CESifo WORKING PAPERS

8287
2020

May 2020

Currency Portfolio of External Debt, Exchange Rate Cyclicality, and Consumption Volatility

Eiji Fujii

CESifo

Impressum:

CESifo Working Papers
ISSN 2364-1428 (electronic version)
Publisher and distributor: Munich Society for the Promotion of Economic Research - CESifo GmbH
The international platform of Ludwigs-Maximilians University's Center for Economic Studies and the ifo Institute
Poschingerstr. 5, 81679 Munich, Germany
Telephone +49 (0)89 2180-2740, Telefax +49 (0)89 2180-17845, email office@cesifo.de
Editor: Clemens Fuest
https://www.cesifo.org/en/wp
An electronic version of the paper may be downloaded
· from the SSRN website: www.SSRN.com
· from the RePEc website: www.RePEc.org
· from the CESifo website: https://www.cesifo.org/en/wp

CESifo *Working Paper No. 8287*

Currency Portfolio of External Debt, Exchange Rate Cyclicality, and Consumption Volatility

Abstract

Even though external debt can play a buffer role against adverse shocks to assist consumption smoothing, it may also exert a volatility amplifying effect, depending on the currency of denomination and the cyclicality of the borrower's exchange rate. We empirically investigate the nexus between the debt denomination portfolio, exchange rate cyclicality, and consumption volatility of low- and middle-income countries. On constructing the debt-weighted effective exchange rates, we examine how the denomination portfolio affects the debtors' exchange rate cyclicality to influence the consumption response to transitory income shocks. We find that portfolio concentration enhances exchange rate pro-cyclicality, which makes consumption more volatile when income shocks occur. Our results suggest that portfolio diversification is a useful tool for countries with original sin to hedge against bumpy consumption paths.

JEL-Codes: F340, F310.

Keywords: external debt, currency portfolio, original sin, exchange rate cyclicality, consumption volatility.

Eiji Fujii
School of Economics
Kwansei Gakuin University
1-155Uegahara Ichiban-cho, Nishinomiya
Japan – Hyogo 662-8501
efujii@kwansei.ac.jp

This research is supported by JSPS KAKENHI Grant Number 18K01715. The author is grateful to the workshop participants at Université Catholique de Louvain and the Center for Risk Research of Shiga University for helpful comments. All remaining errors are solely those of the author.

1. Introduction

Access to external capital is a valuable tool for alleviating the effects of adverse income shocks, especially for countries in which the credit and insurance markets are underdeveloped. By borrowing abroad, they can create a buffer against income shocks so as to stabilize consumption. However, if denominated in foreign currency, external debt can also become a source of unwanted risk exposure. A common problem occurs when domestic currency depreciates and induces debt revaluation and balance sheet deterioration. Moreover, theoretical studies suggest that foreign currency debt can generate far-reaching effects, including those on the borrower's macroeconomic volatility (Korinek, 2011), default risk (Gumus, 2013), and currency regime (Bleaney and Ozkan, 2011).

For international debt, the choice of denominating currency is crucial because it determines who will undertake the inherent exchange rate risk. Unless the borrowing country and its currency possess solid credibility and a thick market, it is more likely than not that the debt will be denominated in a currency other than the borrower's. From this perspective, it is not surprising that "original sin" persists while a few major currencies of affluent economies dominate international financial markets.[1]

For many developing countries, resolving original sin is, although desirable, unrealistic, at least in the short run.[2] If they continue to rely on foreign currency debt, it is imperative that they seek a means to attenuate the negative consequences of such debt and hedge against adverse incidents in the future. This is the motivation of this paper.

[1] "Original sin" refers to the inability of a country to borrow abroad in its own currency (Eichengreen, Hausmann, and Panizza, 2005).

[2] For instance, Caballero and Krishnamurthy (2003) argues that the limited financial development in emerging markets is a significant factor behind the excessive dollar-denominated debt that often feeds into financial crises. Market development is an issue that can be addressed only in the long run.

It is worth emphasizing that, in reality, the choice of the debt-denominating currency is not merely a binary one. Unlike theoretical models that assume the domestic-or-foreign binary choice for simplicity, there are actually multiple foreign currencies in which a country can denominate its external debt. An important implication is that, for a given amount of foreign currency debt, borrowers can adjust their risk exposure by altering their denominating currency portfolios. Therefore, it is conceivable that countries that share the same degree of original sin experience significantly different effects of foreign currency debt by holding dissimilar denomination portfolios. If so, such a fact will provide us with a clue in the search for a means to attenuate the undesirable consequences of original sin.

More specifically, we are interested in how the choices of the debt-denominating currency shape the cyclicality of borrowers' exchange rates. As theoretically argued by Korinek (2011), exchange rate cyclicality may translate into the consumption dynamics of borrowers. If a debtor's exchange rate is pro-cyclical, foreign currency-denominated debt requires large (small) repayment in bad (good) economic states. Thus, the effect of output fluctuation can be amplified to make consumption more volatile than it would be otherwise. The extent to which this effect arises should depend on the denomination currency portfolio and the resulting exchange rate cyclicality.

This paper empirically examines the nexus among the debt denomination currency portfolio, exchange rate cyclicality, and consumption volatility for a large number of low- and middle-income countries (LMICs). Using data on their public and publicly guaranteed (PPG) external debt for the time period 1980–2017, we construct debt-weighted effective exchange rate (DEER) indices to quantify the extent to which borrowers were exposed to debt revaluation effects. We further investigate how the debt

denomination portfolio relates to exchange rate cyclicality, which, in turn, affects consumption volatility.

Our chief findings are summarized as follows. In general, the PPG external debt of LMICs continues to be denominated primarily in foreign currency, particularly in the US dollar (USD). A rising foreign currency share and a rising portfolio concentration characterize the general denomination trend over the past four decades. Foreign currency portfolio concentration was especially manifested after the advent of the euro.

Holding the share of foreign currency debt constant, we find that portfolio concentration significantly contributes to exchange rate pro-cyclicality. Furthermore, pro-cyclicality makes households' consumption more volatile in responding to income shocks. Altogether our results suggest that, even with the plague of original sin, there still exists room to mitigate these negative consequences *via* portfolio diversification.

The remainder of this paper is structured as follows. Section 2 presents a selective literature review. On describing the data, Section 3 quantifies debt denomination by currency share and portfolio measures. Section 4 constructs the DEER to gauge the extent of debt revaluation and exchange rate cyclicality. Section 5 estimates the effects of debt denomination on exchange rate cyclicality. Section 6 examines consumption responses to transitory income shocks under cyclical exchange rate movement. An extended discussion is followed by concluding remarks in Section 7.

2. Selective Literature Review

Recent literature on external debt has flourished with many studies highlighting the current prevalence of original sin, the inability of a country to borrow abroad in its own currency, and the danger this brings about for indebted countries (Eichengreen, Hausmann,

and Panizza, 2005, 2007; Hausmann and Panizza, 2003). The primary message they deliver is that an accumulation of foreign currency-denominated debt eventually suppresses the debtor's economic activity, especially when the country does not possess sufficient foreign currency assets with which to match it (Kourtellos, Stegnos, and Tan, 2013; Panizza and Presbitero, 2014; Ranciere, Tornell, and Vamakidis, 2010; Reinhart and Rogoff, 2010, 2011).[3] Nonetheless, given the status quo of international financial markets, it is not feasible for many LMICs to resolve original sin in the short run. It is imperative that they attenuate the negative consequences it may bring and hedge against adverse future incidents.

To understand the ramifications of foreign currency debt, it is necessary to take account of cyclicality in the borrower's exchange rate. Let exchange rate pro-cyclicality be defined as a tendency of the borrower's currency to depreciate (appreciate) in response to unfavorable (favorable) states of its aggregate economy. If a borrower's exchange rate is pro-cyclical, foreign currency-denominated debt requires large repayments when output contracts, whereas the domestic currency depreciates.[4] Thus, the impact of negative economic shocks will worsen. Conversely, debt repayment will shrink when output expands and the borrower's currency appreciates, which enhances the boom resulting from positive shocks. Therefore, under exchange rate pro-cyclicality, foreign currency debt brings a volatility-enhancing element.

