On the Determinants of Aggregate Currency Mismatch

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Abstract

This paper examines the determinants of aggregate currency mismatch using the panel data set of Lane and Shambaugh (2010a) covering 97 countries over 1990–2004. The estimation results show that larger and richer countries are less likely to have the currency mismatch problem. Enhancing the efficiency of domestic financial systems is the most important factor to control currency mismatching. A country should be financially liberalized and open; encourage domestic securities market to be developed; prudentially supervise financial intermediaries; upgrade institutional quality; and adopt credible monetary policies. However, a choice of exchange-rate regime does not impact currency mismatching.

JEL classification: F30, F31
Key words: Currency mismatch, financial reform, institutional quality

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1. Introduction

Currency mismatch has been a serious threat to financial stability and sustainable economic growth in developing and emerging countries. Almost all emerging-market financial crises of the 1990s were marked by currency mismatch exposures (Allen et al., 2002). Roughly defined at the national level, currency mismatch occurs when there is a net debt to foreigners denominated in foreign currency. For a country with currency mismatch, exchange-rate depreciation increases the value of external net debt in terms of the value of its output, which creates negative balance-sheet effects. Most financial crises have been accompanied by large devaluations. During crises, thus, output contractions and a decline in net wealth and creditworthiness are larger in countries with heavy net foreign-currency debt. Currency mismatches can also undermine the effectiveness of monetary policy during a financial and/or currency crisis and make it difficult to operate floating exchange-rate regimes in developing countries.

Previous studies on currency mismatch have tried to identify its causes and identify how best to control it. Goldstein and Turner (2004) effectively summarized the potential determinants of aggregate currency mismatch suggested in the literature, which originated primarily from domestic rather than international factors. Determinants are related to past and present weaknesses in economic policies and institutions in emerging countries, such as monetary credibility, fiscal accounts, the degree of financial development, exchange-rate regimes, and government regulation and supervision of financial institutions. However, there have been few studies that empirically identify them as statistically significant determinants of aggregate currency mismatch. Most empirical studies have focused on the problem of currency mismatch in a specific sector, such as banks, not for the economy as a whole. The purpose of this paper is to fill this gap by identifying the statistically significant determinants of aggregate currency mismatch using a large panel data set.

The main reason for lack of empirical studies is that there have been no reliable measures of aggregate currency mismatch for a large country sample. The most popular measure of mismatch is the aggregate effective currency mismatch (AECM) by Goldstein and Turner (2004), which is computed from net foreign-currency debt assets, but the data cover only a group of 22 emerging

economies. Recently, Lane and Shambaugh (2010a) compiled data on net foreign-currency exposures on the international balance sheet, including the currency composition of foreign asset and liability positions, for a broad set of countries over 1990–2004. Their measure of foreign-currency exposure is practically equivalent to that of currency mismatch. This paper uses the data set of Lane and Shambaugh (2010a) to empirically identify the determinants of aggregate currency mismatch.

The estimation results of this study suggest that aggregate currency mismatch is caused by both domestic and international factors. Larger and richer countries are less likely to have the currency-mismatch problem. Currency mismatch is not a matter for advanced countries, but that for developing and emerging countries; it is closely associated with weaknesses in economic policies and institutions, as proposed in the literature. Policy implications of the main findings are as follows: in order to control currency mismatching, first, a country should be financially liberalized and open; encourage its domestic securities market to be developed; and prudentially supervise financial intermediaries. Second, a country with good institutions can undergo a worsening of its net foreign asset position, but upgrading institutional quality is needed to enhance the ability to issue domestic-currency liabilities. Although statistical significances are relatively weak, third, the results suggest that a country should adopt credible monetary policies and be open on the real side. Finally, a choice of exchange rate regime does not matter for currency mismatching.

Section 2 reviews the literature on causes of currency mismatch, and section 3 presents various measures of aggregate currency mismatch. Section 4 describes data and empirical specifications, and analyzes empirical results. The final section summarizes the paper's main findings and its policy implications.

2. Causes of currency mismatch: A literature survey

Various factors generating currency mismatches discussed in the literature are primarily associated with weaknesses in economic policies and institutions.[1] Among them are, first, poor inflation

[1] See Goldstein and Turner (2004) for details on the possible causes of currency mismatch.

performance and a lack of monetary credibility (Goldstein and Turner, 2004; Jeanne, 2005). If inflation rates are high and variable, and monetary authorities frequently contrive high inflation to lower their debt obligations, both foreign and domestic investors will lend in foreign currency or in domestic currency at short maturity, thus contributing to currency mismatching. Poor inflation performance also impedes the development of a local domestic-currency bond market.

Second, fiscal policies matter, too (Hausman and Panizza, 2003; Bordo, Meissner and Redish, 2005). A government will have more incentive to devalue or inflate to reduce its real debt obligations to the extent that it has accumulated larger stock of foreign-currency debt through irresponsible fiscal policies. This makes it less attractive for investors to lend in domestic currency.

Third, currency mismatch occurs when domestic financial markets are underdeveloped. In their theoretical model, Caballero and Krishnamurthy (2003) show that when financial constraints affect borrowing and lending between domestic agents, agents undervalue insuring against exchange-rate depreciation.[2] Underinsurance leads domestic agents to choose external debt denominated in foreign currency rather than in domestic currency. Caballero and Krishnamurthy also suggest that limited financial development reduces the incentives for foreign lenders to enter emerging markets.

The fourth factor is associated with the exchange-rate regime. There are two contradictory views for the currency regime. One view is that fixed exchange rates offer free insurance to market participants who borrow in foreign currency and thus encourage foreign-currency borrowing. As shown in recent currency crises in Asia and Mexico, the fixed exchange-rate regime often coincided with implicit or explicit government guarantees against currency risk, which leads to an unhedged currency mismatch between assets and liabilities for domestic sectors such as banks (Dooley, 1997; Burnside, Eichenbaum and Rebelo, 2001). Therefore a more flexible exchange-rate regime would reduce exposures to currency risk. However, the other view is that a flexible regime with higher exchange-rate volatility makes hedging more expensive, which would increase currency mismatching

[2] They show that firms' choice over liability denomination is equivalent to a choice over how much insurance to purchase against states of the world when international collateral is scarce. When domestic financial markets are underdeveloped, the private valuation of this insurance is distorted relative to a planner's valuation. The distortion leads to underinsurance.

(Eichengreen, Hausman and Panizza, 2003).

Fifth, the choice of currency depends on the quality of institutions. Institutional quality is highly correlated with the level of development. Countries with high institutional quality may have the ability to issue domestic-currency liabilities and obtain foreign-currency assets. Aghion et al. (2001) discuss a class of models in which domestic-currency lending can be substituted by foreign-currency lending under credit-market imperfections and poor contract enforcement.

The sixth factor is related to the inefficiency of domestic financial systems. If banks are undercapitalized, risk management is weak, and prudential oversight is inadequate, moral hazard may tempt banks to fund themselves in foreign currency at low interest rates and lend in domestic currency at high rates, resulting in a currency mismatch for banks (Eichengreen et al., 2003). There are many examples of financial-repression policies, which can incur a currency mismatch, such as (i) control of credit and interest rate, and (ii) low priority in developing bond markets, encouraging the availability of hedging instruments, and reducing barriers to the entry of foreign-owned banks (Goldstein and Turner, 2004).

Turning to empirical studies on currency mismatch in the literature, the majority of researchers have investigated the determinants of dollarization of deposits and/or loans (also called "financial dollarization") in the banking sector.[3] For example, the main factors affecting deposit dollarization include the past rate of inflation (Savastano, 1996), volatility of inflation and real exchange rate (Ize and Levy-Yeyati, 2003), the credibility of macroeconomic policy, and the quality of the institution (De Nicoló, Honohan and Ize, 2005). In the case of loan dollarization or dollarization of both deposits and loans, the significant factors are central-bank intervention in the foreign-exchange market, government bailouts through the deposit insurance system, financial development and liberalization (Barajas and Morales, 2003), exchange-rate regimes (Cowan et al., 2005; Arteta, 2005) and interest-rate differentials (Neanidis and Savva, 2009).

However, all these empirical studies focus on currency mismatches of the banking sector only,

[3] The term "dollarization" refers to the holding by residents of a significant share of their assets or liabilities in foreign currency.

using data for a small sample of countries such as Latin American and transition economies. Empirical studies on identifying the determinants of currency mismatch at the aggregate level have been scarce. To my knowledge, the first attempt was made by Hausman and Panizza (2003), who compiled data on the inability of a country to borrow in its own currency, referred to as "original sin".[4] Using the data of developing countries, they found that country size is the only variable that is statistically significant as a determinant of original sin. Domestic factors such as the level of development, monetary credibility, and institutional quality do not account for the widespread nature of the phenomenon. However, an original-sin measure restricts attention to debt liabilities only, ignoring differences across countries and over time on the asset side of the balance sheet. In contrast, Goldstein and Turner (2004) constructed a measure of aggregate currency mismatch, called "aggregate effective currency mismatch (AECM)," which takes into account both debt assets and liabilities denominated in foreign currency, but it has never been used to identify its determinants mainly because of limited country data set. The Lane and Shambaugh (2010b) work may be the first empirical study on this subject, using a large data set of foreign-currency exposure on external balance sheets. Their choice of explanatory variables in regressions is derived from the optimal portfolio allocation to the foreign-currency asset based on a simple open-economy model. This paper uses their data set to measure various currency mismatches. What differs from their paper, however, is that this paper tries to empirically identify the significant factors of aggregate currency mismatch proposed in the literature. Thus the explanatory variables chosen for this study are not based on a specific model, but on the potential determinants of aggregate currency mismatch discussed in this section.

