\left[\Delta \frac{\text{Net foreign assets}}{\text{GDP}} \right]_{t-1}$	
	est.	(s.e.)
$\left[\Delta \frac{\text{Net foreign assets}}{\text{GDP}} \right]_t$.089	(.034)
$\left[\frac{\text{Consumption}}{\text{GDP}} \right]_t$	-.007	(.008)
Real Exchange _t	-.048	(.037)
Real Interest _t	.041	(.021)

Medium-Run Decline in the Dispersion of NFA/GDP



Different Dynamics of Large v Small NFA/GDP Economies

on	Coefficient estimates of			
	$NFA < 0$		$NFA > 0$	
	est.	(s.e.)	est.	(s.e.)
$\left[\Delta \frac{\text{Net foreign assets}}{\text{GDP}} \right]_t$	-0.138	(.034)	-0.210	(.050)
$\left[\frac{\text{Consumption}}{\text{GDP}} \right]_t$	-0.001	(.009)	-0.041	(.014)
Real Exchange _t	-0.021	(.054)	-0.063	(.079)
Real Interest _t	.015	(.027)	.021	(.039)

By Country Group; With Global Economic Shocks

$$\begin{bmatrix} \Delta \frac{\text{Net foreign assets}}{\text{GDP}} \\ \frac{\text{Consumption}}{\text{GDP}} \\ \text{Real exchange} \\ \text{Real interest} \end{bmatrix} = Y$$

$$Y_{j,t} = Y'_{j,t-1}\beta + \Phi + \alpha\Delta S_t + \varepsilon_{j,t}$$

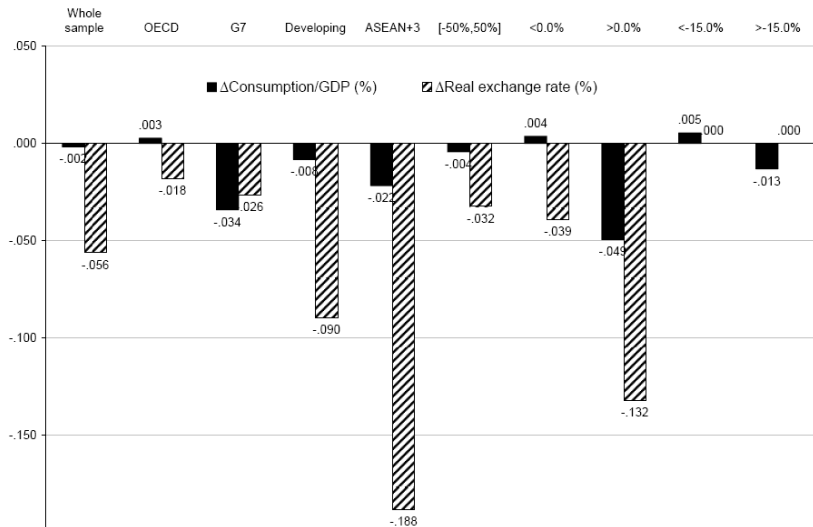
$S \equiv$ Global economic shocks

In the Presence of Global Real Shocks

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on	Coefficient estimates of					
	<i>G7</i>		<i>ASEAN + 3</i>		<i>NFA > 0</i>	
	est.	(s.e.)	est.	(s.e.)	est.	(s.e.)
$\left[\frac{\text{Consumption}}{\text{GDP}} \right]_t$	-.007	(.008)	-.019	(.013)	-.052	(.019)
Real Exchange _t	-.229	(.116)	-.027	(.062)	-.113	(.062)
Real Interest _t	.040	(.025)	-.025	(.029)	-.022	(.039)

Adding NFA/GDP by Another One-Standard Deviation



Summary of Findings and Implications

Short-Run

- Accumulating net foreign assets is associated with a lower consumption and real depreciation. **push, 'global saving glut'?**

Medium-Run

- Declining dispersion in the distribution of net foreign assets (as percentage of GDP) across countries. **pull**

The combination potentially helps sustaining '*global imbalances*' in the long run.

What else can we learn?

Comparing net foreign assets

- relative to economy size:
informal sector?
- relative to population:
working age?

Role of exchange rate regime

- Euro area
- Dollarization
- **de facto monetary interdependence?**

Sovereign wealth funds

- Private sector's foreign assets
- **Public sector's foreign assets?**

Pooling of net foreign assets

- Asymmetric information,
Rothschild-Stiglitz?
- IMF, ASEAN+3; +6

The Trend of Trade, Foreign Direct Investment, and Monetary Flows in East Asia, and its
Policy Implication: *Managing Net Foreign Assets in East Asia**

March 2009

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* Helpful comments and suggestions from Yutaro Oku and researchers at the Nomura Research Institute, Kazunori Koike, Professors Shujiro Urata, Naoyuki Yoshino, Glenn Otto, Jenny Corbett, Trevor Breusch, and participants at the meetings of ASEAN+3, Japan Ministry of Finance in Tokyo, Korea Institute of Finance and Ministry of Strategy and Finance in Seoul, Australian National University, and University of New South Wales are gratefully acknowledged.

Abstract

This study examines from 1981-2006 the relationship between the size of net foreign assets and the dynamics of consumption, real exchange rate, and real interest rate in a cross-section of countries. While the estimated macroeconomic adjustments vary across OECD, G7, developing countries, and East Asia, some notable pattern emerges from the data. We find that the short-run adjustment contributes to the ‘global saving glut’: in the presence of positive global real economic shocks, the accumulation of net foreign assets/GDP further by a one-standard deviation is associated with a lower level of consumption/GDP by .05% per year and a depreciation of real exchange rate by .1% per year. Against these short-run dynamics is the observed convergence in the distribution of net foreign assets/GDP across countries, a combination which potentially helps sustaining the ‘global imbalances’ over the long-run.

Keywords: External imbalances, Net foreign assets, Global economic shocks

JEL Classification: F32, F41, F42, G15

1. Introduction

Country's wealth in the form of net foreign asset is the value of assets that a country owns abroad, minus the value of domestic assets owned by foreigners. The net foreign asset position at any given point in time can be measured by the initial position plus the cumulative current account and cumulative net capital gains on cross-border positions.¹ The accumulation of net foreign assets in developing countries, particularly in East Asia, has received attention from policymakers, academics and medias, manifesting in recent years by the size and persistency of U.S. current account deficits.

By and large, the discussion on net foreign assets has been in the context of 'global imbalances' debate, the role of 'sovereign wealth funds,' and the consequences of 'global saving glut.'² Yet, given these important considerations, understanding the macroeconomic implications of net foreign assets remains a challenge both theoretically and empirically. Existing studies have examined the role of net foreign asset accumulation, taking it either as an exogenous variable to other macroeconomic variables [cross-country empirical evidence: Lane and Milesi-Ferretti (2002) and Lane and Milesi-Ferretti (2004)], or as an endogenous variable among the others [theoretical models and evidence for industrial countries: Masson, et al. (1994), Cavallo and Ghironi (2002), Ghironi, et al. (2008)]. Other closely related, though more established, strands of the literature focus on the accumulation of foreign exchange reserves [i.e. Aizenman and Riera-Crichton (2008) and Rodrik (2006) on the determinants and consequences of holding it] and current account adjustment [i.e. Faruquee and Lee (2008) and Debelle and

¹ Lane and Milesi-Ferretti (2007) provide detailed discussion on the measures of net foreign assets.