Using a theoretical model of a small open emerging-market economy, Korinek (2011) finds that the greater the fraction of debt denominated in foreign currency, the higher the impact of a given output shock on aggregate demand, and the more volatile consumption

[3] For an alternative view, see Borensztein and Panizza (2010) and Levi-Yeyati and Panizza (2011).
[4] Under exchange rate pro-cyclicality, the local currency value of foreign currency-denominated debt is counter-cyclical to the aggregate state of the economy.

will be. A critical feature of the model is that the borrower's exchange rate is pro-cyclical. However, as we will present in Section 4, empirically speaking, the extent of exchange rate cyclicality varies significantly by country, ranging from counter-cyclical to pro-cyclical to various degrees. Thus, theoretical findings need to be placed in a specifically empirical context in order to draw relevant implications.[5]

For empirical analyses, it is crucial to measure external debt denomination in portfolio terms. A country's share of foreign currency debt, which is the standard theoretical measure, does not fully convey the information about the borrower's effective exchange rate fluctuation—unless external debt is denominated entirely in a single foreign currency.

The importance of the portfolio perspective is demonstrated, for instance, by Claessens (1992). The author argued that developing countries might better manage their external exposure by pursuing a risk-minimizing currency composition in their debt. As an example, he found that in the 1970s and 1980s, debt crisis-stricken Mexico and Brazil could have lowered their currency exposures by altering their denomination compositions.

Dodd and Spiegel (2005) extensively discussed currency portfolio issues for developing countries. They proposed the issuance of international debt denominated in the currencies of multiple borrowers to manage exposure. By examining the currency composition of external debt and trade for LMICs, Fujii (2017) provided additional insight that the extent of portfolio mismatch between debt and trade exerts significant negative effects on economic growth. The aforementioned studies, together, suggest the significance of taking a portfolio perspective when considering issues related to external debt denomination.

[5] We also note that many LMICs do not share the features of a small open emerging-market economy.

3. Measuring External Debt Denomination

3.1 Data

The World Bank's International Debt Statistics (IDS) database provides information on the currency composition of long-term PPG external debt. Of all the countries listed in the database, we retained 106 countries for the period 1980–2017 by data availability.[6] Shorter sample periods apply to some countries due to data limitations. The data frequency is annual. Further information is provided in the data appendix.

Panel A of Table 1 presents the average share of PPG debt in all debt. The PPG debt stock and service take up approximately 73% and 68%, respectively, of all debt. The shares are higher in the pre-euro period (1980–2000) than in the euro period (2001–2017), presumably reflecting the gradual development of private bond markets. Overall, the data indicate that PPG debt serves as a reasonable proxy for LMICs' external debt by comprising the bulk of it.

The IDS provides the denominating shares of the USD, the euro, the Japanese yen (JPY), the British pound (GBP), and the Swiss franc (CHF). For the pre-euro period, the shares of the German mark (DM) and the French franc (FF) are available. In addition, the IDS reports the shares of three other categories: "SDR", "multiple currencies", and "all other currencies". For LMICs, the SDR is a basket of foreign currencies.[7] Thus, we treat SDR debt as foreign currency debt. Because multiple currencies must include at least one foreign currency, we also regard the debt in this category as foreign currency debt.

Considering the fact that all eminent international currencies are already tallied, the foremost candidate for "all other currencies" is, arguably, the domestic currencies of

[6] To ensure consistency and comparability of the empirical results in Tables 1 through 3, we limited our sample to the countries that have effective observations on the debt denomination, exchange rates, and output growth for both pre-euro and euro periods.

[7] An exception is China in 2016 and 2017, when 10.92% of the SDR was comprised by renminbi.

borrowers. In the absence of further information, we assume that the share of "all other currencies" reflects the share of the debtors' domestic currencies.

3.2 Foreign currency share

As an empirical counterpart to the standard measure of theoretical studies, we first calculated the total share of foreign currency-denominated debt for each country:

$$TFS_{i,t} = \sum_{j} FS_{i,j,t} \ , \qquad (1)$$

where *i* and *j* denote the borrowing country and the debt-denominating foreign currency, respectively. $FS_{i,j,t}$ is the foreign currency *j*'s share of country *i*'s PPG debt in year *t*.

Panel B of Table 1 presents the average compositional shares by currency and in aggregate. Figure 1 visualizes this information. On average overall, foreign currency debt takes up approximately 80% of all PPG debt.[8] The 1980–2000 and 2001–2017 sub-period averages are 75% and 87%, respectively. These figures suggest that original sin is not just prevalent, but increasingly so.

The USD is, by far, the most dominant currency for debt denomination. The average USD share is approximately 50%. Interestingly, the advent of the euro is followed by a substantial rise in the USD share from the sub-period averages of 41% to 61%. The euro, second only to the USD, has an average share of 12%. Although greater than the combined share of the DM and the FF in the preceding era, the euro's share is approximately one fifth of the USD's for the corresponding period.[9]

The shares of the JPY, GBP, and CHF are far smaller and only approximately 5%, 2%, and 1%, respectively, during the 1980–2017 period in average terms. The sub-period

[8] As noted in the previous sub-section, we include the shares of "multiple currencies" and "SDR" categories in the foreign currency aggregate.

[9] The "synthetic euro" share in Table 1 connects the two series, the sum of the DM and the FF (1980–2000) and the euro (2001–2017).

statistics reveal that on the introduction of the euro, the shares of the GBP and the CHF were eroded substantially, plunging to less than half a percentage point.

Countries may increase or decrease their reliance on foreign currency debt over time. To identify the direction of these shifts, we fitted a linear time trend to aggregate and individual currency shares.[10] Figure 2 presents the results reported in panel C of Table 1. Over the period of 1980–2017, 67 countries exhibited a significant upward trend in aggregate foreign currency share, whereas only 16 exhibited a downward trend. On the other side of the coin, 67 countries exhibited a declining trend in the share for "all other currencies", presumably domestic currencies. The trends in the by-currency shares highlight the increasing presence of the USD. A significantly rising USD share was estimated for 84 countries, whereas only 9 obtained declining estimates.

The sub-period results reveal opposing trends between the 1980–2000 and 2001–2017 time periods. The first period is characterized by rising shares in the foreign currency debt, for which the USD and the JPY were the chief drivers. The second period witnessed a reduction in the foreign currency shares of many countries, together with an increase in domestic currency shares. Nonetheless, the USD stands as an exception. Even during the period between 2001 and 2017, the number of countries with increasing USD shares well exceeds that of those with declining shares.

3.3 Foreign currency portfolio

A borrower may alter its level of risk exposure by diversifying or concentrating its currency portfolio without changing the total share of foreign currency debt. Although the total foreign currency share may be suitable for theoretical analyses that assume a

[10] We regressed the foreign currency shares, on both a constant and a time trend, to check if the coefficient of the time trend was significantly positive or negative.

binary denomination choice, empirically, it is an insufficient measure because it conveys no information regarding other portfolio features. We address this problem by constructing a Herfindahl–Hirschman index to gauge the extent of portfolio concentration/diversification:

$$HI_{i,t} = \sum_{j} (FS_{i,j,t} / TFS_{i,t})^2 , \qquad (2)$$

where $FS_{i,j,t}$ and $TFS_{i,t}$ are as defined by (1). The index equals a value between 0 and 1, or $0 < HI_{i,t} \leq 1$, with a larger (smaller) value indicating a more concentrated (diversified) portfolio of country *i*'s foreign currency debt.

Because the SDR is comprised of several currencies, it is reasonable to decompose the share of SDR-denominated debt into the individual shares of SDR-composing currencies by using the International Monetary Fund's (IMF) official weights.[11] We thus add the decomposed SDR shares to the shares of the USD, euro, DM, FF, JPY, and GBP.

In the absence of concrete information on the content of the "multiple currencies", we make the assumption that the share of this category is distributed over individual currencies according to their relative shares. Specifically, using the SDR-inclusive shares and shares of CHF, we calculated the weights by which we decomposed the "multiple currencies" share into shares of the USD, euro, DM, FF, JPY, GBP, and CHF. The decomposed shares were then added to each currency's share prior to calculating $HI_{i,t}$.

