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Effects of Quantitative Easing on Asian Emerging Economies: Exchange Rates, Macroprudential Policy, and the Role of Institutions[+]

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FIRST AND PRELIMINARY DRAFT – PLEASE DO NOT CITE OR CIRCULATE!

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Abstract

This paper investigates the impact quantitative easing (QE) policies of major advanced economies on financial and macroeconomic conditions in emerging market economies (EMEs), with a special focus on exchange rate valuation and foreign currency borrowing of Asian EMEs. In particular, it examines the impact of governance along with macroprudential policies adopted by EMEs in response to international capital flows. One contribution of this paper is to flag the importance of quality of institutions and good governance, and not just the mere existence of capital account and macroprudential policies in dealing with foreign borrowing. There are two findings. First, QE policies of advanced economies indeed caused appreciation pressures on EME currencies and contributed to exchange rate overvaluation, thus making foreign currency borrowing more attractive. Second, after the Global Financial Crisis (GFC), there is a clear indication that more effective EME governments dampened foreign currency borrowing in order to avoid overborrowing in foreign currencies. This is good news for developing East Asian countries, which, among EMEs, have significantly better governance.

Keywords: Quantitative easing; capital flows; cross-border bank lending; Asian emerging markets; exchange rates; macroprudential policy.

JEL Classification: E44, E58, F31, F32, F34.

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"Massive capital inflows into EMEs ... promoted by the excess global liquidity created a sense of exuberance, which in turn generated mispricing in some assets in many EMEs, meaningful real exchange rate appreciations and opened the door for potential sudden capital flow reversals." (Carstens 2015)

I. Introduction

After the start of the Federal Reserve Bank's quantitative easing (QE) policy in late 2008, many emerging market economies (EMEs) faced large-scale capital inflows with subsequent appreciation of real exchange rates and asset prices, causing then Brazilian President Rousseff to complain about a 'monetary tsunami' that was making its way into EMEs. The scale of the US QE has been large: only in the first round of QE which started in November 2008, the Fed purchased $100 billion of agency debt and $500 billion of mortgage back securities – far more than the other central banks which implemented QE after the Global Financial Crisis (GFC). Since QE was adopted in the US, the Bank of Japan[1], the Bank of England and (recently) the European Central Bank have likewise adopted QE policies, thus contributing to high levels of liquidity in global financial markets.

Given the volatile nature of short-term capital flows and the danger of reversals of capital flows (so-called "sudden stop"), many EMEs have implemented macro-prudential policies and (often temporary) measures of capital account management to better cope with capital flows. The speed at which the direction of flows can change was illustrated when Fed Chairman Bernanke hinted at the possibility for tapering the Fed's QE program in May 2013, leading to strong volatility in capital flows and rapid exchange rate depreciation, and stirring fear of financial crises in a number of EMEs[2].

Against this background, this paper investigates the impact of US's QE policies on financial and macroeconomic conditions in EMEs, with a special focus on exchange rate valuation and foreign currency borrowing of EMEs. In addition to EMEs as a whole, we look at selected East Asian countries and make comparisons with other EMEs. In particular, it examines how EMEs respond to international capital flows, paying special attention to the role of institution and macroprudential policies. Among different types of capital flows, we focus on net cross-border bank borrowing, using the confidential version of Bank for International Settlements' (BIS's) locational banking statistics, which comprises comprehensive cross-border lending information that includes details on currency break-down. While the paper focuses on Asian EMEs, because of the small sample size of selected East Asian countries, we conduct empirical analysis for all EMEs first. Then we expand our analysis to East Asia, comparing to other EMEs.

The paper contributes to the existing literature in several ways. First, we formally test how QE impacted the *valuation* (not change) of exchange rate of EMEs. Second, controlling for standard macroeconomic factors and capital account management, we examine how macroprudential policies and/or effective government contributed to prevent overborrowing in foreign currencies when their home currencies are overvalued as a result of QE spill-overs. Our conjecture is that whilst overvaluation leads to more

[1] The Bank of Japan (BoJ) was the first central bank to implement QE (between March 2001 and March 2006). The second round of unconventional monetary policy was re-launched in 2010, when BoJ implemented Comprehensive Monetary Easing (Asset Purchase Program). In 2013, the BOJ adopted aggressive QE policies (QQE policy) as the first pillar of Abenomics.

borrowing in foreign currencies, a more effective and prudent government would put a lid on over-borrowing to prevent bubbles to reduce the risk of unwanted consequences.

To the best of our knowledge, this is the first study which looks at how institutional settings and currency valuation interact in determining the borrowing pattern of EMEs in the period of high capital inflow pressures from QE spillovers.

Our main findings are as follows:

- QE-related capital inflow to EMEs contributed to overvaluation of their exchange rates.
- There is a significant structural break before and after the global financial crisis (GFC) in how overvaluation and governance affect the cross-border borrowing patterns in EMEs;
- Overvaluation of exchange rates, as well as good governance, have a positive effect in foreign currency borrowing – a more overvalued currency makes it cheaper in terms of a home currency to borrow in foreign currencies, and investors prefer to invest in countries with good governance;
- After the GFC, appreciation of EME's currencies created higher incentive to borrow in foreign currencies. However, more effective government limited borrowing in foreign currencies during the QE period.
- Overall, since East Asian economies tend to have far better governance scores compared to other EMEs, they are less likely to have over-borrowed in foreign currencies.

The remainder of this paper is organized as follows. The next section reviews the literature on QE spillovers, the effectiveness of macroprudential and capital flow management policies, and governance and economic policy management more broadly. Section III lays out our empirical strategy. Section IV provides an overview of our data, and Section V discusses our empirical findings. Section VI concludes with policy implications.

II. Literature review

Our work is a part of the growing literature of managing financial stability risks associated with cross-border capital flows and the build-up of foreign credit against the backdrop of QE policies in the US and other major economies.

Quantitative easing and its spill-over effects

It is well established that QE policies in the major advanced economies created spill-over effects in EMEs. Chen et al. (2012), for instance, show that QE "influenced prices of a broad range of emerging market assets, raising equity prices, lowering government and corporate bond yields and compressing CDS spreads. ... the impact on emerging economies was in general stronger than that on the other advanced economies. In some economies, such as Hong Kong and Brazil, the expansionary impact of US quantitative easing was significant and associated with rapid credit growth and strong capital inflow, currency

appreciation and inflationary pressures." Likewise, Lavigne et al. (2014) documented that QE "put somewhat unwelcomed upward pressure on asset prices and exchange rates."

QE spillovers to EMEs, work through various channels[2]: (i) portfolio balancing channel: by compressing the term premium of long-duration assets (e.g. government bonds), the demand for alternative assets, including assets in EMEs, would increase; (ii) signaling channel: forward guidance have clearly played an important role in setting expectations that the Fed (or other central banks) will commit to QE. This will push down the risk-component of bond yields, which makes higher interest rates in EMEs more attractive. The importance of the signaling channel is evidenced by the acute financial instability in the world financial markets after Ben Bernanke's tapering talk in the end of May 2013; (iii) trade channel: on one hand, QE depreciated the dollar, which may have increased the demand for the US goods; on the other hand, QE underpinned domestic demand in the US (and other governments that adopted QE) so the net effect is unclear; and (iv) exchange rate channel: via the portfolio channel, capital outflows to EMEs occurred, and many EME currencies, especially the one of economies with strong economic fundamentals and/or flexible exchange rate, experienced the rapid surge in real appreciation of exchange rate.