3. Measures of aggregate currency mismatch

In general, currency mismatch is defined as differences in the values of the foreign-currency denominated assets and liabilities on the balance sheets of domestic sectors (households, firms, and government). Aggregate currency mismatch refers to as those measured for the economy as a whole.

[4] The same work was done by Eichengreen, Hausman and Panizza (2005a,b), but published later.

It is important to note that the sign of currency mismatch can be negative or positive. In the literature, the term *currency mismatch* is used when a country has a negative net debt-asset position in foreign currency. Precisely speaking, this is the case for a negative currency mismatch. If a country has a positive net debt-asset position in foreign currency, its balance sheet is a positive currency mismatch. A negative currency mismatch is not in itself good or bad. Although having a negative currency mismatch means losses on the balance sheet if there is a depreciation of the domestic currency, it conversely means gains in the case of an appreciation. However, many emerging economies have historically had a negative net debt-asset position in foreign currencies and undergone depreciations rather than appreciations of their domestic currencies. Thus I assume that the balance-sheet problem gets worse (better) to the extent that an indicator of currency mismatch has a larger negative (positive) value**.**

A measure of aggregate currency mismatch that has been used most in the literature is the aggregate effective currency mismatch (AECM) of Goldstein and Turner (2004), defined as

$$AECM = \frac{NFCA}{EXP} * FC\%TD$$

where *NFCA* is net foreign-currency debt assets, *EXP* is exports, and *FC%TD* is the foreign-currency share of the total (both international and domestic) debt. This measure does not incorporate portfolio equity and foreign direct investment (FDI) on the international balance sheet. Goldstein and Turner emphasize both the stock and the flow aspect of a currency mismatch, and argue that AECM is a good indicator of mismatches in the overall economy since it captures both assets and liabilities on the balance sheet and accounts not only for the sensitivity of the balance sheet (net worth) to changes in the exchange rate, but also for the sensitivity of the income statement (net income) to changes in the exchange rate. However, data on net foreign-currency debt assets and the foreign-currency share of international debt are available only for a select group of countries, so that AECM cannot be computed for a large country sample.

Eichengreen et al. (2003) suggest an indicator of aggregate currency mismatch similar to AECM for a larger sample as follows:

$$MISMATCH\_1 = \frac{RES - DEBT}{EXP} * OSIN$$

RES is international reserves, *DEBT* is international debt, and *OSIN*[5] denotes original sin, which they define as the inability of a country to borrow abroad in its own currency. They find that MISMATCH_1 is close to AECM; their correlation coefficient is 0.82 (p value = 0.000) for the countries that have data on both measures. They also suggest an alternative indicator of aggregate currency mismatch, which makes more sense to them, as

$$MISMATCH\_2 = \frac{RES - DEBT * OSIN}{EXP}$$

However, there are several problems with these measures. For an adequate measure of the extent of aggregate currency mismatch, first, a country's international reserves and non-reserve foreign-currency denominated financial assets should be netted from total external liabilities denominated in foreign currency. However, these two measures take into account international reserves only, excluding non-reserve foreign-currency financial assets. Second, an original-sin measure is used to calculate foreign-currency debt liabilities. But it is relevant to foreign-debt securities only, without considering other external liabilities such as bank loans. The third problem, which also applies to AECM, is that the index is normalized by exports. The rationale behind this is as follows: when an economy is in a net debtor position, a depreciation of the domestic currency increases the net cost of servicing foreign-currency external obligations, but also increases its capacity to meet debt-service obligations by increasing export revenues. As Eichengreen et al. (2003) themselves admit, however, it is inadequate that stocks of net foreign assets are compared with flows of export revenues.

Recently, Lane and Shambaugh (2010a) compiled data on net foreign-currency exposures on the international balance sheet for a broad set of countries over 1990–2004. Foreign-currency exposure is not the same as currency mismatch since the former can be alleviated by cross-border hedging through currency-related derivative trade, even if the latter exists. However, Lane and Shambaugh (2010a) do not take into account hedging data in constructing foreign-currency exposures because the

[5] $OSIN_i = max\left(1 - \frac{securities\ \ in\ currency\ \ i}{securities\ \ issued\ \ by\ country\ \ i}, 0\right)$

extent of cross-border currency hedging is difficult to assess and the data are scarce. Thus their measure of foreign-currency exposure is practically equivalent to that of currency mismatch.

There are two measures of foreign-currency exposure in their data. The first one is aggregate foreign-currency exposure (FXAGG), which measures aggregate currency mismatch for the full set of foreign assets and liabilities including the portfolio equity and FDI of the international balance sheet. It is defined as

$$FXAGG = \omega^{A} * \left(\frac{A}{A+L}\right) - \omega^{L} * \left(\frac{L}{A+L}\right)$$

where A and L are foreign assets and liabilities, respectively, and ω^{A} (ω^{L}) is the share of foreign assets (liabilities) denominated in foreign currencies. FXAGG 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 matches a country which has only foreign-currency assets and no foreign-currency liabilities.

The second one is similar to AECM and MISMATCH, which only take into account debt assets and liabilities on the balance sheet. I call this measure ACMDEBT, defined by

$$ACM\ DEBT = \frac{RES + DEBTA^{FC} - DEBTL^{FC}}{DEBTA + DEBTL}$$

where *DEBTA* and *DEBTL* denote portfolio and non-portfolio ("other") debt assets and liabilities, respectively; and the superscript, FC, stands for "foreign-currency denominated." This indicator of foreign-currency exposure is a better measure of aggregate currency mismatch than AECM and/or MISMATCH. The reason is, first, that it is scaled to stocks (debt assets plus debt liabilities) rather than flows (exports or imports). In contrast to MISMATCH, second, it includes not only international reserves but also other foreign-currency denominated debt assets. Third, it is calculated from the actual currency composition of each country's foreign debt assets and liabilities. Finally, the data are available for a large country sample.

If a country has a zero value of ACMDEBT, it has a balanced foreign-currency debt position, which implies no currency mismatch (or, no foreign-currency exposure) in debt and thus balanced

changes in the exchange rate would not affect the aggregate balance sheet. A negative (positive) ACMDEBT means a short (long) net debt-asset position in foreign currencies in which case depreciations of the domestic currency generate losses (gains) in the balance sheet. As already discussed in this section, I assume that a positive (negative) value of ACMDEBT denotes a favorable (unfavorable) position in the balance sheet. This means that the magnitude of the currency-mismatch problem becomes greater to the extent that ACMDEBT has a larger negative value.

Table 1 below shows summary statistics for the variables used in the panel estimation in the next section. Note that the mean values of ACMDEBT and FXAGG are both negative, -0.28 and -0.17, respectively, reflecting that, on average, countries in the data set would suffer negative wealth effects if there are depreciations of their domestic currencies.

In sum, this section introduced four indicators of aggregate currency mismatch. Among them, this paper focuses on identifying the determinants of ACMDEBT, a measure of aggregate currency mismatch for debt-only positions on the balance sheet. The reason is that the literature has paid attention to the problem of currency mismatch in debt assets and liabilities. For a robustness check, I also estimate the factors affecting FXAGG which accounts for overall positions on the balance sheet. Figure 1 plots ACMDEBT against FXAGG. It is shown that these two measures are almost linearly and positively correlated with each other. As drawn in Figures 2 and 3, however, ACMDEBT and two MISMATCHs do not show their clear relationships although they commove in the range (-1, 1) of ACMDEBT. Meanwhile, two MISMATCHs almost perfectly match each other, shown in Figure 4.

[Insert Figure 1–Figure 4 here]

4. Econometric analysis

There are two main differences between this paper and Lane and Shambaugh (2010a,b). First, this paper runs unbalanced panel regressions for the data set covering 97 countries over 1990–2004.[6] On the other hand, their pooled regressions use data from three years only: 1996, 2000, and 2004. Second,

[6] The full data sample of Lane and Shambaugh (2010a) includes 117 countries over the period of 1990–2004. In this paper, countries whose data for foreign-currency exposures are not available for the first half of 1990s are excluded so that the data set covers only 97 countries. The countries excluded in the regressions are mostly East European countries and the former Soviet Union members.

the explanatory variables chosen in this study are based on potential determinants of aggregate currency mismatch proposed in previous theoretical and empirical studies, while their choice comes from a dynamic optimal portfolio balance model of the open economy. Despite different motivations of these two empirical studies, some explanatory variables are overlapped, but they are differently measured.

