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# Net Foreign Assets and Current Account Balances

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## **Abstract**

Theory predicts a negative long-run equilibrium relationship between net foreign assets and net exports (the trade balance plus net transfers). In a large sample of countries back to 1971, the data are found to be consistent with this provided that the short-run dynamics are allowed to vary across countries. By contrast, the correlation between net foreign assets and net exports in a given year tends to be positive in most years. The correlation between net foreign assets and the current account balance shows a similar pattern: negative in time series but positive in cross-section. Shocks to relative prices and cycles in international lending prevent the world from settling on an equilibrium for any length of time.

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## 1 Introduction

This paper investigates the relationship between net foreign asset positions and current account balances in the post-Bretton Wood era, using annual data for a large number of countries. In theory, countries which have a large stock of foreign assets relative to their foreign liabilities should have a positive balance on their property income flows, which would tend to pull up their real exchange rate and cause the trade balance to deteriorate. If that does not happen, the country will accumulate yet more foreign assets. In a full stock equilibrium, the ratio of net foreign assets (NFA) to GDP is constant, so in equilibrium countries with a higher ratio of net foreign assets to GDP should have higher real exchange rates and worse net exports (trade balance plus net transfers, sometimes also referred to as the primary balance). A similar negative relationship should hold in long-run equilibrium between net property income flows and net exports, at least provided that the distribution of returns between income and capital appreciation is not too dissimilar across countries. As regards the current account balance as a whole, the sign of the equilibrium relationship between it and net foreign assets is theoretically ambiguous, which suggests that current account imbalances should be limited in size and not particularly correlated with net foreign asset positions.

This paper tests these propositions in a large panel of annual cross-country data. Both the time-series and the cross-section dimensions are of interest. If the negative relationship between NFA and net exports holds across countries in a particular year, that suggests that the world is close to a stock equilibrium in that year; if it holds for individual countries across time, the implication is that net foreign asset positions are sustainable in the sense that they are not on a path towards plus or minus infinity.

The paper reveals consistent and in some cases surprising features of the data. Provided that we allow the dynamics of adjustment to vary across countries (which greatly improves the

fit of the model to the data), net foreign assets and net exports are strongly negatively correlated in individual countries across time. Thus net foreign asset positions appear to be sustainable in the long run. Across countries, however, the picture is very different: net exports are positively correlated with net foreign assets in most years, reflecting the importance and persistence of price and credit shocks in the world economy.

The paper is structured as follows. Section Two contains some theory and a literature review. Preliminary data analysis appears in Section Three, and the main empirical results are presented in Section Four. Section Five concludes.

## 2 Theory and Literature Review

The following identity determines the dynamics of net foreign assets:

$$NFA_t = (1 + r)NFA_{t-1} + NX_t + VE_t \quad (1)$$

where  $NFA_t$  denotes net foreign assets at the end of period  $t$ ;  $r$  is the rate of return on these assets;  $NX$  is net exports; and  $VE$  is the valuation effect of exchange rate movements.<sup>1</sup> Converting this identity to a ratio of gross domestic product ( $Y$ ), which grows at a rate  $g_t$ , equation (1) becomes:

$$\left(\frac{NFA}{Y}\right)_t = \left(\frac{1+r}{1+g}\right)_t \left(\frac{NFA}{Y}\right)_{t-1} + \left(\frac{NX}{Y}\right)_t + \left(\frac{VE}{Y}\right)_t \quad (2)$$

In the long-run steady state the ratio of  $NFA$  to  $GDP$  is constant, and  $VE$  is zero, so in long-run equilibrium:

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<sup>1</sup> Throughout this article net exports will mean all elements of the current account balance other than net property income, so it includes remittances and transfers as well as net trade in goods and services.

$$\left(\frac{r-g}{1+g}\right) \left(\frac{NFA}{Y}\right)_{t-1} = -\left(\frac{NX}{Y}\right)_t \quad (3)$$

Defining the flow of income from net financial assets as net property income (NPI), and  $r_{1t}$  and  $r_{2t}$  as respectively the income and capital returns on these net assets during period  $t$ , equation (3) also implies that

$$\left(\frac{NPI}{Y}\right)_t = \left(\frac{r_1}{1+g}\right) \left(\frac{NFA}{Y}\right)_{t-1} = -\left(\frac{r_1}{r_1+r_2-g}\right) \left(\frac{NX}{Y}\right)_t \quad (4)$$

or

$$\left(\frac{r_1+r_2-g}{r_1}\right) \left(\frac{NPI}{Y}\right)_t = -\left(\frac{NX}{Y}\right)_t \quad (5)$$

Equation (5) shows that the two elements of the current account will have opposite signs in long-run equilibrium, provided that the no-Ponzi condition of  $r_1 + r_2 > g$  holds. The sign of the relationship between the current account balance and net foreign assets depends on the relative sizes of  $r_1$  and  $r_2$ :

$$\left(\frac{CA}{Y}\right) = \left(\frac{NX}{Y}\right) + \left(\frac{NPI}{Y}\right) = \left(\frac{g-r_2}{1+g}\right) \left(\frac{NFA}{Y}\right) \quad (6)$$

This will be positive or negative depending on whether  $g$  is greater or less than  $r_2$ , i.e. whether the return on assets consists largely of an income flow (as with nominal bonds), in which case  $r_2$  is small, or of capital gains, so that  $r_2$  is large.

These equilibrium relationships are only stable provided that  $r_1$ ,  $r_2$  and  $g$  are stable across time and space. Clearly that condition is not met: since the financial crisis real interest rates and growth rates have been lower before, and various authors have suggested that the United States earns higher returns on its foreign assets than other countries do (e.g. Hausman and Sturzenegger, 2007), although Curcucu *et al.* (2008) argue that this is true only of direct

rather than portfolio investments.<sup>2</sup> Even if rates of return on cross-border holdings have not differed much between countries, GDP growth rates clearly have.

Assuming that  $r_1 + r_2 > g$ , equation (3) predicts a negative relationship between net foreign assets and net exports. If net exports are largely determined by the real exchange rate, then this implies a positive relationship between net foreign assets and real exchange rates. This positive relationship has largely been confirmed in empirical tests by Lane and Milesi-Ferretti (2004), Christopoulos *et al.* (2012) and Bleaney and Tian (2014), although the evidence is stronger for emerging markets and developing countries than for the industrial countries. Note however that, because the real effective exchange rate is an index, these tests can only exploit the time-series dimension of the data: that is, they ask whether a country's real exchange rate increases with its net foreign assets, and not whether at a given date a country that has more net foreign assets than another has a higher real exchange rate.

In work that is quite closely related to ours, Durdu et al. (2013) offer a direct test of the relationship between the trade balance and net foreign assets. They refer to the series as “net exports” rather than the trade balance, but a remark in the NBER Working Paper version makes it clear that they mean by this the trade balance, and not the primary balance, even though the theory implies that the transfers element should not be ignored. The point is not a trivial one since, as Table 1 shows, net transfers can be quite large.<sup>3</sup> Using data for 50 countries back to 1970 (where available), Durdu et al. (2013) estimate separate time-series regressions between the trade balance and net foreign assets as ratios of GDP for each country; they also re-estimate these regressions restricting the long-run coefficients (but not the dynamics) to be identical

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<sup>2</sup> Their point is that data on US net financial assets have from time to time been revised upwards as a result of periodic asset surveys, but even though this may be the effect of higher capital flows than previously estimated, capital flows data have remained unrevised, creating the impression of higher returns.

<sup>3</sup> On page 5 of Durdu et al. (2012), they use the phrase “NX-GDP (or primary balance-GDP)”, clearly meaning that these are different quantities, and they define NX as exports minus imports, with no mention of net income transfers.

across countries, which greatly reduces the standard errors of the coefficients. They find considerable support for their hypothesis in the data, particularly using the second method. Nevertheless, by allowing the intercept term to vary across countries, they only use the time-series dimension of the data. In effect they are not estimating equation (3) as it stands, but a generalization of it that includes a country-specific constant. As Bohn (2007) shows, such a specification is an adequate test of long-run sustainability, since it shows that net exports respond so as to prevent net foreign assets from following an explosive path, but it is in reality equivalent to amending equation (1) by a country-specific shift factor. Inclusion of this shift factor implies that net foreign assets are increasing or decreasing each year by a constant amount in a particular country, for no apparent reason, and that in equilibrium, two countries may have similar net foreign asset positions but quite different net export ratios. In other words, Durdu *et al.* (2013) test a specification that is rather less restrictive than the underlying theory suggests, as well as using the trade balance rather than the whole of net exports.

Also relevant is the work of Chinn and Prasad (2003), who estimate a cross-country regression for the average current account balance (as a ratio of GDP) over the period 1971 to 1995 for 89 countries. Since the ratio of net foreign assets to GDP is one of the regressors, this is like estimating an extended version of equation (6). They find a significant positive coefficient for net foreign assets, both in the cross-country regression using time-averaged data and when they split the time period up into five-year or annual intervals and estimate a panel regression. Chinn *et al.* (2014) estimate a similar panel regression with more recent data and confirm this result, as do Gruber and Kamin (2007).