² See for example Bernanke (2005) and Jen (2007).

Galati (2007) on its global distribution and relationship with trade and financial integration].

[Figure 1]

One complication in the literature is the pattern of net foreign asset accumulation across countries. While there is a large cross-country variation in the size of net foreign assets, the distinct pattern is the growth of net foreign assets/GDP of the developing countries. For instance, China registered a 195 percent growth of net foreign assets/GDP from 1999-2004, accumulating the assets much in the form of foreign exchange reserves and new portfolio investment abroad.³ Figure 1-A contrasts the size of net foreign asset as percentage of GDP for the OECD and developing countries.⁴ The rising trend of net foreign assets/GDP is clearly evident in the case of developing countries (beginning around the early 1990s), whereas the OECD countries have registered a decline over the same period. The observed pattern is quite surprising given that developing countries have relatively low capital/labor ratio in comparison to the OECD countries. Figure 1-B plots the capital/labor ratio in 1996⁵ against the growth net foreign assets/GDP during 1996-2006. We can see that the relationship deviates from the Neoclassical growth theory: low capital/labor ratio countries have been lending, and East Asian countries with relatively low capital/labor ratio has become a net lender, to the rest of the world.

Motivated by the accumulation of net foreign asset in the developing countries and the lack of evidence of its consequences, the objective of this study is to further our

³ As of 2006, the position is about 20 percent of GDP. See also Dollar and Kraay (2006) where a long-run forecast of China's NFA position is around 3-9 percent of its total wealth.

⁴ To take into account the country size, the net foreign assets/GDP series are weighted by each countries' GDP in the group.

⁵ Estimated by Caselli and Feyrer (2007).

understanding on its empirical relationship with other macroeconomic variables. Our approach is to first gathering the theoretical connections between macroeconomic variables and the accumulation of net foreign assets in the literature. We then provide a battery of estimation which nests together the key issues from the existing studies: in a cross-section of countries, we study how the size of net foreign asset affects consumption, real exchange rate, and real interest rate. The empirical section examines the data from 1980 to 2006 for 128 countries, 48 of which have information for the multivariate panel estimation. Because of the structural differences across countries, we conduct the analysis for the whole sample of countries, and by country group, including OECD, G7, developing countries, and East Asia: ASEAN plus China, Japan, and South Korea (ASEAN+3). The disaggregation of countries into OECD and developing countries serves to account for the level of income and development threshold. For the G7 countries, their net foreign assets have been studied in Ghironi, et al. (2008). The group of East Asia: ASEAN+3 countries represent a growing economic cooperation in Asia. Further, after the financial crisis in 1997, the group has established bilateral swap agreements among member countries.⁶ Kohlscheen and Taylor (2008) provide some evidence that the swap agreements take into account the correlation of foreign exchange reserves which constitute a significant part of net foreign assets in East Asia. Hence,

⁶ The agreement is the on-going effort to establish a self-managed reserve pool by multilateralizing the bilateral swaps under the Chiang Mai Initiative in 1999. The objective is to manage short-term liquidity among the country members in the event of financial crisis, particularly when resources of international organizations (i.e. IMF) are committed to other countries. For studies on the crises and management of international reserves, see for example Aizenman, et al. (2007) and Edwards (forthcoming).

while our study is empirical in nature, it also takes into account the political economy considerations.

To preview the results, we find that the short-run adjustment adds to the ‘global saving glut’: in the presence of positive global real economic shocks, the accumulation net foreign assets/GDP further by a one-standard deviation is associated with a lower level of consumption/GDP by .05% per year and a depreciation of real exchange rate by .1% per year. Against these short-run dynamics is the observed convergence in the distribution of net foreign assets/GDP across countries, a combination which potentially helps sustaining the ‘global imbalances’ over the long-run. While the estimated macroeconomic adjustments vary across OECD, G7, developing countries, and East Asia, we find this as a notable pattern emerging from the data.

Section 2 discusses conceptually how the size of net foreign assets is related to macroeconomic adjustments. Section 3 examines the data and reports the estimation on macroeconomic consequences of accumulating net foreign assets. Section 4 discusses the implications of our findings and concludes.

2. The size of net foreign assets and possible macroeconomic implications

This section first discusses the measurement of net foreign assets. We then summarize theoretical connection between the size of net foreign asset and the macroeconomic variables, and discuss the empirical approach that nests the key issues from previous studies. Note that our focus is not on whether the large net foreign asset is a source of instability [i.e. Henderson and Rogoff (1982)], but instead on the feedbacks between net

foreign asset position and macroeconomic variables together with the accumulation of net foreign assets in developing countries.

Country's wealth in the form of net foreign asset is the value of assets that a country owns abroad, minus the value of domestic assets owned by foreigners. To measure the size of net foreign assets, we use the standard measures of Lane and Milesi-Ferretti (2007): the net foreign asset position at time t is the initial position plus the cumulative current account and cumulative net capital gains on cross-border positions.⁷ Net foreign asset differs from the current account by the size of capital gains or valuation change. Like the current account, the size of country's net foreign asset position is sensitive to asset price valuation and exchange rate movements. While beyond the scope of this paper, the measurement issue has important implications: Lane and Milesi-Ferretti (2008) and Curcuru, et al. (2008) note that owing to mismeasurement of net financial inflows, the US current account deficit could have been overestimated by as much as 0.6% per year.⁸

The theoretical connections between the size of net foreign asset and the macroeconomic variables can be categorized into two groups: one that takes the net foreign asset as an exogenous variable, and another where all the macroeconomic variables including the net foreign asset are endogenous. Taking the net foreign asset as an exogenous factor, Lane and Milesi-Ferretti (2002) provide some evidence on how the size of net foreign assets influences trade balance and real exchange rate. Taking the net

⁷ The initial positions are based on the estimates in Sinn (1990).

⁸ An alternative approach in Gourinchas and Rey (2007) considers both the current accounts (flow) and the net foreign assets (stock). While this latter approach is appealing conceptually, the data requirement and forecasting procedure is rather demanding. See also Helbling, et al. (2008).

foreign asset as one of the endogenous variables, Ghironi, et al. (2008) examine how the consumption dynamics in the G7 countries related to the size of net foreign assets. We now illustrate the key issues of these previous studies.

[Figure 2-a]

Figure 2-a illustrates the dynamics when the net foreign asset position is considered as exogenous. In Lane and Milesi-Ferretti (2002), the impact of a country's net foreign asset position on its long-run real exchange rate can be described as (i) the relation between net foreign asset position on the trade balance; and (ii) holding other fixed determinants, the relation between trade balance and the real exchange rate. The argument runs as follows: a positive steady state net external asset position enables a country to run persistence trade deficits; conversely, a country with negative net foreign assets have to run trade surpluses to service its external liabilities, which requires real exchange rate depreciation. If the country with negative net foreign assets grows quickly and manages to earn returns on its foreign assets that are higher than the payouts on its foreign liabilities, then these favorable conditions translate into a smaller trade surplus required to stabilize its negative net foreign asset position.

[Figure 2-b]

Figure 2-b illustrates the dynamics when the net foreign asset position is considered as endogenous. Studies taking on this approach include Masson, et al. (1994), Cavallo and Ghironi (2002), Ghironi, et al. (2008), and Ghironi (2008). The global economic structure is composed of countries with different discount factors, giving rise to non-zero steady-state net foreign assets. There are gains from asset trade due to different discounting of future utility across countries. In response to positive global

(productivity) shocks, the relatively patient country accumulates assets and its per capita consumption rises from below.