Overall, QE spillovers have been a major policy challenge for many EMEs; while QEs underpinned economic growth in the aftermath of the GFC in the US, as well as rest of the world, thereby having contributed to stabilizing the world economy. However, they also put upward pressures on asset prices and economic activity in EMEs through various channels (Lavigne et al. 2014), in part raising concern about pro-cyclical overheating and financial instability.

Cross-border borrowing by EMEs and exchange rate

An important and still under-researched question relates to the effects of QE's spill-overs to EME's exchange rates, cross-border borrowing patterns, and policy responses by EME authorities to them. As Shin (2015) points out, the conventional view was that currency appreciation will have a contractionary effect on an economy because it will hurt exports and domestic output. However, in today's world of financial globalization, exchange rate appreciation in EME countries can be expansionary, as EMEs can borrow cheaply in local currency terms.[3] As shown in a model by Bruno and Shin (2015), an appreciation of the domestic currency strengthens the balance sheets of domestic borrowers, which reduces their credit risk and leads to increased bank lending capacity, and hence greater risk-taking by domestic banks. As a consequence, "a currency *appreciation* [may go] hand in hand with rapid credit growth and buoyant economic activity on the back of more permissive financial conditions" (Shin, 2015). The increase of leverage in the no-bank sector, however, may also lead to increasing financial vulnerabilities of the economy. The link between currency appreciation and domestic credit growth has been documented by Kaminsky and Reinhart (1999) and Reinhart and Reinhart (2009), among others. In a recent study, Hofmann et al. (2016) show empirically that EME currency appreciation against the US dollar is related to

[2] Lavigne et al. (2014)

[3] See also Blanchard et al. (2015). This underlines the argument of Borio and Zhu (2012), who coined the "risk-taking channel" of exchange rate changes, that is, the impact that exchange rate changes have on financial conditions.

a reduction in EME sovereign yields – which tends to prompt an increase in domestic bank lending – and increased inflows of portfolio investment.

But exchange rate appreciation also impacts on foreign currency borrowing, since foreign credit becomes cheaper in terms of domestic currency. This, again, creates risks as excessive foreign currency loans create currency mismatch problems when assets/revenue are in the local currency, which is typically the case. This paper specifically focuses on the effects of currency valuations on cross-border borrowing and lending, and how the government can alter the risks associated with sudden and huge capital inflows which cannot be justified by the economic fundamentals.

To deal with adverse effects of QE in advanced economies, many EMEs introduced various capital control and macroprudential measures in the aftermath of the GFC. There has been considerable debate as to their efficacy. For instance, Jinjarak et al. (2013) suggest that capital control measures had little impact in Brazil over the period 2008-2011, a conclusion that is rejected by Chamon and Garcia (2016). Forbes, et al. (2016a) find that changes to the tax on capital inflows imposed by Brazil from 2006 to 2013 affected portfolio allocations to Brazil, at the same causing externalities to other countries whose inflows increased or decreased as a consequence of an increase or reduction of Brazil's tax on foreign investment, respectively. They also claim that since capital restriction measures don't discriminate among different measures—they may hurt some lenders (such as small and medium-sized enterprises) who are actually in need of foreign money. They also argue that capital flow restrictions suffer from leakage, making MPPs a preferable option, as these are more targeted to the finance sector.

Macroprudential policy

One of the first study to summarize the literature related to macroprudential policy is Galati and Moessner (2013), who point out that the idea of macroprudential policy is old, but it was not really employed as central banks' regulatory toolkits until GFC. They stress the need to move from micro-prudential approach to more macro-level of financial regulation and supervision. This is also in line with Frankel (2015), who points out that the importance of macroprudential thinking, which is "whole of the financial system is more than the sum of the parts."

With the increasing use of macroprudential policies over recent years, there has also been a growing literature on the effectiveness of macroprudential policy and related efforts to construct macroprudential databases (e.g. Cerrutti et al. 2015; Bruno et al. forthcoming). The difference between capital flow management and macroprudential measures is that the former focus on cross-border flows, whereas the latter focus on domestic leverage. However, for small open economies, the overlap of those two policies is often wide – i.e., a macroprudential policy can also be a capital flow management if the measure is designed to limit foreign borrowing, especially in order to avoid a currency mismatch (overborrowing in foreign currencies).[4]

In the most comprehensive study to date, Cerutti et al. (2015) comprise a dataset which covers various macroprudential policies to counter financial cycles for 119 countries over the period 2000-2013. They

[4] Korinek and Sandri (2016) argue that policymakers should utilize a combination of macroprudential regulation and capital control measures to "make the economy more stable and reduce the incidence and severity of crises."

find that using macroprudential policies are "generally associated with reductions in the growth rate in credit, with a weaker association in more developed and more financially open economies". However, they also find that "using [macroprudential] policies can be associated with relatively greater cross-border borrowing" (Cerutti et al. 2015). Forbes et al. (2015), who use data on weekly changes in capital controls and macroprudential measures related to international exposures for 60 countries over the period 2009 to 2011, find that "macroprudential measures can significantly reduce some measures of financial fragility" while "other key targets ... such as exchange rates, capital flows, interest-rate differentials, inflation, equity indices, and different volatilities" are not significantly affected.

In summary of the theoretical and empirical literature, Galati and Moessner (2014) describe the theoretical work on macroprudential policy as still being in its infancy and providing only limited guidance, whereas the empirical evidence is still weak. There are several problems to incorporate macroprudential measures into empirical context: (i) numerating policy measures: since macroprudential policy includes many measures (including, for instance, loan to value ratios, debt to income ratios, central bank discount rates) which can be employed to different degrees and enforced in different manners, making it difficult to draw general conclusions; (ii) endogeneity: macroprudential policies are implemented to respond to financial institution's behavior; (iii) regulatory arbitrage; since macroprudential policy is the "new kid on the block", it lacks international coordination. Reinhardt and Sowerbutts (2015) find evidence of regulatory arbitrage, i.e., when home authority takes macroprudential policy action, borrowing from foreign banks by no-bank sector increases.[5] Against this backdrop, Engel (2015) stresses the importance of international coordination in macroprudential policies. Overall, effectiveness seems to be tool-specific, time-specific and country-specific, and there is no strong general consensus on the efficacy of macroprudential policy as such.

III. Empirical approach

We proceed in two steps. In the first step we investigate the effect of global liquidity (especially the Fed's balance sheet) on exchange rates of EMEs. In the second step we check if overvaluation led to more foreign borrowing, and if capital flow management, macroprudential policies, and good governance played some role in curbing potentially excessive foreign currency borrowing during the QE period.