Unlike previous research, we investigate the relationship between net foreign assets and net exports (the current account minus net property income), and we do so in both the time-series and cross-section dimensions. To estimate the long-run relationship between net exports

and net foreign assets, we use an error-correction model on a panel of annual data that takes the form:

$$\Delta \left( \frac{NX}{GDP} \right)_{it} = a(i, t) + b \Delta \left( \frac{NFA}{GDP} \right)_{it-1} - c \left( \frac{NX}{GDP} \right)_{it-1} + e \left( \frac{NFA}{GDP} \right)_{it-2} + u_{it} \quad (7)$$

where  $\Delta$  is the first difference operator,  $i$  represents countries and  $t$  time,  $a$ ,  $b$ ,  $c$  and  $e$  are parameters to be estimated, and  $u$  is a random error term. The existence of a long-run relationship requires  $c > 0$ ; and the estimated long-run effect of  $NFA$  on  $NX$  is  $\hat{e}/\hat{c}$ . We consider three different variants of the intercept term  $a(i, t)$ :

- (1) Pooled Ordinary Least Squares (OLS):  $a(i, t) = a$ ;
- (2) Pooled OLS with time dummies:  $a(i, t) = a_t$ ; and
- (3) Fixed country effects with time dummies:  $a(i, t) = a_t + v_i$ .

Pooled OLS gives equal weight to the cross-section and the time-series relationships in the data, whereas fixed country effects allow the cross-section and time-series relationships to differ by introducing a country-specific intercept. In practice we do not report results for variants (1) and (2), since they turn out to be very similar to the results for variant (3). However, in order to investigate the time-series and cross-section dimensions more deeply, we also estimate equation (7) as a time-series relationship for individual countries, and we examine graphically the correlation between  $NFA$  and  $NX$  across countries in individual years.

We then estimate similar regressions with  $NFA$  replaced by net property income, as a test of equation (4). Finally, we estimate a similar error-correction model to equation (7) for the current account as a share of GDP.



### 3 Preliminary Data Analysis

Except where otherwise indicated, data are taken from the World Bank World Development Indicators (WDI) database. Data on net foreign assets from 1971 to 2011 are from the updated version of the Lane and Shambaugh (2010) data set, and these are supplemented for later years by IMF *International Financial Statistics* data on international investment positions.<sup>4</sup> The countries in the sample are listed in the Appendix and are divided into five groups: (a) industrial, (b) fuel-exporters; (c) offshore financial centres; (d) emerging markets; and (e) other developing countries. Industrial countries and fuel-exporters are taken from IMF Direction of Trade Statistics, offshore financial centres from Lane and Milesi-Ferretti (2008) and emerging markets are as listed by Morgan Stanley Capital International.

Table 1 shows some basic statistics on the average country's net foreign asset position and current account balance and its components, all as a share of GDP, for the whole sample and by country group. Fuel-exporting countries have the best current account balance and net asset position, on average, and also the largest standard deviation (both within and between countries) for every variable in the table.

Figure 1 shows the trend of gross foreign assets and liabilities and of absolute net foreign asset positions across the globe (multiplied by ten) both as a share of GDP. Gross assets and liabilities have grown from around 70 percent of GDP on average in 1970 to 700 percent in 2017, with most of the growth occurring in the decade preceding the financial crisis. Absolute net foreign assets grew from about 30 percent of GDP in 1970 to 90 percent in 1989, with most of the growth occurring after 1980, and have since gradually declined to under 70 percent in 2017. Thus the period of rapid growth in cross-border asset holding was not accompanied by a rise in average absolute net positions. As has been much discussed in recent years (e.g. Gourinchas and Rey, 2007; Lane and Shambaugh, 2010), this growth in two-way

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<sup>4</sup> The data are available at <http://www.philiplane.org/EWN.html>.

cross-border asset holdings has significant implications for the adjustment process when there are differences between a country's assets and liabilities in the types of assets held and in their currency denomination. It may also mean that NFA is subject to increasing measurement error, since it is the difference between two increasingly large numbers.

Table 2 shows that the expected relationship between net property income (NPI) and NFA holds in the data: net property income is significantly positively related to foreign asset stocks and negatively related to foreign liabilities for every group of countries. Fuel-exporting economies tend to have particularly high income rates of return on both their assets and be because income rates of return vary significantly across countries and time. Figure 2 shows the cross-country correlation between NPI and lagged NFA by year. Apart from the very early years when there are very few observations, the correlation is always positive, but it has fallen somewhat since the turn of the century. Up to 2000 the correlation was always above 0.6, whereas since then it has usually been less than that, and below 0.3 in two years. Even with data of 100% accuracy, the correlation will not be perfect, but the expansion of cross-border holdings in recent years has no doubt contributed to the trend reduction in the correlation between NPI and lagged NFA because different assets yield different levels of income flow.

Table 1. Basic Statistics (all as a proportion of GDP)

	Mean	SD	Min	Max	SD within	SD Between	No_Obs	No_Cty	T_Avg
Net Foreign Assets									
All countries	-0.296	1.349	-33.141	13.366	0.919	1.018	7698	198	38.88
Advanced	-0.179	0.549	-6.559	2.626	0.445	0.329	1119	27	41.44
FinOffshore	-0.182	1.072	-4.127	13.013	0.740	0.817	1112	30	37.07
Fuel_Econ	0.334	1.881	-5.421	13.366	1.108	1.543	1013	27	37.52
EmMarkets	-0.25	0.317	-1.516	2.004	0.197	0.268	1167	27	43.22
OthDev	-0.584	1.559	-33.141	6.664	1.155	1.087	3287	87	37.78
Net Exports (Trade Balance plus Income Transfers)									
All countries	-0.011	0.110	-2.897	0.666	0.089	0.088	6048	189	32
Advanced	0.006	0.046	-0.176	0.214	0.035	0.033	911	26	35.04
FinOffshore	-0.025	0.113	-0.417	0.557	0.079	0.107	906	28	32.36
Fuel_Econ	0.051	0.194	-2.897	0.621	0.177	0.142	697	25	27.88
EmMarkets	0.014	0.047	-0.163	0.227	0.042	0.023	1010	26	38.85
OthDev	-0.038	0.101	-0.733	0.666	0.082	0.073	2524	84	30.05
Net Property Income									
All countries	-0.023	0.050	-0.542	0.609	0.030	0.049	6084	190	32.02
Advanced	-0.013	0.026	-0.210	0.070	0.019	0.020	930	27	34.44
FinOffshore	-0.03	0.046	-0.222	0.110	0.033	0.040	908	28	32.43
Fuel_Econ	-0.02	0.101	-0.345	0.609	0.050	0.107	698	25	27.92
EmMarkets	-0.028	0.020	-0.121	0.012	0.015	0.014	1010	26	38.85
OthDev	-0.024	0.044	-0.542	0.357	0.028	0.037	2538	84	30.21
Current Account Balance									
All countries	-0.033	0.111	-2.405	0.623	0.085	0.090	6101	189	32.28
Advanced	-0.007	0.051	-0.246	0.162	0.038	0.037	911	26	35.04
FinOffshore	-0.049	0.116	-0.407	0.409	0.079	0.106	929	28	33.18
Fuel_Econ	0.033	0.192	-2.405	0.567	0.163	0.155	705	25	28.2
EmMarkets	-0.014	0.044	-0.258	0.175	0.040	0.022	1012	26	38.92
OthDev	-0.062	0.100	-0.65	0.623	0.082	0.068	2544	84	30.29

Notes. "T\_Average" denotes average number of years per country; SD = standard deviation.

Table 2 – Net Property Income Flows and Gross Foreign Assets and Liabilities

	(1)	(2)	(3)	(4)	(5)	(6)
	All	Industrial	Financial	Fuel	Emerging	Other Dev.
Foreign Assets (-1)	0.021*** (3.25)	0.027*** (5.31)	0.005 (1.20)	0.045*** (3.40)	0.025*** (2.92)	0.028** (2.38)
Foreign Liabilities (-1)	-0.021*** (-3.11)	-0.028*** (-5.39)	-0.005 (-1.11)	-0.048*** (-3.22)	-0.037*** (-4.26)	-0.025*** (-8.29)
Constant	-0.017*** (-4.67)	-0.005** (-2.23)	-0.030*** (-4.90)	-0.018 (-1.43)	-0.013*** (-3.52)	-0.014*** (-3.89)
No. Observations	5937	921	889	691	994	2442
No. Countries	189	27	28	25	26	83
R-Squared	0.19	0.46	0.03	0.34	0.26	0.35
RMSE	0.044	0.019	0.046	0.082	0.017	0.033

Notes. The dependent variable is net property income. All variables are divided by GDP. Figures in brackets are heteroscedasticity-robust t-statistics. \*\*\*, \*\*, \*: significant at 1, 5 and 10 % respectively.

