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ABSTRACT

The Long or Short of it: Determinants of Foreign Currency Exposure in External Balance Sheets *

Recently, there have been numerous advances in modelling optimal international portfolio allocations in macroeconomic models. A major focus of this literature has been on the role of currency movements in determining portfolio returns that may hedge various macroeconomic shocks. However, there is little empirical evidence on the foreign currency exposures that are embedded in international balance sheets. Using a new database, we provide stylized facts concerning the cross-country and time-series variation in aggregate foreign currency exposure and its various subcomponents. In panel estimation, we find that richer, more open economies take longer foreign-currency positions. In addition, we find that an increase in the propensity for a currency to depreciate during bad times is associated with a longer position in foreign currencies, providing a hedge against domestic output fluctuations. We view these new stylized facts as informative in their own right and also potentially useful to the burgeoning theoretical literature on the macroeconomics of international portfolios.

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1 Introduction

The continuing expansion of gross cross-border investment positions has stimulated a new wave of interest in the international balance sheet implications of currency movements. These exchange rate based valuation effects depend crucially on the currency composition of international portfolios. At the same time, recent advances in macroeconomic theory have provided a more nuanced consideration of the general equilibrium characteristics of the portfolio allocation problem than was attained in the earlier wave of "portfolio balance" models (see, amongst others, Devereux and Sutherland 2006, Tille and van Wincoop 2007 and Engel and Matsumoto 2008). A major concern of this new research programme has been to identify the role of currency movements in the design of optimal portfolios.

However, this literature has been constrained by a lack of empirical evidence concerning the currency exposures that are present in the international balance sheet. In recent work (Lane and Shambaugh 2007), we have compiled and described the currency composition of foreign asset and liability positions for a broad set of countries over 1990-2004. In that work, we established that the currency profiles of international portfolios show tremendous variation, both across countries and over time.

Accordingly, our goal in this paper is to synthesize two recent advances in the literature — the expansion of knowledge concerning the data on the currency composition of cross-border portfolios and the advances in theory regarding those positions — to study the determinants of the cross-country and cross-time variation in foreign currency exposure.[1] We pursue two broad lines of analysis. First, we provide a decomposition of aggregate foreign currency exposure into its constituent elements. This is important, since much of the theoretical literature has focused on particular dimensions of foreign-currency exposure, whereas the valuation impact of currency movements depends on the aggregate net foreign currency position. Second, we conduct a panel analysis of variation in foreign currency exposure in order to identify which country characteristics help to explain the cross-sectional and time-series variation in the level of foreign currency exposure.

In the decomposition, we divide aggregate foreign-currency exposure into two primary subcomponents: the net foreign asset position and the level of foreign currency exposure embedded in a zero net foreign asset position. While some models focus on the latter component, the data suggest that the net foreign asset position is the most important

[1] We are interested in economy-wide exposure measures, as captured by the international investment position. There is also an extensive literature on measuring currency exposure at the firm level (see, for example, Adler and Dumas 1984 and Tesar and Dominguez 2006).

determinant of aggregate foreign currency exposure. In addition, the decomposition shows that the structure of foreign liabilities (across portfolio equity, direct investment, local-currency debt and foreign-currency debt) is a key determinant of foreign currency exposure, with the equity share in liabilities more important than the currency composition of foreign debt liabilities. These findings point to the importance of analyzing the mix of liabilities and not focusing on one type within a model.

We next analyze the panel variation in foreign currency exposures. We find that factors such as trade openness and the level of development help to explain the cross-sectional variation in foreign currency exposure: richer, more open economies take longer positions in foreign currency. Once the cross-sectional variation is eliminated by including a set of country fixed effects in the estimation, we find support for a key general prediction of the theoretical literature: an increase in the propensity for a currency to depreciate during bad times is associated with a longer position in foreign currencies, which acts as a hedge against domestic output fluctuations. Our final contribution is to show that there is substantial heterogeneity in the roles of each regressor in explaining the variation in individual subcomponents of foreign-currency exposure: accordingly, it is important to take a broad perspective rather than examining individual components in isolation.

Our work is related to several previous empirical contributions. In relation to developing countries, the closest is Eichengreen, Hausmann and Panizza (2005) who compiled data on the currency composition of the external debts of developing countries. However, our approach is more general in that we calculate the currency composition of the entire international balance sheet. As such, we go beyond Goldstein and Turner (2004) who extended the empirical approach of Eichengreen et al by constructing estimates of net foreign-currency debt assets for a selected group of countries but did not incorporate the portfolio equity and FDI components of the international balance sheet. For the advanced economies, Tille (2003) calculates the foreign currency composition of the international balance sheet of the United States, while Lane and Milesi-Ferretti (2007c) calculate dollar exposures for a large number of European countries, plus Japan and China. Relative to these contributions, we provide greatly-expanded coverage for a large number of countries and estimate the full currency composition of the international balance sheet.

The structure of the rest of the paper is as follows. Section 2 lays out the conceptual framework for the study, while Section 3 briefly describes our dataset. Stylized facts are presented in Section 4, with the main empirical analysis reported in Section 5. Section 6 concludes.

2 Conceptual Framework

2.1 Exchange Rate Fluctuations and Portfolio Returns

The role played by nominal exchange rate fluctuations in determining the payoffs to cross-border holdings and the pattern of international risk sharing has long been recognised in the literature (see, amongst others, Helpman and Razin 1982, Persson and Svensson 1989, Svensson 1989, Neumeyer 1998 and Kim 2002). Most recently, the new macro-finance literature in which cross-border portfolio positions are endogenously determined has also emphasised the potential role played by nominal assets and liabilities in contributing to international risk sharing.

The mechanism varies across models. For instance, Devereux and Saito (2006) consider a single-good flexible-price world economy in which home and foreign countries are subject to shocks to endowments and inflation. If it is assumed that the covariance between productivity and inflation is negative (as is empirically the case), a striking result is that complete risk sharing can be achieved if asset trade is restricted to home and foreign nominal bonds. Since the return on nominal bonds is procyclical in this setting, risk sharing is accomplished by the home country taking a long position in the foreign currency bond and a short position in the domestic currency bond — the portfolio payoff will be high when the home endowment is low.

A similar result is obtained by Devereux and Sutherland (2006a) who consider independent shocks to endowments and money stocks. In their symmetric model, the share of foreign-currency bonds held by domestic residents (financed by an opposite position in domestic-currency bonds) is

$$FC = \frac{\sigma_Y^2}{2(\sigma_Y^2 + \sigma_M^2)(1 - \beta\rho_Y)} \tag{1}$$

where σ_Y^2 and σ_M^2 are the variances of the endowment and money shocks, β is the discount factor and ρ_Y is the autoregressive parameter for the endowment shock. Accordingly, the long position in foreign currency (and short position in domestic currency) is increasing in the relative importance of endowment shocks versus monetary shocks and also increasing in the persistence of the endowment shock. The intuition is that nominal bonds are better able to deliver risk sharing, the less important are monetary shocks (Kim 2002 also makes this point). Moreover, the importance of risk sharing (and hence the gross scale of positions) is increasing in the volatility and persistence of endowment shocks.

An alternative account is provided by Engel and Matsumoto (2008) who provide an illustrative model featuring a one-period horizon, sticky prices and home bias in consumption. Sticky prices mean that hedging nominal exchange rate movements offers protection against shifts in the real exchange rate and the terms of trade and a simple foreign-exchange forward position (achievable through holding a long-short portfolio in foreign-currency and domestic-currency bonds) can deliver full risk sharing, making trade in equities redundant.[2] In their baseline model, a portfolio position that delivers a payoff that is proportional to the nominal exchange rate achieves full risk sharing, where the elasticity of the payoff to the nominal exchange rate is

$$x_t = \delta s_t, \qquad \delta = \frac{\alpha - 1}{2}\left\{\left(1 - \frac{1}{\rho}\right)[1 - b(1-\alpha)] + (1+\alpha)(\omega - 1)b\right\} \tag{2}$$

where x_t denotes the portfolio payoff, s_t is the domestic-currency price of foreign currency, ρ is the coefficient of relative risk aversion, $(1+\alpha)/2$ is the share of home goods in nominal expenditure, b is the degree of pass through and ω is the elasticity of substitution between home and foreign goods.

Devereux and Sutherland (2007) consider a world economy, in which there is a limited substitutability between home and foreign goods, with shocks to productivity and money stocks. There is endogenous production of varieties of the goods and prices are sticky in the format of Calvo-style contracts. In contrast to the other papers, a monetary policy rule is specified that adjusts the interest rate in response to inflation. (In this setting, a positive domestic productivity shock causes a nominal exchange rate depreciation - accordingly, the optimal hedge is for the home country to hold a long position in the domestic-currency bond and a short position in the foreign-currency bond.) In the case where only nominal bonds are traded, the authors show that a monetary policy of strict price stability eliminates the influence of monetary shocks on bond returns and hence allows bond portfolios to fully deliver risk sharing (whether prices are sticky or flexible).

The overall message from this line of research is that a portfolio exhibiting exposure to nominal exchange rate movements can play a role in contributing to international risk sharing. A country will wish to go long on foreign currency and short on domestic currency if the value of the domestic currency positively co-moves with domestic wealth. Moreover, nominal currency positions are more useful, the less volatile are monetary shocks. Finally, the gross scale of positions is increasing in the importance of sharing risk - that is, the more volatile and persistent are wealth shocks.

[2] In an infinite horizon model with price adjustment, these authors show that trade in equities is also required to deliver full risk sharing. However, even in that case, only limited equity trade may be required in view of the stabilizing properties of foreign-currency hedges.

2.2 Moving from Theory to Empirics

In Lane and Shambaugh (2007), we defined aggregate foreign currency exposure by

$$FX_{it}^{AGG} = \omega_{it}^{A} * \left(\frac{A_{it}}{A_{it}+L_{it}}\right) - \omega_{it}^{L} * \left(\frac{L_{it}}{A_{it}+L_{it}}\right) \tag{3}$$

where ω_{it}^{A} is the share of foreign assets denominated in foreign currencies, and ω_{it}^{L} is defined analogously. FX^{AGG} lies in the range $(-1,1)$ where the lower bound corresponds to a country that has no foreign-currency assets and all its foreign liabilities are denominated in foreign currencies, while the upper bound is hit by a country that has only foreign-currency assets and no foreign-currency liabilities. Accordingly, FX^{AGG} captures the sensitivity of a country's portfolio to a uniform currency movement by which the home currency moves proportionally against all foreign currencies. This measure explicitly examines the financial or balance sheet currency exposure; the real side impact of currency movements on trade flows is not considered here.

In developing an empirical specification, it is desirable to encapsulate the main hypotheses generated by the theoretical literature. Accordingly, for empirical purposes, the desired net foreign-currency exposure of country i's balance sheet may be expressed as:

$$\begin{aligned} FX_{it}^{AGG*} &= \alpha + \rho * OPEN_{it} + \beta * VOL(Z_{it}) + \gamma * COV(Z_{it}, E_{it}) \\ &\quad -\varphi_H * VOL(\pi_{it}) - \varphi_F * VOL(E_{it}) - \varphi_F * VOL(\pi_{Fit}) + \varepsilon_{it} \end{aligned} \tag{4}$$

where $OPEN_i$ is trade openness, Z_i is the vector of 'wealth risk factors,' E_i is the nominal exchange rate, π_i is domestic inflation and π_F is foreign inflation. Trade openness is included because the value of foreign assets in a portfolio is increasing in a country's propensity to consume imports (Obstfeld and Rogoff 2001). In relation to the latter three terms, nominal volatility at home limits the ability of domestic residents to issue domestic-currency assets to foreign investors, while nominal volatility overseas reduces the willingness of domestic investors to hold foreign-currency bonds.

