The Dollar Squeeze and Economic Growth

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Abstract

We explore how covered interest parity deviations—measured by the cross-currency basis (CCB)—affects output growth. Using quarterly data from advanced economies (AE) and emerging markets (EM) in a panel VAR model and local projections, we find that positive shocks to the CCB typically lead to negative responses in output, implying that looser dollar funding conditions induce contractions. This counterintuitive result may be understood by recognizing that the effects of dollar access operates by altering the relative attractiveness of dollar versus non-dollar-denominated assets. During financial crises in AEs, the safe-haven demand for dollar assets is so pronounced that shortfalls in international liquidity become especially debilitating for growth. During normal times, however, easier dollar access induces agents in EMs to increase their purchases of local-currency assets, impairing domestic liquidity and hence growth; whereas in AEs, the exchange rate appreciates to compensate holders of local-currency assets, which erodes export competitiveness and growth.

Keywords: CIP deviations; cross-currency basis; dollar squeeze; output growth; panel VAR
JEL codes: E51, F31, F43, G15

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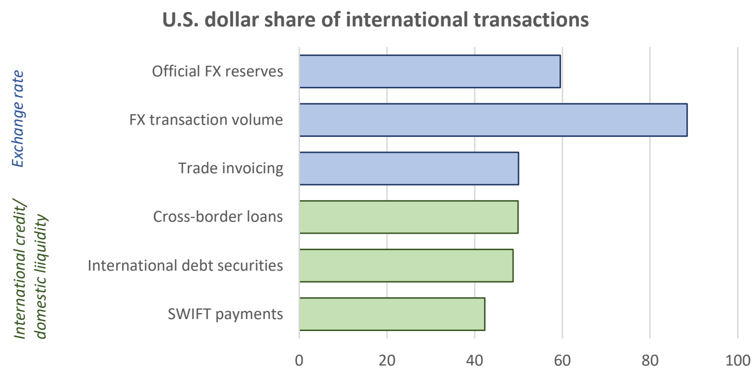
"Why can't we do trade based on our own currencies? Who was it that decided that the dollar was *the* currency after the disappearance of the gold standard?"

Luiz Inácio Lula da Silva
President of Brazil (1945–)

1 Introduction

The dollar squeeze, as conventionally understood, refers to the economic effects of U.S. dollar liquidity on foreign borrowers. It is a first-order concern for global private-sector investors and public-sector policymakers alike. The squeeze reflects the dominance of the dollar in international finance, where half or more of all transactions—ranging from cross-border lending to trade invoicing—are denominated in the currency (Figure 1). It is also the mechanism by which Federal Reserve policy can spill over to other economies worldwide. Given the dominance of the greenback, it would be unsurprising if access to dollars affects trade, investment, and economic performance in nations that do not otherwise transact in the currency.



Source: Authors' compilation, using BIS (2022).

Figure 1: The U.S. dollar is ubiquitous in cross-border transactions, reflecting the importance of the greenback in international trade and finance. Dollar dominance in foreign exchange, reserves, and trade invoicing embody an exchange rate channel through which the currency influences growth, while the denomination of cross-border loans, debt, and payments capture an international credit channel—which in turn can alter domestic liquidity—both of which may affect economic performance.

Typically, the dollar squeeze is associated with a tightening of dollar liquidity, which in turn reduces growth. While this is true in certain models (Dong & Wen 2024; Jiang, Krishnamurthy & Lustig 2021, 2023), we contend that the question of how dollar liquidity matters for economic outcomes is, ultimately, an empirical one. After all, economies finance investment not just from foreign sources but also via domestic saving (Feldstein & Horioka 1980), and even in the presence of capital inflows, exchange rate developments may substantially alter the calculus of consumption and investment choices made by households and firms.

In this paper, we argue that the dollar squeeze should be interpreted more broadly, as the manner by which constrained access to short-term dollar funding inhibits economic performance. Importantly, these conditions may apply to situations of either *looser* or tighter liquidity. More pointedly, we find that the traditional notion—that dollar shortages imply insufficient financial resources to support economic activity—applies in only one specific circumstance: in advanced economies, during a financial crisis. Under normal conditions, in contrast, the dollar squeeze operates by diminishing the attractiveness of dollar-denominated assets, which in turn induces trade and financial flows that conspire to lower growth.

In particular, we establish two additional, indirect channels for the dollar squeeze. For EMs, the reduction in convenience yields on safe-haven dollar assets increases the attractiveness of local currency-denominated assets. Elevated purchases of such assets, in turn, both raises the cost of capital, while lowering domestic liquidity available to finance growth. For AEs—where yields are already more comparable to that of the U.S. to begin with—the local currency instead appreciates to otherwise compensate asset holders, and this erodes the country's export performance and suppresses growth.

While there are many ways to assess dollar needs, one mechanism has recently come into greater prominence, especially after the 2007/08 global financial crisis: large and persistent deviations from covered interest parity (CIP), frequently referred to as the cross-currency basis (CCB). The presence of a nonzero CCB is itself remarkable, since, prior to the crisis, CIP was one of the more reliable examples of efficient financial arbitrage. Deviations—to the extent that they emerged—were typically miniscule, and quickly corrected. Yet this previously-dependable relationship changed as a result of the crisis (Baba & Packer 2009; Coffey, Hrung, Nguyen & Sarkar 2009; Hui, Genberg & Chung 2011), and has persisted thereafter (Cerutti, Obstfeld & Zhou 2021; Du, Tepper & Verdelhan 2018; Iida, Kimura, Sudo *et al.* 2018).

We exploit the CCB as our metric for dollar liquidity. We compute cross-currency bases vis-à-vis the dollar for a mix of 50 advanced economies (AEs) and emerging markets (EMs), before, during, and after the global crisis, and match these with macroeconomic data, especially output, prices, the money stock, and the exchange rate. We apply a panel vector autoregression (PVAR) model to the system, and consider how dollar liquidity shocks shape economic outcomes. To further secure identification, we further consider local projections (LPs), instrumented with exogenous monetary policy shocks. Our central finding—that greater dollar liquidity is accompanied by lower growth, except for AEs during crises—is remarkably robust, surviving checks for endogeneity, model specification, and variable measurement.

Related research. The literature on deviations from covered interest parity dates back to the heyday of research on determinants of exchange rates in the 1970s and 80s. Earlier papers mostly found that deviations were small and short-lived (Browne 1983; Clinton 1988). When the hitherto robust CIP relationship broke down after 2007, scholars began to explore why. Explanations include heightened counterparty risk (Baba & Packer 2009; Hui *et al.* 2011), greater illiquidity in the foreign exchange market (Fong, Valente & Fung 2010; Pinnington & Shamloo 2016), a strengthening of the dollar (Avdjiev, Du, Koch & Shin 2019; Cerutti *et al.* 2021), increases in hedging demand for dollars (Borio, McCauley, McGuire & Sushko 2016; Liao & Zhang 2020), rising transactions costs of various kinds (Cenedese, Della Corte & Wang 2021; Du *et al.* 2018; Liao 2020; Rime, Schrimpf & Syrstad 2022), and monetary policy divergences (Fukuda & Tanaka 2017; Iida *et al.* 2018). We depart from this family of papers in not attempting to explain the *causes* of CIP deviations, as much as outlining some of its *consequences.*

That said, two papers are more closely aligned with our work here. Eguren Martin (2020) builds a two-country New Keynesian model with financial frictions, and finds that dollar shortages lead to deviations from *un*covered interest rate parity, reducing bank lending, and contracting output. Ibhagui (2020) instead links CIP deviations to (relative) money supply and output growth via a standard monetary model, and finds that dollar *surpluses* are associated with increases in output. Both papers are based more on macro-theoretic models, in contrast to the more micro-oriented approach adopted here.

Moreover, most existing analyses of CIP limit themselves to currencies of advanced (and especially G10[1]) economies. However, global demand for dollar assets has increased dramatically following the global financial crisis, by EM sovereigns (Dittmar & Yuan 2008), banks (Aldasoro, Eren & Huang 2021), and corporates (Alfaro, Asis, Chari & Panizza 2019; Kim & Shin 2021). Conclusions about the effects of dollar liquidity made using a sample that excludes EMs are therefore likely to be incomplete. Our study plugs this gap.

Another related area of research are papers that examine global currency competition (Aizenman, Cheung & Qian 2020; Flandreau & Jobst 2009; Fratzscher & Mehl 2014) and international currencies (Lane & Shambaugh 2010; Matsuyama, Kiyotaki & Matsui 1993), especially regarding the dominant role of the dollar (Goldberg & Tille 2009; Maggiori, Neiman & Schreger 2019). The dollar enjoys a disproportionate share of foreign exchange reserves (Lilley, Maggiori, Neiman & Schreger 2022), sovereign (Jiang *et al.* 2021), and corporate debt issuance (Jiang *et al.* 2023; Maggiori, Neiman & Schreger 2020), which is unsurprising. But it also exerts an influence on real trade flows (Bruno & Shin 2023; Goldberg & Tille 2008; Gopinath, Boz, Casas, Díez, Gourinchas & Plagborg-Møller 2020). The question remains, however, if the dollar's importance for real economic outcomes in foreign countries goes beyond trade, which is our focus here.

Finally, our work also speaks to a very large body of work on the international transmission of monetary policy (Buch, Bussierè, Goldberg & Hills 2019; Takáts & Vela 2014), especially when emanating from the United States (Obstfeld 2020). The effects of these shocks have been considered for not only conventional (Di Giovanni & Shambaugh 2008; Morales, Osorio, Lemus & Sarmiento 2022) but also, more recently, unconventional (Bauer & Neely 2014; Lim & Mohapatra 2016) forms of monetary policy.

A number of these papers are fairly close to our own, in terms of methodology. Kim (2001), for instance, use recursively-identified VARs, while Neuenkirch & Nöckel (2018) rely on identification via sign restrictions. In a panel setting, Basso, Calvo-Gonzalez & Jurgilas (2011) apply Cholesky decompositions to a panel VAR, while Crespo Cuaresma, Doppelhofer, Feldkircher & Huber (2019) instead prefer a global VAR (and sign restrictions). What is common to these—as well as virtually all other papers that explore the spillover effects of the dollar on other economies (Caceres, Carriere-Swallow, Demir & Gruss 2016; Gerko & Rey 2017; Miranda-Agrippino & Rey 2020; Passari & Rey 2015; Rey 2016)—is a focus on interest rates (in varying

[1]The G10 are the most heavily traded and liquid currencies, and comprise the Australian, Canadian, (the U.S.) and New Zealand dollars, the euro, the Japanese yen, British pound, Swiss franc, Norwegian krone, Danish krone, and Swedish krona. Given that the U.S. dollar is the counterpart currency in calculating CCB, we do not consider it in our analysis since it always equals to zero.

forms) as their primary measure of the shock to U.S. monetary policy. In contrast, we are more interested in a shock to dollar liquidity, proxied with the CCB.

Some papers have probed deeper into how certain channels transmit monetary policies from one country to another. Demirgüç-Kunt, Horváth & Huizinga (2020), for example, explore spillover effects via the bank lending channel, whereas Lin & Ye (2018) address how the credit channel can affect trade. The risk-taking channel is considered in Neuenkirch & Nöckel (2018), while Cesa-Bianchi & Sokol (2022) take on the informational channel. Like these papers, our work also seeks to unpack key cross-border transmission channels, but we do so in the context of dollar liquidity (rather than interest rates), while concentrating our efforts on international credit, domestic liquidity, and the exchange rate.

2 Theoretical Background

2.1 Measures of liquidity

Liquidity—the ease of access to funding—is a rich financial concept. In the finance literature, measures often distinguish between market and funding liquidity (Brunnermeier & Pedersen 2009); the former captures the ease of trading an asset, while the latter refers to the ability to obtain resources for executing trades. In the context of currencies, the former is more relevant, and may be approximated by the amount of currency volatility relative to trade volumes (Ranaldo & de Magistris 2022). Yet if anything, it is global liquidity that matters more for most open economies, since its access could drastically alter the amount of financing available to fund real economic activity.

Global liquidity encapsulates not only domestic narrow money issued by the central bank, but also international reserves (along with any applicable bilateral swap arrangements, as well as credit lines from multilateral financing institutions such as the IMF). Generally, there is no consensus on a singular measure of global liquidity (Beckmann, Belke & Czudaj 2014); analysts have variously relied on deviations of the short-term rate from Taylor (1993)-implied rules, excess valuation in asset prices, spreads between deposit and overnight index swap rates, and foreign reserve holdings (BIS 2011). While these proxies undeniably capture important aspects of global liquidity, what is common across these disparate indicators is that they do not isolate the currency accessibility element of liquidity, especially with respect to U.S. dollars.

Doing so is important, because of the dollar's status as the international currency *par excellence*, used as a medium of exchange (as a vehicle or intervention currency), unit of account (in invoicing or anchoring), and store of value (via assets or reserves). Changes to dollar liquidity have the potential to afflict all economies without the ability to print the currency—that is, all economies other than the United States. Since the global financial crisis of 2007/08, deviations from covered interest parity have become a useful gauge of the pure liquidity effects of dollar access.

2.2 The cross-currency basis as a measure of global liquidity

Covered interest parity is a non-arbitrage condition in international finance, which states that the returns from two different cash markets for the same tenor should be equal, after hedging exchange rate risk via a forward contract. For a country i facing continuously compounded interest rates at time t with an n-period tenor, CIP may be expressed as:

$$e^{n \cdot r^*_{t,t+n}} = e^{n \cdot r_{it,i(t+n)}} \cdot \frac{S_{it}}{F_{it,i(t+n)}} \tag{1}$$

where $r_{it,i(t+n)}$ ($r^*_{t,t+n}$) represents the interest rate for the currency of country i (U.S. dollar), and S_{it} and $F_{it,i(t+n)}$ are the directly quoted[2] spot and forward exchange rates, respectively.

With perfect arbitrage, (1) will hold with equality at all times. However, deviations from CIP may emerge, and this is expressed as a wedge, $x_{it,i(t+n)}$,[3] which captures the difference between the dollar interest rate and its synthetic equivalent. Incorporating $x_{it,i(t+n)}$ into equation (1) yields:

$$e^{n \cdot r^*_{t,t+n}} = e^{n \cdot \left(r_{it,i(t+n)} + x_{it,i(t+n)}\right)} \cdot \frac{S_{it}}{F_{it,i(t+n)}}. \tag{2}$$

By taking logarithms and solving (2) for $x_{it,i(t+n)}$, we obtain the expression for the cross-currency basis for country i:

$$x_{it,i(t+n)} = r^*_{t,t+n} - \left[r_{it,i(t+n)} - \frac{1}{n} \left(f_{it,i(t+n)} - s_{it} \right) \right] \tag{3}$$

where $f_{it,i(t+n)}$ (s_{it}) represents the log-equivalent term for the forward (spot) exchange rate. (3) expresses the CCB as the difference between the direct and synthetic dollar interest rates (the term in the square brackets), with the latter obtained by borrowing local currency first, before swapping it for dollars in the foreign exchange (FX) market with a forward contract, thereby hedging exchange rate risk.

From the perspective of dollar borrowers, the two rates represent the alternative funding costs of borrowing dollars—for American versus foreign investors, respectively—and any resulting spread may serve as a reasonable proxy for (global) dollar liquidity constraints (Filipe, Nissinen & Suominen 2023; Goldberg 2024). The sign of $x_{it,i(t+n)}$ thus indicates not only the direction of CIP deviations, but also the relative funding cost differential. When $x_{it,i(t+n)} < 0$, it is cheaper to borrow dollars directly from the dollar cash market, as opposed to the cross-currency swap market (and *vice versa* when $\mathbf{x}_{it,i(t+n)} > 0$). Thus, a negative basis implies a relative dollar shortage for investors outside of the United States, with decreases suggesting a worsening of this liquidity condition. This is the stereotypical reference to a "dollar squeeze", when non-U.S. entities are in need of dollars to finance lending or investment, but are unable to secure them in money markets.

Conversely, a dollar *surplus*—when the CCB is positive—means that investors outside the U.S. can borrow dollars more readily. The reduced opportunity cost of holding the dollar may thus be interpreted as a diminution of the "convenience yield" (Jiang *et al.* 2021; Robe 2022), accrued for otherwise holding dollar assets. This, in turn, renders non-dollar-denominated assets more attractive, and encourages substitution into them. An increase (decrease) in the CCB is

[2] That is, the price in local currency per U.S. dollar, such that an increase amounts to a depreciation.

[3] We follow Du *et al.* (2018) and measure the cross-currency basis in terms of the currency of country i against the U.S. dollar. As such, a negative basis implies a dollar shortage for investors outside of the U.S., which is the opposite of other studies that measure the cross-currency basis of the dollar vis-à-vis a foreign currency (see, for example, Baba & Packer 2009; Coffey *et al.* 2009; Fukuda & Tanaka 2017; Levich 2012).

therefore associated with a fall (rise) in convenience yields. Recognizing this relationship also makes it clear that the global liquidity element captured by our metric applies specifically to high-frequency, unanticipated short-term dollar needs—not already covered by forward or FX swap contracts—rather than those resulting from lower-frequency cross-border financial flows.

2.3 Transmission of the cross-currency basis

Markets frequently refer to a shortage of dollar liquidity as a dollar "squeeze", because access to the dollar is often deemed necessary to support economic activity. However, this squeeze on the macroeconomy may manifest itself in other ways. Changes to dollar liquidity can alter the attractiveness of holding dollars and dollar-denominated assets, which also carry implications for economic activity. Theory has identified some key transmission channels by which shocks to dollar liquidity may propagate to the real economy.

The most direct manner by which dollar shocks can alter real activity in foreign countries is via the *international credit* channel (Miranda-Agrippino & Rey 2020).[4] Given the prevalence of dollar as an international funding currency, financial institutions without easy access to dollars may face an elevated external finance premium, which hampers their ability to intermediate between foreign creditors and domestic borrowers. Consequently, these banks deleverage and pare back on lending at home, which in turn weakens aggregate demand. Such international illiquidity can become particularly severe during financial crises (Chang & Velasco 2001). Unfortunately, flexible exchange rates—the traditional buffer between foreign shocks on the domestic economy—are insufficient to insulate economies from such spillovers (Rey 2016).

Empirical studies have pointed to how international credit crunches were relevant for the 2007/08 global crisis (Ivashina & Scharfstein 2010; Miranda-Agrippino & Rey 2020) as well as the European sovereign debt crisis of 2010 (Correa, Sapriza & Zlate 2021),[5] and how crisis-induced credit constraints hindered real economic activity (Cesa-Bianchi & Sokol 2022; Dell'Ariccia, Detragiache & Rajan 2008). The channel may also be pertinent in non-crisis settings, as demonstrated in Mexico (Miranda-Agrippino & Rey 2020).

Besides the direct channel of international credit, which appears most empirically relevant during crisis events, there are also indirect channels where dollar liquidity changes may potentially affect growth.

The *domestic liquidity* channel can amplify or offset the effects of dollar liquidity changes on the economy. In closed economies, differences in investment opportunities available to entrepreneurs imply that liquid funds are necessary for financing capital accumulation; shocks to liquidity could then trigger substitution between money and assets (Kiyotaki & Moore 2019), which in turn affect consumption and investment (and hence output) (Shi 2015). Liquidity shocks may also alter risk-taking appetite—especially in the corporate bond market—which would likewise lead to declines in real activity (Borio & Zhu 2012; Gilchrist & Zakrajšek 2012).

In open economies, such substitution may occur between domestic and (foreign) dollar-

[4]The credit channel was first advanced by Bernanke (1983) in an effort to understand non-monetary effects of a financial crisis on output. However, most studies had hitherto focused on the effects of crisis transmission via domestic, rather than international, credit.

[5]Some (for example, Logan 2021) have also stressed how dollar liquidity shocks were relevant during the pandemic crisis.

denominated assets. Reductions in the convenience yield on dollar assets may induce local investors to pursue local-currency assets instead, as their appetite for safe-haven assets (Caballero & Krishnamurthy 2009; He, Krishnamurthy & Milbradt 2016) diminishes. Such buying may be financed either by cash holdings at the central bank, or by borrowing dollars at home, with exchange rate risk hedged via an FX swap. Either way, heightened asset purchases will tighten the domestic money supply, while simultaneously raising the cost of capital.[6] The reduced credit available for domestic investment then prompts a growth slowdown. Given the more volatile investment profile of EMs, we suspect that this channel may be more relevant for this group.

The evidence supports the notion that liquidity shocks mattered in the run-up to the Great Depression (Calomiris, Jaremski & Wheelock 2022), and that such constraints can exert a quantitatively large effect on output, while also altering the pace of recovery in the aftermath of the Great Recession (Del Negro, Eggertsson, Ferrero & Kiyotaki 2017). Local credit cycles have also been found in more limited contexts, including in emerging markets such as Turkey (Di Giovanni, Kalemli-Özcan, Ulu & Baskaya 2021).

There is another relevant indirect channel: changes to the relative attractiveness of dollar assets may prompt movements in the exchange rate, to otherwise compensate for return differentials (more generally, such adjustments are driven by global portfolio rebalancing). This is the classic *exchange rate* channel, implied by *un*covered interest parity. For example, local currency appreciation will, *ceteris paribus*, promote financial inflows, which could make nondollar assets relatively more attractive, in the event that yield differentials are already trivial. But as long as relative prices remain stable and the Marshall-Lerner condition holds, the consequent real exchange appreciation will also mean a worsening of the current account and, in turn, poorer growth.[7] Since portfolio rebalances of this nature are more likely between AE assets, we believe that this channel will be more applicable to this group.

