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Global liquidity and exchange market pressure in emerging market economies

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Non-technical summary

Research Question

While there is ample empirical evidence suggesting that capital flows between advanced and emerging market economies are strongly affected by global factors such as liquidity conditions in advanced economies, evidence on the impact of global liquidity on emerging market currencies is scarce. Exchange rate analyses are impeded by the fact that most emerging market countries have not maintained fully flexible exchange rates over recent decades but intervened, at least temporarily, in the foreign exchange market.

Contribution

We account for the lack of exchange rate flexibility by analysing the impact of global liquidity on exchange market pressure, a concept that allows us to gauge the response of emerging market currencies to changes in global liquidity even in the presence of foreign exchange interventions. A panel data analysis is conducted based on 32 emerging market economies for a sample period from 1995 to 2015, thereby capturing different stages of the global financial cycle.

Results

Increases in global liquidity are robustly related to appreciation pressure on emerging market currencies, based on a large set of liquidity indicators and allowing for different definitions of exchange market pressure. The impact is restricted to periods of comparatively low stress in financial markets, however. In times of high volatility, when emerging market economies often face abrupt and pronounced currency depreciations, this effect vanishes. Our results imply that ample liquidity provision in advanced economies may contribute to a build-up of financial stability risks in emerging market economies during tranquil periods, while further liquidity injections will not immediately alleviate depreciation pressure on emerging market currencies in times of crisis.

Nichttechnische Zusammenfassung

Fragestellung

Während eine Reihe empirischer Untersuchungen zeigt, dass Kapitalflüsse zwischen fortgeschrittenen Volkswirtschaften und Schwellenländern in hohem Maße von globalen Faktoren wie den Liquiditätsbedingungen in den fortgeschrittenen Volkswirtschaften beeinflusst werden, gibt es bislang kaum empirische Evidenz darüber, wie sich Änderungen der globalen Liquidität auf die Währungen von Schwellenländern auswirken. Entsprechende Analysen werden dadurch erschwert, dass die Mehrheit der Schwellenländer über die letzten Jahrzehnte hinweg keine vollkommen flexiblen Wechselkurse zuließ, sondern zumindest phasenweise am Devisenmarkt intervenierte.

Beitrag

Um dennoch die Auswirkungen globaler Liquidität auf die Währungen von Schwellenländern abschätzen zu können, werden hier ihre Auswirkungen auf den sogenannten Wechselkursdruck analysiert. Der Wechselkursdruck ist ein zusammengesetzter Indikator, der unabhängig vom Wechselkursregime Auf- oder Abwertungsdruck auf eine Währung anzeigt. Zur Schätzung der Effekte wird eine Paneldatenanalyse auf Basis von 32 Schwellenländern für den Zeitraum 1995 bis 2015 durchgeführt. Der Untersuchungszeitraum deckt damit verschiedene Phasen des globalen Finanzzyklus ab.

Ergebnisse

Die empirischen Ergebnisse zeigen, dass ein Anstieg der globalen Liquidität mit Aufwertungsdruck auf Schwellenländerwährungen einhergeht. Dieses Resultat gilt für eine Vielzahl von Liquiditätsindikatoren und auf Basis verschiedener Definitionen des Wechselkursdrucks. Der Effekt ist jedoch auf Zeiten vergleichsweise geringer Anspannung an den Finanzmärkten begrenzt. In Zeiten hoher Anspannung, in denen Schwellenländerwährungen oft abrupt und stark abwerten, kann kein signifikanter Einfluss festgestellt werden. Somit kann eine großzügige Liquiditätsbereitstellung in fortgeschrittenen Volkswirtschaften in Zeiten normaler Finanzmarktbedingungen zu einem Anstieg der Risiken für die Finanzmarktstabilität in Schwellenländern führen, wohingegen zusätzliche Liquiditätsinjektionen in Krisenzeiten nicht unmittelbar dem Abwertungsdruck auf Schwellenländerwährungen entgegenwirken.

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Global Liquidity and Exchange Market Pressure in Emerging Market Economies*

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Abstract

We analyse the relationship between global liquidity and exchange market pressure in 32 emerging market economies. Exchange market pressure is a measure of excess currency demand that is applicable across different exchange rate regimes as it accounts for changes in exchange rates, foreign exchange reserves and, optionally, interest rates. Surges in monetary liquidity, credit provision, and short-term funding in advanced economies are shown to be robustly associated with appreciation pressure on emerging market currencies. The underlying transmission mechanism, however, only operates under regular financial market conditions: ample liquidity provision in advanced economies contributes to the build-up of financial stability risks in emerging market economies in tranquil times, but further liquidity injections do not avert the pronounced depreciation pressure on emerging market currencies in times of high market volatility.

Keywords: Global liquidity, emerging markets, exchange market pressure, search for yield, global financial cycle

JEL classification: F31, E51, E58, C23.

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1 Introduction

In 2012, Brazil's then president Dilma Rousseff accused Western economies of having caused a "monetary tsunami" affecting Brazil and other emerging market economies (EMEs) through their pursuit of aggressive expansionary monetary policies (Financial Times, 2012). She also defended the foreign exchange (FX) interventions of the Brazilian central bank aimed at mitigating the ensuing appreciation of the Brazilian real, which could otherwise have undermined Brazil's international price competitiveness in what has been dubbed a "currency war" (Eichengreen, 2013). Her statement reflects a general concern that the exceptionally accommodative monetary policy stance in advanced economies (AEs) could have negative side effects for EMEs resulting from excessive capital inflows. In fact, the evidence in Gourinchas and Obstfeld (2012) identifies domestic credit expansion and real currency appreciation as the most significant and robust predictors of financial crises.

Apart from compromising the international price competitiveness of EMEs, prolonged periods of loose monetary policy may raise the vulnerability of emerging market economies to capital flow reversals ("hot money"), placing their financial stability at risk once monetary policy in advanced economies returns to 'pre-crisis mode'. In fact, several EMEs experienced sizable capital inflow reversals and currency depreciations when, in May 2013, the Fed but described conditions under which it would want to scale back its asset purchases. In the wake of the announcement, the Brazilian real and Uruguayan peso, for instance, depreciated by more than 11% against the US dollar within three months (from end of April to end of July 2013).

The magnitude of that market reaction has revitalised research on the determinants of capital inflows to emerging market economies in general (Ahmed and Zlate, 2014) and on the impact of loose US monetary policy on EM economies in particular (among others, Bowman, Londono and Sapriza, 2015; Mohanty, 2014). Specifically for the role of monetary policy in advanced economies, the literature has identified three distinct – yet potentially reinforcing – transmission channels: a "carry-trade channel" (Brunnermeier, Nagel and Pedersen, 2008; Menkhoff, Sarno, Schmeling and Schrimpf, 2012) arising from the 'forward premium puzzle' in low-volatility markets, a "risk-taking channel" (Borio and Zhu, 2012; Bruno and Shin, 2015a) that operates through leverage in the banking sector, and a "funding-liquidity channel" (Adrian, Etula and Shin, 2015) resulting from time-varying and currency-specific risk factors.

While substantial efforts have been directed at examining the impact of monetary policy in advanced economies on *capital flows* to emerging market economies, evidence on the role of broader concepts of global liquidity (e.g. the global monetary stance) for EM *exchange rates* is surprisingly scarce. A particular challenge arises from the fact that only few EMEs have had flexible exchange rates for a sufficiently long period of time to allow for a meaningful empirical analysis. Unless exchange rates are allowed to fluctuate to a sufficient degree over the observation period, the impact of global liquidity will not be adequately reflected in exchange rate dynamics.[1]

We account for the lack of exchange rate flexibility by analysing the impact of global liquidity on *exchange market pressure* (EMP) for a broad group of 32 EM economies (see

[1] Only five of the 32 EMEs considered in our panel have been classified by the IMF as floating-rate regimes over the entire sample period (January 1995 to December 2015); see Table 10.

Table 1 for a list of countries included in this study). EMP not only records exchange rate changes but also incorporates changes in international reserves (Girton and Roper, 1977) and, under some definitions, interest rates (e.g. Eichengreen, Rose and Wyplosz, 1996).[2] As there is no consensus on the exact definition of EMP in the literature, we proceed by considering eight different EMP variants and performing sensitivity tests.

Table 1: List of emerging market economies

Country name	**Country code**	**Country name**	**Country code**
Albania	AL	Jamaica	JM
Argentina	AR	Korea	KR
Bolivia	BO	Malaysia	MY
Brazil	BR	Mexico	MX
Bulgaria	BG	Pakistan	PK
Chile	CL	Paraguay	PY
Colombia	CO	Peru	PE
Costa Rica	CR	Philippines	PH
Czech Republic	CZ	Poland	PL
Dominican Republic	DO	Romania	RO
Egypt	EG	Russia	RU
Guatemala	GT	Singapore	SG
Honduras	HN	South Africa	ZA
Hungary	HU	Thailand	TH
Indonesia	ID	Turkey	TR
Israel	IL	Uruguay	UY

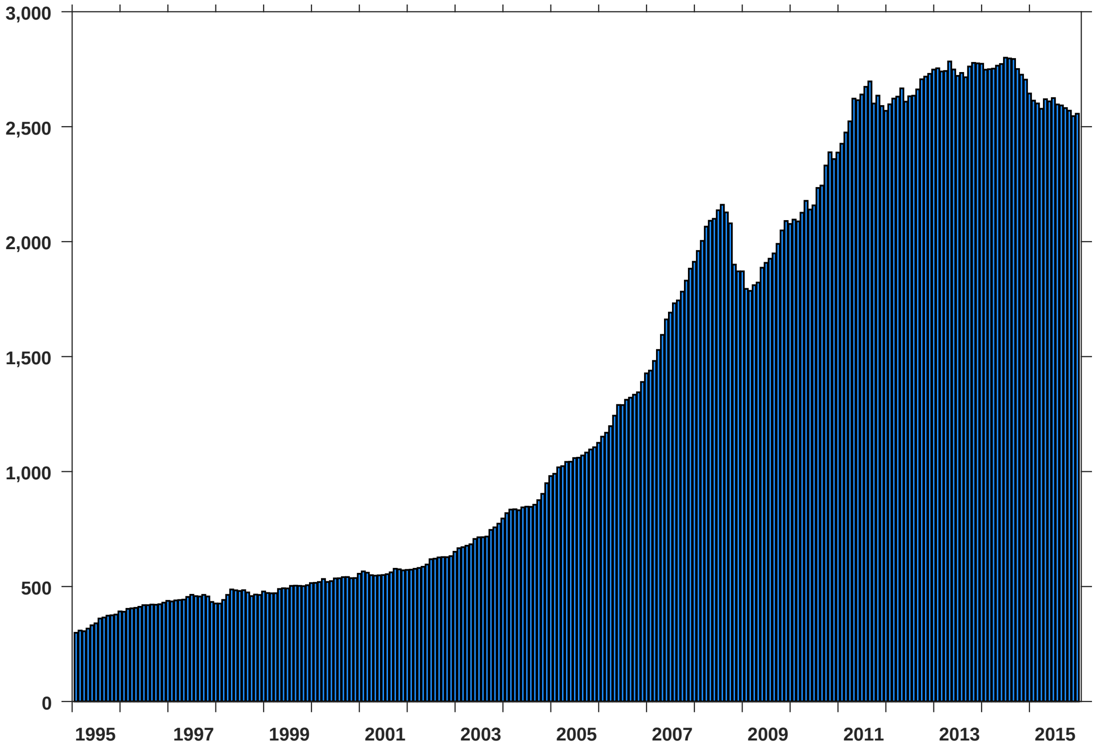
The contributions of this paper are as follows: First, instead of analysing liquidity spillovers into emerging market capital flows, we directly examine the impact on EMP for a large group of 32 emerging market economies. To ensure robustness, we apply several different definitions of EMP previously used in the literature. Second, we consider a broad spectrum of global liquidity measures and calculate 17 different indicators, among them indicators of monetary liquidity, measures of credit provision, and measures of funding liquidity. Third, the empirical relationships between the different liquidity measures themselves yield several interesting findings, especially from a financial stability perspective. Fourth, we examine the impact of global liquidity on EMP in emerging market economies through linear and regime-specific panel regressions. Our specifications control for a large number of country-specific as well as global factors to ensure that our results are not driven by omitted-variables bias. Notably, we empirically differentiate between liquidity and financial stress, two concepts that have frequently been used interchangeably but that – anticipating our findings – have distinct impacts on EMP.

In its simplest form, EMP is calculated as the sum of the rate of exchange rate appreciation and the growth rate of FX reserves held by a country's central bank. Hence it is illustrative simply to compare the exchange rates of the 32 countries in our sample with this simple EMP measure. While the 32 EM currencies *depreciated* against the

[2] This approach also pays heed to the warning that "currency appreciation [alone] is not a summary measure of the transmission of accommodative monetary policy" (He and McCauley, 2013).

US dollar at an annualised rate of 5.7% on average from 1995 to 2015, mean annualised exchange market pressure for that period amounted to 8.5%, implying *appreciation pressure* on average.[3] Thus to the extent that global liquidity is one of the factors causing upward pressure on emerging market currencies, its impact would likely be substantially underestimated (and possibly even incorrectly signed) if only exchange rates were to be considered. Moreover, the positive sign of the EMP mean value across countries and time reflects the fact that EMEs have on average accumulated reserves. In fact, EM policymakers (over-)compensated for appreciation pressure through the accumulation of FX reserves to such an extent that their currencies have even *depreciated* on average according to this simple EMP measure. Figure 1 displays the development of FX reserves for the 32 EMEs considered in this study.