4.1 Data and the empirical specification

The following panel equation is used to investigate the determinants of aggregate currency mismatch.

$$Y_{\boldsymbol{t}} = \alpha + \beta' X_{\boldsymbol{t}} + \varepsilon_{\boldsymbol{t}} \quad (1)$$

where the dependent variable denotes ACMDEBT, X is a set of explanatory variables, and the subscripts, i and t, stand for country i and year t, respectively. Detailed definitions and sources of the explanatory variables are provided in Appendix B.[7]

Regarding explanatory variables, real GDP per capita (*RPGDP*) is included as a general control variable. The degree of currency mismatch depends on the quality of policies and institutions, which is highly correlated with the level of development, as discussed in section 2. Following Lane and Shambaugh (2010b), I want to check whether the variables relevant to policies and institutions in the equation have explanatory power even when holding per capita GDP fixed. The second control variable is country size, measured as GDP or population. Larger countries are better able to issue debt liabilities in their own currency, thus reducing foreign-currency exposure (Eichengreen et al., 2005a; Hausman and Panizza, 2003). The coefficients of these two control variables are expected to be positive.

The third variable is domestic inflation volatility (*VOL*(π)), measured as the annualized standard deviation of the first log difference of the quarterly consumer price index over the current and past year. The inflation rate is also used to check robustness. Higher and more volatile domestic inflation

[7] Fiscal deficit/surplus is excluded from the explanatory variables since the data are available only for a limited number of countries.

lowers real debt obligations and makes them more uncertain. Thus investors are less willing to lend in domestic currency, leading to the higher share of foreign-currency debt liabilities. Inflation volatility is expected to have a negative coefficient.

The fourth variable is exchange rate volatility (*VOL*(E)), measured as the annualized standard deviation of the first log difference of quarterly special drawing rights (SDR) exchange rate over the current and past year. Its effect is not unambiguous since there are two conflicting views, as discussed in section 2. On the one hand, higher exchange-rate volatility makes hedging more expensive, thus increasing foreign-currency liabilities (Eichengreen, Hausman and Panizza, 2005a). It makes foreign-currency assets more risky, too. Based on data for 46 countries, Ize and Levy-Yeyati (2003) confirmed that foreign-currency bank deposits were negatively related to volatility of the real exchange rate. However, higher exchange-rate volatility leads to lower exposure to currency risk, which reduces currency mismatching. Using data for Chilean non-financial firms, Cowan et al. (2005) empirically showed that firms were forced to internalize currency risk caused by exchange-rate uncertainty and significantly reduced the level of currency mismatch (measured as the ratio of net dollar debt to total assets) after the exchange rate was floated freely in 1999. The coefficient of exchange-rate volatility is expected to be negative in the former case, but positive in the latter case.

The fifth and sixth variables are openness in the real and financial side. Trade openness (*TOPEN*), measured as the ratio of export plus import to GDP, may be positively correlated with ACMDEBT. The reason is that the greater the share of imports in domestic consumption, the more important is the role of foreign assets in portfolios (Obstfeld and Rogoff, 2001). Barajas and Morales (2003) also find that trade openness has a negative effect on foreign-currency liabilities (dollarization of liabilities) because in periods of increasing credit, nontradable activities engage in foreign-currency borrowing more intensively. However, the effect of financial openness (*FOPEN*) is not clear. On the one hand, domestic borrowers, especially in emerging economies, will have more opportunities to access foreign-currency loans with greater openness of capital account. Barajas and Morales (2003) support this proposition. On the other hand, foreign-currency assets are more available to domestic investors, too. Thus the role of financial openness depends on which one dominates. Financial openness is

measured by the capital-openness index of Chinn and Ito (2008).

Following Lane and Shambaugh (2010b), the *de facto* exchange-rate regime (*Ex_regime*) is included as a seventh variable. The regime is the classification of Shambaugh (2004), which comprises binary coding of peg = 1 and nonpeg = 0. The exchange-rate regime may be correlated with exchange-rate volatility, but I want to test whether fixed exchange-rate regime aggravates the currency mismatch problem, as is argued in the literature. The *de facto* exchange-rate regimes of Levy-Yeyati and Sturzenegger (2005) and Reinhart and Rogoff (2004) are also employed to check for robustness.

The eighth variable is institutional quality (*QUALITY*), which is highly correlated with the level of development. Countries with high institutional quality may have the ability to issue domestic-currency liabilities and obtain foreign-currency assets, indicating that institutional quality has a positive coefficient (Lane and Shambaugh, 2010b). However, countries with better institutions have better investment environments, leading to larger inflows of foreign capital, and thus their net positions on the international balance sheet may get worse. If the net debt-asset position becomes negative, institutional quality can be negatively correlated with ACMDEBT. As a measure of institutional quality, I use a political risk index in the International Country Risk Guide (ICRG), published by the PRS Group, which comprises twelve subcomponents.[8] The index ranges from 0 to 100, where a higher point means lower risk.

The ninth variable is financial depth. When domestic financial markets are underdeveloped, domestic agents tend to borrow in foreign currency rather than in domestic currency (Caballero and Krishnamurthy, 2003). Thus the coefficient of financial depth is expected to have positive signs. Financial depth is measured by domestic credit to the private sector as a share of GDP (*P_credit*), money and quasi-money as a share of GDP (*M2*), financial assets as a share of GDP (*Fasset*) and outstanding amounts of domestic debt securities as a share of GDP (*Dom_securities*). Hausman and Panizza (2003) found a strong bivariate negative relationship between original sin and financial depth

[8] Alfaro et al. (2008) use the same data and confirm the positive relationship between institutional quality and private capital inflows for developing countries. But they considered the inflows of direct and portfolio equity investment only, excluding portfolio debt flows.

(*P_credit* and *M2*).

The last variable used in estimation is an aggregate index of financial reforms (*REFORM*), which measures the efficiency of domestic financial systems. It is obtained from the database of financial reforms constructed by Abiad et al. (2008). The data cover 91 countries over 1973–2005. The index is the normalized sum of seven different subdimensions of financial sector policy: (i) credit controls and reserve requirements, (ii) interest rate controls, (iii) entry barriers, (iv) bank privatization, (v) capital-account restriction, (vi) security-market policy, and (vii) bank supervision. With the exception of the last subdimension, they track the presence of restrictions so that a lesser degree of government intervention in these areas is coded as a reform. Of the seven subdimensions, however, bank supervision is the only one where a greater degree of government intervention is coded as a reform. A score is assigned to each subdimension: a graded scale from zero to three, with zero corresponding to the highest degree of repression and three indicating full liberalization. The index of financial reform is normalized between zero and one, and a higher score corresponds to more advanced reforms. Thus the index is expected to have a positive sign.

4.2 Estimation results

The data set covers 97 countries, listed in Appendix 1, over 1990–2004.[9] The countries are divided into two groups: (i) advanced, and (ii) developing and emerging countries. Table 1 reports summary statistics for the variables used in estimation. The countries and data periods are chosen on the basis of a dataset of Lane and Shambaugh (2010a).[10] Since the countries have different histories and political and financial institutions, I assume the error term $\varepsilon_{it} = \eta_i + \upsilon_{it}$ where $\upsilon_{it} \sim iid$ $N(0, \sigma_v^2)$. The Breusch-Pagan specification test detects that η_i is random for all regressions in this study, which supports the random-effects models. It is assumed in the random-effect model that country-specific effects are uncorrelated with the other regressors. If they are correlated with each other, the random-effects treatment may suffer from inconsistency due to omitted variables, and thus

[9] Due to lack of data in some countries, the data structure is an unbalanced panel.
[10] The dataset is available at http://www.philiplane.org/LASER/LASERdata.html.

the fixed-effect model is preferred. The Hausman specification test is employed to check orthogonality of country-specific effects and the regressors. However, both fixed-effect and random-effect estimation results will be reported, if needed. With an exception of GDP per capita and GDP, all explanatory variables are lagged one year to avoid possible endogeneity.

[Insert Table 1 here]

4.2.1 Results for ACMDEBT

The base equation

Table 2 provides the random-effect and fixed-effect results for ACMDEBT. There are three empirical specifications for *X*. The first specification includes the base variables such as the level of development, economic size, monetary credibility, exchange-rate volatility and trade openness, which have been used as explanatory variables in previous empirical literature. I add institutional quality, exchange-rate regime, financial development, and financial openness in the second specification. Finally, the third specification considers the full set of regressors including the degree of financial reforms. This study may be the first attempt to empirically examine the effect of the overall efficiency of the domestic financial system on aggregate currency mismatch.