Recent empirical work has shown that exchange rate changes are closely tied to CIP deviations. While some authors find that a decline in the basis unambiguously results in dollar appreciation (Avdjiev *et al.* 2019), others have found that any immediate appreciation is ultimately followed by a subsequent depreciation (Jiang *et al.* 2021). The reality of international portfolio rebalancing between different risk assets, more generally, is also borne out in the data (Albertazzi, Becker & Boucinha 2021). Exchange rates—especially their fixity during the Gold Standard era—have also been implicated in the transmission of the Great Depression from the United States to the rest of the world (Eichengreen & Temin 2000). Finally, the external adjustment process is also the subject of a large empirical literature (Engel 2002), for which more recent work has stressed the relative importance of the dominant currency (Casas, Meleshchuk

[6]While the credit channel is generally viewed as operating on interest rates, the close inverse relationship between increased rates and a contraction in money stock suggests that the two may be considered in tandem. Furthermore, the traditional monetarist argument likewise affirms the link between tight money, higher rates, and output contractions (Belongia & Ireland 2016; Christiano, Eichenbaum & Evans 1999). In the empirical analysis that follows, we also unpack the two and consider the interest rate and money separately.

[7]Risk-taking may also come into play in the global context: lower dollar funding costs promotes greater international risk-taking, which leads to inflows and appreciation, seemingly in a virtuous circle (Neuenkirch & Nöckel 2018). However, during a downturn, the same amplification mechanism can reinforce financial distress; as borrowing firms' liabilities rise relative to their assets, the weakening of their balance sheets leads to reductions in investment.

& Timmer 2023).

Figure 2 summarizes how these distinct channels transmit changes in dollar liquidity to growth. Notably, the (direct) international credit channel affects international bank lending, especially during crisis periods. The (indirect) domestic liquidity and exchange rate channel alters holdings of foreign dollar assets and domestic exports, respectively, and appear to operate during normal periods. Changes in these variables then impact growth outcomes in the next period.

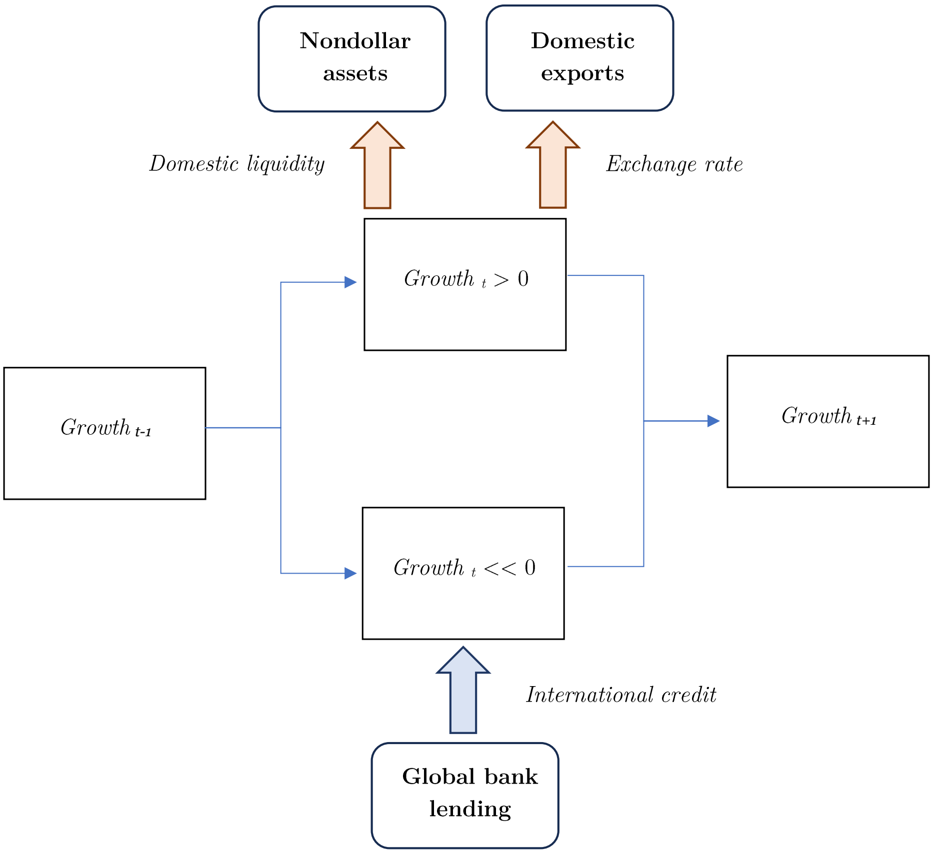


Figure 2: Transmission of the cross-currency basis to growth outcomes include the international credit, domestic liquidity, and exchange rate channels. The first is most direct, and most likely to be empirically relevant during crisis periods; it affects growth by reducing access to financing from international bank lending. The latter two are indirect, and most likely to apply during normal economic conditions. One affects growth when liquidity tightens as a result of increased purchases of non-dollar assets, while the other influences growth when domestic export performance suffers as a result of a strong exchange rate.

3 Empirical measures

3.1 Data sources and construction

Our baseline sample is an unbalanced panel spanning from 2000Q1 to 2020Q4,[8] which covers up to 50 AEs and EMs. Since we are primarily interested in understanding the relationship between dollar liquidity and economic growth in the short run, we use the three-month IBOR and forward/spot rates from Bloomberg for our cross-currency basis;[9] the continuously-compounded basis is then calculated for each currency against the U.S. dollar, based on the formulation in (3).[10]

Figure 3(a) illustrates the evolution of the CCB for the G10 group of most-traded AE currencies, relative to the U.S. dollar, for the most recent decade. Prior to 2007, CCBs were close to zero, in spite of fluctuations (Akram, Rime & Sarno 2008). The 2007/08 crisis led to massive deviations from CIP, and serves as an obvious dividing line between when CCBs were smaller and stabler, versus larger and more volatile. Other subsequent spikes include the European sovereign debt crisis, and the more recent COVID-19 pandemic crisis.[11] Even so, CCBs for AEs remain far smaller than in EMs; notice that the vertical axis in Figure 3(a) is an order of magnitude smaller than Figure 3(b), and how CIP does not appear to hold for some currencies, even in the pre-crisis period. These distinctions between G10 and EM currencies has also been documented by others (Cerutti & Zhou 2024).[12]

The majority of our other macroeconomic data are from Bureau Van Dijk's *Economist Intelligence Unit Country Data*, including real GDP, the consumer price index (CPI), the money stock (M2), as well as the nominal exchange rate (ER) (all used in our baseline). The producer price index (PPI), lending interest rate, real effective exchange rate, and current account data—used for robustness checks—are also from the same source. We supplement these with additional controls from various sources, such as trade openness, the dependency ratio, and level of financial development from the World Bank's *World Development Indicators*, political risk from the Political Risk Services group's *International Country Risk Guide*, and a machine learning democracy index by Gründler & Krieger (2021).

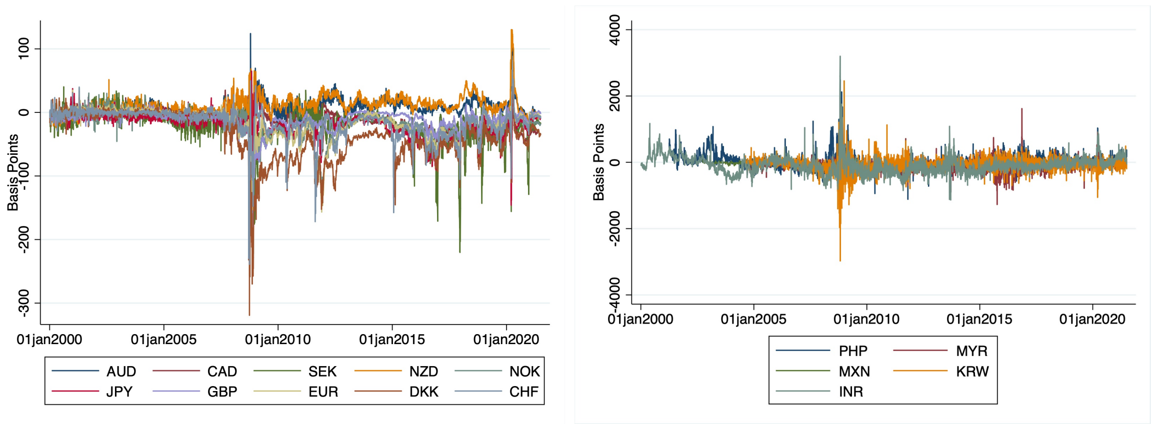
[8]This includes the period with the COVID-19 pandemic. Since our sample also covers the 2007/08 global crisis, we believe this sample choice, which retains maximum coverage, is justified. However, we demonstrate in the appendix that our baseline results go through even when we exclude this period.

[9]One currency—the Chilean peso—presents known issues for the computation of the CCB. We document robustness checks with varying ways of handling this anomaly in the appendix.

[10]The relevant variables are actually available at the daily frequency; we use these to construct a daily IBOR basis, but average these up to obtain a quarterly measure, so as to conform with the frequency of the other macroeconomic variables. Additional details on variable construction are presented in the appendix.

[11]One may observe that the CCB actually *rose*, for a number of currencies, during the pandemic crisis. This is because Treasury price movements, coupled with revised Basel III capital requirements, led to an amplification of the *in*convenience yield for holding dollars during this period (He, Nagel & Song 2022). Seen this way, increases in CCBs remain consistent with our definition of global liquidity (discussed in Section 2.2), because there was no appreciable global dollar shortage during this episode, owing to the diminished attractiveness of dollar assets.

[12]Notably, Cerutti & Zhou (2024) also argue that CIP deviations in EM currencies move in the opposite direction during global risk-off episodes. An examination of the CCBs for EM currencies in our sample does not, however, reveal any systematic direction for their movement (we plot the CCB for each of the currencies in our sample in the appendix).



(a) G10 AE currencies

(b) 5 EM currencies

Figure 3: The 3-month cross-currency basis for the G10 group of most-traded advanced-economy currencies (minus the dollar), and a selection of 5 important EM currencies, reveal that the CCB was generally larger and more volatile for EMs, and for some currencies, CIP may not have held even in the pre-crisis period.

3.2 Econometric methodology

Our baseline specification is based on a k-variate, homogeneous panel vector autoregression model of order p, with $i = 1, 2, \ldots, N$ economies and $t = 1, 2, \ldots, T$ periods. It takes the form

$$\mathbf{Y}_{i,t} = \sum_{j=1}^{p} \mathbf{Y}'_{i,t-j}\boldsymbol{\beta}_j + \mathbf{X}'_{i,t}\gamma + \boldsymbol{\alpha}_i + \boldsymbol{\epsilon}_{i,t}, \tag{4}$$

where $\mathbf{Y}_{i,t}$ is a $(1 \times k)$ vector of endogenous variables, $\mathbf{X}_{i,t}$ is a $(1 \times m)$ vector of exogenous covariates, $\boldsymbol{\alpha}_i$ is a $(1 \times k)$ vector of time-invariant country-specific panel fixed effects, and $\boldsymbol{\epsilon}_{it}$ is a $(1 \times k)$ vector of idiosyncratic errors. The $(k \times k)$ matrix of $\boldsymbol{\beta}_1, \ldots, \boldsymbol{\beta}_p$ and $(m \times k)$ matrix $\boldsymbol{\gamma}$ are the coefficients to be estimated. We assume that the idiosyncratic errors follow

$$\boldsymbol{\epsilon}_{i,t} \sim \mathrm{IID}(\mathbf{0}, \boldsymbol{\Sigma}), \tag{5}$$

where $\mathbf{E}\left(\boldsymbol{\epsilon}_{i,t}\right) = \mathbf{0}$, $\mathbf{E}\left(\boldsymbol{\epsilon}'_{i,t}\boldsymbol{\epsilon}_{i,t}\right) = \boldsymbol{\Sigma}$, and $\mathbf{E}\left(\boldsymbol{\epsilon}'_{i,t}\boldsymbol{\epsilon}_{i,s}\right) = \mathbf{0}$ whenever $t > s$.

We follow the prior literature (Holtz-Eakin, Newey & Rosen 1988) and further assume that each of the economies in the cross section shares the same data-generating process, such that the reduced-form coefficients $\boldsymbol{\beta}_1, \ldots, \boldsymbol{\beta}_p$ and $\boldsymbol{\gamma}$ are common among all the N economies.

For what follows, we define the vector of two variables $\mathbf{Y}^p = [CCB\ GDP]$ as our parsimonious model. To accommodate additional macroeconomic dynamics, we expand this by adding prices (CPI), the monetary stock (M2) and exchange rate (ER) to the system,[13] to obtain the five-variable comprehensive model $\mathbf{Y}^c = [CCB\ GDP\ CPI\ M2\ ER]$.

In our robustness checks, we also consider local projections estimated via instrumental variables (Jordà, Schularick & Taylor 2020). We estimate a series of regressions for the response of

[13] Although we regard changes in the money stock as our primary measure of a monetary shock, we also consider replacing the money supply with the (lending) interest rate as a robustness check.

$\tilde{Y}^r_{i,t+h-1}$ over the horizon $h = 1, \ldots, H$ of the form

$$\tilde{Y}^r_{i,t+h-1} = \tilde{\beta}_{i,-i,h} \tilde{Y}^m_{i,t-1} + \tilde{\mathbf{X}}'_{i,t} \tilde{\boldsymbol{\gamma}} + \tilde{\alpha}_i + \tilde{\epsilon}_{i,t+h-1}, \tag{6}$$

where α_i and $\tilde{\epsilon}_{i,t}$ are country fixed effects and cluster-robust standard errors, respectively, $\tilde{\mathbf{X}}_{i,t}$ is the vector of covariates, and the lagged impulse variable $\tilde{Y}_{i,t-1}$ is instrumented by the instrument set $\mathbf{Z_{i,t-1}}$. We restrict our examination to just output as the response ($\tilde{Y}^r = GDP$) to the impulse from the cross-currency basis $\tilde{Y}^m = CCB$, while retaining the other endogenous variables as covariates ($\tilde{\mathbf{X}} = [CPI\ M2\ ER]$, in the case of the comprehensive model).

3.3 Estimation and identification strategy

3.3.1 Estimation

In the estimation of PVAR model, we employ generalized method of moments (GMM), which typically requires "small T, large N" panels to obtain consistent estimators (Arellano & Bond 1991; Blundell & Bond 1998). That said, Alvarez & Arellano (2003) have convincingly argued that GMM estimators are still consistent when $T/N \to c$, $\forall c \in (0, 2]$, which is consistent with our data. As such, we exploit the assumption of serial uncorrelatedness of the error terms to instrument the lagged differenced variables, to obtain consistent estimators. In light of the unbalancedness of our panel, we employ forward orthogonal deviations (instead of first differences) to reduce data loss, such that the country-specific effect $\boldsymbol{\alpha}_i$ is removed as well. Finally, we choose the optimal lag of the model based on information criteria.

For the local projections, we likewise rely on the GMM estimator, with errors clustered at the country level. For both the parsimonious and comprehensive models, we consider up to four lags of GDP and the CCB, as is standard in the literature, and run our projections for a horizon of $H = 10$ quarters. The selection of instruments, and their validity, is discussed below.

3.3.2 Timing validity

Since the variables in the PVAR system are generally regarded as endogenous, their ordering is crucial to identifying the impulse response functions. Our baseline relies on a Cholesky decomposition, with variables ordered earlier assumed to affect subsequent variables both contemporaneously and with a lag, whereas those ordered later only influence prior variables with a lag.

Our identification of the central relationship between the cross-currency basis and output is based on treating CCB as more exogenous than GDP. The reason is straightforward: the basis is largely comprised of variables external to the domestic economy (such as the dollar exchange and interest rate), which effectively renders such liquidity exogenous. Moreover, shocks to the cross-currency basis are observed instantaneously by market participants—financial institutions with portfolios that include dollar assets, or multinational corporations with currency exposure—who react in continuously-traded financial markets. Only after market participants adjust their choices do their actions subsequently become captured in demand, and reflected as a change in output. Economic activity, in contrast, does not exhibit a similar pattern; it is unaffected by contemporaneous dollar funding conditions, but only responds with a lag.

The reliance on shocks from high-frequency financial market data as a means of identifying VARs is now fairly established, owing to the pioneering works of Bagliano & Favero (1999), Cochrane & Piazzesi (2002), and Faust, Swanson & Wright (2004). While identification via these approaches generally rely on *surprise* deviations (rather than higher frequency alone), the underlying principle that motivates our timing assumption employed here is similar. Since CCB is available at a daily (or even higher) frequency, whereas GDP is only updated at a quarterly (or monthly, at best) frequency, and often with delays,[14] agents are more likely to respond to official updates on the evolution of GDP significantly later than information about changes to the basis. Even taking into account recent advances in nowcasting (Giannone, Reichlin & Small 2008), it is entirely plausible to treat the basis as more exogenous than output.

Identification for the remaining variables in the comprehensive model treats prices as less endogenous than the money supply, and the exchange rate[15] as most endogenous; that is, CPI affects M2 and ER both contemporaneously and with a lag, but M2 and ER affect the former only with a lag.[16] The ordering of output, price, and money supply follows the spirit of Favara & Giordani (2009), Mumtaz & Surico (2009), and Peersman & Smets (2001), on the basis that GDP does not respond contemporaneously to policy shocks, since firms do not alter their output within a given period when confronted with unexpected monetary shocks (due to menu costs). Finally, despite its rapid adjustment,[17] the exchange rate is typically treated as one of the most endogenous variables in open-economy macroeconomics, owing to how it absorbs influences from all manner of shocks to the economy. We therefore place it after the money stock, which is also consistent with the extant literature, such as Bjørnland (2008) and Kim (2002).

Admittedly, some in the literature maintain the assumption that information delays means that monetary policy cannot respond within the same period to output and the price level, on the basis that transparently-published data on the money supply is available within one quarter, but accurate data on prices and output are not (Kim & Roubini 2000; Sims & Zha 2006). Still, given the lack of consensus regarding the relative exogeneity of these other variables, we allow for alternative orderings of these variables in our robustness checks.[18]

Finally, one may object to treating the exchange rate as most endogenous, given how the CCB—which has an exchange rate component—is simultaneously the most exogenous. Despite

[14]GDP data for a given quarter is never published immediately at the end the final month of the quarter, becoming available only a month or two later.

[15]Here, we utilize the directly-quoted exchange rate, measured as units of local currency per U.S. dollar, transformed into log differences. Increases imply a depreciation of the domestic currency vis-à-vis the dollar.

[16]While one could argue that the timing assumptions for additional endogenous variables are inconsequential (Plagborg-Møller & Wolf 2021) for identifying the strict effect of CCB on growth, the ordering still matters if we are interested in the endogenous response of the remaining variables, which we are, as revealed in Sections 4.4 and 5.

[17]While this may appear inconsistent with the discussion on the CCB above, recall that dollar liquidity is also comprised of variables that are largely external to the home economy, compared to the domestic exchange rate. Nevertheless, we consider robustness checks where the exchange rate is placed at a comparable order of exogeneity as the basis (that is, $[ER\ CCB\ \cdots]$ or $[CCB\ ER\ \cdots]$).

[18]Some structural VAR models in the literature place endogenous variables in the order $[M2\ CPI\ GDP]$. This alternative ordering of variables tends to have little impact on results, especially when restrictions are imposed on the structural VARs. Since we do not impose such restrictions, we test the sensitivity by introducing specifications where we hold the CCB and ER as most exogenous and endogenous, respectively, but employ different permutations for the remaining variables (i.e. $Y = [CCB\ \cdots\ ER]$).

embedding the (spot and forward) exchange rates, we view these two variables as fundamentally distinct. After all, the CCB and exchange rate measure different concepts (dollar liquidity on one hand, and the relative value of a currency on the other), and are only very weakly correlated ($\rho(CCB, ER) = -0.01, p = 0.50$). Indeed, some authors (e.g. Georgiadis & Müller 2024; Jiang *et al.* 2023) have even allowed the cross-currency basis to depend on financial market conditions. Accordingly, we perform additional robustness checks where we assume that the two are placed among the most exogenous variables (Section 6.3).[19]

3.3.3 Instrument validity

Even if we accept that the greater responsiveness of the cross-currency basis to unobserved shocks allows us to rule out the contemporaneous response of economic variables, one may still be uncomfortable with the purely timing-based identification approach discussed above. More specifically, one could argue that unobserved shocks that simultaneously affect both the CCB and economic variables may somehow become embedded in forward-looking behavior by agents, which could in turn invalidate the assumption of weak exogeneity.

Accordingly, our alternative identification strategy applies instrumental variables to local projections, following (6). Conditional on appropriate instruments, this may offer potentially more credible identification of the effects of CCB on growth. Our main instrument comprises domestic monetary policy *shock* estimates (MPS), drawn from Choi, Willems & Yoo (forthcoming). These shocks are obtained using a blend of methods, including monetary policy surprises identified via high-frequency studies, changes in the three-month swap or short-term domestic government bond yields around monetary policy decision days, deviations of rate realizations from expectations of financial market participants, and residuals from estimated Taylor rules (under the premise that such rules imply reasonable forecasts, and hence residuals capture the innovation element).[20] The database covers 176 countries and are available on a monthly basis; we aggregate these into quarterly equivalents. Since such monetary policy shocks are, by construction, unanticipated, they are likely to satisfy the exclusion restriction. But they also satisfy the relevance condition, since monetary policy shocks will appreciably alter the amount of liquidity (including dollar liquidity) available in the economy.