Table 2 summarizes the constructed portfolio concentration index. The full sample average is 0.64. For the sub-periods, the average increases from 0.61 for 1980–2000 to

[11] Until 1980, the SDR consisted of 16 currencies with their weights changing annually. The SDR composition was fundamentally revised in 1981 to a basket consisting of the USD, DM, FF, JPY, and GBP with weights being revised every 5 years. In 1999, the euro replaced the DM and the FF, and in 2016, the Chinese renminbi became part of the basket. For 1980, we use the same weights as those used for 1981.

0.69 for 2001–2017. Thus, there is an indication of portfolio concentration during the recent period.

To shed additional light, we also fitted a linear trend to $HI_{i,t}$. A significantly negative (positive) trend indicates portfolio diversification (concentration) over time. As reported in Table 2 and depicted by Figure 3, the number of portfolio-concentrating countries exceeds, by far, the number of portfolio-diversifying countries (66 versus 18). The sub-period results reveal that the portfolio-concentrating trend was manifested primarily during the 2001–2017 period. In the preceding period, the number of portfolio-concentrating countries and that of portfolio-diversifying countries were more balanced (36 versus 27).

From Tables 1 and 2, we notice that foreign currency portfolio concentration is more commonly observed during the 2001–2017 period when a substantial number of countries reduced their total foreign currency share. On the other hand, during the 1980–2000 period when numerous countries raised their aggregate foreign currency shares, a good number of the countries actually pursued portfolio diversification of their foreign currency debt. By making a distinction between changes in the aggregate share and those in the portfolio, we highlight the effects arising from these alternative aspects of external debt denomination below.

4. Debt Revaluation and Exchange Rate Cyclicality

4.1 Debt-weighted effective exchange rates (DEER)

The extent to which a borrowing country experiences debt revaluation depends not only on its denomination portfolio but also on exchange rate changes. A relevant measure

must reflect what percentage of the debt is denominated in which currency and how variable the exchange rates are between domestic and denominating currencies.

As an index to capture the aforementioned factors, we construct the DEER index:

$$DEER_{i,t} = \prod_j \left(\frac{S_{i,j,t}}{S_{i,j,2010}} \right)^{\gamma_{i,j,t}} \quad (3)$$

where $\gamma_{i,j,t}$ is the share of currency *j* in country *i*'s total PPG debt in year *t*, and $S_{i,j,t}$ is the bilateral nominal exchange rate between *i*'s currency and currency *j*. Currency *j* in this case includes *i*'s domestic currency and all foreign currencies. The bilateral exchange rate is expressed in domestic currency units per currency *j* and indexed to its 2010 value.[12] An increase in the value of the DEER indicates a revaluation of the external debt due to changes in the denominating currency portfolio and/or the corresponding exchange rates. All exchange rate data, including the SDR data, come from the IMF's International Financial Statistics (IFS).[13]

Panel A of Table 3 presents the descriptive statistics of the average growth rates of the DEER (i.e., the average rates of the debt revaluation). When averaged across all countries over the 1980–2017 period, the debt revaluation occurred at approximately 10% annually. When divided into sub-periods, the DEER reveals a discernible difference between the pre-euro and euro periods. The average debt revaluation rate is approximately 20% for 1980–2000, whereas for 2001–2017, it is only 1.5%. This indicates that debt revaluation pressure has been substantially reduced in recent years.

The apparent decline in the debt revaluation rate is potentially driven by a few factors. For instance, the maximum and median values suggest that the large 1980-2000 average

[12] A rise in the value of the DEER indicates an effective depreciation in *i*'s currency.
[13] We used the period average exchange rate series.

is driven partly by extreme observations such as those on civil-war-torn Angola. The pre-euro sample period was also marred by massive debt crises that occurred in Latin American countries in the 1980s. On the lender side, the 2008 world financial crisis generated a persistent deflationary and low interest rate environment, which tended to constrain the debt revaluating pressure during the 2001-2017 period.[14]

4.2 The cyclicality of the DEER

We stress that the use of the DEER is crucial when empirically evaluating the extent of exchange rate cyclicality. Unless a country's debt is denominated entirely in a single foreign currency, a bilateral exchange rate is an inadequate measure for this purpose. A generally appropriate exchange rate is the effective exchange rate defined by (3), which is constructed by using the weights based on the debt denomination currency shares.

As a measure of exchange rate cyclicality by country, we calculated the correlation between the growth rate of the DEER and output:

$$XCL_i = COR(\Delta \ln DEER_{i,t}, \Delta \ln Y_{i,t}), \qquad (4)$$

where $Y_{i,t}$ is the GDP of country i in time t. GDP growth rate data are obtained from the World Bank's World Development Indicators (WDI) database.[15] A negative (positive) value of XCL_i indicates the pro-cyclicality (counter-cyclicality) of i's DEER.

Panel B of Table 3 provides the summary statistics of XCL_i in percentage terms. The average and median correlation turns out to be negative, implying a general tendency toward pro-cyclicality. However, the extent of cyclicality differs widely by country as the large standard deviations indicate. For 1980–2017, XCL_i ranges from –82% (Tajikistan)

[14] Other contributing factors include the dollarization by countries such as Ecuador and El Salvador.
[15] They measure the growth rate of GDP in constant local currency units.

to 34% (Eritrea) with a standard deviation of 27%. Sub-period statistics, particularly the ranges, also suggest that LMICs are diverse in their DEER cyclical properties. We further note that the average and median extent of pro-cyclicality rose in the second sub-period.

5. Implications of Debt Denomination for Exchange Rate Cyclicality

We are now poised to analyze the connection among debt denomination portfolio, exchange rate cyclicality, and consumption volatility. This section investigates whether a country's external debt denomination significantly determines the extent of its exchange rate cyclicality. We estimated a panel regression model for the income elasticity of the DEER:

$$\left(\frac{\Delta \ln DEER}{\Delta \ln Y}\right)_{i,t} = \sum_i \alpha_i + \phi\, TFS_{i,t} + \lambda\, HI_{i,t} + Z_{i,t}\Gamma + \varepsilon_{i,t}, \qquad (5)$$

where $TFS_{i,t}$ and $HI_{i,t}$ are the share and portfolio measures of the foreign currency debt, respectively, defined as (1) and (2) in Section 3. $Z_{i,t}$ and Γ denote the vector of the control variables and their coefficients, respectively, and α_i s are country-specific constants.

Exchange rate pro-cyclicality is the tendency that domestic currency depreciation coincides with output contraction (i.e., $\Delta \ln DEER > 0$ with $\Delta \ln Y < 0$), and/or appreciation occurs with output expansion (i.e., $\Delta \ln DEER < 0$ with $\Delta \ln Y > 0$). Therefore, a significantly negative (positive) coefficient estimate on the explanatory variables indicates a pro-cyclicality-enhancing (counter-cyclicality-enhancing) effect.

The control variables include exchange rate regime category dummies, debt stock-to-gross national income (GNI) ratios, current account balances, net foreign assets, reserves-

to-debt ratios, capital account openness, and trade openness.[16] In addition, we included a dummy variable to control for the effect of *coups d'état* because political turmoil often jolts LMICs' economic performances.[17] The variable is set equal to unity when a coup attempt, successful or not, was observed in the corresponding country and year.[18] Data limitations on the control variables resulted in an unbalanced panel of 101 countries with 2016 as the most recent year of observation.[19]

While $TFS_{i,t}$ and $HI_{i,t}$ may affect debt revaluation, the borrowing country may adjust their debt denomination currency shares and portfolios by observing the extent of debt revaluation and output growth. This reaction may occur in a concurrent fashion in the annual frequency data we use. Thus, we treated $TFS_{i,t}$ and $HI_{i,t}$ as endogenous regressors. It is possible that the control variables on external account conditions may also be endogenous to exchange rate changes and output growth. To avoid the simultaneity bias, we conducted two stage least squares estimations using lagged terms of the endogenous variables as instruments.

