DEBT BUILDUP AND CURRENCY VULNERABILITY

EVIDENCE FROM GLOBAL MARKETS

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ABSTRACT

In this study, we examine how public and private debt buildup is related to currency depreciation pressure. Our empirical analysis of a panel dataset of 59 advanced and emerging markets reveals that both private and public debt exacerbate currency vulnerability. However, the evidence of a significant effect on currency depreciation pressure is more robust and consistent for private debt than public debt. Furthermore, we find that excessive private debt buildup can be particularly harmful in emerging markets. In addition, our evidence suggests that greater dependence on external financing exacerbates the impact of debt buildup on currency stress. Overall, the evidence highlights the importance of a comprehensive debt surveillance framework which monitors both public and private debt buildup, especially in emerging markets.

Keywords: currency stress, exchange rate, financial vulnerability, private debt, public debt

JEL codes: E44, E50, F31, G15

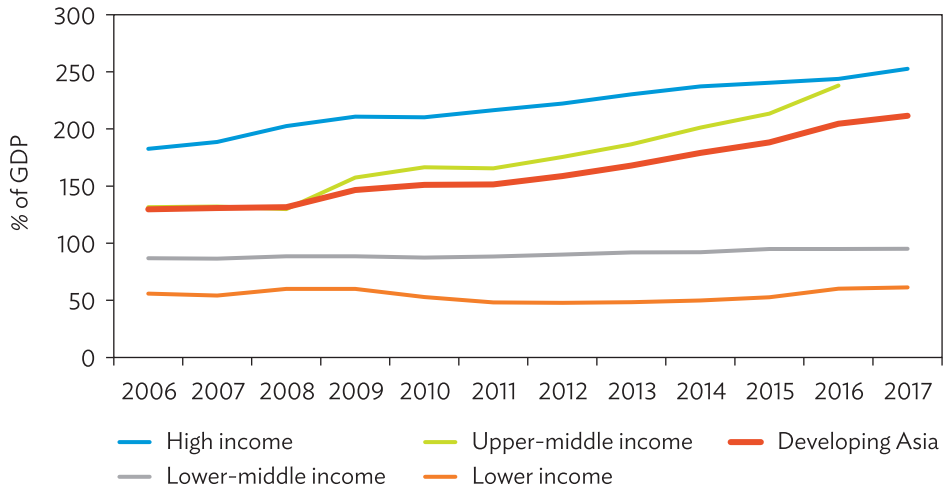
I. THE DEBT BUILDUP IN EMERGING MARKETS IN THE AFTERMATH OF THE GLOBAL FINANCIAL CRISIS

Debt has risen substantially in developing Asia since the global financial crisis (GFC). While both private and public debt contributed to the debt buildup, private debt has grown more rapidly. Although an increase in debt can be a healthy sign of financial development and deepening of financial markets, it can raise concerns about the health and stability of the financial system if it is too much or too quick. Existing research shows that rapid debt buildups can harm the real economy (Mian, Sufi, and Vernier 2017) and exacerbate recessions (Jordà, Schularick, and Taylor 2013; Sutherland and Hoeller 2012).

Here, we present recent empirical analysis that sheds some light on the association between debt buildup and exchange rate vulnerability in emerging markets. This is one of the most important aspects in the nexus between debt and economic outcome because a debt crisis often causes a currency crisis in emerging markets. As the debt level builds up, investors become more sensitive to vulnerabilities arising from weak fundamentals and pull their money out of the country, weakening the currency. Yet this mechanism has been underinvestigated empirically in the existing literature and we believe our paper makes a significant contribution in this connection. This question becomes particularly relevant during the coronavirus disease (COVID-19) outbreak, which weakens economic fundamentals and triggers more borrowing to mitigate the economic impact of pandemic.

Total debt, the sum of public and private debt, took off in developing Asia after 2008, as the low interest rate environment following the GFC significantly reduced borrowing costs for both public and private sectors (Figure 1). The region's weighted average of total debt to gross domestic product

Figure 1: Debt-to-Gross Domestic Product Ratio in Developing Asia



GDP = gross domestic product, GNI = gross national income, US = United States.

Notes: Aggregates (income classifications) are weighted averages computed using the World Bank's GNI, Atlas method (current US dollars) as weight. Economies income classification is based on the World Bank's country income classifications by income level: 2017–2018.

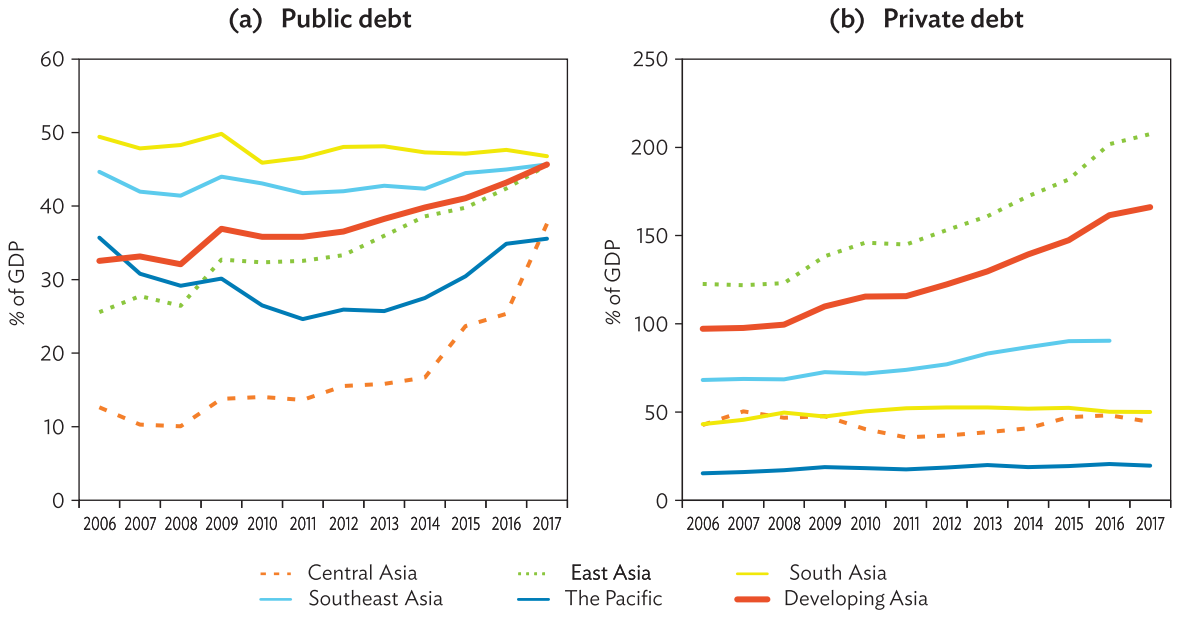
Source: Computed from the International Monetary Fund, Global Debt Database. https://www.imf.org/external/datamapper/datasets/GDD (accessed 16 April 2019).

(GDP) ratio rose from 131.5% in 2008 to 211.7% in 2017. According to the Institute of International Finance (2020), debt in emerging Asia has increased to 280% GDP in the first quarter (Q1) 2020 compared to 260% in Q1 2019.

Both public debt and private debt contributed to the growth of total debt in developing Asia, but with varying patterns across subregions. As a result of the countercyclical fiscal stimulus implemented during the GFC, the weighted average public debt-to-GDP ratio of developing Asia increased by around two-fifths from 2008 to 2017. While public debt remained relatively stable in South Asia and Southeast Asia at around 45% of subregional GDP, it increased by almost three-fourths in East Asia and more than tripled in Central Asia, albeit from low levels (Figure 2a). Much of the increase in Central Asia's public debt occurred from 2015 onward, as economies in the subregion increased public spending and investment in part to offset the downturn in commodity prices.