However, monetary policy shocks are only indirectly tied to dollar liquidity. To further secure the relevance of the instrument set, we also include lags of the synthetic rate (r_{synth}), which—as discussed in Section 5—better capture the pure liquidity aspect of the dollar squeeze (since it excludes the interest differential). Moreover, while the synthetic dollar rate covaries significantly with the CCB ($\rho(CCB, r_{synth}) = -0.23, p = 0.00$), thereby satisfying relevance, there is no clear *a priori* reason for the lagged synthetic rate—comprised of underlying variables that are notoriously difficult to predict[21]—to systematically alter the contemporaneous basis or output growth. This enables us to exploit its lags as plausibly exogenous instruments consistent

[19] More specifically, we apply orderings where CCB and ER are the most exogenous variables, with $Y = [CCB\ ER\ \cdots]$ or $Y = [ER\ CCB\ \cdots]$.

[20] These estimates are obtained hierarchically, in the order described, with the plurality obtained from Taylor residuals.

[21] The challenges of successfully forecasting exchange rates has been repeatedly demonstrated empirically (Cheung, Chinn & Pascual 2005; Meese & Rogoff 1983), and the record for forecasting interest rates is similarly dismal (Duffee 2013).

with the exclusion restriction. For specifications that include these lagged instruments, we further assess the stability of our estimates to the addition of controls, to assess conformity with the lagged exogeneity condition of Miranda-Agrippino & Ricco (2023).

While arguably better identified, this alternative approach inhibits our ability to derive spillover effects between the different variables in the system, and in turn, obtain important insights into the potential transmission channels for dollar liquidity on growth. In contrast, these are available when the variables are analyzed as a PVAR system. Hence, our preference is to treat the local projections as a useful check on the robustness of our main effect, while retaining the PVAR model as the baseline.

4 Empirical results

4.1 Preliminary tests

We perform a series of preliminary empirical checks to reduce the risk of misspecification of the PVAR. In particular, we ensure that all series entering the system are stationary and not cointegrated. We also apply various information criteria to determine optimal lag length. We summarize the results here, and refer the interested reader to the tables and detailed discussion in the appendix.

Our stationary checks comprise three different panel unit root tests, performed on levels, logarithms of levels, and first differences of the logarithmic series. With the exception of the CCB—which is stationary even in levels[22]—we cannot reject the null of a unit root for the logarithmic series. However, the first differences of logarithmic series for GDP, CPI, M2 and ER are all stationary. Accordingly, we adopt the CCB in levels, while the other four variables enter in first differences.

While there is no fully-consistent result for the panel cointegration tests, the majority of the group mean and within-panel statistics indicate that there is no cointegration for the series in the panel.[23] Tests for spatial dependency indicate little evidence of cross-sectional dependence for our key variable of interest—CCB—but possible concerns with the other variables. With neither issue a major concern, we proceed with the PVAR specification specified in our baseline, but also present regressions that allow for potential cointegration and spatial dependency in our robustness checks.

The order of our model is based on a set of information criteria. While the tests do not provide a uniform signal, the majority point to the selection of a first-order panel VAR, which we adopt as our baseline.

4.2 Baseline results

We report our baseline estimation results in Table 1, for both the parsimonious and comprehensive models. While the interpretation of coefficient estimates are typically secondary to VAR analyses, it is useful to observe that the most variables in both models are statistically

[22]This is the case regardless of whether we include a trend term or not. For this reason, we do not report checks for stationarity for the logarithmic and first difference transforms.

[23]The exceptions are for the Westerlund (2007) test, especially in the absence of a time trend.

significant, which attests to their relevance to the overall macroeconomic system. Notably, the coefficient of the response of output growth to changes in the (lagged) cross-currency basis is negative and statistically significant, regardless of model.[24] This hints at the relationship that is of central interest to us, the response of a dollar liquidity impulse on output growth.

Table 1: Baseline estimation results for parsimonious and comprehensive PVAR models, 2000Q1–2020Q4 (unbalanced)

Response to	Response of				
	CCB_t	GDP_t	CPI_t	$M2_t$	ER_t
			Parsimonious		
CCB_{t-1}	0.356***	-8.98e-06***			
	(0.085)	(1.98e-06)			
GDP_{t-1}	-4,913***	-0.086***			
	(1,450)	(0.027)			
Observations			3,511		
Countries			50		
			Comprehensive		
CCB_{t-1}	0.554***	-1.04e-05***	-1.71e-06	-3.44e-06	1.69e-05***
	(0.0453)	(3.33e-06)	(1.22e-06)	(4.38e-06)	(5.42e-06)
GDP_{t-1}	-1,318***	-0.148***	0.0215***	0.213***	0.139***
	(207.5)	(0.0223)	(0.00548)	(0.0277)	(0.0257)
CPI_{t-1}	3,007***	-0.712***	0.147***	-0.198**	0.290**
	(1,021)	(0.112)	(0.0412)	(0.0917)	(0.140)
$M2_{t-1}$	-1,044***	-0.1690***	-0.1060***	0.0149	0.0560*
	(228.4)	(0.0343)	(0.0174)	(0.0298)	(0.0297)
ER_{t-1}	-666.1***	-0.115***	-0.0271***	0.0370**	0.185***
	(134.4)	(0.0146)	(0.00743)	(0.0158)	(0.0276)
Observations			3,415		
Countries			49		

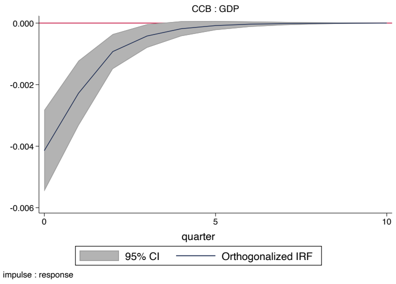
† Panel VAR model estimated by GMM, with fixed effects removed via forward orthogonal deviations. Coefficients correspond to the response of the endogenous variables listed in the second row, to the lagged variables in the first column. Heteroskedasticity-robust standard errors reported in parentheses, where *, ** and *** indicates significance at the 10 percent, 5 percent, and 1 percent level, respectively.

Figure 4 illustrates the impulse response functions (IRFs) of a one standard deviation innovation of CCB_t on GDP_t, and vice versa, accompanied by their 95 percent confidence intervals. For the parsimonious model, a positive change in the cross-currency basis results in a clear, statistically significant, and negative effect on economic growth. This shock persists for around four quarters. While less precisely estimated and with a smaller magnitude, this negative effect continues to hold in the comprehensive model.

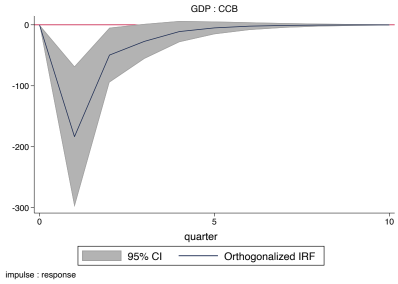
Separately, the same negative relationship can be seen in the opposite direction; output expansions (contractions) give rise to decreases (increases) in the cross-currency basis. This is likewise the case in both models, although the effect does not show up on impact, but only a quarter later. This implies that economic growth reduces dollar liquidity.

The effects of the dollar squeeze are also economically significant. The cumulative effect of

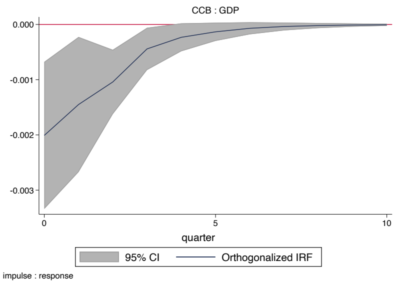
[24]Indeed, this negative relationship holds in our sample even independently of any additional structure we impose. As we report in the appendix, the correlation between the two variables is negative and significant ($\rho(CCB, GDP) = -0.05, p = 0.00$).



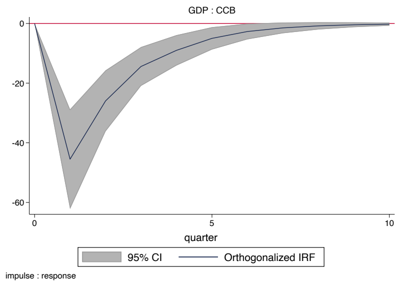
(a) Dollar liquidity on output, parsimonious



(b) Output on dollar liquidity, parsimonious



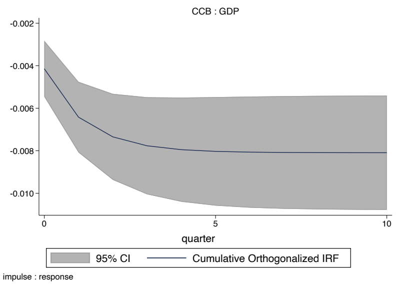
(c) Dollar liquidity on output, comprehensive



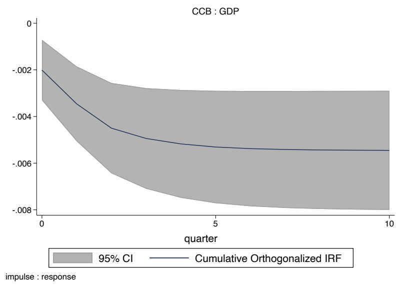
(d) Output on dollar liquidity, comprehensive

Figure 4: Orthogonalized impulse response functions for dollar liquidity on output growth (left panel) and output growth on dollar liquidity (right panel) in the baseline sample comprising AEs and EMs, 2000Q1 to 2020Q4. For a one standard-deviation innovation, the 10-quarter evolution is reported after the shock. In both instances, the shocks lead to statistically-significant declines in the response variables, dissipating after about a year.

a one standard-deviation increase in CCB[25]—shown in Figure 5—shaves off between 0.5 and 0.8 percentage points a year overall from GDP growth (depending on the model), with around half of this effect realized in the first quarter after impact.



(a) Dollar liquidity on output (cumulative), parsimonious



(b) Dollar liquidity on output (cumulative), comprehensive

Figure 5: Cumulative orthogonalized impulse response functions for dollar liquidity on output growth in the baseline, 2000Q1 to 2020Q4. The total effect is clearly negative and ranges from 0.5–0.8 percentage points of GDP, with around half of this realized in the first quarter.

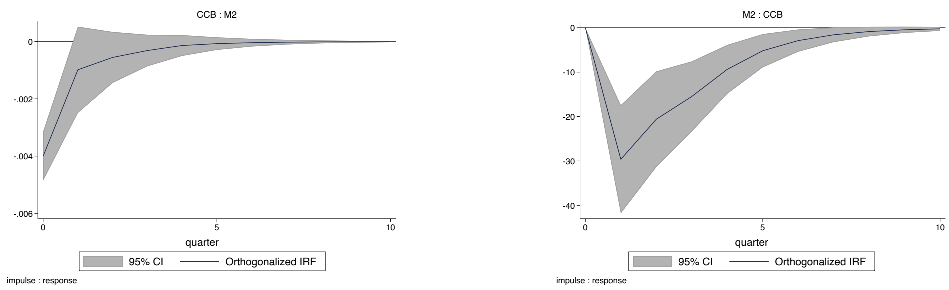
The bidirectional negative relationship between CCB and growth may seem counterintuitive. But it can be rationalized, especially for open economies. Under normal conditions, an increase

[25]This amounts to an approximately 193 basis point (bps) move in the CCB. The volatility of this shock is significantly higher for EMs (329 bps) compared to AEs (26 bps), however.

in the cross-currency basis suppresses the convenience yield associated with holding dollars and dollar-denominated assets. As discussed in Section 2.3, this encourages portfolio investors outside the U.S. to purchase more local-currency assets, given their relatively lower opportunity cost. Agents do so by drawing down on their cash holdings, or by borrowing in dollars and executing an FX swap. Either way, the substitution into domestic assets leads to a reduction in the money stock, and an attendant tightening of local financing conditions. This in turn reduces investment, and hence growth, via the domestic liquidity channel. Alternatively, in the absence of changes in relative interest rates, arbitrage would imply an appreciation of the exchange rate, so that total return differentials equalize. Through this exchange rate channel, the current account deteriorates, inducing a growth slowdown.

Conversely, growth accelerations—as a barometer of the country's economic performance and potential—are likely to attract investors from abroad. Heightened international demand for local currency-denominated assets supplies additional dollars to the economy, thereby easing the dollar constraint and lowering the cross-currency basis.

These mechanisms are corroborated by Figure 6, which shows the associated changes in the money stock to a dollar liquidity shock, *vice versa* (the full matrix of IRFs is reported in the appendix, see figure A.1). A positive shock to CCB contracts the domestic money supply, diminishing available liquidity. Fascinatingly, this effect is even more unambiguous than the direct effect of monetary shocks on output. In particular, while a positive shock is likewise followed by an output drop, the effects of looser money only kicks in at the third quarter, consistent with how monetary impulses operate with a lag. Put another way, our results indicate that, in open economies, international substitution effects come into play earlier (and end up dominating) any stimulative effect from any easing of monetary policy. This credit crunch is one important channel whereby a dollar squeeze acts to lower growth.

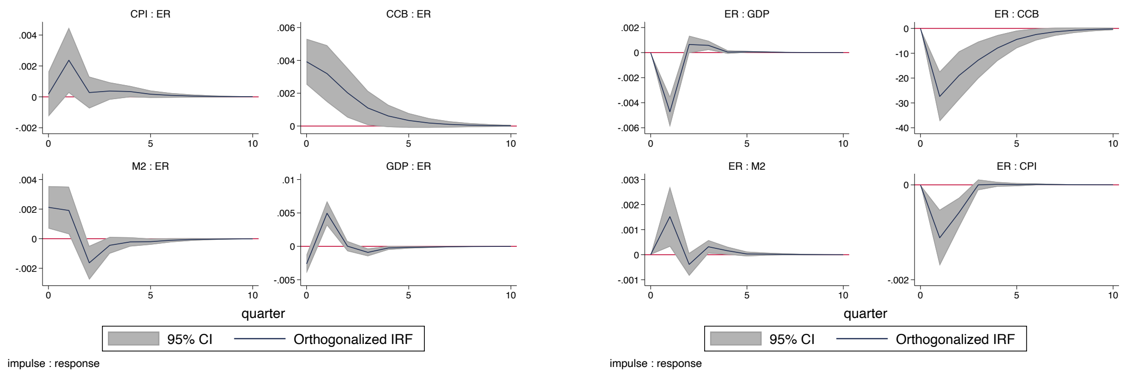


(a) Dollar liquidity on money stock, comprehensive

(b) Money stock on dollar liquidity, comprehensive

Figure 6: Orthogonalized impulse response functions for changes to dollar liquidity on the money stock, and *vice versa*, in the baseline comprehensive model, 2000Q1 to 2020Q4. Positive innovations to the CCB leads to a contraction in the money supply, and the same occurs when the money stock increases. This negative effect of dollar liquidity on output is also more unambiguous than a shock to the money supply on GDP.

Figure 7 illustrates the response of the exchange rate to innovations in the other endogenous variables in the system, and *vice versa*. The nominal exchange rate depreciates in reaction to a positive CCB impulse. This is surprising, not only because it stands in contrast with the finding reported in Avdjiev *et al.* (2019), where dollar appreciation is associated with a more negative cross-currency basis. It also appears inconsistent with the typical effect of the exchange rate on output, since depreciations do not generally result in long-run growth contractions. However, a careful examination of the IRF of the exchange rate on output suggests that this could be because of a J-curve effect, where depreciations are first accompanied by a worsening of the current account balance (and an output drop), before the weak currency eventually boosts export performance (accompanied by a growth rebound). This distinction between the shorter and longer run direction of the dollar is also affirmed by Jiang *et al.* (2021), and may go some way toward explaining the unexpected effect of the CCB on the exchange rate.



(a) Endogenous variables on exchange rate, comprehensive model

(b) Exchange rate on endogenous variables, comprehensive model

Figure 7: Orthogonalized impulse response functions for changes in other endogenous variables on the exchange rate, and *vice versa*, in the comprehensive model, 2000Q1 to 2020Q4. Positive innovations to the CCB gives rise to depreciation (as do shocks to most of the other variables in the system). The effect of depreciations, moreover, lead to contractions in output growth. These counterintuitive results may be due to differences in the response of AEs and EMs, a hypothesis that we subsequently explore.

Taken together, the seemingly-counterintuitive effect of the CCB on growth, along with somewhat-inconsistent results relative to prior empirical literature, make a strong case for examining the results in a more disaggregated manner. After all, the pernicious effects of dollar shortages may well vary in crisis versus non-crisis settings.[26] Furthermore, variations in financial market development, trade openness, and capital market liberalization can easily affect the transmission channels that apply in AEs versus EMs.[27] We probe our results for these two groups, for different temporal periods, in the next section.

4.3 Liquidity constraints in crisis versus normal times

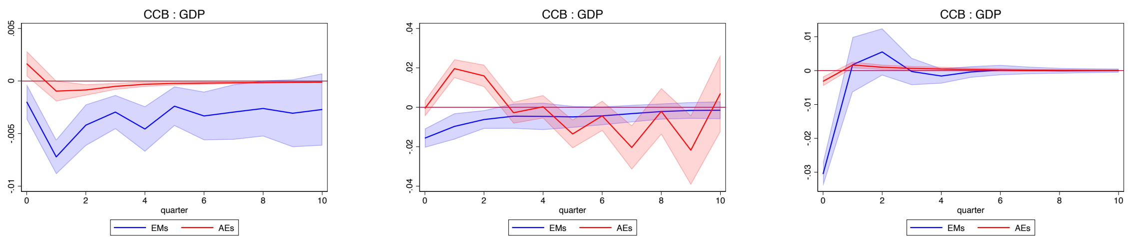
As discussed in Section 3.1, the cross-currency basis was generally very small prior to the global crisis (especially among AEs), and large and persistent CIP deviations only emerged after 2007 (Cerutti *et al.* 2021; Du *et al.* 2018; Iida *et al.* 2018). Moreover, financing conditions tend to be materially different in the context of a crisis; liquidity squeezes that would otherwise

[26]Our baseline includes not only the anomalous data resulting from the 2007/08 global crisis; it also worth recalling that there was a rift in CCBs that only emerged post-2007.

[27]Our baseline sample comprises not only G10 currencies—the case for much of the extant literature—but a significant number of additional AEs, along with EMs.

work themselves out in normal times may easily morph into insolvency during a crisis.

To gain additional insight, we repeat our analysis in the previous subsection, but further subdivide the sample into several (overlapping) periods, corresponding to the pre-crisis, crisis, and crisis-cum-post-crisis phases.[28] We also present the results by income group, AEs and EMs. The IRFs for CCB shocks on growth, for the comprehensive specification over each of these three subperiods, are shown in Figure 8.[29]



(a) Pre-crisis (b) Crisis (c) Crisis-cum-post-crisis

Figure 8: Orthogonalized impulse response functions of dollar liquidity on output in the *comprehensive* model for advanced (in red) and emerging (in blue) economies, for partially-overlapping pre-crisis (2000Q1–2007Q3), crisis (2007Q4–2009Q2), and crisis-cum-post-crisis (2007Q4–2020Q4) periods. The liquidity shocks retain their negative impact on growth in normal times, but during the crisis period, this effect reverses for advanced economies, reflecting the importance of dollar-based financing under especially tight financial conditions. All the specifications include one lag.

The most notable observation is that, for advanced economies, the effect of a basis shock on growth *reverses sign*, before fading away over the course of the crisis (the effect is also positive on impact in the pre-crisis period, but this response turns negative quickly, before dissipating; the cumulative effect turns out to be statistically indistinguishable from zero[30]). This implies that access to dollars is especially critical under crisis conditions, to an extent that easing this constraint is even sufficient to stimulate (short-run) growth. For EMs, however, the flight-to-safety aspect of financial flows appears to trump increases in dollar liquidity, such that the effect remains negative.[31] This is also the case for both AEs and EMs in the final period, which implies that dollar liquidity has become vastly more important over the most recent decade-and-a-half, along the lines described earlier.

In light of this observation, a reasonable *a priori* belief would be that the magnitude of GDP responses to CCB innovations would also be larger in the crisis-cum-post-crisis, as compared to the pre-crisis, period. The results are indeed in line with this expectation, whether for advanced or emerging economies (in the appendix, we verify that the more-than-doubling of the output response to a basis shock during this period, also holds when considering the combined sample

[28]We define 2000Q1–2007Q3 as the pre-crisis period, the remainder—when CIP deviations began to become pronounced—as the crisis-cum-post-crisis period, and 2007Q4–2009Q2 as the crisis period. Due to the change in sample, the information criteria suggest different lag structures, relative to the baseline. We retain the single lag 1 for all the models.

[29]The corresponding IRFs for the respective parsimonious models suggest similar results, and are reported in the appendix. See figure A.13 for details.

[30]The cumulative IRF is available on request.

[31]Put another way, the international illiquidity suffered by emerging markets during financial crises (Chang & Velasco 2001) finds no relief in EMs, whereas only AEs without dollar access suffer output drops.

of AEs and EMs[32]).

