Board of Governors of the Federal Reserve System

International Finance Discussion Papers

Number 975

June 2009

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Abstract: Theory predicts that a nation's stochastic intertemporal budget constraint is satisfied if net foreign assets (NFA) are integrated of any finite order, or if net exports (NX) and NFA satisfy an error-correction specification with a residual integrated of any finite order. We test these conditions using data for 21 industrial and 29 emerging economies for the 1970-2004 period. The results show that, despite the large global imbalances of recent years, NFA and NX positions are consistent with external solvency. Country-specific unit root tests on NFA-GDP ratios suggest that nearly all of them are integrated of order 1. Pooled Mean Group error-correction estimation yields evidence of a statistically significant, negative response of the NX-GDP ratio to the NFA-GDP ratio that is largely homogeneous across countries.

Keywords: global imbalances, external solvency, debt sustainability, Pooled Mean Group estimation

JEL Codes: F41, F32, E66

[*] Author notes: We thank Shaghil Ahmed, Daniel Beltran, Betty Daniel, Linda Goldberg, David Romer, Barbara Rossi, participants of the Global Imbalances workshop at the Federal Reserve Board for comments and suggestions; Stephanie Curcuru, John Rogers for kindly sharing their data sets; Paul Eitelman, Justin Vitanza and George Zhu Yi for excellent research assistance. We also thank Gian Maria Milesi-Ferretti and Philip Lane for the data on net foreign asset positions (posted at http://www.imf.org/external/pubs/ft/wp/2006/data/wp0669.zip). The analysis undertaken in this paper would not have been possible without their efforts. All remaining errors are exclusively our responsibility. The views in this paper are solely the responsibility of the authors and should not be interpreted as reflecting the views of the International Monetary Fund, the Board of Governors of the Federal Reserve System or of any other person associated with the Federal Reserve System. Correspondence: bora.durdu@frb.gov, mendozae@econ.umd.edu, mterrones@imf.org.

1 Introduction

The most significant development in international finance in the last ten years was the emergence of large imbalances in current accounts and net foreign asset positions. Figure 1 shows the evolution of these "global imbalances" since 1997. The U.S. current account deficit rose sharply in this period, reaching a record 6 percent of GDP in 2006 (see Figure 1a), while current account surpluses grew to record levels in Emerging Asia, oil exporting countries, and Japan. In line with these changes, the dispersion of NFA positions widened substantially (see Figure 1b). The NFA position of the United States declined markedly, while those of Japan, Emerging Asia, and the oil exporting countries rose. Recent economic turmoil in the United States has reduced the U.S. current account deficit somewhat, but the nation's large negative NFA position has changed little, and this "stock imbalance" is very likely to persist.

Large and persistent imbalances in the NFA positions of nations pose two central questions that this paper aims to address: First, are these global imbalances sustainable, in the sense of being consistent with external solvency conditions (i.e., with the countries' intertemporal budget constraints)? Second, are there differences in the sustainaibilty of external positions across different country groupings depending on their characteristics (such as income levels or whether countries are net creditors or debtors)?

To answer these questions, we conduct two tests of external solvency based on recent theoretical results derived by Bohn (2007):[1]

(1) Bohn's Proposition 1 (henceforth, PB1) shows that if the NFA series is integrated of order m for any finite $m \geq 0$, then NX and NFA satisfy the intertemporal budget constraint (IBC), and NFA satisfies the associated transversality condition (TC). Hence, PB1 implies that external solvency can be assessed by testing whether NFA is stationary after any finite order of differencing of the original data. This result also illustrates, however, that testing for solvency per se is not very useful, since it is hard to imagine a macroeconomic time series that is not integrated of low order. In addition, Bohn shows that if bounds on debt or nfa

[1]Bohn focused on public debt, the primary fiscal balance and the government's IBC, but obviously his results also apply to NFA, NX and the open-economy IBC. One important caveat is that his analysis establishes only sufficiency conditions for solvency. Hence, if our tests yield positive results they do represent evidence indicating that the IBC holds, but failure of the tests does not reject it.

exist, testing the null hypothesis of difference-stationarity seems economically uninteresting. Because, with debt limits, $m = 1$ is not sufficient for sustainability. Hence, sheding light on the characteristics of the adjustment process that sustains solvency is a more important task, which Bohn tackled with the following result.

(2) Bohn's Proposition 3 (henceforth, PB3) proves that if NX and NFA satisfy an error-correction specification of the form $NX_t + \rho NFA_{t-1} = z_t$, and z_t is integrated of order m for some $\rho < 0$,such that $|\rho| \in (0, 1 + r]$, where r is a constant real interest rate, then the IBC holds. This proposition implies that we can assess external solvency by estimating an error-correction "reaction function" between NX and NFA testing for a negative, statistically significant relationship between the two. Evidence that this reaction function exists indicates that NX reacts in the long run to changes in NFA in such a way that NFA grows slower than what a Ponzi scheme implies. Moreover, the magnitude of ρ drives the speed of the adjustment process by which trade surpluses or deficits adjust to larger or smaller NFA positions, and it becomes a key determinant of the long-run average of NFA.

We test PB1 and PB3 using a large dataset covering 51 countries during the period 1970-2004. We test PB1 by performing standard Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests of the NFA-GDP ratio (*nfa*) using data for each individual country separately. Then, we test PB3 by estimating an error-correction model of *nfa* and the NX-GDP ratio (*nx*) taking advantage of the panel dimension of the dataset. We estimate Pesaran et. al.'s (1998) Pooled Mean Group (PMG) and Mean Group (MG) estimators, and find strong evidence in favor of the former vis-a-vis the latter. PMG is particularly useful in our analysis because it models the *nx*-*nfa* relationship as a long-run relationship common to all countries in the sample, with homogeneity tests to validate this assumption (v. the MG estimator that uses country-specific long-run relationships). Moreover, PMG allows for country-specific short-run deviations from the long-run relationship.

The results of the unit root tests show that the hypothesis that a unit root is present in *nfa* data in levels cannot be rejected for all countries in the sample. The same hypothesis is rejected, however, for the first-difference of *nfa* in almost all the countries. Hence, these results provide strong evidence in favor of the result derived in PB1. In particular, *nfa* is integrated of order 1 in most countries in our sample, and therefore the IBC and TC hold.

Our finding that in most countries $nfa \sim I(1)$ implies that both IBC and TC are satisfied, but it does not show how nx adjusts over time so that its expected present value matches the initial nfa position, and it does not let us identify whether there are differences in the nature of this adjustment across countries with different characteristics. The PMG estimation aims to fill these gaps.

The PMG results show that there is a statistically significant error-correction relation between nx and nfa both for the full sample of countries and for sub-samples separating emerging from industrial countries, and creditor from debtor countries. The systematic long-run component of nx responds negatively to movements in nfa, in line with Bohn's PB3, and homogeneity tests cannot reject the hypothesis that this component is similar across countries (v. the null of country-specific components produced by MG estimation).

The long-run response coefficient is estimated at -0.07, which indicates that a one percentage point drop in nfa leads to a 0.07 percentage points increase in nx *in the long run.* This result also implies that, assuming realistic growth-adjusted real interest rates (below 7 percent), both nx and nfa are stationary processes.[2] The error correction coefficient is estimated at 0.31, which implies that the adjustment of nx to a given change in nfa has an average half-life of over 1.5 years.

The PMG results also show that nx is more responsive to movements in nfa in emerging markets than in industrial countries. The response coefficient is 1.6 times larger in the former than in the latter. Keeping other factors constant (i.e. country-specific fixed effects), this difference implies that industrial countries converge to lower long-run averages of nfa that are consistent with external solvency.

Our work is related to the large empirical literature on tests of fiscal and external solvency. Studies include Mendoza and Ostry (2008), Trehan and Walsh (1991), Wickens and Uctum (1993), Ahmed and Rogers (1995), Liu and Tanner (1996), Wu (2000), Wu, Show-Lin and Lee (2001), Engel and Rogers (2006), and Nason and Rogers (2006). The tests we conduct differ from several of the tests conducted in this literature, and in the related literature testing

[2] This evidence is contrary to the country-specific unit root tests that suggested that nx and nfa are not stationary. The difference in results is due to the small-sample problems of unit root tests, and to the fact that the unit root tests are country specific, while PMG estimation uses the full panel dataset to identify the error-correction relationship.

for fiscal solvency, which (with the exception of Mendoza and Ostry) generally test for unit roots in the foreign debt-GDP (or public debt-GDP) and NX-GDP (or primary balance-GDP) ratios; for cointegration between exports and imports (or between fiscal revenues and outlays); or for specific orders of integration in debt (public or external). Bohn (1998, 2005, 2007) showed that failure of these tests cannot be relied on to evaluate solvency because the tests consider only sufficiency conditions that are not necessary for the IBC to hold, and hence can indicate that observed debt dynamics violate solvency, when in fact they do not.

Our tests are in line with the literature on fiscal reaction functions pioneered by Bohn (1998) with an application to U.S. data, and extended to a cross-country fiscal panel by Mendoza and Ostry (2008).[3] However, these reaction functions were estimated using fiscal datasets in which public debt and fiscal balances are stationary as shares of GDP. In contrast, the hypothesis of unit roots cannot be rejected in our external accounts data (in levels or in shares of GDP), and hence we cannot implement Bohn's (1998) reaction function specification for stationary variables. Instead, we use the more general error-correction formulation characterized in PB3, which applies even when the relevant debt stock and net revenue flow variables are not stationary, and we also conduct the m^{th} -order-difference stationarity tests implied by PB1.