In Table 4, the entries in the first and second columns are the instrumental variable (IV) estimates without and with the *coups d'état* dummy, respectively. The estimates indicate that portfolio concentration exerts a highly significant negative effect. The

[16] The magnitude of exchange rate changes needs to be conditioned on the flexibility of the regimes. The remaining variables capture the external account conditions that may relate to debt revaluation and/or output growth. They are included in order to isolate the effects of key explanatory variables *TFS* and *HI*. Current account balances, net foreign assets, and trade are measured as percentages of GDP. The exchange rate regime index (Ilzetzki, Reinhart and Rogoff, 2017), available only up to 2016, is downloaded from http://www.carmenreinhart.com/data/. We use coarse classifications. Capital account openness is measured by the index of Chinn and Ito (2006) that codifies IMF's tabulation of restrictions on cross-border financial transactions. Data on the other control variables are drawn from the WDI and the IFS.

[17] For instance, see the debt devaluation rate of Angola in Table 3 in sub-section 4.1.

[18] We use "Dataset 2: Coup Attempts, 1950–Present" of Powell and Thyne (2011).

[19] Due to data constrains, the following five countries do not have effective observations in estimating Equation (5): Ethiopia, Malaysia, Panama, Papua New Guinea, and Yemen.

coefficient estimates of the foreign currency share are also negative but statistically insignificant. The estimates suggest that, holding constant the total share of foreign currency debt and the various control variables, a more concentrated portfolio of foreign currency debt enhances the pro-cyclicality of the DEER. The diagnostic *J*-statistics for the over-identifying restriction test corroborate the exogeneity of the instruments.[20]

As shown in the second column, the results are robust to incorporation of the *coups d'état* dummy. The portfolio and currency share estimates remain virtually intact, while all control variables, including the *coups d'état* dummy, exhibit statistical significance.

For comparison, we additionally reported the ordinary least squares (OLS) estimates in the remaining columns. In general, the OLS estimates are qualitatively similar. Quantitatively, the portfolio effect appears smaller in magnitude by point estimates.

6. Consumption Smoothing Under Cyclical Exchange Rate Movement

By acting as a buffer against income fluctuation, external debt may help LMICs stabilize consumption. However, if the borrower's effective exchange rate behaves in a manner such that the burden of repayment obligation becomes heavier when income stagnates, external debt may also exert a hindering effect on consumption smoothing.

To extract the transitory components of income growth, we regress $\Delta \ln Y_{i,t}$ on a constant and a time trend. The resulting residuals, denoted by $\Delta \tilde{y}_{i,t}$, capture the deviations from the growth trend, which we used as our measure of income shock. We use the fitted component, denoted by $\Delta \hat{y}_{i,t}$, as predicted income growth.

[20] The coefficients are over-identified in the first specification and just identified in the second specification.

Households may not necessarily react to positive and negative income shocks in a symmetrical fashion. For instance, without well-functioning credit and insurance markets, they may find it more difficult to keep consumption unaffected by a surprise income loss than by an unexpected income gain.

Our benchmark specification allows for the asymmetry in the consumption response to positive and negative shocks:

$$\Delta c_{i,t} = \sum_i \alpha_i + \varphi \Delta \hat{y}_{i,t} + \beta_P \Delta \tilde{y}^P_{i,t} + \beta_N \Delta \tilde{y}^N_{i,t} + W_{i,t}\Phi + \varepsilon_{i,t} \quad (6)$$

where $\Delta c_{i,t}$ is the households' final consumption expenditure growth rate, $\Delta \hat{y}_{i,t}$ is the predicted income growth, and $\Delta \tilde{y}^P_{i,t}$ and $\Delta \tilde{y}^N_{i,t}$ are positive and negative income shocks, respectively. $W_{i,t}$ consists of the control variables, including the exchange rate regime dummies, current account balances, debt stock to GNI, capital account openness, trade openness, and *coups d'état* dummy. When consumption is perfectly smoothed, it does not respond to transitory income shocks such that $\beta_P = \beta_N = 0$. Imperfect smoothing should result in $0 < \beta_P, \beta_N$ with a possibility of $\beta_P \neq \beta_N$ as asymmetrical responses.

The specification of our chief interest elaborates on (6) in order to allow additional asymmetry by exchange rate cyclicality:

$$\Delta c_{i,t} = \sum_i \alpha_i + \varphi \Delta \hat{y}_{i,t} + (\rho_A A_{i,t} + \rho_D D_{i,t}) \Delta \tilde{y}^P_{i,t} + (\eta_A A_{i,t} + \eta_D D_{i,t}) \Delta \tilde{y}^N_{i,t} + W_{i,t}\Phi + \varepsilon_{i,t} \quad (7)$$

where $A_{i,t}$ and $D_{i,t}$ are dummy variables that are set equal to unity if *i*'s DEER appreciates and depreciates, respectively. This specification allows not only asymmetric reactions to positive and negative shocks but also varying responses, depending on whether the income shocks coincide with the DEER appreciation or depreciation.

Pro-cyclical exchange rate movement refers to the tendency that positive income shocks coincide with appreciation and/or negative income shocks occur with depreciation. Thus, ρ_A and η_D are the relevant coefficients. Counter-cyclical exchange rate movement refers to cases where the DEER depreciation (appreciation) coincides with positive (negative) income shocks. The relevant coefficients in this case are ρ_D and η_A.

Because of endogeneity between consumption and income, we estimate Equations (6) and (7) by the IV regression. The borrower's income growth is instrumented by its growth in exports, government consumption expenditures, gross capital formation, and gross fixed capital formation.[21] They comprise income growth that is not directly attributed to households' final consumption growth. We also instrumented the debt stock-to-GNI ratio, current account balance, capital account openness, and trade openness by their lagged terms. Data requirements become more stringent as we adopt more instruments. Consequently, the effective number of countries in the panel declines to 87.[22]

Table 5 presents the IV estimates. As a starting point, column 1 presents the preliminary estimates when we impose $\beta_P = \beta_N$ on (6), so that no asymmetry is allowed. The coefficient estimate of this restricted model suggests that approximately 43% of income shocks are not smoothed to result in consumption fluctuations. If taken at face value, more than one-half of income shocks are smoothed.

In column 2 we present the estimates of (6). The coefficient estimate for positive income shocks is approximately 47% and statistically significant. The corresponding

[21] We use the interaction (i.e., product) terms of the growth deviation components and the dummies that differentiate positive and negative income shocks under pro- and counter-cyclicality.

[22] The following countries were further dropped due to data constraints: Angola, Central African Republic, China, Dominica, Fiji, Gambia, Grenada, Guyana, St. Lucia, Maldives, Solomon Islands, Tonga, Vanuatu, and Samoa. Ethiopia, dropped in the previous section, is in the sample. The regressions are run on an unbalanced panel of 87 countries.

estimate for negative income shocks is 38%, but it is not significant. The reason for this insignificance becomes clear when we estimate less restrictive specifications below.

Column 3 presents estimates of (7) that are further differentiated between shocks under pro-cyclicality and counter-cyclicality. Once differentiating income shocks also by the direction of concurrent exchange rate movement, we find that consumption responses differ significantly by underlying exchange rate cyclicality. More specifically, consumption responds significantly to positive shocks that concur with the DEER appreciation and negative shocks that coincide with the DEER depreciation.

In other words, consumption becomes significantly more volatile under exchange rate pro-cyclicality. In the case of positive income shocks with appreciation, the consumption response is approximately 47%. When a surprise dent in income growth concurs with depreciation, consumption shrinks by 65% of the income shrinkage.

Meanwhile, under exchange rate counter-cyclicality, the consumption response to income shocks are muted. The coefficient estimates are insignificant for both positive and negative income shocks that are accompanied by counter-cyclical exchange rate fluctuations. Thus, cyclicality of the DEER has crucial ramifications. The insignificant estimate on negative income shocks in column 2 is a result of imposing a homogeneity coefficient restriction on shocks under exchange rate pro- and counter-cyclicality.

For robustness, we elaborated the specification further by controlling for world output growth and presented the estimates in Column 4. This specification is motivated by the predication of general equilibrium models of international fluctuations (Backus, Kehoe, and Kydland, 1992).[23] The effect of world output growth turns out insignificant, which

[23] They suggest that a country's consumption will be perfectly correlated with world output when asset markets are complete, whereas it will be perfectly correlated with domestic output in the absence of any asset trade. See Pakko (1998) for empirical evidence on selected OECD countries.

is consistent with the view that LMICs are not well equipped with asset markets. Importantly, the consumption response coefficient estimates are essentially unaffected.