Interestingly, the analogous outcome is less evident when comparing the respective variance decompositions, shown in Table 2.[33] In the comprehensive model, the response of GDP that is attributable to CCB turns out to be larger after the crisis—9.2 percent—as compared to before (6.5 percent). However, the converse holds true for the parsimonious specification; the variability of GDP due to CCB shocks in the crisis-cum-post-crisis periods is slightly smaller compared to the pre-crisis phase (1.1 versus 1.4 percent, respectively). Although slightly inconsistent, the small difference between the variances in the parsimonious model—compared to the much larger magnitude in the crisis-cum-post-crisis period for the comprehensive one—leads us to place greater weight on the latter result.[34]

Table 2: Variance decomposition for the full, pre-crisis, and crisis-cum-post-crisis periods† PVAR, parsimonious and comprehensive models(unbalanced)

Response of	**Parsimonious**		*Response to* **Comprehensive**				
	CCB_t	GDP_t	CCB_t	GDP_t	CPI_t	$M2_t$	ER_t
			Full period (2000Q1-2020Q4)				
GDP_{t+10}	0.0164	0.9836	0.0049	0.9374	0.0220	0.0205	0.0152
CCB_{t+10}	0.7400	0.2600	0.8526	0.0596	0.0289	0.0324	0.0265
CPI_{t+10}			0.0017	0.0293	0.8357	0.1130	0.0203
$M2_{t+10}$			0.0213	0.0742	0.0058	0.8955	0.0032
ER_{t+10}			0.0172	0.0176	0.0033	0.0061	0.9558
			Pre-crisis (2000Q1-2007Q3)				
GDP_{t+10}	0.0139	0.9861	0.0652	0.7512	0.1176	0.0590	0.0070
CCB_{t+10}	0.9808	0.0192	0.5348	0.3539	0.0864	0.0221	0.0028
CPI_{t+10}			0.0104	0.0564	0.9246	0.0071	0.0015
$M2_{t+10}$			0.1750	0.3870	0.1497	0.2591	0.0292
ER_{t+10}			0.2145	0.3885	0.0662	0.1104	0.2204
			Crisis-cum-post-crisis (2007Q4-2020Q4)				
GDP_{t+10}	0.0114	0.9886	0.0916	0.8151	0.0859	0.0020	0.0054
CCB_{t+10}	0.9069	0.0931	0.5968	0.2510	0.0682	0.0785	0.0055
CPI_{t+10}			0.2118	0.2730	0.5044	0.0094	0.0014
$M2_{t+10}$			0.1970	0.2067	0.0284	0.5363	0.0316
ER_{t+10}			0.0058	0.0195	0.0136	0.0106	0.9505

† The full, pre-crisis and crisis-cum-post-crisis periods refer to 2000Q1-2020Q4, 2000Q1-2007Q3 and 2007Q4-2020Q4, respectively. For the parsimonious specification in pre-crisis period, a lag 2 model is estimated according to the order selection criteria. Share of forecast error variance for predicted variables 10 periods ahead in each row are explained by the variables in each column.

One separate observation is worth noting from Table 2: in the comprehensive model, the contribution of dollar liquidity to GDP is of a similar order of magnitude to that M2 in the

[32]Check Figure A.12 for details.

[33]As is typical for variance decompositions of VAR models, most of the subsequent variations in each variable is determined mostly by itself; in our application, this amounts to more than 80 percent in most cases.

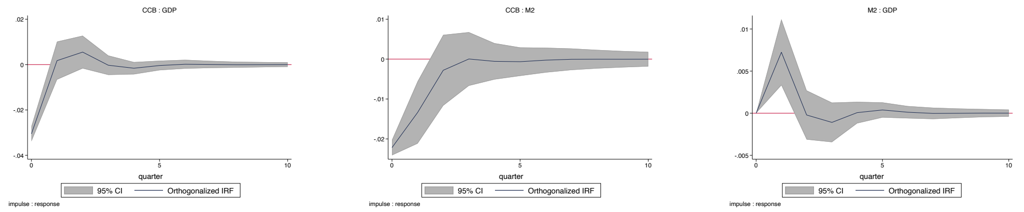
[34]It is worth noting that this difference may also be attributable to the lag structure of the respective models. In contrast to the other specifications, the pre-crisis specification adopts two lags (as recommended by information criteria). We reran the pre-crisis subsample with only one lag, as a check, but the relatively higher variance remains unchanged.

pre-crisis period, but this becomes much larger in the crisis-cum-post-crisis period,[35] even as domestic liquidity becomes virtually irrelevant (the difference is about 45 times). This is consistent with the work of Rey (2013), which suggests that monetary policy in the center country (and hence dollar access) has become far more important than domestic monetary policy (which alters the local money supply) in recent times, and likely also reflects the effects of a shift to quantitative easing (QE) policies worldwide. Given the much more pronounced effects of the CCB both during the crisis and after, we concentrate on this period in the next subsection.

4.4 Distinct transmission channels for advanced and emerging economies

The domestic liquidity channel and EMs. For EMs, we are particularly interested in the relationship between domestic (M2) and dollar (CCB) liquidity, both with respect to output, but also each other. Figure 9 plots the relevant IRFs. As was the case in Section 4.3, a positive shock to the cross-currency basis leads to decreases in growth (left panel). For the 2007Q4–2020Q4 timeframe, the drop is around 3 percent of GDP, which dissipates after two quarters.

Fascinatingly, the relationship between the two forms of liquidity is *negative*—a positive shock to dollar liquidity leads to a decline in domestic liquidity—which implies that the two operate as substitutes (middle panel). To the extent that enhanced dollar access leads to a drop in the money supply, this would in turn result in a (short-run) output contraction, since the relationship between the money supply and growth is positive (right panel). On this basis, we conclude that the domestic liquidity channel is likely to be a key transmission channel for the CCB, at least among EMs.[36]



(a) Dollar liquidity on output, EMs

(b) Dollar liquidity on domestic liquidity, EMs

(c) Domestic liquidity on output, EMs

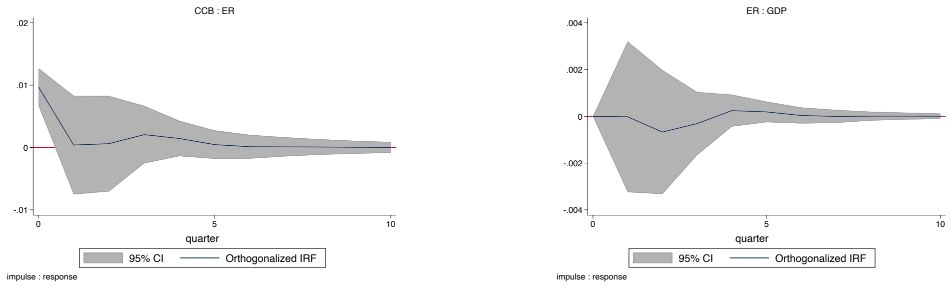
Figure 9: Selected orthogonalized impulse response functions for dollar liquidity, money stock, and output growth in the comprehensive model for emerging economies, during the crisis-cum-post-crisis (2007Q4–2020Q4) period. Since positive innovations to dollar liquidity lead to contractions in domestic liquidity, and declines in domestic liquidity will induce output contractions, the substitution out of previously safe-haven dollar assets in favor of local-currency investments is likely responsible for the negative impact of the cross-currency basis on growth.

We probe this further by looking at the exchange rate channel. Selected IRFs are reported

[35]This is because the contribution of dollar liquidity more than doubles among EMs. We report this result in the appendix.

[36]As an additional check, we also replace M2 with the current account balance and re-estimate the model. CCB impulses do not give rise to any statistically significant response on the current account, which is consistent with how it is changes to *domestic* portfolio asset holdings, rather than cross-border financial flows, that is responsible for the effect. These results are available on request.

in Figure 10[37]. For the effect of CCB on the exchange rate, we find a significant depreciation on impact, albeit one that fades quickly after a quarter (left panel). This depreciation is actually consistent with the logic of interest parity and the domestic liquidity channel: to support a path of *expected* appreciation that would result from expanded purchases of local currency assets (which follows from the decline in the convenience yield on dollars), there must be an initial depreciation.[38] Given how the process essentially entails reallocation of domestic portfolio holdings, however, it is unsurprising that the exchange rate move is not persistent, and thereby fails to exert any discernible impact on output (right panel).



(a) Dollar liquidity on exchange rate, EMs

(b) Exchange rate on output, EMs

Figure 10: Selected orthogonalized impulse response functions for dollar liquidity, the exchange rate, and output growth in the comprehensive model for emerging economies, during the crisis-cum-post-crisis (2007Q4–2020Q4) period. Dollar liquidity shocks result in exchange rate depreciation, but the exchange rate has no discernible effect on output.

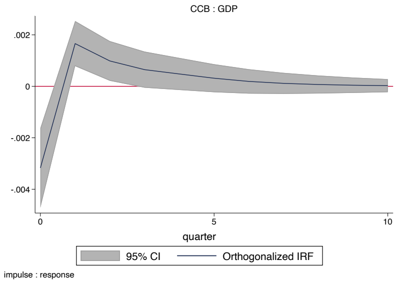
The exchange rate channel and AEs. For AEs, we are more interested in the relationship that dollar liquidity and the exchange rate have with respect to output, and each other. Figure 11 plots the relevant IRFs.[39] Again, consistent with the results in Section 4.3, a positive impulse in the cross-currency basis gives rise to a sharp growth contraction, of around 0.3 percent of GDP (upper left panel); this effects of this shock, however, turns slightly positive (and significant) briefly, in the second quarter.

In contrast to EMs, a positive basis shock *increases* domestic liquidity (upper right panel). Given how their more mature financial markets afford access to dollar fund flows, easier global financing conditions translate into more abundant domestic liquidity in AEs. Yet as dollar convenience yields fall, global investors become more inclined to look to alternative assets. Since AEs already exhibit a trivial yield differential vis-à-vis the United States, it is exchange rate appreciation that allows local-currency assets in these economies to remain attractive, relative to returns offered by EM assets. This is indeed what we observe; even as domestic liquidity rises in concert with dollar liquidity, the exchange rate appreciates (bottom left panel).[40]

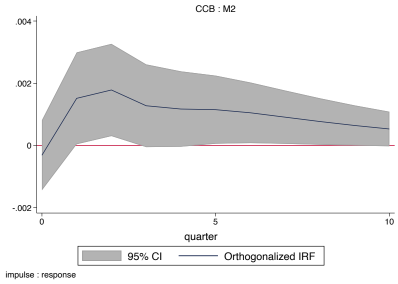
And what happens to GDP? As expected, appreciations lead to slowdowns in growth (bot-

[37]The full matrix of IRFs is reported in the appendix, see Figure A.3.

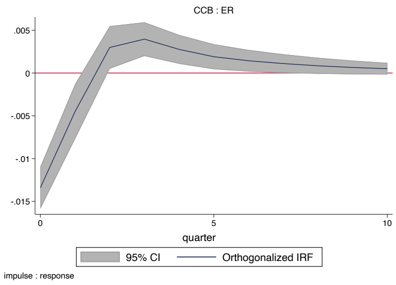
[38]More formally, if we replace interest rates in the uncovered interest parity relation, we obtain the relationship $\phi(\lambda - \lambda^*) \approx S^e/S - 1$, where λ and λ^* are the convenience yields on local currency and dollar assets, respectively (such that the difference represents relative convenience yields), and $\phi > 0$ is a multiplier that maps relative returns to relative convenience yields. Then, for an expected appreciation, the right-hand side of the expression must be negative, in which case we require $S > S^e$, which is an initial depreciation. The mechanism is not unlike



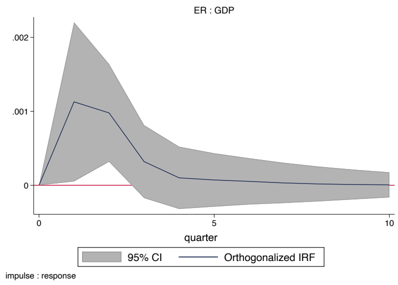
(a) Dollar liquidity on output, AEs



(b) Dollar liquidity on domestic liquidity, AEs



(c) Dollar liquidity on exchange rate, AEs



(d) Exchange rate on output, AEs

Figure 11: Selected orthogonalized impulse response functions for dollar liquidity, money stock, the exchange rate, and output growth in the comprehensive model for advanced economies, during the crisis-cum-post-crisis (2007Q4–2020Q4) period. Positive shocks in dollar liquidity give rise to expansions of domestic liquidity, as easier global financing conditions allow their more mature financial markets to offer more domestic non-dollar assets. But the associated exchange rate appreciation ultimately results in a GDP slowdown.

tom right panel).[41] On the assumption that the Marshall-Lerner condition holds, this is the typical effect we expect from a strengthening of the exchange rate, since there is a reduction in the competitiveness of the nation's exports.

5 Discussion

5.1 Domestic liquidity channel

The post-crisis period coincided with a period of extraordinary dollar liquidity worldwide, due to the Fed's QE policies. While QE-related dollar liquidity was, in principle, only accessible to U.S. banks and their foreign affiliates, such policies nevertheless led to a substantial easing of global liquidity conditions, even for non-U.S. entities (Bauer & Neely 2014; Lim & Mohapatra 2016; Lo Duca, Nicoletti & Vidal Martínez 2016).[42] Such easing activity may have resulted in

that of the dynamics of the exchange rate in standard overshooting models (Dornbusch 1976).

[39] As before, the full IRF matrix is in the appendix, see Figure A.4.

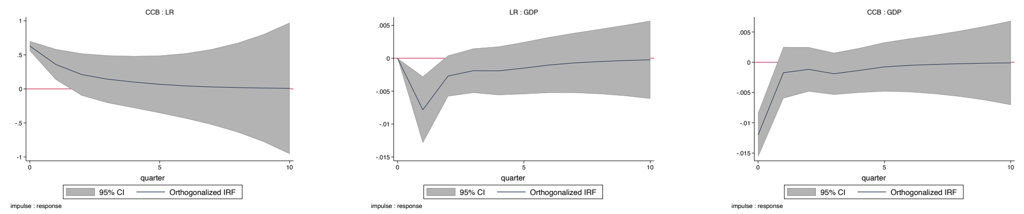
[40] Incidentally, the CCB shock also induces exchange rate appreciation, albeit without a lag.

[41] Recall that an increase in the exchange rate is a depreciation, but this results in increases in GDP, hence the converse (decreases result in contractions) holds as well.

[42] Indeed, central banks worldwide—especially those in advanced economies such as the European Union, Japan, and the United Kingdom, but also including those in emerging economies, such as China, Indonesia, Lebanon, and Romania—have since pursued their own iterations of QE.

artificial increases in the money stock, without materially improving liquidity access.[43]

We therefore consider various aspects of the domestic liquidity picture in EMs in greater detail. We begin by replacing the monetary stock with the lending rate in the comprehensive model. The IRFs[44] shown in Figure 12 corroborate three conjectures, hinted at earlier. First, that increases in dollar liquidity result in concomitant increases in the cost of capital, given by the lending rate (left panel). When taken together with the decline in the money stock, it is indicative of tighter domestic liquidity conditions. Second, that increases in the interest rate are indeed followed by output contractions, after a lag (as expected in theory; middle panel). And third, even with this alternative specification, improved dollar liquidity continues to lead to output contractions (right panel).[45]



(a) Dollar liquidity on the lending rate, EMs

(b) Lending rate on output, EMs

(c) Dollar liquidity on output, EMs

Figure 12: Selected orthogonalized impulse response functions for dollar liquidity, the lending rate, and output growth in the comprehensive model for emerging economies, during the crisis-cum-post-crisis (2007Q4–2020Q4) period. Increases in the lending rate—which moves in the opposite direction to the money supply—lead to output contractions, even as dollar liquidity retains its effects (as per the baseline). This implies that associated domestic liquidity changes are indeed a key driver of our results.

But as shown in (3), the cross-currency basis is comprised of the dollar rate and the synthetic rate, r_{synth}. If we are truly concerned with the *liquidity* aspects of the dollar, it is worth ruling out more fully the possibility that interest rate differentials, *per se*, are driving our result. Hence, we replace the basis with r_{synth}, and repeat our analysis. The two relevant IRFs[46] are shown in Figure 13.

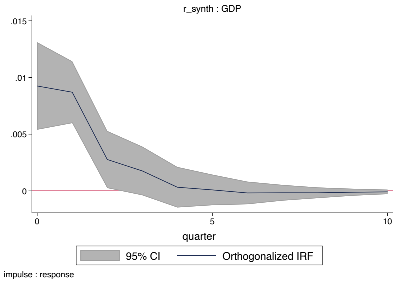
We verify that positive shocks to the synthetic dollar interest rate leads to an increase in GDP (left panel). Hence, it is not so much changes to the dollar rate that alter the dollar liquidity-output growth relationship. Rather, it is changes in the relative attractiveness of local-currency assets, either due to reductions in the dollar convenience yield, or appreciations of the exchange rate (as discussed in detail in Section 4.4). Furthermore, innovations in the synthetic dollar rate move in the same direction as domestic liquidity, which is consistent with how increased dollar availability tightens available domestic liquidity (right panel).

As the negative relationship between dollar liquidity and output growth in EMs may have

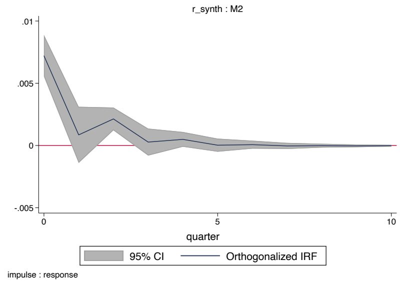
[43]For instance, actual bank lending may be constrained more by reserves held at the central bank (which are part of the monetary base but not M2) than the deposit base, and hence offer an incomplete picture of credit availability. Others have argued that the rise of the shadow banking system reduces the reliability of M2 as a liquidity indicator, especially since such institutions are often known to withdraw market liquidity during difficult economic conditions.

[44]The full matrix is in appendix as Figure A.5.

[45]Variance decomposition results, shown in Table A.11 of the appendix, likewise suggest that MEs are more affected by policies conducted by the Fed than their own domestic monetary policy, despite the smaller magnitude



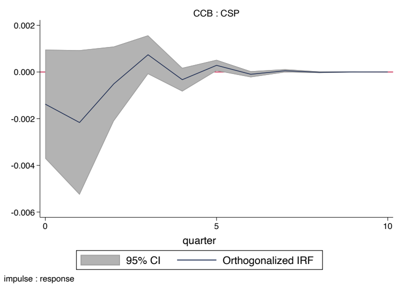
(a) Synthetic dollar rate on output, EMs



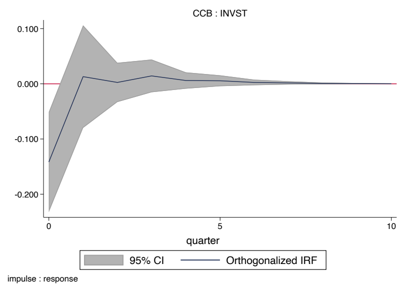
(b) Synthetic dollar rate on domestic money stock, EMs

Figure 13: Selected orthogonalized impulse response functions for the synthetic dollar rate (r_{synth}) and output growth in the comprehensive model for emerging economies, during the crisis-cum-post-crisis (2007Q4–2020Q4) period. The effects of the synthetic dollar rate on GDP is the same as that of dollar liquidity, which corroborates the notion that domestic liquidity substitution is reacting to the convenience yield component, rather than the U.S. interest rate, *per se*.

distinct effects on different aspects of real domestic activity, it is worthwhile exploring if such liquidity changes affect households or firms more. Accordingly, we replace output growth with private consumption or net direct investment, and re-estimate the regressions to produce the two relevant IRFs in Figure 14.[47]



(a) Dollar liquidity on private consumption, EMs



(b) Dollar liquidity on direct investment capital flow, EMs

Figure 14: Selected orthogonalized impulse response functions for the dollar liquidity and private consumption (net direct investment capital flow) in the comprehensive model for emerging economies, during the crisis-cum-post-crisis (2007Q4–2020Q4) period. While the effects of the dollar liquidity on private consumption is negative, it is small and insignificant. By contrast, the negative impact on direct investment is larger and significant, suggesting that increased dollar liquidity does not boost but instead deteriorate private consumption or net direct investment flows, the two components of GDP.

We find that improvements in dollar liquidity lead to declines in the flows of both private consumption and investment, although the effect is more muted in the former (both in terms of significance and magnitude). This points to how liquidity effects tend to flow more through

compared to the results found earlier.

[46]Again, the full matrix of IRFs is reported in the appendix, where our main result retains. Ses Figure A.6.

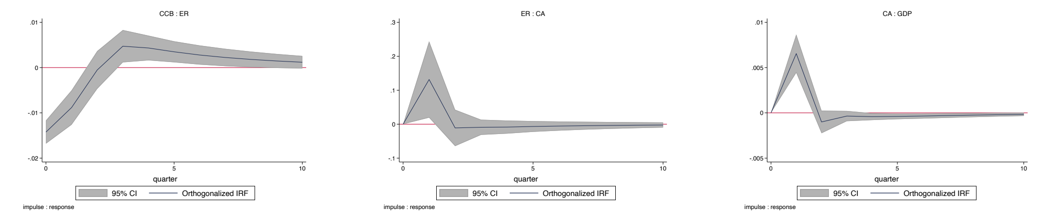
[47]The full matrix of all IRF combinations corresponding to the two specifications are reported in Figure A.7 and Figure A.8, respectively.

the latter, consistent with the extant evidence for developing countries (Karlan, Osman & Zinman 2016). Since this occurs in tandem with an increase in the attractiveness of non-dollar-denominated local assets, we conclude that such purchases tend to occur in the secondary market, with no direct impact on real economic activity. The effect of such portfolio reallocations is therefore indirect, becoming a drag on growth only as a result of reductions in the availability of domestic liquidity.