Our work is also related to the large and growing literature on global imbalances. This literature presents opposing views about the sustainability of the global imbalances, along with explanations of why the observed NFA dynamics may be consistent or inconsistent with solvency considerations.[4] In this context, the results of our work suggest that global imbalances are consistent with external solvency. In fact, this can be the case even if *nfa* is

[3]Engel and Rogers (2006) tested for external solvency in the United States using Bohn's (1998) test. They estimated a conditional linear reaction function for nx and the *negative* of the net external financial position-to-GDP ratio over the 1791-2004 period. They obtained a negative and statistically significant response coefficient, which indicates failure of the sufficiency condition for external solvency.

[4]One group of studies (e.g., Summers(2004), Obstfeld and Rogoff (2004), Roubini and Setser (2005), Blanchard, Giavazzi and Sa (2005), Krugman (2006)) argues that these imbalances are not sustainable. On the other hand, other studies (e.g., Backus, Henriksen, Lambert and Telmer (2005), Bernanke (2005), Croke, Kamin and Leduc (2005), Durdu, Mendoza and Terrones (2008), Gourinchas and Rey (2005), Hausmann and Sturzenegger (2005), Henriksen (2005), Mendoza, Quadrini and Rios-Rull (2007), Lane and Milesi-Ferretti (2005), Caballero, Farhi and Gourinchas (2006), Cavallo and Tille (2006), Engel and Rogers (2006), Fogli and Perri (2006), Ghironi, Lee and Rebucci (2006)), argue that the imbalances are an equilibrium outcome of various developments such as differences in business cycle volatility, financial development, demographic dynamics, a 'global savings glut,' self insurance against financial crises, or valuation effects.

not stationary, but as long as the growth of nfa and the predicted response of nx is such that net foreign liabilities grow at a slower pace than the one implied by a Ponzi scheme.

The rest of the paper is organized as follows: Section 2 describes the analytical foundations of our empirical methodology. Section 3 presents the results of the empirical tests. Section 4 concludes.

2 Methodology

Our methodology for testing external solvency adapts Bohn's (2007) theoretical findings to an open-economy environment. Consider an open economy with the following standard period-by-period resource constraint:

$$NFA_t = X_t - M_t + (1 + r_t)NFA_{t-1}, \tag{1}$$

where M denotes imports, X exports, and r the interest rate on external assets and liabilities. These variables could be expressed in nominal terms, real terms, or as a ratio to GDP as long as r is adjusted accordingly (i.e., if the variables are in nominal terms, r is the nominal interest rate; if the variables are in real terms, r is the real interest rate; if the variables are ratios to GDP, $1 + r$ is the growth-adjusted real interest rate that follows from dividing the gross real interest rate by the gross rate of output growth).

Under alternative standard simplifying assumptions about the nature of the r_t process, the resource constraint implies:[5]

$$NFA_t = -\psi E_t[X_{t+1} - M_{t+1} - NFA_{t+1}], \tag{2}$$

where $\psi = 1/(1 + r) < 1$, and $r = E[r_{t+1}]$. The above expectational difference equation, together with this TC,

$$\lim_{n\to\infty} \psi^n E_t[NFA_{t+n}] = 0, \tag{3}$$

[5]Three of these assumptions reviewed in Bohn (2007) are: (1) r positive and constant, (2) r i.i.d with a positive and constant conditional expectation, or (3) r is any stationary stochastic process with mean $r > 0$, and subject to implicit restrictions that may be required so that the process of "interest adjusted imports" ($M_t^* = M_t - (r_t - r)NFA_{t-1}$) has similar statistical properties as M_t.

implies the following IBC:

$$NFA_t = -\sum_{t=1}^{\infty} \psi^i E_t(X_{t+i} - M_{t+i}). \tag{4}$$

In the subsections that follow, we review Bohn's PB1 and PB3, which are propositions that establish testable predictions about the time-series behavior of NFA and NX that characterize economies for which (3) and (4) hold.

2.1 Testing Solvency with NFA Integration Tests

The following proposition from Bohn (2007) states that a stochastic time series of debt or assets is consistent with its corresponding IBC if the series is stationary at *any* finite order of differencing:[6]

Proposition 1 ***PB1.*** *If NFA is integrated of order* m *(*$NFA_t \sim I(m)$*) for any finite* $m \geq 0$*, then NFA satisfies the TC, and NFA and NX satisfy IBC.*

Proof. See p. 1840 in Bohn (2007). ■

In our context, PB1 indicates that as long as any finite difference of NFA is stationary, the NFA positions are consistent with solvency (i.e., they satisfy 4). Thus, PB1 implies a simple but practical way to test for external solvency. The intuition, as pointed out by Bohn (2007), is that if NFA is m^{th}-order integrated, its n-period-ahead conditional expectation is a polynomial that is *at most* of order m. The discount factor in the TC, however, grows exponentially with n. Since exponential growth dominates polynomial growth of any order, NFA grows slower than the discount factor in TC as long as NFA is integrated of any finite order.

2.2 Testing Solvency with Error-Correction Reaction Functions

[6] A common test used to evaluate external solvency is to test if NFA is difference-stationary (integrated of order 1). Rejection of this hypothesis was commonly taken as evidence against external solvency, but PB1 demonstrates that this interpretation is incorrect.

Our second test of external solvency looks for a systematic negative response of *NX* to *NFA* in the form of an error-correction specification. In particular, Bohn (2007) established the following result:

Proposition 2 ***PB3.*** *If* $NX_t - \rho NFA_{t-1} = z_t \sim I(m)$ *for some* $\rho < 0$*,such that* $|\rho| \in (0, 1 + r]$*, and* $r_t = r$ *is constant, then* NFA *satisfies TC.*

Proof. See p. 1844 in Bohn (2007). ■

This proposition states that if a country's NX and NFA positions are linked through an error-correction relationship with a ρ coefficient that satisfies the stated conditions, then TC and IBC hold. Existence of such reaction function implies that, implicitly, households, firms and the government adjust their savings and investment plans over time in a manner that is in line with the financing requirements implied by changes in the economy's NFA position. With this response in place, the economy's external liabilities grow at a slower pace than what a Ponzi scheme implies, so that external positions are consistent with the IBC. For countries with more negative ρ, the response of net exports to changes in net foreign assets is stronger. In turn, more negative ρ's are likely to reflect limitations affecting the financial markets that those countries can access, in terms of the level of financial development and/or the presence of financial frictions.

Efficient estimation of country-specific error-correction reaction functions linking NFA and NX requires large data sets that are generally not available for a large number of countries. The best data available for NFA positions, which is the dataset constructed by Lane and Milesi-Ferretti (2006), covers only the 1970-2004 period. The alternative, therefore, is to exploit the cross-sectional, time-series structure of the data to estimate a panel error-correction specification of the following form:

$$nx_{it} - \rho nfa_{it-1} = \eta_{it}, \tag{5}$$

where η is an $I(0)$ process. This is an error-correction specification in the class of those allowed by PB3.

Following Pesaran et al. (1999), we can nest the above relationship in an auto-regressive distributed lag (ARDL) model in which dependent and independent variables enter the right-hand-side of the model with lags of order p and q, respectively:

$$nx_{i,t} = \mu_i + \sum_{j=1}^{p} \lambda_{i,j} nx_{i,t-j} + \sum_{l=0}^{q} \delta'_{i,l} nfa_{i,t-l} + \varepsilon_{i,t}, \tag{6}$$

where $nx_{i,t}$ and $nfa_{i,t}$ denote the net exports-GDP and NFA-GDP ratios in country i at time t respectively, and μ_i denotes country-specific fixed effects. ε is a set of normally distributed error terms with country-specific variances, $\text{var}(\varepsilon_{it}) = \sigma_i^2$.

The above equation can be expressed in terms of a linear combination of variables in levels and first differences, as follows:

$$\Delta nx_{i,t} = \mu_i + \phi_i nx_{i,t-1} + \varphi_i nfa_{i,t} + \sum_{j=1}^{p-1} \lambda^*_{i,j} \Delta nx_{i,t-j} + \sum_{l=0}^{q-1} \delta^*_{i,l} \Delta nfa_{i,t-l} + \varepsilon_{i,t},$$

where $\phi_i = -(1 - \sum_{j=1}^{p} \lambda_{i,h})$, $\varphi_i = \sum_{j=0}^{p} \delta_{i,j}$, $\lambda^*_{i,j} = -\sum_{m=j+1}^{p} \lambda_{i,m}$, $\delta^*_{i,l} = -\sum_{m=l+1}^{q} \delta_{i,m}$, with $j = 1, 2, ..., p-1$, and $l = 1, 2, ..., q-1$.

To highlight the long-run relationship, the above equation can be rearranged as:

$$\Delta nx_{i,t} = \mu_i + \phi_i [nx_{i,t-1} - \rho_i nfa_{i,t}] + \sum_{j=1}^{p-1} \lambda^*_{i,j} \Delta nx_{i,t-j} + \sum_{l=0}^{q-1} \delta^*_{i,l} \Delta nfa_{i,t-l} + \varepsilon_{i,t}, \tag{7}$$

where $\rho_i = -\phi_i^{-1} \varphi_i$ denotes the long-run relationship between nx and nfa, and ϕ_i denotes the speed at which NX adjusts towards the long-run relationship following a change in NFA. A negative and statistically significant ρ is sufficient to guarantee that IBC in eq. (4) holds.