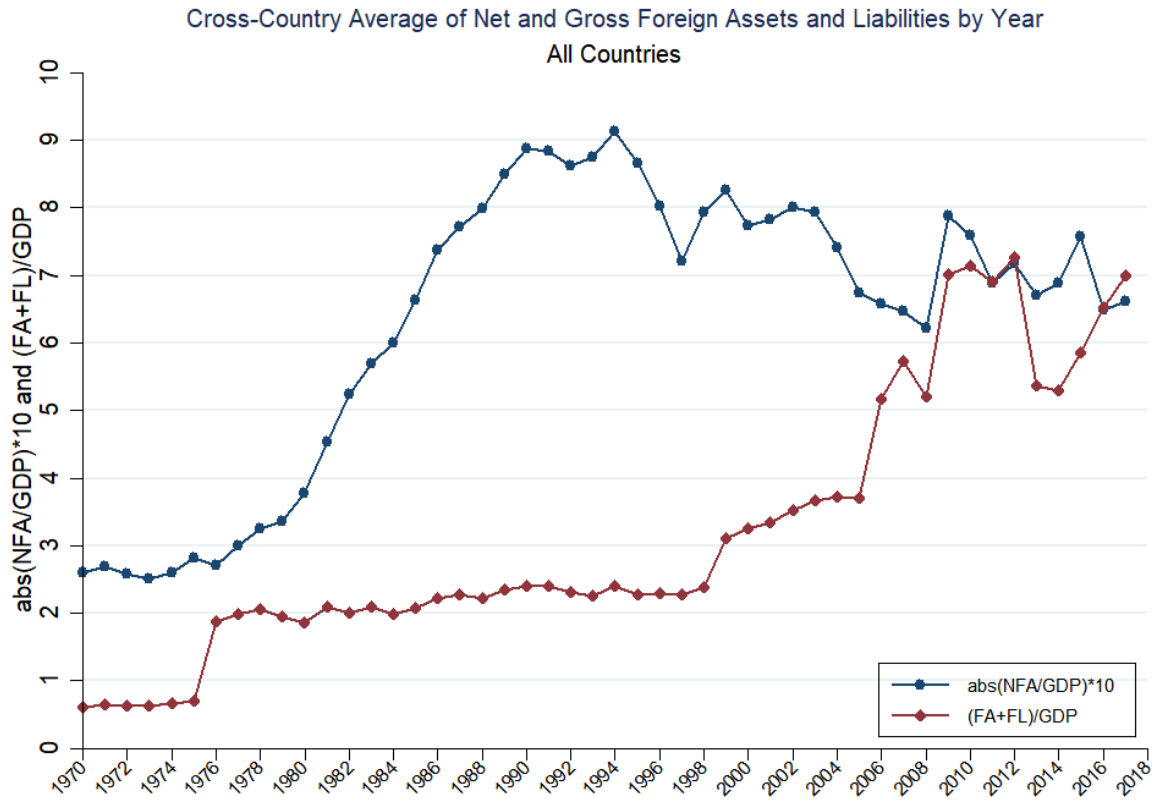


Figure 1. Net and Gross Financial Assets/GDP (Cross-Country Average)

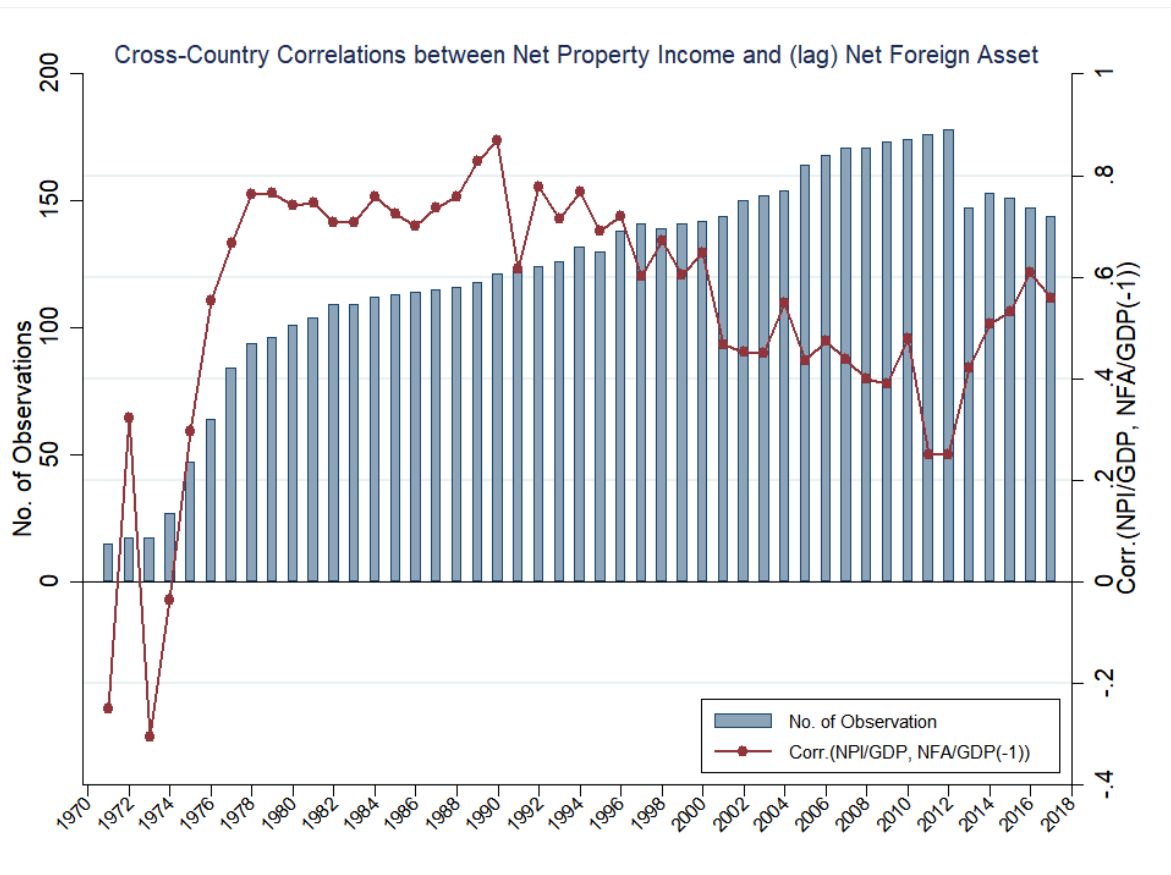


Figure 2. Cross-country correlations between net property income and lagged net foreign assets

#### 4 Empirical Results

Table 3 shows the results of estimating the error-correction model relating net exports to NFA (equation (7)) over the period 1971-2017 for the whole sample, and for the five country groups individually. The estimation includes both country and time fixed effects. The root mean square error (RMSE) is much smaller for the industrial countries and emerging markets (0.020 and 0.026 respectively) than for the other groups (0.065 for financial centres, 0.060 for other developing countries and 0.154 for fuel exporters). This means that there is considerable heteroscedasticity in the full sample, for which the coefficients tend to be dominated by the developing countries group because of a combination of their numerical superiority and their high RMSE.

The lagged level of net exports has a negative coefficient that is always significant at the 1% level, indicating reversion towards a long-run equilibrium. If we look at the implied long-run coefficient of net exports on lagged NFA, however, we find that it is positive rather than negative for the sample as a whole, and is not significantly negative at the 5% level for any sub-group of countries. Only for emerging markets is the coefficient negative and significant at 10%. We look into this somewhat more deeply below, but first we examine what happens if we replace NFA with net property income.

Since Table 2 illustrates that net property income flows are correlated in the expected way with net foreign assets, we would expect to see a relationship between net exports and net property income flows (NPI) that mirrors that for NFA in Table 3. Table 4 reports the results of an error correction model relating NX to NPI. What is striking is that for the whole sample the long-run NPI coefficient is significantly negative at the 1% level, and this is also true for every sub-sample except offshore financial centres, for which it is still negative but significant only at 10%. Thus the results for the NX-NPI relationship do not simply mirror those for the NX-NFA relationship; instead they are much more supportive of the theoretically expected equilibrium relationship.

Table 3. Net Exports and Net Foreign Assets: Country Fixed Effects with Time Dummies

	(1)	(2)	(3)	(4)	(5)	(6)
	All	Industrial	Financial	Fuel	Emerging	Other Dev.
dNFA(-1)	-0.005 (-0.99)	-0.014*** (-5.85)	0.003 (0.76)	-0.024 (-0.61)	-0.053*** (-3.33)	-0.010** (-2.26)
NX (-1)	-0.278*** (-3.89)	-0.089*** (-4.94)	-0.178*** (-3.52)	-0.483*** (-3.09)	-0.163*** (-6.08)	-0.236*** (-8.42)
NFA (-2)	0.002 (0.89)	-0.001 (-1.05)	0.003 (0.87)	-0.004 (-0.37)	-0.008* (-1.92)	-0.001 (-0.46)
Constant	0.021*** (2.94)	0.001 (0.27)	0.057*** (17.67)	0.064 (1.21)	0.044*** (5.83)	0.032*** (3.17)
No. Countries	186	26	26	25	26	83
No. Observations	5650	874	811	663	967	2335
R2-Overall	0.15	0.16	0.16	0.36	0.24	0.17
R2-Within	0.22	0.19	0.22	0.40	0.27	0.21
R2-Between	0.00	0.12	0.01	0.00	0.01	0.04
RMSE	0.075	0.020	0.065	0.154	0.026	0.060
p-Value Year Dummies	0.000	0.000	0.000	0.000	0.000	0.000
Calculated Long-Run Coefficient						
Lagged NFA	0.006 (0.87)	-0.016 (-1.18)	0.017 (0.90)	-0.008 (-0.41)	-0.051* (-1.76)	-0.003 (-0.48)

Notes: all variables are divided by GDP. The dependent variable is the change in net exports (NX). Figures in parentheses are heteroscedasticity-robust t-statistics. \*\*\*, \*\*, \*: significant at the 10, 5 and 1 percent levels. NFA = net foreign assets. Both country and time fixed effects are included.