Our empirical approach is to nest the key ingredients of the previous studies. Specifically, we will run a battery of estimation to study the dynamics of consumption, real exchange rate, and real interest rate, taking the net foreign asset position as endogenous, in the presence of global economic shocks. One issue is whether to normalize the net foreign asset position by GDP as in Lane and Milesi-Ferretti (2002), or by population as in Ghironi, et al. (2008). Because one feature of the current account is that the sustainability of its imbalances is related to the economy's size,⁹ we choose to normalize the net foreign assets and consumption series by GDP to take into account the country size consideration. The testing hypothesis is that in the presence of positive global economic shocks, as the relatively patient country accumulates net foreign assets/GDP, its consumption/GDP rise relatively slower, together with real exchange depreciation and relatively higher real interest rate, than that of the impatient country.¹⁰

3. Estimating macroeconomic consequences of accumulating net foreign assets

3.1 Sample

The data are collected for all countries possible on annual basis from various sources as documented in the Data appendix. The variables of interests are net foreign asset/GDP, consumption/GDP, real exchange rate, and real interest rate. After constructing the

⁹ Aizenman and Sun (2008) find that, with the exception of the US, the length of current account deficit spells is negatively related to the relative size of the countries' GDP.

¹⁰ These considerations are also drawn from the literature on the current accounts, including for example Boileau and Normandin (2008) on real interest rate differentials, and Lee and Chinn (2006) on real exchange rates.

lagged value necessary for each variables, we keep countries with at least 10 observations, which leaves us with 48 countries (from the original 128) for the estimation.

[Table 1]

Table 1 reports for each time periods the mean (GDP weighted) of the variables by country group. The marked trend witnessed is the decline of net foreign assets/GDP in G7, and the increase in ASEAN+3 countries. Note that net foreign assets/GDP increased over the period when the US is excluded from the G7 group. We can also see some real exchange rate depreciation in the group of developing countries and East Asia, in comparison to the OECD and G7 countries. Real interest rates are slightly lower in the first half of the 2000s, reflecting potentially the declining global interest rates during this period.¹¹ The patterns of these macroeconomic variables suggest that each country group's experiences are quite unique, potentially due its size, level of income and development threshold. We account for these structural differences, using various estimation techniques and alternative specifications, as well as producing the estimation by country group.

[Table 2]

¹¹ We have also examined the mean of these variables for fixed and flexible exchange rate countries. Consumption/GDP tends to be more volatile under the fixed exchange rate regimes, whereas the opposite applies to net foreign assets/GDP and real interest rates. However, the preliminary statistics suggest no distinct pattern on the macro dynamics between the two groups. Nonetheless, while beyond the scope of this study, the effects of exchange rate regimes, and possibly inflation targeting on the accumulation of net foreign assets warrant further analysis. See Chinn and Wei (2008) in the case of current account adjustments. The challenge, however, is to categorize countries into a varying degree of exchange rate flexibility across time periods.

As suggested by the theoretical predictions in Section 2, the correlations between variables reported in Table 2 show that consumption/GDP, real exchange rate, and real interest rate are highly correlated, and particularly with net foreign assets/GDP (about .6). To see whether these correlations represent regional economic interdependence [the ‘de-coupling’ debate, e.g. Kose, et al. (2008)], Table 3 provides cross-country correlation (equally weighted) for each variable by country group. We can see that the correlation of net foreign assets/GDP is relatively higher and positive in ASEAN+3 than in other country groups. After the financial crisis in 1997, the group has established bilateral swap agreements among member countries. Kohlscheen and Taylor (2008) provide some evidence that the swap agreements take into account the correlation of foreign exchange reserves which constitute a significant part of net foreign assets in East Asia. The consumption correlations are small across the country groups, consistent with previous findings on the international consumption correlation puzzle [i.e. Backus, et al. (1992)]. The negative correlations of consumption/GDP and real exchange rates among China, Japan, and South Korea are caused by the negative correlations of these variables between China and the other two countries. We can also see higher correlations of real interest rates among the OECD and G7 countries, reflecting a tighter financial integration within these country groups.

[Table 3]

3.2 Empirical specification

Our empirical approach is to first estimate the baseline dynamics of net foreign assets/GDP, consumption/GDP, real exchange rate, and real interest rate, all taken as endogenous. We then introduce the global economic shocks into the system, measuring

the effect of net foreign assets/GDP on the macroeconomic variables in the presence of these shocks. This allows us to understand how the macroeconomic adjustments to global economic shocks depend on the country's level of net foreign assets/GDP.

We consider two global economic shocks: real and financial. For the real shock, we use the global real economic activity shock in Kilian (forthcoming). The index is a measure of the worldwide real economic activity, which drives demand for industrial commodities in global industrial commodity markets. For the financial shock, we use the S&P500 implied volatility index compiled by the Chicago Board of Exchange (CBOE) as a measure of global financial shock.¹² This index measures of the expectation of volatility in the financial markets over the next 30 day period; a higher volatility means the options which can be used by the financial investors to avoid risk. We use the measure as a proxy for global financial shock as it is found to be a factor in asset pricing [Ang, et al. (2006)].

[Figure 3]

As can be seen in Figure 3, the negative global real shocks characterize the 1980s and the 1990s, whereas the early 2000s witnessed the positive shocks. On the financial side, the volatility was relative high from the late 1990s to early 2000s. The contemporaneous cross-correlation between the two shocks are highly negative as shown in the cross-correlations at the bottom of the figure. While the positive global real shock is favorable, it is not clear whether the level of financial market volatility is a good proxy for negative shocks. This reservation is underlined by the cross-correlations between the

¹² Instead of the VIX which is frequently cited in the media, we use the VXO index, because it has a longer time span for our panel data sample.

two series at longer lags which become positive and large.¹³ Due to this difficulty of interpretation, we give more attention on the macroeconomic dynamics in the presence of global real shocks.

As our interest in this study focuses on cyclical variation in macroeconomic variables rather than on long-term trends, we linearly de-trend the series country-by-country. To make sure all the variables in our estimation are of the same order of integration, we apply panel unit root test of Maddala and Wu (1999) to NFA/GDP, consumption/GDP, real exchange rate, and real interest rate series, and Phillips-Perron test to the global real and financial shocks series.¹⁴ Table 4 reports p-value of the tests under the null of unit root. As the net foreign assets/GDP, and global real and financial shocks appear to have unit root, we therefore use their first-difference of these three series (which is stationary, as shown in the second column of Table 4) in our estimation. Similarly, we also use the first differences of the global real and financial shocks as they both contain unit roots.

[Table 4]

Let B_t denotes net foreign assets/GDP at time t , C_t consumption/GDP, Q_t real exchange rate, R_t real interest rate, and Z_t global (real, financial) shock. We consider the following multivariate regression:

$$Y_t^i = Y_{t-1}^i \beta_B^i + \Phi_j^i + \varepsilon_{j,t}^i$$

¹³ Similar finding applies to the monthly frequency.