QE-related capital inflows and exchange rate

In the first set of regressions, we examine the effect of global liquidity on EME currency valuations. We include various measures of global liquidity (explained in the next section) in addition to the "usual suspect" of exchange rate determinants – inflation, interest rates, capital account balance per GDP and growth. We run different specifications for all EMEs for the entire sample. Our panel regression is as follows:

[5] In contrast, Forbes at al. (2016b) find that an increased use of microprudential capital requirements tends to reduce cross-border lending and the interaction with unconventionally monetary policy amplifies this effect, which may explain the recent decline in cross-border bank lending, or "de-globalization" as they call it.

$$Overval_{i,t} = \alpha + \beta_1 GloabLiq_{i,t-1} + \beta_2 \boldsymbol{X_{i,t-1}} + \delta_t + \varepsilon_{i,t} [1],$$

where *Overval*, the dependent variable, represents different measures of exchange rate appreciation or overvaluation; *GlobalLiq* represents global liquidity defined as (i) the total asset of the Fed system; (ii) global liquidity indicator by BIS; and (iii) QE dummy which takes value of one during 2008-2014 and zero otherwise. **X** is a matrix of various macroeconomic conditions (inflation, business cycle, current account balance per GDP), δ is year fixed effect[6], and ε is an error term. We use a clustered standard deviation on the country level to control for heterogeneity across different countries. With expect to have positive impacts on exchange rate in EMEs and valuation.

Overvaluation and cross-border borrowing

In the second set of regressions, we test (i) if overvaluation leads to more cross-border borrowing in foreign currencies (mostly in the dollar) by no-bank sector; and (ii) how institutional factors, macroprudential policies and capital openness affects cross-border borrowing in foreign currencies by EME no-bank sector. Specifically, we estimate how the overvaluation, governance, and MPI (and its sub-indices) relate to the country's (EME only) cross-border borrowing in foreign currencies in the no-bank sector in foreign currencies.

Our baseline estimation is as follows.

$$\mathrm{Y}_{i,t} = \alpha + \beta_1 \mathrm{Y}_{i,t-1} + \beta_2 Overval_{i,t-1} + \beta_3 Gov_{i,t-1} + \beta_4 Overval_{i,t-1} * Gov_{i,t-1} + \beta_4 \boldsymbol{X_{i,t-1}} + \delta_t + \varepsilon_{i,t} \quad [2]$$

Where Y is the annual change in a country's cross-border bank borrowing in foreign currencies (by no-bank sectors) from BIS reporting banks (exchange rate valuation change adjusted). Our explanatory variables and expected signs are: *Overval* (LC/$ divided by PPP conversion factor, expected sign: +), *Gov* (Governance, +), the cross term captures how governance and overvaluation interacts (expected sign -, as the good governance would avoid overborrowing, especially in the backdrop of QE spill-overs, in foreign currencies in order to avoid a potential currency mismatch), δ represents year fixed effects, which captures that time-varying economic conditions and unobservable factors like confidence and crisis, and ε is an error term which is assumed to be well-behaved. **X** is a matrix of macroeconomic conditions (growth, current account balance per GDP, financial depth, capital openness, and systemic banking crisis as defined by Laeven and Valencia, 2012., expected sign: -). We use clustered standard errors by the country level, in order to control for the time-invariant differences in country's economic policy, i.e., our panel data is nested within clusters at the country level. In addition to Governance, we run additional regression using a measure for macroprudential policy, *MPIFX*:

$$\mathrm{Y}_{i,t} = \alpha + \beta_1 \mathrm{Y}_{i,t-1} + \beta_2 Overval_{i,t-1} + \beta_3 MPIFX_{i,t-1} + \beta_4 Overval_{i,t-1} * MPIFX_{i,t-1} + \beta_5 \boldsymbol{X_{i,t-1}} + \delta_t + \varepsilon_{i,t} \quad [3]$$

[6] The appendix shows the list of variable and their sources.

IV. Data

Our sample comprises 193 developing and advanced countries and covers the period 2000-2014, although data is not available for all variables and all countries for the entire period. To control for a major change in monetary policy and investment climate before and after the GFC, we divide the sample into two subsamples (2000-2006; 2008-2014), in addition to looking at the entire sample. In the following, we briefly discuss our key variables. An overview of all variables and their sources is given in the Appendix.

Measure of overvaluation and exchange rate appreciation

We use two measures of exchange rate overvaluation/appreciation as the dependent variable: First, we use an overvaluation measure calculated as local currency per dollar divided by PPP conversion ratio (source: World Banks' World Development Indicators, WDI). We also use the changes to the real effective exchange rate (REER) from the WDI.

Measure of cross-border borrowing

For cross-border bank borrowing, we use confidential version of BIS locational banking statistics. This dataset contains many kinds of borrowing, but we use annual changes of net cross-border borrowing in foreign currencies by no-bank sectors adjusted for exchange rate valuation.

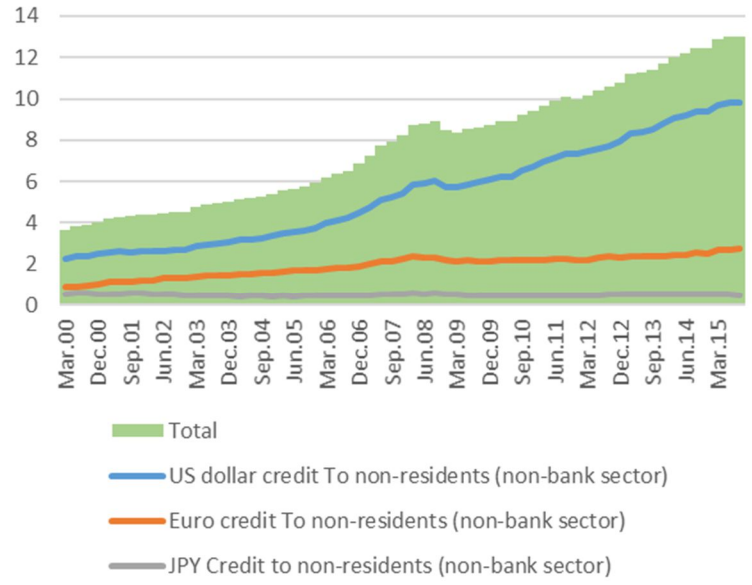
Global liquidity

Global liquidity is defined by "ease of finance" by the BIS (BIS, 2011). Specifically, it is the aggregate of credit outstanding by global banks[7]. The global liquidity measure by currency-break down is presented in Figure 1. As can be seen, the correlation with USD global credit to the no-bank sector is very high (0.998), indicating US QE can explain the most part of global liquidity during the QE periods. We hence consider the total asset of the Fed system the best indicator of QE-related global liquidity[8].

We use two liquidity measures to examine the effect of QE policies: (i) a measure of global liquidity taken from the BIS global liquidity condition database; (ii) the total asset of the Fed system (US): the measure is the most direct measure of the size of QE - Figure 2 shows the total assets held by the Fed. The start of QE1 (Nov 2008) and the end of QE3 (Oct 2014) are clearly defined[9]; and (iii) QE dummy which takes the value of one when US QE was implemented (2008-2014) and zero otherwise.