Developing Asia's private debt expanded at a faster pace than public debt, growing by around two-thirds during the past decade. The private debt buildup has been most pronounced in East Asia, where debt has risen from 123% of GDP in 2008 to 207% of GDP in 2017, driven mainly by the People's Republic of China (PRC). There has also been a more moderate expansion in Southeast Asia, from 68% of GDP to 90% of GDP over the same period. In other subregions, private debt level remained relatively stable (Figure 2b).

Figure 2: Public and Private Debt across Subregions in Developing Asia



GDP = gross domestic product, GNI = gross national income, US = United States.

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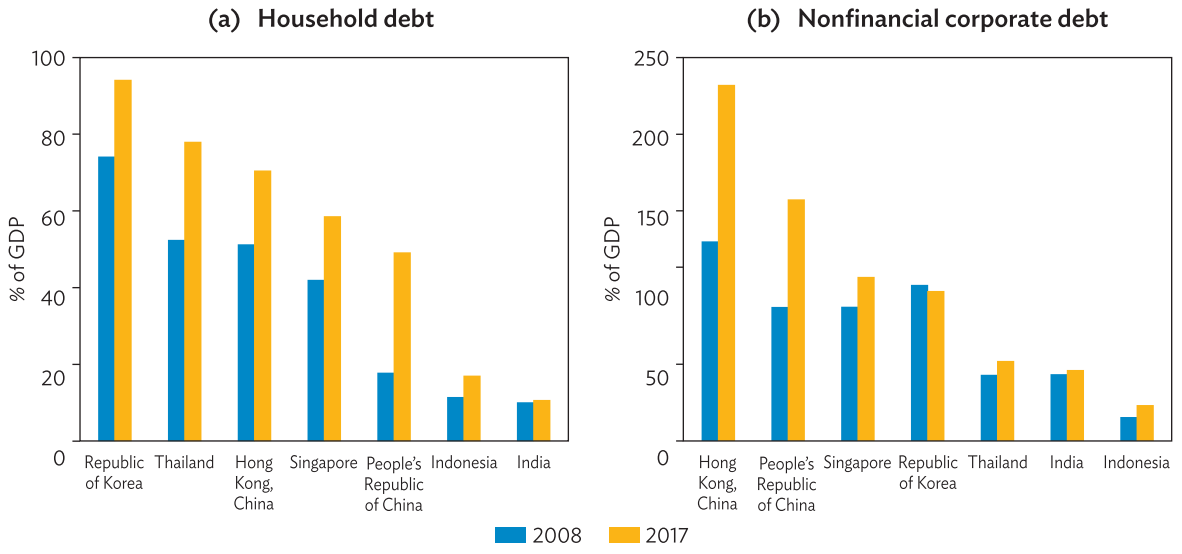
Source: Computed from the International Monetary Fund, Global Debt Database. https://www.imf.org/external/datamapper/datasets/GDD (accessed 16 April 2019).

In terms of its composition, the growth of private debt also shows varying patterns across the region. In the Republic of Korea and Thailand, for instance, the growth of private debt is driven mainly by household debt expansion, while in some other economies—like the PRC and Hong Kong, China—both household and corporate debt are contributing to private debt expansion (Figures 3a and 3b). In the case of the PRC, private debt increased by over 80% of GDP from end-2008 to end-2018, with roughly two-fifths of the increase coming from household debt, and three-fifths from corporate debt (including state-owned enterprises).

Figure 3: Household Debt and Nonfinancial Corporate Debt in Selected Asian Economies



GDP = gross domestic product.

Source: International Monetary Fund, Global Debt Database. https://www.imf.org/external/datamapper/datasets/GDD (accessed 16 April 2019).

An accumulation of private debt may not necessarily be a problem in and of itself. Higher debt levels can reflect the development of the finance sector, which channels consumption-smoothing savings by households to finance investment activity. But too rapid or too large a debt buildup may contribute to excessive leverage in inefficient sectors which do not use the debt productively, contributing to an overall deterioration in the quality of the debt. In addition, rapid debt buildups, sometimes referred to as credit booms, can fuel asset and consumption booms that can eventually turn to busts. In the face of negative shocks which tighten liquidity conditions, asset values may decline sharply. The currency composition of debts also matters. Countries with larger exposure to foreign currency-denominated debts are likely to be hit harder by external shocks such as faster than expected slowdown in the global economy and/or abrupt reversals in capital flows. Households and corporates would then find it more difficult to service their debts, causing nonperforming bank loans to rise and liquidity to contract further. Such a vicious cycle poses a systemic risk to the entire financial system and may eventually lead to a government bailout, which would expand fiscal deficits and jeopardize public debt sustainability.

Furthermore, evidence indicates that excessive private debt buildups can cause larger output declines in emerging economies than in advanced economies, and excess buildups of both corporate debt and household debt are potentially harmful to the real economy (Park, Shin and Tian 2018). The existing evidence thus suggests that the post-GFC buildup of debt in Asia, particularly private debt, can challenge the region's growth and stability. Although developing Asia's fundamentals remain solid and the region's authorities pursue relatively sound policies geared toward maintaining macroeconomic stability, it is still important to understand the risk that rising debt poses to the economy. In this study, we specifically examine the relation between public and private debt buildup on one hand and currency depreciation pressures on the other hand. We also examine whether the relation depends on financial market stress, whether the market is an emerging market, and dependence on external financing. These additional tests are particularly useful during the COVID-19 period, which witnessed financial instability and a sharp economic downturn.

II. DATA DEBT, RECESSION, AND FINANCIAL STABILITY: A LITERATURE REVIEW

While the nexus between debt and financial stability is not straightforward, excessive debt buildups have widely been viewed as a contributor to deeper recessions and financial vulnerability. Debt level reflects past fiscal and monetary policies as well as macroeconomic fundamentals, and may be related to financial stability (Guscina 2008, Das et al. 2010). Intuitively, there are several reasons why high and rising public and private debts can be destabilizing.

Rapid expansion of public debt raises investor concerns about fiscal sustainability and the government's liquidity and solvency. Such concerns lay at the root of eurozone sovereign debt crisis. Das et al. (2010) indicate that excessive public debt can harm financial stability by damaging the balance sheets of public and private sectors, triggering inflation-related policies, and weakening investor confidence. At the same time, rapid accumulation of private debt can jeopardize the ability of companies and households to service their debt. For example, the Asian financial crisis of 1997–1998 underlined the large potential damage of an unchecked private debt buildup. Cecchetti, Mohanty, and Zampolli (2011) show that excessive private debt can limit the capacity of the financial system to smooth economic activities. It can also trigger recessions via large movements in asset prices when growth moderates.

High levels of debt render the economy more vulnerable to shocks. Debt expansion exacerbates the duration and intensity of economic recessions (Jordà, Schularick and Taylor 2013; Mian, Sufi, and Verner 2017), and this negative impact is more pronounced in emerging economies than in advanced economies (Bernardini and Forni 2017). Sutherland and Hoeller (2012) demonstrate that high debt levels increase economic vulnerability by amplifying and transmitting economic shocks. High government debt tends to increase output volatility, while high private debt increases consumption and investment volatility. They further find that higher private debt could increase the probability of recession and lead to deeper recessions and slower recoveries. Park, Shin, and Tian (2018) investigate the association between private debt buildup and depth of recessions and show that recessions following a rapid buildup of private debt is more severe than other recessions. Further, the buildup of both corporate debt and household debt can exacerbate debt-related recessions, which tend to be more pronounced in emerging markets.