¹⁴ We use Maddala-Wu test since it does not require balanced panel as the Im, et al. (2003) and Levin, et al. (2002) tests. Based on the p-values of individual unit root tests, this test assumes that all series are non-stationary under the null hypothesis against the alternative that at least one series in the panel is stationary.

where $Y_t^i \in \{\Delta B_t, C_t, Q_t, R_t\}$ and Φ_j^i is a set of country fixed effects. This estimation procedure closely corresponds to a vector autoregression (VAR) in a panel. Essentially, the multivariate system regresses each of the dependent variables on the same set of lagged regressors, imposing the constraints that the coefficients do not differ across panels.

[Table 5]

3.3 Results

Table 5 reports the baseline estimation for the whole sample of countries.

$\Delta[NFA / GDP]_{t-1}$ has a positive association with $\Delta[NFA / GDP]_t$ indicating the persistence of the net foreign asset/GDP series. Persistency also characterizes all the other three variables. We can also see that $\Delta[NFA / GDP]_{t-1}$ is associated negatively with $[Consumption / GDP]_t$ and real exchange rate, and positively with real interest rate.

The macroeconomic dynamics in countries with positive net foreign assets may differ from countries with negative net foreign assets. The upper panel of Figure 4 plots the distribution of net foreign assets/GDP for the 5-year average from 2001-2005. While negative net foreign asset positions may not constitute an independent source of macroeconomic instability [Henderson and Rogoff (1982)], a few countries with a very large negative or positive position may render the sample as non-representative. To avoid the outlier countries with very large or small net foreign assets/GDP, the lower panel of Figure 4 plots the kernel density estimates of the cross-sectional distribution for

each time periods, truncating net foreign assets/GDP between -50% and +50%.¹⁵ We can see that the medium-run decline in the dispersion net foreign assets/GDP from the 1980s to early 2000s, towards the median of -15.0%.

[Figure 4]

To take into account the difference between positive versus negative net foreign assets/GDP across countries and the changing distribution, we provide in Table 6 the estimates for each country groups with the cutoff of 0.0% and -15.0%. Focusing on the effects of $\Delta[NFA / GDP]_{t-1}$ on the other three variables, the difference between the large and the small net foreign assets/GDP shows up significantly in the case of consumption/GDP variable. Specifically, using the 0.0% cutoff in the upper panel of Table 6 [15.0% in the lower panel], the effect of lagged net foreign assets/GDP on the consumption is -.041 [-.026] for countries above the cutoff, whereas the effect is insignificant for countries below the cutoff.

[Table 6]

We now introduce the global economic shocks, $Z_t \in \{real, financial\}$, into our system of estimation, in order to see how the macroeconomic responses to these shocks depend on the level of net foreign assets/GDP. Table 7 summarizes our main findings, reporting the coefficient estimates of $\Delta[NFA / GDP]_{t-1}$ for the whole sample and by country group. We find that the accumulation of net foreign assets/GDP is negatively associated with consumption/GDP, for the whole sample of countries, and the subset of G7, developing countries, ASEAN+3, and countries with net foreign assets above our

¹⁵ There are about a quarter of sample observations outside this range. The kernel is the Epanechnikov.

two cutoffs [0% and -15%]. For the real exchange rate, its negative association with net foreign assets/GDP is found in the case of OECD, G7, and countries with net foreign assets/GDP in the range of [-50%,50%].

Although we find that macroeconomic variables in OECD, G7, developing countries and ASEAN+3 display different dynamics, some pattern emerges from the data: the accumulation of net foreign assets is associated with a relatively lower consumption and depreciation of real exchange rate. Some economic interpretation drawn from the pattern in these findings are in order. On the real exchange rate, one possible explanation is that countries accumulating larger net foreign assets/GDP tend to consume relatively less, implying a lower domestic inflation and thus real exchange rate depreciation. On the real interest rate, we do not detect any significant dependence to the lagged net foreign assets/GDP in the presence of global economic shocks of both types.¹⁶ From the intertemporal perspective, a conventional wisdom of the long-run adjustment in real exchange rate suggests that a country that has a large negative net foreign asset position relative to its GDP must eventually service its liabilities by running trade surpluses which requires real exchange rate depreciation. Such process can take place through a depreciation of nominal exchange rate and/or a lower domestic price level relative to foreign prices. Conversely, a country with a significant stock of positive net foreign assets relative to its GDP, in equilibrium, must eventually run trade deficits which is accompanied by real exchange rate appreciation. Similarly, the adjustment may be through an appreciation of nominal exchange rate and/or a higher domestic price level relative to foreign prices.

¹⁶ This finding on real interest rate is also in line with Ghironi, et al. (2008) where in the model of US and other G7 countries the response of real interest rate is not statistically different from zero.

[*Table 7*]

To gauge the economic significance of our estimates, we calculate how the adjustment of consumption and real exchange rate to global real economic shocks are affected by a one-standard deviation increase in the level of net foreign assets/GDP. Based on the coefficient estimates from in Table 7, the effects of accumulating net foreign assets/GDP are calculated by multiplying its coefficient estimate on real exchange rate and consumption by a one standard deviation of the net foreign assets/GDP for each country group. For instance, in the whole sample the coefficient estimate of NFA/GDP on consumption/GDP is $-.007$; one standard deviation of NFA/GDP is $.2449$; the economic significance of $+1$ s.d. change of NFA/GDP on the consumption/GDP is $-.007 \times .2449 = -.002$. Figure 5 plots this calculation across country groups. We can see that the impact of net foreign asset accumulation on consumption is strongest for the G7 countries, while the impact of real exchange rate is most significant for the East Asian countries.

The distinct pattern is that the macroeconomic consequences of accumulating net foreign assets are most significant in countries with positive net foreign asset position. We find that the short-run adjustment adds to the ‘global saving glut’: in the presence of positive global real economic shocks, the accumulation net foreign assets/GDP further by a one-standard deviation is associated with a lower level of consumption/GDP by $.05\%$ per year and a depreciation of real exchange rate by $.1\%$ per year. Against these short-run dynamics is the observed convergence in the distribution of net foreign assets/GDP across countries, a combination which potentially helps sustaining the ‘global imbalances’ over the long-run.

[Figure 5]

4. Concluding remarks

We provide the evidence that the dynamics of consumption and real exchange rate vary with the level of country's net foreign asset accumulation. In the presence of positive global real economic shocks, raising the level of net foreign assets/GDP further by a one standard deviation is associated with a lower consumption/GDP by $-.05\%$ and $.1\%$ depreciation of the real exchange rate in the countries with positive net foreign asset position.

In the short run, our findings suggest that a country with relatively large net foreign assets as percentage of its GDP tends to accumulate more foreign assets in the presence of positive global real economic shocks, thereby contributing to the 'global saving glut' argument. In the medium to long run, we observe the declining dispersion across countries in the distribution of net foreign assets/GDP. Together, the evidence suggest that differences in the level of net foreign assets across countries are driven by the dynamics of consumption and real exchange rate in the short run, while the medium-run convergence potentially helps sustaining the 'global imbalances' in the long-run.

What still not known is how the dynamics of macroeconomic variables and net foreign assets depend on the global financial volatility. Our findings show that in the presence of a higher volatility of global financial markets the effects of net foreign assets on the macroeconomic adjustments are similar as in the case of positive global real shocks. These findings are difficult to interpret: is the global financial volatility a positive shock? Perhaps the dynamics of net foreign assets and macroeconomic variables depend on the second moment of global economic shocks. In addition, a negative

correlation (about -.5) between the global real and financial shocks suggests that the valuation channel on the net foreign assets may dominate the negative effect of financial volatility. Future investigation could shed more lights on this issue by disaggregating the net foreign assets into types of assets, e.g. portfolio investment and others, considering also the strength of the correlation between a country's financial market to the global centers.¹⁷ A useful extension may also look into the difference between various measures of economy size (formal and informal sector) and population (total and working age); private and public net foreign assets (i.e. sovereign wealth funds); and flexible and fixed exchange rate regime (i.e. the Euro area, dollarization).