Figure 1: FX reserves of 32 emerging market economies in bn USD



Note: The figure shows the sum of (convertible) foreign exchange reserves in bn USD at market exchange rates for the 32 emerging market economies included in the panel.

The unprecedented build-up of reserves may have been in support of price competitiveness, or it could reflect concerns about financial stability in the event of sudden capital inflow reversals (Sobrun and Turner, 2015).[4] It is supported by evidence that EMEs with high levels of official reserves face a lower probability of entering a financial crisis (Gourinchas and Obstfeld, 2012) and experience higher post-crisis economic growth (Dominguez,

[3]Note that the two sample means display opposite signs even though the corresponding group-mean correlation coefficient in Table 3 is positive (0.59). This sign pattern of sample means also holds for the reduced sample of 18 EMEs reported in Table 3.

[4]Domestic currency appreciation and related terms-of-trade gains could lead households to engage in excessive risk taking as their perceived permanent income increases. Banks might in turn overestimate borrower quality for the same reasons (see Sobrun and Turner, 2015; Bruno and Shin, 2015a).

Hashimoto and Ito, 2012).

We account for the "multiple facets" of global liquidity (ECB, 2011) by employing a whole spectrum of different indicators. Our data set includes measures of monetary liquidity, specifically indicators based on monetary aggregates and a measure of the effective monetary stance, as well as measures based on international credit aggregates to proxy for liquidity conditions in the private sector. We also calculate measures of excess liquidity, such as the monetary overhang in advanced economies and the credit-to-GDP gap, and employ several funding (or market) liquidity measures such as the stock of commercial paper outstanding, bank leverage, and the TED spread.

The paper is structured as follows. Section 2 provides a short overview of the related literature focusing on studies dealing with spillover effects from advanced economies to EMEs. In Section 3, we survey alternative definitions of exchange market pressure and analyse how similar or dissimilar they are to each other. In Section 4, we present our different measures of global liquidity and perform a simple correlation analysis. The data sample and regression models are introduced in Section 5. Section 6 discusses the results obtained from the baseline regressions, while in Section 7 results from threshold specifications driven by financial-stress regimes are presented. Section 8 summarises our main findings, and the Appendix provides details on our data series and further results from a robustness analysis.

2 Literature review

Our analysis primarily contributes to the literature on monetary policy spillovers from advanced economies to emerging markets and on the global financial cycle. The paper also discusses the concept of exchange market pressure and provides an empirical overview of global liquidity indicators, two important building blocks of our main analysis. For the sake of succinctness, the current section will focus on the topic of the paper's primary contribution, and we will include literature discussions on EMP and global liquidity in Sections 3 and 4, respectively.

A growing literature on the international transmission of monetary policy in advanced economies to EMEs has identified three distinct – possibly mutually reinforcing – transmission channels: the well-established "carry-trade channel", the credit-driven "risk-taking channel", and the more recent "funding-liquidity channel". The carry-trade channel identifies widening interest rate differentials and the build-up of carry trade positions as causes for upward pressure on high-interest-rate currencies (e.g., Brunnermeier et al., 2008; Menkhoff et al., 2012). Under the risk-taking channel, monetary policy in advanced economies shifts global investors' risk perception and risk tolerance and thereby affects banking-sector leverage (Borio and Zhu, 2012; Bruno and Shin, 2015a). The funding-liquidity channel (Adrian et al., 2015) presumes that improved funding conditions lead to a higher risk appetite among international investors. Unlike the carry-trade channel, it predicts a homogeneous impact on high- and low-yielding currencies and represents a third transmission channel to the extent that monetary policy affects short-term funding liquidity.

Most closely related to the current paper is Bruno and Shin (2015a) who analyse the impact of US monetary policy on cross-border bank capital flows and the tradeweighted US dollar exchange rate. According to their results from a VAR analysis, an expansionary monetary policy shock in the US is associated with higher global bank leverage and an increase in cross-border bank capital flows as well as a depreciation of the US dollar in effective terms. In a similar vein, Bekaert, Hoerova and Duca (2013) find that loose monetary policy conditions lower the degree of risk aversion and uncertainty, thereby potentially contributing to excessive cross-border capital flows to emerging market economies. In a broader setting, Rey (2015) finds that US monetary policy drives a 'global financial cycle' in capital flows, asset prices, and credit growth that is strongly related to the VIX but not necessarily to countries' domestic economic conditions. According to Adrian et al. (2015), growth in US-dollar-denominated banking sector liabilities forecasts appreciation of the US dollar against a large set of currencies.

Our paper differs from the above literature in several aspects: in contrast to Bruno and Shin (2015a), our analysis not only considers the upswing of the global financial cycle until 2007 but extends to the end of 2015. Thus we also capture periods of liquidity shortage during the global financial crisis, followed by the unprecedented growth in central-bank balance sheets in advanced economies over recent years. Moreover, considering exchange market pressure allows us to analyse emerging market economies despite their oftentimes tightly managed exchange rates, whereas Bruno and Shin focus on the US and rely on exchange rates, regardless of exchange arrangements. Specifying a panel model instead of a VAR allows us to control for a large set of country-specific and global factors that may impact emerging market exchange rates and EMP, but it does not allow us to estimate a dynamic response profile.

The group of countries considered by Adrian et al. (2015) excludes countries with tightly controlled exchange rates, which make up for a substantial portion of EMEs given that their sample starts as early as 1993 (see Table 10 for an overview of countries' FX regime classifications). Moreover, Adrian et al. consider only one particular dimension of global liquidity, a specific measure of dollar funding liquidity. By comparison, our sample additionally includes EMEs with heavily managed exchange rates and considers a much broader set of liquidity indicators. According to our findings, different types of global liquidity measures, e.g. monetary and credit aggregates, turn out to be very robustly related to exchange market pressure in EMEs, which is not always the case for the three measures of short-term funding liquidity included in our analysis. Balakrishnan, Danninger, Elekdag and Tytell (2011) show the extensive transmission of financial stress from advanced to emerging market economies, a parameter that is sometimes employed as an inverse proxy for liquidity. Our results, however, identify distinct roles for financial stress and for our chosen liquidity indicators, which suggests that the two concepts are not merely two sides of the same coin.

A number of recent papers have specifically studied the international effects of *unconventional* monetary policy measures, such as large-scale asset purchase programmes, on emerging market economies (see, among others, Ahmed and Zlate, 2014; Neely, 2011; Bowman et al., 2015). The focus of these papers is typically on capital flows and bond markets rather than on exchange rates, however (see Chen, Mancini-Griffoli and Sahay, 2014, and references therein), which is in line with much of the earlier literature on emerging markets (e.g. Calvo, Leiderman and Reinhart, 1996). A recent shift in that literature away from considering net capital flows towards analysing gross flows has produced diverging results on the key determinants of cross-border flows (e.g. Forbes and Warnock, 2012; Rey, 2015), a sensitivity that our analysis of EMP avoids. The seminal finding established by Calvo et al. (1996) that global 'push' factors play a more important role for cross-border flows than domestic 'pull' factors continues to hold (cf. Forbes and Warnock, 2012; Rey, 2015), however, which lends additional support to our empirical approach of analysing the role of global liquidity and controlling for country-specific factors.

3 Exchange market pressure

Prior empirical work on exchange market pressure has employed varying definitions of EMP and provided little guidance on the underlying selection criteria. As a universally 'best' EMP variant cannot be identified ex ante, we discuss several EMP definitions proposed in the literature and perform a simple correlation analysis of the resulting series. They all have in common that a positive (negative) value of the respective EMP measure indicates net excess demand (supply) for (of) a particular currency. A positive (negative) EMP value reflects an appreciation (depreciation) of the domestic currency, an increase (a reduction) in foreign reserves, a decrease (an increase) in domestic interest rates, or a combination of the three. Thus EMP not only records actual exchange rate changes but also adds countervailing policy measures through changes in foreign reserves and, where applicable, interest rates.

The exchange rate, e_t, is defined in terms of USD per national currency. Further variables included in the different EMP definitions are the level of convertible FX reserves (IR_t), the level of the monetary base (MB_t), and the domestic short-term interest rate (i_t).[5] Girton and Roper (1977) originally defined exchange market pressure as the sum of the exchange rate appreciation of the domestic currency and the change in international reserves relative to the monetary base in the previous period (EMP_1 in Table 2). Subsequently, several authors have modified this measure: they either subtracted an interest rate component in order to account for the possibility of an increase (decrease) in interest rates intended to alleviate depreciation (appreciation) pressure (EMP_3, EMP_4), or they modified the weights assigned to the different components entering the index (all EMP measures with a suffix 's').[6]

Whereas Eichengreen et al. (1996) specify the absolute change in the interest rate differential against a base country, Heinz and Rusinova (2015) employ the relative change in the domestic interest rate. In our view, the latter approach has two advantages, particularly within the framework of our primary analysis. First, it eases the interpretation of EMP since all components are defined in growth rates. Second, in contrast to the measure proposed by Eichengreen et al. (1996), it does not include the interest rate of the base country (in our case, the US), which can subsequently be specified as an exogenous regressor in the econometric analysis. Furthermore, a number of authors divide the change in reserves by the previous period's level of reserves (i.e. they employ the growth rate of international reserves) rather than specifying the monetary base in the denominator. To test whether this is an appropriate simplification of the original EMP definition by Girton

[5] Further details on all series are provided in Tables 12 and 13.

[6] For recent examples see Heinz and Rusinova (2015), Aizenman, Lee and Sushko (2012), and Balakrishnan et al. (2011). Akram and Byrne (2015) perform an empirical analysis of the determinants of EMP in emerging market economies for a large panel of 40 countries. However, their study does not consider any proxy for global liquidity.

Table 2: Alternative definitions of exchange market pressure (EMP)

$$
\begin{aligned}
\mathrm{EMP}_1 &\equiv \frac{\Delta e_t}{e_{t-1}} + \frac{\Delta \mathrm{IR}_t}{\mathrm{MB}_{t-1}} \\
\mathrm{EMP}_2 &\equiv \frac{\Delta e_t}{e_{t-1}} + \frac{\Delta \mathrm{IR}_t}{\mathrm{IR}_{t-1}} \\
\mathrm{EMP}_3 &\equiv \frac{\Delta e_t}{e_{t-1}} + \frac{\Delta \mathrm{IR}_t}{\mathrm{MB}_{t-1}} - \frac{\Delta i_t}{i_{t-1}} \\
\mathrm{EMP}_4 &\equiv \frac{\Delta e_t}{e_{t-1}} + \frac{\Delta \mathrm{IR}_t}{\mathrm{IR}_{t-1}} - \frac{\Delta i_t}{i_{t-1}} \\
\mathrm{EMP}_{1,s} &\equiv \frac{1}{\sigma_{\Delta e_t/e_{t-1}}} \cdot \frac{\Delta e_t}{e_{t-1}} + \frac{1}{\sigma_{\Delta \mathrm{IR}_t/\mathrm{MB}_{t-1}}} \cdot \frac{\Delta \mathrm{IR}_t}{\mathrm{MB}_{t-1}} \\
\mathrm{EMP}_{2,s} &\equiv \frac{1}{\sigma_{\Delta e_t/e_{t-1}}} \cdot \frac{\Delta e_t}{e_{t-1}} + \frac{1}{\sigma_{\Delta \mathrm{IR}_t/\mathrm{IR}_{t-1}}} \cdot \frac{\Delta \mathrm{IR}_t}{\mathrm{IR}_{t-1}} \\
\mathrm{EMP}_{3,s} &\equiv \frac{1}{\sigma_{\Delta e_t/e_{t-1}}} \cdot \frac{\Delta e_t}{e_{t-1}} + \frac{1}{\sigma_{\Delta \mathrm{IR}_t/\mathrm{MB}_{t-1}}} \cdot \frac{\Delta \mathrm{IR}_t}{\mathrm{MB}_{t-1}} - \frac{1}{\sigma_{\Delta i_t/i_{t-1}}} \cdot \frac{\Delta i_t}{i_{t-1}} \\
\mathrm{EMP}_{4,s} &\equiv \frac{1}{\sigma_{\Delta e_t/e_{t-1}}} \cdot \frac{\Delta e_t}{e_{t-1}} + \frac{1}{\sigma_{\Delta \mathrm{IR}_t/\mathrm{IR}_{t-1}}} \cdot \frac{\Delta \mathrm{IR}_t}{\mathrm{IR}_{t-1}} - \frac{1}{\sigma_{\Delta i_t/i_{t-1}}} \cdot \frac{\Delta i_t}{i_{t-1}}
\end{aligned}
$$

and Roper (1977), all aforementioned EMP variants are specified a second time based on the growth rate of international reserves (EMP_2, $\mathrm{EMP}_{2,s}$, EMP_4, and $\mathrm{EMP}_{4,s}$).

To get an impression of the degree of similarity across the different EMP measures, we calculate group-mean correlation coefficients of all EMP variants for a group of 18 countries. The sample period for this correlation analysis is 2002M1–2015M12.[7] The group-mean correlation coefficients are calculated in two steps. First, bivariate correlation coefficients are computed for each pair of indicators for each of the 18 countries individually. Second, the average of these correlation coefficients is calculated across countries. Table 3 depicts the group-mean correlation coefficients for the various EMP series and the rate of exchange rate appreciation.[8]

First of all, the correlation of each of the different EMP definitions with the rate of exchange rate appreciation never exceeds 0.81 and reaches all the way down to 0.27. This finding suggests that ignoring the limited exchange rate flexibility of many EMEs by modelling the impact of global liquidity on exchange rates (instead of EMP) would likely give rise to misleading results regarding the impact of global liquidity on EMEs. The correlation analysis also shows that the behaviour of EMP is not materially affected

[7] The sample start is chosen because all EMP series that specify the monetary base can only be calculated from 2002M1 onwards due to a lack of (consistently defined) data prior to this date. Countries are selected based on the IMF's annual reports on exchange arrangements and exchange restrictions (IMF, 2015a) summarised in Table 10, whereby all countries with flexible exchange regimes from 2002M1 to 2015M12 have been excluded from the correlation analysis. Since for two countries (AR, SG) data on the monetary base are missing entirely, they had to be excluded from the sample, too.