We estimate the dynamic panel equation (7) using MG and PMG estimators. MG estimates independent error-correction equations for each country and computes the mean of the country-specific error-correction coefficients and its relevant statistics (see Pesaran and Smith (1995)). This approach produces consistent estimates of the average of the coefficients as long as the country-specific coefficients are independently distributed and the regressors are exogenous. If some of the coefficients are the same for all countries, however, the MG estimates are inefficient. In this case, PMG is efficient (see, Pesaran, et al (1999)). The PMG estimator imposes the restriction that the long-run coefficients are the same across countries, but the intercept, short-term coefficients and error variances can differ. The criterion for choosing whether the PMG estimator is preferred to the MG estimator is a standard Hausman test on the homogeneity restriction that the long-run coefficient is the same for all countries (see Pesaran et al. (1999)).

Using the results from PMG or MG estimation, we can derive estimates of the long-run average nfa positions to which each country converges. For the long-run average of nfa to exist, nfa must be stationary, and this requires that the estimation results satisfy three conditions: $\phi < 0, \rho < 0$ and $|\rho| > r$. The first condition is required for the error-correction specification to be well-defined, and the last two follow from PB3. Note that if $\rho < 0$ but $|\rho| \leq r$, PB3 still holds, but nfa and nx are not stationary (see Bohn (2007)).

If nfa is stationary, equation (7) and the resource constraint imply that each country's nfa position converges to the following long-run average:

$$E[nfa_i] = \frac{\mu_i}{\phi_i\,(\rho_i + r)}. \tag{8}$$

Using our PMG results, ρ_i is the same for all countries in the estimation panel, but there can still be significant heterogeneity in the predicted values of $E[nfa_i]$ because the estimator still allows for country-specific estimates of ϕ_i and μ_i.

Since the stationarity conditions imply $\phi_i < 0$ and $(\rho_i + r) < 0$, the denominator of the right-hand-side of the above expression is positive, and therefore $sign(E[nfa_i]) = sign(\mu_i)$. The intuition for this result is straightforward: if μ_i is positive (negative), the country's long-run trade balance converges to a deficit (surplus), and the resource constraint dictates that in the long run $E[nfa_i] = -E[nx_i]/r$ (i.e., net foreign assets are equal to the negative of the annuity value of the trade balance).

It is important to note that $sign(\mu_i)$ also determines whether $E[nfa_i]$ is a positive or negative function of the parameters that determine it. $E[nfa_i]$ is a positive (negative) function of ρ_i, ϕ_i or r if μ_i is positive (negative). This result has an important implication: everything else constant, countries with lower ρ converge to higher (lower) mean nfa positions if μ_i is negative (positive). This result is also intuitive. Comparing two net debtor countries (each with $\mu_i < 0$), the one with a stronger response coefficient responds to temporary declines in its nfa by adjusting its trade surplus relatively more, vis-a-vis the alternative of widening more the current account deficit, and the larger surpluses imply a higher (less negative) long-run average of nfa. A similar intuition applies to a comparison of two creditor countries. This suggests that stronger response coefficients can be viewed as evidence that the corresponding countries have more limited access to financial markets, either to borrow or to save, than those that display weaker response coefficients.

2.3 General Equilibrium Representation

The derivation of the IBC eq. (4) followed from a generic setup that applies to a variety of intertemporal open-economy models, as long as TC, and the assumptions about the r process that support the expectational difference equation for NFA_t hold. The latter can be particularly restrictive, however, because they effectively imply that the expected future stream of trade balances in the right-hand-side of (4) can be discounted at a time- and state-invariant average interest rate. This simplification is very useful for the proofs of PB1 and PB3, but it is important to note that the key implications of these propositions still hold in more general environments that do not restrict discount rates in the same way. In particular, we show below that this the case in a canonical general equilibrium model of a small open economy with complete markets of state contingent claims traded at exogenous world-determined prices.

Domestic output (y) in this economy is an exogenous random process, and there are similar processes driving the output of a large number of identical countries. The world-wide state of nature s (i.e., the vector of all country output realizations) follows a stochastic process with the Markov transition density function $f(s_{t+1}, s_t)$. Since agents have access to complete international markets of state-contingent claims $b_t(s_{t+1})$, the small open economy's period-by-period budget constraint is:

$$\int Q_1(s_{t+1}|s_t) b_t(s_{t+1}) ds_{t+1} = b_{t-1}(s_t) + y(s_t) - c(s_t), \tag{9}$$

where $Q_1(s_{t+1}|s_t)$ is the period-t world-determined price of a state-contingent claim that pays one unit of good in state s_{t+1} at period $t + 1$. At equilibrium, these prices are equal to the corresponding stochastic marginal rates of substitution in consumption across time and states of nature. Given these prices, and if the appropriate TC holds, the above budget constraint implies the following IBC:

$$b_{t-1}(s_t) = NX_t + \sum_{j=1}^{\infty} E_t \left[\frac{\beta^j u'(y_{t+j} - NX_{t+j})}{u'(y_t - NX_t)} NX_{t+j} \right], \tag{10}$$

where $u'(\cdot)$ denotes the marginal utility of consumption, β denotes the subjective discount factor, and $\frac{\beta^j u'(y_{t+j} - NX_{t+j})}{u'(y_t - NX_t)}$ is the stochastic discount factor. If we denote by R_{jt} the rate of return of a j-period-ahead risk-free asset, we can rewrite the IBC as follows:[7]

$$b_{t-1}(s_t) = NX_t + \sum_{j=1}^{\infty} \left\{ [R_{jt}]^{-1} E_t(NX_{t+j}) + cov_t \left[\frac{\beta^j u'(y_{t+j} - NX_{t+j})}{u'(y_t - NX_t)}, NX_{t+j} \right] \right\}. \tag{11}$$

If the economy's output process represents purely diversifiable country-specific risk (e.g., if the country-specific output processes are i.i.d. and aggregate into a non-stochastic world-wide income), domestic agents would attain a perfectly smooth consumption path constant across time and states, and the compounded risk-free rate would be $[R_{jt}]^{-1} = \beta^j$. In this case, the small open economy's IBC simplifies to the same expression in (4), and propositions PB1 and PB3 obviously apply.

If domestic agents cannot attain perfectly smooth consumption (which could happen for a variety of reasons, such as a global component in country output fluctuations, the existence of nontradable goods, country-specific government purchases, incomplete markets, etc.), the expressions of the IBC in (4) and (11) are not equivalent. In particular, the co-variance terms in the right-hand side of (11) are not zero, and as a result a constant discount factor equal to the unconditional expectation of the interest rate, as assumed in (4), is not the appropriate discount factor that is consistent with the true solvency condition (11). The correct discount factor is given by the equilibrium asset pricing kernel.

The intuition for why the risk-free rate is not the appropriate discount factor is that, depending on the shocks hitting the economy, the NFA stocks that result from the resource

[7] At equilibrium, this interest rate satisfies $[R_{jt}]^{-1} = \beta^j E_t \left[\frac{u'(y_{t+j} - NX_{t+j})}{u'(y_t - NX_t)} \right]$

constraint can vary over a wide range and be correlated with sources of risk such as terms-of-trade shocks, foreign demand shocks, etc. As a result, NFA, NX, and asset prices and returns implied by the equilibrium pricing kernel are likely to follow very different stochastic processes, and therefore risk-free interest rates are not appropriate discount rates for the relevant TC. As Bohn (2005) puts it: "not just technically wrong, but also providing a misleading economic intuition."

Eq. (11) also implies an interesting relationship between the economy's initial NFA position and the sequence of conditional covariances of stochastic discount factors and NX. In particular, given the same expected present discounted value of net exports, a Country A with lower covariances than a Country B should display a lower initial NFA position. In turn, assuming a standard isoelastic utility function, the covariances can be re-interpreted as covariances between inverse consumption growth rates and net exports, which can then be related to observed co-movements between these variables (see Section 3.2 below).

A second important implication of eq. (11) is that, as Bohn (1995 and 2005) showed, it again implies that a reaction function with a negative, linear response of NX to NFA is sufficient to guarantee that external solvency holds. Thus, this sufficiency condition for solvency holds here even with an interest rate that is generally *not* time- and state-invariant as assumed in PB3.

3 Estimation Results

3.1 Data

Our analysis is based on annual data for the period 1970-2004 covering 21 industrial countries (IC) and 29 emerging markets (EM). The IC mainly comprise the core OECD countries while the EM are those listed in Appendix 1. NFA data in U.S. dollars are from Lane and Milessi-Feretti (2006). Data for NX and GDP in U.S. dollars are from the International Monetary Fund's *International Financial Statistics*.[8] Our sample selection is simply based on data quality and availability. The sample includes all the countries for which NFA and NX data

[8] Summary statistics are provided in Table 1.

start on or before 1990. Overall, the sample consists of 1742 observations for both the NX and NFA positions–of which 733 observations correspond to IC group and 1009 observations to EM group.

3.1.1 Integration of NFA-GDP Ratios

We test PB1 using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests to determine the degree of integration of *nfa* for each country in our sample. We use both ADF and PP tests because, although they are asymptotically equivalent, they can differ significantly in small samples (see Hamilton (1999)). We first test the null hypothesis that *nfa* is integrated of order 1 (H(0): $nfa \sim I(1)$) against the alternative that it is stationary (H(1): $nfa \sim I(0)$). Second, if the null is accepted, we test the null hypothesis that the first difference of *nfa* is integrated of order 1 (i.e., H(0): $\Delta nfa \sim I(1)$) against the alternative that it is stationary (H(1): $\Delta nfa \sim I(0)$). We continue on this procedure until we arrive at stationarity at a finite order of differencing. As detailed, we arrive at stationarity in the first order of differencing on most cases.