There is, however, less direct empirical evidence on how increases in debt levels are associated with financial stability and financial crisis, especially in developing economies. Adrian and Boyarchenko (2012) develop a dynamic macroeconomic model with procyclical leverage cycles due to risk constraints of financial intermediation. They show that while leverage fosters output and smooths consumption in normal times, such procyclical buildup of leverage will increase forward-looking systematic risks and probability of crisis. Bauer and Granziera (2017) examine how the debt level may influence the effect of monetary policy tightening in a financial crisis. Using a sample of 18 developed economies, they find that private debt-to-GDP ratio will affect the probability of financial crisis after monetary tightening. Higher level of private sector debt will increase the likelihood of financial crisis after unexpected monetary policy tightening in the short run. Barrell, Davis, and Pomerantz (2006) evaluate the impact of banking crisis and currency crisis on consumption, and they document that high debt level will make financial crisis more costly.

While these studies looked mostly at the link between debt buildup and financial crisis, it is worthwhile to examine how debt buildup is linked to exchange rate instability. Herz and Tong (2008) show that debt and currency crises share common economic fundamental drivers and establish a causal relation from debt crisis to currency crisis.

III. EMPIRICAL METHODOLOGY AND DATA

In this study, we empirically analyze the association between debt buildups and currency instability in the foreign exchange market. It revisits the debt–stability nexus by using the CMAX ratio as a proxy for currency stress in the foreign exchange market. CMAX is a widely used hybrid volatility-loss measure that gauges the maximum loss of a financial indicator, such as equity index and foreign exchange rate, over a specific time horizon.[1]

More specifically, the CMAX indicator for economy *i* over year *t* is defined in the spirit of Illing and Liu (2006) as follows:

$$CMAX_{i,t} = \frac{1}{12}\sum_{j=1}^{12} \frac{p_{i,j,t}}{\max\left[p \in (p_{i,j-k} | k=0,1,\ldots,11)\right]} \quad (1)$$

where $p_{i,j,t}$ denotes the inverted nominal exchange rate (United States [US] dollar value per unit of local currency—an indirect quote of exchange rate) of country *i* in month *j* of year *t*. The $\max\left[p \in (p_{i,j-k} | k = 0,1,\ldots,11)\right]$ is the maximum value of p over the past 12 months. Dips in the ratio of $CMAX_{i,j} = \frac{p_{i,j,t}}{\max\left[p \in (p_{i,j-k,t} | k=0,1,\ldots,11)\right]}$ capture a period of relative weakness in the currency within the past 12 months. Because some control variables in equation (1) are available only at annual frequency, the ratio is averaged over each calendar year to get $CMAX_{i,t}$ in each year *t*.

The underlying intuition behind the causal relationship from indebtedness to currency volatility is that as debt level builds up, investors become more sensitive to vulnerabilities arising from weak fundamentals and pull their money out of the country, weakening the currency. The question

[1] See Illing and Liu 2006, Huotari 2015, and Austria 2017, for example.

then becomes the extent to which high or rising public and private debts is an indicator of weak fundamentals. The analysis thus explores how private and public debt buildups affect currency stress in global markets. Specifically, we utilize the following panel data regression model to explore the relationship between debt buildups and exchange rate stress:

$$CMAX_{i,t} = \beta_0 + \beta_1 debt_{i,t-1} + \beta_2 debt_{i,t-1}^2 + \beta_3 ca_{i,t-1} + \beta_4 inf_{i,t} + \beta_5 ExR_{i,t} + \beta_6 fisb_{i,t-1} + \beta_7 irspread_{i,t} + u_{i,t} \quad (2)$$

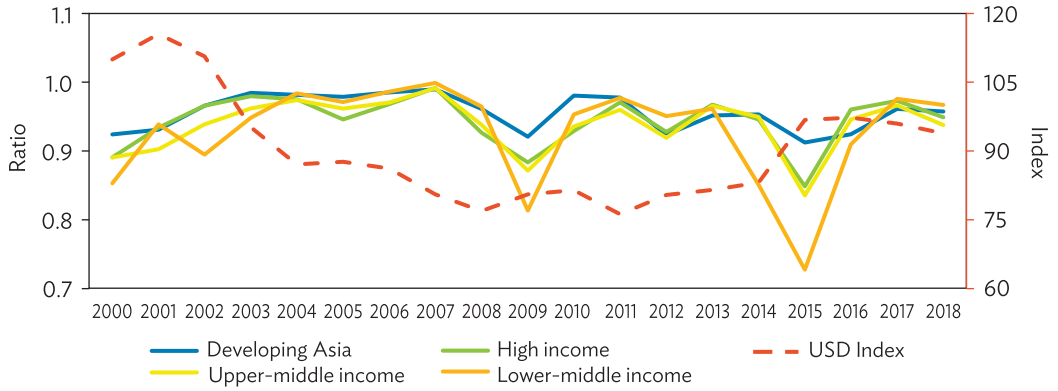
where the key explanatory variables in equation (2) are as follows. The $debt_{i,t-1}$ is the level of debt as a share of GDP of country i at the end of year t-1, denoting either private debt (loans and debt securities) or government debt, depending on the specification used in the estimation. The squared term of debt is included to account for possible nonlinearity in this association. Five macroeconomic factors—current account balance, inflation, fiscal balance, interest rate spread, and exchange rate regime—are included as control variables because they are widely believed to affect currency volatility and hence financial vulnerability. More specifically, $ca_{i,t-1}$ is current account balance (expressed as a percentage of GDP), $inf_{i,t}$ is inflation (annualized consumer price index expressed as a percentage), $ExR_{i,t}$ is exchange rate regime (a higher number indicating a more flexible regime), $fisb_{i,t-1}$ is consolidated fiscal balance (as a percentage of GDP), and $irspread_{i,t}$ is average monthly policy rate spread between local market and the US in year t. $country_i$ is a vector of country fixed effects that are included to account for time-invariant country-specific heterogeneities. Finally, $u_{i,t}$ is the error term.

A. CMAX Index

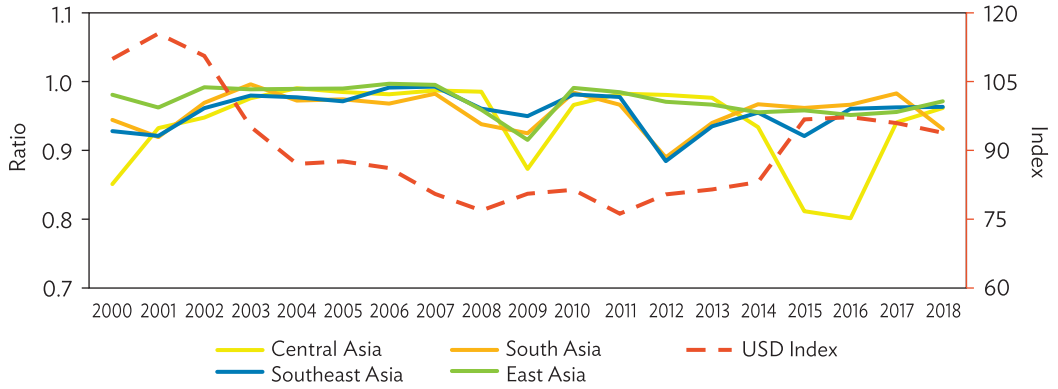
The estimated CMAX indicators for different economy groups are shown in Figure 4. During the GFC of 2008, taper tantrum of 2013, and the unwinding of the US Fed's quantitative easing in 2015, global currencies came under depreciation pressure. However, developing Asian currencies have been more resilient compared to other income and regional country groups, suffering smaller losses during periods of currency stress. Among the different subregions of developing Asia, Central Asia suffered relatively larger dips during stress periods, especially during the recent strong US dollar cycle that began in 2015. Figure 5 further presents details of the currency stress across different regions during stress periods.