Table 4. Net Exports and Net Property Income: Country and Time Fixed Effects

	(1)	(2)	(3)	(4)	(5)	(6)
	All	Industrial	Financial	Fuel	Emerging	Other Dev.
dNPI	-0.754*** (-3.74)	-0.078 (-0.44)	-0.620*** (-4.17)	-1.026*** (-2.65)	-0.713*** (-3.69)	-0.580*** (-4.35)
NS (-1)	-0.274*** (-4.35)	-0.104*** (-5.44)	-0.169*** (-3.60)	-0.473*** (-3.58)	-0.207*** (-10.29)	-0.255*** (-6.36)
NPI (-1)	-0.186*** (-3.46)	-0.098*** (-3.35)	-0.123* (-1.83)	-0.258** (-2.53)	-0.274*** (-5.72)	-0.177*** (-2.68)
Constant	-0.005 (-1.09)	0.005 (1.32)	0.068*** (12.79)	0.014*** (3.48)	-0.021*** (-5.82)	-0.025*** (-8.88)
No. Countries	189	26	28	25	26	84
No. Observations	5843	885	877	669	983	2429
R2-Overall	0.20	0.15	0.21	0.40	0.28	0.21
R2-Within	0.26	0.19	0.26	0.44	0.31	0.25
R2-Between	0.01	0.02	0.00	0.03	0.02	0.15
RMSE	0.074	0.021	0.063	0.148	0.026	0.061
p-Value Year Dummies	0.000	0.000	0.000	0.000	0.000	0.000
Calculated Long-Run Coefficient						
NPI	-0.680*** (-5.22)	-0.944*** (-3.47)	-0.731* (-1.78)	-0.545*** (-5.72)	-1.321*** (-4.72)	-0.697*** (-3.16)

Notes. See notes to Table 3. Both country and time fixed effects are included. NPI = net property income.

Table 5 reports results for an error-correction model of the relationship between the overall current account balance and NFA. Since  $CA = NX + NPI$ , and NPI is positively correlated with NFA, we would expect the coefficients of NFA to be more positive (or less negative) than in Table 3. In Table 5, the long-run NFA coefficient is significantly positive at 1% for the whole sample, and for the sub-samples of offshore financial centres (at 5%), fuel exporters (1%) and other developing countries (1%), but negative and not statistically significant for industrial countries and emerging markets. These results of a generally positive relationship between current account balances and net foreign assets are in line with the previous work of Chinn and Prasad (2003), Chinn et al. (2014) and Gruber and Kamin (2007) for smaller samples.

Table 5. Current Account Balances and Net Foreign Assets: Country and Time Fixed Effects

	(1)	(2)	(3)	(4)	(5)	(6)
	All	Industrial	Financial	Fuel	Emerging	Other Dev.
dNFA(-1)	0.002 (0.59)	-0.006 (-1.43)	0.002 (0.51)	-0.002 (-0.06)	-0.036** (-2.46)	-0.001 (-0.12)
CA (-1)	-0.286*** (-4.23)	-0.094*** (-5.09)	-0.191*** (-4.28)	-0.472*** (-3.50)	-0.178*** (-6.92)	-0.257*** (-8.55)
NFA (-2)	0.010*** (2.86)	-0.002 (-1.29)	0.008** (2.02)	0.019*** (2.97)	-0.002 (-0.38)	0.007*** (5.65)
Constant	0.023*** (2.60)	0.001 (0.18)	0.073*** (180.31)	0.066 (1.13)	0.040*** (5.56)	0.024*** (3.03)
No. Countries	186	26	26	25	26	83
No. Observations	5698	874	834	670	968	2352
R2-Overall	0.15	0.15	0.17	0.34	0.23	0.17
R2-Within	0.20	0.18	0.22	0.38	0.25	0.21
R2-Between	0.00	0.00	0.00	0.00	0.02	0.03
RMSE	0.073	0.023	0.063	0.148	0.026	0.059
p-Value Year Dummies	0.000	0.000	0.000	0.000	0.000	0.000
Calculated Long-Run Coefficient						
Lagged NFA	0.036*** (5.33)	-0.023 (-1.15)	0.044** (2.43)	0.041*** (3.76)	-0.010 (-0.37)	0.026*** (4.67)

Notes. See notes to Table 3. The dependent variable is the change in the current account balance (CA). Both country and time fixed effects are included. NPI = net property income.

We now take a closer look at the NX-NFA relationship in the time series and cross-section dimensions. One possibility, instead of estimating a model with country fixed effects, which constrains coefficients other than the intercept term to be identical across countries, is to estimate a separate time-series model for each country, and to examine the pattern of implicit long-run relationships estimated. Table 6 gives some information about the distribution of the long-run NFA coefficients estimated country by country. The upper part of the table includes results for all 180 countries, and the lower part includes only the results for the 70 countries with at least 30 years' data. Table 6 shows the mean, minimum, maximum, median and the 25<sup>th</sup> and 75<sup>th</sup> percentiles of the distribution. The median for the whole sample is -0.067, but -0.051 when we consider only the 70 countries with 30+ years' data. In both cases the 75<sup>th</sup> percentile in the whole sample, and for every sub-sample except offshore financial centres, is negative as well. The mean is even further from zero than the median in each case. This compares with an estimate of +0.006 from the fixed effects regression in Table 3. This implies that when we estimate individual time series for each country, we typically find a strongly negative long-run relationship between NX and NFA, in contrast to what is observed in panel fixed-effects estimation.

Thus the individual time-series estimates are very different from the panel estimates. The question therefore is which specification provides the best fit to the data: (a) one where all parameters are different in the time-series regressions for each country (Table 6), (b) one where only the intercept varies across countries (Table 3), or perhaps (c) an intermediate specification where the long-run relationship is constrained to be identical across countries, but not the short-run dynamics (the pooled mean group method of Pesaran et al., 1999). The results of pooled mean group (PMG) estimation of the NX-NFA relationship are shown in Table 7. In Table 7 the long-run NFA coefficient is always negative and significant at 1%. In that respect the PMG results are closer to the individual time-series results than to the panel estimates. The Hausman

$p$ -value tests the PMG null hypothesis of an identical long-run NFA coefficient across all countries, and is always high (above 0.650), indicating that the null cannot be rejected. At the same time the RMSE in Table 7 is always about 10% less than in Table 3, indicating that PMG offers a considerable improvement of fit relative to two-way fixed effects. In other words specification (c) provides a significantly better fit than specification (b), and cannot be rejected in favour of specification (a). The issue is critical because the estimated long-run NFA coefficient in Table 7 is always negative and significant at the 1% level, in marked contrast to Table 3, where it was never significant even at the 5% level. Thus the PMG results clearly suggest that the theoretically expected long-run time-series relationship between NX and NFA holds in the data, provided that we allow for country-specific short-run dynamics.

To examine the cross-section relationship, we estimate the correlation between NX and lagged NFA in each year. Figure 3 is a graph showing the results for the whole sample, together with the correlation between NX and NPI for comparison. What stands out is that the correlation is negative in only nine years out of 48, and positive in 39. By contrast the correlation between NX and NPI is negative in 40 years out of 48, and positive in eight. Figures 4 to 8 show that the same pattern holds for every sub-sample of countries. We can see that for industrial countries (Figure 4) and emerging markets (Figure 7), the relationship between NX and NFA is strongly positive in the early years of the 21<sup>st</sup> century, when there was a great deal of discussion of emerging markets running large current account surpluses and building up their international reserves, and the United States was running a large deficit. For other developing countries (Figure 8), the correlation has been most positive in the last few years and in the period of high oil prices up to 1985.

Table 6. Net exports and net foreign assets: country-by-country estimates

	count	mean	Min	max	p25	p50	p75
Whole Sample							
Advanced	26	-0.092	-0.557	0.093	-0.115	-0.059	-0.015
Fin. Offshore	28	0.083	-0.710	2.620	-0.107	-0.037	0.048
Fuel Econ.	25	-0.142	-0.873	0.397	-0.199	-0.106	-0.040
EMs	19	-0.132	-0.707	0.322	-0.259	-0.116	-0.012
Oth.Dev.	85	-0.121	-2.354	1.812	-0.143	-0.072	-0.006
Whole sample	183	-0.090	-2.354	2.620	-0.176	-0.067	-0.008
Countries with at least 30 years' data							
	count	mean	Min	max	p25	p50	p75
Advanced	14	-0.046	-0.212	0.093	-0.071	-0.032	-0.001
Fin. Offshore	16	-0.025	-0.271	0.517	-0.097	-0.044	0.035
Fuel Econ.	5	-0.119	-0.208	-0.040	-0.180	-0.106	-0.060
EMs	9	-0.049	-0.263	0.322	-0.132	-0.056	-0.006
Oth.Dev.	32	-0.092	-0.765	0.079	-0.093	-0.051	-0.004
Whole sample	76	-0.066	-0.765	0.517	-0.106	-0.051	-0.002

Note. The data refer to the implied long-run NFA coefficient in equation (7) estimated as a time series regression for each country separately. P25, p50, p75: 25<sup>th</sup>, 50<sup>th</sup>, 75<sup>th</sup> percentiles respectively.