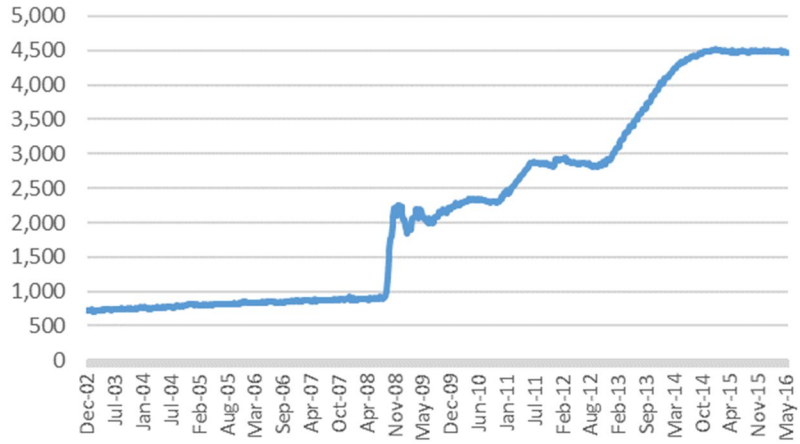
[7] See for detail the BIS website https://www.bis.org/statistics/gli.htm?m=6%7C333 (Retrieved on June 14, 2016)
[8] The reason why we did not include QEs of the Eurozone, the UK, and Japan is follows. Since Europe did not start QE until 2015, and the total of UKs' QE operation is about 10% of the US (Q1-Q3) in its size, and the nature and history of Japan's QE is very different from others.
[9] For the detailed timeline of the US unconventional monetary policy, see Appendix I

Figure 1: Global credit by currency (bank credit to non-residence, no-bank sector, trillion US dollar)



Source: BIS Global liquidity database.

Figure 2: Total asset of the Federal Reserve (in billions of US$)



Source: The Board of Governors of Federal Reserve System

Macroprudential measures

We use three measures of the macroprudential policy index. In addition to the aggregate macroprudential index (MPI) constructed by Cerutti et al. (2015), which is the sum of various macroprudential measures (such as loan to value ratio, debt to income ratio, etc.), each of which is expressed in a binary manner (1 when implemented; 0 otherwise). Along with this aggregated number, we use a foreign-currency exposure targeted MPI measure (which is one component of the index, also binary) to account for the

findings of Bruno et al. (forthcoming) that EMEs tend to use the macroprudential policy targeted at foreign currency exposure. One advantage of their database, which is based on an IMF survey on Global Macroprudential Policy Instruments, is that it has the widest coverage with 119 countries over the period 2000-2013 (we make an assumption that the MPI in 2014 is the same as the one in 2013). We also use the dataset constructed by Bruno et al. (forthcoming), which covers about 60 countries for the period 1990-2011.[10]

Governance

Given the limitation of quantifying macroprudential policy especially in terms of its scope, reach and strength of the enforcement, we also employ broader measures of governance as a proxy for macroprudential policies. The idea is as follows: if the government is efficient or prudent, respects the rule of law, and enforces it efficiently, it would put the lid on overborrowing on foreign currency by no-bank sectors in order to avoid a potential currency mismatch problem. There is indeed growing literature that establishes a strong nexus between institutional quality and the (pro- or anti-) cyclicality of monetary and fiscal policies in developing and emerging economies: Duncan (2014), based on a sample of 56 advanced and developing countries, suggests a "linkage among the quality of institutions, the cyclicality of monetary policy, and the volatility of output and the nominal interest rate." Similarly, Calderón et al. (forthcoming) find that "[c]ountries with strong institutions adopt countercyclical macroeconomic policies, reflected in extended monetary policy and fiscal policy rules." A recent study by Adigozalov and Rahimov (2015) on transition economies finds that "the quality of institutions plays a significant role in their ability to carry out counter-cyclical macroeconomic policy."

There are various governance indicators, often employed for political economy and economic growth studies.[11] The major ones include the Democracy Index by Transparency International, International Country Risk Group's ICR index, and the World Bank's Ease of Doing Business/Governance index. In our analysis, use of government effectiveness, which we consider the most relevant to the proper management of monetary policy (definition is "the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies."[12])

Capital openness

In our model, we use capital openness measure of Chinn-Ito (2006) which covers 182 countries. There are several capital openness measures, such as Quinn's openness measure (2003), Heritage Foundation's financial openness measure, and more recently, Fernández et al. (2015) created a more detailed measure of capital openness, which also separates inflow and outflows. Of these, we use Chinn-Ito's capital openness measure, because (i) Fernández et al. (2015) covers only 100 countries, as opposed to 182

[10] The novelty of the MPI measure of Bruno et al. (2015) is that they also take into account a "loosening" measure, in addition to the tightening measure (tightening measure is +1, the loosening measure is -1, neutral measure is zero). The original index is a monthly frequency, so we simply summed them up to get annual numbers.

[11] Unfortunately, to the best of our knowledge, there is no central bank governance index to cover the wide range of countries, although the BIS recently started to measure central bank governance for limited number of countries (not available to public). See Central Bank Governance Forum: http://www.bis.org/cbgov/

[12] For details, please refer to http://info.worldbank.org/governance/wgi/index.aspx#home (retrieved on June 13, 2016)

countries of Chinn-Ito; (ii) Chinn-Ito's measure is based on a Principal Component Analysis of coding of major categories of the IMF's AREAER (Annual Report of Exchange Rate Arrangements and Exchange Rate Restriction's) database, thus is more objective; on the other hand, Quinn's measure is based on the qualitative assessment of texts of AREAER related to capital and current account restrictions, argumented by other information (if a country entered international agreements such as OECD and EU). On the top of that, Quinn's measure is not publicly available, although it is updated to 2015[13].

V. Results

QE-related capital inflows and EME's exchange rates

Table 1 shows the estimation results on the effect of QE on EME's exchange rates.

When we take *Overvaluation* as a dependent variable, the QE dummies, BIS global liquidity measure, and Fed's assets are all positive and highly significant, suggesting that QE policies did indeed exert upward pressure on EME's currency valuation, thus justifying claims by policymakers of EMEs that QE spill-over is overheating their asset prices, which includes exchange rate.

For *REER*, the coefficients are (except one specification) of the expected sign but statistical significance is weak. The reason why the specifications with changes in the REER as the dependent variable are mostly insignificant is probably that it is an indexed number, so we can trace the change over-time, however cross-country comparison and judgement on valuation analysis cannot be done. In addition, REER is weighted by trade partners' currency, and all too often it does not necessarily coincide with the actual purchasing power of the currency, especially for financial transactions (i.e. African countries trade a lot among themselves, but they settle the trade using the US dollar, the Euro, etc., and when they do financial transactions, they also those currencies)

[13] Authors thank Dennis Quinn for kindly sharing the data with us.