Figure 4: Foreign Exchange Rate CMAX Dynamics of Different Groups of Economies

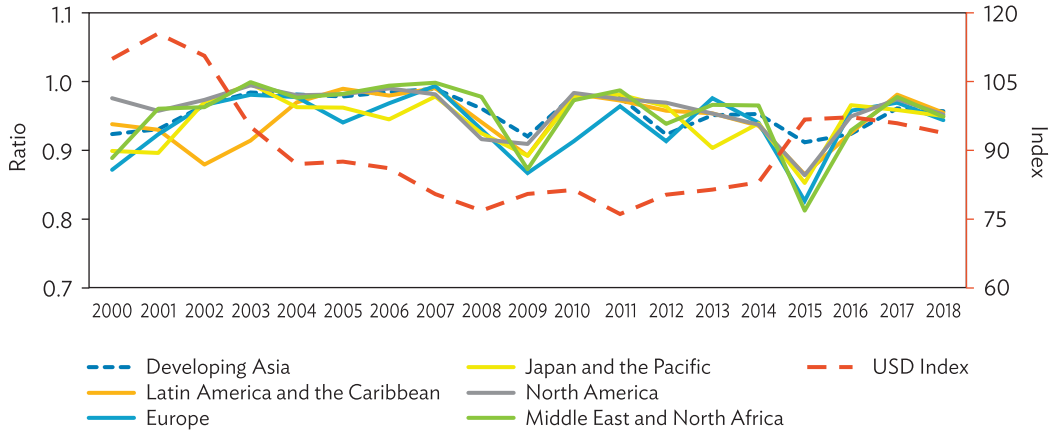
(a) CMAX ratio by income group and USD Index



(b) CMAX ratio in developing Asia and USD Index



(c) CMAX ratio by region and USD index

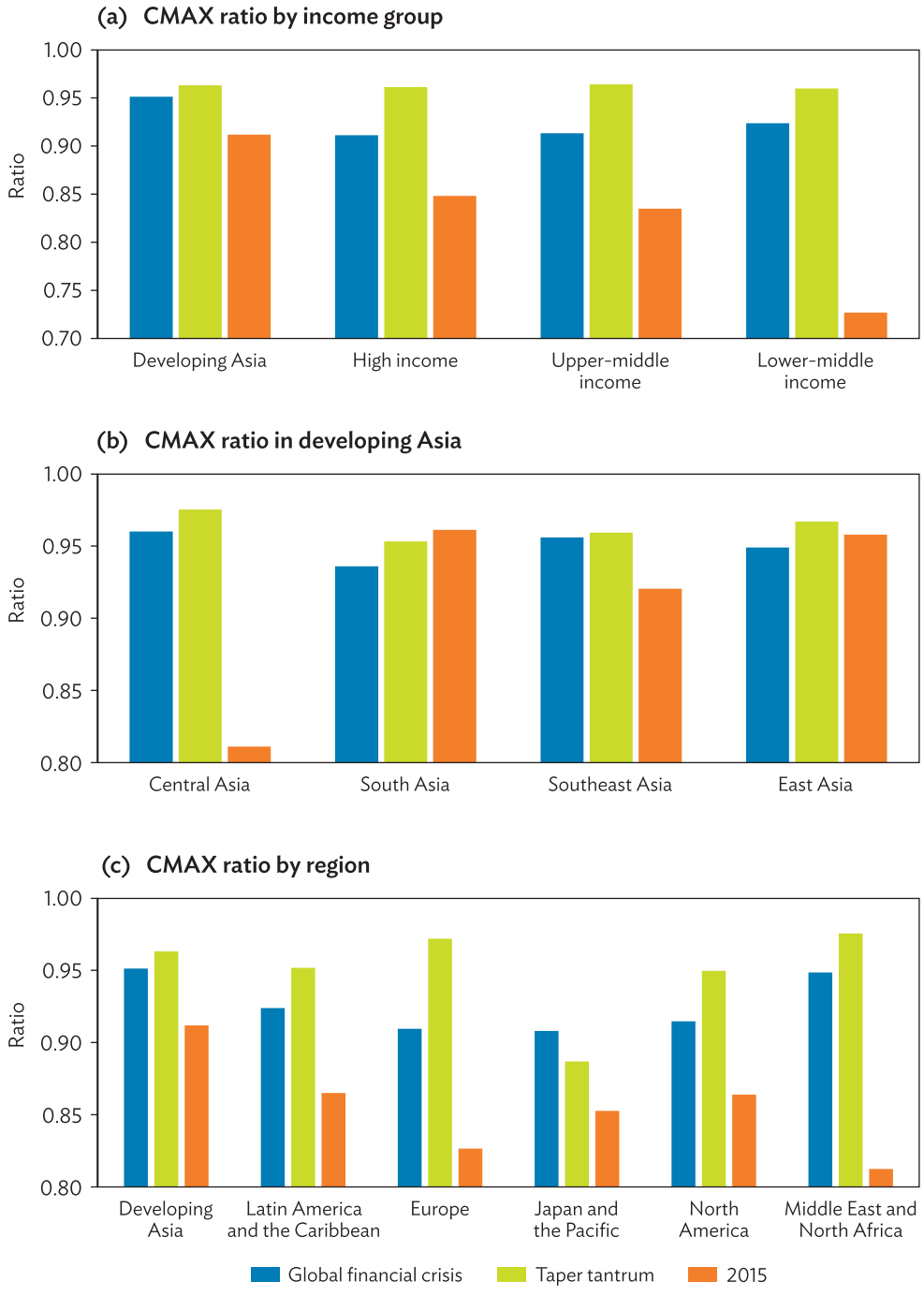


USD = United States dollar.

Note: CMAX is the average monthly inverted nominal exchange rate (USD value per unit of local currency) compared with the maximum value over the previous 12 months.

Sources: International Monetary Fund, International Financial Statistics. https://data.imf.org/?sk=4c514d48-b6ba-49ed-8ab9-52b0c1a0179b and Bloomberg (accessed 19 August 2019).