The debate over 'global imbalances' intensified in the early 2000s, when the world witnessed strong economic growth, low financial market volatility, and the 'global saving glut.' Triggered by the subprime mortgage crisis in the US, the global economy has then entered into the period of a sharp slow down. As of 2008, roughly one-half of the resources at the IMF (about USD250 billion) has either been committed or is close to being committed to its member countries with liquidity problems. The issues of how countries should tap on the stock of foreign exchange reserves, manage net foreign assets, or pool their wealth as a part of international cooperation, taking into account the macroeconomic objectives, have become ever more a challenging task.

¹⁷ The challenge has to do with different types of net foreign assets are subject to measurement errors to a varying degree. See Lane and Milesi-Ferretti (forthcoming).

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Table 1: Net foreign assets/GDP (%) and macroeconomic variables (GDP weighted).

period	<u>Net foreign assets/GDP</u>	<u>Consumption/GDP</u>	<u>Real exchange rates</u>	<u>Real interest rates</u>
Whole Sample				
1982-1989	-4.341	75.376	116.379	5.474
1990-1999	-6.424	74.257	92.429	6.208
2000-2006	-7.609	70.028	96.100	4.140
OECD countries				
1982-1989	-1.073	78.371	97.717	5.995
1990-1999	-2.792	77.956	98.390	5.739
2000-2006	-5.899	73.450	99.750	3.262
G7				
1982-1989	1.852	78.666	97.332	6.028
1990-1999	-.332	78.476	97.483	5.678
2000-2006	-3.846	73.781	98.233	3.359
G7 excluding USA				
1982-1989	2.600	75.623	94.696	5.271
1990-1999	4.738	75.326	102.346	5.645
2000-2006	11.391	74.132	97.895	3.142
Developing countries				
1982-1989	-23.775	58.352	230.881	2.597
1990-1999	-25.110	55.239	59.636	7.743
2000-2006	-14.290	56.648	82.080	7.514
ASEAN+3 countries				
1982-1989	-.228	68.038	72.104	3.911
1990-1999	7.259	67.712	89.880	3.891
2000-2006	19.648	63.877	90.954	3.265
China, Japan, South Korea				
1982-1989	3.839	67.825	73.919	3.824
1990-1999	11.433	67.850	89.927	3.539
2000-2006	23.423	63.448	89.999	3.181

Table 2: Between-variables correlation.

	<u>Net foreign assets/GDP</u>	<u>Consumption/GDP</u>	<u>Real exchange rates</u>
<u>Consumption/GDP</u>	0.6640*		
<u>Real exchange rates</u>	0.6139*	0.9733*	
<u>Real interest rates</u>	0.5344*	0.9664*	0.9307*

Table 3: Between-countries correlation

	<u>Net foreign assets/GDP</u>	<u>Consumption/GDP</u>	<u>Real exchange rates</u>	<u>Real interest rates</u>
OECD	-.036	.080	.094	.238
G7	-.122	.048	-.074	.145
Developing	.078	.019	.149	.111
ASEAN+3	.229	.006	.242	.155
China, Japan, South Korea	-.101	-.176	-.378	-.034

Table 4: Stationary tests under the null of unit root.

<u>Maddala-Wu panel unit-root test (p-value)</u>		
	<u>X_(t)</u>	<u>ΔX_(t)</u>
Net foreign assets/GDP	.3463	.0000
Consumption/GDP	.0009	.0000
Real exchange rates	.0000	.0006
Real interest rates	.0000	.0000
<u>Phillips-Perron unit-root test (p-value)</u>		
	<u>X_(t)</u>	<u>ΔX_(t)</u>
Global shocks		
Real	.2220	.0001
Financial	.1859	.0000

Table 5: Macroeconomic dynamics - baseline estimation for the whole sample of countries.

The estimation is multivariate regression, including country fixed effects and time trend (coefficient estimates not reported). Standard errors are in parentheses. *** (**, *) signifies statistical significance at 1 (5,10) percent level.

48 countries; 892 observations [min. 10 obs./country]	Δ NFA/GDP _(t)	Consumption/GDP _(t)	Real Exchange Rates _(t)	Real Interest Rates _(t)
	<u>est. (s.e.)</u>	<u>est. (s.e.)</u>	<u>est. (s.e.)</u>	<u>est. (s.e.)</u>
Δ NFA/GDP _(t-1)	.089 (.034) ***	-.007 (.008)	-.048 (.037)	.041 (.021) *
Consumption/GDP _(t-1)	.077 (.108)	.687 (.025) ***	-.138 (.115)	-.036 (.066)
Real Exchange Rates _(t-1)	-.174 (.025) ***	.023 (.006) ***	.557 (.027) ***	-.044 (.015) ***
Real Interest Rates _(t-1)	-.161 (.049) ***	.026 (.011) **	-.136 (.053) **	.531 (.030) ***
Goodness of fit (R-sq)	.094	.986	.869	.503

Table 6: Estimation with net foreign assets/GDP cutoffs.

The estimation is multivariate regression, including country fixed effects and time trend (coefficient estimates not reported). Standard errors are in parentheses. *** (**, *) signifies statistical significance at 1 (5,10) percent level.