[8] Country-specific results for EMP correlations are available from the authors upon request.

Table 3: Group-mean correlation coefficients for EMP and rate of exchange rate appreciation

	EMP_1	$EMP_{1,s}$	EMP_2	$EMP_{2,s}$	EMP_3	$EMP_{3,s}$	EMP_4	$EMP_{4,s}$	$dlog(E)$
EMP_1	1	0.95	0.96	0.91	0.55	0.83	0.50	0.76	0.59
$EMP_{1,s}$	0.95	1	0.92	0.98	0.52	0.87	0.48	0.82	0.76
EMP_2	0.96	0.92	1	0.92	0.53	0.80	0.52	0.78	0.59
$EMP_{2,s}$	0.91	0.98	0.92	1	0.50	0.85	0.47	0.84	0.81
EMP_3	0.55	0.52	0.53	0.50	1	0.84	0.96	0.85	0.30
$EMP_{3,s}$	0.83	0.87	0.80	0.85	0.84	1	0.81	0.98	0.65
EMP_4	0.50	0.48	0.52	0.47	0.96	0.81	1	0.83	0.27
$EMP_{4,s}$	0.76	0.82	0.78	0.84	0.85	0.98	0.83	1	0.66
$dlog(E)$	0.59	0.76	0.59	0.81	0.30	0.65	0.27	0.66	1

Note: The table shows bivariate group-mean correlation coefficients for the various EMP measures. Due to a lack of consistent data on the monetary base for most countries prior to 2002, the correlation analysis spans the subsample 2002M1–2015M12 based on 18 countries. The remaining countries are excluded either because they had flexible exchange rates from 2002M1–2015M12 (IMF exchange rate regime categories '1' and '2') or because of missing data (for AR and SG, data on the monetary base are not available).

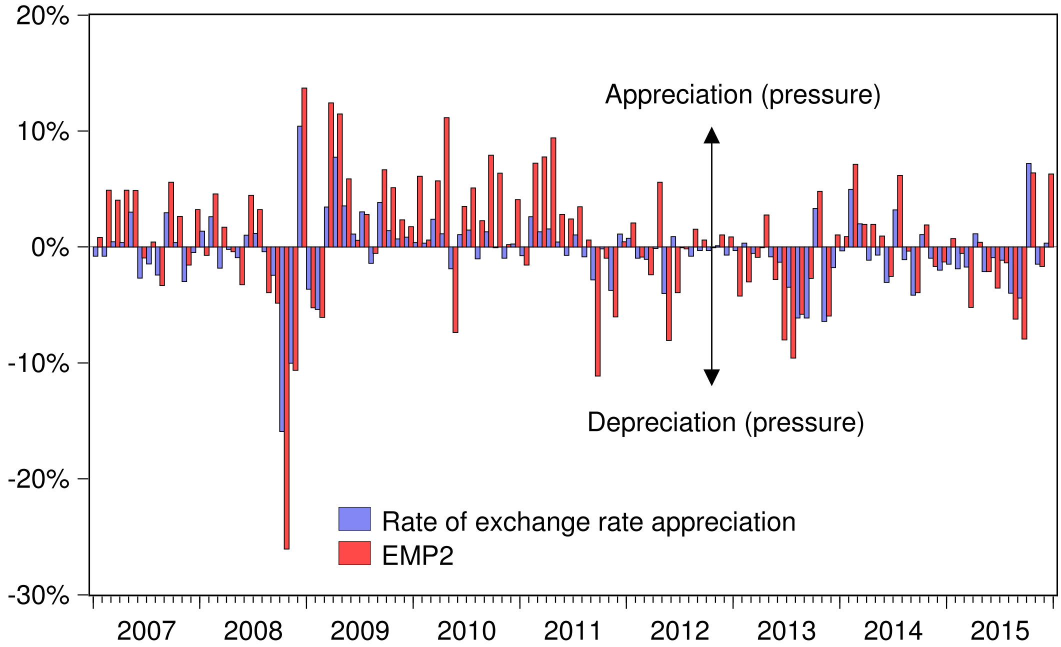
by using the growth rate of international reserves rather than scaling changes in reserves by the monetary base (for instance, the correlation coefficient between EMP_1 and EMP_2 is 0.96). That result allows us to use EMP_2 instead of EMP_1 in the regression analysis below, with data coverage starting in 1995M1 instead of 2002M1 only. We further observe from Table 3 that standardising all EMP components tends to increase the correlation coefficients among measures that include an interest rate term, while there is only a minor impact on EMP measures without an interest rate component.

Based on the above observations, we choose EMP_2 as the primary indicator for our analysis due to its ease of interpretation, its availability over the full sample period, and its high correlation with other EMP measures that omit an interest rate component. For robustness, we will also report detailed estimation results for $EMP_{4,s}$ as a conceptual alternative that includes an interest rate term and employs standardised components.[9] In addition, we provide summary tables of the main regression results for all of our eight different EMP measures.

For an illustration of the difference between pure exchange rate changes and EMP, Figure 2 displays the monthly rate of exchange rate appreciation for the Indonesian rupiah (USD/IDR) together with the corresponding exchange market pressure as measured by EMP_2 starting in 2007. Most striking is the large positive gap between EMP_2 and the rate of exchange rate depreciation at the time of the Lehman default, when financial tensions were particularly large and market liquidity correspondingly low. The positive gap indicates that the depreciation of the Indonesian rupiah would have been even more pronounced had the central bank not intervened by selling FX reserves.

[9] Aizenman et al. (2012) also motivate their choice of an EMP measure by its simpler interpretation. However, they do not compare its behaviour with that of any other EMP definitions.

Figure 2: Indonesia: The rate of exchange rate appreciation vs. EMP_2



4 Indicators of global liquidity

The ECB (2011) points out that "liquidity is a multifaceted concept and, if anything, the common element in all of the definitions appears to be *ease of financing*", while Shin (2014) acknowledges "the vagueness of the word *liquidity*". These two quotations already illustrate the difficulty in finding a uniform definition of "global liquidity". It has thus become common practice to consider a broad set of indicators to capture the different facets of global liquidity. We adhere to this approach and collect a large number of different indicators.[10] While our focus is on quantity-based indicators, we also consider a number of price-based measures. Our list of indicators starts with measures of monetary liquidity, comprising simple indicators based on monetary aggregates as well as more elaborate measures of the global monetary stance (effective monetary stance, money overhang). We continue with indicators of private-sector liquidity that build on international credit aggregates and the credit-to-GDP gap. Finally, we specify several funding (or market) liquidity measures such as the stock of commercial paper outstanding, bank leverage, or the TED spread. A detailed overview of all measures considered in this paper is provided in Table 12. Here we will briefly outline the different indicators and discuss only the less conventional ones.[11] The section concludes with a simple correlation analysis of all liquidity measures to illustrate their pairwise empirical relationships.

[10]While rather comprehensive, the list of indicators employed here is still not exhaustive. See Eickmeier, Gambacorta and Hofmann (2014) or Landau (2013) for an overview of global liquidity indicators.

[11]For a comprehensive discussion of the different indicators, the reader is referred to Landau et al. (2011) and ECB (2011), whereas up-to-date assessments of actual liquidity conditions are provided in the March and September issues of the BIS Quarterly Review.

4.1 Monetary liquidity

Historically, global liquidity has been closely associated with monetary liquidity (see Shin, 2014), for which we consider six different measures. The simplest indicators available are those based on specific monetary aggregates. We consider three aggregates, the monetary base (MB), M1, and M3 for advanced economies (suffix: AE), with a focus on the US, Japan, and the UK. National data series have been converted to USD at market exchange rates, and we either calculate the growth rate of the sum of the respective national aggregates (series: $\mathrm{MB_{AE,S}}, \mathrm{M1_{AE,S}}, \mathrm{M3_{AE,S}}$), or, alternatively, we extract the first principal component of the growth rates of national series (series: $\mathrm{MB_{AE,PC}}, \mathrm{M1_{AE,PC}}, \mathrm{M3_{AE,PC}}$).[12] Forbes and Warnock (2012) use very similar monetary aggregates for measuring the impact of global liquidity on international capital flows.

We also derive a measure of (broad) money overhang, which can be interpreted as excess money supply in advanced economies, by estimating the standard form of a money demand function for the US, Japan, the UK, and the euro area (EA) based on the following panel fixed-effects regression:[13]

$$m_{it} \;=\; \alpha_{0i} \;+\; \alpha_1 \, gdp_{it} \;+\; \alpha_2 \, r_{it} \;+\; \nu_{it}\,, \tag{1}$$

where m_{it} denotes the log of real broad money supply, gdp_{it} the log of real GDP, and r_{it} the short-term treasury bill rate, with nominal series converted to real series based on consumer price indices.[14] The Kao panel cointegration test (Kao, 1999) rejects the null hypothesis of no cointegration with a p-value of 0.024. According to our estimation results, the income elasticity is 1.14 and the interest rate semi-elasticity -0.05. Both values appear highly plausible and are well within the range of point estimates reported in previous studies. These estimates provide us with country-specific money overhang, OV_{it}, as the difference between actual money supply and predicted money demand, i.e. $\mathrm{OV}_{it} = m_{it} - \hat{m}_{it} = \hat{\nu}_{it}$, where $\hat{m}_{it} = \hat{\alpha}_{0i} + \hat{\alpha}_1 \, gdp_{it} + \hat{\alpha}_2 \, r_{it}$. We then extract the first principal component from these series (series: $\mathrm{OV_{AE,PC}}$) and also use the US series as an alternative money overhang indicator (series: $\mathrm{OV_{US}}$).[15]

Several studies employ plain interest rate yields as a further measure of the monetary policy stance or monetary liquidity. We do not follow this approach here but use the so-called "effective monetary stimulus" (EMS) by Krippner (2014) and Halberstadt and Krippner (2016) instead. In contrast to observed interest rates, this metric is meant to reflect the monetary policy stance by taking into account both conventional and unconventional monetary policy interventions. It is particularly useful whenever policy rates are

[12] The aggregation approach follows McKinnon (1982). We exclude the euro area, which would either cause a structural break or shorten the sample period.

[13] As the data panel consists of only four countries, estimation is based on data series starting as early as 1987 to increase the number of degrees of freedom. Only for the euro area does the sample start in 1999 (to avoid using synthetic euro-area data).

[14] See, for instance, Carstensen, Hagen, Hossfeld and Neaves (2009) for further details on the derivation of money overhang measures with a focus on euro-area countries. Mark and Sul (2003) also estimate money demand functions through panel estimation techniques by imposing the assumption of long-run homogeneity of coefficients across countries.

[15] The first principal component is only extracted from the money overhang series of the US, Japan, and the UK, because the euro-area series only starts in 1999 and we want to avoid a discrete jump in the principal-component scores at that date.

constrained by the zero lower bound and unconventional policy action would otherwise not be reflected in monetary policy rates.[16]

4.2 Liquidity measures based on credit aggregates

The role and importance of credit aggregates has never been more prominent, both for the monetary transmission mechanism and for financial stability (Bruno and Shin, 2015a; Schularick and Taylor, 2012). As in the case of monetary liquidity, our indicators for credit provision rely predominantly on quantity-based cross-country aggregates but also include the credit-to-GDP gap. We employ credit aggregates from the locational banking statistics section of the BIS due to the high number of credit categories available and the comprehensive data coverage in the time dimension. Worldwide bank claims are reported separately as local claims (LC_W) and as cross-border claims (CBC_W), and the latter can be split further into cross-border debt ($CBC_{W,\text{Debt}}$) and cross-border loans ($CBC_{W,\text{Loans}}$). The most comprehensive credit aggregates are the series on "total credit to the non-financial sector" from the credit statistics section of the BIS, which encompass credit by domestic banks, all other sectors of the economy, and non-residents, both worldwide (TC_W) and for advanced economies only (TC_{AE}). For the latter, a subseries on total credit to the private non-financial sector ($TC_{AE,\text{Private}}$) is available, but that series (together with $CBC_{W,\text{Debt}}$ and $CBC_{W,\text{Loans}}$) will only be used in the robustness section of our regression analysis and is not part of the correlation analysis in Section 4.4.

As a measure of excess credit provision, we compute the credit-to-GDP gap for advanced economies (series: GAP_{AE}). The credit-to-GDP gap measures the deviations of the credit-to-GDP ratio from its long-term trend and plays an important role in the Basel-III regulatory framework. We adhere to the Basel definition (cf. BIS, 2010) and apply a Hodrick-Prescott filter (Hodrick and Prescott, 1997) with $\lambda = 400,000$ to the credit-to-GDP ratio (based on total credit to the private non-financial sector) for advanced economies.