Table 1: Determinants of EME's exchange rate during the period of QE (2008-2014)

	Overvaluation+					Change in real effective exchange rate				
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
QE Dummy	0.0323***		0.0346***			0.413***		0.0469		
	(0.00176)		(0.00398)			(0.109)		(0.0878)		
Global Liquidity		0.210***		0.208***			1.187*		-1.107	
		(0.0125)		(0.0204)			(0.495)		(0.797)	
Log(Total Fed Assest)					0.289***					1.815
					(0.0340)					(1.804)
Inflation			-0.00635**	-0.00284	-0.000247*			0.167*	0.152	0.154
			(0.00194)	(0.00301)	(0.000111)			(0.0821)	(0.0889)	(0.215)
Nominal interest rate			-0.00305	-0.00230	-0.00213*			-0.119	-0.154	-0.358
			(0.00446)	(0.00502)	(0.000841)			(0.122)	(0.119)	(0.386)
CA balance per GDP			-0.000062	-0.000271	0.000383			-0.0648	-0.0807*	-0.133
			(0.00189)	(0.00144)	(0.00176)			(0.0387)	(0.0399)	(0.122)
Cyclical component			0.710**	1.401***	1.189***			11.10	13.11	81.33
			(0.249)	(0.178)	(0.328)			(9.312)	(8.740)	(83.94)
Chi-Square	339.010	280.880	281.500	290.510	195.140	14.410	5.750	10.040	18.070	5.860
Prob>Chi2	0.000	0.000	0.000	0.000	0.000	0.000	1.165	0.047	0.003	0.320
R-square (overall)	0.150	0.134	0.268	0.253	0.268	0.046	0.008	0.045	0.057	0.003
# of observations	1794	1794	525	525	707	806	806	274	274	417

Standard errors in parentheses

Constant terms are not reported

+ overvaluation is defined as nominal exchange rate (LC/$) divided by PPP conversion factor

***, **, * denotes statistical significance of 1, 5 and 10% respectively.

Sample Period 2001-2014

Country fixed-effect panel regression with clustered standard errors at the country level

QE Dummy is set to 1 for all sample countries between 2008 and 2014, zero otherwise

Cyclical component is calculated using HP filter (λ = 6.25)

Overvaluation and cross-border borrowing

Table 2 shows the estimation results for the regressions using net cross-border no-bank sector borrowing as a dependent variable. The first three columns cover the entire period, whereas the second and third sets cover before and after the GFC, respectively. The panel regressions are run with year fixed effects and clustered standard errors to control for the correlation in error terms by country level.

Looking at the entire period ([1] – [3]), the results are of expected signs with statistical significance in most cases. Net bank lending in foreign currencies is pro-cyclical and has a negative relationship with the current account (i.e. countries with current account surplus means they have a financial account deficit – they do not have to borrow). Most importantly, the three variables of interest (the shadowed part) – overvaluation, government effectiveness and the cross-term of the two, are all of expected signs and statistically significance, except overvaluation and the cross-term in the first estimation, which is borderline significant. This indicates that: (i) countries that have their currencies overvalued tend to borrow in foreign currencies; (ii) countries with good governance receive more bank lending, clearly because banks prefer to lend to countries with good governance; (iii) the coefficient of cross-term is negative, indicating that more effective government would dampen bank borrowing in foreign currencies caused by overvaluation, in order to avoid excessive leveraging and a currency mismatch problem. However, these results seem to be driven by post-GFC observations: in the pre-GFC period (results [4]-[6]), while coefficients on overvaluation are of correct signs, significance is very low and the coefficients interaction terms are positive, thus the capital was flowing out from EMEs to advanced countries during this period ("Lucas Paradox").

After the GFC ([7]- [9]), overvaluation and their cross term with government effectiveness is of the right sign, thus supporting our hypothesis that effective governments take precautionary measures to avoid overborrowing in foreign currencies. However, government effectiveness has a negative sign. Since is it not logical to assume that banks avoided lending to countries with bad governance, we can interpret that effective governments were being very cautious against foreign borrowing and took actions even without currency overvaluation. In addition, given that Asia has a significantly higher governance indicator compared to other EMEs, it is conceivable that governments in the region took appropriate measures to dampen the excessive foreign currency bank lending.

Finally, the interpretation of continuous-continuous cross-terms requires caution, as the level, sign and statistical significance of one variable may change when the over variable changes. In Figure 3, we drew estimates with 95% confidence intervals, which shows the sign, level and statistical significance of government effectiveness under the different degrees of exchange rate overvaluation. The third graph (after GFC) confirms that our story holds at most levels of overvaluation, as the 95% confidence interval is falls above/below zero. The pre-crisis period shows an opposite result (positive slope), but is statistically significant at overvaluation, indicating that overvaluation and good governance was interacting positively, perhaps because of the reason mentioned above. Since these two periods have opposite results, a graph of the entire period is clearly a mix of these two opposite effects, so it does not give us much information.

Table 2: Determinants of the annual change cross-border bank borrowing in foreign currency

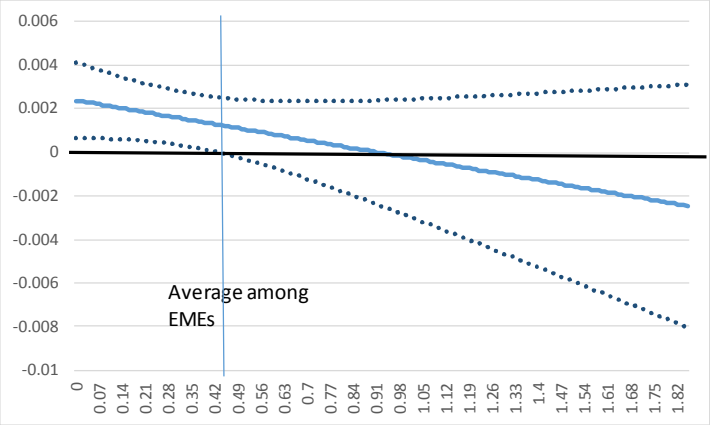
Sample countries: non-OECD countries, excluding tax-haven jurisdictions defined by the OECD.