[Insert Table 2 here]

The random-effect results are presented in the first three columns. Among the base variables, GDP per capita, GDP, and trade openness have positive and significant coefficients for all three specifications. When GDP is replaced by population, the results do not change. The coefficient of a financial-reform index is positive and significant at the 1% level, too. Higher inflation volatility is significantly associated with a more negative value of ACMDEBT, which supports the concept that a lack of monetary credibility causes the currency mismatch problem. But its statistical significance disappears when financial reform is included in column (3). Financial openness and financial depth are significantly and positively related to ACMDEBT, but their significance is gone with the inclusion of financial reform, too. The possible reason for these results is that one of seven subdimensions for financial reforms is an index of capital-account restriction, which may be correlated with the capital openness index of Chinn and Ito. When Chinn and Ito's index is excluded from the equation to solve

the possible multicollinearity problem, however, the estimation results for the other explanatory variables remain intact. The insignificance of financial depth is possible since financial-sector reforms lead to deeper financial markets (Tressel and Detragiache, 2008).[11] The coefficients of institutional quality are significant and negative, rather than positive for all cases, unexpectedly. An interpretation for this result is that better institutional quality induces more debt inflows from abroad, thus worsening net debt-asset position. Finally, the coefficients of exchange-rate volatility and the exchange-rate peg are positive and negative, respectively, but none of them are significant. Despite their statistical insignificance, their signs imply that a more flexible exchange-rate regime is associated with reducing exposures to currency risk and a more positive level of currency mismatch.

For the fixed-effect results shown in the last three columns, institutional quality and financial reform keep their statistical significance and signs. Economic size and GDP per capita do too, but depend on whether a financial reform index is included. However, statistical significance disappears for all the other explanatory variables including inflation volatility and trade openness.

[Insert Table 3 here]

The Hausman tests shown in Table 2 favor the fixed-effect results for all three specifications. Thus the estimation results are quite surprising, since the main determinants of aggregate currency mismatch proposed by previous studies such as monetary credibility, exchange-rate regime, and financial development do not have statistical significance. Thus I re-estimate equation (1) with other proxy variables to check for robustness. The full set of regressors is used for estimation, and the fixed-effect results are presented at Table 3. The results are summarized as follows: as a proxy for lack of monetary credibility, first, lagged inflation rate is used in column (2). Its coefficient is negative as expected, but insignificant. Second, I use two additional *de facto* exchange-rate regimes, those of Reinhart and Rogoff (2004) and Levy-Yeyati and Sturgenegger (2005) in columns (3) and (4). For Reinhart and Rogoff (RR), the coarse-grid classification, which is coded from 1 to 5, is used for estimation; a higher number denotes a more flexible regime. In contrast, a higher number refers to a

[11] Tressel and Detragiache (2008) use the same dataset for 91 countries over 1973-2005 and find that financial reforms has led to financial deepening, but only in countries with political institutions that protect property rights.

more rigid regime for the classification of Levy-Yeyati and Sturgenegger (LYS), which is coded from 1 to 3. The estimation results are similar to those for Shambaugh (2004) in column (1): RR and LYS classifications have positive and negative coefficients, respectively. That is, a more flexible exchange-rate regime is associated with a more positive (less negative) level of currency mismatch. Just like the case of Shambaugh, however, they show no statistical significance. Finally, I use three other variables for financial depth in columns (5)–(7). They are money and quasi-money as a share of GDP (*M2*), financial assets as a share of GDP (*F_asset*), and amounts outstanding of domestic debt securities as a share of GDP (*Dom_securities*), respectively. Among them, as shown in column (5), the size of liquid assets (M2) is the only variable that is positively correlated with ACMDEBT with statistical significance. The development of a domestic-debt securities market is supposed to be an important factor for reducing negative currency mismatches (Goldstein and Turner, 2004). The BIS reports data for domestic-debt securities, but they are available only for 42 countries. Despite the limited data availability, the coefficient for the size of domestic-debt securities is positive as expected, but not significant. However, it has a significant coefficient with positive sign (not shown here) when its current, not lagged, value is used.

Regarding the other explanatory variables, financial reform and institutional quality have positive and negative coefficients, respectively, and are significant at the 1% to 10% level for all cases except column (7) where the significance of institutional quality vanishes. GDP per capita has a positive coefficient which is significant for four of seven cases. Statistical significance does not appear for the rest of the explanatory variables. For the random-effect results (not shown here), GDP and trade openness are significantly and positively correlated with ACMDEBT, in addition.

Summarizing the results in Tables 2 and 3, a country is less likely to have a currency mismatch problem to the extent that it is richer and larger, and that it has domestic financial systems that are more efficient and developed. Meanwhile, better institutional quality does not lead to an improvement in net foreign-currency debt-asset position. Weak statistical significance is found in the other potential determinants of currency mismatch such as monetary credibility and exchange-rate regimes.

Countries

Currency mismatch has generally been regarded as a problem for developing and emerging countries. Thus the data set is divided by two country groups: developed versus developing and emerging countries. Table 4 presents the random- and fixed-effect results for each country group using the full set of regressors. The Hausman test prefers the fixed-effect results for developed countries and the random-effect results for developing and emerging countries. For developed countries, none of the estimated coefficients for the explanatory variables are statistically significant with the exception of domestic credit to the private sector. The value of R^2 is only 0.07. The results imply that developed countries are similar to each other in their level of economic development and institutions, and thus the determinants of currency mismatch proposed in the literature have nearly no explanatory power. On the other hand, the random-effect result in column (3) suggests that currency mismatch is significantly affected by GDP per capita, economic size, institutional quality and the degree of financial reform for developing and emerging countries. When *M2* is used to represent financial depth, its coefficient is positive and significant (not shown here), reflecting that the level of financial development is also an important determinant of aggregate currency mismatch in developing and emerging countries.

[Insert Table 4 here]

Institutional quality

Institutional quality is a composite index, containing twelve subcomponents.[12] The estimation results obtained up to now demonstrate that higher institutional quality is significantly associated with a more negative level of ACMDEBT. However, that does not mean that all subcomponents have negative coefficients with statistical significance. I replace the institutional quality index with each of its subcomponents and re-estimate equation (1). For estimation, first, the data set covers only developing and emerging countries, since institutional quality does not matter for developed countries,

[12] The subcomponents are (1) government stability (*Gov_stability*), (2) socioeconomic conditions (*Socio*), (3) investment profile (*Investment*), (4) internal conflict (*Int_conflict*), (5) external conflict (*Ext_conflict*), (6) corruption (*Corruption*), (7) military in politics (*Mil_politics*), (8) religious tensions (*Rel-tension*), (9) law and order (*Law_order*), (10) ethnic tensions *(Ethn_tension*), (11) democratic accountability (*Democracy*), and (12) bureaucracy quality (*Bureaucracy*). See the ICRG for details on their definitions.

as shown in Table 4. Second, M2 supplants domestic credit to the private sector since the former is a more popular measure of financial depth for developing countries and shows statistical significance in Table 3. As with the composite index, third, all subindexes are one year lagged, too. The fixed-effect results are presented at Table 5.

[Insert Table 5 here]

The results indicate that all subcomponents are not statistically significant. The subcomponents that have negative coefficients at least at the 10% significance level are bureaucracy quality, corruption, external and internal conflict, law and order, military in politics, and religious tension. These variables stand for social and institutional stability, which are positively related to foreign-capital inflows. Those with positive signs are government stability and investment profile, but only the latter has statistical significance. Investment profile assesses the risk to investment. It comprises three subcomponents (contract viability/expropriation, profit repatriation, and payment delays) all of which closely link to property rights. The evidence implies, thus, that foreign investors are more likely to buy domestic assets denominated in domestic currency to the extent that property rights are more protected.

For the other variables, both financial depth and financial reform have positive coefficients at least at the 5% significance level for all cases. Economic size is also a significant factor for five of twelve cases. No statistical significance is found for the rest of the explanatory variables.

Financial reform

Financial reform is also a composite index that comprises seven different dimensions of financial-sector policy.[13] I re-estimate equation (1) for the cases where each of seven policies is added as a separate explanatory variable. Only data for developing and emerging countries are used, and the fixed-effect results are shown in Table 6. The results indicate that all dimensions of financial-sector policy have positive coefficients at least at the 5% significance level, with the exception of state

[13] See Appendix C for details on the definitions of the financial reform index and its subindexes.

ownership in the financial sector. Policy implications for these results can be summarized as follows: to mitigate the negative level of currency mismatch, it is necessary (i) to impose no control over credit and interest rate, (ii) to allow the entry of new financial intermediaries including foreign banks into the financial system, (iii) to liberalize capital accounts, (iv) to prudentially supervise the banking sector, and (v) to encourage development of securities markets. Some caveats should be mentioned. As shown in column (5), first, the coefficient of capital-account restriction is positive at the 1% significance level even when Chinn–Ito's index for capital-account openness is controlled. This implies that capital-account liberalization will alleviate the currency mismatch problem, which contradicts the findings by Barajas and Morales (2003) that increasing financial globalization leads to a higher foreign-currency share (dollarization) of liabilities. Among the seven subindexes, second, bank privatization is the only one that has a negative sign with no statistical significance, as shown in column (6), reflecting that state ownership in the financial sector is not directly correlated with financial development and currency mismatching. This finding is also upheld by the raw data where changes in bank privatization have a very low correlation with the other subindexes of financial reform.