Table 7. Net Exports and Net Foreign Assets: Pooled Mean Group Estimates

	(1) All	(2) Industrial	(3) Financial	(4) Fuel	(5) Emerging	(6) Other Dev.
Long-Run						
NFA	-0.077*** (-17.18)	-0.101*** (-8.95)	-0.025*** (-2.80)	-0.060*** (-6.01)	-0.165*** (-10.06)	-0.063*** (-9.85)
Short-Run						
Error Correction	-0.372*** (-17.44)	-0.219*** (-6.78)	-0.382*** (-9.64)	-0.488*** (-4.90)	-0.288*** (-9.33)	-0.416*** (-14.84)
dNFA	-0.029*** (-2.85)	0.010 (1.11)	0.003 (0.16)	-0.002 (-0.07)	-0.046*** (-3.28)	-0.051*** (-2.62)
Constant	-0.005 (-0.61)	-0.004 (-1.58)	-0.008 (-0.86)	0.053 (1.13)	-0.009*** (-2.93)	-0.027*** (-7.63)
No. Observations	183	26	26	24	26	81
No. Countries	5640	874	811	661	967	2327
Log-Likelihood	11047.71	2476.52	1306.40	754.21	2273.82	4254.59
RMSE	0.065	0.019	0.059	0.141	0.026	0.055
p-value Hausman	0.673	0.683	0.925	0.793	0.843	0.656

Notes: all variables are divided by GDP. The dependent variable is the change in net exports (NX). Figures in parentheses are heteroscedasticity-robust t-statistics. \*\*\*, \*\*, \*: significant at the 10, 5 and 1 percent levels. NFA = net foreign assets. The null of the Hausman test is that the long-run NFA coefficient is identical across countries. Estimation method: pooled mean group (Pesaran et al., 1999). The PMG method estimates identical long-run coefficients across countries but the other coefficients are country-specific, and the table shows the mean of these country-specific coefficients.

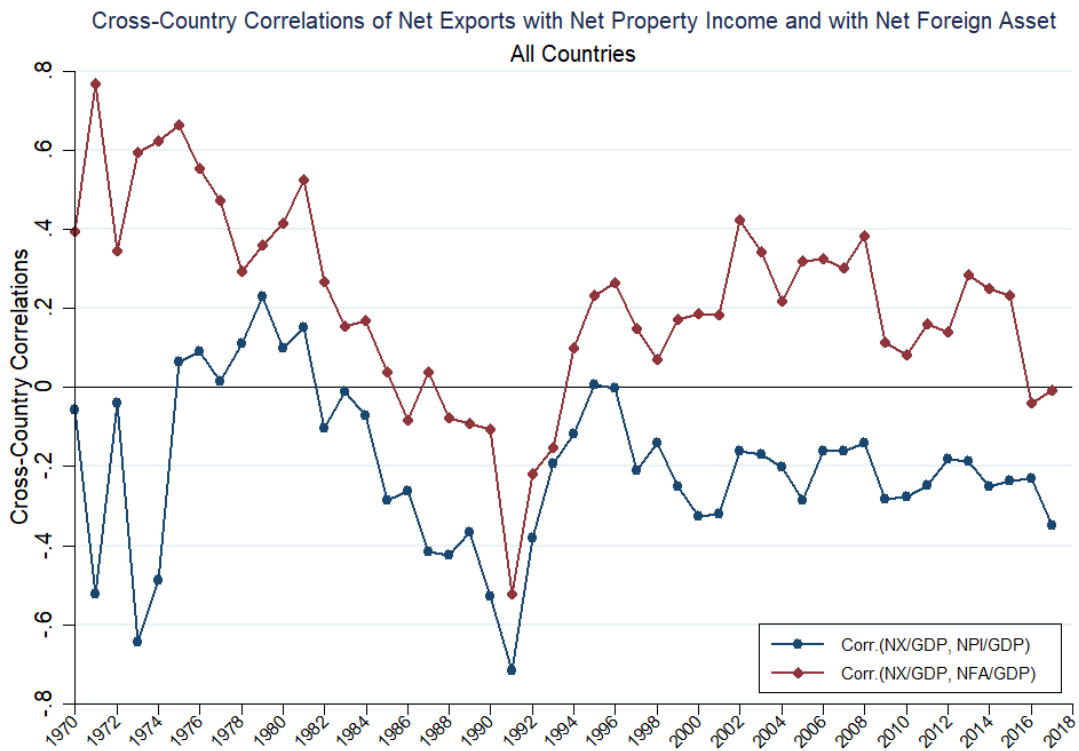


Figure 3. Cross-Country Correlations of Net Exports with Net Property Income and with Net Foreign Asset: All Countries

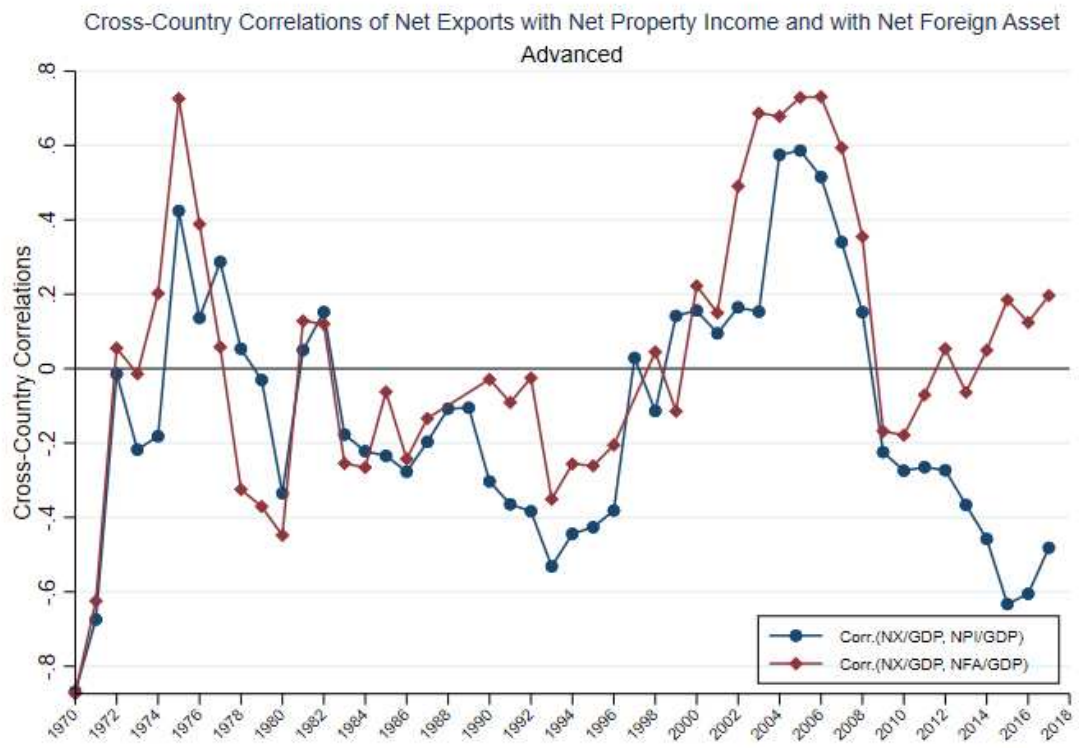


Figure 4. Cross-Country Correlations of Net Exports with Net Property Income and with Net Foreign Asset: Advanced economies

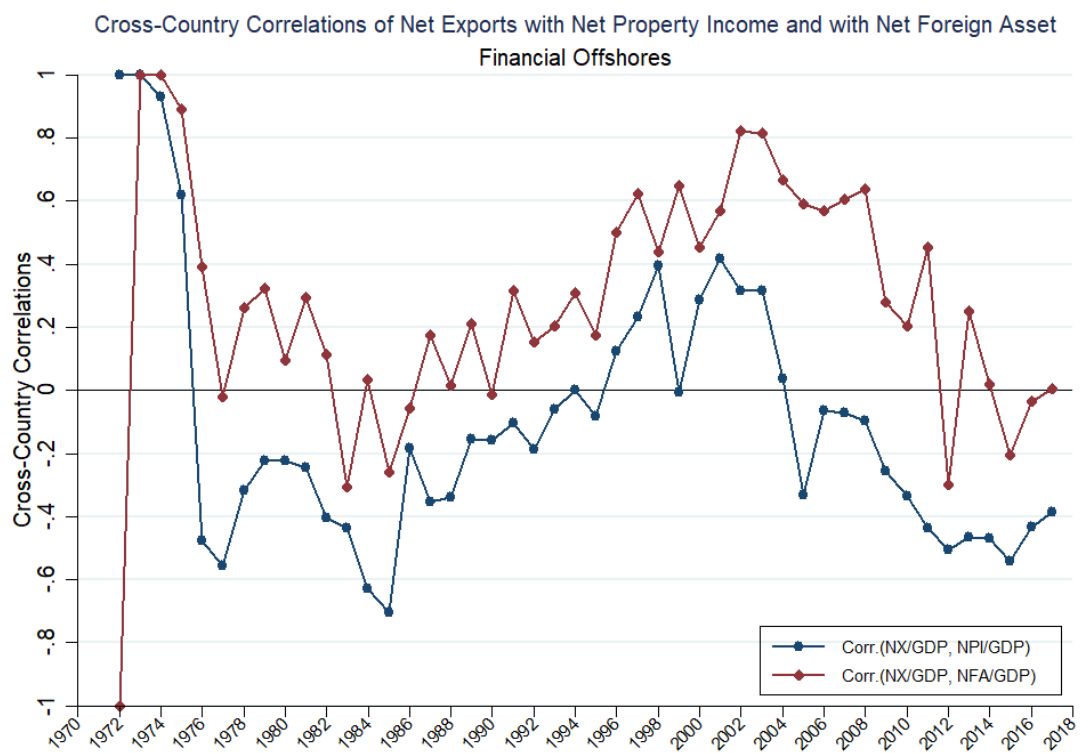


Figure 5. Cross-Country Correlations of Net Exports with Net Property Income and with Net Foreign Asset: Financial Offshores economies