In Column 5, we present the estimates of a parsimonious specification that drop insignificant control variables. The estimates are reasonable in that the consumption response to the predicted income growth is also significant but smaller in magnitude than it is to negative income shocks. Again, the consumption responses to income shocks are significant only for the cases with pro-cyclical exchange rate movement.

7. Extended Discussion and Conclusions

To shed additional light, Table 6 highlights the features of highly-concentrated portfolio cases by focusing on the 2001–2017 period during which portfolio concentration prevailed.[24] Panel A presents the by-currency denomination shares. For the general sample, the USD share is approximately 64 %. When the sample is limited to observations for which the portfolio concentration index is within the highest quantile, the USD share rises steeply to 84%. Thus, portfolio concentration generally means concentration on the USD. The "debt dollarization" is found consistently across all exchange rate regime sub-groups in the remaining columns.

Portfolio diversification may make little difference in terms of debt revaluation if LMICs' bilateral USD exchange rates co-move closely with bilateral rates *vis-à-vis* other currencies. Panel B presents the correlations between LMICs' bilateral USD rate changes and those for other currencies. As a general observation, bilateral exchange rates exhibit strong positive correlations. However, the correlation weakens with the observations with concentrated portfolios. The decline in the correlation is discernible particularly for the

[24] The entries of the table are based on the initial sample of 106 countries.

float regime. Overall, it is conceivable that portfolio diversification can make a modest contribution in terms of limiting the extent of debt revaluation.[25]

Panel C of Table 6 displays the correlations between income growth deviations and bilateral exchange rate changes. For the full sample, the USD has a negative correlation (i.e., pro-cyclicality) with the largest (absolute) coefficient. The coefficient size increases when we focus on the observations with highly concentrated portfolios. In general, the borrowers' exchange rates against other currencies are not as pro-cyclical as the USD rates. The observation, jointly with the results in Sections 5 and 6, implies room for ameliorating the consumption volatility effect by portfolio diversification.

All in all, the observations above imply a hidden cost to immoderate reliance on USD debt. Nevertheless, if the seemingly excessive USD debt results from financial market underdevelopment (Caballero and Krishnamurthy, 2003), it would be difficult to pursue a solution by converting into domestic currency debt. Portfolio diversification among international currencies is, arguably, a more feasible option that helps borrowers keep their consumption path less volatile.

In this study, we have examined currency compositional trends in the external debt of LMICs over the last four decades. The data reveal that not all debtors with original sin are alike in their borrowing behavior. The differences provide useful information to help us understand the implications of the external debt denomination.

Although it is not common in the literature to analyze issues of foreign currency debt from the perspective of multicurrency portfolios, empirically, the portfolio perspectives are found to be quite important. More specifically, we find that the cyclical property of LMICs' currency values is significantly associated with denominating foreign currency

[25] Recall that the extent debt revaluation is already low for this period as confirmed by Table 3.

portfolios, rather than the mere foreign currency share. A more concentrated foreign currency portfolio is associated with a more pro-cyclical movement in the borrower's effective exchange rate. We further find empirical evidence that exchange rate pro-cyclicality hinders consumption smoothing in responding to income shocks.

Altogether, our results suggest that the ramifications of external debt denomination are not limited solely to debt revaluation. They encompass the cyclical properties of borrowers' exchange rates and consumption volatility. An important policy implication to draw from our findings is that, even though original sin continues to prevail, there is room for borrowers to attenuate the negative consequences it may bring about. Diversifying portfolios will help some borrowers keep their consumption less volatile by attenuating the extent of debt revaluation and exchange rate pro-cyclicality.

Of course, the overall welfare of borrowers also depends on the specific debt structures defined by the maturity and interest rates. In the absence of detailed data on those values, we point only to the potential role that denomination currency portfolios may play in providing room for hedging against adverse ramifications.

For the foreseeable future, foreign-currency-denominated debt is likely to continue to be an important instrument for many LMICs. Unfortunately, it is also likely to remain as a potential source of financial havoc, such as a debt crisis. This concern is of increasing relevance as the ongoing worldwide low interest rate environment and the global waves of debt (Kose, Nagle, Ohnsorge and Sugawara, 2019) continue to persist.

In this regard, our findings contribute to the literature by shedding light on the covert cost of foreign currency debt and suggesting room where indebted countries can reconsider their borrowing practices to hedge against inauspicious developments in the future.

Data appendix

Sources

Currency composition of external debt: World Bank's *International Debt Statistics*.
Exchange rate regime indicators: Ilzetzki, Reinhart and Rogoff (2017).
Index of capital account openness: Chinn and Ito (2006).[a]
Incidents of *coups d'état*: Powell and Thyne (2011).[b]
Other macroeconomic and external account variables: World Bank's *World Development Indicators,* and International Monetary Fund's *International Financial Statistics*.

Notes: [a] The index is based on the binary dummy variables that codify the tabulation of restrictions on cross-border financial transactions reported in IMF's Annual Report on Exchange Arrangements and Exchange Restrictions. It is the first principal component of the original variables pertaining to regulatory controls over current or capital account transactions, the existence of multiple exchange rates, and the requirements of surrendering export proceeds.
[b] Coups are defined as illegal and overt attempts by the military or other elites within the state apparatus to unseat the sitting executive. Our dummy variable is set equal to unity for both successful and unsuccessful attempts because they indicate political instability.

Frequency

Annual for all series.

Sample periods

The primary sample period is 1980–2017. The pre-euro and euro sub-periods are 1980–2000 and 2001–2017, respectively. Depending on data availability, some countries have shorter samples.
Euro: exchange rate 1999–2017; currency composition 2001–2017.
Deutsche mark and French franc: exchange rate 1973–1998; currency composition 1973–2000. The exchange rates for 1999 and 2000 are set to 1 euro = 1.95583 DM and 1 euro = 6.55957 FF.
Synthetic Euro: 1980–2017, of which the 1980–2000 period is calculated by the weighted sum of DM- and FF-denominated debt.

Sample countries

Our sample consists of low-income, lower middle-income, and upper middle-income

countries listed in the WDI for which data on external debt currency composition, exchange rate, GDP growth rate are available for both pre-euro and euro periods. The primary sample consists of 106 countries (24 LICs and 82 MICs) listed below. For the analyses in Sections 5 and 6, the effective number of countries in the sample is reduced because of limited data availability of the variables required for the estimations. More specifically, the effective number of countries is 101 and 87 for Tables 4 and 5, respectively. See footnotes 18 and 21 in the main text.

Income stratification

Low-income countries (24 countries): Burundi, Benin, Burkina Faso, Central African Republic, Dem. Rep. Congo, Comoros, Eritrea, Ethiopia, Guinea, Gambia, Guinea-Bissau, Haiti, Madagascar, Mozambique, Malawi, Niger, Nepal, Rwanda, Senegal, Sierra Leone, Chad, Togo, Tanzania, Uganda.

Lower middle-income countries (42 countries): Angola, Armenia, Bangladesh, Bolivia, Bhutan, Cote d'Ivoire, Cameroon, Rep. Congo, Cabo Verde, Egypt, Georgia, Ghana, Guatemala, Honduras, Indonesia, India, Jordan, Kenya, Kyrgyz Republic, Cambodia, Lao, Sri Lanka, Lesotho, Morocco, Moldova, Mongolia, Mauritania, Nigeria, Nicaragua, Pakistan, Philippines, Papua New Guinea, Sudan, Solomon Islands, El Salvador, Tajikistan, Ukraine, Vietnam, Vanuatu, Samoa, Yemen, Zambia.

Upper middle-income countries (40 countries): Albania, Azerbaijan, Bulgaria, Belarus, Belize, Brazil, Botswana, China, Colombia, Costa Rica, Dominica, Dominican Republic, Algeria, Ecuador, Fiji, Gabon, Grenada, Guyana, Iran, Jamaica, Kazakhstan, Lebanon, St. Lucia, Maldives, Mexico, Mauritius, Malaysia, Panama, Peru, Paraguay, Romania, Russia, Serbia, Thailand, Tonga, Turkey, St. Vincent and the Grenadines, Venezuela, Samoa, South Africa.