[Insert Table 6 here]

4.2.2. Results for FXAGG

A measure of aggregate currency mismatch, ACMDEBT, takes into account net foreign-debt assets only, while dismissing the portfolio equity and FDI components of the international balance sheet. Lane and Shambaugh (2010a,b) also incorporated portfolio equity and FDI and constructed a new measure of currency mismatch called "aggregate foreign currency exposure" (FXAGG). In the cases of portfolio equity and FDI, their assets and liabilities are denominated in foreign currency and domestic currency, respectively. Hence, ACMDEBT is more negative than FXAGG, on average.

[Insert Table 7 here]

As for ACMDEBT, the three specifications of the explanatory variables are applied to FXAGG, and the random-effect and fixed-effect results are presented in Table 7. The Hausman test also favors

the fixed-effect results for all three specifications. The results are nearly identical to those for ACMDEBT, with some exceptions. The main difference is that lagged inflation volatility enters with significantly negative coefficients except for the fixed-effect estimation in column (6), where financial reform is included as a control variable. In addition, the coefficients of institutional quality become smaller for all cases, and even positive or insignificant as shown in columns (2) and (5). Such results imply that FDI and portfolio equity liabilities are positively linked to domestic monetary credibility and institutional quality. Alfaro et al. (2008) also confirm that better institutional quality leads to larger inflows of direct and portfolio equity for developing countries.

4.2.3 Results for subcomponents of FXAGG

Aggregate currency mismatch defined in the literature can be decomposed into two subcomponents: the net foreign-debt asset position, and the foreign-currency share of foreign-debt assets and foreign-debt liabilities. It may be valuable to identify the determinants of each subcomponent and compare them with those of aggregate currency mismatch.

To do this, I use the data of Lane and Shambaugh (2010a), which take into account the full set of foreign assets and liabilities in the international balance sheet. They decomposed FXAGG into two subcomponents: the first is the net foreign-asset position (scaled by the sum of foreign assets and liabilities) (*NFA*). The second is the aggregate foreign-currency exposure evaluated at a zero net foreign-asset position (*FXAGG*0). *FXAGG*0 denotes the difference in the foreign-currency share between the asset and liability sides of the balance sheet when the net foreign-asset position is zero. It is measured by the sum of portfolio equity and FDI liabilities plus domestic-currency debt liabilities minus domestic-currency debt assets, where all terms are scaled by the sum of foreign assets and liabilities. Based on their data sample, Lane and Shambaugh find that *NFA* is the most important determinant of *FXAGG*. To a great extent, that is, a country's position in currency mismatch is determined by its status as a debtor or creditor.

[Insert Table 8 here]

As Lane and Shambaugh did, I run two separate panel regressions for *NFA* and *FXAGG*0. Table 8

presents the random- and fixed-effect results for the specification that includes the full set of regressors used in Table 7. The Hausman test favors the random-effect results for *NFA* in column (1) and the fixed-effect results for FXAGG0 in column (4). The significant results indicate that a country that is larger in size and more efficient in its domestic financial system has a more positive level of both NFA and FXAGG0. Richer countries have a greater chance to be a net creditor. The coefficients of inflation volatility are negative but significant only for FXAGG0, reflecting that monetary credibility is an important factor determining the currency composition of foreign assets and liabilities. On the other hand, institutional quality has a negative and significant coefficient only for NFA, implying that the negative relationship between institutional quality and aggregate currency mismatch originates mainly from a country's net foreign-asset position.

Note the role of FDI and portfolio equity liabilities that are denominated in domestic currency. For FXAGG0, the coefficients of exchange-rate volatility are negative, but significant only for the random-effect results. When a financial-reform index is excluded, its fixed-effect coefficient becomes significant (not shown here). This implies that the foreign-currency share of net foreign liabilities is larger to the extent that the exchange rate is more volatile, which is the opposite of the earlier findings for ACMDEBT in this study. The possible reason is that the volatility of the exchange rate has a negative relationship with FDI and equity liabilities that are the major components of FXAGG0.

5. Concluding remarks

There has been a debate on whether aggregate currency mismatch is caused by domestic or international factors. The empirical findings of this study suggest that both factors matter. Larger and richer countries are less likely to have a currency mismatch problem. Currency mismatch is not a problem of advanced countries, but that of developing and emerging countries. All its determinants proposed in the literature are not statistically significant.

The main findings and their policy implications are summarized as follows: first, the extent of currency mismatch depends on how financial-sector policies are enforced to improve the efficiency of domestic financial systems. The results suggest that a country should be financially liberalized and

open to the rest of the world; encourage domestic securities markets to be developed; and prudentially supervise financial intermediaries. Such financial-sector reforms lead to deeper financial markets, thus reducing currency mismatching.

Second, institutional quality is a significant factor, but associated with a more negative level of currency mismatch. However, this result does not necessarily negate the positive relationship between institutional quality and the ability to issue domestic-currency liabilities. The reason is that a country with good institutions can undergo a worsening of its net foreign-asset position since it will attract foreign capital. This hypothesis is confirmed by the negative relationship between institutional quality and net foreign assets, shown in the case where aggregate foreign-currency exposure is divided into two subcomponents. For a sample of developing and emerging countries, moreover, some subcomponents of institutional quality, which represent property rights, are correlated with more positive values of currency mismatch. Overall, thus, more effort to upgrade institutional quality should be expended to lower those countries' share of foreign liabilities denominated in foreign currency.

Regarding the other explanatory variables, third, exchange-rate volatility and/or exchange-rate regime are not the significant factors, although their signs imply that a more flexible exchange-rate regime is preferred to reduce currency mismatching. Inflation volatility and trade openness show expected signs, but with weak statistical significance. Some reservations should be made, however. When the portfolio equity and FDI components of the balance sheet are incorporated in measuring aggregate currency mismatch, both variables gain statistical significance for several specifications. And the insignificance of trade openness may be caused by financial openness.[14] Inflation volatility becomes a significant determinant, especially for the currency composition of foreign assets and liabilities. Thus the results suggest that countries should adopt credible monetary policies and be open in the real side to overcome the currency mismatch problems.

Countries whose currencies are internationally used as a vehicle and reserve currency are able to

[14] Aizenman and Noy (2009) find that there exists a two-way feedback between trade and financial openness, and Granger causality from financial openness to trade openness is somewhat stronger than that from trade to financial openness.

issue domestic-currency liabilities and obtain foreign-currency assets; thus they do not suffer from currency mismatching. The literature identifies a number of factors affecting international-currency status, including economic size; confidence in the value of currency (control of inflation and exchange-rate volatility); net creditor position; open, deep, and broad financial markets; and low country risk.[15] Notice that the determinants of international currencies are almost equivalent to those of aggregate-currency mismatch obtained from this study.

Overall, it is not impossible for developing and emerging countries to control currency mismatching. Their first priority should be to improve the efficiency of domestic financial systems and institutional quality, along with sustaining macroeconomic stability. And the raw data indicate that a country's position in currency mismatch is determined largely by its status as a debtor or a creditor. Thus, being a net creditor can be an intermediate target to solve the problem.

[15] For example, see Tavlas (1991), Tavlas and Ozeki (1992), Chinn and Frankel (2006) for the determinants of international currencies.

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A. Country list

Developing and Emerging Countries	Ghana	Nigeria	*Developed Countries*
	Guatemala	Oman	
	Guinea	Pakistan	Australia
Algeria	Haiti	Papua New Guinea	Austria
Argentina	Honduras	Paraguay	Belgium
Bangladesh	Hong Kong	Peru	Canada
Benin	Hungary	Philippines	Denmark
Bolivia	India	Poland	Finland
Botswana	Indonesia	Rwanda	France
Burkina Faso	Iran	Senegal	Germany
Cambodia	Israel	Singapore	Greece
Cameroon	Jamaica	Slovak Republic	Iceland
Chad	Jordan	South Africa	Ireland
Chile	Kenya	Sri Lanka	Italy
China,P.R.: Mainland	Korea	Syrian Arab Republic	Japan
Colombia	Latvia	Tanzania	Netherlands
Congo, Republic of	Lithuania	Thailand	New Zealand
Cote d′Ivoire	Madagascar	Togo	Norway
Dominican Republic	Malaysia	Trinidad and Tobago	Portugal
Egypt	Mali	Tunisia	Spain
El Salvador	Mexico	Turkey	Sweden
Equatorial Guinea	Morocco	Uganda	Switzerland
Estonia	Mozambique	Uruguay	United Kingdom
Ethiopia	Nepal	Venezuela	United States
Fiji	Nicaragua	Vietnam	
Gabon	Niger	Zambia	

B. Data descriptions and sources

Variable	Description and Source
RPGDP	Real GDP per capita, ppp (constant, 2005 US dollar) (WDI)
GDP	Nominal GDP, ppp, (current, million US dollars) (WDI).
POP	Total population, millions (WDI)
Vol(π)	Standard deviation of the first log difference of quarterly CPI over the current and past year, annualized, (Author′s calculation using IFS)
Vol(E)	Standard deviation of the first log difference of quarterly SDR exchange rate over the current and the past year, annualized, (Author′s calculation using IFS)
Inflation	Annual change in CPI (%) (IFS)
Topen	Trade Openness. Sum of exports and imports of goods and services (% of GDP) (WDI)
Kopen	Capital openness index of Chinn and Ito (2008)
Shambaugh	*De facto* exchange rate regime of Shambaugh (2004), peg = 1, nonpeg = 0
Reinhart	*De facto* exchange rate regime of Reinhart and Rogoff (2004)
	De facto peg = 1, *De facto* crawling peg = 2, Managed floating = 3, Freely floating = 4,
	Freely falling = 5. See Reinhart and Rogoff (2004) for details on the classification code.
Levi-Yeyati	*De facto* exchange rate regime of Levi-Yeyati and Sturzenegger (2005)
	Float = 1, Intermediate = 2, Fix = 3.
Quality	Institutional quality (PRS Group, ICRG). See Appendix C.
P_credit	Domestic credit to the private sector as a share of GDP (WDI)
M2	Money and quasi money (% of GDP) (WDI)
Fasset	Total financial assets (sum of IFS lines 12, 22, and 42a through d and 42h)
	as a share of GDP (IFS).
Dom_securities	Amounts outstanding of domestic debt securities as a share of GDP (BIS)
Reform	An aggregate index of financial reforms (Abiad, et al., 2008)
	See Appendix D.