4.3 Funding liquidity

Funding or market liquidity is captured through three different measures, starting with the growth rate of commercial paper outstanding in the US, a short-term debt instrument that has become increasingly important as a funding source for large corporations.[17] The same indicator is used by Eickmeier et al. (2014) along with Chung, Lee, Loukoianova, Park and Shin (2015) and Kacperczyk and Schnabl (2010) who discuss the role and dynamics of the commercial-paper market during the financial crisis. As another quantity-based indicator of funding liquidity we include the bank leverage ratio (defined as assets divided by equity) for US commercial banks as a "footprint" of global liquidity in the banking system (McGuire and Sushko, 2015). Bruno and Shin (2015a) show how bank leverage in the US affects liquidity conditions globally as the US dollar is the world's preeminent

[16] Halberstadt and Krippner (2016) provide empirical evidence suggesting that EMS is superior to short-term interest rates as a monetary policy metric.

[17] We use 'funding' and 'market' liquidity synonymously in this paper. For a detailed discussion and formal model of how market liquidity is predicated on funding liquidity, see Brunnermeier and Pedersen (2009).

funding currency. The only price-based indicator in this category is the TED spread, i.e. the difference between the 3-month LIBOR rate and the 'riskless' US short-term treasury bill rate, to proxy for liquidity in the interbank market (whereby a lower spread indicates *higher* liquidity in the interbank market).

4.4 Correlation analysis of global liquidity indicators

A number of interesting results emerge from a simple correlation analysis of the various liquidity indicators presented in Table 4, both from a financial stability perspective and also to guide the choice of liquidity indicators for our main empirical analysis.[18] Since a rigorous conceptual discussion of the relationships between different indicators is beyond the scope of this paper, we focus on some key observations here.

First, we find a positive relationship between growth rates in monetary aggregates (based on the sum of national series) and indicators of credit provision, pointing towards common dynamics. Second, there is hardly any statistically significant relationship between growth rates in monetary aggregates and funding liquidity measures, which indicates that monetary liquidity (when measured through monetary aggregates) and market liquidity do not move together.[19] Third, the derived measures of money overhang show negative correlations with indicators of credit provision, commercial paper outstanding and the bank leverage ratio in the US, only the relationship with the TED spread displays the expected sign (as a lower TED spread indicates higher market liquidity). These contradictory findings cast doubt on the stability of the estimated money demand function or could indicate that some liquidity measures may require a time lag to move in the expected direction. Finally, the growth rates of the various monetary aggregates (whether based on the sum of national series or their principal components) are – as expected – positively correlated. While the correlation coefficients between the broad aggregates and the monetary base are comparatively low at less than 0.5 (looking at the sums of national series), the correlation coefficient of the growth rates of M1 and M3 stands at 0.96, which is why only one of these measures (M3) will be employed besides the monetary base in the further empirical analysis.

[18] In Table 4, monetary aggregates, credit aggregates, and commercial paper outstanding are defined in log-differences to avoid detecting spurious correlations, whereas all other measures remain in levels, which better reflects their derivation and interpretation.

[19] The derived measures of money overhang, however, show a negative relationship with indicators of funding liquidity, which may be due to an unstable money demand function.

Table 4: Correlation analysis of liquidity indicators

		Monetary liquidity									**Credit provision**					**Funding liquidity**		
		$MB_{AE,S}$	$MB_{AE,PC}$	$M1_{AE,S}$	$M1_{AE,PC}$	$M3_{AE,S}$	$M3_{AE,PC}$	EMS_{US}	OV_{US}	$OV_{AE,PC}$	LC_W	CBC_W	TC_W	TC_{AE}	GAP_{AE}	CP_{US}	BL_{US}	TED_{US}
$MB_{AE,S}$	Δlog	**1**	**0.87**	**0.42**	**0.70**	**0.45**	**0.50**	**0.30**	0.18	**0.23**	-0.04	-0.16	0.14	0.17	0.17	-0.04	-0.10	0.14
$MB_{AE,PC}$	Δlog	**0.87**	**1**	**0.30**	**0.68**	**0.32**	**0.61**	**0.23**	0.19	0.20	-0.03	-0.22	-0.08	-0.02	0.00	0.13	-0.14	0.11
$M1_{AE,S}$	Δlog	**0.42**	**0.30**	**1**	**0.40**	**0.96**	0.16	0.14	-0.11	-0.16	0.09	**0.40**	**0.70**	**0.74**	**0.37**	-0.04	0.16	-0.02
$M1_{AE,PC}$	Δlog	**0.70**	**0.68**	**0.40**	**1**	**0.43**	**0.81**	**0.33**	0.16	**0.27**	0.03	**-0.36**	-0.09	-0.03	0.03	-0.20	-0.14	0.22
$M3_{AE,S}$	Δlog	**0.45**	**0.32**	**0.96**	**0.43**	**1**	0.22	0.06	-0.17	-0.14	0.10	**0.39**	**0.69**	**0.74**	**0.46**	-0.03	**0.24**	0.10
$M3_{AE,PC}$	Δlog	**0.50**	**0.61**	0.16	**0.81**	0.22	**1**	0.12	0.09	0.17	0.06	**-0.43**	**-0.31**	**-0.23**	-0.17	-0.06	-0.09	**0.32**
EMS_{US}	L	**0.30**	**0.23**	0.14	**0.33**	0.06	0.12	**1**	**0.51**	**0.54**	0.09	**-0.31**	0.00	-0.02	0.13	**-0.30**	**-0.49**	**-0.37**
OV_{US}	L	0.18	0.19	-0.11	0.16	-0.17	0.09	**0.51**	**1**	**0.86**	-0.02	**-0.45**	**-0.28**	**-0.31**	**-0.37**	-0.13	**-0.89**	**-0.39**
$OV_{AE,PC}$	L	**0.23**	0.20	-0.16	**0.27**	-0.14	0.17	**0.54**	**0.86**	**1**	0.01	**-0.57**	**-0.30**	**-0.34**	-0.09	**-0.23**	**-0.72**	-0.17
LC_W	Δlog	-0.04	-0.03	0.09	0.03	0.10	0.06	0.09	-0.02	0.01	**1**	-0.12	-0.03	-0.01	-0.07	0.13	-0.09	-0.05
CBC_W	Δlog	-0.16	-0.22	**0.40**	**-0.36**	**0.39**	**-0.43**	**-0.31**	**-0.45**	**-0.57**	-0.12	**1**	**0.75**	**0.74**	**0.33**	**0.29**	**0.43**	-0.13
TC_W	Δlog	0.14	-0.08	**0.70**	-0.09	**0.69**	**-0.31**	0.00	**-0.28**	**-0.30**	-0.03	**0.75**	**1**	**0.99**	**0.58**	0.12	**0.30**	-0.09
TC_{AE}	Δlog	0.17	-0.02	**0.74**	-0.03	**0.74**	**-0.23**	-0.02	**-0.31**	**-0.34**	-0.01	**0.74**	**0.99**	**1**	**0.57**	0.13	**0.33**	-0.05
GAP_{AE}	L	0.17	0.00	**0.37**	0.03	**0.46**	-0.17	0.13	**-0.37**	-0.09	-0.07	**0.33**	**0.58**	**0.57**	**1**	-0.20	**0.57**	**0.23**
CP_{US}	Δlog	-0.04	0.13	-0.04	-0.20	-0.03	-0.06	**-0.30**	-0.13	**-0.23**	0.13	**0.29**	0.12	0.13	-0.20	**1**	-0.06	-0.22
BL_{US}	L	-0.10	-0.14	0.16	-0.14	**0.24**	-0.09	**-0.49**	**-0.89**	**-0.72**	-0.09	**0.43**	**0.30**	**0.33**	**0.57**	-0.06	**1**	**-0.51**
TED_{US}	L	0.14	0.11	-0.02	0.22	0.10	**0.32**	**-0.37**	**-0.39**	-0.17	-0.05	-0.13	-0.09	-0.05	**0.23**	-0.22	**-0.51**	**1**

Note: The table shows bivariate Pearson correlation coefficients for all liquidity series, where Δlog and L denote specification in log-differences and levels, respectively. Since some of the variables are available from 2002 and at quarterly frequency only, the correlation analysis is based on the common sample 2002Q1–2015Q4. A green (red) cell indicates positive (negative) correlation, with a darker cell colour and bold type denoting correlation coefficients that are significantly different from zero at a 10% level of significance.

5 Baseline econometric models and data

Our panel consists of the 32 EMEs listed in Table 1 plus data on the US. China and India, which we originally aimed to include, have been omitted due to data-availability constraints. The panel is based on monthly data spanning 1995M1–2015M12.[20]

In the analysis presented below all 32 EMEs are included. Since 27 of those countries have experienced managed exchange rate regimes during part or even all of the sample period, we use exchange market pressure as the dependent variable. As explained in Section 3, we present detailed estimation results for $\mathrm{EMP}_2 \equiv \frac{\Delta e_t}{e_{t-1}} + \frac{\Delta \mathrm{IR}_t}{\mathrm{IR}_{t-1}}$ and $\mathrm{EMP}_{4,s} \equiv \frac{1}{\sigma_{\Delta e_t/e_{t-1}}} \cdot \frac{\Delta e_t}{e_{t-1}} + \frac{1}{\sigma_{\Delta \mathrm{IR}_t/\mathrm{IR}_{t-1}}} \cdot \frac{\Delta \mathrm{IR}_t}{\mathrm{IR}_{t-1}} - \frac{1}{\sigma_{\Delta i_t/i_{t-1}}} \cdot \frac{\Delta i_t}{i_{t-1}}$ as our measures of exchange market pressure. The baseline econometric model for EMP_2 can be regarded as an augmented UIP regression that accounts for EME-specific characteristics:

$$\mathrm{EMP}_{2,it} = \beta_{0i} + \beta_1\left(i_{i,t-1} - i^{\mathrm{US}}_{t-1}\right) + \beta_2\left(\pi_{i,t-1} - \pi^{\mathrm{US}}_{t-1}\right) + \beta_3 \mathrm{GL}_{jt} + \phi_1' x_{i,t-1} + \phi_2' f_t + \nu_{it}, \quad (2)$$

where i_t is the interest rate, π_t the inflation rate, GL_{jt} is the global liquidity indicator, $x_{it} = \left[\mathrm{BCrisis}_{it}, \mathrm{SCrisis}_{it}, \mathrm{FO}_{it}, \mathrm{TO}_{it}, (\mathrm{CA/GDP})_{it}, \Delta\log(\mathrm{Credit}_{it})\right]$ are country-specific control variables and $f_t = \left[\Delta\log(\mathrm{Commodity}_t), \Delta\log(\mathrm{Energy}_t), \Delta\log\left(\mathrm{VIX}^{\mathrm{US}}_t\right)\right]$ are global factors.

Estimation is based on a static fixed-effects panel regression since our choice of exchange market pressure (instead of exchange rates) dictates that the dependent variable be defined in growth rates. The panel model allows us to include a large number of control variables (up to eleven) in order to carve out the marginal effect of the global liquidity indicator. Under this approach, we cannot estimate a dynamic response profile like we would, for instance, with a VAR model applied to exchange rates, however even the unrestricted specification of a proper panel VAR(p) model applied to our set of variables would require the estimation of up to $K^2 p = 169p$ slope coefficients. As a key advantage, our econometric approach allows us to include the onset and aftermath of the global financial crisis, which typically causes a structural break in VAR-based studies (e.g. Bekaert et al., 2013; Bruno and Shin, 2015a). Adding a lagged dependent variable to our panel model produces an insignificant autoregressive coefficient, confirming that a static specification is indeed the appropriate choice for modelling EMP.

Interest and inflation rates, country-specific control variables (x_{it}), and all global liquidity indicators defined in levels are specified with a time lag in order to avoid potential endogeneity problems.[21] For interest rates, short-term money market rates are employed. Whenever these are not available for a specific country, we use the closest available substitute. For some countries in the panel, money market rates are only available for a subsample. In these cases, they are backcasted using the growth rate of the closest available substitute. Whenever possible, we eyeballed the different series over the common

[20] As some of the liquidity indicators and control variables are available at monthly, others only at quarterly frequency, we checked the robustness of our results by repeating the analysis based on quarterly data.

[21] For all EMP measures that include an interest rate component, we also compute results for a slightly modified model, in which the interest rate differential is replaced by the growth rate of the US interest rate as a regressor. By construction, the interest rate differential will be endogenous whenever the EMP measure on the left-hand side of the equation contains the growth rate of the domestic interest rate (EMP_3, $\mathrm{EMP}_{3,s}$, EMP_4, and $\mathrm{EMP}_{4,s}$). This modification leaves the results qualitatively unchanged.

sample before starting with the backcasting procedure in order to ensure comparability of the series.[22] Annualised monthly inflation rates are calculated based on log-differences of the consumer price index (CPI) as $\pi_{it} = 1200\big[\log(\text{CPI}_{it}) - \log(\text{CPI}_{i,t-1})\big]$. Further country-specific control variables include country-risk dummy variables for banking and sovereign debt crises ($\text{BCrisis}_{i,t-1}$ and $\text{SCrisis}_{i,t-1}$, respectively), the degree of financial openness ($\text{FO}_{i,t-1}$), the degree of trade openness ($\text{TO}_{i,t-1}$), the current-account-to-GDP ratio ($(\text{CA/GDP})_{i,t-1}$), and the lagged growth rate of total credit to the non-financial sector ($\Delta\log(\text{Credit}_{i,t-1})$).