Figure appendix

Figure 1.

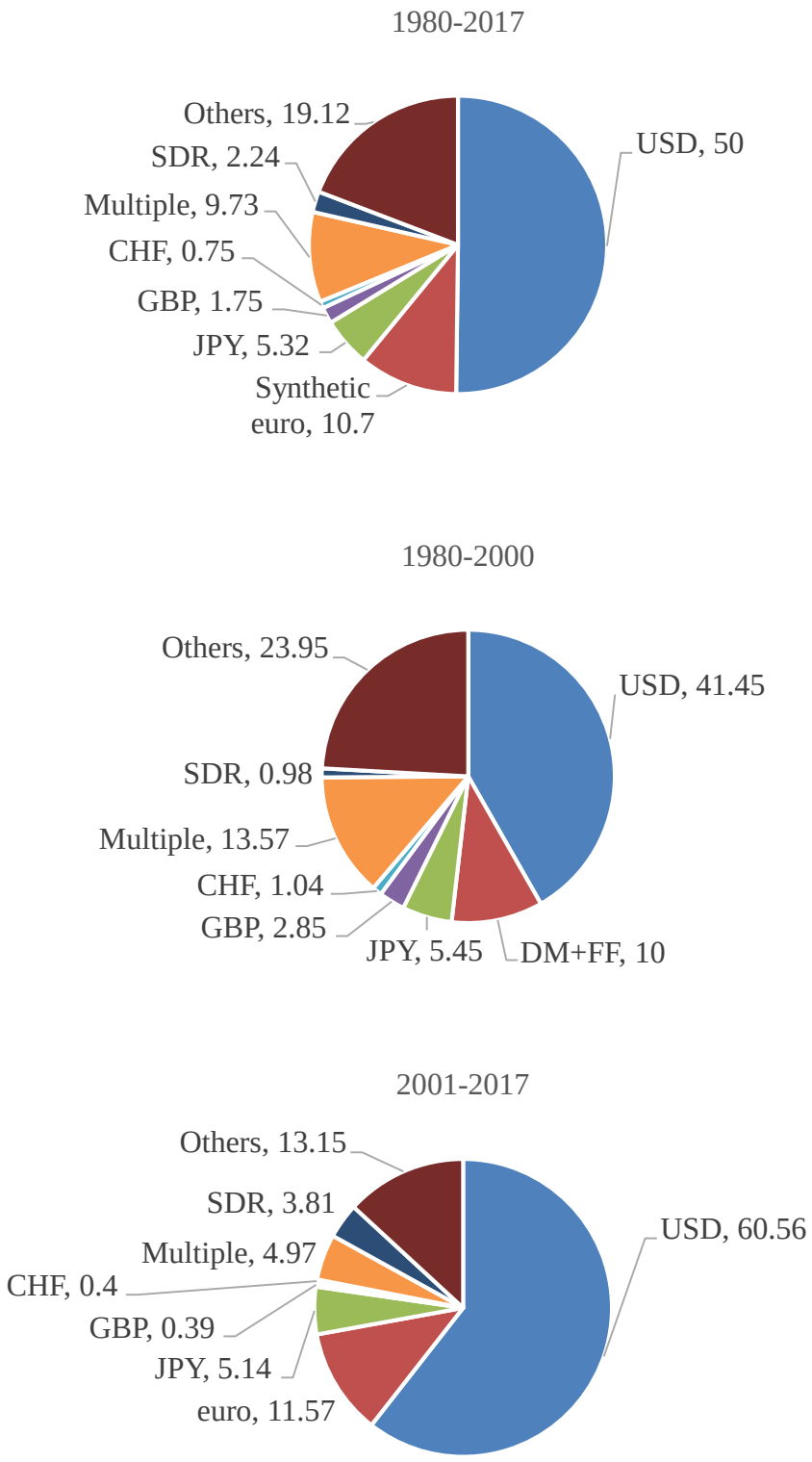
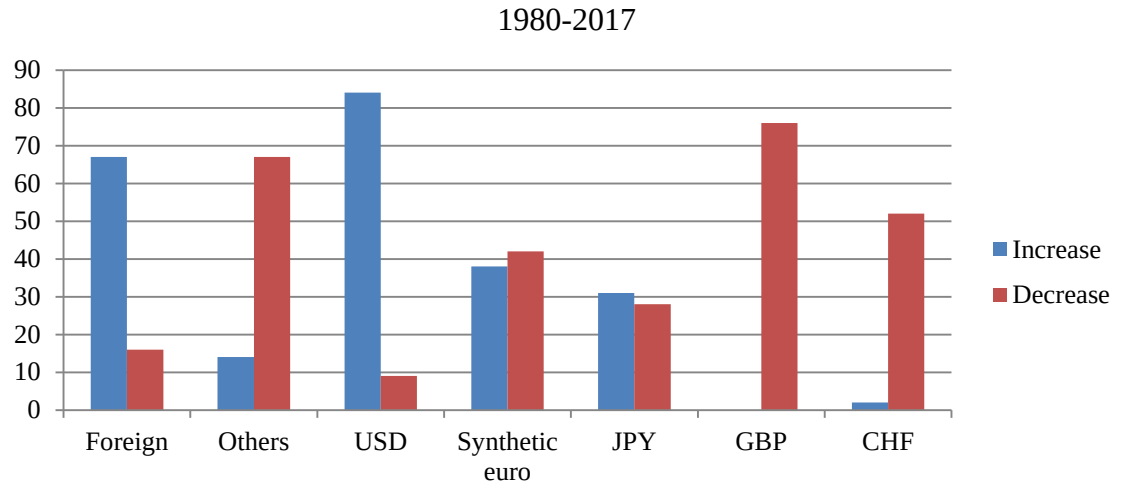
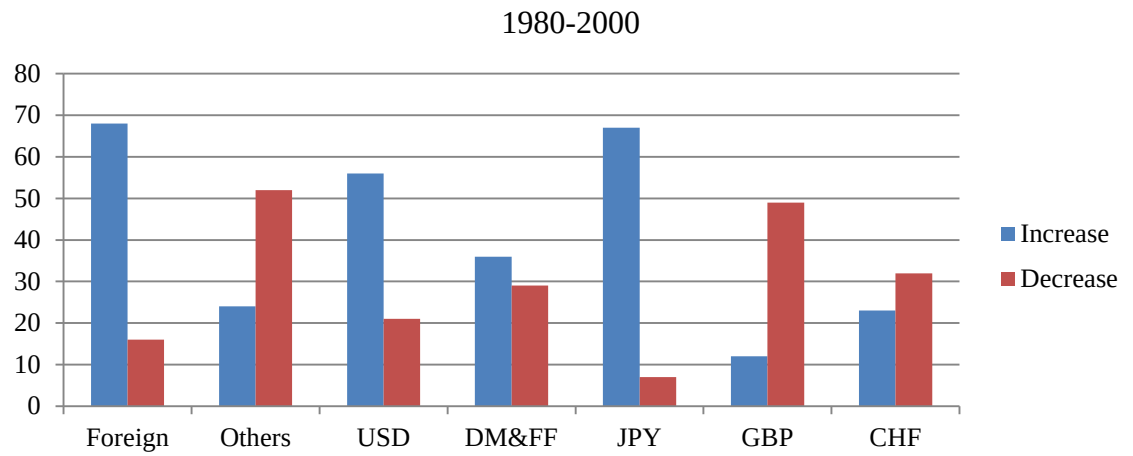


Figure 2. The numbers of countries with increasing/decreasing trends in the currency shares