Source: IFS, *International Financial Statistics*, IMF.
WDI, *World Development Indicators*, the World Bank.
BIS, *International Banking and Financial Market Developments*, Bank for International Settlements.
ICRG, *International Country Risk Guide*, PRS Group.
Abiad et al. (2008), Chinn and Ito (2008), Levi-Yeyati and Sturzenegger (2005),
Reinhart and Rogoff (2004), and Shambaugh (2004).

C. The financial reform index and its subindexes

Financial reform (*Reform*). This is an index, which measures domestic financial reforms, derived from Abiad et al. (2008), covering 91 countries from 1973-2005. The index is the sum of seven subindexes that track the presence of restrictions in the areas listed below. Each subindex is coded on a three-point scale, and a higher score corresponds to more advance reforms. The index of financial reform is normalized between zero and one. The subindexes are as follows:

Credit controls and reserve requirements (*Credit_control*). The tightness of mandatory bank reserve requirements, the existence of compulsory credit allocation requirements, the presence and extent of subsidized schemes, and the existence of quantitative restrictions on bank credit growth.

Interest rate controls (*Interest_control*). The extent to which deposit and lending rates are market determined rather than subject to administrative ceilings.

Entry barriers (*Entry_barriers*). Restrictions on entry into the banking sector, including restrictions on foreign bank entry, as well as restrictions on branching and scope of bank activities.

Bank privatization (*Privatization*). The extent to which bank assets are controlled by private owners rather than the government.

Capital account restrictions (*Capital_control*). Restrictions on international financial transactions such as multiple exchange rates for various transactions, as well as transactions taxes or outright restrictions on inflows and/or outflows specifically regarding financial credits.

Security market policy (*Security_markets*). The policies governments use to either restrict or encourage development of securities markets. These include the auctioning of government securities, establishment of debt and equity markets, and policies to encourage development of these markets, such as tax incentives or development of depository and settlement systems. Policies on the openness of securities markets to foreign investors are also included here.

Bank supervision (*Supervision*). The extent to which Basel capital regulation and a number of characteristics of the bank supervisory system have been adopted, (i.e., the degree of independence of supervisory agency, the effectiveness of on-site and off-site examinations of banks by supervisory agency, and whether all banks are subject to supervision or not).

Figure 1. ACMDEBT vs FXAGG

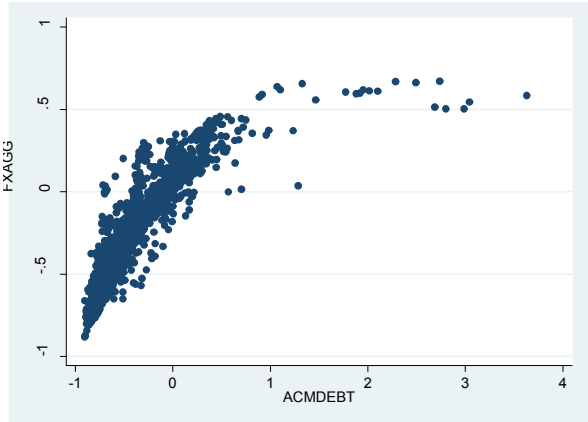

Figure 2 ACMDEBT vs MISMATCH_1

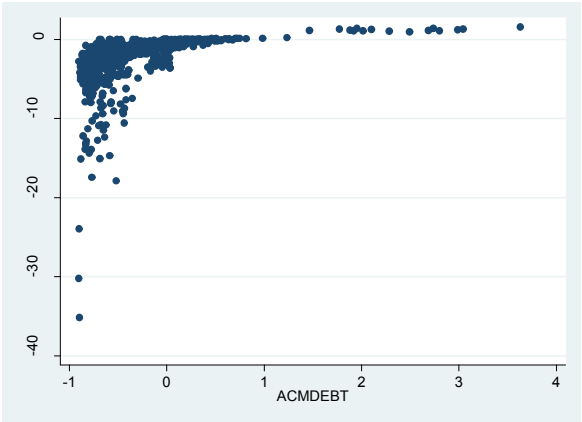

Figure 3 ACMDEBT vs MISMATCH_2

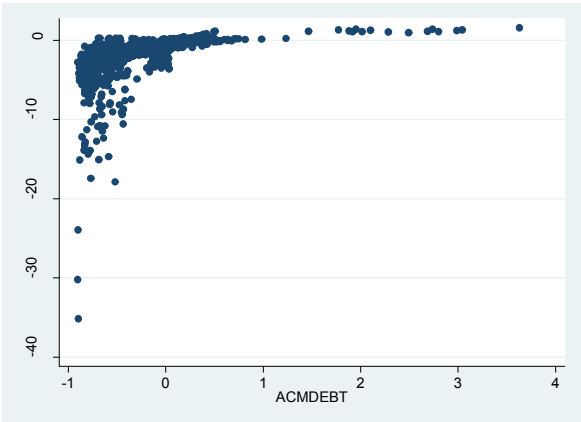

Figure 4 MISMATCH_1 vs MISMATCH_2

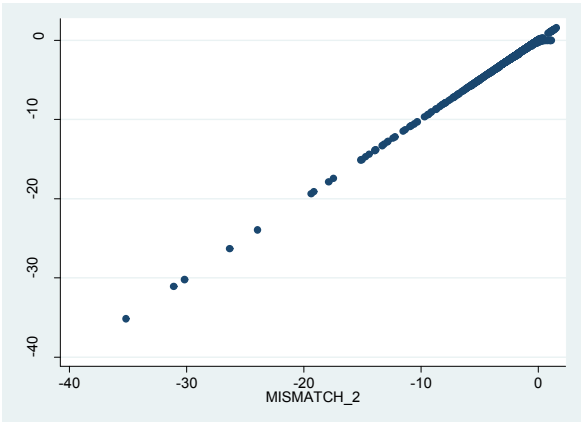

Table 1. Summary Statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
Dependent variable					
FXAGG	1427	-0.174	0.316	-0.883	0.671
ACMDEBT	1422	-0.28	0.461	-0.904	3.630
MISMATCH_2	1181	-2.131	3.026	-35.159	1.551
Independent variable					
RPGDP	1528	8.604	1.296	5.931	10.764
GDP	1529	298169.1	1040665	125.745	1.24E+07
Vol(π)	1427	1.895	2.67	0.073	56.265
Vol(E)	1491	5.817	9.613	0	132.717
Inflation	1460	0.203	2.321	-0.113	65.594
Topen	1511	73.476	45.793	10.830	444.315
Kopen	1509	0.412	1.584	-1.811	2.531
Shambaugh	1427	0.391	0.488	0	1
Reinhart	1379	2.219	1.1909	1	5
Levi-Yeyati	1286	2.21	0.866	1	3
Quality	1399	67.438	13.665	18	97
P_credit	1504	1.675	7.068	-1.136	113.195
M2	1302	44.502	36.941	0.918	256.633
Fasset	1477	0.676	0.507	0.005	3.457
Dom_securities	661	0.573	0.426	0.001	3.153
Reform	1179	0.691	0.229	0	1

Source: Author's calculation

IMF, *International Financial Statistics*, June 2010.
World Bank, *World Development Indicators*, 2010.
BIS, *International Banking and Financial Market Developments*, Bank for International Settlements.
ICRG, *International Country Risk Guide*, PRS Group.
Abiad et al. (2008), Chinn and Ito (2008), Levi-Yeyati and Sturzenegger (2005),
Reinhart and Rogoff (2004), and Shambaugh (2004).