'$\text{BCrisis}_{i,t-1}$' and '$\text{SCrisis}_{i,t-1}$' are dummy variables for banking and sovereign debt crises (1 = crisis, 0 = no crisis), respectively, taken from the updated "systemic banking crises database" by Valencia and Laeven (2012). The Chinn-Ito Financial Openness Index (Chinn and Ito, 2006), which is based on capital-account restrictions as documented in the aforementioned IMF (2015a) annual reports, is used as a normalised measure of financial openness (interval between 0 and 1, whereby a larger value implies a more open capital account).[23] Trade openness is proxied by the sum of exports and imports over GDP, i.e. $\text{TO}_{it} = \frac{\text{X}_{it}+\text{M}_{it}}{\text{GDP}_{it}}$, while the current-account-to-GDP ratio ($(\text{CA/GDP})_{i,t-1}$) is directly reported by the World Bank's WDI database. Finally, we also account for country-specific growth rates of credit to the non-financial sector in emerging market countries ($\Delta\log(\text{Credit}_{i,t-1})$). This variable follows the same definition as the corresponding global liquidity indicator for advanced economies (TC_{AE}) and is instrumented with its own lag in order to avoid endogeneity bias.[24] However, this variable is not inlcuded in the baseline specification but serves only as a robustness check since it reduces the number of degrees of freedom substantially as data series are available for only 15 of the 32 EMEs and do not cover all periods.

Non-energy commodity prices ($\Delta\log(\text{Commodity}_t)$, taken from the World Bank) are included as a global factor to account for the fact that some EMEs heavily rely on commodity exports, such as Russia, Malaysia, Chile, and Argentina, while others are net importers of commodities, such as Thailand, Turkey, and the Philippines (see IMF, 2015b, Figure 1.24). An energy price index ($\Delta\log(\text{Energy}_t)$, also by the World Bank) is included for similar reasons. Since these two global factors may impact differently on individual EMEs depending on whether economies are net commodity (or energy) exporters or importers, the respective coefficients were initially estimated heterogeneously (ϕ'_{2i}) and mean-group estimates reported. However, here we show results for a fully homogeneous specification ($\phi'_{2i} = \phi'_2 \; \forall \; i$) as the coefficients turned out to be virtually identical to those in a partly heterogeneous setup. Finally, the Chicago Board Options Exchange (CBOE) volatility index ($\Delta\log\big(\text{VIX}_t^{\text{US}}\big)$) measures the volatility of S&P 500 index options. This index is often described as a measure of investors' degree of risk aversion and has also been employed as an inverse proxy for market liquidity in the past. Including the VIX as a separate control variable allows us to distinguish to what extent its role is separate from (or identical to) the effect of global liquidity indicators.[25]

[22] Table 14 in the Appendix gives a detailed overview of the availability of short-term interest rates and how data gaps have been bridged.

[23] We assume that the values of the two crisis dummy variables and the financial openness index, which are only available at annual frequency, are constant over the year.

[24] Appreciation pressure could for instance also be relieved through an expansion of domestic credit fuelled by lower interest rates.

[25] Habib and Stracca (2012) include a few additional variables. Although some of them are statistically

6 Estimation results for linear models

This section presents results based on Equation 2, both in the baseline specification using the full sample, and as an augmented model that includes three additional explanatory variables but uses fewer countries and observations. The focus of our discussion is on estimates for EMP_2 (in Table 5), but detailed results for $EMP_{4,s}$ (Table 6) and a summary of results for all EMP measures (Tables 7 and 8) are presented, too. As we analyse the impact of global liquidity on exchange market pressure in EMEs, our research hypothesis hinges on the global liquidity coefficient (β_3). However, since there appear to be but few papers on the determinants of exchange rates or exchange market pressure in EMEs, we will also comment on notable results obtained on any of the other regression variables. Marginal significance levels for coefficient estimates are based on Driscoll and Kraay (1998) standard errors, which account for within-group correlation, heteroskedasticity, and cross-sectional correlation.

According to the estimation results for EMP_2 in Table 5, surges in monetary liquidity in advanced economies exert appreciation pressure on EM currencies. More specifically, a 1% increase in the growth rate of the monetary base (of M3) is expected to raise exchange market pressure in emerging market economies by 0.15% (0.38%), controlling for all other variables. Since all exchange rates are defined as USD pairs, our finding of appreciation pressure in EMEs caused by increases in AE money supply mirrors the result in Eichenbaum and Evans (1995) that expansive US monetary policy leads to subsequent USD depreciation. While the results for quantity-based measures of monetary liquidity indicate a significant positive relationship between monetary liquidity and EMP_2, the coefficient sign for the effective monetary stance (EMS) is negative (if only at the 10% significance level) and hence counterintuitive. As the robustness analysis will illustrate, the results for EMS are ambiguous and depend on the EMP definition employed. While in several instances (as under EMP_2) a negative coefficient obtains, in most cases EMS has no significant effect on exchange market pressure in EMEs.[26] Increases in credit provision, too, lead to appreciation pressure in EM currency markets. Here an increase in the growth rate of total credit to the non-financial sector in advanced economies of 1% is expected to increase exchange market pressure in emerging markets by 0.99%, ceteris paribus. Likewise, an increase in the credit-to-GDP gap by 1 percentage point raises EMP in EMEs by 0.05%, so among the indicators of credit provision, the quantity-based and the derived measures tell the same story. We present results for further quantity-based measures of credit provision (cf. Section 4) in Table 17 in the Appendix. It turns out that all indicators based on total credit or cross-border bank claims lead to qualitatively similar results, only the indicator based on local bank claims shows no significant effect on EMP.

The two quantity-based funding-liquidity indicators also positively affect EMP in EMEs: a 1% increase in the growth rate of commercial paper outstanding is associated with an increase in the appreciation pressure on EM currencies of 0.18%, while a one-unit increase in the bank leverage ratio (defined as total assets divided by bank capital) raises

significant, their quantitative impact on the dependent variable is very limited, however.

[26] A similar pattern emerges for money overhang (OV_{US}), which under some EMP definitions shows a counterintuitive negative yet significant coefficient, while in the majority of cases the coefficient estimate remains insignificant (results available upon request).

Table 5: Estimation results for EMP_2: Baseline model

	EMP_2	EMP_2	EMP_2	EMP_2	EMP_2	EMP_2	EMP_2	EMP_2
$(i_{t-1} - i^{US}_{t-1})$	-0.029	-0.029	-0.030	-0.039*	-0.035	-0.051**	-0.034	-0.029
	(0.029)	(0.029)	(0.029)	(0.023)	(0.022)	(0.025)	(0.031)	(0.029)
$(\pi_{t-1} - \pi^{US}_{t-1})$	0.018*	0.018*	0.018*	-0.013	-0.014	-0.009	0.018*	0.018*
	(0.010)	(0.010)	(0.010)	(0.018)	(0.020)	(0.023)	(0.010)	(0.010)
BCrisis_{t-1}	-5.888***	-5.886***	-6.018***	-6.335***	-6.477***	-7.133**	-6.768***	-5.896***
	(1.352)	(1.358)	(1.368)	(2.372)	(2.328)	(2.944)	(1.424)	(1.361)
SCrisis_{t-1}	0.248	0.220	0.275	1.636	1.764*	1.253	0.415	0.236
	(1.256)	(1.256)	(1.248)	(1.003)	(0.976)	(1.226)	(1.263)	(1.249)
FO_{t-1}	0.521	0.546	0.790	-0.576	-0.781	-1.089	0.049	0.615
	(0.598)	(0.594)	(0.590)	(0.698)	(0.702)	(0.851)	(0.594)	(0.587)
$\Delta\log(\text{Commodity}_t)$	0.370***	0.330***	0.345***	0.268***	0.335***	0.352***	0.339***	0.343***
	(0.078)	(0.080)	(0.072)	(0.090)	(0.082)	(0.065)	(0.082)	(0.073)
$\Delta\log(\text{Energy}_t)$	0.033	0.025	0.032	0.028	0.027	0.029	0.020	0.032
	(0.025)	(0.024)	(0.026)	(0.026)	(0.027)	(0.027)	(0.023)	(0.026)
$\Delta\log(\text{VIX}^{US}_t)$	-0.033***	-0.035***	-0.033***	-0.039***	-0.039***	-0.035***	-0.035***	-0.032***
	(0.011)	(0.011)	(0.011)	(0.012)	(0.013)	(0.012)	(0.011)	(0.011)
$\Delta\log\left(\text{MB}^{AE,S}_t\right)$	0.145**							
	(0.059)							
$\Delta\log\left(\text{M3}^{AE,S}_t\right)$		0.384***						
		(0.081)						
EMS^{US}_{t-1}			-0.027*					
			(0.015)					
$\Delta\log(\text{TC}^{AE}_t)$				0.988***				
				(0.195)				
GAP^{AE}_{t-1}					0.046**			
					(0.022)			
$\Delta\log(\text{CP}^{US}_t)$						0.184**		
						(0.076)		
BL^{US}_{t-1}							0.312***	
							(0.113)	
TED^{US}_{t-1}								-0.040
								(0.392)
Constant	0.480	0.488	0.804	0.981**	1.444***	1.806***	-3.329**	0.570
	(0.459)	(0.464)	(0.491)	(0.491)	(0.503)	(0.630)	(1.522)	(0.498)
Countries	32	32	32	32	32	32	32	32
Observations	7,967	7,967	7,967	6,432	6,432	5,728	7,584	7,967
R-squared (within)	0.049	0.053	0.048	0.079	0.066	0.086	0.057	0.047
Avg. obs. per country	249	249	249	201	201	179	237	249

Note: A description of all regression variables is provided in Sections 4 and 5 as well as in Tables 12 and 13. All specifications use panel fixed effects with robust standard errors (Driscoll and Kraay, 1998) shown in parentheses below coefficients. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

EMP by 0.31%. The TED spread as the only price-based measure, on the other hand, does not display any significant effect on EMP. When we additionally interact each of the liquidity indicators with the degree of financial openness ($FO_{i,t-1}$), that additional term is always insignificant while all other results stay essentially unchanged. Results for any of the other liquidity indicators shown in Table 4 but not discussed in the current section are available upon request.

By the very definition of 'global' liquidity, we cannot completely rule out the possibility that part of the EMP dynamics in at least a few of the 32 EMEs in our sample may ultimately bear upon some of the global liquidity indicators presented above. In fact, the risk that reported results could be impaired by reverse causality is inherent to the majority of papers on exchange rates and capital flows that we cite above. On conceptual grounds, we regard the monetary liquidity indicators, the growth rate in US commercial paper and the TED spread as largely immune to reverse-causality effects, while – to a minor extent – credit provision and, more importantly, bank leverage could be more exposed. For instance, some papers have explicitly shown that domestic-currency appreciations in EMEs are associated with higher foreign-currency bond issuance (Bruno and Shin, 2017) or accelerated bank capital flows (Bruno and Shin, 2015b). While contemporaneous feedback effects are precluded on statistical grounds by working with predetermined regressors, our model cannot account for dynamic response patterns. However, Bruno and Shin (2015a) employ a VAR model and find hardly any significant dynamic effect of the effective US dollar exchange rate on broker-dealer leverage even within 90% confidence bands, whereas the effect of leverage on the exchange rate is both significant and persistent.[27] Moreover, Adrian et al. (2015) estimate a specification that is similar to our model but additionally include advanced economies in their panel, which should make our own results rather more robust to endogeneity effects by comparison.

Looking at the coefficient estimates of the other regressors, several observations are noteworthy. First, the estimated coefficient of the interest rate differential is (slightly) negative, but hardly significant in most specifications. Second, the banking-crisis dummy is highly significant. According to our estimation results, the occurrence of a banking crisis increases depreciation pressure on EM currencies by about 6% on average. Third, an increase in commodity prices exerts appreciation pressure on EM currencies.[28] Finally, increases in the growth rate of the VIX are associated with higher depreciation pressure, a result which is consistent with investors withdrawing capital from EMEs when financial uncertainty increases. An important result is that the significance of the various global liquidity indicators obtains while we control for the VIX, which suggests that liquidity plays an important role in its own right that cannot be explained through risk considerations alone.

[27] The findings in Bruno and Shin (2015a) have guided our own approach and fully support our results, however they appear to contradict the regression estimates in Bruno and Shin (2015b). The key difference is that Bruno and Shin (2015b) specify the exchange rate as exogenous and include global factors (our GL variables), local factors (our control variables), and exchange rate changes (our dependent variable) all together as regressors for explaining bank capital flows. In light of our own results (and the pairwise response profiles for leverage, bank flows, and the exchange rate in Bruno and Shin, 2015a), mutual dependencies may shroud marginal effects in such a comprehensive specification.

[28] Although we estimated the impact of commodity and energy prices on EMP heterogeneously at first, we present homogenous estimates in the regression output since imposing the homogeneity restriction does not notably alter any of the other coefficient estimates.

A comparison of the results obtained for the baseline model with those for the augmented model (see Table 15 in the Appendix) suggests that, while particularly country-specific credit growth seems to be a significant determinant of EMP in EMEs that substantially increases the fit of the model, its consideration does not affect the coefficient estimates of the included global liquidity indicators to any notable degree.[29] The robustness of our results to the inclusion of country-specific credit growth also implies that the effect of global liquidity can be clearly distinguished from the impact of local credit growth, which illustrates the importance of liquidity as a global 'push' factor.

A similar conclusion can be drawn from a comparison of the baseline regression results for EMP_2 with results for $EMP_{4,s}$ in Table 6. While the coefficients of interest certainly change in magnitude due to the standardisation of the components entering the dependent variable, money growth, total credit growth, and the growth rate in commercial paper outstanding remain significant determinants of EMP and their coefficients still show a positive sign as in the EMP_2 regressions above, with only bank leverage turning insignificant.