	Entire Period			Before GFC (2000-2006)			After GFC (2008-2014)		
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
Lagged Y	0.135	0.156	0.156	0.146	0.160	0.156	0.0621	0.0963	0.0999
	(0.0923)	(0.0855)	(0.0858)	(0.132)	(0.123)	(0.122)	(0.108)	(0.101)	(0.102)
Overvaluation (1 lag)	0.00207	0.00505**	0.00497**	0.00386	0.00623	0.00620	0.00326*	0.00503***	0.00526***
	(0.00180)	(0.00192)	(0.00189)	(0.00389)	(0.00337)	(0.00338)	(0.00142)	(0.00119)	(0.00119)
World Bank Govt Effectiveness (1 lag)	0.00311**	0.00249**	0.00255**	0.00128	-0.00120	-0.00107	-0.00184	-0.00122	-0.00123
	(0.00111)	(0.000894)	(0.000798)	(0.00195)	(0.00152)	(0.00154)	(0.00195)	(0.00170)	(0.00167)
Cross Term (Overvaluation and Governmnet effectiveness), 1 lag	-0.00381	-0.00363*	-0.00339*	0.00150	0.00618*	0.00619*	-0.00525*	-0.00985***	-0.00943***
	(0.00201)	(0.00166)	(0.00159)	(0.00521)	(0.00277)	(0.00276)	(0.00260)	(0.00185)	(0.00186)
Capital openness, (Chinn-Ito) 1 lag	-0.000180	0.000721		0.000272	0.000464		-0.000204	0.00155	
	(0.000550)	(0.000743)		(0.00106)	(0.00110)		(0.000825)	(0.00121)	
Financla depth (Credit per GDP), 1 lag	-0.00000468	-0.00000757	-0.0000103	-0.00000751	0.00000578	0.00000470	0.00000599	0.00000146	-0.00000543
	(0.00000794)	(0.0000105)	(0.0000111)	(0.0000175)	(0.0000162)	(0.0000160)	(0.00000973)	(0.00000961)	(0.00000909)
Current account per GDP (1 lag)	-0.000105***	-0.0000955**	-0.0000880**	-0.000109	-0.000101	-0.0000935	-0.0000924**	-0.0000891**	-0.0000788**
	(0.0000311)	(0.0000345)	(0.0000292)	(0.0000699)	(0.0000784)	(0.0000651)	(0.0000289)	(0.0000322)	(0.0000265)
HP_Cycle (1 lag)	0.0139***			0.00497			0.0182**		
	(0.00399)			(0.00507)			(0.00587)		
Growth average of past 5 years		0.000231*	0.000222*		0.0000385	0.0000354		0.000385**	0.000351**
		(0.0000957)	(0.0000877)		(0.000102)	(0.0000996)		(0.000147)	(0.000131)
Systemic banking crisis (1 lag)	-0.00357	-0.00348	-0.00352	-0.00517	-0.00505	-0.00506	-0.0000125	0.00141	0.00128
	(0.00268)	(0.00261)	(0.00260)	(0.00316)	(0.00313)	(0.00313)	(0.00406)	(0.00399)	(0.00394)
R-square	0.07	0.07	0.06	0.084	0.12	0.12	0.04	0.07	0.07
Wald chi square	63.13	54.57	54.91	N/A	N/A	N/A	N/A	N/A	N/A
Prob>Chi2	0.000000	0.0002	0.0001	N/A	N/A	N/A	N/A	N/A	N/A
N	1396	1382	1408	632	617	623	668	669	688

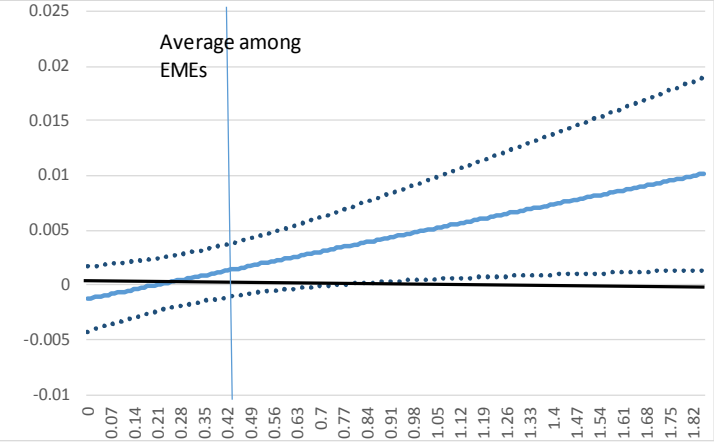
Figure 3: Interaction term's level and significance

The impact of government effectiveness on net cross-border FX borrowing at different levels of currency valuation (dotted lines denote 95% confidence interval)

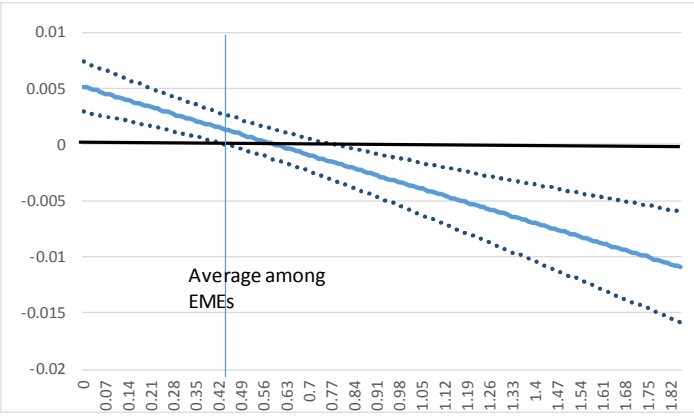
Entire period



Before GFC



After GFC



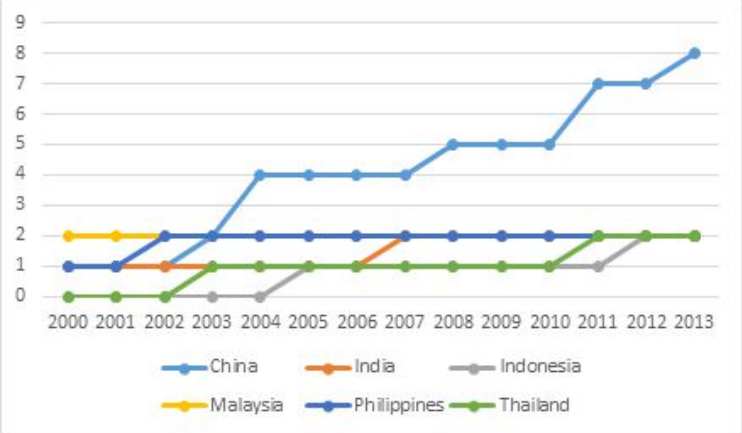
Macroprudential policy's effect on foreign currency borrowing

Despite some of the limitations of MPI, previously discussed, we replace the governance indicator with three measures of MPIs (Cerutti et al.'s MPI aggregate, MPI foreign currency borrowing targeted, Bruno et al.'s MPI (Bruno et al., forthcoming)) in order to see how it works in our model, as discussed above. The results are shown in Table 3. As expected, while statistical significance is low, MPI *after the GFC* has negative coefficients throughout different measures of the MPI. Notably, with Bruno et al.'s measure, they are negative throughout the entire sample period. This indicates that macroprudential policy (as defined by Bruno et al., forthcoming) had a desired effect in curbing an excessive build-up of credit. These, however, must be taken with a pinch of salt, as the statistical significance is weak. This requires more detailed country-by-country observation, which is the beyond the scope of this paper. Table 5 shows Cerutti et al. (2015)'s MPI taken by our sample of Asian countries. It seems that China has rapidly implemented various macroprudential tools since 2002, probably in order to address rapid accumulation of debt, independent of QE.