Figure 5: Foreign Exchange Rate CMAX in Stress Periods



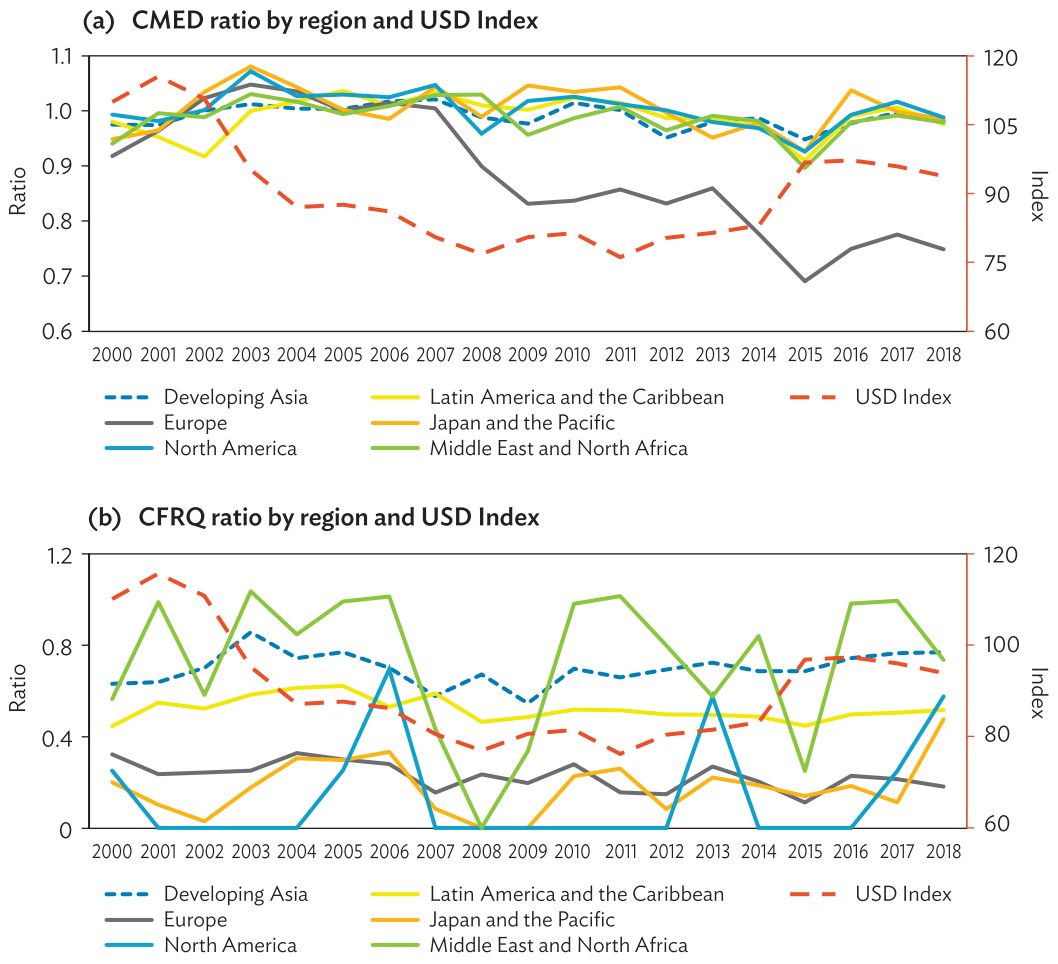
USD = United States dollar.

Notes: CMAX is the average monthly inverted nominal exchange rate (USD value per unit of local currency) compared with the maximum value over the previous 12 months. GFC period is from July 2007 to June 2009. Taper tantrum period is from April to August 2013.

Source: International Monetary Fund, International Financial Statistics. https://data.imf.org/?sk=4c514d48-b6ba-49ed-8ab9-52b0c1a0179b (accessed 19 August 2019).

To check for robustness, we consider two additional alternative measures of currency depreciation pressure. More specifically, we benchmark a monthly exchange rate to its median value over the past 12 months (CMED) and to its past most frequent value (CFRQ). In this context, CMAX is a stricter measure of currency stress than the other two alternatives since it takes the strongest currency value as a benchmark reference. While CMAX has a maximum value of 1, the two alternative indicators can take values greater than 1, which allows them to indicate both currency appreciation and depreciation pressures. While CMED is highly correlated with CMAX, CFRQ is not. (See Appendix 1 for details.) Although positive, the correlation coefficient of CFRQ and CMAX is very small, especially for monthly measures. Figure 6 shows how CMED and CFRQ change across different regions in recent years. As shown, developing Asia's currency pressure from external shocks such as GFC and the end of quantitative easing in 2015 is more pronounced for CMAX and CMED than CFRQ.

Figure 6: Foreign Exchange Rate CMED and CFRQ Dynamics by Region



USD = United States dollar.

Notes: CMED is the average monthly inverted nominal exchange rate (USD value per unit of local currency) compared with the median value over the previous 12 months. CFRQ is the average monthly inverted nominal exchange rate (USD value per unit of local currency) compared with the most frequent value over the previous 12 months.

Sources: International Monetary Fund, International Financial Statistics. https://data.imf.org/?sk=4c514d48-b6ba-49ed-8ab9-52b0c1a0179b and Bloomberg (accessed 19 August 2019).

B. Data

The data for this study come from multiple sources. Public and private debt as a share of GDP are collected from the International Monetary Fund (IMF) Global Debt Database. Nominal exchange rate used to construct the indices of CMAX, CMED, and CFRQ is collected from the IMF's International Financial Statistics. Current account deficit and inflation rate are from the World Bank's World Development Indicators and consolidated fiscal balances are from CEIC Data Company. Exchange rate regime is defined following the annual fine classification in Ilzetzki, Reinhart, and Rogoff (2019). The monthly average policy interest rate spread between local market and the US is computed from the CEIC database. Due to limitations in data availability, the share of foreign currency-denominated debt to total debt is proxied by the share of outstanding foreign currency-denominated debt securities to total debt securities outstanding. The data are from Bloomberg. See Appendix 2 for details.

After matching different variables from all sources, the final panel dataset consists of debt and macroeconomic variables of 59 economies during 2000–2016. The economy sample includes 21 advanced economies and 38 emerging market economies across the world.[2] Table 1 shows the summary statistics for the explanatory variables in equation (1).

Table 1: Summary Statistics

Variables	Observation	Mean	Std Dev	Min	Max	Median
Debt (% of GDP)						
Private	719	98	81.2	2.9	679.7	71.2
Public	657	39.8	28.7	1.3	216	34
Current account balance (% of GDP)	719	−0.9	8	−43.8	33.7	−1.4
Inflation	719	4.6	5	−3	57.1	3.4
Exchange rate regime	719	8	3.7	1	15	8
Fiscal balance (% of GDP)	719	4.6	5	−3	57.1	3.4
Interest rate spread	719	3.6	4	−4.1	24.8	2.8
% share of foreign currency debt						
Private	581	60.1	27.9	0.7	100	61.1
Public	567	31.9	29.0	0.0	100	23.67

GDP = gross domestic product.

Note: For exchange rate regime, mode is reported instead of median.

Source: Authors' calculations.

The median values of public debt and private debt as shares of GDP are 34% and 71.2%, respectively. On average, our sample economies are running a current account deficit and a fiscal balance surplus. Median inflation is lower than its mean, suggesting some high inflation economies on the right tail of our sample distribution. The interest rate is on average higher than the US interest rate. The exchange rate regime takes the value of 1–15 from the most rigid to the flexible regime, following

[2] Albania; Algeria; Australia; Azerbaijan; Bangladesh; Brazil; Bulgaria; Canada; Chile; Colombia; Croatia; Cyprus; Czech Republic; Denmark; Ecuador; Estonia; Georgia; Hong Kong, China; Hungary; Iceland; India; Indonesia; Japan; Kazakhstan; Kyrgyz Republic; Lao People's Democratic Republic; Latvia; Lithuania; Macedonia; Malaysia; Malta; Mexico; Moldova; Mongolia; Myanmar; Nepal; New Zealand; Norway; Pakistan; Paraguay; People's Republic of China; Peru; Philippines; Poland; Republic of Korea; Romania; Russian Federation; Singapore; Slovak Republic; Slovenia; Sri Lanka; Sweden; Switzerland; Tajikistan; Thailand; Turkey; Ukraine; United Kingdom; Uruguay.

Ilzetzki, Reinhart, and Rogoff (2019). Most of our sample economies have exchange rate regimes with de facto crawling band that is narrower than or equal to +/-2%.

To explore whether debt buildup could contribute to additional currency pressure during periods of financial stress, we include a dummy variable (Stress) that takes a value of 1 during the three stress periods in the sample period and 0 otherwise. These are the GFC of 2008, the taper tantrum of 2013, and the end of US monetary easing in 2015. We also include a dummy variable for emerging markets to examine if the impact of debt levels on currency stress is more pronounced for these economies, which tend to have generally weaker fundamentals than the advanced ones. Our sample consists of 38 emerging market economies that are classified as such under the IMF's *World Economic Outlook* country listing, which is based on three criteria: (i) per capita income level; (ii) export diversification—i.e., oil exporters with high per capita GDP are not classified as advanced since 70% or more of their exports are oil; and (iii) degree of integration into the global financial system.