In Tables 7 and 8, the signs and marginal significance levels of the estimated coefficients of the various global liquidity indicators are presented for all of the different EMP measures. Each cell summarises a separate regression such that 96 regressions have been performed in total for each of the two tables. Table 7 presents the results for the baseline specification and Table 8 for the augmented regression. The first eight columns in each table refer to the model that specifies the interest rate differential as a regressor, the last four columns refer to the modified model, in which the interest rate differential has been replaced by the growth rate of the US interest rate. As a further robustness check, we transformed the static into a dynamic model by adding a lagged EMP term as an explanatory variable. However, since this leaves the results virtually unaffected we do not report the additional estimates here.

The results presented in these summary tables reinforce our previous findings. Quantity-based measures of monetary liquidity and total credit are very robustly related to exchange market pressure in EMEs across virtually all different EMP definitions. For commercial paper outstanding and bank leverage, that relationship is most robust for the EMP variants without an interest rate component, while excess credit supply is robust only under the baseline specification. By contrast, derived measures of excess money supply in advanced economies show relatively little robustness in their impact on EMP in emerging market economies, and the TED spread remains virtually always insignificant.

[29] For a valid comparison of the goodness of fit, the baseline specification is repeated in Table 16 based on the restricted sample available for the augmented model.

Table 6: Estimation results for $EMP_{4,s}$: Baseline model

	$EMP_{4,s}$	$EMP_{4,s}$	$EMP_{4,s}$	$EMP_{4,s}$	$EMP_{4,s}$	$EMP_{4,s}$	$EMP_{4,s}$	$EMP_{4,s}$
$\Delta\log\left(i_t^{US}\right)$	-0.001	-0.002	-0.004	-0.002	-0.003	-0.004	-0.003	-0.004
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)
$\left(\pi_{t-1} - \pi_{t-1}^{US}\right)$	-0.000	-0.000	-0.000	-0.007**	-0.007**	-0.007*	-0.000	-0.000
	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.004)	(0.002)	(0.002)
BCrisis_{t-1}	-1.687***	-1.692***	-1.702***	-1.752***	-1.782***	-2.030***	-2.020***	-1.688***
	(0.468)	(0.469)	(0.468)	(0.513)	(0.492)	(0.627)	(0.491)	(0.468)
SCrisis_{t-1}	0.004	-0.002	0.004	0.274	0.310	0.241	0.052	-0.004
	(0.271)	(0.270)	(0.270)	(0.244)	(0.234)	(0.318)	(0.276)	(0.270)
FO_{t-1}	0.284**	0.292**	0.303**	0.135	0.062	0.059	0.241	0.298**
	(0.134)	(0.135)	(0.130)	(0.149)	(0.144)	(0.188)	(0.149)	(0.132)
$\Delta\log\left(\text{Commodity}_t\right)$	0.111***	0.104***	0.108***	0.088***	0.099***	0.107***	0.103***	0.106***
	(0.021)	(0.021)	(0.020)	(0.025)	(0.025)	(0.021)	(0.022)	(0.018)
$\Delta\log\left(\text{Energy}_t\right)$	0.007	0.006	0.007	0.007	0.007	0.008	0.007	0.008
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
$\Delta\log\left(\text{VIX}_t^{US}\right)$	-0.009***	-0.010***	-0.009***	-0.012***	-0.012***	-0.010***	-0.010***	-0.009***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
$\Delta\log\left(\text{MB}_t^{AE,S}\right)$	0.035**							
	(0.017)							
$\Delta\log\left(\text{M3}_t^{AE,S}\right)$		0.069***						
		(0.021)						
EMS_{t-1}^{US}			-0.001					
			(0.004)					
$\Delta\log\left(\text{TC}_t^{AE}\right)$				0.196***				
				(0.050)				
GAP_{t-1}^{AE}					0.013*			
					(0.006)			
$\Delta\log\left(\text{CP}_t^{US}\right)$						0.033*		
						(0.018)		
BL_{t-1}^{US}							0.040	
							(0.032)	
TED_{t-1}^{US}								-0.074
								(0.123)
Constant	-0.127	-0.122	-0.102	-0.050	0.064	0.088	-0.614	-0.074
	(0.083)	(0.083)	(0.094)	(0.094)	(0.098)	(0.130)	(0.433)	(0.099)
Countries	32	32	32	32	32	32	32	32
Observations	7,967	7,967	7,967	6,432	6,432	5,728	7,584	7,967
R-squared (within)	0.064	0.067	0.063	0.088	0.081	0.093	0.073	0.063
Avg. obs. per country	249	249	249	201	201	179	237	249

Note: A description of all regression variables is provided in Sections 4 and 5 as well as in Tables 12 and 13. All specifications use panel fixed effects with robust standard errors (Driscoll and Kraay, 1998) shown in parentheses below coefficients. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 7: Global liquidity indicators and their impact on different EMP measures: coefficient signs and significance levels for the baseline model

	1	1S	2	2S	3	3S	4	4S	3	3S	4	4S
$MB_{AE,S}$	**	**	**	***	0	**	0	**	0	*	0	**
$M3_{AE,S}$	***	***	***	***	*	***	0	***	*	***	0	***
EMS_{US}	0	**	*	0	0	**	0	0	0	*	0	0
TC_{AE}	***	***	***	***	**	***	**	***	**	***	**	***
GAP_{AE}	***	***	**	***	*	**	**	**	0	*	0	*
CP_{US}	**	**	**	**	0	*	0	*	0	*	0	*
BL_{US}	***	***	***	***	0	*	0	*	0	0	0	0
TED_{US}	0	0	0	0	0	0	0	0	0	0	0	0

Note: The table is based on 96 separate regressions. It shows the estimated coefficient signs and indicates whether a particular coefficient is significantly different from zero in each particular regression. A green (red) cell indicates that an increase in the particular GL-indicator is associated with an increase (decrease) in the particular EMP measure, thereby indicating appreciation (depreciation) pressure.
***, **, and * denote statistical significance at the 1, 5, and 10% levels, respectively. '0' indicates the lack of statistical significance at the 10% level. The first eight EMP columns refer to the baseline model. The last four columns show results based on the modified model that specifies the growth rate of the US interest rate instead of the interest rate differential.

Table 8: Global liquidity indicators and their impact on different EMP measures: coefficient signs and significance levels for the augmented model

	1	1S	2	2S	3	3S	4	4S	3	3S	4	4S
$MB_{AE,S}$	***	***	***	***	***	***	**	***	*	**	0	**
$M3_{AE,S}$	***	***	***	***	**	***	*	***	*	***	0	***
EMS_{US}	0	0	***	**	0	0	*	*	0	0	0	*
TC_{AE}	***	***	***	***	**	***	0	***	0	***	0	***
GAP_{AE}	*	0	0	0	0	0	0	0	0	0	0	0
CP_{US}	**	**	**	**	0	0	0	0	0	0	0	0
BL_{US}	**	0	**	**	0	0	0	0	0	0	0	0
TED_{US}	0	0	0	0	0	0	**	0	0	0	*	0

Note: See notes for Table 7. In contrast to the baseline model, the augmented model includes three further explanatory variables: trade openness, $(\text{TO})_{i,t-1}$, the current account-to-GDP ratio, $(\text{CA/GDP})_{i,t-1}$, and the lag of the country-specific credit growth rate, $\Delta\log(\text{Credit}_{i,t-1})$. They are excluded from the baseline regression as their inclusion substantially reduces the degrees of freedom.

7 Regime-specific estimation results

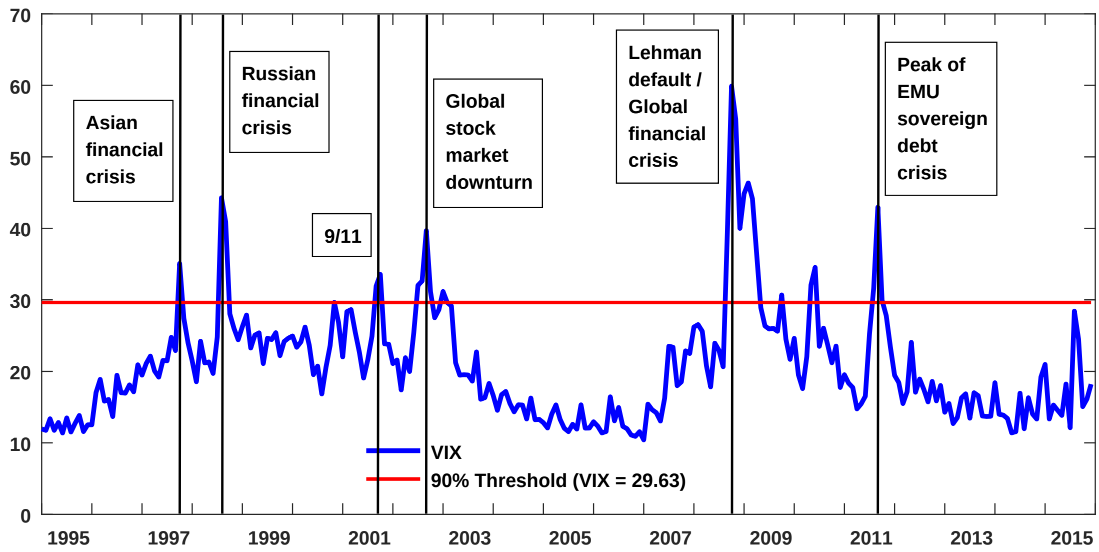
The effect of various global liquidity indicators on EMP under a linear regression specification has been shown to be distinct from the role of financial uncertainty as reflected by the VIX. This finding is significant in its own right as the VIX itself has occasionally been used as an (inverse) liquidity proxy in the literature. Since previous studies have detected a structural break for dynamic models during the global financial crisis (Bekaert et al., 2013; Bruno and Shin, 2015a), we want to explore the connection between liquidity and uncertainty further by testing if the impact of liquidity created in advanced economies is different during times of high volatility in financial markets as opposed to tranquil times. We would expect to find surges in monetary liquidity to affect EMP in emerging market economies specifically in times of benign conditions in financial markets: while investors "search for yield", surges in liquidity will find their way into EMEs, whereas during times of market turmoil, safety considerations will more likely dominate investment behaviour. The answer to that question will tell us whether or not advanced economies can contribute to the stabilisation of EM currencies during times of crisis – when EMEs typically face pronounced depreciation pressure – through monetary liquidity injections.

We follow Hansen (1999) and allow for different coefficient values between low- and high-volatility periods in our panel model by specifying a threshold regression. The low-volatility regime contains all periods with a VIX value within the 90% quantile and the high-volatility regime accordingly all remaining observations. The chosen threshold level is close to the endogenously determined optimal sample split for several of our global liquidity indicators and in each case statistically highly significant.[30] As the threshold model suffers from the 'Davies problem' (Davies, 1977, 1987) in that the threshold parameter is not identified under the null hypothesis, the statistical significance of the chosen sample split needs to be bootstrapped. In line with using Driscoll and Kraay (1998) standard errors to account for cross-sectional correlation as before, we adjust the bootstrap procedure of Hansen (1999, Section 4) by drawing the entire cross section for each time period to preserve the empirical correlation structure. While this adjustment results in more conservative significance levels than under simple random sampling, the regime split is still significant at the 1% level in all cases. Figure 3 plots the VIX and its 90% quantile and indicates events associated with major market distress. It shows that well-known periods of high market distress are correctly associated with the high-stress regime based on the 90%/10% regime split.

Table 9 shows regime-specific estimation results for the monetary base, M3, total credit, and bank leverage, so all three liquidity types (monetary, credit, and funding) are considered. While liquidity has a significant and sizable effect on EMP during normal times, that link breaks down and the VIX "takes over" in times of financial market turmoil. The most striking result is the complete loss of significance for each of the liquidity indicators. Moreover, the coefficient on the growth rate of the VIX is more significant and almost six times as large on average in the high-volatility regime compared with low-

[30] The optimal sample split based on a goodness-of-fit criterion (cf. Hansen, 1999) naturally varies across the different indicators. While in several cases a 90%/10% split is found to be optimal, in some other cases the statistically optimal split would point towards a 60%/40% split. We decided to use a homogeneous 90%/10% regime split, which ensures comparability across all liquidity indicators and better informs our research question than splitting the sample in almost equal halves.

Figure 3: The CBOE Volatility Index (VIX) 1995–2015



volatility periods, and it is still about three times as large as under the linear full-sample specification. Combining these observations with the high statistical significance of the regime split itself suggests that allowing for regime dependence is a fundamental building block in explaining the effect of global liquidity on emerging market EMP.

The findings in this section support our stated hypothesis and carry an important policy lesson, specifically for monetary liquidity. While liquidity expansions in advanced economies contribute to appreciation pressure on emerging market currencies in normal times, further liquidity injections will not alleviate the depreciation pressure on emerging market currencies during financial market crises.