However, a host of factors may inhibit a country's ability to attain its desired net foreign-currency position. The capacity to issue domestic-currency liabilities (whether domestic-currency debt or equity instruments) is limited by a poor-quality domestic institutional environment, especially in relation to the treatment of foreign investors. On the other side, the ability to acquire foreign-currency assets may be limited by capital controls, regulatory prohibitions on institutional investors, or simply the wealth of the country. Accordingly, the observed foreign-currency exposure may be characterized by

$$FX_{it}^{AGG} = FX_{it}^{AGG*} - C(F_{it}) \tag{5}$$

where F_i denotes the set of proxies for the limits on the capacity to issue domestic-currency liabilities and acquire foreign-currency assets.

This allows us to write an empirical specification

$$\begin{aligned} FX_{it}^{AGG} &= \alpha + \rho * TRADE_{it} + \beta * VOL(Z_{it}) + \gamma * COV(Z_{it}, E_{it}) \\ &\quad -\varphi_H * VOL(\pi_{it}) - \varphi_F * VOL(\pi_{Fit}) - -\varphi_F * VOL(E_{it}) - \sigma * F_{it} + \varepsilon_{it} \end{aligned} \tag{6}$$

2.3 Components of the Net Foreign Currency Asset Position

Aggregate foreign currency exposure can be decomposed into two primary subcomponents

$$FX_{it}^{AGG} = \left(\frac{NFA_{it}}{A_{it} + L_{it}}\right) + \left[\omega_{itDC}^{L} * \left(\frac{L_{it}}{A_{it} + L_{it}}\right) - \omega_{itDC}^{A} * \left(\frac{A_{it}}{A_{it} + L_{it}}\right)\right] \tag{7}$$

This expression shows that FX^{AGG} is the sum of the net foreign asset position plus the share of foreign liabilities which are in local currency minus the share of foreign assets which are in local currency. Accordingly, if all assets and liabilities are in foreign currency, the aggregate foreign-currency exposure is simply the scaled net foreign asset position. Conversely, if the net foreign asset position is zero, aggregate foreign-currency exposure is the difference in the foreign-currency share between the asset and liability sides of the international balance sheet. Accordingly, we label this second part of the equation $FX_{it}^{AGG,0}$ and rewrite our equation as

$$FX_{it}^{AGG} = \left(\frac{NFA_{it}}{A_{it} + L_{it}}\right) + FX_{it}^{AGG,0} \tag{8}$$

where NFA_{it} is the net foreign asset position (scaled by $A + L$) and $FX_{it}^{AGG,0}$ is the aggregate foreign currency exposure evaluated at a zero net foreign asset position. This decomposition is useful, since much of the theoretical literature has focused on scenarios in which the net foreign asset position in zero, even if non-zero net foreign asset positions are empirically important in determining aggregate foreign currency exposures.

In turn, it is helpful to make further decompositions of each of these terms

$$\begin{aligned} FX_{it}^{AGG} &= \left[\left(\frac{A_{NRit} - L_{it}}{A_{it} + L_{it}}\right) + \frac{FXR_{it}}{A_{it} + L_{it}}\right] + \\ &\quad \left[\left(\frac{PEQL_{it} + FDIL_{it}}{A_{it} + L_{it}}\right) + \left(\frac{DEBTL_{it}^{DC}}{A_{it} + L_{it}}\right) - \left(\frac{A_{NRit}^{DC}}{A_{it} + L_{it}}\right)\right] \end{aligned} \tag{9}$$

That is, FX^{AGG} decomposes into two elements of the net foreign asset position (non-reserve net foreign assets $A_{NR}-L$, plus foreign-exchange reserves FXR) and three elements of $FX^{AGG,0}$ (portfolio equity and direct investment foreign liabilities, plus domestic-currency debt liabilities minus local-currency debt assets), where all terms are scaled to $A+L$. This decomposition has several appealing features. First, it clearly differentiates between the relative contributions of foreign-exchange reserves and non-reserve components in the overall net foreign asset position. Second, it highlights that $FX_{it}^{AGG,0}$ is driven by three separate factors: all else equal, a greater share of equities in foreign liabilities reduces reliance on foreign-currency financing, while the foreign-currency position is more positive, the greater is the share of domestic currency in foreign debt liabilities and the smaller is the share of domestic-currency assets in non-reserve foreign assets.[3] In our empirical work, we examine each of these elements in some detail, since diverse strands of the existing theoretical and empirical literatures have typically focused on individual elements rather than the aggregate position.

Lane and Shambaugh (2007) show that the quantitative impact of a uniform currency movement is product of FX^{AGG} and the gross scale of the international balance sheet

$$NETFX = FX^{AGG} * IFI \tag{10}$$

where $IFI = A + L$ is the outstanding gross stock of foreign assets and foreign liabilities. We will examine $NETFX$ in addition to FX^{AGG} and its subcomponents in our empirical analysis.

Finally, we also construct an alternative measure of foreign-currency exposure that only takes into account debt assets and liabilities. While we view the aggregate position as the most comprehensive and useful, some models have specific predictions for the debt-only position (see, amongst others, Coeurdacier, Kollman, and Martin 2007). We calculate

$$FXDEBT_{it}^{AGG} = \frac{FXR_{it} + PDEBTA_{it}^{FC} + ODEBTA_{it}^{FC} - PDEBTL_{it}^{FC} + ODEBTL_{it}^{FC}}{DebtA_{it} + DebtL_{it}} \tag{11}$$

where $PDEBT$ and $ODEBT$ denote portfolio and non-portfolio ("other") debt respectively. The net foreign currency position in the debt portion of the balance sheet is scaled to the size of the debt balance sheet, the debt assets plus debt liabilities.

[3] The domestic-currency share in non-reserve foreign assets will typically be driven by the domestic-currency share in non-reserve foreign debt assets. The exception are those countries that share a currency with other countries, such that a proportion of foreign equity assets will be denominated in domestic currency.

3 Data

The construction of the dataset is described in detail in Lane and Shambaugh (2007). Since the focus in this paper is on aggregate foreign-currency exposure, our focus here is on describing our approach to estimating the foreign-currency and domestic-currency components of foreign assets and foreign liabilities. Since, for this purpose, we do not depend on the composition of the foreign-currency component across different currencies, the calculations here are less taxing than the bilateral currency estimates reported by Lane and Shambaugh (2007).

In relation to foreign assets, foreign-exchange reserves are by definition denominated in foreign currencies. For the portfolio equity and direct investment categories, we make the assumption that an equity position in destination country j carries an exposure to the currency of country j. In effect, this assumption implies that the home-currency returns on foreign equity assets can be analyzed as consisting of two components: the foreign-currency return, plus the exchange rate shift between the foreign and home currencies. So long as the two components are not perfectly negatively correlated, the home-currency return will be influenced by currency movements such that the equity category indeed carries a currency exposure.

The portfolio debt category poses the most severe challenge since many countries issue debt in multiple currencies, while the propensity to purchase bonds issued in particular currencies varies across investors of different nationalities. We make extensive use of the international securities dataset maintained by the BIS, which reports the currency denomination of international bonds for 113 issuing countries.[4] For some countries (such as the United States), international bonds are issued mainly in domestic currency; for other countries, international bonds are typically denominated in foreign currency.

In order to allow for the propensity of investors to buy international bonds that are denominated in their own currency, we exploit the data provided by the United States Treasury, the European Central Bank and the Bank of Japan regarding the currency composition of the foreign assets of these regions. The United States reports the currency

[4] Where the BIS data set lacks data on the currency of issue for a country, we rely on the World Bank's *Global Financial Development* database of the currency composition of external debt. This is an imperfect measure because it includes non portfolio long term debt (such as bank loans), but the countries which are missing BIS data make up a small fraction of internationally held debt assets. Our dataset focuses on international bond issues - while foreign investors have become active in the domestic bonds markets of developing countries in very recent years, the international bond issues are more important for the vast bulk of our sample period.

denomination of its portfolio debt assets in each destination country (US Treasury 2004). From the Bank of Japan data, it is clear that Japanese investors purchase (virtually) all of the yen-denominated debt issued by other countries, while the European Central Bank data suggests that investors from the euro area hold 66 percent of the euro-denominated debt issued by other countries (European Central Bank 2005).[5] Accordingly, we adjust the currency weights derived from the BIS data to take into account the portfolio choices by the investors from the major currency blocs and employ these adjusted weights in working out the currency composition of the foreign holdings of investors from other countries.[6] This procedure delivers estimates of the foreign- and domestic-currency components of the foreign portfolio debt assets held by each country (in addition to details on the composition of the foreign-currency component). Finally, in relation to non-portfolio debt assets, we are able to exploit the BIS locational banking statistics to obtain a breakdown between home-currency and foreign-currency bank assets.

The treatment of foreign liabilities is largely symmetric. Portfolio equity and direct investment liabilities are assumed to be in the home currency, while the BIS databanks on bank debt liabilities and securities issuance allows us to obtain a breakdown of debt liabilities between the domestic currency and foreign currency components. (For developing countries, we use the World Bank's Global Development Finance database to obtain the currency breakdown of external debt.)

As discussed in Lane and Shambaugh (2007), it is possible that some exposure is hedged using derivatives. It is important to note that any within country derivative sales are moot as they simply shift exposure across parties within the country's overall balance sheet. Also, anecdotal evidence and some country studies suggest cross border hedging is not on the same scale as the asset and liability positions we examine.

Finally, Lane and Shambaugh (2007) show that that valuation effects that we derive from the financially-weighted exchange rate indices are strong predictors of actual valuation effects, suggesting our measures are good approximations of actual positions.

Our full sample of countries includes 117 countries where we have full data. We eliminate hyperinflation episodes due to their status as outliers, and start a country's data after the conclusion of a hyperinflation (countries with hyperinflations late in the sample are

[5] Bank of Japan data show the currency composition and amount of Japanese foreign long-term debt assets. When compared with the BIS currency denomination issuance data set, we see that effectively all yen-denominated debt issued outside Japan is held by Japanese investors.

[6] That is, if US, European, and Japanese investors all hold debt in Brazil and Brazil issues debt in local currency, dollars, euro, and yen, then the US investor most likely holds dollar debt, the Japanese investor most likely holds more yen debt and the European investor most likely holds more euro debt.

dropped). Many results examine the variation between 1994 to 2004 (1996 to 2004 in the regression analysis). These results use a smaller 102 country sample that has full data from 1994 through 2004.[7]

4 Foreign-Currency Exposure: Stylized Facts

Table 1 shows some summary statistics for FX^{AGG}, $NETFX$ and $FXDEBT^{AGG}$ for different country groups for 1994 and 2004. The data show a general move towards a more positive FX^{AGG} position between 1994 and 2004. Table 1 also shows considerable cross-group variation. For each period, FX^{AGG} is more positive for the typical advanced economy relative to the typical emerging market economy, while the typical developing country has a negative FX^{AGG} position. These patterns also broadly apply in relation to $NETFX$ but the long position of the typical advanced economy is amplified by the much higher level of international financial integration for this group than for the lower-income groups.