5.2 Exchange rate channel

The manner by which exchange rate appreciations (depreciations) lead to a loss of (gain in) output is via a drop (pickup) in external demand. To ascertain the validity of this channel in AEs, it is important to explore the dynamics of the trade balance in more detail. We do so by replacing CPI with the current account (CA)[48] in the comprehensive model.

The IRFs, depicted in Figure 15, substantiate the (intuitive) transmission mechanism: easier dollar financing gives rise to a nominal appreciation over the first two quarters (left panel). A stronger currency then leads to a worsening of the current account balance, which—consistent with J-curve lags—are felt only after several quarters (middle panel).[49] Output, likewise, responds in an analogous manner (right panel).



(a) Dollar liquidity on exchange rate, AEs

(b) Exchange rate on current account, AEs

(c) Current account on output, AEs

Figure 15: Selected orthogonalized impulse response functions for the current account, nominal exchange rate, and output growth in the comprehensive model for advanced economies, during the crisis-cum-post-crisis (2007Q4–2020Q4) period. The current account worsens as the currency appreciates, suggesting that output contractions due to a dollar liquidity shock are indeed due to typical Marshall-Lerner effects.

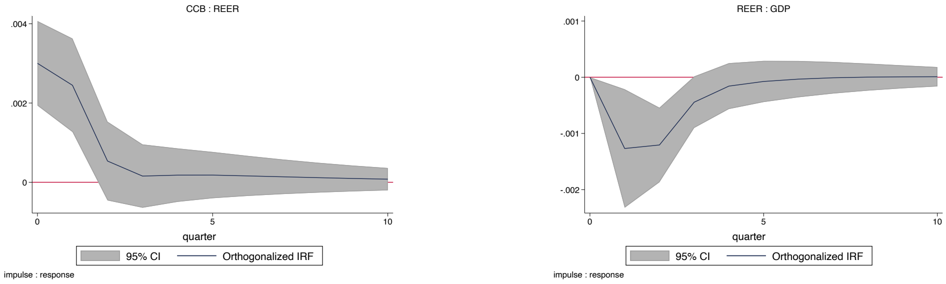
Strictly speaking, the response of the trade balance to the Marshall-Lerner condition depends on the *real*, rather than nominal, exchange rate. We therefore experiment with replacing the nominal with the real effective exchange rate[50] (REER) in the comprehensive model. The IRFs in Figure 16 capture this variation.

We find that the REER consistently appreciates in response to a positive innovation in the basis (left panel). The REER, in turn, moves in line with growth; hence appreciations (depreciations) induce contractions (expansions), and as before, with a brief lag (right panel). As a further check on the stability of this mechanism, we simultaneously replace the nominal

[48] We deploy the current account instead of the trade balance as cross-country data on the latter are less widely available on a cross-country basis.

[49] Analogous to the explanation in footnote 41, as depreciations imply improvements in the current account, appreciations lead to the opposite.

[50] The real effective exchange rate is an index measuring the strength of a currency relative to a basket of other currencies. Hence, it is measured such that an increase indicates appreciation of the domestic currency.



(a) CCB on REER, AEs

(b) REER on output, AEs

Figure 16: Selected orthogonalized impulse response functions including the real effective exchange rate (REER) instead of the nominal rate in the comprehensive model for advanced economies, during the crisis-cum-post-crisis (2007Q4–2020Q4) period. The REER appreciates in response to a rise in dollar liquidity, which subsequently contributes to output declines.

exchange rate with REER, and the CPI with the current account.[51] Again, we find that the deterioration in current account resulting from a strengthening exchange rate is the main transmission channel in the negative dollar liquidity-output relationship in AEs.[52]

6 Robustness

6.1 Sensitivity to the inclusion of additional and alternative variables

We consider two different sets of checks along the following lines: (1) adding exogenous variables that may have an impact on GDP growth to both the original parsimonious and comprehensive specifications; and (2) replacing endogenous variables in the comprehensive specification with other alternative macroeconomic indicators.[53]

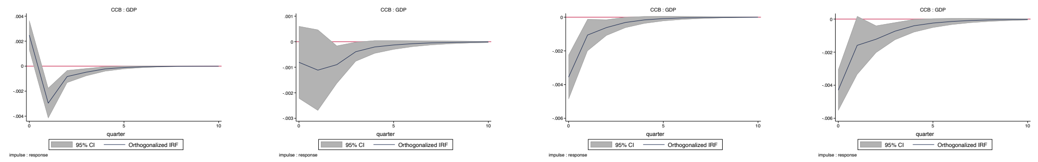
In the baseline, we included only variables in the endogenous system. Here, we populate $\mathbf{X}_{i,t}$ in (4) with exogenous variables, identified in the literature, that may have an impact on growth in open economies. These include trade openness, the dependency ratio, democracy, financial development, default risk, and political risk (the definitions and sources of these are provided in the appendix). The results with these additional variables are given in Figure 17.

Virtually all the results reaffirm the significant and negative relationship between dollar liquidity and output growth, although some specifications exhibit a smaller magnitude or a larger error band. The sole exception is when democracy is included in the parsimonious specification; here, there is a positive but temporary effect of CCB on growth on impact, before this turns negative and troughs the following quarter (the shock fades over subsequent quarters, consistent with the baseline). The overall message remains qualitatively unchanged: that positive CCB innovations lead to output drops.

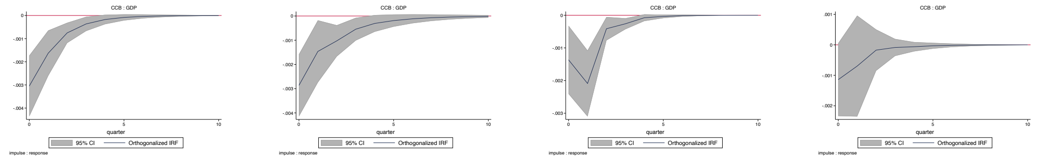
[51]The IRFs are in the appendix, in Figure A.15.

[52]Separately, we also consider replacing, as we did for EMs, the CCB with the synthetic dollar rate. The results, shown in Figure A.11 of the appendix, indicate that positive shocks to the synthetic rate is accompanied by depreciations in the nominal exchange rate, and increases in output.

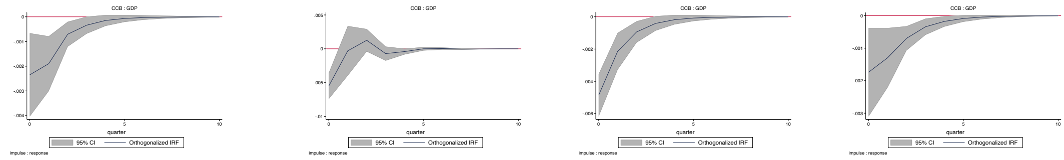
[53]For presentational clarity, we report only the orthogonalized IRF of dollar liquidity on output growth for each specification; the full matrix for chosen specifications are reported in the appendix, and others are available on request.



(a) Democracy, parsimonious (b) Democracy, comprehensive (c) Trade openness, parsimonious (d) Trade openness, comprehensive



(e) Dependency, parsimonious (f) Dependency, comprehensive (g) Political risk, parsimonious (h) Political risk, comprehensive



(i) Default risk, parsimonious (j) Default risk, comprehensive (k) Financial development, parsimonious (l) Financial development, comprehensive

Figure 17: Orthogonalized impulse response functions for dollar liquidity on output with the inclusion of exogenous variables, full sample (2000Q1–2020Q4). The majority of the results indicate a significant and negative relationship between CCB and growth, although some demonstrate a smaller magnitude or a larger error band.

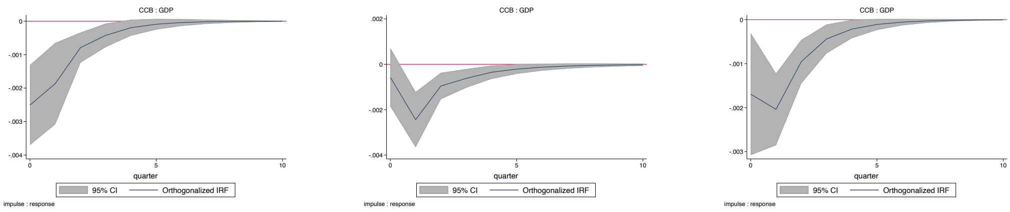
We next examine our comprehensive specification with alternative macroeconomic variables. We first replace the CPI with the PPI (under the notion that producer goods may better capture the sort of liquidity demand relevant to dollar needs). Next, we retain the PPI in place of the CPI, but further replace M2 with the lending rate (to admit completely distinct inflation and interest rate measures relative to the baseline). Finally, we replace the nominal exchange rate with the REER (to emphasize the importance of relative prices against primary trading partners, instead of just the U.S.), while keeping PPI and the lending rate. The corresponding IRFs are depicted in Figure 18.

The negative and significant relationship between dollar liquidity and output remains unchanged despite these variations. Indeed, as was the case in the baseline, variance decompositions (reported in the appendix[54]) reveal that impulses in dollar liquidity better explain subsequent variations in output growth, compared to the domestic lending rate (the small magnitude of both notwithstanding).

6.2 Potential cointegration and cross-sectional heterogeneity

In Section 4.1, we flagged the possibility that cross-sectional heterogeneity may be an issue for some variables in the system, whereas cointegration was unlikely to be. Here, we report dynamic heterogeneous panel regressions, for both the parsimonious and comprehensive spec-

[54]See Table A.12 and Table A.13.



(a) Replace CPI with PPI

(b) Replace CPI with PPI and M2 with the lending rate

(c) Replace CPI with PPI, M2 with the lending rate, and nominal exchange rate with REER

Figure 18: Orthogonalized impulse response functions for dollar liquidity on output with alternative variables, full sample (2000Q1–2020Q4). The negative dollar liquidity-output relationship persists when alternative macroeconomic variables are used.

ifications. These include techniques that can accommodate potential cointegration (dynamic fixed effects and mean group estimators, left panel of Table 3) or spatial dependency (spatial correlation-consistent and dynamic common correlated mean group estimators, right panel of Table 3).

The results generally echo our baseline findings. Even after controlling for dynamic heterogeneity, the effect of the CCB on growth remains negative. The coefficients in the short run are typically negative (although not always significant), and for the long run—the usual application for this class of models—the effects of the dollar squeeze on output is likewise negative.

6.3 Endogeneity concerns

We consider two sets of checks to address residual endogeneity concerns.

Relative endogeneity of variables. We evaluate two possibilities for alternative timing assumptions. First, we retain the relative exogeneity of the CCB and the relative endogeneity of the exchange rate, consistent with the arguments laid out in Section 3.3. However, we introduce permutations in the order of output, prices, and the money stock. These are reported in Figure 19. We obtain only very small variations in the impulse responses, relative to the baseline; this is consistent with arguments that stress how the order of these intermediate endogenous variables do not matter for identification (Plagborg-Møller & Wolf 2021).

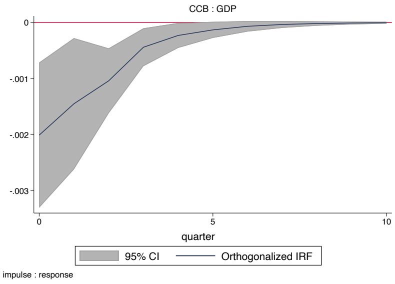
Second, we let the exchange rate take on a comparable order of exogeneity as the cross-currency basis. Thus, the exchange rate may either be more exogenous than the CCB (left panel of Figure 20), or just slightly less (while still being more exogenous than the remaining variables, right panel). The order of the remaining endogenous variables then follow that of the baseline. In neither case does this alternative treatment of the endogeneity of the exchange rate matter.[55]

[55] As a final robustness check, we take on the most extreme possibility and consider a specification where the cross-currency basis is *more* endogenous than output, despite its violation of our identification assumptions documented in Section 3.3.2. Yet even with this setup, the IRFs retain a negative relationship between the two variables; these are available on request.

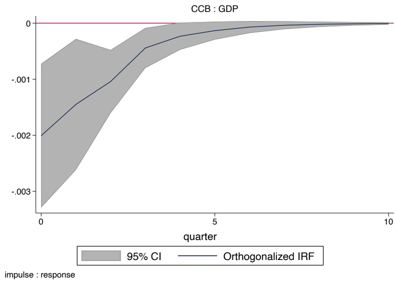
Table 3: Dynamic heterogeneous panels, parsimonious and comprehensive models

	Potential cointegration				*Potential spatial dependency*			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				Short-run				
ΔCCB_t-1	-0.0000	-0.0000	-0.0001	-0.0001**	-0.0000	-0.0000	-0.0001***	-0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
ΔGDP_t-1	-0.1724***	-0.1230***	-0.0756***	-0.2958***	-0.1902**	-0.1400**		
	(0.0155)	(0.0158)	(0.0179)	(0.0468)	(0.0792)	(0.0588)		
ΔCPI_t		0.1678		0.5286***		0.1577		-0.2347
		(0.4011)		(0.1715)		(0.2422)		(0.1943)
$\Delta M2\_t$		0.0370		-0.1025		0.0297		-0.1615*
		(0.1117)		(0.1007)		(0.0562)		(0.0864)
ΔER_t		-0.0719		-0.1117		-0.0650*		0.1940***
		(0.0739)		(0.0708)		(0.0373)		(0.0747)
				Long-run				
CCB_t-1	-0.0000	-0.0000	0.0006	-0.0020	-0.0000**	-0.0000	-0.0039	0.0004
	(0.0000)	(0.0000)	(0.0015)	(0.0024)	(0.0000)	(0.0000)	(0.0054)	(0.0006)
GDP_t-1	0.0182	-0.0317			-0.0310**	-0.0799***	-0.0210*	-0.3194***
	(0.0284)	(0.0386)			(0.0147)	(0.0157)	(0.0111)	(0.0473)
CPI_t		-0.0347		0.0279		-0.0173		0.1849
		(0.0553)		(0.0309)		(0.0191)		(0.7448)
$M2\_t$		0.0253		-0.4540		0.0283**		0.4322
		(0.0260)		(1.0201)		(0.0120)		(0.2803)
ER_t		0.0021		-0.4385		-0.0030		-0.4391
		(0.0205)		(0.3519)		(0.0126)		(0.3351)
Estimator	DFE-C	DFE-C	MG	MG	SSC	SSC	DCCE	DCCE
Model	Pars.	Comp.	Pars.	Comp.	Pars.	Comp.	Pars.	Comp.
R^2							0.843	0.626
Observations	3465	3372	3492	3397	3492	3397	3292	3125

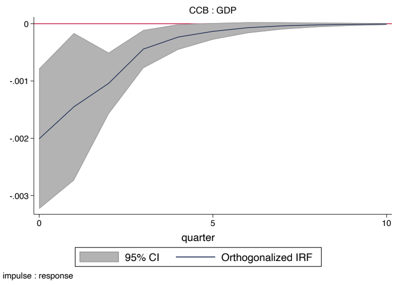
The dependent variable is the GDP growth rate. Dynamic heterogeneous panel methods reported in the first row of the lower panel, corresponding to biased-corrected dynamic fixed effects (DFE-C), mean group (MG), spatial correlation-consistent (SCC), and dynamic common correlated (DCCE) estimators. DFE-C estimates are initialized with the Anderson-Hsiao estimator and corrected to O(1/NT). Within goodness of fit (adjusted R2) reported where available. Reported periods are averages, since the panel is unbalanced. A homogeneous constant was included in all specifications, but not reported. Standard errors are given in parentheses, and are bootstrapped over 200 simulations (DFE-C), Driscoll-Kraay spatial dependency, heteroskedasticity, and autocorrelation-corrected standard errors (SCC). * indicates significance at the 10 percent level, ** significance at the 5 percent level, and *** significance at the 1 percent level.



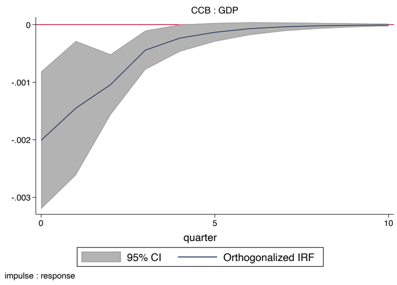
(a) Ordering: CCB CPI M2 GDP ER



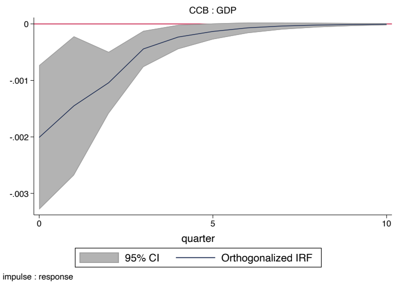
(b) Ordering: CCB CPI GDP M2 ER



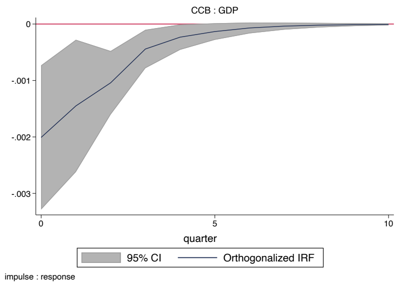
(c) Ordering: CCB M2 GDP CPI ER



(d) Ordering: CCB M2 CPI GDP ER

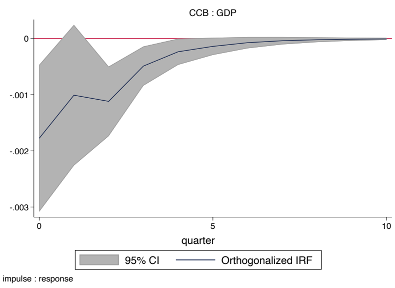


(e) Ordering: CCB GDP M2 CPI ER

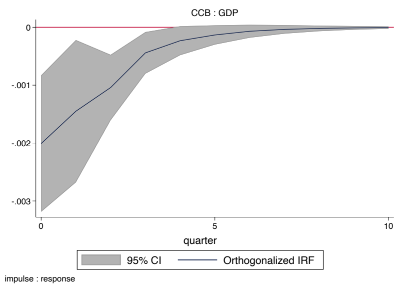


(f) Ordering: CCB GDP CPI M2 ER

Figure 19: Orthogonalized impulse response functions for dollar liquidity on output using different timing assumptions, full sample (2000Q1–2020Q4), with alternative orderings of endogenous variables other than the cross-currency basis and the exchange rate. The negative effect of CCB on GDP is essentially unchanged.



(a) Ordering: ER CCB GDP CPI M2



(b) Ordering: CCB ER GDP CPI M2

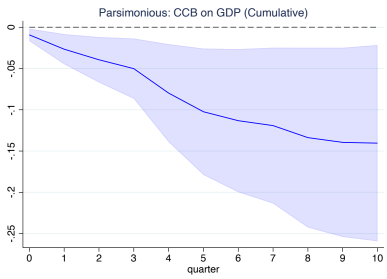
Figure 20: Orthogonalized impulse response functions for dollar liquidity on output using different timing assumptions, full sample (2000Q1–2020Q4), with the cross-currency basis and exchange rate as most exogenous. The negative effect of CCB on GDP remains unaltered by this placement of the exchange rate as among the most exogenous.

Relaxing strict exogeneity of the CCB. We also estimate local projections using instruments. As explained in Section 3.3, our candidate instruments are lags of the synthetic dollar rate (top panel) and country-specific monetary policy shocks (middle panel); we also consider both in combination (bottom panel).[56] The cumulative impulse responses, corresponding to the parsimonious (left column) and comprehensive (right column) models, are shown in Figure 21.[57]

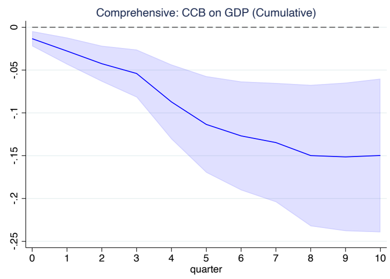
As is common for such projections, the IRFs are nowhere as smooth as those generated from the PVAR system. Even so, the cumulative effect of dollar liquidity on output growth is still negative. The impulse tends to peak after between 2 and 5 quarters, and—other than for the specifications instrumented solely with monetary policy shocks—remain significant for a full ten quarters after impact. Moreover, the outcomes hold for the AE and EM subsamples (these are reported in the appendix). As these results are also robust to the inclusion of external controls—consistent with the lagged exogeneity test proposed by Miranda-Agrippino & Ricco (2023) for assessing lagged internal instruments in a VAR setting—we also obtain some further validation of our instruments. Our main conclusion about the negative effect of CCB on growth remains true, even when we accommodate the possibility of endogeneity in the CCB.

[56]We allow for lags of up to 4 quarters, although, technically, contemporaneous realizations of the monetary policy shock may be included, given its construction. The results reported here correspond to those that are for one lag for each, but changes to the lag structure, as well as the inclusion of additional controls, yield qualitatively similar results. The first-stage results are reported and discussed in detail in the appendix, and results with other lag structures are available on request.