Analysis of Asian economies

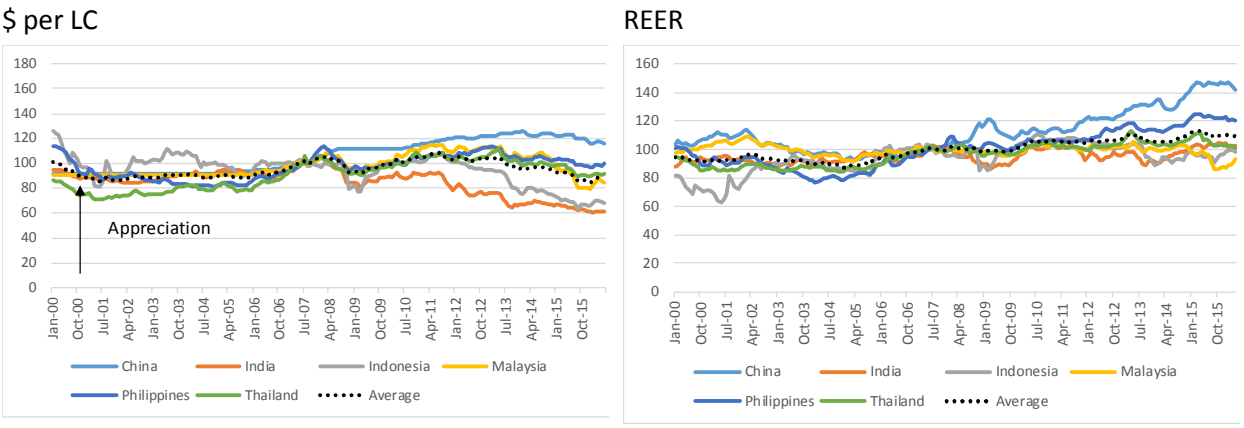
Since our interest is East Asian economies, we conduct regression analysis of the baseline East Asian countries, which are: China, India, Indonesia, Korea, Malaysia, Philippines and Thailand (the reason why Hong Kong and Singapore are not included in the sample is because they are tax-haven jurisdictions according to the OECD). This small sample size makes the statistical significance lower than the entire sample. However, the specification [6] (after GFC specification) governance and their cross-term are of the expected sign and with statistical significance. Overvaluation is negative and significant, but currencies of these economies did not show much overvaluation (except for China) even during the QE episode (Figure 5), which is a stark contrast to Latin American countries (not reported). This may be related to exchange rate policy; the importance of exchange rate valuation for international borrowing implies the importance of exchange rate management as a part of the policy toolbox.

Figure 4: Cerutti et al.(2015)'s Macroprudential Index of selected Asian countries



The aggregate of different 18 macroprudential measures (LTV, DTI, etc.)implemented.
Source: Cerutti et al. (2015)

Figure 5: Exchange rates of selected Asian countries (indexed: average of 2007=100)



Source: Authors' calculation based on data from Pacific Exchange Service, BIS

Table 3: Determinants of the annual change cross-border bank borrowing in foreign currency (with MPI)

	Cerutti's MPI (aggregate)			**Cerutti's MPI (FX borrowing targeted)**			**Bruno and Shim (2015) MPI+**		
	Entire period	Before GFC	After GFC	Entire period	Before GFC	After GFC	Entire period	Before GFC	After GFC
Lagged Y	0.422***	0.459***	0.346**	0.422***	0.463***	0.347**	0.267	0.376**	0.0899
	(0.0759)	(0.0717)	(0.105)	(0.0759)	(0.0700)	(0.107)	(0.188)	(0.143)	(0.201)
Overvaluation (1 lag)	0.00362	0.0146**	-0.00996*	0.00386	0.0121*	-0.00842	0.0000339	0.00709	-0.00929*
	(0.00209)	(0.00514)	(0.00505)	(0.00252)	(0.00539)	(0.00586)	(0.00381)	(0.00642)	(0.00407)
MPI, 1 lag	0.000255	0.00127	**-0.000674**	0.000292	0.000800	**-0.000372**	**-0.000403**	**-0.000150**	**-0.000677**
	(0.000365)	(0.000800)	**(0.000545)**	(0.000510)	(0.000942)	**(0.000964)**	**(0.00129)**	**(0.000817)**	**(0.00110)**
Cross Term (Overvaluation and MPI), 1 lag	-0.000551	-0.00450	0.00195	-0.000757	-0.00291	0.00129	0.000907	-0.00217	0.00182
	(0.000856)	(0.00243)	(0.00130)	(0.00123)	(0.00306)	(0.00225)	(0.00273)	(0.00174)	(0.00193)
Capital openness (Chinn-Ito), 1 lag	0.00140	0.00210	0.000500	0.00135	0.00209	0.000661	0.00292	-0.00205	0.00557
	(0.00102)	(0.00168)	(0.00144)	(0.000994)	(0.00166)	(0.00146)	(0.00318)	(0.00338)	(0.00607)
Financial depth (credit per GDP), 1 lag	-0.00000867	0.0000255	-0.0000116	-0.00000911	0.0000227	-0.00000888	-0.0000616*	0.00000204	-0.0000277
	(0.0000102)	(0.0000170)	(0.0000107)	(0.0000103)	(0.0000183)	(0.0000117)	(0.0000279)	(0.0000192)	(0.0000252)
Current account per GDP, 1 lag	-0.0000905*	-0.000153*	-0.0000650	-0.0000901*	-0.000156*	-0.0000599	-0.000185	-0.000552	-0.000228
	(0.0000357)	(0.0000685)	(0.0000335)	(0.0000353)	(0.0000685)	(0.0000333)	(0.000222)	(0.000295)	(0.000160)
Growth of past 5 years	0.000298*	0.000237	0.000146	0.000298*	0.000237	0.000163	0.000187	-0.000135	0.000157
	(0.000138)	(0.000151)	(0.000145)	(0.000140)	(0.000149)	(0.000150)	(0.000227)	(0.000144)	(0.000798)
Systemic Banking Crisis, 1 lag	-0.00397	-0.00473	0.0000882	-0.00402	-0.00469	-0.000251	-0.000883	0.00154	-0.00164
	(0.00371)	(0.00424)	(0.00441)	(0.00372)	(0.00424)	(0.00445)	(0.00311)	(0.00262)	(0.00756)
R-square	860	360	437	391	360	437	206	104	88
# of Obs	0.23	0.31	0.21	0.23	0.30	0.21	0.26	0.42	0.17

+Sample period for Bruno and Shim specification ([7]-[9]) 1990-2011

Year fixed effects, country-level clustered standard errors; Standard errors are in parenthesis;

***, **, * denotes statistical significance at 1, 5 and 10% level, respectively.

Table 4: Determinants of the annual change cross-border bank borrowing in foreign currency (selected Asian countries)