IV. DEBT BUILDUP AND CURRENCY VULNERABILITY: THE EMPIRICAL EVIDENCE

In this section, we report and discuss the result of our empirical analysis. Table 2 reports the main empirical results of our analysis. The results indicate that higher private debt is associated with greater currency vulnerability. Model specifications in columns (1)–(3) include private debt and control variables that influence exchange rate stress. The magnitude of the coefficient in model specification (1) suggests that an increase in private debt by 10% of GDP from the sample median value is, on average, associated with an additional 1% depreciation pressure. In the sample, this means that comparing a country at the 25th percentile of private debt (39% of GDP) to one at the 75th percentile (161% of GDP), exchange rate loss is 12.6% larger for the latter. Model specification (2), which includes the stress period dummy, shows that currencies experience an additional 1.7% of depreciation pressure during periods of financial stress. Model specification (3), which includes an emerging market dummy, shows that private debt has a bigger impact on exchange rate vulnerability in emerging markets than in advanced economies. More precisely, a 10% higher ratio of private debt to GDP induces an additional 0.6% depreciation pressure in emerging markets relative to advanced economies. The additional fall in CMAX is 7.6% for an emerging market economy at the third quartile of the ratio of private debt to GDP relative to one at the first quartile.

Model specifications in columns (4)–(6) estimate the impact of public debt buildup on foreign exchange CMAX. Model specification (4) shows that, on average, public debt does not have any significant effect on depreciation pressure. However, model specification (5) indicates that public debt undermines currency stability during periods of financial stress. In particular, 10% higher ratio of public debt to GDP is associated with 0.4% more depreciation pressure. Model specification (6) shows that the effect of public debt buildup on currency pressure is not significantly different between emerging market economies and advanced economies. In addition, most control variables do not have any significant effect on currency loss pressure, except the current account balance and interest rate spread. A larger current surplus is associated with less currency stress. On the other hand, a wider interest rate spread, which can reflect a higher country risk premium, is associated with more currency stress.

Table 2: Private Debt, Public Debt, and Currency Vulnerability Proxied by CMAX

	Private Debt			Public Debt		
Dependent Variable: CMAX	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Debt (% of GDP)	−0.111***	−0.096***	−0.071***	−0.053	−0.047	−0.091*
	(−4.64)	(−3.77)	(−3.32)	(−1.07)	(−1.02)	(−2.00)
Debt (% of GDP)^2	0.000***	0.000***	0.000**	0.000	0.000	0.000
	(3.81)	(3.09)	(2.58)	(1.410)	(1.451)	(1.366)
Stress = 1		−1.656***			−1.258	
		(−2.90)			(−1.45)	
Stress x Debt (% of GDP)		−0.004			−0.036**	
		(−0.94)			(−2.08)	
EM x Debt (% of GDP)			−0.062*			0.060
			(−1.83)			(1.34)
Current account balance (% of GDP)	0.149***	0.149***	0.145***	0.193***	0.188***	0.191***
	(2.94)	(2.87)	(2.86)	(3.84)	(3.91)	(3.76)
Inflation	0.113	0.127	0.105	0.009	0.018	−0.003
	(0.75)	(0.84)	(0.69)	(0.07)	(0.14)	(−0.02)
Exchange rate regime	−0.435	−0.449	−0.429	−0.430	−0.479	−0.441
	(−1.41)	(−1.48)	(−1.41)	(−1.30)	(−1.50)	(−1.32)
Fiscal balance (% of GDP)	−0.079	−0.034	−0.099	0.051	0.080	0.023
	(−0.95)	(−0.38)	(−1.20)	(0.50)	(0.80)	(0.23)
Interest rate spread	−0.670***	−0.632***	−0.639***	−0.709***	−0.662***	−0.715***
	(−3.84)	(−3.66)	(−3.75)	(−4.66)	(−4.40)	(−4.64)
Constant	109.00***	108.17***	107.90***	102.02***	102.60***	102.24***
	(31.48)	(30.73)	(33.95)	(37.15)	(38.31)	(36.98)
Observations	719	719	719	706	706	706
R-squared	0.178	0.196	0.185	0.157	0.193	0.160
Number of markets	59	59	59	58	58	58
Country fixed effect	YES	YES	YES	YES	YES	YES
F values	13.51	13.59	15.40	8.071	14.76	6.636

EM = emerging market, GDP = gross domestic product.

Notes: CMAX is the average monthly inverted nominal exchange rate (USD value per unit of local currency) compared with the maximum value over the previous 12 months. Robust t-statistics in parentheses, significance level at p<0.01 is ***, p<0.05 is **, and p<0.1 is *.

Source: Authors' calculations.

A. Alternative Proxies for Currency Vulnerability

While CMAX is a widely used proxy for exchange rate vulnerability, it looks only at depreciation pressure by comparing current currency price to its historically high levels. However, policy makers also monitor currency appreciation, which may affect trade and investment. More specifically, large appreciation may erode international competitiveness of a country's exports. To overcome this drawback of CMAX, we also consider two alternative measures of currency vulnerability, namely CMED and CFRQ. The same specifications in Table 1 are reestimated using CMED and CFRQ as the dependent variable. The results are reported in Tables 3 and 4 below.

The results for model specification in columns (1)–(3) in Table 3 are largely consistent with the results in Table 2. Above all, higher private debt is associated with greater currency depreciation pressures. Model (2) indicates that currencies suffer an additional 1% depreciation and economies with higher private indebtedness suffer an 0.1% additional loss in currency value during periods of financial stress. Model specification (3) shows that private indebtedness significantly increases currency vulnerability in emerging markets relative to advanced economies. The only difference here is that among control variables, only interest rate spread came up statistically significant. Current account balance no longer appears to be statistically significant, although its sign is consistently positive. Model specification in columns (4)–(6) of Table 3 report the impact of public debt buildup on CMED. In line with Table 2, although there is some evidence that public debt is associated with currency depreciation, its effect is relatively noisy. Model specification (5) suggests that currency depreciation pressure increases during periods of financial stress, but the increase is not significantly related to the level of public debt indebtedness.

Table 3: Private Debt, Public Debt, and Currency Vulnerability Proxied by CMED

	Private Debt			Public Debt		
Dependent Variable: CMED	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Debt (% of GDP)	−0.100***	−0.081***	−0.077***	−0.051	−0.049	−0.091**
	(−7.14)	(−5.55)	(−4.75)	(−1.29)	(−1.39)	(−2.26)
Debt (% of GDP)^2	0.000***	0.000***	0.000***	0.000	0.000	0.000
	(6.19)	(4.69)	(4.02)	(1.008)	(1.024)	(0.982)
Stress = 1		−0.987**			−2.226***	
		(−2.00)			(−3.37)	
Stress x Debt (% of GDP)		−0.012***			−0.015	
		(−2.81)			(−1.24)	
EM x Debt (% of GDP)			−0.037*			0.064
			(−1.77)			(1.62)
Current account balance (% of GDP)	0.048	0.050	0.045	0.102**	0.096**	0.100**
	(1.35)	(1.30)	(1.28)	(2.41)	(2.44)	(2.32)
Inflation	0.115	0.128	0.110	0.058	0.070	0.045
	(1.44)	(1.62)	(1.38)	(0.64)	(0.74)	(0.53)
Exchange rate regime	−0.117	−0.125	−0.113	−0.098	−0.153	−0.110
	(−0.63)	(−0.68)	(−0.62)	(−0.45)	(−0.75)	(−0.49)
Fiscal balance (% of GDP)	0.030	0.089	0.018	0.126	0.160**	0.097
	(0.45)	(1.37)	(0.26)	(1.47)	(2.00)	(1.15)
Interest rate spread	−0.295***	−0.252***	−0.277***	−0.380***	−0.327***	−0.387***
	(−3.11)	(−2.72)	(−2.95)	(−3.82)	(−3.36)	(−3.86)
Constant	109.38***	108.17***	108.72***	103.33***	104.12***	103.56***
	(56.13)	(54.50)	(57.24)	(57.28)	(59.71)	(56.22)
Observations	719	719	719	706	706	706
R-squared	0.145	0.188	0.149	0.070	0.132	0.076
Number of markets	59	59	59	58	58	58
Country fixed effect	YES	YES	YES	YES	YES	YES
F values	25.08	27.62	28.06	7.296	19.26	5.424

EM = emerging market, GDP = gross domestic product, USD = United States dollar.