To put these figures in context, a negative $NETFX$ value of minus 22 percent (the typical developing country) means that a uniform 20 percent depreciation against other currencies generates a valuation loss of 4.4 percent of GDP, while the same currency movement generates a 7.2 percent of GDP valuation gain for a country with a positive $NETFX$ value of 36 percent (the typical advanced economy). These wealth effects are considerable and demonstrate why the aggregate foreign-currency position against the rest of the world is an important indicator.

Table 1 also shows positions for $FXDEBT^{AGG}$. First, we note the mechanical pattern that debt-only positions are automatically more negative than overall positions. Since FDI and portfolio equity liabilities are in local currency and foreign equity assets are in foreign currency, equity positions on either side of the balance sheet makes FX^{AGG} more positive. Hence, $FXDEBT^{AGG}$ is more negative than the overall FX^{AGG} in all years. A somewhat surprising result is that even advanced countries in 2004 have negative $FXDEBT^{AGG}$ positions. This occurs because so many of their assets are either in local-currency debt

[7] The remaining data comes from standard sources. Exchange rate and inflation data are from the International Monetary Fund's *International Financial Statistics* database, while GDP and trade data are from the World Bank's *World Development Indicators* database, and the institutional data comes from the World Bank's *Worldwide Governance Indicators* database (www.govindicators.org). The peg variable is from Shambaugh (2004), capital controls data come from di Giovanni and Shambaugh (2008) and is a binary variable summarizing information from the IMF yearbooks (using the alternative indicators developed by Chinn and Ito (2007) or Edwards (2007) makes nearly no difference and the choice is based on maximising data availability).

assets or equity assets, even though they have few foreign currency debt liabilities, the net currency position in foreign bonds is negative.

Table 2 shows summary statistics for the cross-country distribution of FX^{AGG} and its various subcomponents (plus $NETFX$) for 2004 (the final year in the dataset). Across the full sample, the average country has a roughly-balanced foreign-currency position, but the range extends from minus 72 percent to plus 68 percent. It is important to note that a positive value of FX^{AGG} is not in itself good or bad. Instead, the optimal allocation could depend on the factors noted above. While having a negative FX^{AGG} means losses on the balance sheet if there is a depreciation, it conversely means gains in the case of an appreciation.[8] The typical net foreign asset position is negative, on the order of 30 percent of assets and liabilities, while the $FX_{it}^{AGG,0}$ terms tends to partly balance this out, since it is typically positive.[9]

As for the subcomponents, the non-reserve component of the net foreign asset position of most countries is negative but, by definition, foreign-exchange reserves are always at least slightly positive. Portfolio equity and direct investment are on average about 20 percent of liabilities, giving most countries a built-in set of domestic-currency liabilities. Many countries have no domestic- currency foreign debt liabilities, and even more have no domestic-currency foreign assets.[10] Finally, $NETFX$ is a more skewed variable with a much larger standard deviation as some countries have very large ratios of foreign assets and liabilities to GDP.

We can re-organize the decomposition of FX^{AGG} into a series of bivariate decompositions. At the upper level, we decompose FX^{AGG} between NFA (scaled by $A+L$) and $FX^{AGG,0}$. In turn, we decompose the overall net foreign asset position between non-reserve net foreign assets and foreign-exchange reserves and $FX_{it}^{AGG,0}$ between the equity share in foreign liabilities and the domestic currency share term ($DCSHARE = DEBTL^{DC} - A_{NR}^{DC}$). Finally, the $DCSHARE$ term can be disaggregated into its two constituent parts.

[8] Lane and Shambaugh (2007) provide an extensive discussion of the distribution and trends in this particular statistic. For context, a negative position of -0.5 suggests that for every 10 percent depreciation of the currency, the country will face valuation losses of 5 percent times the assets plus liabilities divided by GDP. For the typical country, this would mean a loss of 10 percent of GDP.

[9] To exhibit a negative value of $FX_{it}^{AGG,zero}$ would require more foreign assets in local currency than foreign liabilities. Since most countries have some local currency liabilities (due to direct investment and portfolio equity) and few countries have local currency foreign assets, only two countries actually have a negative value of $FX_{it}^{AGG,zero}$.

[10] The latter is expressed as a negative number, since it enters the decomposition negatively.

In order to assess the relative contributions of each term in a bivariate decomposition, we report three statistics. Taking the generic pair $Q = N_1 + N_2$, we generate: (i) the R^2 from a regression of Q on N_1; (ii) the R^2 from a regression of Q on N_2; and (iii) $\rho(N_1, N_2) = Correl(N_{1,} N_2)$. The pooled estimates are reported in Table 3, while Figures 1-5 show the distributions of these statistics from country-by-country estimation.

Unless the correlation between N_1 and N_2 is zero, we cannot make a pure decomposition of the variance of Q into the part driven by N_1 and the part driven by N_2 (because $VAR(Q) = VAR(N_1) + VAR(N_2) + 2COV(N_1, N_2)$).

In some cases, researchers look at variance ratios and arbitrarily allocate the covariance term, frequently just splitting it in half. If the covariance term is zero, the R^2 in our bivariate regression simply equals the variance ratio because the estimated coefficient (beta) on N_1 would be equal to 1 and the $R^2 = \beta^2 VAR(N_1)/VAR(Q)$. If the covariance is positive, the beta is biased upwards and is greater than one in both regressions. In these cases we are effectively allocating the covariance to both variables. Alternatively, if the covariance is negative, beta is biased towards zero and our R^2 will be lower than a variance ratio. A disadvantage of using simple ratios of variances is that if the correlation of N_1 and N_2 approaches negative 1, the variance of Q can approach zero, in which case the ratio of the variance of either variable to the variance of Q will approach infinity.

No technique can purely separate what is driving Q in such a decomposition, but the technique we follow has the advantage of being bounded between $(0, 1)$. In the case where the two components are positively correlated, we are saying that either one could be explaining the movement in Q and if they are negatively correlated, we are saying that neither explains it particularly well since they cancel one another out.

Figure 1 shows the country-by-country decomposition of FX^{AGG} between NFA and $FX_{it}^{AGG,0}$. It shows that both factors independently have high explanatory power for most countries but with the net foreign asset position typically having the higher bivariate R^2. In terms of comovement, the sample is evenly split between cases where the net foreign asset position and $FX^{AGG,0}$ are positively correlated and those where the correlation is negative. In the pooled regressions in Table 3, net foreign assets are much more important, with the R^2 from a regression of FX^{AGG} on $FX^{AGG,0}$ typically close to zero, with the exception of the emerging market group.

Figure 2 decomposes the net foreign asset position between the non-reserve net foreign asset position and foreign-exchange reserves. The former is clearly the dominant factor. Within countries, a regression of the aggregate net foreign asset position on the non-reserve net foreign asset position has an R^2 close to unity for nearly all countries, while at least half the sample has an R^2 less than 0.5 when the regressor is the level of foreign-exchange reserves. Again, the split between positive and negative correlations between the two elements is relatively balanced, but is 60-40 in favor of positive cases.

The pooled regressions in Table 3 emphatically reinforce this point. In the full sample and all subsamples, the R^2 when the non–reserve net foreign asset position is the regressor is at least 0.9 and the only subsample where reserves appear important is the developing world. Table 3 shows a negative correlation of reserves and non-reserve NFA in advanced countries suggesting that reserves could be held as a hedge against losses in the non-reserve balance sheet, but there is no correlation in the emerging countries and developing countries actually show a positive correlation. This implies that countries with a positive NFA hold more reserves, suggesting they are not a hedge of private positions in poor countries.

Figure 3 powerfully shows that the equity share in liabilities is far more important than the currency composition of debt assets and liabilities in driving the behaviour of $FX_{it}^{AGG,0}$. Especially in non-advanced countries, there is simply far more variation in the importance of FDI and portfolio equity liabilities than in domestic-currency foreign debt liabilities (which is relatively low) or domestic-currency foreign assets (which are almost always zero), meaning that $FX^{AGG,0}$ will be almost entirely determined by the extent of portfolio equity and direct investment liabilities. In terms of comovements, it is interesting that there is a 60-40 balance in favor of negative cases. In turn, Figure 4 shows the relative contributions of the liability and asset sides to the currency composition factor and shows that the liability side has slightly more explanatory power. The correlation is 80-20 in favor of negative cases as countries with large domestic-currency debt liabilities also have large domestic-currency non-reserve foreign assets.

Finally, Figure 5 shows the decomposition of $NETFX$ between FX^{AGG} and IFI.[11] It is interesting that FX^{AGG} has relatively more explanatory power than IFI: the overall net currency exposure of the economy is driven more by the currency exposure of the international balance sheet than by the gross scale of asset and liability positions relative to the economy. There is a reasonably even split between positive and negative correlations ($60-40$ in favor of positive). In Table 3, we see that FX^{AGG} is more important than IFI in the full pooled sample, but their relative importance varies across the various subsamples.

Our analysis is static in nature, looking at exposure to a change in the exchange rate based on holdings at a given point in time. One may worry that a collapsing currency (or fears of one) could lead to a collapsing position if a country is suddenly forced to borrow

[11] This decomposition is of a slightly different nature in that $NETFX$ is the product of FX^{AGG} and IFI, whereas each of the other decompositions is of a sum.

extensively in foreign currency. This might mean that apparently safe positions are illusory. In fact, a change in the exchange rate typically has little impact on FX^{AGG}. Consider a country with no assets and all foreign currency liabilities. If the exchange rate depreciates, they face valuation losses but FX^{AGG} is -1 throughout. If assets equaled half of liabilities and FX^{AGG} is -0.5, the same applies. Only if there is an extensive amount of domestic currency liabilities on the balance sheet can a depreciation shift FX^{AGG} to a more negative position (by increasing the relative size of the foreign currency liabilities). In fact there is only a slight decrease in FX^{AGG} in the year prior to a sudden stop and FX^{AGG} on average does not change at all in the year of a sudden stop.[12] Thus we do not view this concern as particularly problematic, and instead see our measure as a good indicator of the external balance sheet exposure of countries.

5 Econometric Analysis

5.1 Regression Specification

We begin our analysis with the determinants of aggregate foreign currency exposure, before moving on to the subcomponents. Table 4 explores a variety of specifications to explain variation in FX^{agg}.

We adopt a panel framework

$$Y_{it} = \alpha + \phi_t + \beta' X_{it} + \varepsilon_{it} \tag{12}$$

where $t = 1996, 2000, 2004$. We consider four specifications for X. The baseline specification follows the setup described in equation (4) above, which focuses on the types of variables that are identified as potentially important in a 'friction free' environment. We include the following variables

- Trade Openness (trade to GDP ratio)
- Volatility of real GDP per capita
- Covariance of real per capita GDP and the nominal effective exchange rate
- Volatility of the nominal effective exchange rate

[12] Thailand and Korea in 1997 do show declining FX^{AGG}, but the decline is small and is balanced by countries that show and increasing FX^{AGG} (perhaps due to being forced to pay back foreign loans when funding dries up).