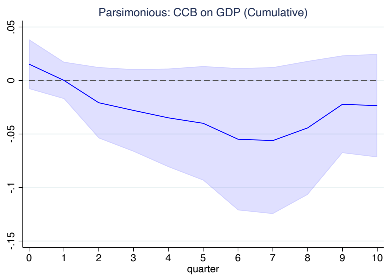
[57]We choose the cumulative IRFs due to the volatility of their orthogonalized variants, which inhibits interpretation of their total effects. For completeness, we also report the orthogonalized IRFs in the appendix.



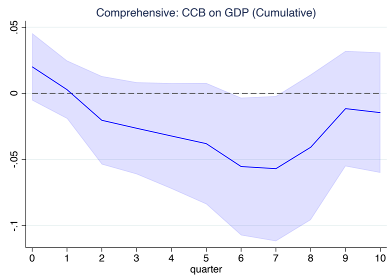
(a) Synthetic rate only, parsimonious model



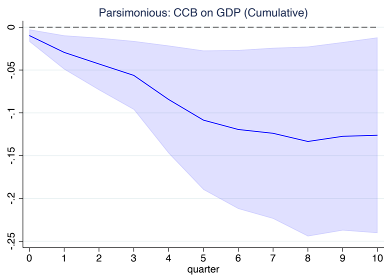
(b) Synthetic rate only, comprehensive model



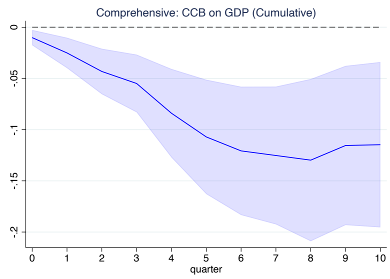
(c) Domestic shocks only, parsimonious model



(d) Domestic shocks only, comprehensive model



(e) Synthetic rate and domestic shocks, parsimonious model



(f) Synthetic rate and domestic shocks, comprehensive model

Figure 21: Cumulative impulse response functions for CCB on GDP estimated via local projections, full sample (2000Q1–2020Q4). Local projections for the parsimonious (left column) and comprehensive (right column) models are estimated via GMM, with standard errors clustered at the country level, and instrumented with 1 quarter lag of the variables listed in the subcaptions. For a one standard-deviation innovation, the evolution 10 quarters after the shock is reported. The light blue areas indicate the 90 percent confidence intervals. While more volatile than the uninstrumented PVARs, the cumulative effect of dollar liquidity on growth remains negative, attaining its long-run effect after 2 quarters, and is significant for up to eight quarters after impact.

7 Conclusion

This paper finds that CIP deviations, proxied by the cross-currency basis, tend to exert a negative effect on economic growth, especially in the aftermath of the global financial crisis of 2007/08. We attribute this result—which we term a "dollar squeeze"—to three factors. First, in the heat of a financial crisis, the ability to access dollar financing in advanced economies does bolster growth. This is consistent with the works of others, such as Ivashina & Scharfstein (2010), which have stressed the importance of international liquidity during a crisis. Second, during normal times, improved dollar liquidity promotes substitution out of previously safe-haven dollar assets into domestic local-currency holdings, which tightens the money supply and lowers growth. This effect is more prominent in emerging markets, and is aligned with the findings in Rey (2013). Third, easier dollar access in normal times also triggers exchange rate appreciation in advanced economies, consistent with *un*covered interest parity, with currency strength prompting a deterioration in the trade balance and erodes growth.

We have focused our efforts here on the effects of the cross-currency basis on a key dimension of economic performance: GDP growth. But the analyses in Sections 4.4 and 5 have revealed that dollar liquidity may also exert important and nuanced influences on other key aspects of the open economy, especially cross-border trade and financial flows. While we have touched on these as transmission channels in this paper, we leave a deeper exploration of these additional dimensions to future research. The specific channels may also be further corroborated with micro-level data on changes in asset holdings by investment funds, in response to dollar liquidity shocks.

Policy implications. The dollar has become so critical to the smooth functioning of international finance that the Federal Reserve has even occasionally taken on the *de facto* role of the guardian of global financial stability. This prompted the institution of central bank liquidity swap arrangements,[58] denominated in dollars, first introduced after the global financial crisis (Obstfeld, Shambaugh & Taylor 2009), and reprised during the COVID-19 pandemic (Bahaj & Reis 2022). Such dollar swap lines are meant to cap the extent of CIP deviations, but evidence on their efficacy remains somewhat mixed, with some authors documenting stronger support (Bahaj & Reis 2022) than others (Allen, Galati, Moessner & Nelson 2017). While our paper does not resolve this issue, we provide additional perspective on why such lines may not work as advertised.

Our work suggests that such swap arrangements may play an important role in shielding economies from output contractions during crisis conditions. But their utility tends to be limited to AEs, which, in fairness, comprise the vast majority of counterparty central banks in any case.[59] During normal times, however, dollar liquidity access may confer much more limited benefits than typically assumed. Standing foreign exchange swap arrangements—such as the Chiang Mai Initiative Multilateralization—may turn out to be counterproductive, and improved eurodollar deposit facilities may likewise trigger unanticipated (and undesirable) short-term slowdowns.

Moreover, the shortage of safe assets within the EM space suggests that policymakers in such settings should be careful of what they wish for. Lowering the cost of dollar financing during times of financial stress may, paradoxically, promote capital flight. That said, if any given central bank views such dollar liquidity provision as unavoidable, then it should do what it can to avoid a domestic liquidity collapse, either through keeping policy rates low, or (more

[58] As a result of the global crisis, the Fed created standing swap arrangements with five central banks: the Bank of Cananda, Bank of England, Bank of Japan, the ECB, and the Swiss National Bank. In March 2020, it extended short-term swap arrangements to the monetary authorities of nine additional countries: Australia, Brazil, Mexico, Denmark, South Korea, Norway, New Zealand, Singapore, and Sweden.

[59] Of the 14 central banks authorized with dollar liquidity swap lines in 2007, 11 were in AEs (the exceptions were the Banco Central do Brasil, Bank of Korea, and Banco de Mexico).

drastically) by imposing capital controls. Another implication of our findings is that, in the longer run, promoting financial deepening in EMs may go beyond its development benefits alone, by providing insulation from dollar squeezes.

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Online Appendix

Contents

A.1 Preliminary tests

This section discusses preliminary tests of the time-series properties of the panel data and lag selection for the baseline model.

A.1.1 Stationarity

We report a series of panel unit root tests [60] for CCB, GDP, CPI, M2 and ER in Table A.1. These were estimated with and without a time trend, for levels (top panel), log-levels (middle panel), and first differences (bottom panel). Obviously, the cross-currency basis series are proved to be stationary in levels either with and without time trend for all the three types of tests, indicating no unit root issues with CCB[61]. However, other variables in levels and log-levels, more or less do not pass certain tests, suggesting the existence of nonstationarity problem. When first differences series for the rest four variables are examined, they all prove stationary regardless of considering time trend or not.

[60] Tests from Im, Pesaran & Shin (2003) and Choi (2001) do not take into account cross-sectional dependence in the error term, and the variables were demeaned before the testing. However, the test by Pesaran (2007) allows for the presence of an unobserved common factor with heterogeneous factor loadings; during this test, up to 4 lagged differences were considered to account for potential serial correlation.

[61] Since no evidence of unit root issues are found for CCB series, we do not consider tests for the other two forms series.

Table A.1: Panel unit root tests for levels, log levels, and first difference transformations†

	Levels									
	with constant only					*with constant and trend*				
	CCB	GDP	CPI	M2	ER	CCB	GDP	CPI	M2	ER
Im-Pesaran-Shin	-14.571***	2.226	5.429	26.047		-14.706***	-2.066**	3.999	13.779	
Fisher ADF	-16.296***	2.593	-0.706	12.128	1.916	-14.716***	-9.728***	4.334	8.631	5.733
Pesaran CADF	-11.248***	3.227	15.244	8.673	-0.771	-10.622***	7.165	5.727	11.293	-1.404*
	Log levels									
	with constant only					*with constant and trend*				
		GDP	CPI	M2	ER		GDP	CPI	M2	ER
Im-Pesaran-Shin		-1.070	-2.248**	5.611			1.888	3.853	-0.235	
Fisher ADF		-0.513	-10.806***	1.789	1.951		-5.716***	2.925	4.028	5.560
Pesaran CADF		2.246	-0.648	6.794	0.661		9.851	1.451	9.374	-3.403***
	First differences									
	with constant only					*with constant and trend*				
		GDP	CPI	M2	ER		GDP	CPI	M2	ER
Im-Pesaran-Shin		-40.446***	-24.474***	-14.952***			-40.220***	-27.451***	-14.397***	
Fisher ADF		-54.750***	-38.262***	-47.715***	-39.276***		-53.841***	-38.132***	-46.426***	-36.038***
Pesaran CADF		-32.108***	-22.820***	-27.335***	-25.766***		-32.192***	-21.855***	-26.999***	-23.963***

† The null hypothesis is nonstationarity or the existence of a unit root. Lags for the tests are chosen by the Akaike criterion. The Im-Pesaran-Shin test reports the W_{t-bar} statistic, the Fisher ADF test reports the inverse normal Z, and the Pesaran CADF reports the Z_{t-bar} statistic. *, ** and *** indicate significance at 10 percent level, 5 percent level and 1 percent level, respectively. The Im-Pesaran-Shin tests do not produce results for ER due to insufficient periods, however, other tests suggest that ER is not stationary except in first differences. Therefore, we adopt ER in first difference in our analysis.

A.1.2 Cointegration

Table A.2 presents two sets of panel cointegration: a residual-based test (Pedroni 1999), and an error-correction-based one (Westerlund 2007). As before, we also consider tests with and without a time trend, and report the test statistics for variables included in the parsimonious in the top panel and comprehensive in the bottom panel. Overall, the results suggest potential cointegration except the Westerlund α test for the parsimonious model. We leave the cointegration possibilities for robustness check.

Table A.2: Panel cointegration tests, parsimonious and comprehensive models

	Parsimonious			
	with constant only		with constant and trend	
	Panel	Group	Panel	Group
Pedroni ADF	-20.37	-21.05	-19.91	-19.01
Westerlund α Z	-23.92***	-6.08***	-13.23***	-1.21

	Comprehensive			
	with constant only		with constant and trend	
	Panel	Group	Panel	Group
Pedroni ADF	-17.87	-18.72	-19.59	-19.21
Westerlund α Z[§]	1.39	6.70	5.24	9.43

[†] The null hypotheses are of no cointegration for both tests. Variables for the Pedroni (1999) test were time-demeaned to capture common time effects, and the parametric group and panel augmented Dickey-Fuller statistics are reported; the Westerlund (2007) α test explicitly accounts for cross-sectional dependence, reporting the semiparametric group-mean and panel statistics G_α and P_α. Lags for the tests are chosen with the Akaike criterion.

[§] Argentina, Colombia, Qartar, Romania, Slovakia and Saudi Arabia are excluded for the Westerlund α test due to insufficient observations to conduct the test for comprehensive specifications: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

A.1.3 Lag selection

Table A.3 documents the overall model fit for up to four lags for the parsimonious (left panel) and the comprehensive (right panel) specifications. Overall, the majority of the information criteria (except AIC) suggest the selection of the first-order PVAR model. We therefore regard this as our baseline.

Table A.3: Information criteria for lag selection, parsimonious and comprehensive models

	Parsimonious			**Comprehensive**		
Lag	*BIC*	*AIC*	*QIC*	*BIC*	*AIC*	*QIC*
1	-134.505	36.855	-24.427	-807.496	258.593	-123.211
2	-5.517	141.363	88.835	-553.175	360.615	33.355
3	161.646	284.046	240.273	-294.507	466.985	194.268
4	-82.361	15.558	-19.460	-427.169	182.025	-36.149

† Test statistics are computed for a maximum of lag order of 4 quarters, and instrumented with lags of 1 through 8. The moment and model selection criteria correspond to the maximum likelihood-based Akaike (AIC), Bayesian (BIC), and Hannan-Quinn (QIC) Information Criteria, and are reported for all over-identified specifications.

A.2 Data appendix

This section provides additional secondary information related to the data and sample used for the analysis.

A.2.1 Sample countries

As described in the paper, we have 50 countries in our analysis due to the availability of data. Specifically, we include 23 emerging economies and 27 advanced economies, with details in Table A.4.

Table A.4: Sample country

Emerging economies		
Argentina	Bulgaria	Chile
China	Colombia	Czech Republic
Hungary	India	Indonesia
Kazakhstan	Korea	Malaysia
Mexico	Philippines	Poland
Qatar	Romania	Russia
Saudi Arabia	South Africa	Taiwan
Thailand	Turkey	
Advanced economies		
Australia	Austria	Belgium
Canada	Cyprus	Denmark
Finland	France	Germany
Greece	Hong Kong	Ireland
Israel	Italy	Japan
Malta	Netherlands	New Zealand
Norway	Portugal	Singapore
Slovakia	Slovenia	Spain
Sweden	Switzerland	United Kingdom

† Some countries may be dropped out of the sample in certain specifications due to data availability.

A.2.2 Data sources

We use various macro-economic level data in this analysis. Most importantly, the cross-currency basis is calculated according to Equation (3) by interbank offered rates, spot and forward exchange rates from Bloomberg. The detailed tickers for different currencies are displayed in Table A.6. Other variables used in our baseline analysis are collected from EIU Country Data. For better understanding, we describe all the variables together with their definitions and sources in Table A.5.

Table A.5: Sources and definitions for main variables of interest

Variable	Definition	Source
	Baseline variables	
Cross-currency basis	Three-month IBOR basis of a currency against the US dollar	Calculated by author[†]
Real GDP	GDP at constant market prices, rebased to 2010 constant prices	EIU CD[‡]
Consumer price index	The consumer price index in local currency rebased to 2010=100	EIU CD
Money supply (M2)	Total supply of notes and coins demand deposits plus quasi-money, period-end	EIU CD
Nominal exchange rate (ER)	National currency per US dollar, quarterly average	EIU CD
	Robustness and additional variables	
Production price index	The producer price index in local currency rebased to 2010=100	EIU CD
Lending interest rate	Average rate on commercial banks' short- and medium-term loans to the private sector	EIU CD
Real effective exchange rate	Trade-weighted basket of currencies converted to an index (1997=100), CPI-adjusted	EIU CD
Current account	Current account balance	EIU CD
Private consumption	Private consumption expenditure at constant market prices	EIU CD
Investment flows	Net flow of direct investment capital	EIU CD
Democracy index	Machine learning democracy index, a higher value indicates higher level of democracy[§]	Gründler & Krieger (2021)
Dependency ratio	Ratio of < 16 and > 64 year-olds to working-age population[§]	WDI
Default risk	Bank non-performing loans to total gross loans[§]	WDI
Trade openness	Sum of exports and imports of goods and services measured as a share of GDP[§]	WDI
Financial development	Domestic credit to private sector, share of GDP[§]	WDI
Political risk	Weighted index of subjective political-economic risk ratings[§]	ICRG
Synthetic dollar rate	Interest rate faced by non-US investors to borrow dollars via currency swap	Calculated by author

[†] Relevant data come from Bloomberg. See table A.6 for details.
[‡] EIU CD = Economist Intelligence Unit Country Data, WDI = World Development Indicators, ICRG = International Country Risk Guide. ICRG indicators are measured such that higher values indicate lower risk (better outcomes).
[§] Source data are at annual frequency, and interpolated into quarterly data.

Table A.6: Tickers for 3-month IBOR basis computation†

Currency	Forward‡	Spot	IBOR	Day Count Convention
AUD	AUD3M Curncy	AUDUSD Curncy	BBSW3M	365/ACT
CAD	CAD3M Curncy	USDCAD Curncy	CDOR03M	365/ACT
CHF	CHF3M Curncy	USDCHF Curncy	SF0003M	360/ACT
DKK	DKK3M Curncy	USDDKK Curncy	CIBO03M	360/ACT
EUR	EUR3M Curncy	EURUSD Curncy	EUR003M	360/ACT
GBP	GBP3M Curncy	GBPUSD Curncy	BP0003M	365/ACT
JPY	JPY3M Curncy	USDJPY Curncy	JY0003M	360/ACT
NOK	NOK3M Curncy	USDNOK Curncy	NIBOR3M	360/ACT
NZD	NZD3M Curncy	NZDUSD Curncy	NDBB3M	365/ACT
SEK	SEK3M Curncy	USDSEK Curncy	STIB3M	360/ACT
ARS	APN3M Curncy	USDARS Curncy	ARLBP90	365/ACT
BGN	BGN3M Curncy	USDBGN Curncy	SOBR3M & BIR§	360/ACT
CLP	CHN3M Curncy	USDCLP Curncy	PCRR90D Index	360/ACT
CNY	CNN+3M Curncy	USDCNY Curncy	SHIBO3M	360/ACT
COP	CLN+3M Curncy	USDCOP Curncy	COOVIBR3 Index	360/ACT
CZK	CZK3M Curncy	USDCZK Curncy	PRIB03M Index	360/ACT
HKD	HKD3M Curncy	USDHKD Curncy	HIHD03M Index	365/ACT
HUF	HUF3M Curncy	USDHUF Curncy	BUBOR03M	360/ACT
IDR	IHN+3M Curncy	USDIDR Curncy	JIIN3M	360/ACT
ILS	ILS3M Curncy	USDILS Curncy	TELBOR03M	365/ACT
INR	IRN+3M Curncy	INR Curncy	IN003M	360/ACT
KRW	KWN+3M Curncy	USDKRW Curncy	KRBO3M	365/ACT
KZT	KTN+3M Curncy	USDKZT Curncy	KZDR90D	360/ACT
MXN	MXN3M Curncy	USDMXN Curncy	MXIB91DT Index	360/ACT
MYR	MRN+3M Curncy	USDMYR Curncy	KLIB3M	365/ACT
PHP	PPN+3M Curncy	USDPHP Curncy	PREF3MO Index	360/ACT
PLN	PLN3M Curncy	USDPLN Curncy	WIBO3M	360/ACT
QAR	QAR+3M Curncy	USDQAR Curncy	AQII3M	360/ACT
RON	RON3M Curncy	USDRON Curncy	BUBR03M	360/ACT
RUB	RUB3M Curncy	USDRUB Curncy	MMIBR3M	365/ACT
SAR	SAR+3M Curncy	USDSAR Curncy	SAIB3M Index	360/ACT
SGD	SGD3M Curncy	USDSGD Curncy	SIBF3M Index	365/ACT
THB	THB3M Curncy	USDTHB Curncy	THFX3M Index	365/ACT
TRY	TRY3M Curncy	USDTRY Curncy	TRLIB3M Index	360/ACT
TWD	NTN+3M Curncy	USDTWD Curncy	TAIBOR3M	365/ACT
ZAR	ZAR3M Curncy	USDZAR Curncy	JIBA3M	365/ACT

† The corresponding variables are obtained from Bloomberg.

‡ We use forward points to calculate the forward exchange rate for the majority of the currencies when computing the CCBs. For currencies that do not report forward points in Bloomberg, we refer to their outright forward rates instead.

§ The Bulgarian National Bank ceased reporting the SOBR3M index in July 2018, and replaced it with a benchmark interest rate (BIR), at the same tenor, thereafter.

A.2.3 Descriptive statistics

In addition, the summary statistics and the corresponding correlation matrix for the comprehensive specification are reported in Table A.7 and Table A.8, respectively.

Table A.7: Summary statistics for main variables of interest †

Variable	**N**	**Mean**	**Std. Dev.**	**Min**	**Max**
CCB	3,415	18.685	193.378	-1214.810	6024.330
GDP	3,415	0.006	0.038	-0.429	0.266
CPI	3,415	0.007	0.009	-0.031	0.091
M2	3,415	0.020	0.028	-0.182	0.545
ER	3,415	0.001	0.043	-0.166	0.328

† Balanced sample statistics are reported; actual statistics may vary depending on the availability of data for a particular specification. CCB is measured as basis points in levels, while the remaining variables are first differenced, consistent with our baseline.

Table A.8: Correlation matrix for main variables of interest †

	CCB	GDP	CPI	M2	ER
CCB	1				
GDP	-0.0529	1			
CPI	-0.0560	0.1467	1		
M2	0.0128	0.1247	0.1719	1	
ER	-0.0116	-0.0565	0.0105	0.0372	1

† Spearman's correlation corresponding to the comprehensive model sample are reported. CCB is measured as basis points in levels, while the remaining variables are first differenced, consistent with our baseline.

A.3 Full impulse response functions

In the paper, we report only selected impulse response functions for different specifications for both space saving and clear presentation. In this section, we provide the full matrix of orthogonalized impulse response functions for the baseline comprehensive specification (Figure A.1), comprehensive specification for the crisis-cum-post-crisis period with the full (Figure A.2), EMs (Figure A.3), and AEs (Figure A.4) sample countries. Similarly, the full matrices of impulse response functions discussed in Section 5 are provided as well: the modified comprehensive model with lending rate (Figure A.5), synthetic dollar rate (Figure A.6), private consumption (Figure A.7), and net investment (Figure A.8) for the EMs; the modified comprehensive model with current account (Figure A.9), the REER (Figure A.10), and the synthetic dollar rate (Figure A.11) for the AEs.