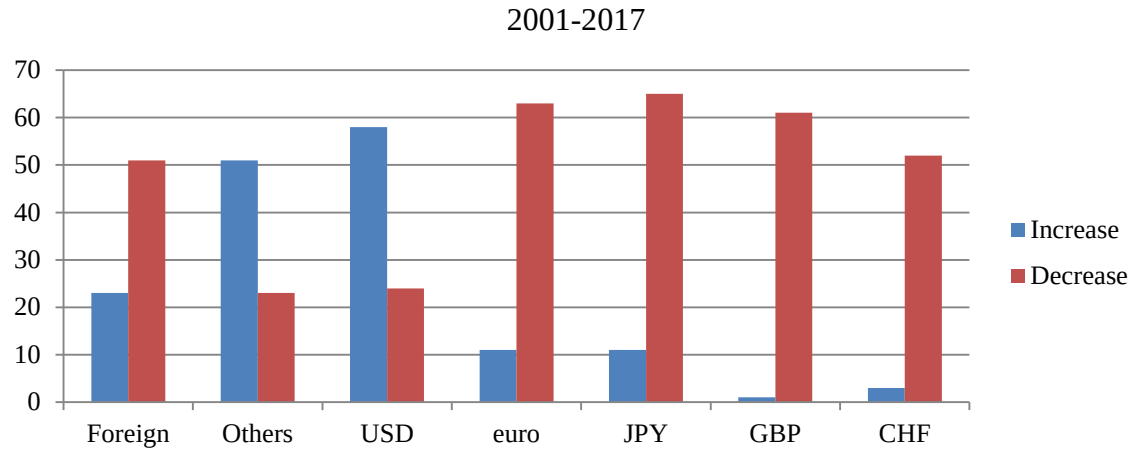
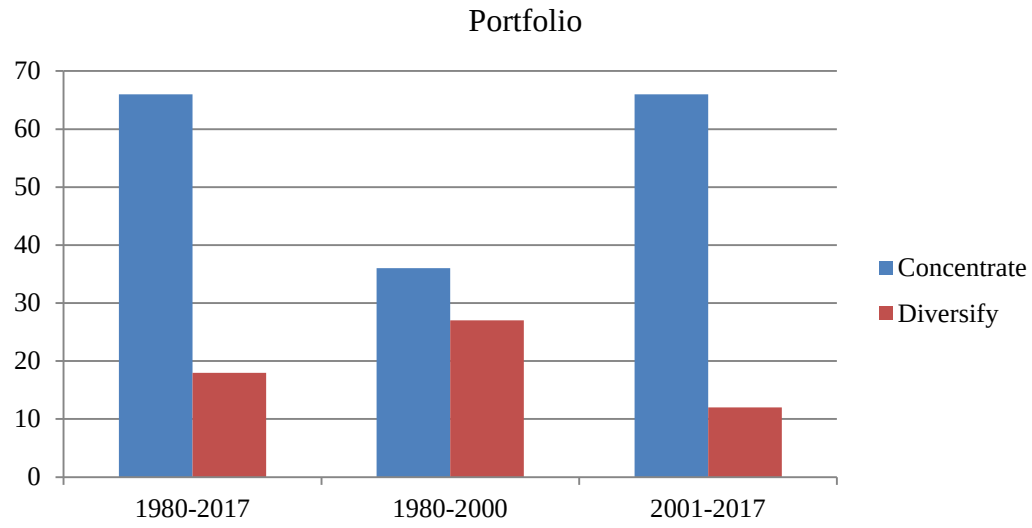


Figure 3. The numbers of countries with concentrating/diversifying trends in portfolios



References

Backus, David K., Patrick J. Kehoe, and Finn E. Kydland. 1992. International real business cycles. *Journal of Political Economy*, 100, 745-775.

Bleaney, Michael and F. Gulcin Ozkan. 2011. The structure of public debt and the choice of exchange rate regime. *Canadian Journal of Economics*, 44, 325-339.

Borensztein, Eduardo and Ugo Panizza. 2010. Do sovereign defaults hurt exporters? *Open Economies Review*, 21, 393-412.

Caballero, Ricardo and Arvind Krishnamurthy. 2003. Excessive dollar debt: Financial development and underinsurance. *Journal of Finance*, 58 (2), 867-893.

Chinn, Menzie D. and Hiro Ito. 2006. What Matters for Financial Development? Capital Controls, Institutions, and Interactions. *Journal of Development Economics*, 81(1), 163-192.

Claessens, Stijn. 1992. The optimal currency composition of external debt: Theory and applications to Mexico and Brazil. *World Bank Economic Review*, 6 (3), 503-528.

Dodd, Randall and Shari Spiegel. 2005. Up from sin: A portfolio approach to financial salvation. *G-24 Discussion Paper Series*, n.34, United Nations.

Eichengreen, Barry, Ricardo Hausmann, and Ugo Panizza. 2005. The pain of original sin, in B. Eichengreen and R. Husmann (eds.), *Other People's Money: Debt Denomination and Financial Instability in Emerging Economies*, University of Chicago Press, Chicago and London.

Eichengreen, Barry, Ricardo Hausmann, and Ugo Panizza. 2007. Currency mismatches, debt intolerance, and the original sin: why they are not the same and why it matters, in S. Edwards (ed.), *Capital Controls and Capital Flows in Emerging Economies: Policies, Practices and Consequences*, NBER, University of Chicago Press, Chicago.

Fujii, Eiji. 2017. External debt and international trade: Another mismatch, in Y.-W. Cheung and F. Westermann (eds.), *International Currency Exposure*, MIT Press,

Cambridge, MA.

Gumus, Inci. 2013. Debt denomination and default risk in emerging markets. *Macroeconomic Dynamics*, 171 1070-1095.

Hausmann, Ricardo and Ugo Panizza. 2003. On the determinants of original sin: An empirical investigation. *Journal of International Money and Finance,* 22, 957-990.

Ilzetzki, Ethan, Carmen M. Reinhart, Kenneth S. Rogoff. 2017. Exchange Arrangements Entering the 21st Century: Which Anchor Will Hold? *NBER Working Paper* No. 23134.

Korinek, Anton. 2011. Foreign currency debt, risk premia and macroeconomic volatility. *European Economic Review*, 55, 371-385.

Kose, M. Ayhan, Peter Nagle, Franziska Ohnsorge and Naotaka Sugawara. 2019. *Global waves of debt: Causes and consequences*. The World Bank Group.

Kourtellos, Andros, Thanasis Stengos, and Chih Ming Tan. 2013. The effect of public debt on growth in multiple regimes. *Journal of Macroeconomics*, 38, 35-43.

Levi-Yeyati, Eduardo and Ugo Panizza. 2011. The elusive costs of sovereign defaults. *Journal of Development Economics*, 94, 95-105.

Pakko, Michael R. 1998. Characterizing cross-country consumption correlations. *Review of Economics and Statistics*, 80, 169-174.

Panizza, Ugo and Andrea F. Presbitero. 2014. Public debt and economic growth: Is there a causal effect? *Journal of Macroeconomics*, 41, 21-41.

Powell, Jonathan M. and Clayton L. Thyne. 2011. Global instances of coups from 1950 to 2010: A new dataset. *Journal of Peace Research*, 48, 249-259.

Ranciere, Romain, Aaron Tornell, and Athanasios Vamvakidis. 2010. Currency Mismatch, Systemic Risk and Growth in Emerging Europe. *Economic Policy*, 25, 597-658.

Reinhart, Carmen M. and Kenneth S. Rogoff. 2010. Growth in a time of debt. *American Economic Review*, 100, 573-578.

Reinhart, Carmen M. and Kenneth S. Rogoff. 2011. From financial crash to debt crisis. *American Economic Review*, 101, 1676-1706.