48 countries; 723 observations [min. 10 obs./country]	$\Delta NFA/GDP_{(t)}$	Consumption/ $GDP_{(t)}$	Real Exchange Rates $_{(t)}$	Real Interest Rates $_{(t)}$
Cut-off at $NFA^* = (1/5)\sum_{i=1,5} (NFA/GDP)_{t-i} = 0.0\%$				
	<u>est. (s.e.)</u>	<u>est. (s.e.)</u>	<u>est. (s.e.)</u>	<u>est. (s.e.)</u>
$NFA^* < 0 \times \Delta NFA/GDP_{(t-1)}$	-.138 (.034) ***	-.001 (.009)	-.021 (.054)	.015 (.027)
$NFA^* < 0 \times \text{Consumption}_{(t-1)}$	-.293 (.101) ***	.702 (.027) ***	-.339 (.159) **	.150 (.078) *
$NFA^* < 0 \times \text{Real Exchange Rates}_{(t-1)}$	-.091 (.022) ***	.019 (.006) ***	.509 (.034) ***	.008 (.017)
$NFA^* < 0 \times \text{Real Interest Rates}_{(t-1)}$	-.054 (.048)	.025 (.013) *	-.036 (.075)	.565 (.037) ***
$NFA^* > 0 \times \Delta NFA/GDP_{(t-1)}$	-.210 (.050) ***	-.041 (.014) ***	-.063 (.079)	.021 (.039)
$NFA^* > 0 \times \text{Consumption}_{(t-1)}$	-.373 (.119) ***	.699 (.032) ***	-.604 (.187) ***	.233 (.091) **
$NFA^* > 0 \times \text{Real Exchange Rates}_{(t-1)}$	-.027 (.039)	.019 (.010) *	.698 (.061) ***	-.062 (.030) **
$NFA^* > 0 \times \text{Real Interest Rates}_{(t-1)}$.090 (.096)	.052 (.026) **	-.223 (.150)	.807 (.074) ***
Goodness of fit (R-sq)	.183	.992	.886	.609
Cut-off at $NFA^* = (1/5)\sum_{i=1,5} (NFA/GDP)_{t-i} = -15.0\%$				
	<u>est. (s.e.)</u>	<u>est. (s.e.)</u>	<u>est. (s.e.)</u>	<u>est. (s.e.)</u>
$NFA^* < -15 \times \Delta NFA/GDP_{(t-1)}$	-.137 (.043) ***	.005 (.012)	.041 (.067)	.089 (.033) ***
$NFA^* < -15 \times \text{Consumption}_{(t-1)}$	-.249 (.104) **	.700 (.028) ***	-.542 (.161) ***	.143 (.080) *
$NFA^* < -15 \times \text{Real Exchange Rates}_{(t-1)}$	-.101 (.030) ***	.021 (.008) ***	.749 (.045) ***	.007 (.023)
$NFA^* < -15 \times \text{Real Interest Rates}_{(t-1)}$	-.120 (.068) *	.053 (.018) ***	-.081 (.105)	.791 (.052) ***
$NFA^* > -15 \times \Delta NFA/GDP_{(t-1)}$	-.135 (.037) ***	-.026 (.010) ***	-.072 (.056)	-.001 (.028)
$NFA^* > -15 \times \text{Consumption}_{(t-1)}$	-.341 (.105) ***	.706 (.028) ***	-.083 (.162)	.193 (.080) **
$NFA^* > -15 \times \text{Real Exchange Rates}_{(t-1)}$	-.053 (.025) **	.012 (.007) *	.404 (.039) ***	-.046 (.019) **
$NFA^* > -15 \times \text{Real Interest Rates}_{(t-1)}$.033 (.052)	.016 (.014)	-.268 (.080) ***	.515 (.040) ***
Goodness of fit (R-sq)	.184	.992	.890	.617

Table 7: The effects of net foreign assets/GDP on macroeconomic variables in the presence of global economic shocks. The estimation is multivariate regression, including country fixed effects and time trend (coefficient estimates not reported). Standard errors are in parentheses. *** (**, *) signifies statistical significance at 1 (5,10) percent level.

Response of	Consumption/GDP _(t)	Real Exchange Rates _(t)	Real Interest Rates _(t)
<u>ΔNFA/GDP_(t-1) w/ ΔGlobal real shocks_(t)</u>			
	<u>est. (s.e.)</u>	<u>est. (s.e.)</u>	<u>est. (s.e.)</u>
Whole sample	-.007 (.008)	-.048 (.037)	.041 (.021) **
OECD	.006 (.007)	-.054 (.030) *	.012 (.024)
G7	-.035 (.016) **	-.229 (.116) *	.040 (.025)
Developing countries	-.014 (.012)	-.040 (.057)	.048 (.031)
ASEAN+3	-.019 (.013)	-.027 (.062)	-.025 (.029)
NFA* = [-50,50]	-.015 (.011)	-.152 (.065) **	-.001 (.031)
NFA* < 0.0%	.009 (.014)	-.165 (.090) *	-.021 (.040)
NFA* > 0.0%	-.052 (.019) ***	-.113 (.062) *	-.022 (.039)
NFA* < -15.0%	.011 (.019)	-.095 (.059)	.076 (.040) *
NFA* > -15.0%	-.029 (.013) **	-.139 (.103)	-.025 (.044)
<u>ΔNFA/GDP_(t-1) w/ ΔGlobal financial shocks_(t)</u>			
	<u>est. (s.e.)</u>	<u>est. (s.e.)</u>	<u>est. (s.e.)</u>
Whole sample	-.008 (.008)	-.014 (.022)	.022 (.019)
OECD	.008 (.007)	-.057 (.030) *	.011 (.013)
G7	-.029 (.017) *	-.222 (.117) *	.040 (.026)
Developing countries	-.019 (.012)	.009 (.032)	.027 (.029)
ASEAN+3	-.021 (.013)	-.033 (.064)	-.030 (.027)
NFA* = [-50,50]	-.016 (.011)	-.059 (.034) *	-.033 (.030)
NFA* < 0.0%	.004 (.014)	-.069 (.043)	-.058 (.041)
NFA* > 0.0%	-.046 (.021) **	-.037 (.052)	-.007 (.040)
NFA* < -15.0%	.013 (.019)	-.103 (.053) *	.067 (.045)
NFA* > -15.0%	-.034 (.014) **	-.043 (.045)	-.029 (.036)

Table A1: Data Appendix.

Data are collected on annual basis from 1981-2006, including 128 countries:

Albania, Algeria, Argentina, Armenia, Australia(#), Austria(#), Azerbaijan, Bahrain, Bangladesh, Belarus, Belgium(#), Benin, Bolivia, Bosnia and Herzegovina, Botswana, Brazil, Bulgaria, Burkina Faso, Burundi, Cameroon, Canada(#*), Chile, China(+), Colombia, Congo, Rep., Costa Rica, Croatia, Cyprus, Czech Republic(#), Denmark(#), Dominican Republic, Ecuador, Egypt, Arab Rep., El Salvador, Estonia, Ethiopia, Fiji, Finland(#), France(#*), Gabon, Georgia, Germany(#*), Ghana, Greece(#), Guatemala, Guinea, Haiti, Honduras, Hong Kong, China, Hungary, Iceland, India, Indonesia(+), Iran, Islamic Rep., Ireland(#), Israel(#), Italy(#*), Jamaica, Japan(#*+), Jordan, Kazakhstan, Kenya, Korea, Rep.(#+), Kuwait, Kyrgyz Republic, Latvia, Lebanon, Libya, Lithuania, Macedonia, FYR, Madagascar, Malawi, Malaysia(+), Mali, Malta, Mauritius, Mexico, Moldova, Morocco, Mozambique, Namibia, Nepal, Netherlands(#), New Zealand(#), Nicaragua, Niger, Nigeria, Norway(#), Oman, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines(+), Poland, Portugal(#), Russian Federation, Rwanda, Saudi Arabia, Senegal, Singapore(+), Slovak Republic, Slovenia, South Africa, Spain(#), Sri Lanka, Sudan, Swaziland, Sweden(#), Switzerland(#), Syrian Arab Republic, Tanzania, Thailand(+), Togo, Trinidad and Tobago, Tunisia, Turkey, Uganda, Ukraine, United Kingdom(#*), United States(#*), Uruguay, Venezuela, RB, Vietnam(+), Yemen, Rep., Zambia, Zimbabwe

[# OECD countries; * G7 countries; + ASEAN plus 3 countries]