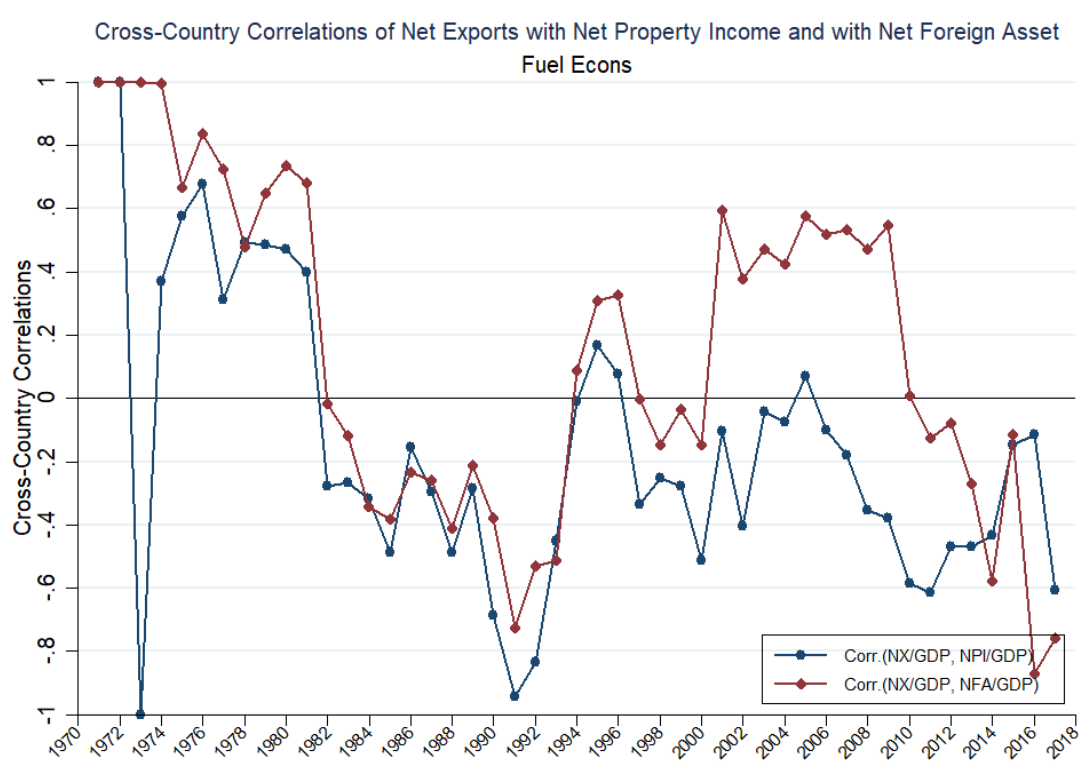


Figure 6. Cross-Country Correlations of Net Exports with Net Property Income and with Net Foreign Asset: Fuel Exporting economies



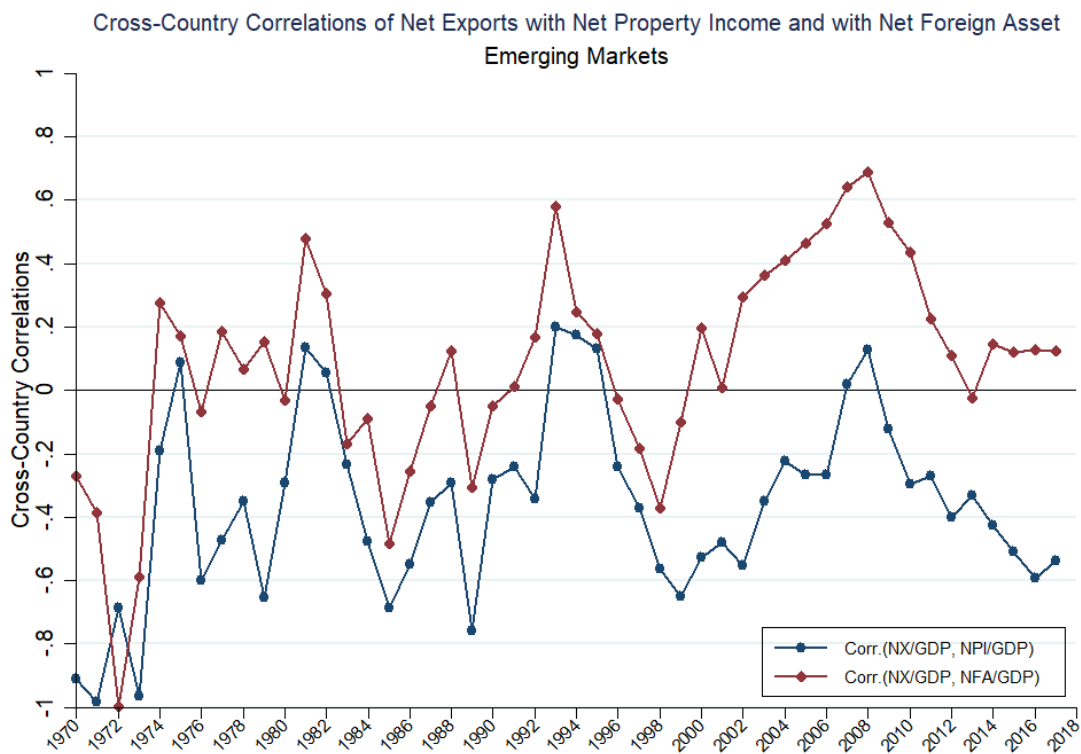


Figure 7. Cross-Country Correlations of Net Exports with Net Property Income and with Net Foreign Asset: Emerging Market economies

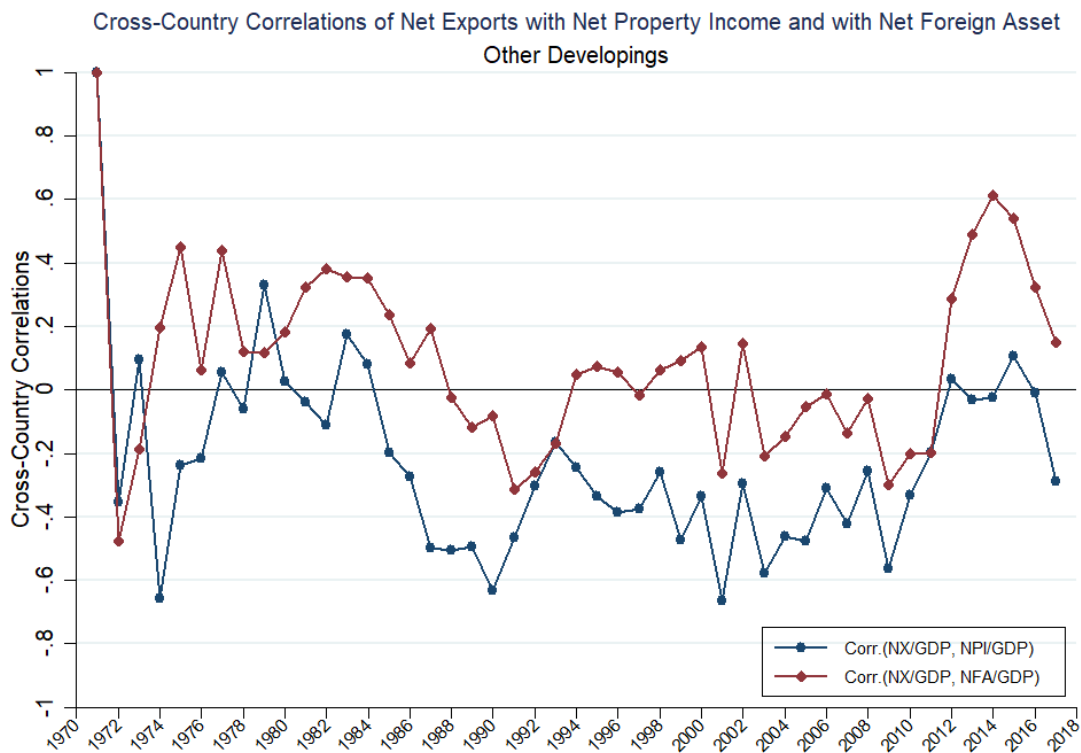


Figure 8. Cross-Country Correlations of Net Exports with Net Property Income and with Net Foreign Asset: Other Developing economies