Figure 2 summarizes our main findings. The top panel of the Figure shows that ADF and PP tests cannot reject the null hypothesis of a unit root in *nfa* at commonly used significance levels for all countries in the sample. The bottom panel shows that when we perform the tests for the first difference of nfa, however, we reject the null hypothesis of a unit root in favor of the alternative of stationarity for almost all of the countries. This means that in most countries nfa is integrated of order 1. Only for very few countries (e.g. Belgium, Norway), we cannot reject the hypothesis of unit roots present in the first differences of *nfa*. This evidence suggests that the observed NFA positions are consistent with external solvency.[9] These results do not change significantly when we allow for the possibility of structural breaks, intercepts and trend components in the time-series processes.

To examine the robustness of our findings, we also conducted tests using the KPSS stationarity test, developed by Kwiatkowski, Phillips, Schmidt and Shin (1992). In contrast

[9] In the case of four transition economies (Lithuania, Poland, Russia, and Slovenia) the tests cannot establish a robust stationarity result. These results, however, are mainly driven by the sample size (for those countries, the sample starts in early 1990s), because the unit root tests tend to be inconclusive in short samples.

with the ADF and PP unit root tests, KPSS tests the null that *nfa* is stationary (H(0): $nfa \sim I(0)$)) against the alternative that it is integrated of order 1 (H(1): $nfa \sim I(1)$)). In the event the null hypothesis is rejected, we next proceed to check if the first difference of *nfa* is stationary (i.e., H(0): $\Delta nfa \sim I(0)$) against the alternative that it is integrated of order 1 (H(1): $\Delta nfa \sim I(1)$). As in the case of the ADF and PP tests, the results of the KPPS test indicate that nfa is integrated of finite order.[10]

We also performed additional robustness tests particularly for the U.S. The U.S. has a large weight in our analysis because of its large share of global imbalances. For this exercise, we performed the aforementioned unit root tests using a long time series data of nfa covering 1790-2004 from Engel and Rogers (2005), and data from Curcuru et al. (2008), which is corrected for valuation changes.[11] We find that our main findings are preserved in both datasets, i.e., nfa is nonstationary in levels but stationary in first differences.

It is important to keep in mind that the usual caveats about inference problems in short samples due to limited power of the tests are relevant for the remainder of our sample. In particular, it is well known that the ADF and PP tests do not have the power to distinguish between a unit root or a near unit root process or between a drifting or trend stationary process. In fact, when we examine the individual AR(1) coefficients for each country (see Figure 3), we find that they span a wide range from 0.59 to 1.06, and that their standard errors are relatively large (ranging from 0.065 to 0.146). Thus, although we could not reject the hypothesis of unit roots in nfa, the possibility remains that due to the low power of the tests the true data generating process is in fact stationary in levels. This, however, would not affect our finding that the data support the hypothesis that the solvency condition holds, since stationarity in levels is also consistent with PB1.

3.1.2 Panel Error-Correction Estimation

We test PB3 by estimating the dynamic panel equation derived in the previous Section using PMG and MG estimators. Table 2 reports results for the full sample combining ICs and EMs and subsamples separating ICs from EMs. The table is divided in two blocks. Block

[10] The results for KPSS tests are available upon requests.

[11] We thank corresponding authors for kindly sharing their dataset.

1 shows our baseline results, and Block 2 shows results obtained with the data expressed as ratios of world gdp.[12] The ARDL lag structure for each country was selected using the Schwartz Bayesian criterion. For the majority of countries, specifications without lagged dependent variables are rejected at conventional levels of statistical significance. Throughout this section, we examine the null hypothesis that there is no error-correction relation between nfa and nx under both the PMG and MG estimators, and use t-statistics to test this hypothesis.

The Full Sample panel in Block 1 of Table 2 shows the main results combining all the countries in our sample. The Hausmann h-statistic test cannot reject the slope homogeneity restriction, indicating that the PMG estimator is preferred to the MG estimator. The PMG estimates of the long-run response coefficient show a negative and statistically signficant response of nx to nfa. A reduction (increase) of one percentage point in nfa rises (lowers) nx by 0.07 percentage points. The estimated error correction coefficient of 0.31 (in absolute value) indicates that the adjustment of nx to a given change in nfa has an average half-life of just over 1.75 years. Overall, these results for the full sample indicate that PB3 and the external solvency conditions hold.

The IC and EM panels of Block 1 in Table 2 show that the results of MG and PMG estimation splitting the sample according to whether countries are industrialized or emerging economies also support the hypothesis that PB3 holds. The null hypothesis of no error-correction relation between nx and nfa is rejected in both the IC and EM groups. The h-test indicates that PMG dominates MG for both the IC and EM groups. Comparing across the two groups, we find that the long-run response coefficient is higher in EMs than in ICs (-0.085 v. -0.053). Both of these estimates are statistically significant at a 5 percent significance level. The error-correction coefficients imply that the adjustment of nx to changes in nfa is more protracted in ICs, for which the average half-life is about 2.8 years, than in EM, for which the average half-life is $1\frac{1}{2}$ years.[13]

The result indicating that the long-run response coefficient of EMs is about 1.6 times

[12] We also studied the results where only those countries with statistically significant EC coefficients, and intercept terms (as reported in Table 3) are kept in the sample. We found that the results are robust to the sample selection.

[13] The half-life is calculated as $\log(0.5)/\log(1-|EC|)$, where EC denotes the error correction coefficient. The higher is the $|EC|$, the lower is the half-life and the faster is the adjustment.

larger than that for ICs implies that net exports in EMs need to respond more to changes in net foreign assets in order to support external solvency. As suggested earlier, this difference can be attributed to the underdevelopment of financial markets or the severity of the financial frictions that EMs face compared to ICs.

Table 3 shows the long-run nfa positions that each country converges to. In this table, we report the estimates for only those countries with statistically significant EC coefficient (phi) and intercept (mu). The nfa estimates reported in column 5 are calculated using the formula in (8). The column labeled "nfa for constant mu" calculates the implied estimate for nfa in the formula where the intercept term (mu) is set to the value estimated for the whole sample (All). The purpose of this exercise is to illustrate the potential changes in estimated nfa driven solely by the changes in the EC term (phi). Likewise, the last column shows the estimates for nfa when the EC coefficient is fixed at the estimate for the whole sample to illustrate the importance of the intercept term (mu). The main lesson we derive from this exercise is that although the long-run coefficient (rho) is kept the same, there are marked variations in long-run nfa estimates that each country converges to. The large changes in these estimates are driven by differences in the EC and intercept terms, which, in turn, is affected by the structural differences across countries.

Figures 4a-b illustrate the impulse responses functions of nfa and nx when the economy is subject to a one-standard-deviation noise shock (figures are shown for only a selected set of countries reported in Table 3 due to space limitations). These impulse responses are calculated using the PMG estimates reported in Tables 4, and setting the initial nfa and nx positions to their long-run values that they converge to. The main finding is that although nx can converge back to its long-run equilibrium faster, the adjustment of nfa (i.e., the stock imbalance) can persist much longer. The convergence of the nfa positions to their long-run values in our sample takes from about 10 years up to 50 years. Our exercise also illustrate that although the long-run coefficients are common across EMs and ICs, there is marked variation among countries in their convergence. This exercise affirms that the framework preserves the heterogeneity across countries on how they respond to similar shocks. This heterogeneity arises due to structural differences among these countries as mentioned earlier.

3.2 Robustness

We study next the robustness of our results to the representation of the data. To do so, we study how our results change when we use an alternative representation of the data in which the NX and NFA series are normalized using world GDP instead of country-specific GDPs (Block 2, Table 2). In the latter exercise, the world GDP is simply the sum of the respective GDPs of the countries in the sample, each expressed in U.S. dollars. The purpose of this exercise is to explore if the baseline results are altered by relative country size and by restrictions that force global market clearing.

In Block 2, the results for the Full Sample panel show that again the Hausman h-test indicates that the cross-country slope homogeneity restriction cannot be rejected, albeit marginally, and that the PMG estimate of the response coefficient (-0.08) must be chosen over the MG estimator. Moreover, the average half-life of adjustment to the long-run relationship in this scenario is $1\frac{3}{4}$ years. These results are very similar to those obtained using the standard nx and nfa measures based on country GDPs.

The results for the IC panel with world gdp ratios are also similar to those obtained with country gdp ratios, but the results for the EM panel are different. The Hausmann h-test cannot reject the long-run homogeneity condition for ICs, which implies that the PMG estimate of -0.057 is preferred to the MG estimator. In addition, the average half life for this country group is 2.6 years. Both of these estimates are very similar to those reported using country gdp ratios. For EMs, however, the Hausmann h-test suggests that the hypothesis of long-run homogeneity should be rejected and that the MG estimate of -0.235 should be chosen. This estimate is almost 3 times larger than the one reported earlier. In contrast, the average half-life is estimated at 1.2 years, which is slightly lower than the one reported earlier.