- Volatility of domestic inflation

The volatility and covariance measures are calculated for the log changes of each variable over a rolling 15 year window (since the real variables are only available on an annual basis for many countries). As was discussed in Section 2.3, the importance of hedging is increasing in the volatility of domestic wealth (proxied here by GDP per capita). A critical factor in determining whether FX^{AGG} should be long or short is the sign of the covariance term between domestic wealth and the nominal exchange rate, proxied here by the the covariance between GDP and the nominal effective exchange rate. The more volatile is the nominal exchange rate, the more risky are foreign-currency assets while domestic inflation volatility increases uncertainty about the real returns on nominal positions. Finally, a time fixed effect is included in equation (12) to control for global factors, such as time-variation in the volatility of global inflation.

We also consider an expanded specification that seeks to take into account institutional and policy factors that may alter the desired optimal net foreign currency position and/or restrict a country's ability to attain its desired level. These variables include:

- Institutional Quality
- Capital Controls
- The *de facto* exchange rate regime
- A marker for being in EMU

A third set of variables is also considered that are viewed as general control variables

- GDP per capita
- Country size (Population)

The level of GDP per capita is included, since many of the characteristics listed above are plausibly correlated with the level of development and we want to be able to ascertain whether these variables have explanatory power even holding fixed GDP per capita. Country size is a second general control variable, since previous empirical evidence suggests that larger countries are better able to issue domestic-currency liabilities (Lane and Milesi-Ferretti 2000, Eichengreen et al 2003).

The regressions use data from 1996, 2000, and 2004.[13] We begin by reporting the results from pooled estimation of the baseline specification in column (1) of Table 4; we add the institutional and policy variables in column (2); while we alternatively add the general control variables in column (3); the full set of regressors are included in column (4). In order to isolate the time-series variation in the date, we add country fixed effects in columns (5) and (6); as an alternative (albeit with a drop in the degrees of freedom), we estimate a 'long' first-differences equation columns (7) and (8) which examines the changes in the variables between 1996 and 2004.

It is worth noting that while we present evidence for the full sample of countries, the results are strikingly similar even if exclude the set of advanced economies. We explicitly control for EMU, GDP per capita and use country fixed effects in some specifications. These techniques appear sufficient to take into account differences across the advanced, emerging, and developing samples.

5.2 Results for FX^{AGG}

5.2.1 Pooled Estimation

Table 4 provides the results. In the pooled estimation with year effects (the first four columns), we see that greater trade openness is clearly associated with a more positive value of FX^{AGG}: this is true whether more extensive controls are present or not, although the estimated coefficient drops in value once additional controls are included in columns (2)-(4). A positive association between trade openness and foreign currency exposure is consistent with the notion that the role of foreign assets in portfolios is more important, the greater is the share of imports in domestic consumption (Obstfeld and Rogoff 2001).

In relation to the other variables in the baseline specification, the estimated coefficients vary in significance and sign across columns (1)-(4). In terms of significant results, the volatility of the nominal exchange rate has the expected negative sign in column (1), while the volatility of domestic inflation is negative and significant in columns (3)-(4). The volatility of GDP is significant only in column (4) but with a positive sign. Finally, the covariance of output and the nominal exchange rate enters with a negative sign in column (4). Accordingly, the results from the pooled estimation do not provide very stable evidence in terms of the relation between the various volatility indicators and the level of foreign-

[13] The World Bank governance data are only available in even years and our data is full for many countries only starting in 1996. We opt to leave 4 year breaks rather than use every year because of the serial correlation of some variables and because of the overlapping nature of the 15 year windows.

currency exposure.

Turning to the institutional and policy variables, the results in column (2) indicate that a better institutional environment is associated with a more positive value for FX^{AGG}, while the estimated coefficient on the exchange rate peg is significantly negative - however, neither capital controls nor the EMU dummy is significant in column (2).[14] However, the inclusion of GDP per capita as a control in column (4) alters these results: the only policy variable that is significant is the EMU dummy which enters with a significantly negative coefficient. Rather, the evidence from columns (3) and (4) is that FX^{AGG} is highly correlated with the level of development: richer countries have a more positive level of foreign-currency exposure. We surmise that the ability to issue domestic-currency liabilities and obtain foreign-currency assets is increasing in institutional dimensions that are highly correlated with the level of development. Finally, the estimated coefficient on country size in columns (3) and (4) is positive but not quite significant.

To obtain a perspective on the quantitative importance of the coefficients, we can consider the magnitudes of the coefficients on trade openness, GDP per capita and the EMU dummy in column (4). In relation to trade openness, the standard deviation in the sample is 0.47, such that that a one standard deviation in trade openness would generate a move of 0.03 in FX^{AGG}. The standard deviation of the natural log of GDP per capita in the sample is 1.6, thus the coefficient on this variable implies a one standard deviation move implies a move of 0.21 in FX^{AGG}, a very substantial shift. The EMU indicator is a dummy, thus being in EMU suggests an FX^{agg} which is 0.14 lower than for other countries, which again is a non-trivial magnitude.

5.2.2 Time Series Variation

The time series variation in the data is captured in the regressions reported in columns (5)-(8) of Table 4. The advantage to holding fixed the cross-sectional variation in the data is that there may be non-observed country characteristics that influence the cross-country distribution of FX^{AGG} values and reduce our ability to accurately capture the impact of some of our variables of interest; the drawback is that other variables in our specification mostly show cross-sectional variation with little time-series variations and these regressors will play less role in explaining intra-country variation.

[14]In this specification, the EMU dummy reflects any extra impact of EMU beyond its stabilising impact on the nominal effective exchange rate, which is captured by the PEG variable. It turns out that the pattern that EMU has led to a less positive foreign-currency position for euro area countries has been well timed, in that the euro has appreciated against other currencies.

In the time series dimension, we see several new results. The most striking finding is that, once either country fixed effects are included or the data are differenced across time, the covariance term now exhibits the expected positive coefficient. Holding fixed other factors, the value of FX^{AGG} becomes more positive for those countries that have experienced an increase in the covariance between domestic output growth and the nominal exchange rate.

This result is not simply driven by a few countries. Figure 6 shows the partial scatter of changes in FX^{AGG} against changes in the covariance of the exchange rate and GDP. We see a clear pattern where those countries with increasingly positive covariance take a more positive FX^{AGG} position. Returning to the size of the effect, a one standard deviation move in the size of the change in the covariance term is 0.005. This implies a one standard deviation shift in the change in the covariance term would come with an increase of 0.035 in FX^{AGG}.

Conversely, the trade openness result is not significant and GDP per capita weakens along the time series dimension: it is clear that these variables help to explain the cross-country variation in the data but are less useful in understanding shifts over time in the value of FX^{AGG}. In contrast, population growth now shows up as an important variable. The logic is twofold. Controlling for GDP per capita, a growing population suggests an economy that is growing larger. Thus, when an economy grows larger, there is a more positive FX^{AGG}. If we instead include population and GDP directly, however, population is still positive and significant, suggesting the demographics themselves may matter directly.

The global shift to more positive FX^{AGG} positions documented in Lane and Shambaugh (2007) can be seen in the positive year dummies for 2000 and 2004 (1996 is the excluded dummy) in columns (1) through (5). Once we consider all controls and include country fixed effects in column (6), the year dummies are no longer significant: the regressors explain a substantial component of the shift to a more positive FX^{AGG} position. We also note that the EMU dummy is negative and significant along the time series dimension, such that the euro area countries clearly shifted towards a more negative position upon the formation of the currency union.

5.3 Results for FXDEBT^{AGG}

We have repeated similar regressions for the debt-only measure of exposure, $FXDEBT^{AGG}$. Table 5 reproduces the specifications in columns (1), (6) and (8) from Table 4 but with $FXDEBT^{AGG}$ as the dependent variable. The results are nearly identical to those for the overall measure. Without country fixed effects, trade openness and GDP per capita are positive and significant (with nearly the same magnitude). The only substantial difference is that the EMU dummy is cut in half and no longer significant. With the inclusion of country fixed effects, the covariance term is still positive and significant, and is in fact slightly larger. The variance of the exchange rate is negative and population is positive and significant and again the EMU dummy has a slightly smaller size, though in this case it is still statistically significant. Looking at the changes specification, the regressions for the debt measure show coefficients with a similar direction but larger size and significance.

5.4 Results for Subcomponents and $NETFX$

We can learn more about the mechanisms behind both the cross-country and time-series variation in the data by examining the various subcomponents of FX^{AGG}; in addition, it is useful to also examine whether the results for FX^{AGG} carry over to $NETFX$. The limitation to this exercise is that the strong patterns of co-variation across the different subcomponents that were identified in Section 3 mean that results for FX^{AGG} may not be easily attributed to the individual subcomponents. For simplicity, we adopt a symmetric approach, whereby we maintain the same set of regressors for each subcomponent of FX^{AGG} and $NETFX$.

To conserve space, we focus on the most general specification which includes the full set of regressors. We report the pooled estimates in Table 6, while the fixed-effects results are contained in Table 7. To assist in comparing results, column (1) in Table 6 repeats column (4) from Table 4, while column (1) in Table 7 repeats column (6) from Table 4.

In relation to the pooled estimates in Table 6, a series of interesting observations arise. In relation to the two primary subcomponents of FX^{AGG}, the positive effect of GDP per capita is clearly operating via the net foreign asset position; in contrast, the EMU dummy affects the $FX^{AGG,0}$ term. At a lower level of decomposition, GDP per capita affects the non-reserve net foreign asset position; in addition, it is associated with higher values for the domestic-currency share of debt liabilities and the domestic-currency share of foreign assets. The EMU dummy has a similar relation with the domestic-currency share of debt liabilities and the domestic-currency share of foreign assets; EMU membership is also associated with a reduction in the level of reserves and a decline in the equity share of liabilities, with both of these effects acting to reduce FX^{AGG}.

The other variables that are individually significant in column (1) – trade openness, the volatility of GDP and the covariance term — are not individually significant for either the net foreign asset position or $FX^{AGG,0}$. However, at a lower level of decomposition, we see that trade openness raises the equity share in foreign liabilities but reduces the domestic-currency share in foreign debt liabilities, which act in opposite directions.[15] The volatility of GDP is only significant in raising the domestic-currency share of non-reserve foreign assets. An increase in the covariance between GDP and the nominal exchange rate is associated with a decline in the non-reserve net foreign asset position, a reduction in the domestic-currency share of foreign debt liabilities and the domestic-currency share of non-reserve foreign assets, all of which are consistent with the overall positive coefficient on the covariance term in the FX^{AGG} regression in column (1).

The main impact of the institutional/policy variables is seen in columns (7) and (8), which show that capital controls are associated with a reduction in the domestic-currency share of foreign debt liabilities and the domestic-currency share of non-reserve foreign assets, while an exchange rate peg raises the domestic-currency share in foreign debt liabilities. Larger countries have more positive non-reserve net foreign asset positions and a higher domestic-currency share in foreign debt liabilities and non-reserve foreign assets. Finally, the pattern that country size is positively associated with a higher domestic-currency share in foreign debt liabilities is consistent with the evidence of Eichengreen et al (2005), who find that original sin is more prevalent for smaller countries.