Table 9: Regime-specific estimation results: Lower-90% vs. upper-10% quantiles of the VIX

% Quantile of VIX:	Lower 90%	Upper 10%	Lower 90%	Upper 10%	Lower 90%	Upper 10%	Lower 90%	Upper 10%
	EMP_2	EMP_2	EMP_2	EMP_2	EMP_2	EMP_2	EMP_2	EMP_2
$(i_{t-1} - i^{US}_{t-1})$	-0.020	-0.157*	-0.021	-0.157	-0.028	-0.144	-0.025	-0.160*
	(0.030)	(0.090)	(0.030)	(0.093)	(0.019)	(0.115)	(0.032)	(0.090)
$(\pi_{t-1} - \pi^{US}_{t-1})$	0.014	0.137**	0.014	0.137**	-0.025	0.105*	0.014	0.144***
	(0.011)	(0.054)	(0.011)	(0.055)	(0.021)	(0.056)	(0.012)	(0.050)
BCrisis_{t-1}	-5.914***	-3.498	-5.914***	-3.481	-6.070**	-7.296*	-7.002***	-3.398
	(1.499)	(3.053)	(1.495)	(3.124)	(2.904)	(3.791)	(1.580)	(3.042)
SCrisis_{t-1}	0.969	-2.897	0.959	-2.972	1.564	4.986	1.137	-2.942
	(1.015)	(5.752)	(1.012)	(5.636)	(1.128)	(3.390)	(1.007)	(5.607)
FO_{t-1}	1.007	-3.404	0.996	-3.267	-0.185	-4.436	0.452	-3.229
	(0.610)	(2.961)	(0.609)	(2.938)	(0.694)	(3.359)	(0.600)	(2.949)
$\Delta\log(\text{Commodity}_t)$	0.336***	0.213	0.297***	0.196	0.253***	0.183	0.302***	0.182
	(0.068)	(0.348)	(0.071)	(0.335)	(0.071)	(0.319)	(0.070)	(0.340)
$\Delta\log(\text{Energy}_t)$	0.034	0.083	0.025	0.081	0.035	0.057	0.018	0.080
	(0.028)	(0.106)	(0.027)	(0.106)	(0.026)	(0.122)	(0.026)	(0.108)
$\Delta\log(\text{VIX}^{US}_t)$	-0.015	-0.097***	-0.017**	-0.099***	-0.023**	-0.115***	-0.017*	-0.097***
	(0.009)	(0.023)	(0.009)	(0.025)	(0.010)	(0.026)	(0.010)	(0.024)
$\Delta\log\left(\text{MB}^{AE,S}_t\right)$	0.163**	0.055						
	(0.076)	(0.103)						
$\Delta\log\left(\text{M3}^{AE,S}_t\right)$			0.399***	0.131				
			(0.085)	(0.254)				
$\Delta\log(\text{TC}^{AE}_t)$					0.930***	0.289		
					(0.197)	(1.064)		
BL^{US}_{t-1}							0.366***	-0.102
							(0.110)	(0.725)
Constant	0.255	3.238	0.288	3.191	0.813*	3.869	-4.210***	4.600
	(0.460)	(2.423)	(0.466)	(2.441)	(0.461)	(2.946)	(1.494)	(9.955)
Countries	32	32	32	32	32	32	32	32
Observations	7,167	800	7,167	800	5,728	704	6,784	800
R-squared (within)	0.036	0.152	0.042	0.152	0.058	0.183	0.045	0.151
Avg. obs. per country	224	25	224	25	179	22	212	25

Note: A description of all regression variables is provided in Sections 4 and 5 as well as in Tables 12 and 13. Each subsample is estimated through panel fixed effects with robust standard errors (Driscoll and Kraay, 1998) shown in parentheses below coefficients. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. The VIX boundary value is 29.63, and the threshold effect in each case is statistically significant at the 1% level based on a bootstrap procedure that accounts for the empirical correlation in the cross section.

8 Conclusions

We have analysed the impact of a large number of global liquidity indicators on exchange market pressure (EMP) for a broad group of 32 emerging market economies based on a comprehensive approach. After controlling for a large number of potentially relevant EMP-determinants and by taking into account alternative definitions of EMP, we find a strong and very robustly identified role for several of our candidate global liquidity indicators. According to our estimation results, simple quantity-based liquidity measures such as money and credit growth in advanced economies are robustly related to exchange market pressure in emerging market economies. Two short-term funding liquidity measures, the growth rate of commercial paper outstanding and the level of bank leverage, are shown to impact EMP, too. For all of these different indicators, liquidity expansions tend to be associated with higher appreciation pressure on emerging market currencies. By contrast, results on derived liquidity measures such as the effective monetary stimulus or money overhang prove inconclusive.

As a further important finding from our regression estimates, the impact of each of the global liquidity indicators is empirically distinct from the role of financial uncertainty as measured by the VIX. While the VIX has been treated as an (inverse) liquidity proxy in some of the earlier literature, our results suggest that liquidity and uncertainty are not merely mirror images of each other.

Finally, results from regime-specific regressions may carry important policy implications from an international perspective. While increases in money and credit growth in advanced economies and the level of bank leverage in the US contribute to appreciation pressure on emerging market currencies during tranquil periods, that influence turns insignificant in times of financial market distress, when safety considerations may be a primary concern for investors. Our results imply that ample liquidity provision in advanced economies may contribute to a build-up of financial stability risks in emerging market economies in normal times, while further liquidity injections will not immediately alleviate depreciation pressure on emerging market currencies in times of crisis.

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A Appendix

Table 10: IMF exchange rate regime classifications 1995-2015

Ctry.	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
US	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
AL	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2
AR	9	9	9	9	9	9	9	2	2	2	2	2	8	8	2	2	4	4	4	4	4
BO	5	5	5	5	5	5	5	5	5	5	5	5	8	5	5	6	6	5	6	6	6
BR	7	7	7	7	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2
BG	1	1	1	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
CL	4	4	4	4	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
CO	4	4	4	4	4	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2
CR	5	5	5	5	5	5	5	5	5	5	5	5	4	4	3	3	3	3	3	3	6
CZ	8	8	7	2	2	2	2	1	2	2	2	2	2	1	1	1	1	1	1	3	6
DO	2	8	2	2	2	2	2	2	2	1	1	2	2	2	3	6	4	4	4	4	4
EG	8	8	8	8	8	8	7	7	2	2	2	8	8	2	3	3	4	6	4	6	6
GT	1	1	1	1	1	2	2	2	2	1	2	2	2	2	2	2	2	6	2	4	4
HN	4	4	4	4	4	4	4	4	4	4	5	8	8	8	6	6	6	4	4	4	5
HU	4	4	4	4	4	4	4	7	7	7	7	7	7	1	2	2	2	2	2	2	2
ID	4	4	4	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	4	2	2
IL	4	4	4	4	4	4	4	4	4	4	1	1	1	1	1	2	2	2	1	2	2
JM	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	6	6	4	4	4	4
KR	4	4	4	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2
MY	2	2	2	2	8	8	8	8	8	8	8	2	2	2	2	3	3	3	3	3	3
MX	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	1	1	1	1
PK	2	2	2	2	2	8	2	2	2	2	2	8	8	2	2	2	6	2	2	3	3
PY	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	2	2
PE	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2
PH	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2
PL	4	4	4	4	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
RO	2	2	2	2	2	2	2	4	4	4	2	2	2	2	2	2	2	2	2	2	2
RU	2	7	7	7	2	1	2	2	2	2	2	2	2	8	3	3	3	3	3	3	2
SG	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	4	6	6
ZA	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2
TH	8	8	8	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2
TR	2	2	2	2	5	5	1	1	1	1	1	1	1	1	2	1	2	2	2	2	2
UY	4	4	4	4	4	4	4	4	1	1	1	2	2	2	2	2	2	2	2	2	2

Note: All information is based on IMF (2015a). For a definition of index values, please see Table 11. Countries with a dark (light) [no] background colour display a fixed regime during all (some) [none] of the years in the sample period. Index values with a dark (light) [no] background colour represent a fixed regime (the residual category) [a floating regime]. The year shown in the column title refers to the year of the relevant IMF publication. In the case of a change in the exchange rate regime within a calendar year, the index value displayed reflects the majority of time within that year.

Table 11: IMF exchange rate regime categories

<table>
<tr><th colspan="2">Regime</th><th>Index Value</th><th>1995 – 1998</th><th>1999 – 2008</th><th>2009 – 2015</th></tr>
<tr><td rowspan="8">Fixed</td><td rowspan="2">Hard peg</td><td>10</td><td rowspan="3">Pegged to single currency or composite of currencies</td><td>Exchange arrangement with no separate legal tender</td><td>No separate legal tender</td></tr>
<tr><td>9</td><td>Currency board arrangement</td><td>Currency board</td></tr>
<tr><td rowspan="5">Soft peg</td><td>8</td><td>Conventional pegged arrangement</td><td>Conventional peg</td></tr>
<tr><td>7</td><td rowspan="6">Managed floating</td><td>Pegged exchange rate within horizontal bands</td><td>Pegged exchange rate within horizontal bands</td></tr>
<tr><td>6</td><td>N/A</td><td>Stabilized arrangement</td></tr>
<tr><td>5</td><td>Crawling peg</td><td>Crawling peg</td></tr>
<tr><td>4</td><td>Crawling band</td><td>Crawl-like arrangement</td></tr>
<tr><td>Other</td><td>3</td><td>N/A</td><td>Other managed arrangement</td></tr>
<tr><td colspan="2" rowspan="2">Floating</td><td>2</td><td>Managed floating with no predet. path for the exch. rate</td><td>Floating</td></tr>
<tr><td>1</td><td>Independent floating</td><td>Independently floating</td><td>Free floating</td></tr>
</table>

Note: All information is based on IMF (2015a). The index values reflect the regime categories applied since 2009, with a higher index value corresponding to an increasingly strict exchange rate regime. Index values 1 and 2 represent floating regimes while all other values reflect fixed regimes. Index value 3 is a residual category that corresponds to a soft peg, values 4-8 denote soft pegs, and values 9-10 represent hard pegs. Since the categories applied before 1999 are too coarse for a valid comparison, the regimes and index values for 1995-1998 have been determined from the text description of the exchange rate arrangements for each country in each year.

Table 12: Description of global liquidity indicators and sources

Liquidity concept	Series	Notes	Availability	Source
Monetary liquidity				
Monetary aggregates				
– Monetary base	$MB_{AE,S}$	Sum of monetary base series of US, JP, UK (bn USD)	1995M1–2015M12	Own calculation,
	$MB_{AE,PC}$	First principal component of national monetary base series (growth rates)		OECD MEI
– M1 money stock	$M1_{AE,S}$	Sum of M1 series of US, JP, UK (bn USD)	1995M1–2015M12	Own calculation,
	$M1_{AE,PC}$	First principal component of national M1 series (growth rates)		OECD MEI
– M3 money stock	$M3_{AE,S}$	Sum of M3 series of US, JP, UK (bn USD)	1995M1–2015M12	Own calculation,
	$M3_{AE,PC}$	First principal component of national M3 series (growth rates)		OECD MEI
Other indicators				
– Effective monetary stimulus	EMS_{US}	Monetary stance indicator proposed by Leo Krippner	1995M1–2015M12	Leo Krippner
Credit aggregates				
Total bank credit (W)				
– Local claims (W)	LC_W	Local claims by banks worldwide (trn USD)	2002Q1–2015Q4	BIS Locational Banking Statistics
– Cross-border claims (W)	CBC_W	Cross-border claims by banks worldwide (trn USD)	2002Q1–2015Q4	BIS Locational Banking Statistics
Non-financial sector				
– Total credit to non-financial sector (W)	TC_W	Total credit to non-financial sector worldwide (bn USD)	1999Q1–2015Q4	BIS Credit Statistics
– Total credit to non-financial sector (AE)	TC_{AE}	Total credit to non-financial sector in advanced economies (bn USD)	1999Q1–2015Q4	BIS Credit Statistics
Excess liquidity				
– Monetary overhang (US)	OV_{US}	Residual from estimated money demand function for US	1995Q1–2015Q4	Own calculation
– Monetary overhang (AE)	OV_{AE}	Residual from estimated money demand function for AEs	1995Q1–2015Q4	Own calculation
– Credit-to-GDP gap (AE)	GAP_{AE}	Deviation of total credit to private non-financial sector as a percentage of GDP from its long-run trend for AEs	1999Q1–2015Q4	Own calculation, BIS Credit Statistics
Funding liquidity				
– Commercial paper outstanding (US)	CP_{US}	Total commercial paper outstanding US (mn USD)	2001M1–2015M12	US Fed FRED
– Bank leverage ratio (US)	BL_{US}	Average total assets / Tier-1 risk-based capital (US commercial banks)	1996Q1–2015Q4	US Fed FRED
– TED spread (US)	TED_{US}	Difference between 3-month LIBOR and the 3-month treasury bill rate	1995M1–2015M12	US Fed FRED

Table 13: Description of other variables and sources

Variable	Description	Source	Frequency	Comments
Country-specific variables				
e	Bilateral nominal exchange rate vs. USD (USD per national currency)	IMF IFS	M	
i	Short-term interest rate (see Table 14 for details)	IMF IFS / OECD MEI	M	
IR	FX reserves in convertible currencies (mn USD)	IMF IFS	M	
MB	Monetary base (mn USD)	IMF IFS (Haver)	M	From 2001M12
CPI	Consumer price index	IMF IFS / Deutsche Bundesbank	M	
BCrisis	Dummy variable (1 = banking crisis, 0 = no banking crisis)	IMF Update of Luc Laeven and Fabian Valencia (2012)	A	
SCrisis	Dummy variable (1 = sovereign debt crisis, 0 = no sovereign debt crisis)	IMF Update of Luc Laeven and Fabian Valencia (2012)	A	
FO	Normalised measure of financial openness (interval 0 to 1, 0 = closed, 1 = open)	Author update (up to 2014) of Chinn and Ito (2012)	A	
TO	Trade openess, measured as sum of exports and imports divided by GDP	Own calculation, IMF IFS	Q	Unbalanced
CA/GDP	Current account balance as a percentage of GDP	World Bank WDI	A	Unbalanced
Credit	Total credit to the non-financial sector (bn USD)	BIS Credit Statistics	Q	Unbalanced
Global factors				
Commodity	Non-energy commodity price index	World Bank Commodities Price Data	M	
Energy	Energy commodity price index	World Bank Commodities Price Data	M	
VIX	Implied volatility of S&P 500 index options	US Fed FRED Database	M	