The next robustness test explores the implications of splitting the sample into creditor countries (also called "High NFA" countries) and debtor ("Low NFA") countries. Creditor (debtor) countries are defined as those with above (below) median nfa using each country's GDP.[14] The results of the dynamic panel estimation are shown in Panel 1 of Table 4. For creditors, the Hausmann h-test cannot reject the cross-country homogeneity restriction and,

[14]The list of countries pertaining to each group is available on request.

thus, indicates that the PMG estimate of -0.095 should be preferred. The average half-life for this group is estimated at 1.94 years. For debtors, the Hausmann h-test indicates that the cross-country homogeneity restriction cannot be rejected and that the PMG estimate of -0.061 is preferred. The average half-life for this group of countries is estimated at 1.6 years. In summary, these findings suggest that in terms of its implications for sustainability, there is no significant behavioral difference between creditor and debtor countries. However, in terms of long-run nfa positions these countries converge to creditor countries will converge to higher nfa positions than debtor countries in the long-run.

Next, we explore the importance of trade openness (panel 2, Table 4). Those countries with a volume of trade as a share of GDP higher than the volume for the median country are treated as more open economies, and the rest is treated as less open economies. For both groups, the long-run homogeneity restriction cannot be rejected. The implied PMG estimates are -0.070 (with half life 2.2 years) and -0.065 (with half life 1.4 years) for more open and less open economies, respectively, suggesting that there is no significant difference between these two groups.

We also explore the importance of institutional quality, financial sector development, and capital account openness as shown in panels 3-5, respectively. In all these cases, Hausmann test cannot reject the long-run homogeneity restriction so that the PMG should be the preferred method. These results mainly show that the countries with relatively weaker fundamentals (i.e., less institutional quality, less financial sector development, and less open to capital) need to respond more strongly to the changes in NFA to keep them on a sustainable path (notice that implied PMG estimates for the long-run coefficient is more negative for these groups compared to their counterparts with stronger fundamentals). However, our baseline findings regarding the sustainability of imbalances are preserved in all these cases.

4 Conclusion

This paper explored whether external solvency conditions hold in existing cross-country data on trade balances and net foreign assets, which largely reflects the recent episode of large and growing global imbalances. We conducted external solvency tests for a panel of 21 industrial and 30 emerging market countries during the 1970-2004 period.

Our solvency tests are based on two propositions postulated by Bohn (2007). The first proposition shows that solvency is satisfied if NFA are integrated of any finite order. When we tested this proposition, we found that we could not reject the presence of unit roots in nfa in levels in all of the countries in our sample, but that unit roots are rejected for the first-differences of nfa in virtually all the countries.

Bohn's second proposition shows that solvency holds if NFA and NX are linked by an error-correction reaction function. Using dynamic panel estimation methods, we found that a statistically significant error-correction relationship between those two series does exist in the data. In particular, we found a systematic, negative long-run response of nx to changes in nfa. Comparing industrial and emerging countries, we found that the response coefficient of the latter is higher, and that as a result emerging economies converge to higher long-run averages of nfa than industrial countries.

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Appendix I: Derivation of the PMG equation

Following Pesaran et al. (1999), we can nest the relationship in eq. 5 in an auto-regressive distributed lag (ARDL) model in which dependent and independent variables enter the right-hand-side of the model with lags of order p and q, respectively:

$$nx_{i,t} = \mu_i + \sum_{j=1}^{p} \lambda_{i,j} nx_{i,t-j} + \sum_{l=0}^{q} \delta'_{i,l} nfa_{i,t-l} + \varepsilon_{i,t},$$

where $nx_{i,t}$ and $nfa_{i,t}$ denote the net exports-GDP and NFA-GDP ratios in country i at time t respectively, and μ_i denotes country-specific fixed effects. ε is a set of normally distributed error terms with country-specific variances, $\text{var}(\varepsilon_{it}) = \sigma_i^2$.

Using the following identity in the left-hand side of the equation $nx_{i,t} = nx_{i,t-1} + \Delta nx_{i,t}$; and the following identities in the right-hand side of the equation $nx_{i,t-1} = nx_{i,t} - \Delta nx_{i,t}$ and $nfa_{i,t-1} = nfa_{i,t} - \Delta nfa_{i,t}$; the above equation can be rewriten as follows:

$$\begin{aligned} nx_{i,t-1} + \Delta nx_{i,t} = \mu_i + \lambda_{i,1} nx_{i,t-1} + \delta_{i,0} nfa_{i,t} + \sum_{j=2}^{p} \lambda_{i,j} [nx_{i,t-j+1} - \Delta nx_{i,t-j+1}] \\ + \sum_{l=1}^{q} \delta_{i,l} [nfa_{i,t-l+1} - \Delta nfa_{i,t-l+1}] + \varepsilon_{i,t}, \end{aligned}$$

or

$$\begin{aligned} \Delta nx_{i,t} = \mu_i - (1 - \lambda_{i,1} - \lambda_{i,2}...) nx_{i,t-1} + (\delta_{i,0} + \delta_{i,1} + ...) nfa_{i,t} - (\lambda_{i,2} \\ + \lambda_{i,3} + ...) \Delta nx_{i,t-1} - (\lambda_{i,3} + \lambda_{i,4} + ...) \Delta nx_{i,t-2} - ... \\ - (\delta_{i,2} + \delta_{i,3} + ...) \Delta nfa_{i,t-1} - (\delta_{i,3} + \delta_{i,4} + ...) \Delta nfa_{i,t-2} - ... + \varepsilon_{i,t}, \end{aligned}$$

or

$$\Delta nx_{i,t} = \mu_i + \phi_i nx_{i,t-1} + \varphi_i nfa_{i,t} + \sum_{j=1}^{p-1} \lambda^*_{i,j} \Delta nx_{i,t-j} + \sum_{l=0}^{q-1} \delta^*_{i,l} \Delta nfa_{i,t-l} + \varepsilon_{i,t},$$

where $\phi_i = -(1 - \sum_{j=1}^{p} \lambda_{i,h})$, $\varphi_i = \sum_{j=0}^{p} \delta_{i,j}$, $\lambda^*_{i,j} = -\sum_{m=j+1}^{p} \lambda_{i,m}$, $\delta^*_{i,l} = -\sum_{m=l+1}^{q} \delta_{i,m}$, with $j = 1, 2, ..., p-1$, and $l = 1, 2, ..., q-1$.

To highlight the long-run relationship, the above equation can be rearranged as:

$$\Delta nx_{i,t} = \mu_i + \phi_i[nx_{i,t-1} - \rho_i nfa_{i,t}] + \sum_{j=1}^{p-1} \lambda^*_{i,j} \Delta nx_{i,t-j} + \sum_{l=0}^{q-1} \delta^*_{i,l} \Delta nfa_{i,t-l} + \varepsilon_{i,t},$$

where $\rho_i = -\phi_i^{-1}\varphi_i$ denotes the long-run equilibrium relationship between nx and nfa, and ϕ_i denotes the speed at which NX adjust toward their long-run equilibrium following a change in NFA.

Appendix II: Sample of Countries

The sample comprises 21 industrial countries and 30 emerging markets.

Industrial Countries: Australia (AUS), Austria (AUT), Belgium (BEL), Canada (CAN), Denmark (DNK), Finland (FIN), France (FRA), Germany (DEU), Greece (GRC), Ireland (IRL), Italy (ITA), Japan (JPN), Netherlands (NLD), New Zealand (NZL), Norway (NOR), Portugal (PRT), Spain (ESP), Sweden (SWE), Switzerland (CHE), United Kingdom (GBR), United States (USA).

Emerging Markets: Argentina (ARG), Brazil (BRA), Chile (CHL), China (CHN), Colombia (COL), Costa Rica (CRI), Ecuador (ECU), Egypt (EGY), El Salvador (SLV), Hong Kong (HKG), Hungary (HUN), India (IND), Indonesia (IDN), Israel (ISR), Jordan (JOR), Korea (KOR), Malaysia (MYS), Mexico (MEX), Morocco (MAR), Pakistan (PAK), Peru (PER), Philippines (PHL), Saudi Arab (SAU), Singapore (SGP), South Africa (ZAF), Thailand (THA), Turkey (TUR), Uruguay (URY), Venezuela (VEN).