Notes: CMED is the average monthly inverted nominal exchange rate (USD value per unit of local currency) compared with the median value over the previous 12 months. Robust t-statistics in parentheses, significance level at $p<0.01$ is ***, $p<0.05$ is **, and $p<0.1$ is *.

Source: Authors' calculations.

Table 4 reports the estimation results when we use CFRQ as the measure of currency vulnerability. Again, higher private debt is significantly related to greater currency depreciation pressure. However, according to model specifications (2) and (3), private debt does not have an additional effect on CFRQ during periods of financial stress or in emerging markets. For model specifications (4)–(6), Table 4 suggests that higher public debt levels seem to be related to currency depreciation pressure. Periods of financial stress witness heightened currency depreciation pressure, but this is unrelated to the public debt level. Overall, our results indicate that private debt has a consistently significant effect on currency depreciation pressure, while the effect of public debt is less robust.

Table 4: Private Debt, Public Debt, and Currency Vulnerability Proxied by CFRQ

	Private Debt			Public Debt		
Dependent Variable: CFRQ	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Debt (% of GDP)	-0.140***	-0.119***	-0.117*	-0.132*	-0.155*	-0.239***
	(-4.04)	(-3.65)	(-1.86)	(-1.69)	(-1.99)	(-3.26)
Debt (% of GDP)^2	0.000***	0.000***	0.000	-0.000	0.000	0.000
	(3.95)	(3.45)	(1.61)	(-0.094)	(0.432)	(0.397)
Stress = 1		-1.591			-1.950*	
		(-1.54)			(-1.83)	
Stress x Debt (% of GDP)		-0.008			-0.024	
		(-0.89)			(-1.39)	
EM x Debt (% of GDP)			-0.033			0.123
			(-0.53)			(1.51)
Current account balance (% of GDP)	0.026	0.031	0.026	0.195***	0.184***	0.199***
	(0.62)	(0.78)	(0.61)	(3.01)	(2.95)	(2.94)
Inflation	-0.143	-0.134	-0.143	-0.156	-0.150	-0.161
	(-1.41)	(-1.32)	(-1.46)	(-1.17)	(-1.13)	(-1.24)
Exchange rate regime	-1.045	-1.061	-1.036	-0.573	-0.651	-0.568
	(-1.58)	(-1.60)	(-1.58)	(-0.90)	(-1.06)	(-0.88)
Fiscal balance (% of GDP)	0.042	0.073	0.020	0.080	0.122	0.028
	(0.34)	(0.60)	(0.17)	(0.62)	(0.99)	(0.20)
Interest rate spread	-0.316	-0.262	-0.301	-0.187	-0.109	-0.210
	(-1.62)	(-1.30)	(-1.56)	(-0.89)	(-0.53)	(-1.01)
Constant	119.71***	118.64***	119.21***	110.76***	111.86***	110.93***
	(20.43)	(20.17)	(20.06)	(22.53)	(23.43)	(23.03)
Observations	352	352	352	353	353	353
R-squared	0.263	0.293	0.265	0.209	0.254	0.217
Number of markets	49	49	49	47	47	47
Country fixed effect	YES	YES	YES	YES	YES	YES
F values	8.340	7.483	26.93	11.47	10.30	9.421

EM = emerging market, GDP = gross domestic product, USD = United States dollar.

Notes: CFRQ is the average monthly inverted nominal exchange rate (USD value per unit of local currency) compared with the most frequent value over the previous 12 months. Robust t-statistics in parentheses, significance level at p<0.01 is ***, p<0.05 is **, and p<0.1 is *.

Source: Authors' calculations.

B. The Role of Foreign Currency-Denominated Debt

To check for the role of foreign currency-denominated debt in affecting currency vulnerability, we conducted additional regressions on the CMAX index by augmenting the basic model in equation (2) with proxies for exposure to foreign currency debt. Due to limited availability of foreign currency-denominated debt data, we use the share of foreign currency- denominated bonds in total government or corporate bonds as a proxy. We interact this share with the ratio of debt to GDP to get an idea on how foreign currency-denominated debt may affect currency vulnerability. In addition, we also perform another regression that includes an interaction term between the current account balance and the debt-to-GDP ratio.

Table 5 reports the estimation results for the two models. The model specification in columns (1) and (3) included an interaction term between the currency denomination of debt and the debt ratios. This interaction term provides a proxy for the share of foreign currency- denominated debt in GDP. The estimation result suggests that, for both private and public debts, foreign currency denomination does not have a statistically significant impact. The model specification in columns (2) and (4) includes an interaction term between the current account balance as a share of GDP and the debt ratios. A current account deficit indicates negative saving–investment gap, which suggests dependence on external financing to fill up the gap. On the other hand, a current account surplus implies that the country is a net lender of capital to the world. The results show statistically positive and significant effects of this additional variable on currency stress for both private and public debts.

Model (1) and (3) imply that the currency structure of debt, be it private or public, may not necessarily stress a currency. One possibility is that the relationship is the other way around—i.e., currency depreciation leads to an increase in the size of foreign currency- denominated debt (e.g., Aghion, Bacchetta, and Banerjee 2001). However, debts would exert stronger currency pressures in countries with larger current account deficits, hence greater dependence on external financing. The effect is much more serious for public rather than private debts, as shown by the much larger estimated coefficient on the interactive term in model (4) relative to model (2). To sum up, while we do not find any evidence of a significant effect of foreign currency-denominated debts on exchange rate vulnerability, we do find that higher dependence on external financing exacerbates the effect of debt on currency pressures.

Table 5: Currency Stress, Debts, and External Dependence

	Private Debt		Public Debt	
Dependent Variable: CMAX	**(1)**	**(2)**	**(3)**	**(4)**
Debt (% of GDP)	−0.106***	−0.115***	−0.050	−0.048
	(−4.632)	(−4.90)	(−0.877)	(−0.96)
Debt (% of GDP) ^{2}	0.000***	0.000***	−0.000	0.000
	(3.548)	(4.48)	(−0.172)	(1.56)
% share of foreign currency debt x Debt (% of GDP)	−0.020		0.014	
	(−1.224)		(0.241)	
Current account balance (% of GDP) x Debt (% of GDP)		0.058*		0.648***
		(1.71)		(2.72)
Current account balance (% of GDP)	0.145**	0.098	0.230***	0.013
	(2.390)	(1.66)	(2.696)	(0.22)

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Table 5 *continued*

	Private Debt		Public Debt	
Dependent Variable: CMAX	**(1)**	**(2)**	**(3)**	**(4)**
Inflation	−0.182	0.117	−0.169	−0.007
	(−1.095)	(0.77)	(−1.070)	(−0.06)
Exchange rate regime	−0.321	−0.446	−0.165	−0.446
	(−0.936)	(−1.45)	(−0.454)	(−1.35)
Fiscal balance (% of GDP)	−0.042	−0.065	0.022	0.016
	(−0.457)	(−0.78)	(0.192)	(0.16)
Interest rate spread	−0.490***	−0.662***	−0.520***	−0.665***
	(−3.106)	(−3.80)	(−2.958)	(−4.62)
Constant	110.381***	109.123***	100.686***	101.775***
	(29.616)	(31.94)	(29.044)	(35.16)
Observations	581	719	567	706
R-squared	0.222	0.180	0.143	0.169
Number of markets	48	59	49	58
Country fixed effect	YES	YES	YES	YES
F values	14.93	12.57	5.556	6.041

GDP = gross domestic product, USD = United States dollar.