Turning to the fixed-effects estimates in Table 7, the significantly positive association between the covariance term and FX^{AGG} in column (1) cannot be traced to individual components in columns (2)-(8): although it carries the expected sign for each component (with the exception of the domestic-currency share in non-reserve foreign assets), none of these effects are individually significant.[16] In results not reported, we also ran the first-difference specification as in column (8) of Table 4 and found that the covariance term has a positive coefficient in regressions for both the net foreign asset position and $FX^{AGG,0}$ but it is larger and statistically significant in the latter case.

In contrast, the volatility of the nominal exchange rate — which is significantly negative in column (1) — also shows up as individually significant with a negative sign in the regressions for $FX^{AGG,0}$ and the equity share in foreign liabilities. The pattern for the EMU dummy is very similar to the pooled estimates, with the exception that it is not

[15] In different specifications, Lane and Milesi-Ferretti (2001) and Faria et al (2007) also show that trade openness is positively associated with the equity share in foreign liabilities.

[16] Looking at the subcomponents in the changes (repeating Table 4's column (8) across subcomponents) the positive coefficient for the covariance seems to come from $FX^{AGG,zero}$ as the change in covariance term has a positive coefficient in regressions on both NFA and $FX^{AGG,zero}$ but it is larger and statistically significant in the regression on $FX^{AGG,zero}$.

significant for the equity share in foreign liabilities once country fixed effects are introduced. The positive time-series association between population growth and FX^{AGG} in column (1) is shown to operate via both the reserve and non-reserve components of the net foreign asset position but does not affect $FX^{AGG,0}$ or its subcomponents.

With regard to the variables that are not individually significant in the FX^{AGG} regression in column (1), several turn out to be significant in regressions for particular subcomponents. While the pattern of time-series results for trade openness are qualitatively similar to the pooled estimates, different patterns obtain for the capital controls and exchange rate peg variables. In particular, capital account liberalization is associated with an increase in the net foreign asset position (the non-reserve component) but an offsetting decline in $FX^{AGG,0}$, while moving from a float to a peg is associated with an increase in FX^{AGG}.

Finally, column (9) in Tables 6 and 7 report the regression results in explaining $NETFX$. The $NETFX$ estimates are broadly similar to those for FX^{AGG} but with some exceptions. In particular, the volatility and covariance terms do not show up as significant in the pooled estimates for $NETFX$, while country size is significant. Along the time series dimension, the volatility of GDP and the exchange rate peg measure are individually significant for $NETFX$ but were not for FX^{AGG}, while the opposite is true for the covariance term and nominal exchange rate volatility.

6 Conclusions

Advances in the theoretical modelling of optimal portfolio allocations have enriched our understanding of the potential risk sharing across countries but also raised questions regarding how country portfolios are actually structured. This paper builds on the data set and analysis in Lane and Shambaugh (2007) to generate new stylized facts regarding the determinants of the aggregate foreign currency exposure embedded in external positions and to loosely explore the predictions of this new set of models.

We believe the project generates a number of stylized facts that are both important in their own right and also of interest to the growing theoretical literature. We highlight that the net foreign asset position plays a key role in determining aggregate foreign-currency exposure: looking only at the currency composition of foreign assets and foreign liabilities misses the fact that the dominant factor for many countries is simply the net balance between foreign assets and foreign liabilities. Still, composition plays a role but the equity share in foreign liabilities is quantitatively more important than whether foreign debt liabilities are denominated in domestic currency or foreign currency. Moreover, the pattern is that many of those countries that issue domestic-currency foreign debt liabilities are also significant holders of domestic-currency foreign assets, such that the net impact on aggregate foreign currency exposure is limited.

In our pooled regression analysis with year fixed effects, we find that country characteristics such as trade openness and GDP per capita are helpful in explaining the cross-country variation in FX^{AGG}. However, there is considerable unexplained variation along the cross-sectional dimension, which may help explain why the volatility and covariance measures suggested in the theoretical literature are either weak or incorrectly signed. Once we eliminate the cross-sectional variation by including country fixed effects, we obtain more support for the theoretical priors. Most notably, we find that an increase in the propensity for a currency to depreciate during bad times is associated with a more positive value for FX^{AGG}, such that a long position in foreign currencies helps to hedge against domestic output fluctuations. Our final contribution is to show that there is substantial heterogeneity in the roles of each regressor in explaining the variation in individual subcomponents of FX^{AGG}. Accordingly, in assessing hypotheses about the determinants of foreign-currency exposures, it is important to take a broad perspective rather than examining individual components in isolation.

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Table 1: Aggregate Foreign Currency Exposure

	1994		2004	
	mean	median	mean	median
		FX^{agg}		
All	-0.24	-0.26	-0.04	-0.03
Advanced	0.04	0.08	0.11	0.09
Developing & Emerging	-0.31	-0.43	-0.08	-0.10
Developing	-0.42	-0.47	-0.14	-0.17
Emerging	-0.11	-0.07	0.04	0.06
		$FXDEBT^{agg}$		
All	-0.33	-0.40	-0.14	-0.10
Advanced	-0.12	-0.05	-0.07	-0.05
Developing & Emerging	-0.39	-0.51	-0.15	-0.20
Developing	-0.50	-0.56	-0.22	-0.27
Emerging	-0.18	-0.18	-0.04	-0.02
		$NETFX$		
All	-0.31	-0.22	0.11	-0.04
Advanced	0.17	0.08	0.51	0.36
Developing & Emerging	-0.45	-0.36	0	-0.13
Developing	-0.73	-0.52	-0.21	-0.22
Emerging	0.06	-0.08	0.38	0.06

Note: $FX^{AGG} = \omega^A s^A - \omega^L s^L$; $NETFX = FX^{AGG} * IFI$. Sample includes the 102 countries with data from 1994 to 2004. Source: Lane and Shambaugh (2007).

Table 2: Foreign Currency Exposure (FX^{AGG}) and Subcomponents

Variable	Mean	Std. Dev.	Min	Max	Median
FX^{AGG}	-0.05	0.27	-0.72	0.68	-0.03
$(A-L)/(A+L)$	-0.28	0.28	-0.87	0.55	-0.30
$FX^{AGG,0}$	0.23	0.14	-0.03	0.85	0.22
$(A_{NR}-L)/(A+L)$	-0.40	0.26	-0.89	0.15	-0.46
$FXR/(A+L)$	0.12	0.10	0.00	0.51	0.10
$(PEQL+FDIL)/(A+L)$	0.24	0.13	0.02	0.85	0.22
$DEBTL^{DC}/(A+L)$	0.03	0.09	0.00	0.47	0.00
$A_{NR}^{DC}/(A+L)$	-0.03	0.10	-0.43	0.00	0.00
$NETFX$	0.08	0.83	-1.57	5.56	-0.05
$FXDEBT^{AGG}$	-0.14	0.30	-0.84	0.72	-0.14

Summary statistics for 2004.

Table 3: Variance Decomposition of Foreign Currency Exposure: Pooled Analysis

	(FX^{AGG}, IFI)	$(NFA, FX^{AGG,0})$	(NFA_{NR}, FXR)	$(EQSH_L, DCSHARE)$	$(DCDEBT_L, A^{DC}_{NR})$
ALL	(0.56,0.24,0.26)	(0.83,0.11,-0.08)	(0.91,0.13,0.08)	(0.93,0.08,0.03)	(0.02,0.15,-0.86)
ADV	(0.46,0.53,0.29)	(0.66,0.03,-0.43)	(0.97,0.03,-0.36)	(0.63,0.47,0.10)	(0.01,0.29,-0.78)
EMU	(0.46,0.62,0.24)	(0.40,0.11,-0.52)	(0.91,0.11,-0.60)	(0.34,0.50,-0.16)	(0.01,0.38,-0.74)
NON-EMU	(0.46,0.77,0.41)	(0.75,0.01,-0.40)	(0.99,0.02,-0.25)	(0.87,0.52,0.42)	(0.34,0.00,-0.77)
EM	(0.38,0.80,0.42)	(0.86,0.23,0.12)	(0.93,0.04,-0.08)	(1.00,0.02,0.13)	(0.58,0.07,-0.82)
DEV	(0.57,0.52,-0.25)	(0.77,0.15,-0.11)	(0.91,0.63,0.58)	(1.00,0.00,-0.03)	(1.00,0.00,)

Each cell reports $(R^2_{N1}, R^2_{N2}, \rho[N1, N2])$ where $Q = N1 + N2$ and R^2_{N1} denotes the R^2 from a regression of Q on $N1$, R^2_{N1} denotes the R^2 from a regression of Q on $N2$, and $\rho[N1, N2]$ is the correlation between $N1$ and $N2$. Pooled data over 1994 to 2004.

Table 4: Determinants of FX^{AGG}: Panel Estimation

	(1) YFE	(2) YFE	(3) YFE	(4) YFE	(5) CFE,YFE	(6) CFE,YFE	(7) Δ	(8) Δ
Trade	0.13 (0.04)**	0.08 (0.03)*	0.07 (0.03)*	0.07 (0.03)*	0.04 (0.07)	0.04 (0.06)	0.07 (0.09)	0.08 (0.09)
$Vol(GDP)$	-0.92 (0.87)	0.09 (0.38)	0.59 (0.37)	0.60 (0.36)+	0.38 (0.55)	0.14 (0.56)	0.31 (0.65)	0.01 (0.71)
$Cov(GDP, E)$	2.86 (1.75)	-0.59 (1.70)	-2.37 (1.50)	-2.66 (1.47)+	4.89 (2.85)+	5.01 (2.94)+	7.46 (3.39)*	7.44 (3.82)+
$Vol(\pi)$	0.08 (0.24)	-0.27 (0.23)	-0.32 (0.19)+	-0.39 (0.19)*	0.61 (0.33)+	0.38 (0.27)	0.74 (0.40)+	0.55 (0.37)
$Vol(E)$	-1.28 (0.62)*	0.61 (0.63)	0.89 (0.61)	0.88 (0.57)	-1.52 (0.55)**	-1.00 (0.55)+	-2.07 (0.62)**	-1.53 (0.64)*
Institutions		0.17 (0.03)**		-0.01 (0.05)		-0.002 (0.06)		0.02 (0.09)
Capital controls		-0.06 (0.05)		-0.04 (0.05)		0.03 (0.03)		0.04 (0.04)
Peg		-0.08 (0.03)*		-0.03 (0.03)		0.001 (0.03)		0.03 (0.05)
EMU		-0.06 (0.05)		-0.14 (0.03)**		-0.12 (0.04)**		-0.15 (0.04)**
GDP per capita			0.13 (0.01)**	0.14 (0.02)**		0.18 (0.10)+		0.05 (0.16)
POP			0.03 (0.02)	0.03 (0.02)		0.78 (0.22)**		0.73 (0.28)**
y2000	0.06 (0.02)**	0.08 (0.02)**	0.08 (0.02)**	0.09 (0.02)**	0.07 (0.01)**	0.03 (0.02)		
y2004	0.14 (0.02)**	0.18 (0.02)**	0.14 (0.02)**	0.15 (0.02)**	0.15 (0.02)**	0.06 (0.03)		
Constant	-0.20 (0.06)**	-0.25 (0.06)**	-1.39 (0.11)**	-1.39 (0.20)**	-0.22 (0.05)**	-3.69 (1.07)**	0.14 (0.02)**	0.08 (0.05)
Obs.	300	297	300	297	300	297	94	90
R^2	0.16	0.43	0.56	0.58	0.92	0.93	0.08	0.26

Standard errors clustered at the country level in parentheses. + significant at 10%; * significant at 5%; ** significant at 1% .