Figure 1a. Current Account Balances

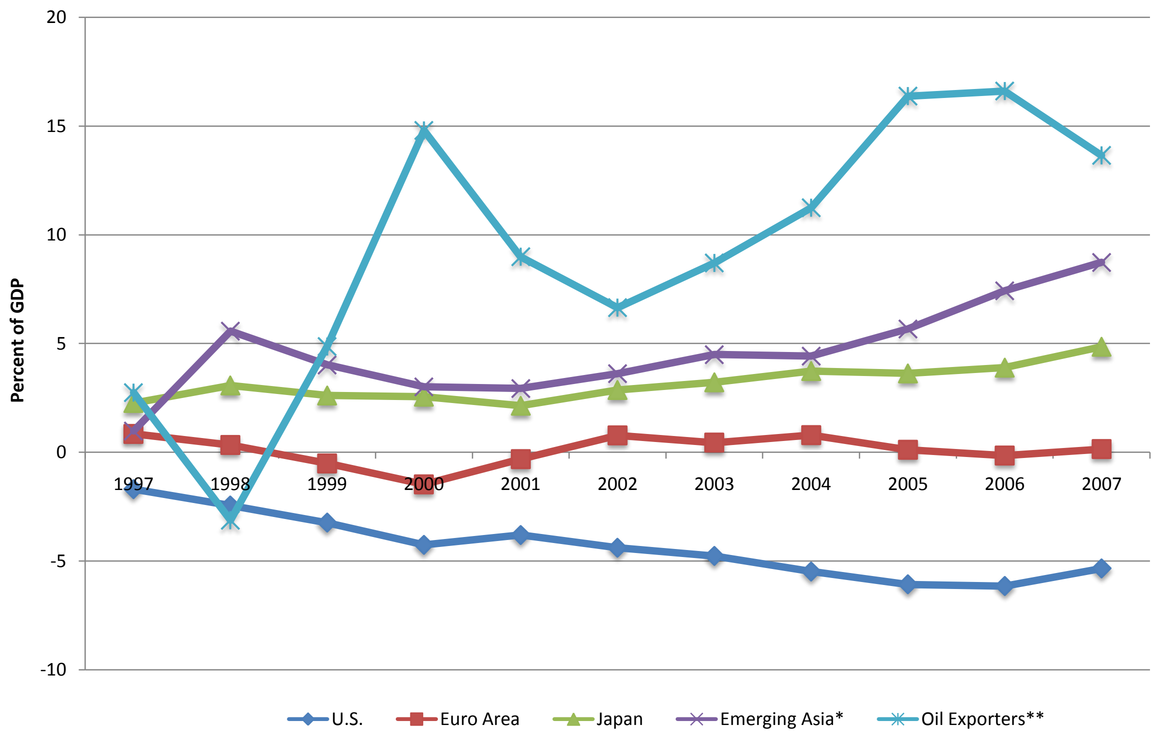
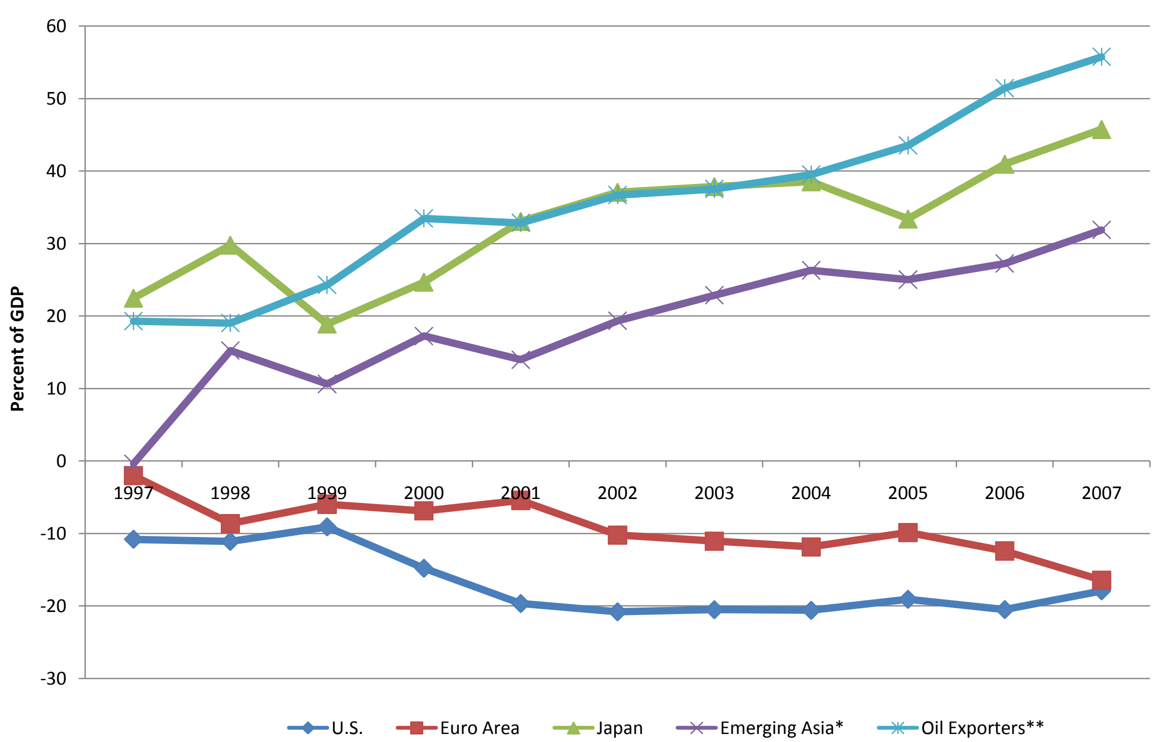


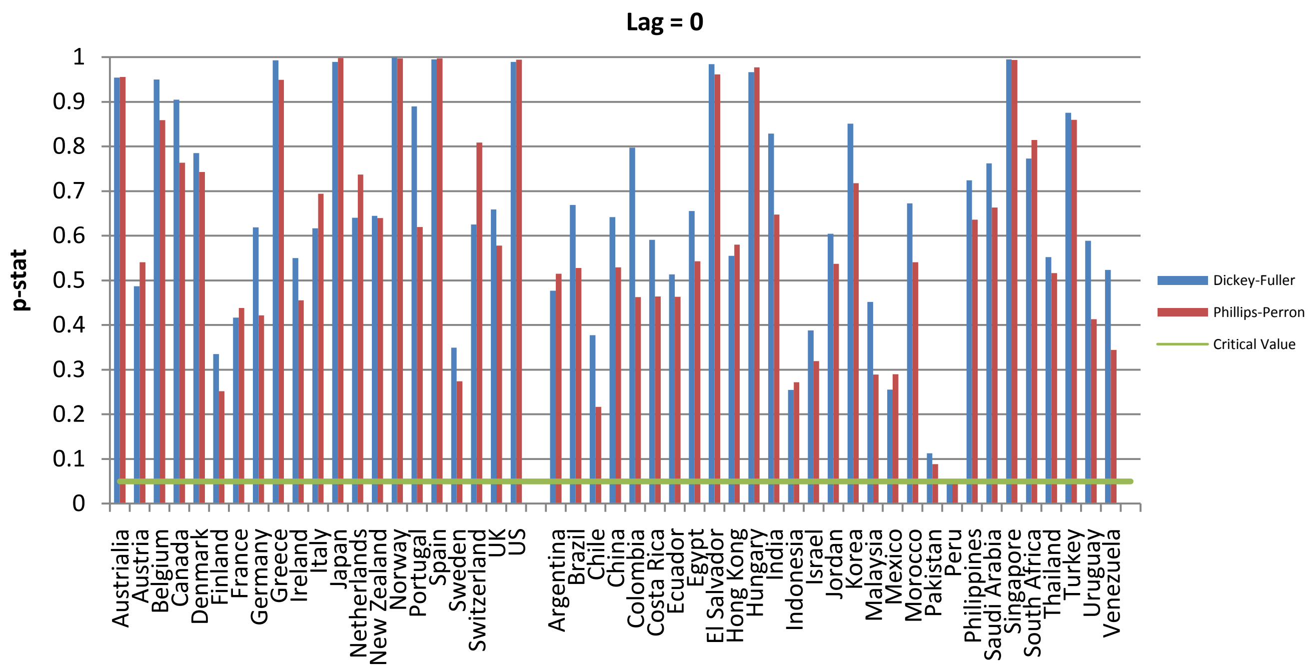
Figure 1b. Net Foreign Assets



* China, Hong Kong, Indonesia, Korea, Malaysia, Philippines, Singapore, Taiwan and Thailand.

** Algeria, Angola, Azerbaijan, Bahrain, Rep. of Congo, Ecuador, Equatorial Guinea, Gabon, Iran, Kuwait, Libya, Nigeria, Norway, Oman, Qatar, Russia, Saudi Arabia, Syria, Turkmenistan, UAE, Venezuela and Yemen