Table 2. Determinants of ACMDEBT

	(1)	(2)	(3)	(4)	(5)	(6)
	RE	RE	RE	FE	FE	FE
ln(RPGDP)	0.149*	0.069***	0.106*	0.220	0.085	0.282***
	(0.036)	(0.039)	(0.027)	(0.165)	(0.188)	(0.156)
ln(GDP)	0.123*	0.130*	0.044*	0.219*	0.238*	0.079
	(0.019)	(0.021)	(0.016)	(0.050)	(0.053)	(0.055)
Vol(π)(-1)	-0.540**	-0.490**	-0.138	-0.236	-0.297	-0.019
	(0.223)	(0.223)	(0.204)	(0.206)	(0.185)	(0.147)
Vol(E)(-1)	0.062	0.017	-0.017	0.090	0.031	0.009
	(0.058)	(0.061)	(0.065)	(0.064)	(0.058)	(0.076)
Topen(-1)	0.094*	0.181*	0.072**	-0.033	0.118	-0.052
	(0.035)	(0.042)	(0.033)	(0.124)	(0.113)	(0.103)
Kopen(-1)		0.019*	-0.002		0.010	-0.006
		(0.006)	(0.006)		(0.012)	(0.014)
Peg(-1)		-0.021	-0.014		-0.034	-0.022
		(0.017)	(0.015)		(0.030)	(0.029)
Quality(-1)		-0.176**	-0.355*		-0.276***	-0.436*
		(0.085)	(0.078)		(0.139)	(0.160)
P_credit(-1)		0.002***	0.000		0.001	-0.000
		(0.001)	(0.001)		(0.002)	(0.001)
Reform(-1)			0.468*			0.433*
			(0.045)			(0.097)
Constant	-2.916*	-2.282*	-1.840*	-4.463*	-3.473**	-3.612*
	(0.208)	(0.251)	(0.164)	(1.175)	(1.411)	(1.067)
Hausman test	104.55*	42.06*	47.39*			
R -squared	0.175	0.170	0.458	0.253	0.180	0.272
Observations	1231	1120	925	1231	1120	925

Notes:

1. RE and FE denote the random and fixed effects, respectively. The parenthesis, (-1), stands for one year lagged.
2. Huber-White-sandwich corrected standard errors in the parentheses
3. *, ** and *** indicate that the estimated coefficients are statistically significant at 1%, 5% and 10% levels, respectively.

Table 3. Robustness checks: Fixed effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
ln(RPGDP)	0.282***	0.400*	0.248	0.308***	0.271***	0.264	0.369
	(0.156)	(0.152)	(0.162)	(0.159)	(0.156)	(0.162)	(0.230)
ln(GDP)	0.079	0.070	0.080	0.064	0.076	0.074	-0.069
	(0.055)	(0.057)	(0.055)	(0.060)	(0.054)	(0.058)	(0.092)
Vol(E)(-1)	0.009	0.017	-0.006	0.011	0.016	-0.004	-0.150
	(0.076)	(0.073)	(0.076)	(0.067)	(0.078)	(0.074)	(0.160)
Topen(-1)	-0.052	-0.084	-0.026	-0.074	-0.108	-0.027	0.047
	(0.103)	(0.105)	(0.111)	(0.109)	(0.099)	(0.107)	(0.136)
Kopen(-1)	-0.006	-0.007	-0.002	-0.002	0.000	-0.002	-0.033***
	(0.014)	(0.015)	(0.015)	(0.014)	(0.015)	(0.014)	(0.017)
Vol(π)(-1)	-0.019		-0.055	-0.084	0.069	0.003	-0.035
	(0.147)		(0.158)	(0.145)	(0.157)	(0.151)	(0.220)
Inflation(-1)		-0.007					
		(0.014)					
Peg							
Shambaugh(-1)	-0.022	-0.016			-0.012	-0.018	-0.021
	(0.029)	(0.029)			(0.029)	(0.030)	(0.042)
Reinhart(-1)			0.000				
			(0.012)				
Levi-Yeyati(-1)				-0.014			
				(0.013)			
Financial depth							
P_credit(-1)	-0.000	-0.000	-0.001	-0.001			
	(0.001)	(0.002)	(0.001)	(0.001)			
M2(-1)					0.002**		
					(0.000)		
Fasset(-1)						-0.012	
						(0.058)	
Dom_securities(-1)							0.111
							(0.185)
Quality (-1)	-0.436*	-0.515*	-0.396**	-0.393*	-0.491*	-0.382**	-0.154
	(0.160)	(0.163)	(0.172)	(0.126)	(0.167)	(0.155)	(0.158)
Reform(-1)	0.433*	0.431*	0.413*	0.358*	0.489*	0.451*	0.385***
	(0.097)	(0.096)	(0.102)	(0.102)	(0.098)	(0.105)	(0.200)
Constant	-3.612*	-4.460	-3.389*	-3.629*	-3.516*	-3.479*	-3.085**
	(1.067)	(1.001)	(1.127)	(1.106)	(1.057)	(1.109)	(1.481)
Hausman test	47.39*	66.17*	27.25*	31.08*	17.50***	33.68*	13.93
R -squared	0.272	0.315	0.273	0.238	0.350	0.280	0.242
Observations	925	944	845	846	764	898	518

Notes: See the notes of Table 1.

Table 4. Countries

	Developed		Developing and emerging	
	(1)	(2)	(3)	(4)
	RE	FE	RE	FE
ln(RPGDP)	0.125	0.324	0.136*	0.401**
	(0.114)	(0.272)	(0.027)	(0.185)
ln(GDP)	0.015	-0.076	0.047**	0.080
	(0.031)	(0.072)	(0.021)	(0.066)
Vol(π)(-1)	-0.785	-0.367	-0.049	0.122
	(2.249)	(3.435)	(0.111)	(0.179)
Vol(E)(-1)	-0.234	-0.359	0.000	0.023
	(0.433)	(0.531)	(0.049)	(0.078)
Topen(-1)	0.041	-0.056	0.054	-0.051
	(0.084)	(0.142)	(0.035)	(0.114)
Kopen(-1)	-0.002	-0.003	0.003	0.000
	(0.009)	(0.021)	(0.007)	(0.017)
Peg(-1)	-0.024	-0.028	-0.011	-0.019
	(0.018)	(0.044)	(0.022)	(0.036)
Quality (-1)	-0.090	-0.093	-0.373*	-0.511*
	(0.144)	(0.289)	(0.110)	(0.180)
P_credit(-1)	-0.004**	-0.005**	0.000	-0.001
	(0.001)	(0.002)	(0.001)	(0.001)
Reform(-1)	0.061	0.092	0.523*	0.463*
	(0.078)	(0.175)	(0.057)	(0.102)
Constant	-1.541***	-2.337	-2.110*	-4.440*
	(0.829)	(1.877)	(0.210)	(1.218)
Hausman test	18.26***		-8.48	
R -squared	0.079	0.073	0.430	0.329
Observations	278	278	647	647

Notes: See the notes of Table 1.

Table 5. Institutional quality (Developing and emerging countries): Fixed effects

	(1)	(2)	(3)	(4)	(5)	(6)
ln(RPGDP)	0.226	0.016	0.156	0.152	0.137	0.188
	(0.153)	(0.174)	(0.179)	(0.181)	(0.178)	(0.173)
ln(GDP)	0.107***	0.109***	0.102	0.105***	0.101	0.104***
	(0.060)	(0.061)	(0.063)	(0.061)	(0.062)	(0.062)
Vol(π)(-1)	0.156	0.171	0.073	0.157	0.128	0.175
	(0.173)	(0.178)	(0.164)	(0.199)	(0.168)	(0.179)
Vol(E)(-1)	0.029	-0.007	0.053	0.022	0.038	0.033
	(0.073)	(0.072)	(0.063)	(0.079)	(0.069)	(0.074)
Topen(-1)	-0.089	-0.114	-0.120	-0.140	-0.133	-0.126
	(0.101)	(0.101)	(0.108)	(0.102)	(0.102)	(0.099)
Kopen(-1)	0.003	-0.002	-0.006	-0.006	-0.006	-0.005
	(0.017)	(0.016)	(0.017)	(0.018)	(0.017)	(0.017)
Peg(-1)	-0.002	-0.009	-0.019	-0.021	-0.017	-0.014
	(0.026)	(0.028)	(0.034)	(0.033)	(0.033)	(0.033)
M2(-1)	0.003*	0.002**	0.003*	0.003*	0.003**	0.002**
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Reform(-1)	0.352*	0.380*	0.441*	0.452*	0.448*	0.460*
	(0.097)	(0.099)	(0.103)	(0.104)	(0.097)	(0.097)
Bureaucracy(-1)	-0.065*					
	(0.016)					
Corruption(-1)		-0.047*				
		(0.017)				
Democracy(-1)			-0.012			
			(0.015)			
Ethn_tension(-1)				-0.027		
				(0.017)		
Ext_conflict(-1)					-0.008***	
					(0.004)	
Int_conflict(-1)						-0.014*
						(0.004)
Constant	-3.511*	-1.777	-2.993**	-2.932**	-2.785**	-3.197*
	(0.977)	(1.099)	(1.174)	(1.130)	(1.112)	(1.121)
Hausman test	24.89*	12.51	18.64**	45.74*	18.65**	26.36*
R -squared	0.380	0.360	0.334	0.345	0.335	0.350
Observations	648	660	648	648	648	648

Notes: See the notes of Table 1.