Table 5: Determinants of $FXDEBT^{AGG}$.

	(1) FX^{AGG} YFE	(2) FX^{agg} Debt YFE	(3) FX^{AGG} CFE, YFE	(4) FX^{agg} Debt CFE, YFE	(5) FX^{AGG} Δ	(6) FX^{agg} Debt Δ
Trade	0.07	0.11	0.04	0.02	0.08	0.10
	(0.03)*	(0.04)**	(0.06)	(0.07)	(0.09)	(0.11)
$Vol(GDP)$	0.60	0.78	0.14	0.35	0.01	0.35
	(0.36)+	(0.51)	(0.56)	(0.78)	(0.71)	(1.00)
$Cov(GDP, E)$	-2.66	-2.51	5.01	7.69	7.44	10.23
	(1.47)+	(2.10)	(2.94)+	(3.75)*	(3.82)+	(4.87)*
$Vol(\pi)$	-0.39	-0.39	0.38	0.72	0.55	0.97
	(0.19)*	(0.26)	(0.27)	(0.36)+	(0.37)	(0.50)+
$Vol(E)$	0.88	0.73	-1.00	-1.52	-1.53	-2.10
	(0.57)	(0.67)	(0.55)+	(0.61)*	(0.64)*	(0.73)**
Institutions	-0.01	-0.07	0.00	-0.03	0.02	-0.03
	(0.05)	(0.06)	(0.06)	(0.07)	(0.09)	(0.10)
Capital Controls	-0.04	-0.05	0.03	0.05	0.04	0.06
	(0.05)	(0.06)	(0.03)	(0.04)	(0.04)	(0.05)
PEG	-0.03	-0.04	0.00	-0.01	0.03	0.02
	(0.03)	(0.04)	(0.03)	(0.04)	(0.05)	(0.06)
EMU	-0.14	-0.06	-0.12	-0.10	-0.15	-0.14
	(0.03)**	(0.05)	(0.04)**	(0.04)*	(0.04)**	(0.05)*
GDP per capita	0.14	0.14	0.18	0.20	0.05	0.13
	(0.02)**	(0.03)**	(0.10)+	(0.14)	(0.16)	(0.21)
POP	0.03	0.02	0.78	0.71	0.73	0.74
	(0.02)	(0.02)	(0.22)**	(0.25)**	(0.28)**	(0.32)*
y2000	0.09	0.06	0.03	0.01		
	(0.02)**	(0.02)**	(0.02)	(0.03)		
y2004	0.15	0.13	0.06	0.06		
	(0.02)**	(0.03)**	(0.03)	(0.04)		
Constant	-1.39	-1.52	-3.69	-3.73	0.08	0.07
	(0.20)**	(0.26)**	(1.07)**	(1.37)**	(0.05)	(0.06)
Obs.	297	297	297	297	90	90
R^2	0.58	0.4	0.93	0.92	0.26	0.23

Robust standard errors in parentheses. + significant at 10%; * significant at 5%; ** significant at 1% .

Table 6: Determinants of Subcomponents: Pooled Estimates

	(1) FX^{AGG}	(2) NFA	(3) $FX^{AGG,zero}$	(4) $A_{NR}-L$	(5) FXR	(6) $EQSH_L$	(7) DC_{DL}	(8) DC_{NRA}	(9) $NETFX$
Trade	0.07	0.03	0.04	0.02	0.01	0.05	-0.02	0.01	0.70
	(0.03)*	(0.03)	(0.03)	(0.03)	(0.02)	(0.03)*	(0.01)**	(0.01)	(0.27)*
$Vol(GDP)$	0.60	0.52	0.07	0.44	0.09	0.07	0.07	-0.07	-0.04
	(0.36)+	(0.39)	(0.18)	(0.30)	(0.16)	(0.18)	(0.05)	(0.04)+	(1.53)
$Cov(GDP, E)$	-2.66	-3.03	0.38	-3.23	0.20	0.44	-0.54	0.47	-4.69
	(1.47)+	(1.87)	(1.01)	(1.68)+	(0.70)	(0.99)	(0.27)+	(0.22)*	(3.83)
$Vol(\pi)$	-0.39	-0.45	0.06	-0.46	0.01	0.07	-0.04	0.03	-0.44
	(0.19)*	(0.27)+	(0.14)	(0.23)+	(0.08)	(0.14)	(0.03)	(0.02)	(0.44)
$Vol(E)$	0.88	0.88	-0.002	0.88	-0.01	0.01	0.01	-0.02	1.76
	(0.57)	(0.81)	(0.38)	(0.71)	(0.18)	(0.37)	(0.04)	(0.04)	(1.26)
Institutions	-0.01	-0.01	0.01	-0.003	-0.01	0.00	0.01	-0.002	0.12
	(0.05)	(0.05)	(0.02)	(0.04)	(0.02)	(0.02)	(0.01)	(0.01)	(0.12)
Capital controls	-0.04	-0.01	-0.03	-0.03	0.02	-0.03	-0.02	0.02	-0.09
	(0.05)	(0.04)	(0.03)	(0.04)	(0.01)	(0.02)	(0.01)**	(0.01)**	(0.10)
Peg	-0.03	-0.03	-0.003	-0.02	-0.01	-0.01	0.01	-0.01	0.02
	(0.03)	(0.03)	(0.02)	(0.03)	(0.01)	(0.02)	(0.004)+	(0.003)	(0.10)
EMU	-0.14	-0.01	-0.13	0.06	-0.07	-0.06	0.18	-0.25	-0.42
	(0.03)**	(0.04)	(0.05)**	(0.04)	(0.02)**	(0.03)+	(0.02)**	(0.03)**	(0.19)*
GDP per capita	0.14	0.13	0.01	0.13	-0.001	0.01	0.01	-0.01	0.20
	(0.02)**	(0.02)**	(0.01)	(0.02)**	(0.01)	(0.01)	(0.003)*	(0.003)*	(0.06)**
POP	0.03	0.02	0.003	0.03	-0.002	0.003	0.01	-0.01	0.12
	(0.02)	(0.02)	(0.01)	(0.01)+	(0.01)	(0.01)	(0.004)*	(0.003)**	(0.04)**
y2000	0.09	0.03	0.06	0.02	0.01	0.06	-0.01	0.01	0.14
	(0.02)**	(0.02)*	(0.01)**	(0.01)	(0.01)+	(0.01)**	(0.003)**	(0.003)**	(0.04)**
y2004	0.15	0.08	0.07	0.05	0.03	0.06	-0.001	0.01	0.24
	(0.02)**	(0.02)**	(0.01)**	(0.02)*	(0.01)**	(0.01)**	(0.003)	(0.003)*	(0.06)**
Constant	-1.39	-1.45	0.06	-1.54	0.09	0.06	-0.04	0.05	-2.63
	(0.20)**	(0.23)**	(0.09)	(0.18)**	(0.09)	(0.08)	(0.03)	(0.02)*	(0.61)**
Obs.	297	297	297	297	297	297	297	297	297
R^2	0.58	0.48	0.17	0.62	0.13	0.17	0.76	0.86	0.55

Standard errors clustered at the country level in parentheses. + significant at 10%; * significant at 5%; ** significant at 1% .

Table 7: Determinants of Subcomponents: Fixed-Effects Estimates

	(1) FX^{AGG}	(2) NFA	(3) $FX^{AGG,zero}$	(4) $A_{NR} - L$	(5) FXR	(6) $EQSH_L$	(7) DC_{DL}	(8) DC_{NRA}	(9) $NETFX$
Trade	0.04	-0.02	0.06	-0.03	0.02	0.08	-0.02	0.00	0.34
	(0.06)	(0.06)	(0.04)	(0.06)	(0.02)	(0.04)*	(0.01)*	(0.01)	(0.44)
$Vol(GDP)$	0.14	0.001	0.13	0.20	-0.19	0.10	0.04	-0.01	2.67
	(0.56)	(0.60)	(0.26)	(0.50)	(0.33)	(0.27)	(0.05)	(0.03)	(1.40)+
$Cov(GDP, E)$	5.01	2.60	2.39	0.98	1.62	1.89	0.41	0.09	7.02
	(2.94)+	(2.69)	(1.54)	(2.19)	(1.13)	(1.54)	(0.52)	(0.19)	(8.74)
$Vol(\pi)$	0.38	0.62	-0.24	0.32	0.30	-0.32	0.06	0.01	0.99
	(0.27)	(0.28)*	(0.17)	(0.21)	(0.11)**	(0.16)*	(0.04)	(0.02)	(0.91)
$Vol(E)$	-1.00	-0.37	-0.63	-0.13	-0.24	-0.51	-0.08	-0.05	-0.95
	(0.55)+	(0.46)	(0.25)*	(0.33)	(0.21)	(0.24)*	(0.06)	(0.03)	(1.21)
Institutions	0.006	-0.01	0.01	-0.02	0.01	-0.002	0.001	0.01	-0.02
	(0.06)	(0.06)	(0.03)	(0.05)	(0.02)	(0.02)	(0.01)	(0.01)	(0.09)
Capital controls	0.03	0.08	-0.05	0.06	0.02	-0.03	-0.02	0.001	0.03
	(0.03)	(0.03)*	(0.02)*	(0.03)*	(0.02)	(0.02)	(0.02)	(0.002)	(0.06)
Peg	0.001	-0.03	0.03	-0.03	0.001	0.02	0.01	0.01	0.13
	(0.03)	(0.03)	(0.02)+	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.06)*
EMU	-0.12	-0.03	-0.09	0.01	-0.04	-0.02	0.15	-0.22	-0.19
	(0.04)**	(0.03)	(0.04)*	(0.03)	(0.01)**	(0.02)	(0.02)**	(0.02)**	(0.12)
GDP per capita	0.18	0.15	0.03	0.11	0.04	0.07	-0.03	-0.01	0.06
	(0.10)+	(0.11)	(0.10)	(0.09)	(0.05)	(0.09)	(0.01)*	(0.02)	(0.23)
POP	0.78	0.82	-0.04	0.52	0.29	0.03	-0.06	-0.003	0.97
	(0.22)**	(0.23)**	(0.17)	(0.21)*	(0.09)**	(0.16)	(0.04)	(0.04)	(0.51)+
y2000	0.03	-0.02	0.04	-0.002	-0.01	0.04	0.00	0.01	0.09
	(0.02)	(0.02)	(0.02)+	(0.02)	(0.01)	(0.02)+	(0.004)	(0.004)	(0.05)+
y2004	0.06	0.003	0.05	0.01	-0.01	0.03	0.02	0.001	0.18
	(0.03)	(0.04)	(0.04)	(0.04)	(0.02)	(0.04)	(0.01)*	(0.01)	(0.09)+
Constant	-3.69	-3.70	0.01	-2.69	-1.01	-0.49	0.44	0.06	-3.69
	(1.07)**	(1.23)**	(1.19)	(1.05)*	(0.55)+	(1.07)	(0.20)*	(0.27)	(2.67)
Obs.	297	297	297	297	297	297	297	297	297
R^2	0.93	0.93	0.88	0.95	0.86	0.88	0.94	0.97	0.94

Standard errors clustered at the country level in parentheses. + significant at 10%; * significant at 5%; ** significant at 1% .