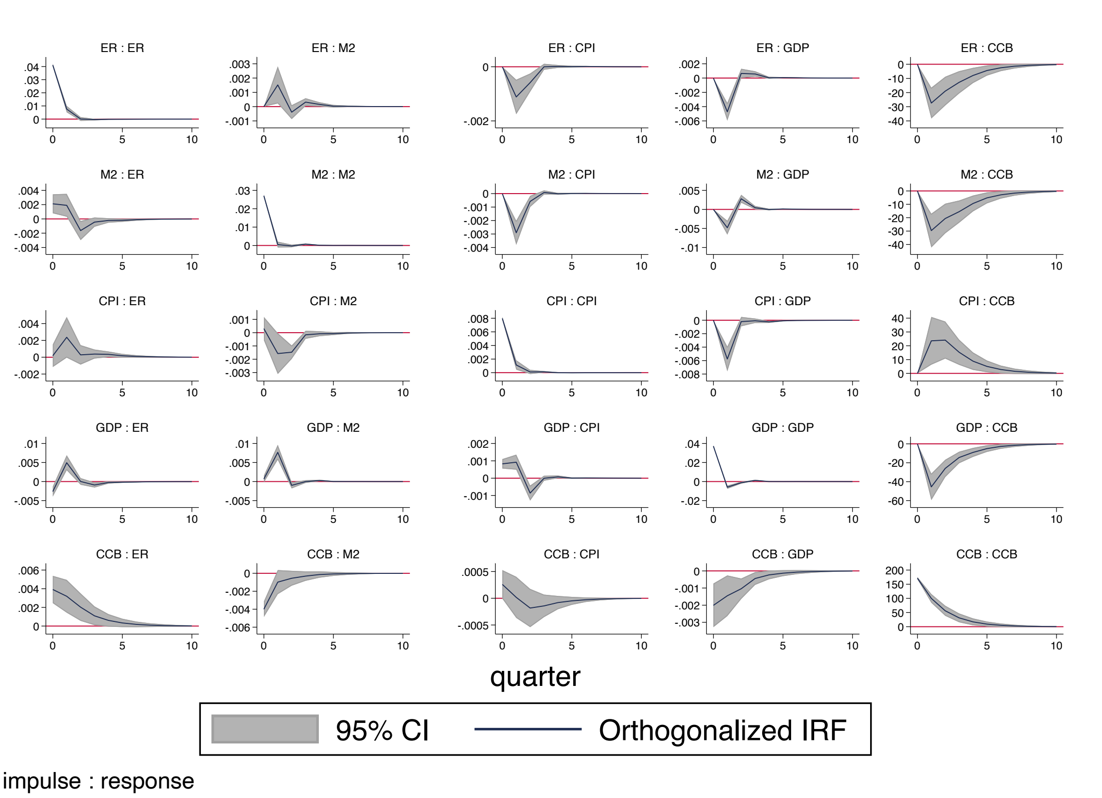


Figure A.1: Full matrix of orthogonalized impulse response functions for the baseline comprehensive model, full sample (2000Q1–2020Q4). The negative impact of dollar liquidity on output growth is found, where the domestic and dollar liquidity prove substitutes for each other. Meanwhile, the nominal exchange rate depreciates in response to positive innovations in dollar liquidity. However, the depreciation of exchange rate does not contribute to output growth, which corresponds to the J curve effect with a closer examination. In addition, positive innovations in domestic liquidity do not suggest a clear-cut positive effect on output.

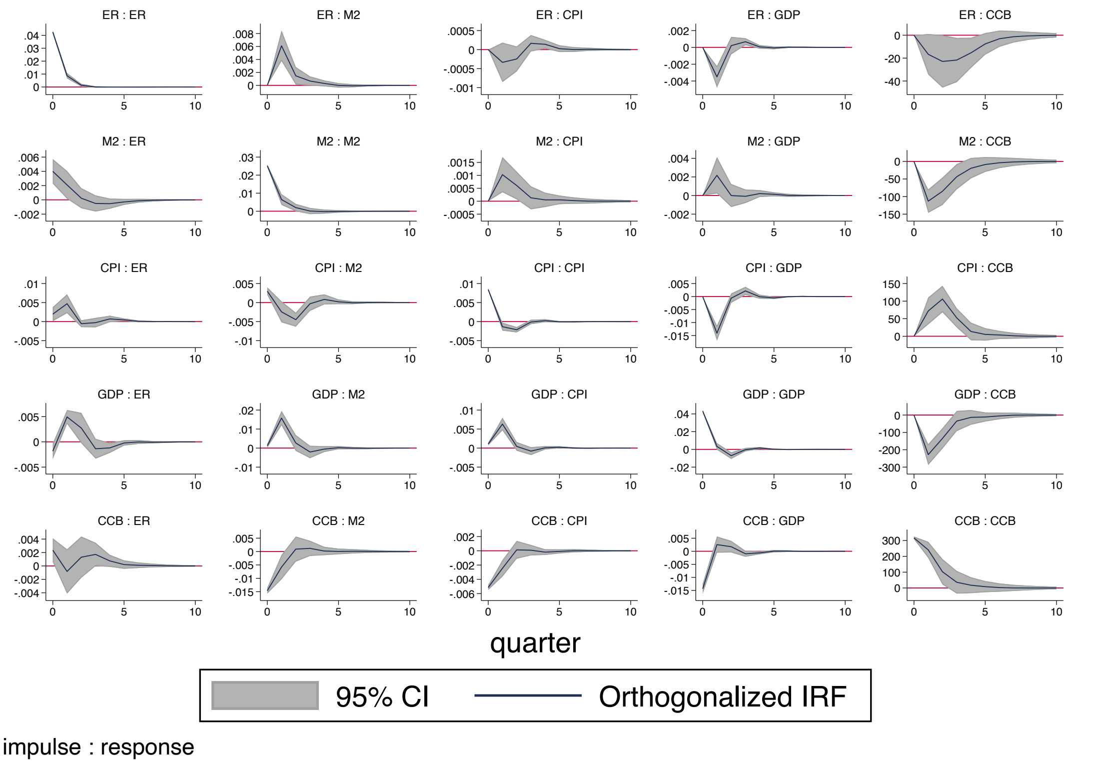


Figure A.2: Full matrix of orthogonalized impulse response functions for the baseline comprehensive model, crisis-cum-post-crisis period (2007Q4–2020Q4). While the negative impacts of dollar liquidity on output growth retain, it is worth noting that the bi-directional negative relationship between money stock and dollar liquidity retains with a larger magnitude compared to the baseline with full sample period. One more interesting finding comes from the positive effect of domestic money stock on output, which provides evidence for the *domestic liquidity* channel. However, the nominal exchange rate seems to be unaffected by dollar liquidity, and exchange rate depreciation surprisingly leads to output contraction. All the abnormal findings suggest the necessity to distinguish EMs from AEs in the sample.

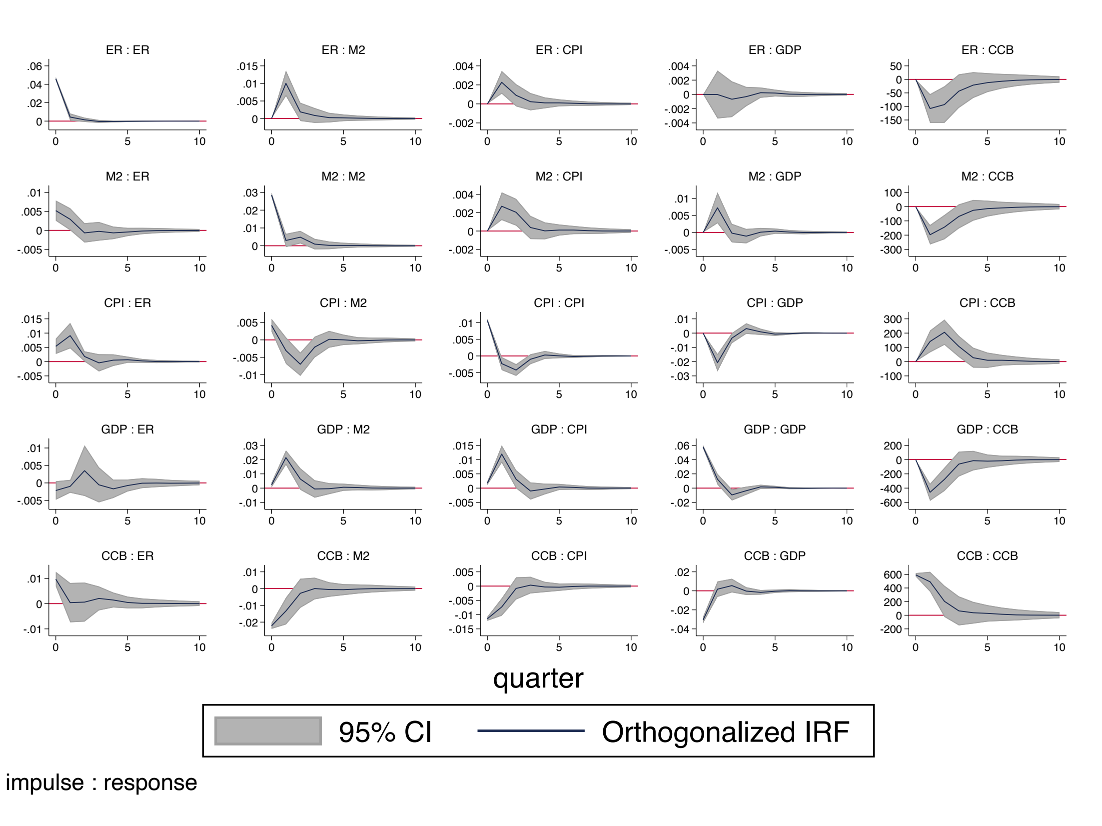


Figure A.3: Full matrix of orthogonalized impulse response functions for the comprehensive model in the emerging economies, during the crisis-cum-post-crisis period (2007Q4–2020Q4). As discussed in Section 4.4, the *domestic liquidity* channel works quite well in the transmission of dollar liquidity shocks on negative response in output in EMs, whereas the *exchange rate* channel seems not to matter much.

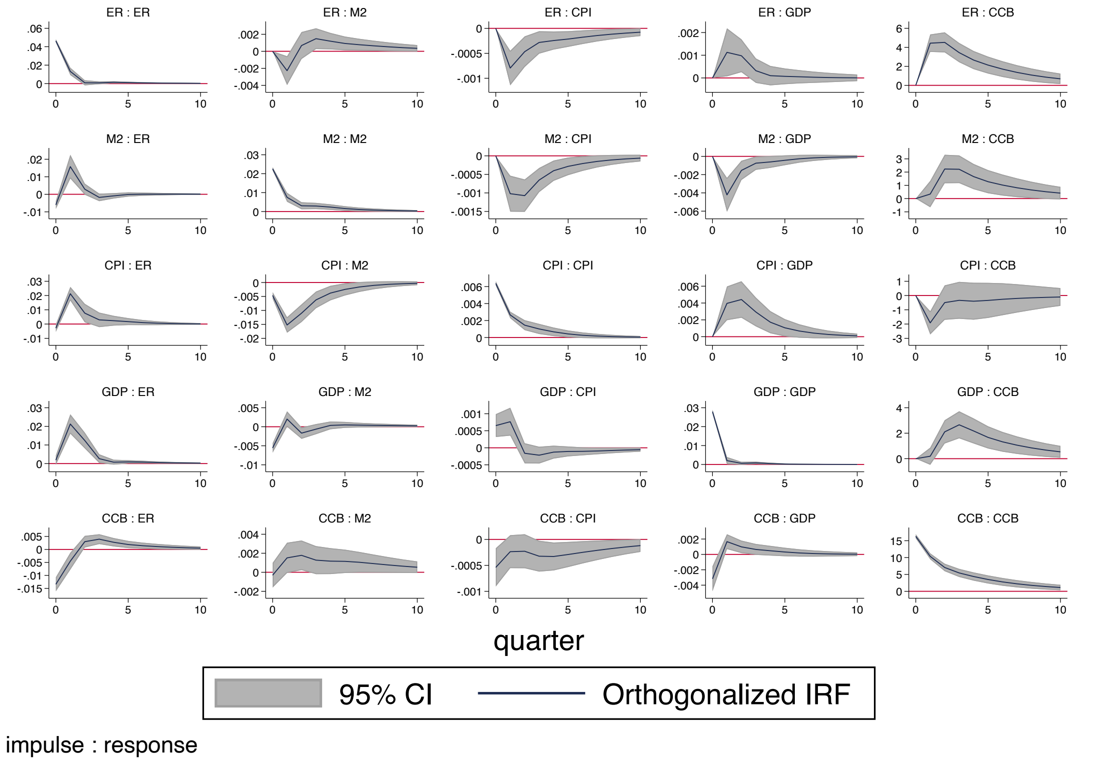


Figure A.4: Full matrix of orthogonalized impulse response functions for the AEs, comprehensive model, crisis-cum-post-crisis (2007Q4–2020Q4) period. As discussed in Section 4.4, positive shocks in dollar liquidity give rise to expansions of domestic liquidity, as easier global financing conditions allow their more mature financial markets to offer more domestic non-dollar assets. Strikingly, the exchange rate appreciation followed by positive innovations in dollar liquidity possibly deteriorates trade competitiveness and ultimately results in a GDP slowdown.

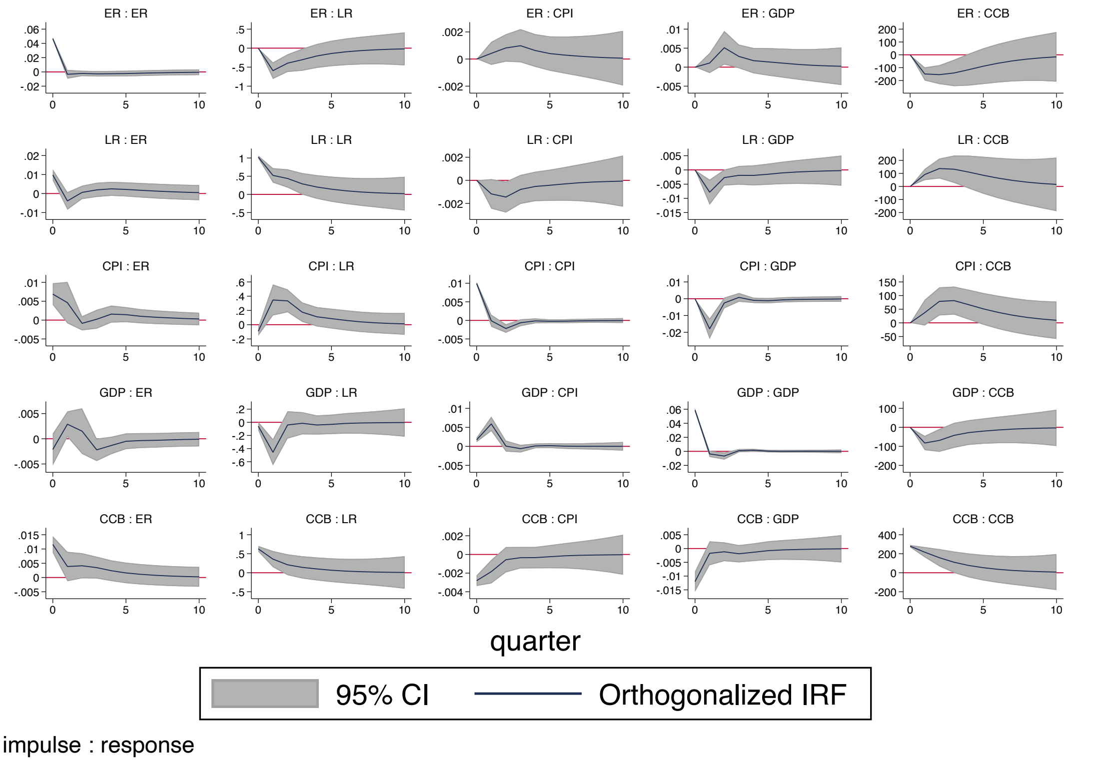


Figure A.5: Full matrix of orthogonalized impulse response functions for the comprehensive model with lending rate replacing money stock in the emerging economies, during the crisis-cum-post-crisis (2007Q4–2020Q4) period. Consistently, the *domestic liquidity* channel remains effective in the transmission of the negative impact of dollar liquidity on growth in EMs. Increases in the lending rate—which moves in the opposite direction to the money supply—lead to output contractions, even as dollar liquidity retains its effects (as per the baseline). Despite the marginally significant and positive response in output when depreciation shocks occur, the *exchange rate* channel does not matter much in EMs.

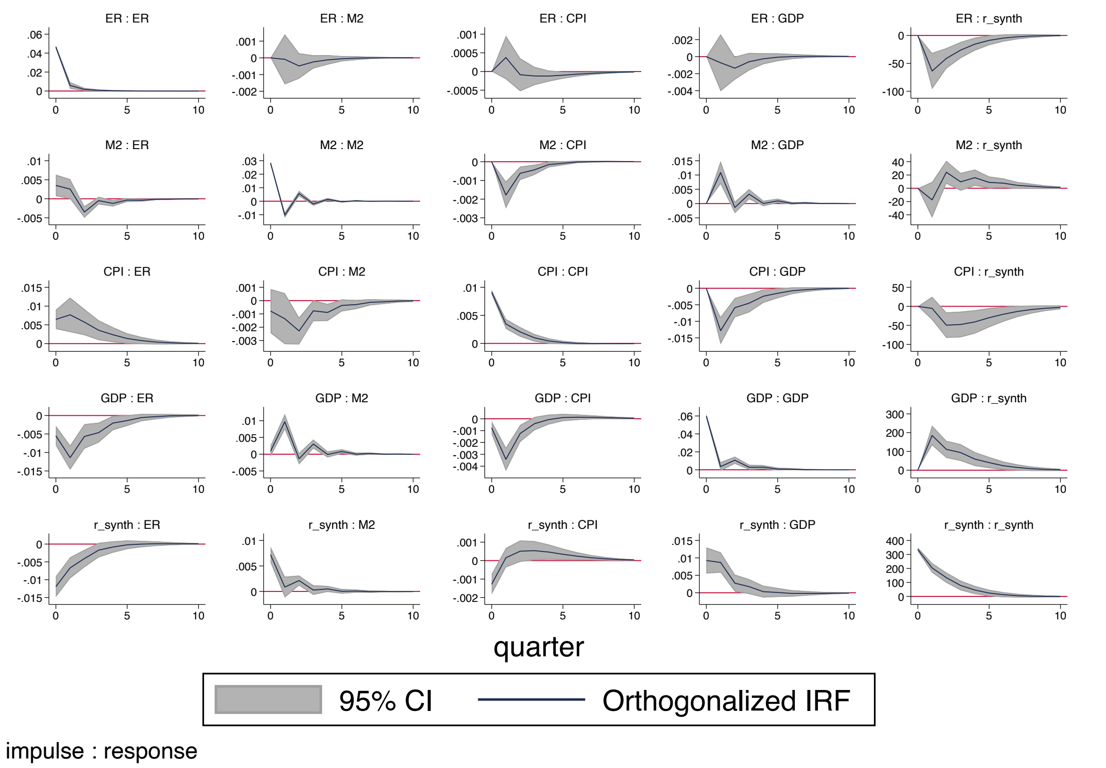


Figure A.6: Full matrix of orthogonalized impulse response functions for the comprehensive model with synthetic dollar interest rate (r_{synth}) replacing dollar liquidity in the emerging economies, during the crisis-cum-post-crisis (2007Q4–2020Q4) period. The effects of the synthetic dollar rate on GDP is the same as that of dollar liquidity, suggesting that domestic liquidity substitution is reacting to the convenience yield component, rather than the U.S. interest rate, *per se*. Consistently, the exchange rate appreciates in response to positive shocks in the synthetic rate, which is also in line with the domestic liquidity. However, exchange rate plays little role in output growth, suggesting negligible impact of *exchange rate* channel in EMs.

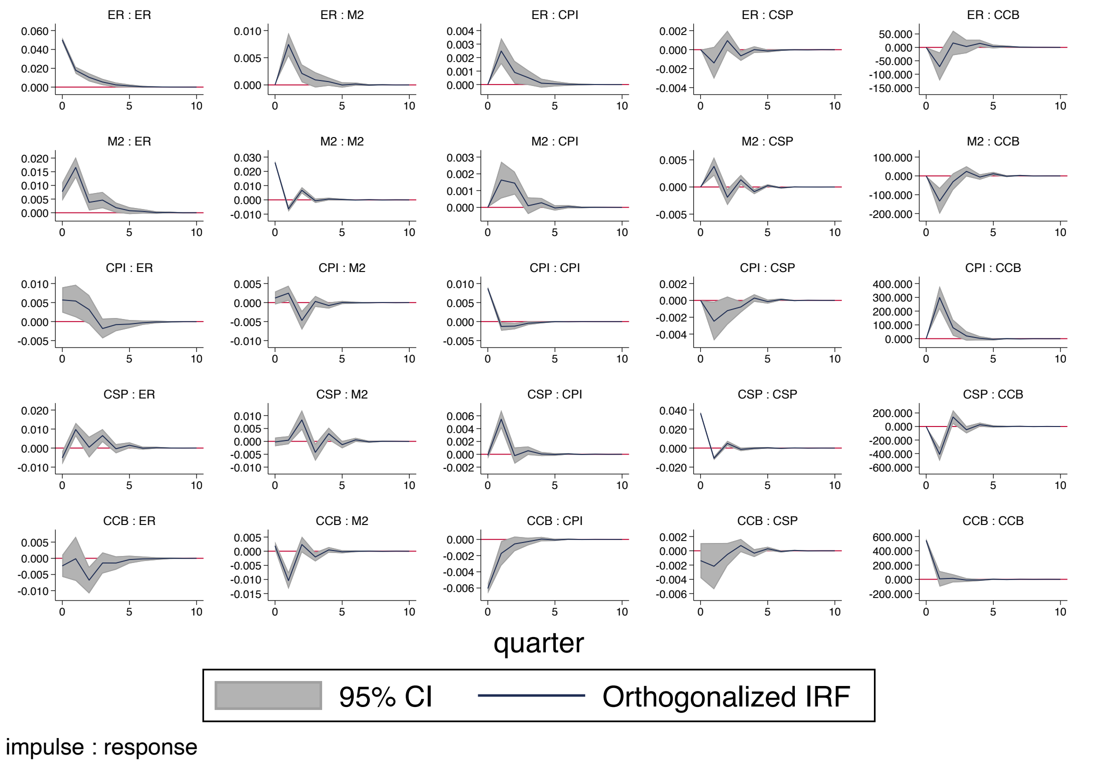


Figure A.7: Full matrix of orthogonalized impulse response functions for the comprehensive model with private consumption (CSP) replacing GDP in the emerging economies, during the crisis-cum-post-crisis (2007Q4–2020Q4) period. Strikingly, the private consumption decreases in response to innovations in dollar liquidity (despite a less significant effect on the former), providing further evidence that the drop in local consumption is the opportunity cost of substitution into local currency assets in EMs, since improved dollar liquidity does not supplement consumption. However, the relationship between dollar liquidity and domestic money stock becomes unclear, suggesting a smaller role of the substitute out of consumption for safe dollar assets.