Table 14: Overview of short-term interest rates and sources

Country	Short-term interest rate	Source
US	Money market rate	IMF IFS
AL	Money market rate, 17 values interpolated	IMF IFS
AR	Money market rate, one value interpolated	IMF IFS
BO	Money market rate	IMF IFS
BR	Money market rate	IMF IFS
BG	Money market rate	IMF IFS
CL	Money market rate 1999M12-2015M12, backcasted with growth rate of discount rate	IMF IFS
CO	Money market rate 1995M3-2015M12, backcasted with growth rate of discount rate	IMF IFS
CR	Money market rate	IMF IFS
CZ	Money market rate	IMF IFS
DO	Money market rate 1996M1-2015M12, backcasted with growth rate of deposit rate	IMF IFS
EG	Deposit rate	IMF IFS
GT	Deposit rate	IMF IFS
HN	Deposit rate	IMF IFS
HU	Deposit rate	IMF IFS
ID	Money market rate	IMF IFS
IL	Treasury bill rate	IMF IFS
JM	Money market rate 1998M1-2015M12, backcasted with growth rate of treasury bill rate	IMF IFS
KR	Money market rate	IMF IFS
MY	Money market rate	IMF IFS
MX	Money market rate	IMF IFS
PK	Money market rate	IMF IFS
PY	Money market rate	IMF IFS
PE	Money market rate 1995M10-2015M12, backcasted with growth rate of discount rate	IMF IFS
PH	Money market rate	IMF IFS
PL	Money market rate	IMF IFS
RO	Money market rate	IMF IFS
RU	Money market rate	IMF IFS
SG	Money market rate	IMF IFS
ZA	Money market rate	IMF IFS
TH	Money market rate	IMF IFS
TR	Money market rate	OECD MEI
UY	Money market rate	IMF IFS

Table 15: Estimation results for EMP_2: Augmented model

	EMP_2	EMP_2	EMP_2	EMP_2	EMP_2	EMP_2	EMP_2	EMP_2
$(i_{t-1} - i_{t-1}^{US})$	-0.050	-0.050	-0.042	-0.080**	-0.073**	-0.084**	-0.049	-0.046
	(0.035)	(0.036)	(0.035)	(0.037)	(0.034)	(0.033)	(0.036)	(0.035)
$(\pi_{t-1} - \pi_{t-1}^{US})$	0.003	0.006	0.007	-0.009	-0.008	-0.007	0.007	0.007
	(0.023)	(0.023)	(0.025)	(0.021)	(0.023)	(0.023)	(0.024)	(0.024)
BCrisis_{t-1}	-3.992***	-4.035***	-4.065***	-2.620	-2.884	-1.830	-4.105***	-4.034***
	(1.338)	(1.353)	(1.361)	(1.804)	(1.837)	(1.701)	(1.343)	(1.388)
SCrisis_{t-1}	2.436*	2.439*	2.143	2.300*	2.260*	0.731	2.224	2.339*
	(1.401)	(1.365)	(1.345)	(1.340)	(1.354)	(1.231)	(1.364)	(1.368)
FO_{t-1}	-0.602	-0.585	-0.314	-1.366*	-1.421*	-1.624	-0.442	-0.490
	(0.710)	(0.717)	(0.722)	(0.777)	(0.789)	(1.107)	(0.711)	(0.707)
$\Delta\log(\text{Commodity}_t)$	0.364***	0.303***	0.318***	0.254**	0.313***	0.335***	0.317***	0.339***
	(0.107)	(0.109)	(0.097)	(0.119)	(0.104)	(0.096)	(0.108)	(0.097)
$\Delta\log(\text{Energy}_t)$	0.036	0.028	0.034	0.041	0.039	0.026	0.028	0.034
	(0.029)	(0.029)	(0.031)	(0.031)	(0.033)	(0.034)	(0.031)	(0.031)
$\Delta\log(\text{VIX}_t^{US})$	-0.048***	-0.051***	-0.048***	-0.052***	-0.052***	-0.048***	-0.049***	-0.046***
	(0.015)	(0.015)	(0.015)	(0.015)	(0.017)	(0.016)	(0.016)	(0.015)
TO_{t-1}	0.660	0.812	0.800	0.438	0.185	-0.126	0.734	0.598
	(0.750)	(0.746)	(0.745)	(0.784)	(0.827)	(0.942)	(0.738)	(0.755)
$(\text{CA/GDP})_{t-1}$	0.097**	0.086**	0.101***	0.161***	0.174***	0.187***	0.089**	0.100**
	(0.041)	(0.041)	(0.036)	(0.044)	(0.044)	(0.054)	(0.040)	(0.039)
$\Delta\log(\text{Credit}_{t-1})$	0.736***	0.725***	0.748***	0.617***	0.686***	0.735***	0.712***	0.739***
	(0.127)	(0.128)	(0.126)	(0.139)	(0.140)	(0.133)	(0.128)	(0.126)
$\Delta\log\left(\text{MB}_t^{AE,S}\right)$	0.215***							
	(0.077)							
$\Delta\log\left(\text{M3}_t^{AE,S}\right)$		0.493***						
		(0.108)						
EMS_{t-1}^{US}			-0.043***					
			(0.016)					
$\Delta\log(\text{TC}_t^{AE})$				0.955***				
				(0.216)				
GAP_{t-1}^{AE}					0.028			
					(0.025)			
$\Delta\log(\text{CP}_t^{US})$						0.214**		
						(0.087)		
BL_{t-1}^{US}							0.275**	
							(0.113)	
TED_{t-1}^{US}								0.439
								(0.492)
Constant	0.069	-0.004	0.580	0.639	1.141	1.585	-3.600**	0.029
	(0.772)	(0.789)	(0.821)	(0.801)	(0.817)	(1.080)	(1.748)	(0.830)
Countries	15	15	15	15	15	15	15	15
Observations	3,001	3,001	3,001	2,768	2,768	2,537	2,986	3,001
R-squared (within)	0.172	0.179	0.169	0.195	0.180	0.206	0.169	0.166
Avg. obs. per country	200	200	200	185	185	169	199	200

Note: A description of all regression variables is provided in Sections 4 and 5 as well as in Tables 12 and 13. All specifications use panel fixed effects with robust standard errors (Driscoll and Kraay, 1998) shown in parentheses below coefficients. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 16: Estimation results for EMP_2: Baseline model (restricted sample)

	EMP_2	EMP_2	EMP_2	EMP_2	EMP_2	EMP_2	EMP_2	EMP_2
$(i_{t-1} - i^{US}_{t-1})$	-0.040	-0.041	-0.033	-0.068*	-0.056*	-0.060*	-0.038	-0.036
	(0.035)	(0.036)	(0.035)	(0.038)	(0.034)	(0.036)	(0.035)	(0.035)
$(\pi_{t-1} - \pi^{US}_{t-1})$	-0.017	-0.014	-0.013	-0.022	-0.023	-0.028	-0.013	-0.013
	(0.024)	(0.023)	(0.025)	(0.022)	(0.024)	(0.026)	(0.024)	(0.025)
BCrisis_{t-1}	-5.789***	-5.762***	-5.875***	-2.993	-3.682*	-2.238	-5.982***	-5.863***
	(1.930)	(1.920)	(2.021)	(1.922)	(1.900)	(1.816)	(1.906)	(1.985)
SCrisis_{t-1}	2.486*	2.467*	2.223	2.353*	2.481*	0.226	2.215	2.395*
	(1.387)	(1.345)	(1.349)	(1.378)	(1.362)	(1.157)	(1.351)	(1.357)
FO_{t-1}	-0.270	-0.233	0.034	-0.819	-1.240	-1.061	-0.097	-0.164
	(0.795)	(0.797)	(0.805)	(0.885)	(0.923)	(1.302)	(0.791)	(0.794)
$\Delta\log(\text{Commodity}_t)$	0.491***	0.423***	0.445***	0.333***	0.407***	0.457***	0.431***	0.467***
	(0.095)	(0.097)	(0.087)	(0.114)	(0.104)	(0.085)	(0.102)	(0.092)
$\Delta\log(\text{Energy}_t)$	0.042	0.033	0.040	0.049	0.043	0.041	0.031	0.040
	(0.029)	(0.029)	(0.032)	(0.030)	(0.032)	(0.035)	(0.030)	(0.031)
$\Delta\log(\text{VIX}^{US}_t)$	-0.049***	-0.052***	-0.048***	-0.052***	-0.053***	-0.048***	-0.049***	-0.047***
	(0.015)	(0.015)	(0.015)	(0.015)	(0.017)	(0.016)	(0.015)	(0.015)
$\Delta\log\left(\text{MB}^{AE,S}_t\right)$	0.225***							
	(0.076)							
$\Delta\log\left(\text{M3}^{AE,S}_t\right)$		0.532***						
		(0.116)						
EMS^{US}_{t-1}			-0.037**					
			(0.018)					
$\Delta\log(\text{TC}^{AE}_t)$				1.261***				
				(0.232)				
GAP^{AE}_{t-1}					0.081***			
					(0.027)			
$\Delta\log(\text{CP}^{US}_t)$						0.234**		
						(0.104)		
BL^{US}_{t-1}							0.433***	
							(0.115)	
TED^{US}_{t-1}								0.480
								(0.488)
Constant	0.873*	0.905*	1.417**	0.978*	1.589***	1.635*	-4.886***	0.776
	(0.514)	(0.525)	(0.565)	(0.578)	(0.588)	(0.837)	(1.615)	(0.577)
Countries	15	15	15	15	15	15	15	15
Observations	3,001	3,001	3,001	2,768	2,768	2,537	2,986	3,001
R-squared (within)	0.124	0.133	0.120	0.159	0.137	0.153	0.126	0.118
Avg. obs. per country	200	200	200	185	185	169	199	200

Note: The table shows results for the baseline model based on the restricted sample of the augmented model (cf. Table 15). A description of all regression variables is provided in Sections 4 and 5 as well as in Tables 12 and 13. All specifications use panel fixed effects with robust standard errors (Driscoll and Kraay, 1998) shown in parentheses below coefficients. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 17: Estimation results for EMP_2: Baseline model for credit provision

	EMP_2	EMP_2	EMP_2	EMP_2	EMP_2	EMP_2	EMP_2	EMP_2
$(i_{t-1} - i_{t-1}^{US})$	-0.029	-0.029	-0.039	-0.033	-0.055	-0.039*	-0.038*	-0.035
	(0.029)	(0.029)	(0.031)	(0.030)	(0.054)	(0.023)	(0.022)	(0.022)
$(\pi_{t-1} - \pi_{t-1}^{US})$	0.018*	0.018*	0.020**	0.019*	-0.008	-0.013	-0.010	-0.014
	(0.010)	(0.010)	(0.010)	(0.010)	(0.023)	(0.018)	(0.019)	(0.020)
$BCrisis_{t-1}$	-5.906***	-5.974***	-6.787***	-6.804***	-8.165**	-6.335***	-6.328***	-6.477***
	(1.358)	(1.405)	(1.432)	(1.431)	(3.544)	(2.372)	(2.376)	(2.328)
$SCrisis_{t-1}$	0.238	0.131	0.480	0.405	1.139	1.636	1.626	1.764*
	(1.253)	(1.256)	(1.259)	(1.246)	(1.249)	(1.003)	(1.010)	(0.976)
FO_{t-1}	0.617	0.724	0.555	0.342	-0.753	-0.576	-0.435	-0.781
	(0.588)	(0.576)	(0.551)	(0.573)	(0.958)	(0.698)	(0.696)	(0.702)
$\Delta\log(Commodity_t)$	0.345***	0.233***	0.316***	0.246***	0.251***	0.268***	0.255***	0.335***
	(0.073)	(0.079)	(0.071)	(0.078)	(0.093)	(0.090)	(0.084)	(0.082)
$\Delta\log(Energy_t)$	0.032	0.030	0.018	0.023	0.030	0.028	0.019	0.027
	(0.026)	(0.025)	(0.024)	(0.024)	(0.027)	(0.026)	(0.026)	(0.027)
$\Delta\log(VIX_t^{US})$	-0.032***	-0.034***	-0.033***	-0.036***	-0.037***	-0.039***	-0.038***	-0.039***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.013)	(0.012)	(0.012)	(0.013)
$\Delta\log(LC_t^W)$	-0.005							
	(0.006)							
$\Delta\log(CBC_t^W)$		0.665***						
		(0.144)						
$\Delta\log(CBC_{Debt,t}^W)$			0.371***					
			(0.110)					
$\Delta\log(CBC_{Loans,t}^W)$				0.584***				
				(0.145)				
$\Delta\log(TC_t^W)$					1.222***			
					(0.231)			
$\Delta\log(TC_t^{AE})$						0.988***		
						(0.195)		
$\Delta\log(TC_{Private,t}^{AE})$							1.018***	
							(0.188)	
GAP_{t-1}^{AE}								0.046**
								(0.022)
Constant	0.558	0.154	0.342	0.488	0.894	0.981**	0.924*	1.444***
	(0.460)	(0.469)	(0.421)	(0.461)	(0.757)	(0.491)	(0.495)	(0.503)
Countries	32	32	32	32	32	32	32	32
Observations	7,967	7,967	7,677	7,677	5,376	6,432	6,432	6,432
R-squared (within)	0.047	0.054	0.059	0.062	0.107	0.079	0.081	0.066
Avg. obs. per country	249	249	240	240	168	201	201	201

Note: A description of all regression variables is provided in Sections 4 and 5 as well as in Tables 12 and 13. All specifications use panel fixed effects with robust standard errors (Driscoll and Kraay, 1998) shown in parentheses below coefficients. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.