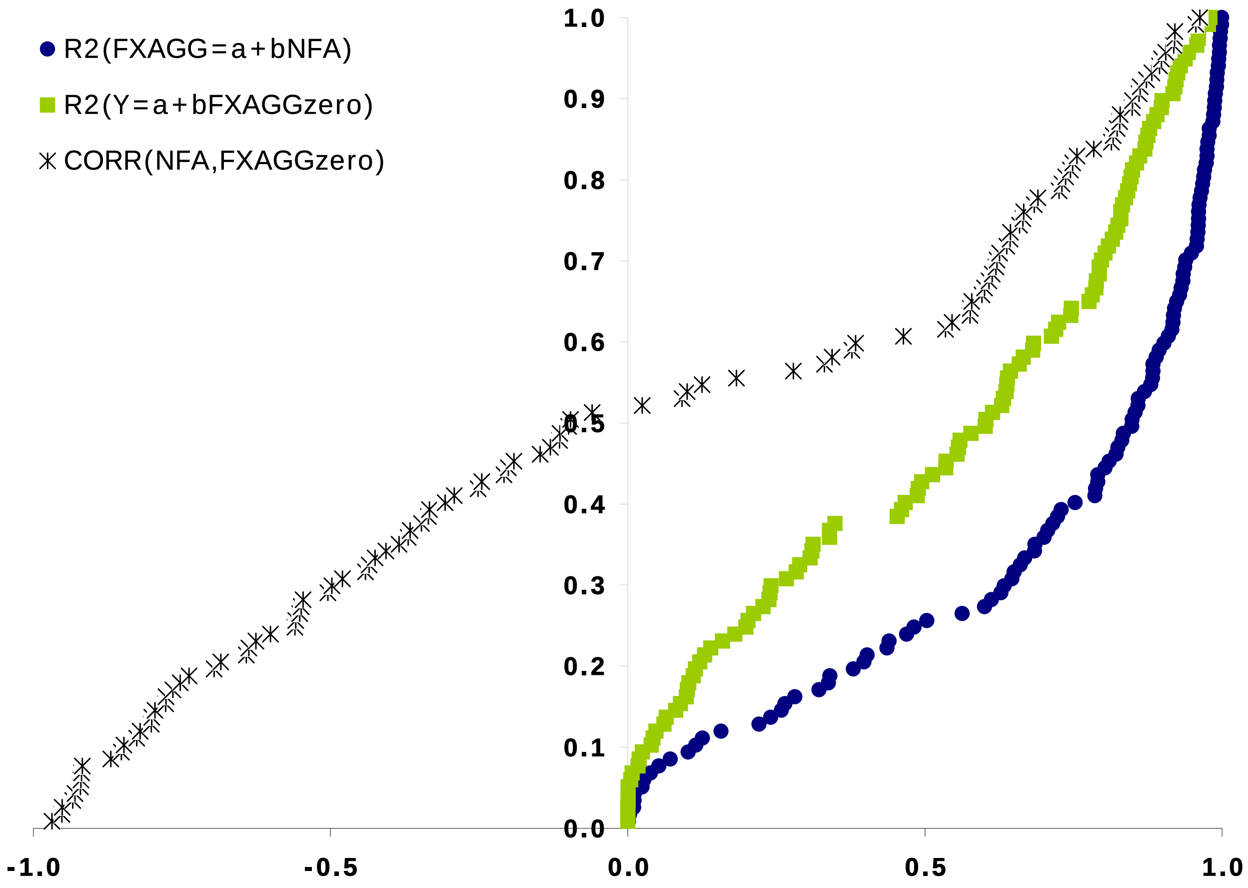

Figure 1: Decomposition $FX^{AGG} = NFA + FX^{AGGm,0}$. Cross-country distribution of statistics.

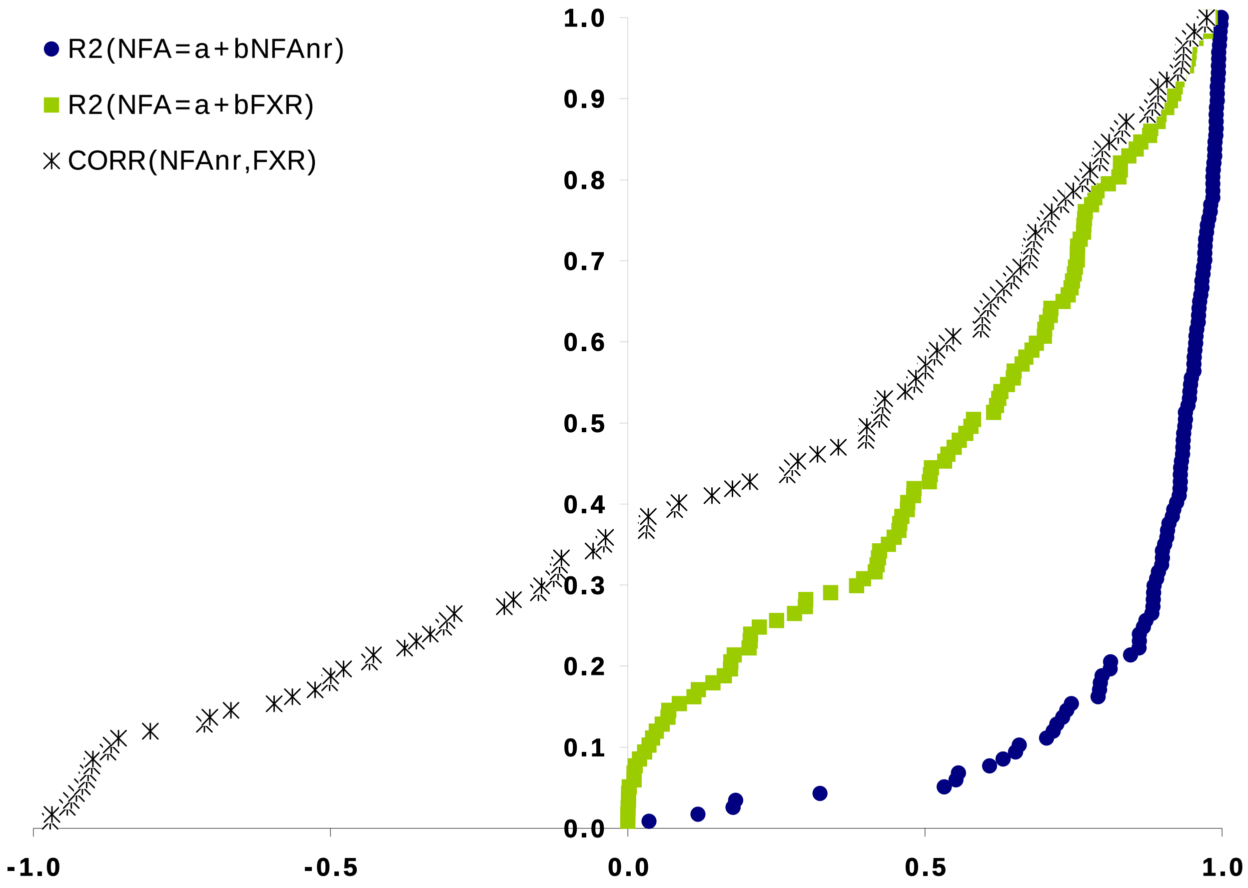

Figure 2: Decomposition of $NFA = NFA_{NR} + FXR$. Cross-country distribution of statistics.

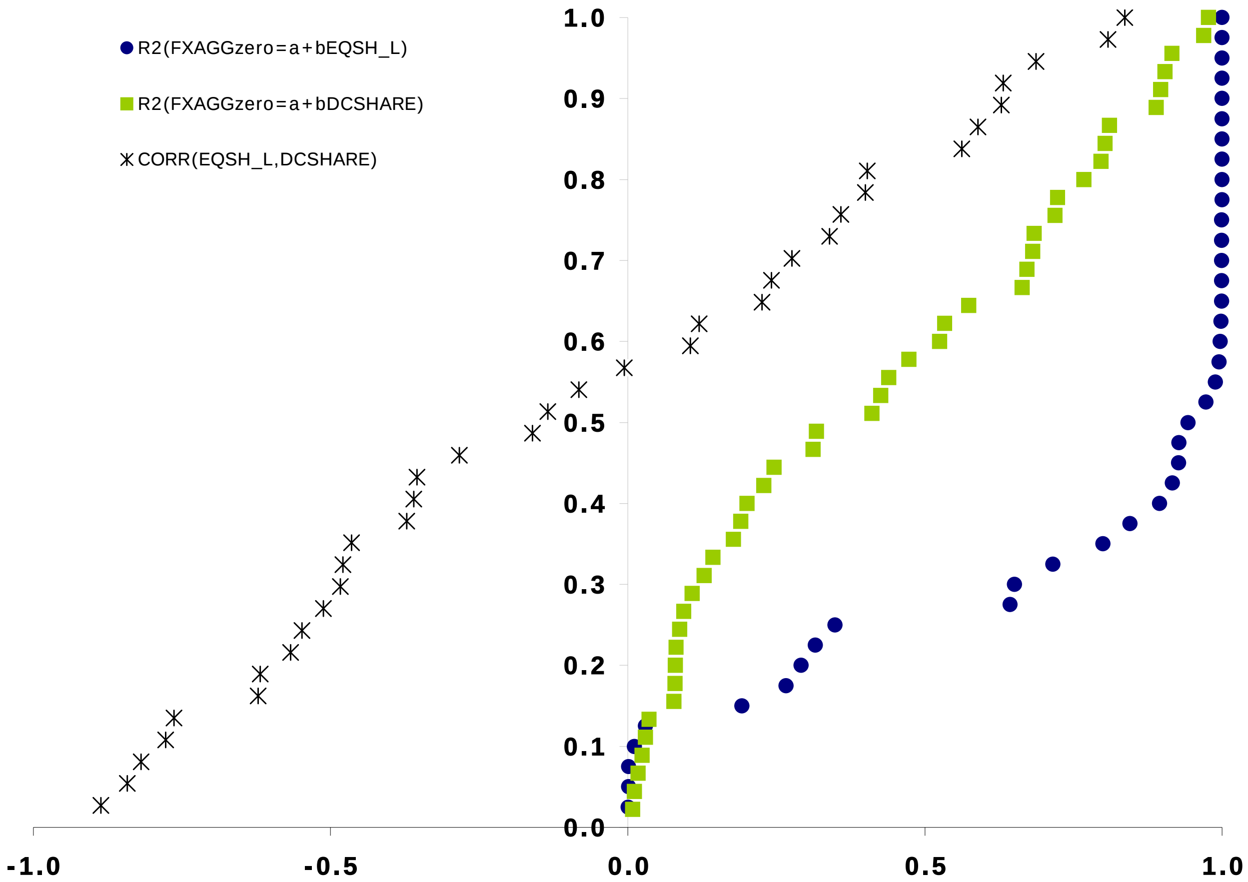

Figure 3: Decomposition $FX^{AGG,0} = EQSH_L + DCSHARE$. Cross-country distribution of statistics.