Thus this analysis shows that the cross-section NX-NFA relationship tends to be of the opposite sign to the time-series relationship. In cross-section, a country with higher NFA tends to have more positive net exports, but the time-series results show that in the long run a given country tends to have more negative net exports when its NFA is higher. The tendency for the correlation of NFA with the current account balance to be positive in most years suggests that there are significant shifts in NFA/GDP ratios over time. This will particularly be the case if current account balances are persistent, as they are. Table 8 shows the persistence of current account balances, after allowing for country and time fixed effects and country-specific linear trends.<sup>5</sup> The dependent variable in Table 8 is the change in the current account balance, and the relatively high degree of persistence is shown by the fact that the lagged current account balance has a coefficient well above minus one. When current account balances are persistent, after a shock they take time to return to a long-run equilibrium relationship with net foreign assets, so a snapshot at a moment in time is not sufficient to uncover long-run equilibrium relationships. One consequence of the persistence of current account imbalances is that the ranking of countries by the ratio of net foreign assets to GDP can change quite significantly over time, as is shown in Table 9. Table 9 shows Spearman's rank correlation coefficient for NFA/GDP at ten-year intervals, for the years 1977, 1987, 1997, 2007 and 2017. The ten-year correlations lie between 0.71 and 0.82, but the twenty-year correlations are 0.61 for 1977/97 and 1987/2007, and down to only 0.46 for 1997/2017.

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<sup>5</sup> The linear trends are included to capture long-run trends in the current account balance that might otherwise distort the estimate of persistence.

Table 8. Current Account Persistence: FE estimation with country-specific trends

	(1)	(2)	(3)	(4)	(5)	(6)
	All	Industrial	Financial	Fuel	Emerging	Other Dev.
dCA(-1)	-0.021 (-0.65)	0.143* (2.06)	0.041 (0.59)	0.006 (0.25)	0.161*** (7.40)	-0.006 (-0.19)
CA (-1)	-0.509*** (-7.41)	-0.336*** (-6.58)	-0.527*** (-9.92)	-0.687*** (-5.91)	-0.394*** (-9.09)	-0.436*** (-7.97)
Constant	-0.017*** (-7.34)	-0.002*** (-3.95)	-0.026*** (-9.45)	0.021*** (4.77)	-0.005*** (-7.99)	-0.027*** (-7.77)
Country Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Country Trend	Yes	Yes	Yes	Yes	Yes	Yes
No. Countries	188	26	28	24	26	84
No. Observations	5690	859	870	647	958	2353
R-Squared	0.30	0.26	0.32	0.47	0.31	0.29
R-2 Within	0.26	0.16	0.24	0.32	0.19	0.23
RMSE	0.07	0.02	0.06	0.14	0.03	0.06

Notes: all variables are divided by GDP. The dependent variable is the change in current account (CA). Figures in parentheses are t-statistics clustered at country level. \*\*\*, \*\*, \*: significant at the 10, 5 and 1 percent levels. Country-specific trend variable are normalised at 1990.

Table 9. Rank Correlations of Countries by NFA/GDP at ten-year intervals

	(1)	(2)	(3)	(4)	(5)
	1977	1987	1997	2007	2017
1977	1				
1987	0.7411	1			
1997	0.6127	0.7807	1		
2007	0.5458	0.6149	0.8180	1	
2017	0.3645	0.4216	0.4733	0.7144	1

Note: the table shows Spearman's rank correlation coefficient between the row and column years for the countries ranked by NFA/GDP.

We can also estimate the relationship between the current account balance and NFA by PMG. When we do that, we get a consistently negative long-run NFA coefficient that is significant at the 1% level for all except fuel-exporters, and less negative than in Table 7 by about 0.02, reflecting the positive correlation between the net property income component of the current account and net foreign assets. The results for the PMG estimation of the current account-NFA relationship are shown in Table 10. The findings are similar to those in Table 7, in that with PMG the RMSE of the regression is significantly reduced, and the null of a common long-run relationship across countries is not rejected.

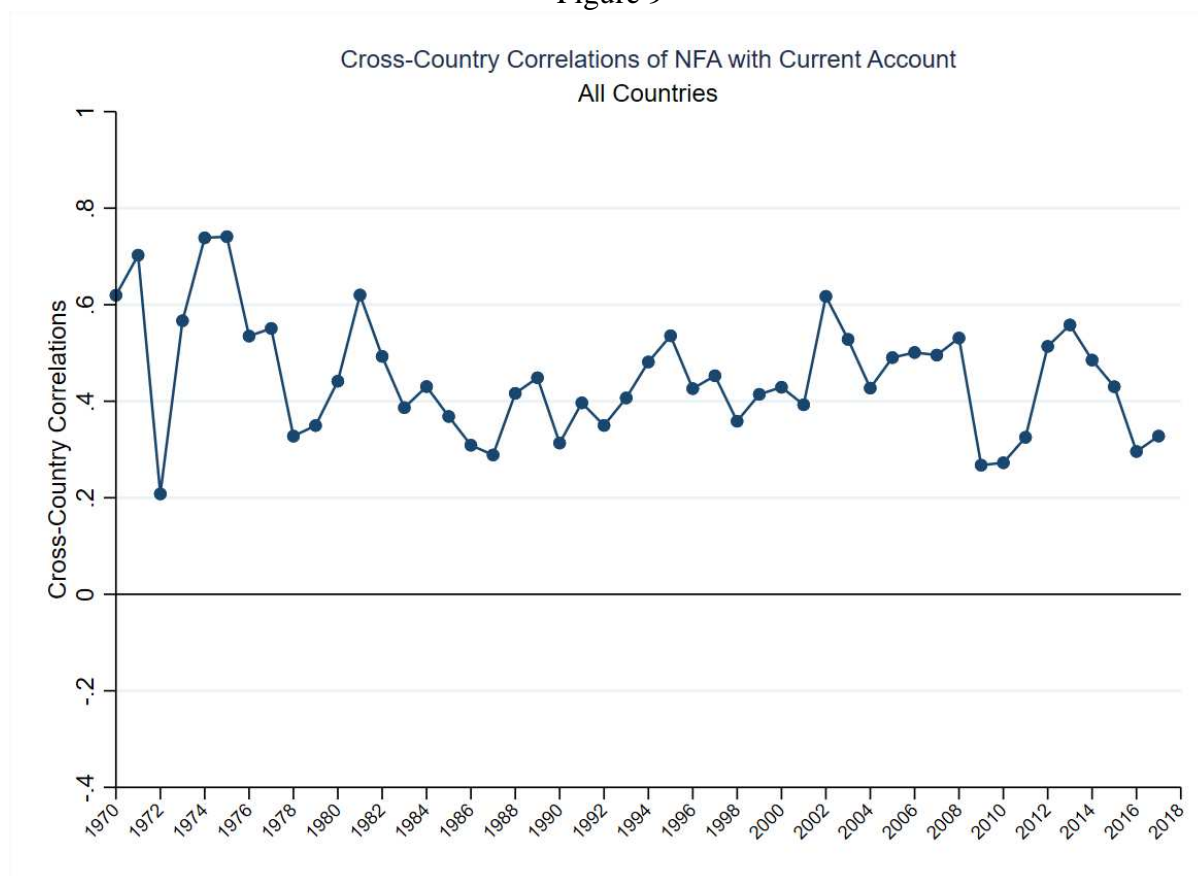
Table 10. Current Account Balances and Net Foreign Assets: Pooled Mean Group estimates

	(1) All	(2) Industrial	(3) Financial	(4) Fuel	(5) Emerging	(6) Other Dev.
<b>Long-Run</b>						
NFA	-0.054*** (-12.04)	-0.074*** (-5.73)	-0.010* (-1.79)	-0.075*** (-4.68)	-0.106*** (-6.56)	-0.040*** (-6.71)
<b>Short-Run</b>						
Error Correction	-0.380*** (-19.21)	-0.241*** (-6.18)	-0.420*** (-8.48)	-0.403*** (-5.19)	-0.302*** (-10.77)	-0.429*** (-15.28)
dNFA	-0.015 (-1.40)	0.027* (1.89)	0.002 (0.10)	-0.016 (-0.56)	-0.021 (-1.38)	-0.031 (-1.56)
Constant	-0.017*** (-4.33)	-0.007** (-2.32)	-0.022** (-2.49)	0.029 (1.18)	-0.014*** (-4.75)	-0.033*** (-8.97)
No. Observations	184	26	26	24	26	82
No. Countries	5692	874	834	668	968	2348
Log-Likelihood	11133.13	2395.26	1341.80	789.66	2306.06	4312.07
RMSE	0.063	0.022	0.057	0.131	0.026	0.055
p-Value Hausman	0.268	0.330	0.436	0.811	0.158	0.774

Notes: all variables are divided by GDP. The dependent variable is the change in the current account balance (CA). Figures in parentheses are heteroscedasticity-robust t-statistics. \*\*\*, \*\*, \*: significant at the 10, 5 and 1 percent levels. NFA = net foreign assets. The null of the Hausman test is that the long-run NFA coefficient is identical across countries. Estimation method: pooled mean group (Pesaran et al., 1999). The PMG method estimates identical long-run coefficients across countries but the other coefficients are country-specific, and the table shows the mean of these country-specific coefficients.