Table 5. Institutional quality (Developing and emerging countries) (Contiued)

	(7)	(8)	(9)	(10)	(11)	(12)
ln(RPGDP)	0.135	0.070	0.196	0.229	0.241	0.189
	(0.180)	(0.191)	(0.169)	(0.171)	(0.162)	(0.177)
ln(GDP)	0.102	0.111***	0.090	0.082	0.081	0.088
	(0.062)	(0.064)	(0.059)	(0.059)	(0.055)	(0.058)
Vol(π)(-1)	0.111	0.127	0.158	0.039	0.008	0.093
	(0.172)	(0.178)	(0.182)	(0.157)	(0.185)	(0.168)
Vol(E)(-1)	0.041	0.065	0.023	0.075	0.051	0.031
	(0.070)	(0.066)	(0.076)	(0.068)	(0.067)	(0.071)
Topen(-1)	-0.127	-0.134	-0.165***	-0.123	-0.132	-0.144
	(0.104)	(0.100)	(0.098)	(0.100)	(0.095)	(0.107)
Kopen(-1)	-0.006	-0.009	-0.006	-0.002	-0.005	-0.003
	(0.018)	(0.017)	(0.017)	(0.017)	(0.016)	(0.017)
Peg(-1)	-0.016	-0.017	-0.017	-0.019	-0.014	-0.014
	(0.033)	(0.034)	(0.032)	(0.034)	(0.030)	(0.032)
M2(-1)	0.002*	0.002*	0.002**	0.002**	0.003*	0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Reform(-1)	0.425*	0.386*	0.503*	0.426*	0.406*	0.398*
	(0.105)	(0.091)	(0.106)	(0.096)	(0.100)	(0.092)
Gov_stability(-1)	0.000					
	(0.003)					
Investment(-1)		0.010***				
		(0.006)				
Law_order(-1)			-0.035*			
			(0.010)			
Mil_politics(-1)				-0.028**		
				(0.012)		
Rel_tension(-1)					-0.052*	
					(0.018)	
Socio(-1)						-0.011
						(0.006)
Constant	-2.856**	-2.449**	-3.122*	-3.318*	-3.253*	-3.053*
	(1.133)	(1.159)	(1.083)	(1.133)	(1.047)	(1.138)
Hausman test	17.54***	15.59	33.98*	18.62**	20.81**	35.34*
R -squared	0.330	0.338	0.357	0.347	0.381	0.337
Observations	648	648	648	648	648	648

Notes: See the notes of Table 1.

Table 6. Financial reform (Developing and emerging countries): Fixed effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
ln(RPGDP)	0.196	0.337***	0.328***	0.249	0.337***	0.292	0.195
	(0.179)	(0.189)	(0.189)	(0.182)	(0.177)	(0.187)	(0.169)
ln(GDP)	0.142**	0.142**	0.185*	0.196*	0.164*	0.231*	0.182*
	(0.061)	(0.064)	(0.064)	(0.064)	(0.057)	(0.067)	(0.065)
Vol(π)(-1)	0.145	-0.029	-0.068	0.046	-0.117	-0.094	0.128
	(0.166)	(0.154)	(0.160)	(0.184)	(0.143)	(0.159)	(0.168)
Vol(E)(-1)	-0.029	0.004	0.025	-0.014	0.018	0.005	0.046
	(0.081)	(0.080)	(0.084)	(0.093)	(0.078)	(0.086)	(0.079)
Topen(-1)	-0.098	-0.055	-0.056	-0.055	-0.046	-0.014	-0.110
	(0.106)	(0.112)	(0.116)	(0.113)	(0.116)	(0.124)	(0.114)
Kopen(-1)	0.010	0.013	0.012	0.003	0.012	0.019	0.008
	(0.016)	(0.015)	(0.017)	(0.018)	(0.017)	(0.017)	(0.016)
Peg(-1)	-0.002	-0.009	-0.006	-0.011	-0.011	-0.000	-0.007
	(0.031)	(0.029)	(0.033)	(0.035)	(0.031)	(0.031)	(0.033)
Quality (-1)	-0.323***	-0.415**	-0.437**	-0.436**	-0.425**	-0.332**	-0.385**
	(0.162)	(0.172)	(0.174)	(0.175)	(0.176)	(0.164)	(0.167)
M2(-1)	0.002***	0.003*	0.002***	0.002**	0.002**	0.002**	0.003*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Supervion(-1)	0.081*						
	(0.019)						
Credit_control(-1)		0.059*					
		(0.017)					
Entry_barriers(-1)			0.039**				
			(0.018)				
Capital_control(-1)				0.051**			
				(0.021)			
Interest_control(-1)					0.052*		
					(0.019)		
Privatization(-1)						-0.021	
						(0.015)	
Security_markets(-1)							0.091*
							(0.027)
Constant	-3.378*	-4.576*	-4.878*	-4.372*	-4.782*	-5.038*	-3.851*
	(1.154)	(1.236)	(1.315)	(1.269)	(1.182)	(1.324)	(1.120)
Hausman test	93.29*	49.77*	58.91*	31.35*	4.04	65.35*	77.27*
R -squared	0.338	0.333	0.307	0.319	0.323	0.298	0.339
Observations	648	648	648	648	648	648	648

Notes: See the notes of Table 1.

Table 7. Determinants of FXAGG

	(1)	(2)	(3)	(4)	(5)	(6)
	RE	RE	RE	FE	FE	FE
ln(RPGDP)	0.070*	0.067*	0.100*	0.027	0.187	0.275**
	(0.019)	(0.020)	(0.018)	(0.092)	(0.113)	(0.123)
ln(GDP)	0.101*	0.095*	0.037*	0.212*	0.192*	0.057
	(0.011)	(0.011)	(0.011)	(0.038)	(0.041)	(0.041)
Vol(π)(-1)	-0.796*	-0.679*	-0.342**	-0.554*	-0.445**	-0.237
	(0.148)	(0.153)	(0.153)	(0.210)	(0.188)	(0.161)
Vol(E))(-1)	0.011	0.004	-0.015	0.030	0.012	-0.001
	(0.039)	(0.042)	(0.048)	(0.054)	(0.045)	(0.065)
Topen(-1)	0.173*	0.165*	0.073*	0.112**	0.102	-0.003
	(0.022)	(0.026)	(0.023)	(0.054)	(0.081)	(0.078)
Kopen(-1)		0.021*	-0.002		0.011	-0.003
		(0.004)	(0.004)		(0.008)	(0.011)
Peg(-1)		-0.006	-0.007		-0.019	-0.011
		(0.011)	(0.011)		(0.019)	(0.019)
Quality (-1)		0.069	-0.145**		-0.070	-0.238***
		(0.057)	(0.058)		(0.110)	(0.126)
P_credit(-1)		0.002*	0.000		0.002***	-0.000
		(0.001)	(0.000)		(0.001)	(0.000)
Reform(-1)			0.463*			0.425*
			(0.033)			(0.084)
Constant	-1.948*	-1.941*	-1.709*	-2.701*	-3.875*	-3.329*
	(0.114)	(0.130)	(0.110)	(0.591)	(0.838)	(0.870)
Hausman test	119.28*	103.50*	41.57*			
R -squared	0.461	0.512	0.684	0.350	0.349	0.422
Observations	1231	1120	925	1231	1120	925

Notes: See the notes of Table 1.

Table 8. NFA and FXAGG0

	NFA		FXAGG0	
	(1)	(2)	(3)	(4)
	RE	FE	RE	FE
ln(RPGDP)	0.095*	0.126	-0.029**	0.005
	(0.019)	(0.103)	(0.012)	(0.053)
ln(GDP)	0.042*	0.037	0.029*	0.061*
	(0.011)	(0.042)	(0.007)	(0.019)
Vol(π)(-1)	-0.003	-0.000	-0.017**	-0.015**
	(0.012)	(0.010)	(0.007)	(0.007)
Vol(E))(-1)	0.012	0.014	-0.044***	-0.031
	(0.042)	(0.051)	(0.026)	(0.020)
Topen(-1)	0.034	0.001	0.047*	0.035
	(0.022)	(0.058)	(0.014)	(0.041)
Kopen(-1)	-0.006	-0.007	0.001	0.001
	(0.004)	(0.009)	(0.002)	(0.005)
Peg(-1)	-0.012	-0.015	-0.001	-0.003
	(0.009)	(0.016)	(0.006)	(0.010)
Quality (-1)	-0.142*	-0.154	0.000	-0.029
	(0.050)	(0.099)	(0.032)	(0.047)
P_credit(-1)	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Reform(-1)	0.266*	0.278*	0.191*	0.150*
	(0.030)	(0.063)	(0.019)	(0.049)
Constant	-1.746*	-1.940*	-0.034	-0.648
	(0.122)	(0.600)	(0.078)	(0.423)
Hausman test	11.59		103.51*	
R -squared	0.536	0.240	0.080	0.325
Observations	1017	1017	944	944

Notes: See the notes of Table 1.