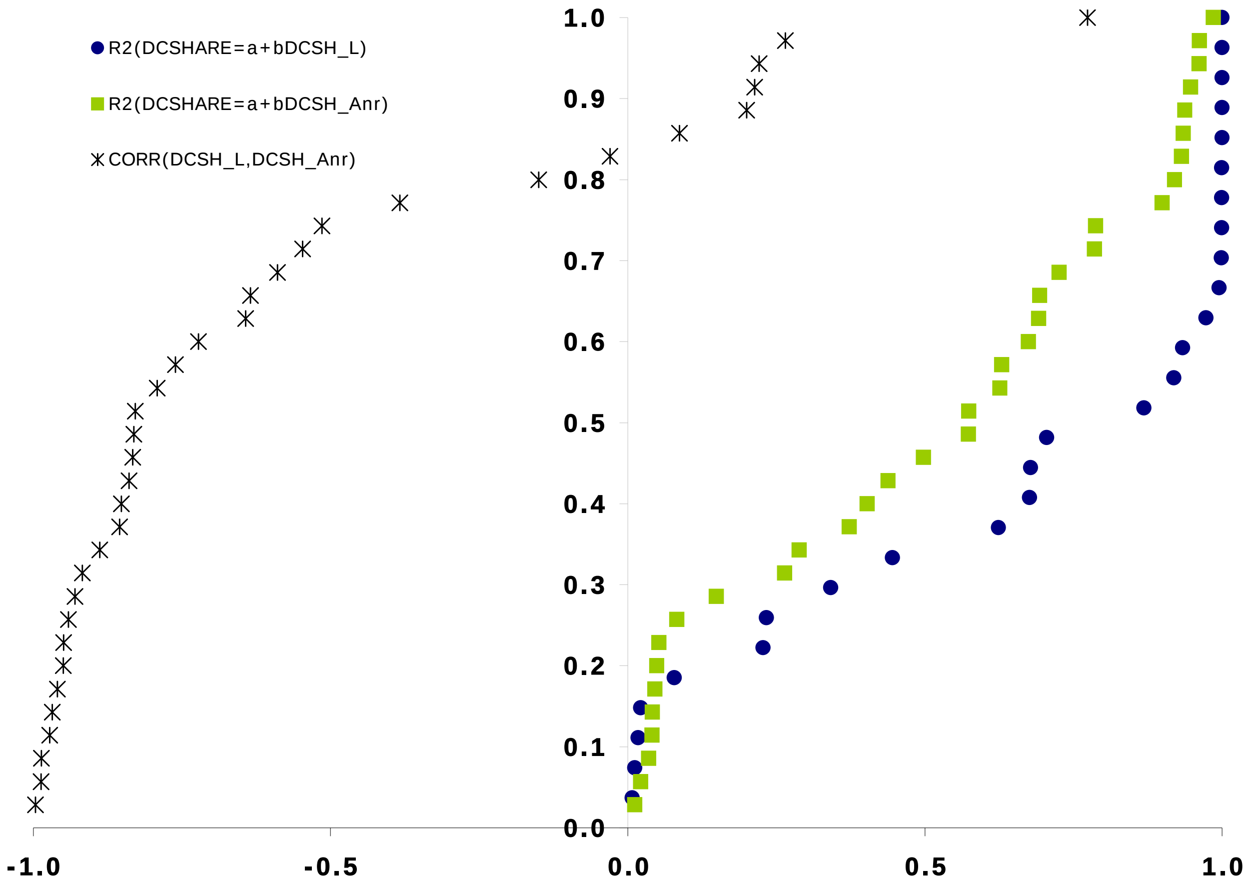

Figure 4: Decomposition of $DCSHARE = DEBTL^{DC} - A^{DC}_{NR}$. Cross-country distribution of statistics.

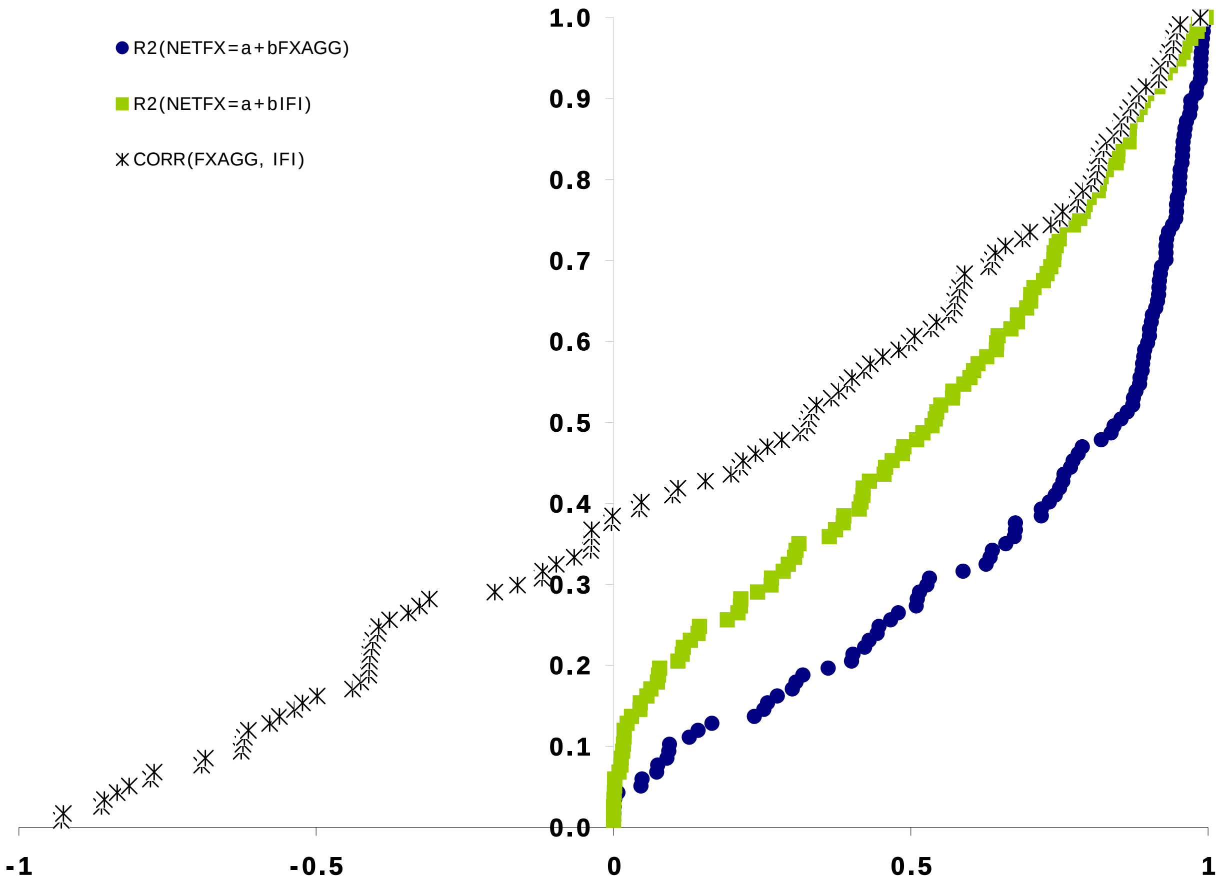

Figure 5: Decomposition of $NETFX = FX^{AGG} * IFI$. Cross-country distribution of statistics.

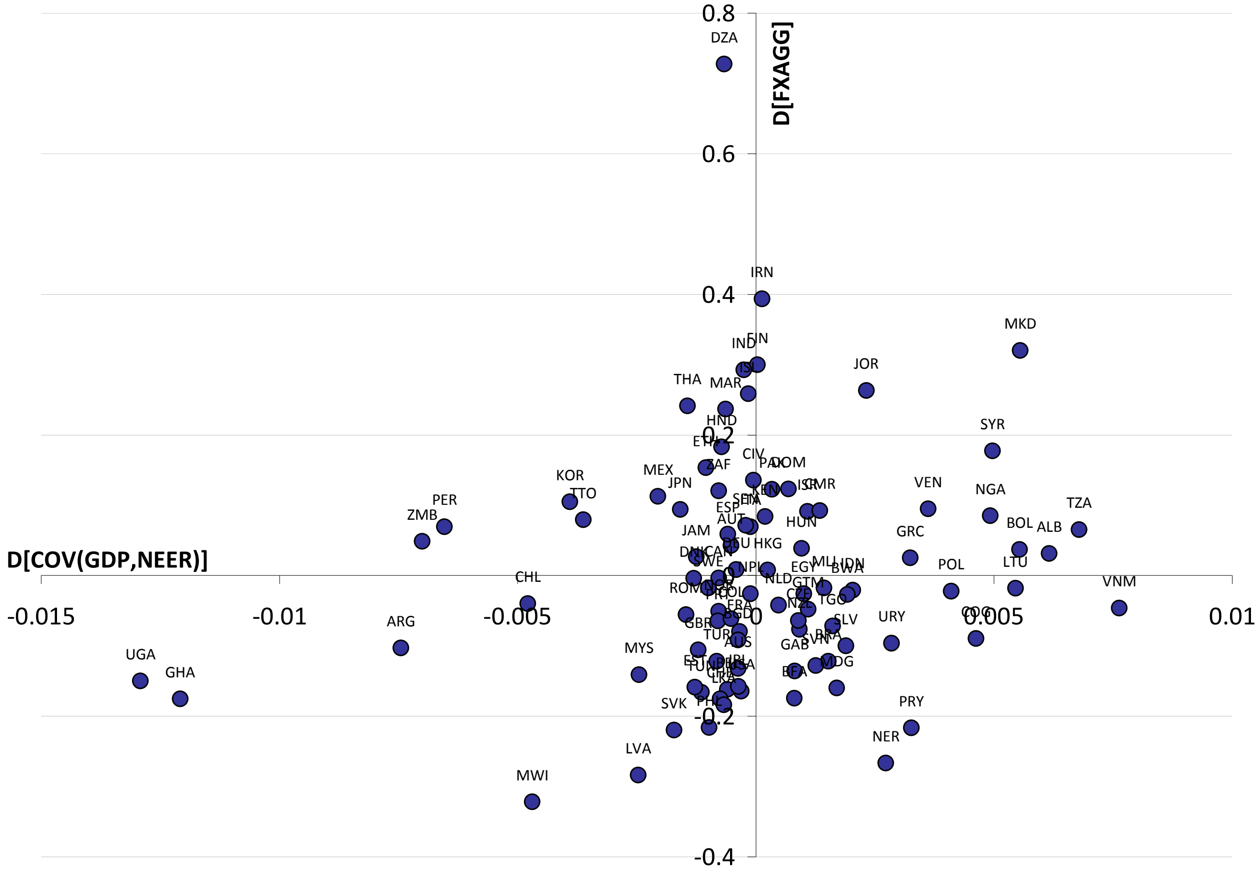

Figure 6: Scatter of Partial Relation between $\Delta COV(GDP, NEER)$ and ΔFX^{AGG}.