As was true in the case of net exports, the cross-section relationship between the current account balance and NFA is of opposite sign to the long-run time-series relationship. Figure 9 shows that the cross-section correlation between the current account balance and NFA has varied between +0.2 and +0.8, and has never been negative. As suggested earlier, this apparent contradiction is likely to be the result of substantial and quite persistent shocks to current account balances.

Figure 9



*Allowing for different rates of return on countries' assets and liabilities*

In equations (1) to (6) it was assumed that rates of return on assets and liabilities, and indeed the split between income and capital gains as well as the growth rate, were identical across countries and time. That is unrealistic; of particular interest is the case where a country's assets earn a different return ( $r_A$ ) from its liabilities ( $r_L$ ). Denoting assets as  $A$  and liabilities as  $L$ , equation (1) then becomes:

$$NFA_t = (1 + r_A)A_{t-1} - (1 + r_L)L_{t-1} + NX_t + VE_t \quad (8)$$

Using the fact that  $A = [(A + L) + (A - L)]/2$  and  $L = [(A + L) - (A - L)]/2$ , equation (8) may be written:

$$NFA_t = [1 + (1/2)(r_A + r_L)]NFA_{t-1} + (1/2)(r_A - r_L)(A_{t-1} + L_{t-1}) + NX_t + VE_t \quad (9)$$

which introduces an extra term in gross financial assets into the long-run equilibrium equation. Moreover, on the assumption that  $r_A$  and  $r_L$  vary across countries, the coefficient of this gross foreign assets term will be country-specific.

Table 11 shows the result of pooled mean group estimation of the relationship between net exports and net foreign assets, including country-specific coefficients for gross foreign assets, as indicated by equation (9). Since the coefficient of gross foreign assets should be proportional to the difference in rates of return on assets and liabilities, its sign varies across countries. Comparing the results in Table 11 with those in Table 7, the long-run NFA coefficient is very similar in magnitude, but its statistical significance is somewhat reduced in Table 11, although it is still always significantly negative at the 5% level, as theoretically predicted in long-run equilibrium. Our results thus appear to be robust to allowing rates of return on assets and liabilities to differ across countries.

Table 11. Net Exports and Net Foreign Assets Allowing for Different Rates of Return

	(1) All	(2) Industrial	(3) Financial	(4) Fuel	(5) Emerging	(6) Other Dev.
<b>Long-Run</b>						
NFA	-0.084*** (-13.27)	-0.124*** (-8.99)	-0.027** (-2.25)	-0.053** (-2.32)	-0.160*** (-7.48)	-0.072*** (-7.46)
FAL(-2)	-0.011 (-0.78)	0.003 (0.56)	0.031 (1.10)	-0.017 (-0.26)	0.005 (0.55)	-0.028 (-1.29)
<b>Short-Run</b>						
Error Correction	-0.465*** (-18.37)	-0.268*** (-8.42)	-0.571*** (-10.32)	-0.725*** (-5.33)	-0.347*** (-9.70)	-0.456*** (-16.33)
dNFA (-1)	-0.036* (-1.84)	-0.024 (-1.49)	-0.002 (-0.07)	0.215** (2.07)	-0.075*** (-3.56)	-0.104*** (-4.07)
dFAL (-1)	-0.065** (-2.21)	-0.018* (-1.95)	-0.003 (-0.09)	-0.305 (-1.62)	-0.029 (-1.22)	-0.046 (-1.23)
Constant	0.001 (0.06)	-0.004 (-0.71)	-0.055 (-1.17)	0.172 (1.41)	-0.015*** (-3.36)	-0.029* (-1.82)
No. Observations	181	26	26	23	26	80
No. Countries	5630	874	811	656	967	2322
Log-Likelihood	11384.50	2532.87	1365.94	800.39	2321.52	4377.56
RMSE	0.060	0.018	0.056	0.128	0.025	0.052
p-Value Hausman	0.078	0.962	0.524	0.623	0.300	0.005

Notes: all variables are divided by GDP. The dependent variable is the change in net exports (NX). Figures in parentheses are heteroscedasticity-robust t-statistics. \*\*\*, \*\*, \*: significant at the 10, 5 and 1 percent levels. NFA = net foreign assets; FAL = the sum of foreign assets and liabilities. The null of the Hausman test is that the long-run NFA coefficient is identical across countries. Estimation method: pooled mean group (Pesaran et al., 1999). The PMG method estimates identical long-run coefficients across countries but the other coefficients are country-specific, and the table shows the mean of these country-specific coefficients.

## 5 Conclusions

We have investigated the relationship between net foreign assets and net exports (defined as the trade balance plus transfers) in the post-Bretton Woods era. Theoretically, in long-run stock equilibrium, where the ratio of net foreign assets to GDP is stable, they should be negatively correlated. This proposition is not supported by the data when the coefficients are constrained to be equal across countries, either with or without time and country fixed effects, and in most years the cross-sectional correlation between net exports and net foreign assets is positive rather than negative. The picture changes radically, however, if we allow for country-specific dynamics. Whether or not the long-run relationship is constrained to be identical across countries, with country-specific dynamics (which greatly improve the fit) there is a significant negative correlation between net exports and net foreign assets.

What exactly do these results mean? The negative time-series relationship suggests that net foreign asset positions are sustainable, but the positive cross-section relationship, in conjunction with the substantial within-country variation in current account balances, implies that shocks of various kinds, such as to oil and other commodity prices or boom-bust cycles in international lending, have prevented the world from staying close to a particular long-run equilibrium. The importance of shocks is also reflected in the relatively high persistence of current account imbalances and the substantial changes over time in the rank ordering of countries by NFA/GDP. These results hold up when we allow for cross-country variation in returns on foreign assets, which introduces gross asset positions into the equation.

Turning to current account balances, a snapshot of countries in a particular year shows a consistent positive correlation between them and net foreign assets, but in time series current account balances are negatively correlated with net foreign assets in the long run. The cross-



section results show that in any particular year current account balances tend not to be close to the level required to stabilise the ratio of net foreign assets to GDP, with the consequence that net foreign asset ratios of particular countries can change substantially over time.

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## **Appendix – Country Classifications**

### ADVANCED

Australia, Austria, Belgium, Canada, Cyprus, Denmark, Estonia, Euro Area, Finland, France, Germany, Iceland, Italy, Japan, Latvia, Lithuania, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Slovak Republic, Slovenia, Spain, Sweden, United Kingdom, United States

### OFFSHORE FINANCIAL CENTRES

Anguilla, Antigua and Barbuda, Aruba, Bahamas, Barbados, Belize, Bermuda, Botswana, Cape Verde, Costa Rica, Dominica, Grenada, Hong Kong, Ireland, Lebanon, Macau, Malta, Marshall Islands, Mauritius, Palau, Panama, St Kitts and Nevis, St Lucia, St Vincent and the Grenadines, Samoa, Seychelles, Singapore, Switzerland, Vanuatu

### FUEL ECONOMIES

Algeria, Angola, Azerbaijan, Bahrain, Brunei, Chad, Congo, Ecuador, Equatorial Guinea, Gabon, Iran, Iraq, Kazakhstan, Kuwait, Libya, Nigeria, Oman, Qatar, Saudi Arabia, South Sudan, Sudan, Timor, Trinidad and Tobago, Turkmenistan, United Arab Emirates, Venezuela, Yemen Arab Republic

### EMERGING MARKETS

Argentina, Brazil, Bulgaria, Chile, China, Colombia, Czech Republic, Egypt, Greece, Hungary, India, Indonesia, Israel, Malaysia, Mexico, Pakistan, Peru, Philippines, Poland, Russia, South Africa, South Korea, Taiwan, Thailand, Turkey, Ukraine, Uruguay

### OTHER DEVELOPING

Afghanistan, Albania, Armenia, Bangladesh, Belarus, Benin, Bhutan, Bolivia, Bosnia and Herzegovina, Burkina Faso, Burundi, Cambodia, Cameroon, Central African Republic, Comoros, Côte d'Ivoire, Croatia, Democratic Republic of the Congo, Djibouti, Dominican Republic, El Salvador, Eritrea, Ethiopia, Faroe Islands, Fiji, French Polynesia, Gambia, Georgia, Ghana, Guatemala, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, Jamaica, Jordan, Kenya, Kiribati, Kosovo, Kyrgyz Republic, Laos, Lesotho, Liberia, Macedonia, Madagascar, Malawi, Maldives, Mali, Mauritania, Micronesia, Moldova, Mongolia, Montenegro, Morocco, Mozambique, Myanmar, Namibia, Nepal, New Caledonia, Nicaragua, Niger, Papua New Guinea, Paraguay, Romania, Rwanda, Sao Tome and Principe, Senegal, Serbia, Sierra Leone, Solomon Islands, Sri Lanka, Suriname, Swaziland, Syria, Tajikistan, Tanzania, Togo, Tonga, Tunisia, Tuvalu, Uganda, Uzbekistan, Vietnam, West Bank and Gaza, Zambia, Zimbabwe