Figure 2. The Order of Intergration of Net Foreign Assets Positions



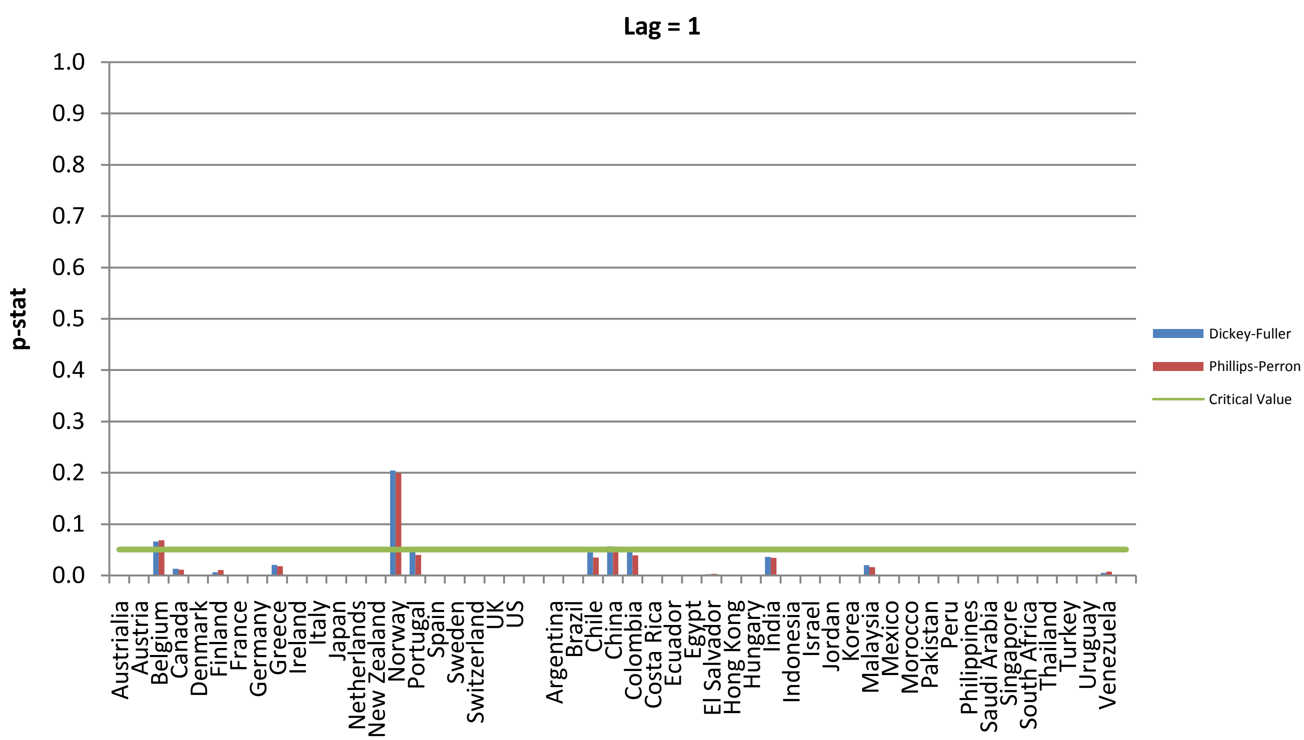


Figure 3. The Estimated AR(1) Coefficients

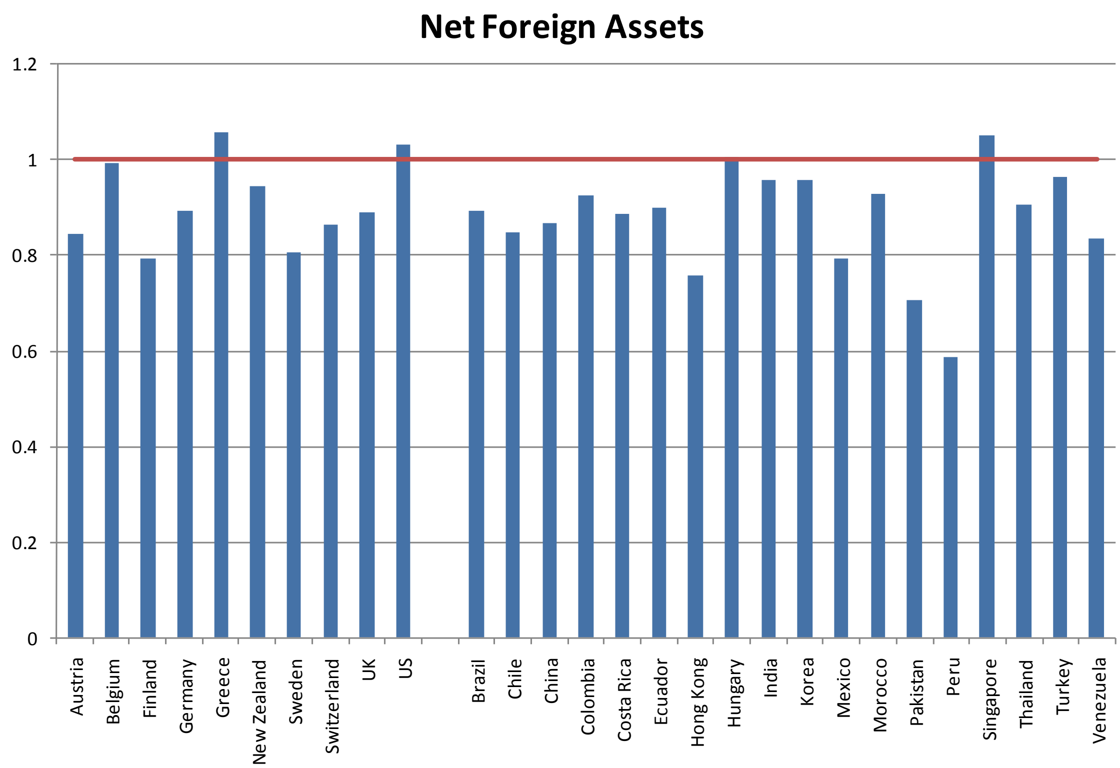


Figure 4a. Impulse Responses to a One-Standard-Deviation
Noise Shock: Selected Industrial Countries

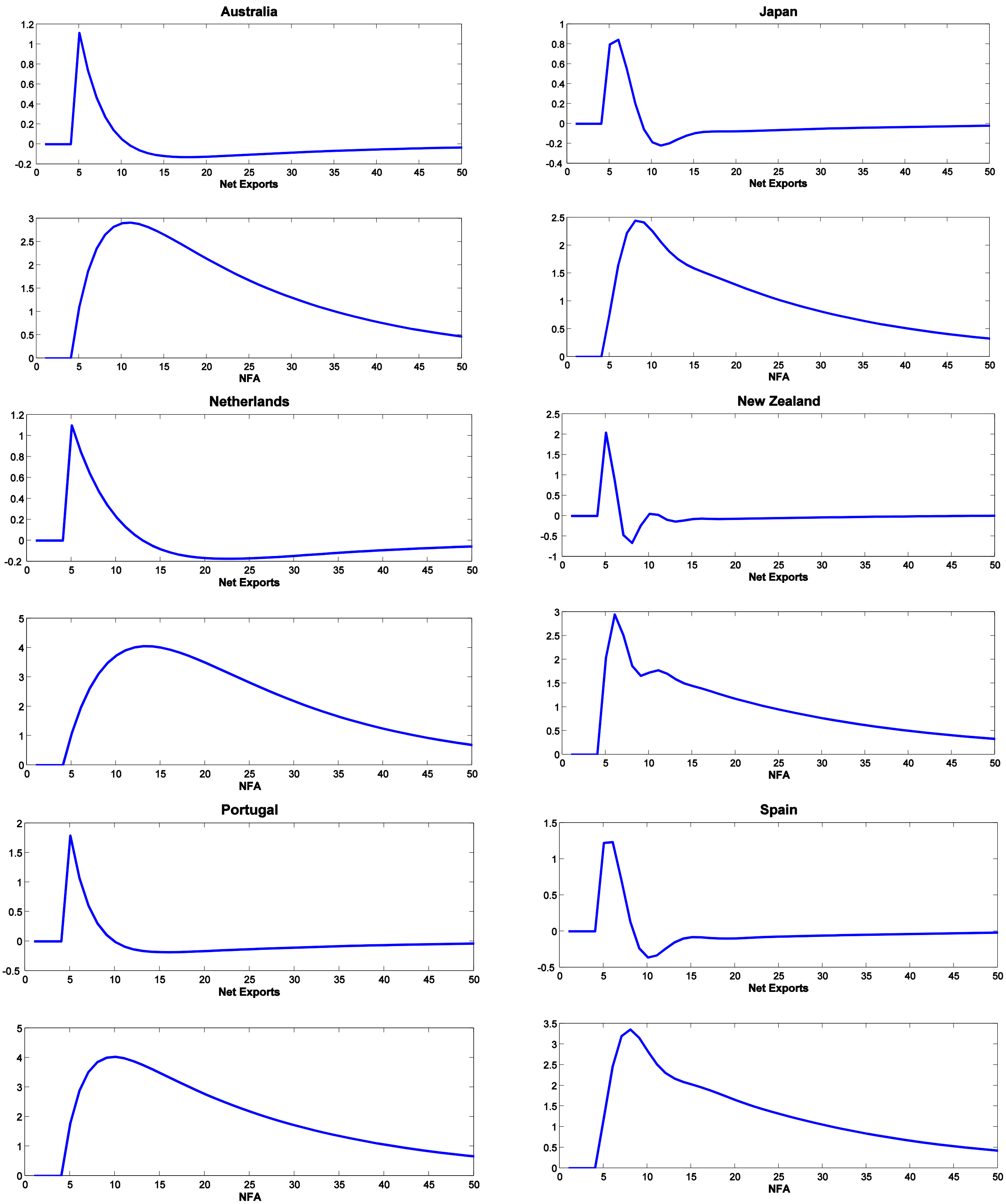


Figure 4b. Impulse Responses to a One-Standard-Deviation Noise Shock: Selected Emerging Markets