Notes: CMAX is the average monthly inverted nominal exchange rate (USD value per unit of local currency) compared with the maximum value over the previous 12 months. Robust t-statistics in parentheses, significance level at p<0.01 is ***, p<0.05 is **, and p<0.1 is *.

Source: Authors' calculations.

V. CONCLUSION AND POLICY IMPLICATIONS

Our empirical analysis suggests that both private debt and public debt buildups adversely affect currency vulnerability. However, the evidence of a significant effect on currency depreciation pressure is more robust and consistent for private debt than public debt. Furthermore, we find that private debt buildup can be particularly harmful in emerging markets. This suggests that policy makers in emerging markets should closely monitor the buildup of both public and private debt, especially in the current global economic environment of slowing growth and high uncertainty. The evidence also shows that greater dependence on external financing will exacerbate the impact of debt buildup on currency pressures.

The results also strengthen the case for shifting from a debt monitoring framework that narrowly focuses on public debt sustainability to a broader framework that monitors both private and public debt. While excessive public debt can jeopardize macroeconomic stability and harm investor sentiment, the more pronounced association between private debt buildup and exchange rate stress, especially in emerging markets, points to the need for a broader debt surveillance framework. When private debt becomes unsustainable for households and corporates, rising nonperforming loans and debt defaults will damage the balance sheet of banks. This can eventually trigger a liquidity crunch which may further evolve into government sector bailouts and fiscal deficits that adversely affect public debt sustainability.

While leverage fosters economic activity and smooths consumption, it poses a risk when debt is allocated to unproductive sectors that cannot generate enough cash flow to service the debt. The risk of debt quality deterioration becomes more pronounced when the economy is slowing down. Many developing countries, especially in Asia, accumulated private debt during the post-GFC global low interest rate era. As such, Asian regulators and policy makers should not neglect prudential financial supervision and regulation even as they are preoccupied with the current unprecedented crisis. This would help to improve the quality of private debt and reduce the probability of recession and crisis in the future.

The severe economic downturn due to COVID-19 will push economies around the world deeper into debt. The government of many economies are borrowing heavily for fiscal stimulus packages that support growth and provide relief for vulnerable groups. At the same time, private companies and households may be forced to borrow more to survive the economic impact of COVID-19. In addition, the economic downturn challenges their capacity to service their existing debts. Therefore, despite widespread concerns about the current escalation of public debt and its sustainability, we should not lose sight of the potential risk from possible surges of private debt. This is especially true for developing Asia, where private debt has grown faster than public debt in recent years, even prior to COVID-19.

APPENDIX

Appendix Table A1: Correlation Coefficients

	Dependent Variables		
Dependent Variables	**CMAX**	**CMED**	**CFRQ**
CMED	0.8283		
	0.0000		
CFRQ	0.5911	0.7115	
	0.0000	*0.0000*	
Independent Variables			
Debt (% of GDP)			
Private debt	-0.0250	0.0599	0.0981
	0.5033	*0.1087*	*0.0661*
Public debt	-0.0037	-0.0126	-0.0490
	0.9251	*0.7473*	*0.3853*
Debt (% of GDP)^2			
Private debt	-0.0611	0.0023	0.0863
	0.1017	*0.9512*	*0.1061*
Public debt	0.0114	0.0030	-0.0282
	0.7709	*0.9384*	*0.6173*
Current account balance (% of GDP)	0.1896	0.0878	0.0980
	0.0000	*0.0185*	*0.0664*
Inflation	-0.1440	-0.1418	-0.3044
	0.0001	*0.0001*	*0.0000*
Exchange rate regime	-0.1896	-0.0400	-0.0127
	0.0000	*0.2843*	*0.8119*
Fiscal balance (% of GDP)	0.0429	0.0639	0.0354
	0.2504	*0.0869*	*0.5074*
Interest rate spread	-0.2734	-0.2745	-0.2846
	0.0000	*0.0000*	*0.0000*

GDP = gross domestic product, USD = United States dollar.

Notes: CMAX is the average monthly inverted nominal exchange rate (USD value per unit of local currency) compared with the maximum value over the previous 12 months. CMED is the average monthly inverted nominal exchange rate (USD value per unit of local currency) compared with the median value over the previous 12 months. CFRQ is the average monthly inverted nominal exchange rate (USD value per unit of local currency) compared with the most frequent value over the previous 12 months. p-values are italicized.

Source: Authors' calculations.

Appendix Table A2: Definition of Variables

Variables	Description and Construction	Data Source
Current account balance (% of GDP)	Current account balance as a percentage of GDP	World Bank, World Development Indicators
Inflation rate	Annual consumer price index growth rate (percentage)	World Bank, World Development Indicators
Exchange rate regime	Exchange rate regime Annual fine classification in Ilzetzki, Reinhart, and Rogoff (2019)	Ilzetzki, Reinhart, and Rogoff (2019)
Fiscal balance (% of GDP)	Consolidated fiscal balance as a percentage of GDP)	CEIC Data Company
Private debt (% of GDP)	Total private debt, loans, and debt securities as a percentage of GDP	IMF, Global Debt Database
Public debt (% of GDP)	Central government debt as a percentage of GDP	IMF, Global Debt Database
Interest rate spread	The average month policy rate spread between local market and the US	CEIC Data Company
CMAX	The average monthly inverted nominal exchange rate (US dollar value per unit of local currency) compared with the maximum value over the previous 12 months	Authors' computation from the IMF, International Financial Statistics
CMED	The average monthly inverted nominal exchange rate (US dollar value per unit of local currency) compared with the median value over the previous 12 months	Authors' computation from the IMF, International Financial Statistics
CFRQ	The average monthly inverted nominal exchange rate (US dollar value per unit of local currency) compared with the most frequent value over the previous 12 months	Authors' computation from the IMF, International Financial Statistics
Stress dummy	Stress = 1 if year captures three stress periods during the sample period: the GFC of 2008–2009, the taper tantrum in 2013, and the start of the US monetary policy normalization in 2015; 0 otherwise	Authors' computation
EM dummy	EM = 1 if countries are emerging markets; 0 otherwise.	Authors' computation
Share of foreign currency debt	The share of foreign currency-denominated government (corporate) bonds to total government (corporate) bond outstanding for public (private) debt analysis.	Authors' computation from Bloomberg

CEIC = Census and Economic Information Center, EM = emerging market, GDP = gross domestic product, GFC = global financial crisis, IMF = International Monetary Fund, US = United States.

Source: Authors' compilation.

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Debt Buildup and Currency Vulnerability

Evidence from Global Markets

Developing Asia has seen a buildup of public and private debt since the global financial crisis. Private debt in particular has grown rapidly, raising concerns about its impact on financial stability. The authors empirically examine how public and private debt buildups are related to currency depreciation pressure. Their analysis of a panel dataset of 59 advanced and developing economies reveals that both private and public debts exacerbate currency vulnerability. However, the evidence is more robust and consistent for private debt than public debt. Furthermore, the authors find that excessive private debt buildup can be particularly harmful in emerging markets.

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