WDI ≡ World Development Indicators

EWN ≡ External Wealth of Nations

IIP ≡ International Investment Positions

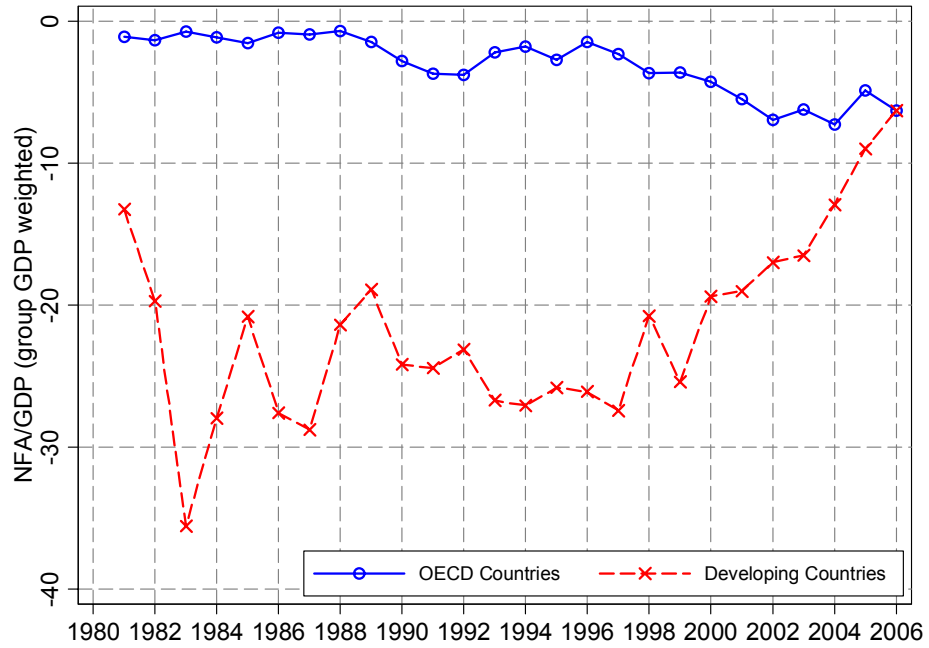
WEO ≡ World Economic Outlook (October 2008)

CBOE ≡ Chicago Board Options Exchange

Variable	Database	Database Code
Net Foreign Asset (% of GDP)	EWN; IIP	79LADZF...; 79AADZF...
Consumption (% of GDP)	WDI	NE.CON.TOTL.KD
Real effective exchange rates	WDI	PX.REX.REER
Real interest rates	WDI	FR.INR.RINR
Trade balance (% of GDP)	WDI	NE.RSB.GNFS.CD
Fiscal balance	WDI	GC.BAL.CASH.GD.ZS
Gross domestic product (current USD)	WDI	NY.GDP.MKTP.CD
Growth of GDP, PPP (constant 2005 international \$)	WEO	PPPGDP
Age dependency ratio (dependents to working-age population)	WDI	SP.POP.DPND
Population growth (annual %)	WEO	LP
Global real economic activity shocks	Lutz Kilian (forthcoming)	rea
S&P 500 implied volatility	CBOE	VXO

Figure 1: Net foreign assets/GDP.

A: Time-series plot by country group (GDP weighted)



B: Scatter plot of NFA/GDP growth and capital/labor ratio in 1996

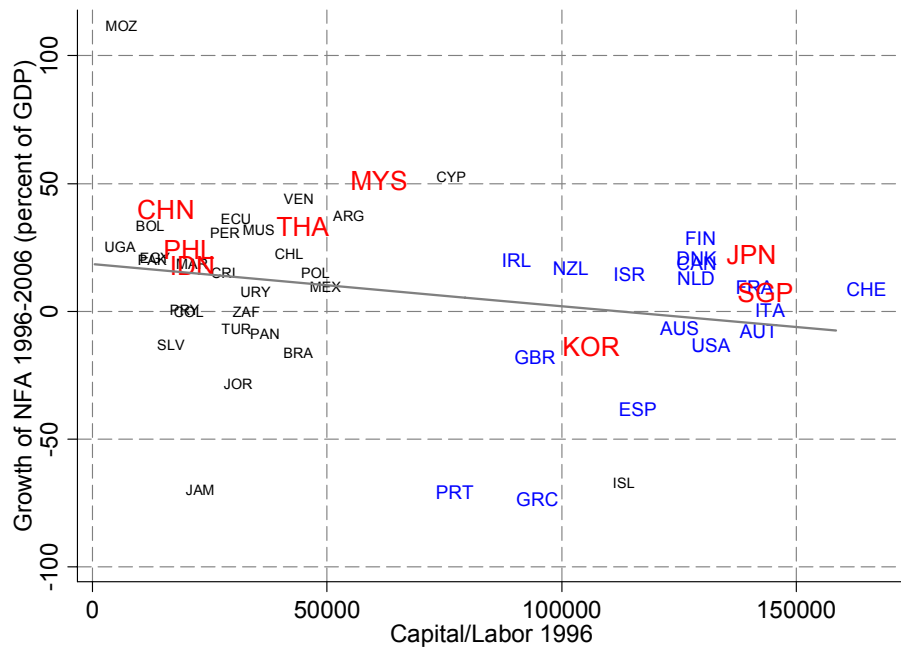


Figure 2-a: Theoretical association between net foreign assets, trade balance, and real exchange rates.

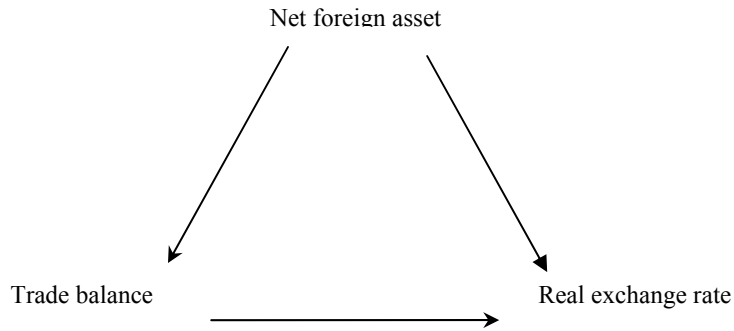


Figure 2-b: Theoretical association between net foreign assets and macroeconomic variables in the presence of global economic shocks.