Dep var. Cross-border borrowing in net term borrowing non bank sectors in lender's currency, annual change						
	Entire Sample		Before GFC		After GFC	
	[1]	[2]	[3]	[4]	[5]	[6]
Lagged Y	-0.150	-0.154	0.490*	0.551*	-0.569***	-0.599***
	(0.112)	(0.116)	(0.219)	(0.253)	(0.0340)	(0.0521)
Capital openness, (Chinn-Ito)		0.00197		0.00656		0.00382
		(0.00142)		(0.00461)		(0.00205)
Overvaluation (1 lag)	-0.00106	0.000405	0.00266	0.0121	0.00524	**0.00605***
	(0.00405)	(0.00427)	(0.0105)	(0.0147)	(0.00308)	**(0.00275)**
World Bank Govt Effectiveness (1 lag)	-0.00174	-0.000889	0.00129	0.00463	0.00326	**0.00607*****
	(0.00209)	(0.00243)	(0.00472)	(0.00619)	(0.00184)	**(0.00163)**
Cross Term (Overvaluation and Governmnet effectiveness), 1 lag	0.00413	0.00181	-0.00261	-0.0140	-0.00434	**-0.00998****
	(0.00405)	(0.00520)	(0.0134)	(0.0192)	(0.00339)	**(0.00382)**
Financla depth (Credit per GDP), 1 lag	0.000000906	0.00000175	-0.0000130	-0.0000191	0.00000440	0.0000116**
	(0.00000849)	(0.00000810)	(0.0000226)	(0.0000199)	(0.00000609)	(0.00000392)
Current account per GDP (1 lag)	-0.000149	-0.000162	-0.000253	-0.000265	-0.000230**	-0.000286***
	(0.000106)	(0.000107)	(0.000242)	(0.000236)	(0.0000759)	(0.0000593)
Growth average of past 5 years	0.000278	0.000336	0.000125	0.000315	0.000502**	0.000653***
	(0.000199)	(0.000174)	(0.000392)	(0.000301)	(0.000178)	(0.000158)
Systemic banking crisis (1 lag)	0.00236	0.00340	-0.000212	0.00306		
	(0.00355)	(0.00308)	(0.00637)	(0.00439)		
R-square	0.3024	0.31	0.46	0.47	0.46	0.49
N	104	104	48	48	49	49

Standard errors in parentheses
Year fixed effect, country-level clustered standard error
***, **, * denotes stastistial significant of 1, 5 and 10% level.

VI. Conclusions

We find that, after the GFC, or QE period –the landscape of cross-border bank borrowing of no-banking sector in EMEs changed significantly. First, the US' QE made valuation of EME currencies higher, and increased the possibility of overvaluation. This overvaluation, in turn, gave more incentives to no-bank sectors in EMEs to borrow in foreign currencies. However, effective governance clearly took effort to dampen the foreign currency borrowing in order to avoid unwanted consequences such as currency mismatch and sudden stops. We found some, albeit weak, evidence that macroprudential policy did dampen the excessive bank lending during QE period. Also, in East Asia, although there is not much significant appreciation perhaps because of exchange rate management, there is an indication that effective governance and overvaluation interact negatively, thus suggesting that government was acting against overborrowing in FX currencies. Combined with our earlier result, this indicates that macroprudential policies, and/or capital flow management policy, need to be effectively enforced.

Also, regarding East Asian countries, our results indicate that, as much as the reversal of US monetary policy was a concern for many EMEs, a full-brown financial crisis as a switch of the monetary policy cycle in the US is unlikely, because of high government efficiencies of Asia compared to other EMEs (Table 5). Graph 6 shows gross and net capital inflows of our sample countries. Note that China's net capital flow (scale is on the right) has been negative and increasing in absolutely term since the data has been available (2004), but this does not seem to be related with the US policy; rather, it is capital outflows as a result of liberalization of capital restrictions. Overall, we cannot observe reversal of capital inflow flows in our sample East Asian countries, both in gross and net terms.

Table 5: World Bank Government Efficiency Indicator, by region (period: 1996, 1998, 2000-2014)

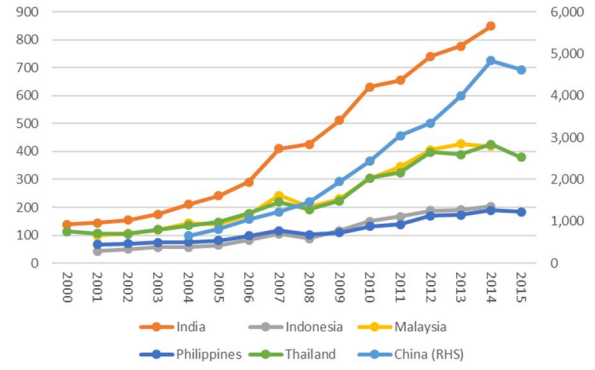
		Mean	st.dev	Mix	Max
By region	Baseline Asia	0.68	0.87	-0.6	2.43
	Latin America	-0.03	0.67	-2.03	1.6
	Middle East and North Africa	-0.18	0.74	-1.95	1.48
	Sub-Saharan Africa	-0.68	0.64	-2.13	1.29
	EMEs total	-0.27	0.79	-2.32	2.43
Baseline Asia	China	0.03	0.09	-0.09	0.19
	India	-0.07	0.08	-0.19	0.11
	Indonesia	-0.31	0.08	-0.45	-0.2
	Malaysia	1.10	0.08	0.99	1.25
	Philippines	-0.02	0.09	-0.20	0.08
	Thailand	0.29	0.09	0.19	0.43
Other Asia	Hong Kong	1.70	0.17	1.3	1.9
	Singapore	2.14	0.16	1.85	2.43
	Japan	1.39	0.15	1.07	1.59

*Baseline Asia = China, India, Indonesia, Malaysia, Philippines, Thailand

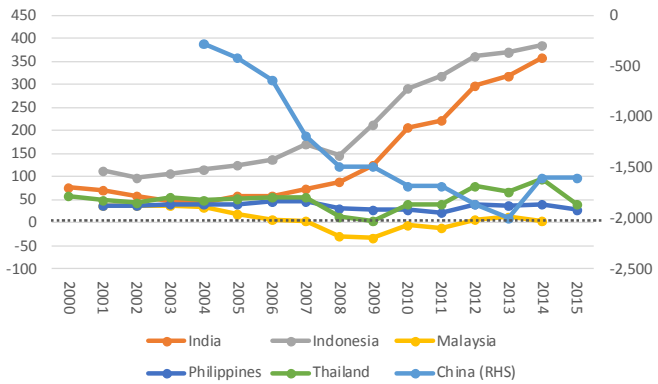
Source: Authors' calculation based on World Bank's Governance Indicators

Graph 6: Liability position (from IIP), Gross and Net

Gross liability position
(billions of US $) *note China's scale is on RHS.



Net liability position (liability minus asset)
(billions of US $)



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Appendix: Variables used and their sources

Variable	Source
Chinn-Ito Capital Account Openness Index	Chinn-Ito (2006)
Current account balance per GDP	World Bank WDI
Cyclical component using HP filter	Calculation by authors based on IMF-WEO
Exchange rate LC/$	World Bank WDI, Pacific Exchange Rate Service
Financial depth (credit per GDP)	World Bank WDI
GDP annual growth, 5 years average	Calculation by authors based on World Bank WDI
Global liquidity	BIS global liquidity database
Government Effectiveness	Governance Indicators, the World Bank
MPI (Macroprudential Policy Indices)	Cerutti et al. (2015)
MPI targeted at foreign currency borrowing	Cerutti et al. (2015)
MPI-BIS	Bruno et al. (forthcoming)
The total asset of the Fed system	FRB
Net cross-border borrowing by non financial sector	BIS Locational Banking Statistics
Nominal effective exchange rate	BIS (monthly), World Bank (annual)
Overvaluation (LC/$, divided by PPP conversion factor)	The World Bank WDI
Real effective exchange rate (REER)	BIS (monthly), World Bank (annual)
Systemic Banking Crisis	Laeven and Valencia (2012)