Table 1. Descriptive statistics of external debt denomination

	1980–2017	1980–2000	2001–2017
A. PPG debt share (%)			
PPG/Total debt stock	72.69	78.87	66.66
PPG/Total debt service	68.40	72.18	65.46
B. By-currency share (%)			
Foreign currencies aggregate	80.49	75.34	86.84
US dollar	50.00	41.45	60.56
Euro	-	-	11.57
German mark	-	3.86	-
French franc	-	6.14	-
Synthetic euro	10.70	10.00	11.57
Japanese yen	5.32	5.45	5.14
British pound	1.75	2.85	0.39
Swiss franc	0.75	1.04	0.40
Multiple currencies	9.73	13.57	4.97
SDR	2.24	0.98	3.81
Other currencies	19.12	23.95	13.15
C. Trends in the shares			
Foreign currencies aggregate	+67, −16	+68, −16	+23, −51
US dollar	+84, −9	+56, −21	+58, −24
Synthetic euro	+38, −42	+36, −29	+11, −63
Japanese yen	+31, −28	+67, −7	+11, −65
British pound	+0, −76	+12, −49	+1, −61
Swiss franc	+2, −52	+23, −32	+3, −52
Other currencies	+14, −67	+24, −52	+51, −23

Notes: The entries in Panels A and B are in percentage terms. In Panel C, the entries with "+" and "–" indicate the number of countries that exhibited an increasing trend and a decreasing trend, respectively, in the corresponding currency share. Synthetic euro is constructed by connecting the summed shares of German mark and French franc for 1980–2000 and the share of euro for 2001–2017. "Foreign currencies aggregate" denotes the aggregated share of US dollar, synthetic euro, Japanese yen, British pound, Swiss franc, SDR, and multiple currencies. The sample consists of 106 low- and middle-income countries listed in Data appendix with an exception that Malaysia and Panama are not included in Panel A because their data on total debt were not available.

Table 2. The index of portfolio concentration/diversification

	1980-2017	1980-2000	2001-2017
Mean	0.64	0.61	0.69
Standard deviation	0.14	0.17	0.15
Portfolio-concentrating countries	66	36	66
Portfolio-diversifying countries	18	27	12

Notes: The means and the standard deviations of the Herfindahl–Hirschman index of portfolio concentration are reported in the top two rows. The index is calculated for the foreign currency portfolio of external PPG debt by (2) in the main text. The entries in the remaining rows indicate the number of countries that exhibited a significantly concentrating/diversifying trend in their debt-denominating currency portfolios during the corresponding sample periods.

Table 3. Debt revaluation and exchange rate cyclicality (%)

	Mean	S. deviaton	Minimum	Median	Maximum
A. Debt revaluation					
1980–2017	9.80	13.62	−8.18 (Ecuador)	5.25	70.26 (Angola)
1980–2000	19.93	27.56	−14.97 (Ecuador)	10.00	155.90 (Angola)
2001–2017	1.53	4.89	−12.83 (El Salvador)	1.03	15.35 (Dem. Rep. Congo)
B. Exchange rate cyclicality					
1980–2017	−15.86	27.38	−82.47 (Tajikistan)	−14.26	34.12 (Eritrea)
1980–2000	−12.24	32.77	−88.91 (Azerbaijan)	−5.48	50.67 (Eritrea)
2001–2017	−15.76	32.11	−85.79 (Dem. Rep. Congo)	−15.50	65.96 (Togo)

Notes: In Panel A, the descriptive statistics are reported for the average changes in the debt-weighted effective exchange rates (DEERs). In Panel B, the entries are for the correlation between growth rate of the DEERs and output as defined by (4) in the main text. The numerical entries are in percentage terms in both panels.

Table 4. Exchange rate cyclicality

	1) IV	2) IV	3) OLS	4) OLS
Portfolio concentration	−1.219**	−1.244**	−.797**	−.807**
	(.211)	(.212)	(.177)	(.177)
Foreign currency share	−.176	−.157	−.306	−.306
	(.272)	(.273)	(.231)	(.231)
Debt stock to GNI	.273**	.256*	.455**	.452**
	(.104)	(.104)	(.060)	(.060)
Current account	−2.129**	−2.150**	−1.581**	−1.586**
	(.561)	(.563)	(.350)	(.350)
Net foreign asset	4.599**	4.595**	3.481**	3.480**
	(.188)	(.189)	(.085)	(.085)
Reserves	−2.246	−2.402*	.240	.219
	(1.179)	(1.186)	(.365)	(.365)
Trade openness	−.696**	−.712**	−.567**	−.581**
	(.187)	(.188)	(.147)	(.147)
Capital acct. openness	−19.110*	−19.885*	−2.938**	−2.967**
	(8.422)	(8.463)	(1.100)	(1.100)
Coups d'état dummy	-	−25.356*	-	−19.234
		(12.105)		(12.346)
Over-identifying restriction	.631	0	-	-
Adjusted-R^2	-	-	.455	.455
N	2747	2747	2810	2810

Notes: The estimates of Equation (5) in the main text are reported. In all estimates, country-specific constants and exchange rate regime dummies are allowed. "**" and "*" indicate statistical significance at 1% and 5% levels, respectively. The *J*-statistic is reported for over-identifying restrictions for the instrumental variable estimations.

Table 5. Consumption responses to income shocks

	1	2	3	4	5
Predicted income growth	.282	.290	.231	.221	.351*
	(.177)	(.180)	(.180)	(.180)	(.172)
Income shocks	.427**	-	-	-	-
	(.085)				
Positive income shocks (β_P)	-	.473*	-	-	-
		(.191)			
Negative income shocks (β_N)	-	.377	-	-	-
		(.203)			
Positive income shocks with appreciation (ρ_A)	-	-	.472*	.454*	.481**
			(.193)	(.192)	(.185)
Positive income shocks with depreciation (ρ_D)	-	-	.401	.381	.401
			(.232)	(.231)	(.224)
Negative income shocks with appreciation (η_A)	-	-	－.670	－.739	－.142
			(.520)	(.513)	(.519)
Negative income shocks with depreciation (η_D)	-	-	.650**	.643**	.724**
			(.234)	(.244)	(.222)
Deb stock to GNI	－.001	－.001	－.001	－.001	-
	(.004)	(.004)	(.004)	(.004)	
Current account balance	.033	.033	.035	.032	-
	(.042)	(.042)	(.041)	(.041)	
Capital account openness	－1.768**	－1.790**	－1.519**	－1.493**	－1.398**
	(.435)	(.445)	(.453)	(.452)	(.424)
Trade openness	.025	.025	.028	.030	-
	(.016)	(.016)	(.016)	(.016)	
Coups d'état dummy	－2.397*	－2.454*	－2.235*	－2.232*	－2.074*
	(1.006)	(1.032)	(1.008)	(1.010)	(.971)
World income growth	-	-	-	.154	-
				(.148)	
Over-identifying restrict.	.935	.950	.929	.949	1.230
N	2059	2059	2059	2059	2078

Notes: The instrumental variable estimates of Equations (6) and (7) in the main text are reported. In all estimates, country-specific constants and exchange rate regime dummies are allowed. "**" and "*" indicate statistical significance at 1% and 5% levels, respectively.

Table 6. Features of highly concentrated portfolio cases

A. Denomination shares by currency

	All	Highly concentrated portfolio cases			
		All regimes	Peg	Middle	Float
USD	64.41	84.26	84.76	83.17	90.95
EUR	12.16	2.21	2.22	2.01	4.29
JPY	5.62	.97	.64	1.25	.75
GBP	.43	.08	.10	.06	.20
CHF	.44	.01	.003	.02	.01

B. Correlations between the USD bilateral exchange rates and other bilateral rates

	All	Highly concentrated portfolio cases			
		All regimes	Peg	Middle	Float
EUR	.82	.74	.71	.75	.69
JPY	.79	.70	.68	.71	.67
GBP	.85	.79	.79	.79	.66
CHF	.89	.84	.81	.86	.81

C. Correlations between the income growth deviations and the bilateral exchange rates

	All	Highly concentrated portfolio cases			
		All regimes	Peg	Middle	Float
USD	−.17	−.26	−.22	−.35	−.12
EUR	−.04	−.05	−.03	−.13	.24
JPY	−.13	−.17	−.11	−.23	−.21
GBP	−.01	−.02	.02	−.09	.19
CHF	−.09	−.10	−.05	−.20	.00

Notes: All figures are for the 2001–2017 period. The highly concentrated portfolio cases consist of the observations for which the Herfindahl index of the denomination portfolio is within the highest quantile. Exchange rates are measured in growth rate terms. The "Middle" category refers to crawling peg and crawling band regimes. The entries in the first column of Panel A denote the adjusted shares after distributing the shares of SDR and multiple currency debt in the original data. Thus, these figures differ from the by-currency shares reported in Table 1. In Panel B, the correlations are between LMCs' bilateral USD exchange rates and bilateral rates *vis-à-vis* other currencies. In Panel C, the correlations are between deviations from income growth trends and bilateral exchange rate changes.