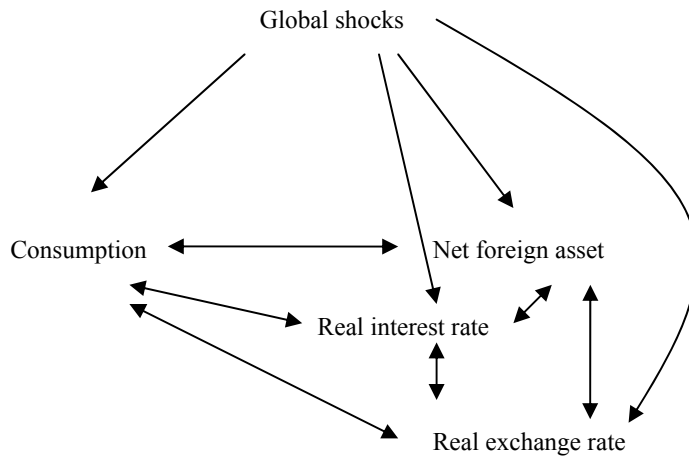
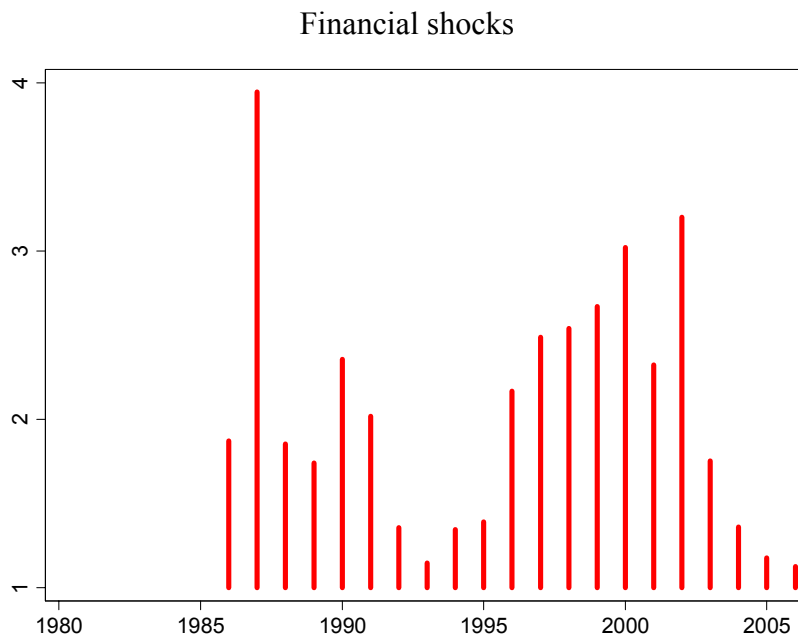
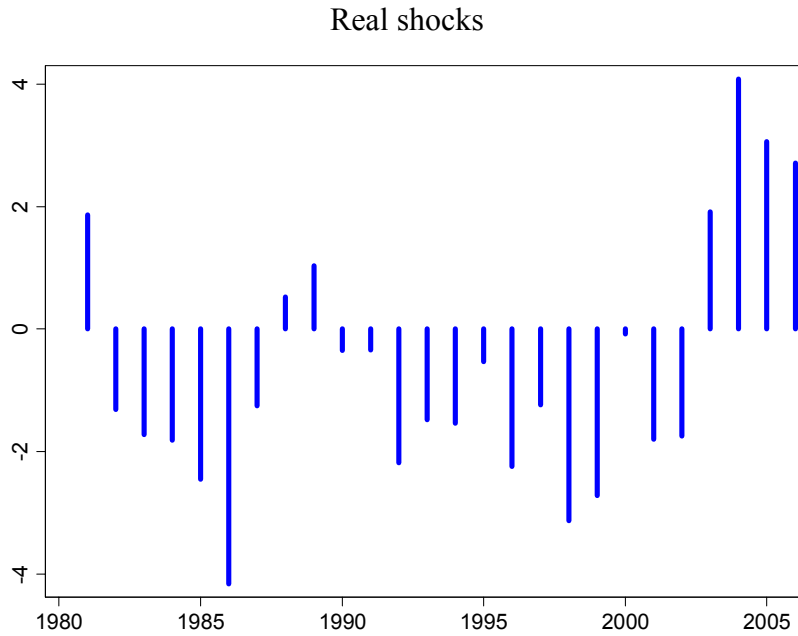


Figure 3: Global real and financial shocks.

The real shocks are measured by the world-wide real economic activity index. The financial shocks are measured by the implied volatility index in S&P 500.



ℓ	$\frac{1}{5}$	$\frac{4}{5}$	$\frac{3}{5}$	$\frac{2}{5}$	$\frac{1}{5}$	0	$\frac{1}{5}$	$\frac{2}{5}$	$\frac{3}{5}$	$\frac{4}{5}$	$\frac{5}{5}$
correlation	.29	.48	.29	.13	-.09	-.41	-.58	-.20	-.17	-.22	-.05

Figure 4: Cross-country distribution of net foreign assets/GDP.

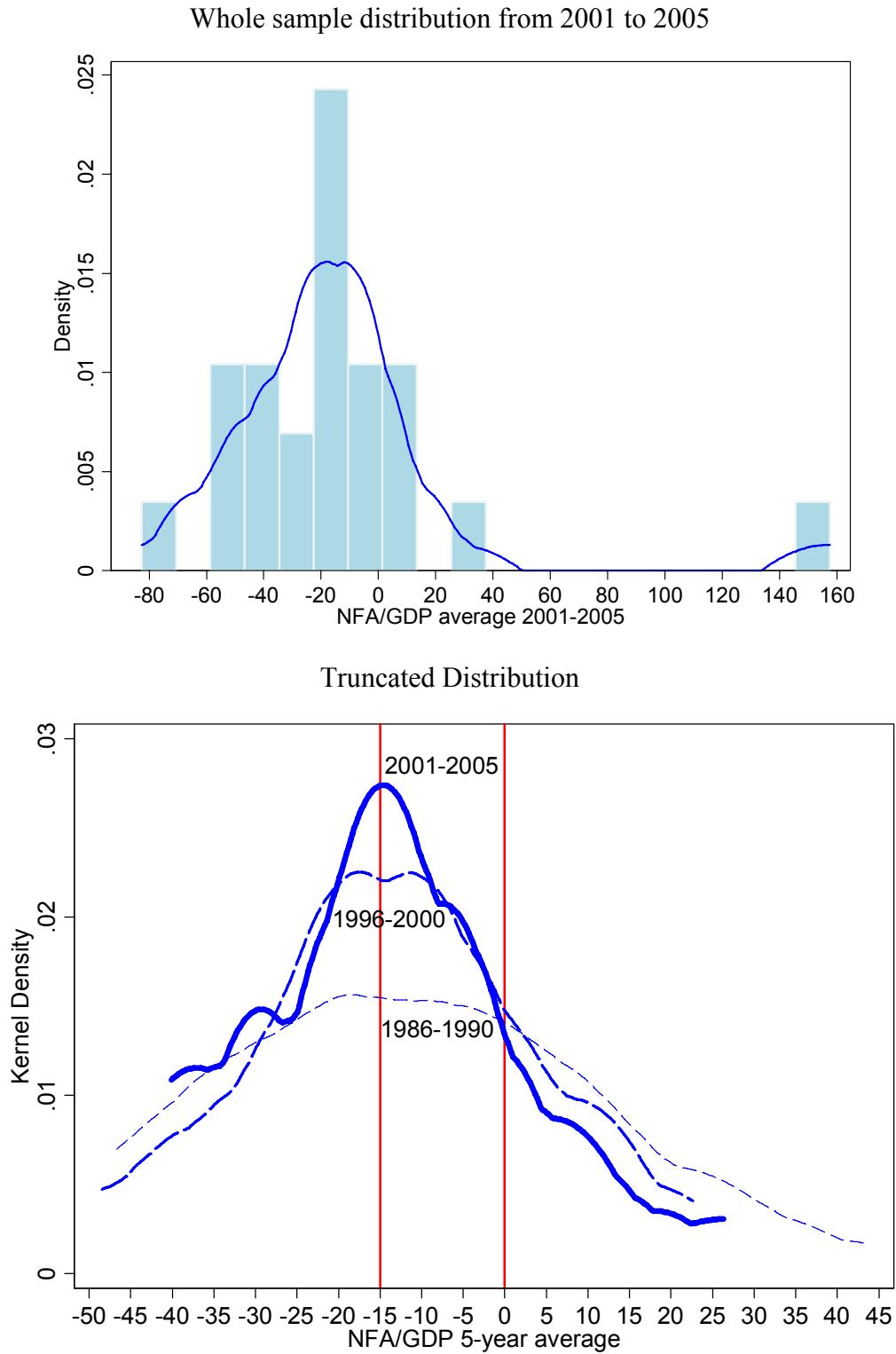


Figure 5: Raising net foreign assets/GDP by one standard deviation, and the response of consumption/GDP and real exchange rate to positive global real economic shocks.