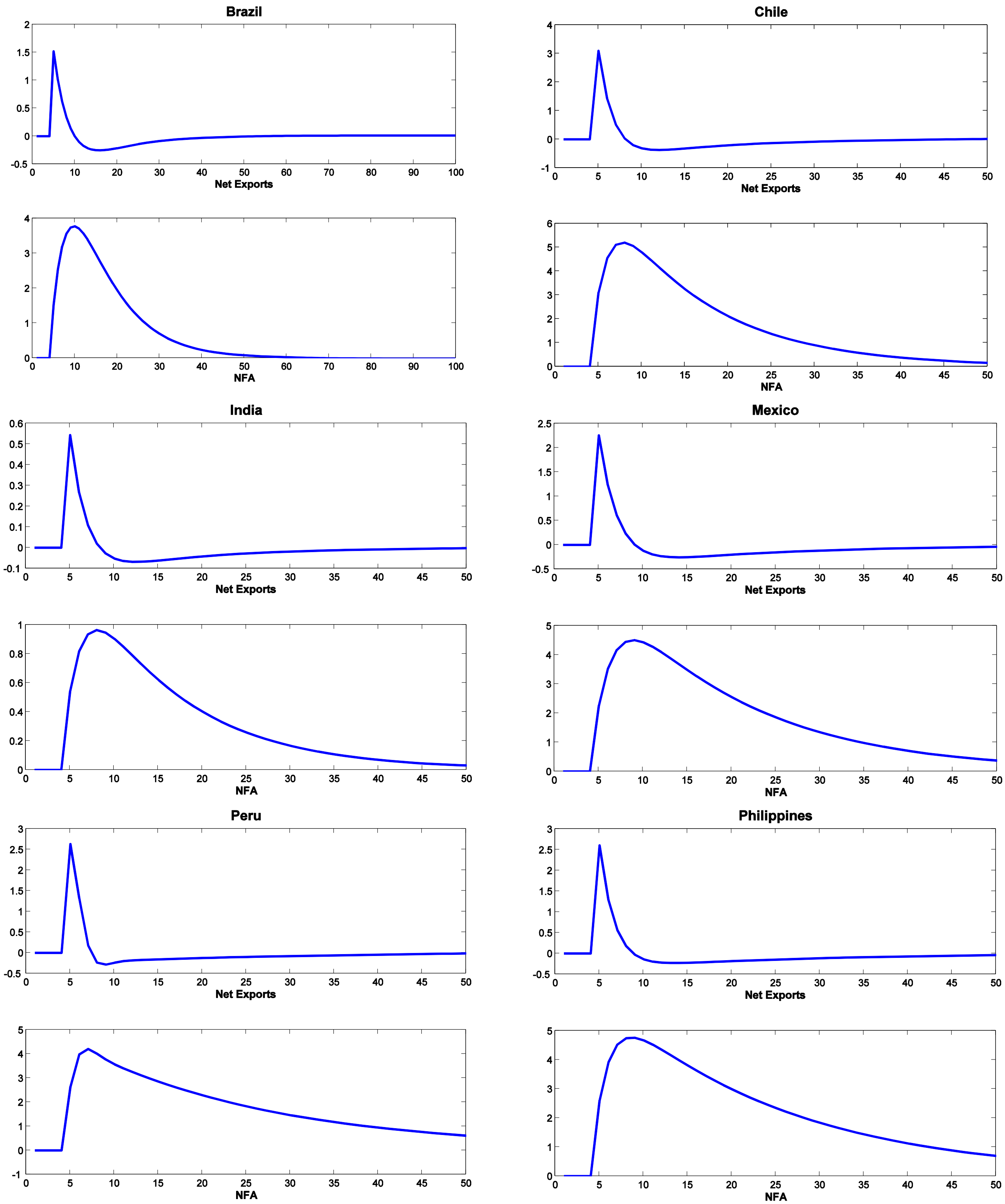


Table 1. Sample Statistics
Period 1970-2004

	All	Industrial Countries	Emerging Market Economies
1. Net exports (% of GDP)			
Mean	-0.872	0.182	-1.637
Median	-0.518	0.196	-1.380
Bottom quartile	-3.640	-1.910	-5.290
Top quartile	2.410	2.430	2.410
Standard deviation	8.367	4.640	10.192
Number of observations	1742	733	1009
Number of countries	50	21	29
2. Net foreign assets (% of GDP)			
Mean	-17.922	-9.195	-24.429
Median	-20.831	-10.021	-31.037
Bottom quartile	-40.105	-25.303	-47.638
Top quartile	-3.997	4.775	-13.497
Standard deviation	43.021	35.082	47.071
Number of observations	1716	733	983
Number of countries	50	21	29

Table 2. Dynamic Panel Estimates of Net Exports on Net Foreign Assets
(1970-2004 period)

	Full Sample		Industrial Countries		Emerging Markets	
	MG	PMG	MG	PMG	MG	PMG
1. As a Percent of Country GDP						
LR Coefficient	-0.186**	-0.068***	-0.243	-0.053***	-0.144***	-0.085***
	[0.084]	[0.008]	[0.194]	[0.011]	[0.039]	[0.012]
EC Coefficient	-0.357***	-0.311***	-0.284***	-0.219***	-0.409***	-0.383***
	[0.035]	[0.037]	[0.045]	[0.043]	[0.050]	[0.052]
Hausman Statistics		1.99		0.97		2.61
p-value		[0.33]		[0.33]		[0.11]
Number of countries	50	50	21	21	29	29
2. As a Percent of World GDP^						
LR Coefficient	-0.491	-0.078***	-0.871	-0.056***	-0.225***	-0.093***
	[0.336]	[0.009]	[0.813]	[0.013]	[0.068]	[0.012]
EC Coefficient	-0.377***	-0.329***	-0.290***	-0.299***	-0.438***	-0.406***
	[0.039]	[0.041]	[0.048]	[0.046]	[0.056]	[0.058]
Hausman Statistics		1.52		1.00		3.95
p-value		[0.22]		[0.32]		[0.05]
Number of countries	51	51	21	21	30	30

Note: The symbols *, ** and *** indicate statistical significance at the 10%, 5% and 1%, levels, respectively. Standard errors are reported in brackets. The Hausman statistic refers to the test statistic on the long-run homogeneity restriction. The maximum number of lags considered in the estimation is 2.

^Includes the Rest of the World, which is created as the negative of the global external imbalances. The World Output is the sum of the outputs of industrial and emerging market countries in our sample.

Table 3. Long-run NFA

Countries	rho	phi	mu	nfa	nfa for constant mu	nfa for constant phi
Industrial Countries						
Australia	-0.053	-0.322***	-1.080**	-45.961	-10.462	-67.599
Japan	-0.053	-0.337***	0.685***	27.840	-9.997	42.854
Netherlands	-0.053	-0.216**	1.109**	70.324	-15.587	69.425
New Zealand	-0.053	-0.889***	-3.386***	-52.150	-3.788	-211.816
Portugal	-0.053	-0.380***	-3.919***	-141.020	-8.852	-245.143
Spain	-0.053	-0.395***	-0.89***	-31.114	-8.529	-56.133
All	-0.053	-0.219***	-0.246**	-15.388	-15.388	-15.388
Emerging Markets						
Brazil	-0.085	-0.313***	-0.748*	-22.746	-33.762	-18.612
Chile	-0.085	-0.499***	-1.582*	-30.159	-21.179	-39.341
Costa Rica	-0.085	-0.409***	-3.428***	-79.728	-25.839	-85.244
Hong Kong	-0.085	-0.117**	1.682*	136.972	-90.435	41.843
Hungary	-0.085	-0.324**	-1.991**	-58.494	-32.637	-49.514
India	-0.085	-0.468***	-1.320***	-26.836	-22.580	-32.834
Jordan	-0.085	-0.209*	-6.936*	-315.912	-50.602	-172.473
Mexico	-0.085	-0.315**	-1.117*	-33.747	-33.548	-27.791
Morocco	-0.085	-0.275***	-3.317***	-114.531	-38.351	-82.504
Peru	-0.085	-0.349***	-2.271**	-61.974	-30.309	-56.489
Philippines	-0.085	-0.282**	-2.456**	-82.851	-37.468	-61.089
All	-0.085	-0.383***	-1.111**	-27.627	-27.627	-27.627

Note: The table shows the long-run NFA positions that the PMG model converges to for the countries with significant phi an mu. The last two columns illustrate the respective implied NFA positions if the EC coefficient and intercept terms were kept constant at the value estimated for the whole sample.

Table 4. Dynamic Panel Estimates of Net Exports on Net Foreign Assets
(As percent of GDP, 1970-2004 period)

	1. Debtor vs. Creditor				2. Trade Openness				3. Institutional Quality			
	Debtor Economies		Creditor Economies		Less Open Economies		More Open Economies		More Institutional Quality		Less Institutional Quality	
	MG	PMG	MG	PMG	MG	PMG	MG	PMG	MG	PMG	MG	PMG
LR Coefficient	-0.285*	-0.061***	-0.087**	-0.095***	-0.104**	-0.065***	-0.267	-0.070***	-0.224	-0.055***	-0.147***	-0.083***
	[0.162]	[0.010]	[0.039]	[0.016]	[0.041]	[0.012]	[0.163]	[0.012]	[0.164]	[0.011]	[0.041]	[0.012]
EC Coefficient	-0.349***	-0.315***	-0.364***	-0.300***	-0.488***	-0.404***	-0.266***	-0.218***	-0.287***	-0.226***	-0.427***	-0.403***
	[0.046]	[0.046]	[0.055]	[0.059]	[0.056]	[0.061]	[0.036]	[0.033]	[0.040]	[0.039]	[0.056]	[0.058]
Hausman Statistics		1.91		0.05		0.99		1.48		1.06		2.79
p-value		[0.17]		[0.82]		[0.32]		[0.22]		[0.30]		[0.09]
Number of countries	25	25	25	25	25	25	25	25	25	25	25	25

	4. Financial Sector Development				5. Capital Account Openness			
	More Financial Sector Dev.		Less Financial Sector Dev.		More Open to Capital		Less Open to Capital	
	MG	PMG	MG	PMG	MG	PMG	MG	PMG
LR Coefficient	-0.235	-0.063***	-0.137***	-0.074***	-0.230	-0.054***	-0.141***	-0.085***
	[0.164]	[0.011]	[0.041]	[0.012]	[0.164]	[0.011]	[0.040]	[0.013]
EC Coefficient	-0.280***	-0.226***	-0.434***	-0.397***	-0.299***	-0.240***	-0.414***	-0.386***
	[0.036]	[0.037]	[0.058]	[0.060]	[0.049]	[0.049]	[0.049]	[0.052]
Hausman Statistics		1.11		2.56		1.16		2.16
p-value		[0.29]		[0.11]		[0.28]		[0.14]
Number of countries	25	25	25	25	25	25	25	25

Note: The symbols *, ** and *** indicate statistical significance at the 10%, 5% and 1%, levels, respectively. Standard errors are reported in brackets. The Hausman statistic refers to the test statistic on the long-run homogeneity restriction. The maximum number of lags considered in the estimation is 2.