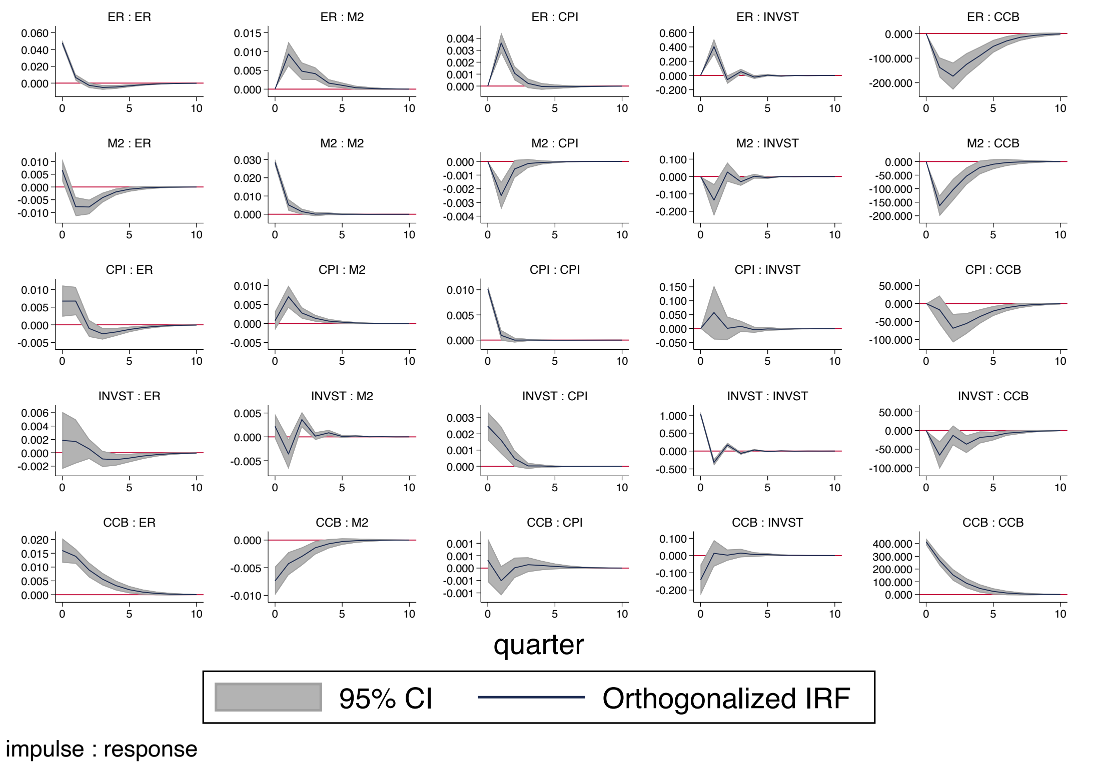


Figure A.8: Full matrix of orthogonalized impulse response functions for the comprehensive model with direct investment capital (INVST) replacing GDP in the emerging economies, during the crisis-cum-post-crisis (2007Q4–2020Q4) period. While the domestic and dollar liquidity are still substitutes, direct investment capital flows witness a fall in response to innovations in dollar liquidity. This is suggestive of the possibility that increased holdings of local currency assets need not translate into actual changes in real investment, but rather entail portfolio reallocations with asset purchases from the secondary market.

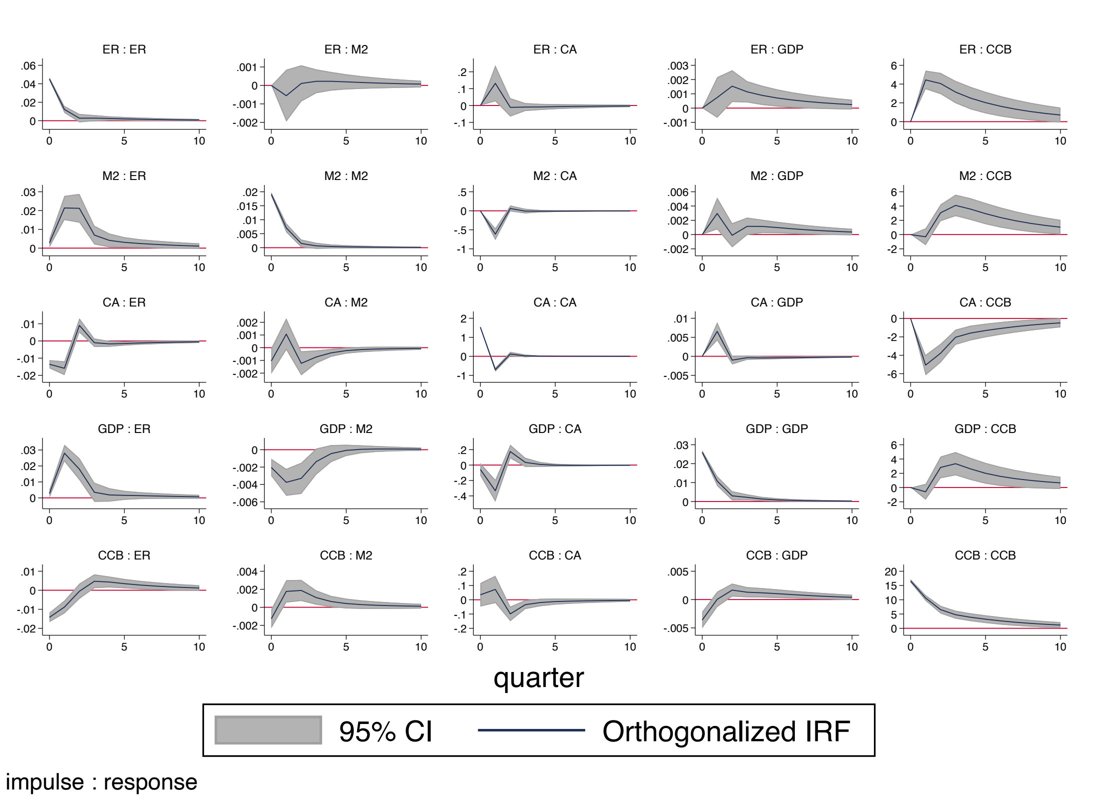


Figure A.9: Full matrix of orthogonalized impulse response functions for the AEs with current account replacing CPI, crisis-cum-post-crisis (2007Q4–2020Q4) period. Similarly, the negative impacts of dollar liquidity on output persist for the first quarter after the shock before fading away. Strikingly, the *exchange rate* channel remains effective. The exchange rate appreciates in response to an increase in dollar liquidity, which subsequently worsens export performance (current account) and leads to a output slowdown.

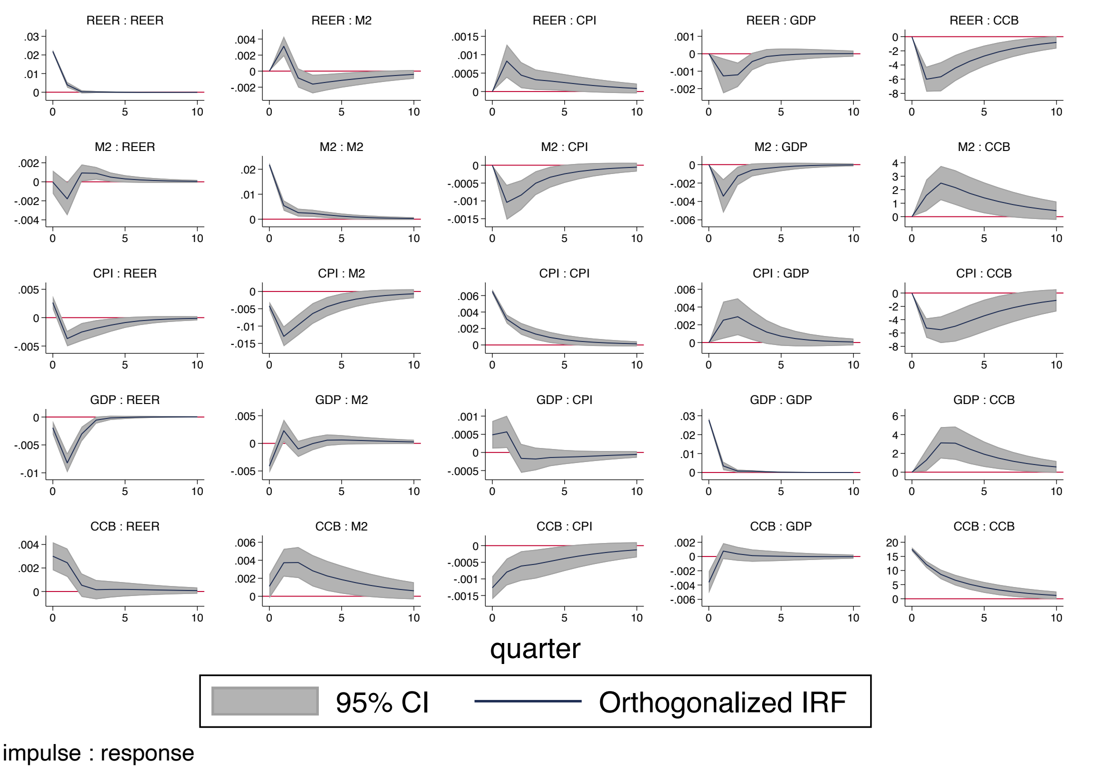


Figure A.10: Full matrix of orthogonalized impulse response functions for the AEs with REER replacing the nominal exchange rate, crisis-cum-post-crisis (2007Q4–2020Q4) period. Similarly, the negative impacts of dollar liquidity on output persist, and the domestic liquidity also increases when there is a positive shock in dollar liquidity. Strikingly, the *exchange rate* channel remains effective. The REER appreciates in response to a rise in dollar liquidity, which subsequently contributes to output declines.

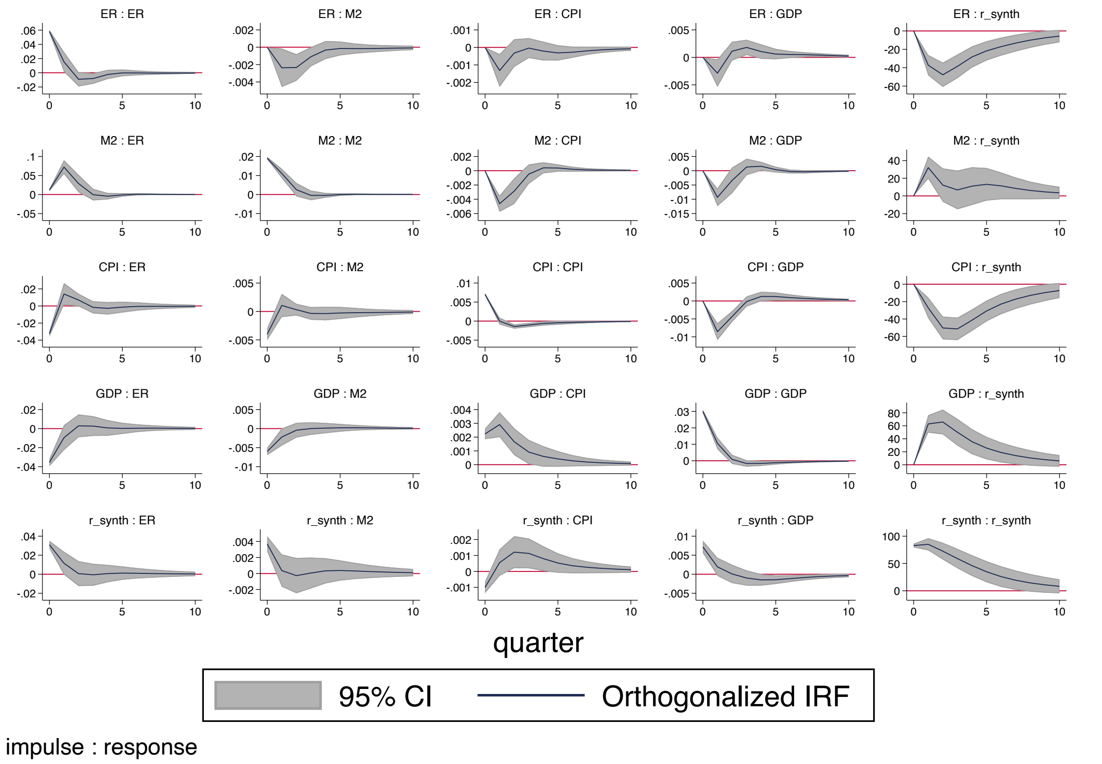
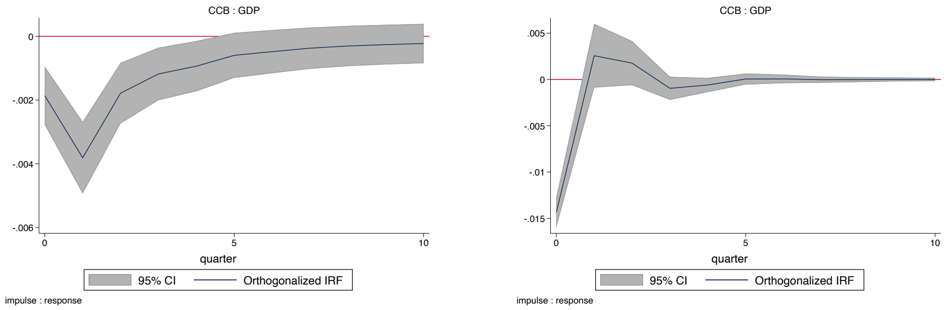


Figure A.11: Full set of orthogonalized impulse response functions for the AEs with the synthetic dollar rate (r_{synth}) replacing dollar liquidity in the comprehensive model, crisis-cum-post-crisis (2007Q4–02020Q4) period. Consistently, positive shocks to the synthetic rate is accompanied by depreciations in the nominal exchange rate, and increases in output, suggesting effectiveness of the *exchange rate* channel in AEs.

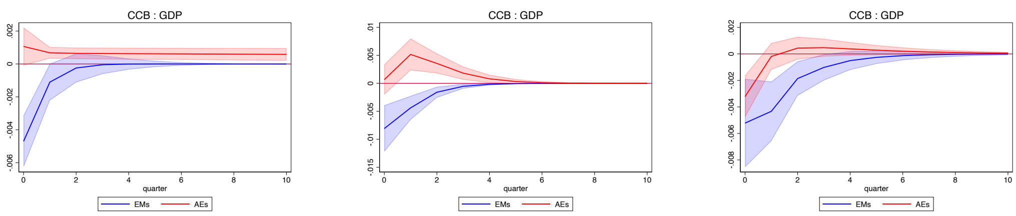
A.4 Additional subsample analyses

In this section, we report additional comparisons between different subsamples. These include: the effect of dollar liquidity on output growth from the comprehensive model between pre-crisis and crisis-cum-post-crisis period for the full sample country (Figure A.12), parsimonious model for the EMs and AEs (Figure A.13). On balance, we find larger magnitude of effect for the crisis-cum-post-crisis period than the pre-crisis period. Figure A.14 depicts the impulse response functions of dollar liquidity on growth in both the parsimonious and comprehensive models for EMs and AEs estimated with the full sample period, respectively. The negative relationship between dollar liquidity and economic growth persists after splitting the sample country for the full period (2000Q1–2020Q4).



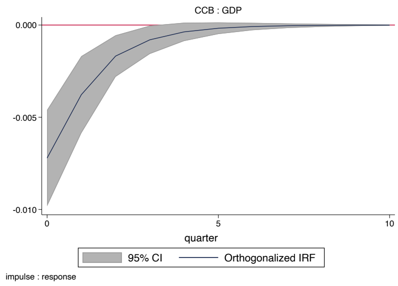
(a) Pre-crisis (b) crisis-cum-post-crisis

Figure A.12: Orthogonalized impulse response functions of dollar liquidity on output in the comprehensive model for pre-crisis (2000Q1–2007Q3), and crisis-cum-post-crisis (2007Q4–2020Q4) period. The liquidity shocks retain their negative impact on growth in both periods, with a larger effect at 1.5 percentage points on impact in the crisis-cum-post-crisis period and a mere 0.2 percentage point in the pre-crisis period. This result is in line with the fact that CIP deviations become larger since the global financial crisis.

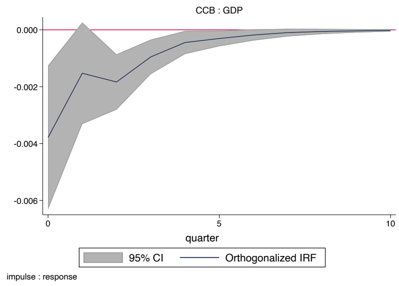


(a) Pre-crisis (b) Crisis (c) crisis-cum-post-crisis

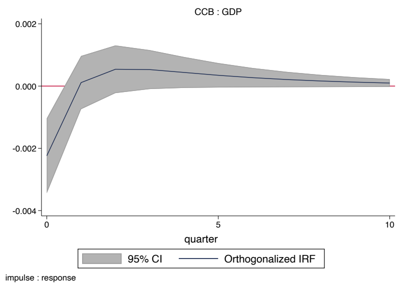
Figure A.13: Orthogonalized impulse response functions of dollar liquidity on output in the *parsimonious* model for advanced (in red) and emerging (in blue) economies, for partially-overlapping pre-crisis (2000Q1–2007Q3), crisis (2007Q4–2009Q2), and crisis-cum-post-crisis (2007Q4–2020Q4) periods. The liquidity shocks retain their negative impact on growth in normal times, but during the crisis period, this effect reverses for advanced economies, reflecting the importance of dollar-based financing under especially tight financial conditions.



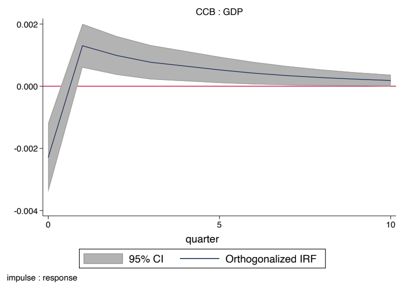
(a) Emerging economies group, parsimonious



(b) Emerging economies group, comprehensive



(c) Advanced economies group, parsimonious



(d) Advanced economies group, comprehensive

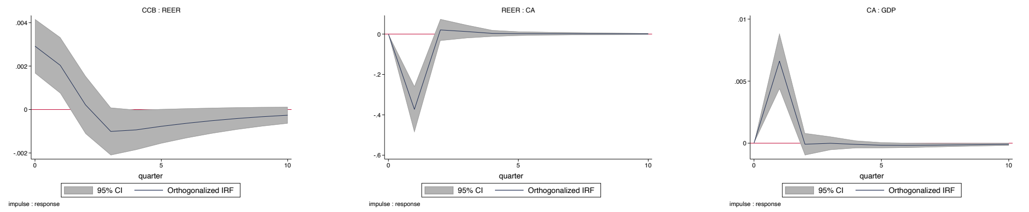
Figure A.14: Orthogonalized impulse response functions of dollar liquidity on output in the parsimonious and comprehensive specifications for emerging (top panel) and advanced (bottom panel) economies, full period (2000Q1–2020Q4). The negative effect of dollar liquidity on growth retains in both emerging and advanced economies despite a slightly positive impact in the comprehensive model for advanced economies two quarters after the shock before fading away. However, it is significant and negative on impact.

A.5 Additional robustness checks

This section reports additional robustness checks that were not considered in the main paper.

A.5.1 Additional channels for AEs

We replace nominal exchange rate with REER, and CPI with current account simultaneously in the comprehensive model for the AEs. The corresponding selected impulse response functions for the current account, REER, and output growth are displayed in Figure A.15. Consistent with the findings in Section 5, the real effective exchange rate appreciates in response to a positive dollar liquidity shock, which deteriorates the current account and therefore results in output contraction.



(a) Dollar liquidity on REER, AEs

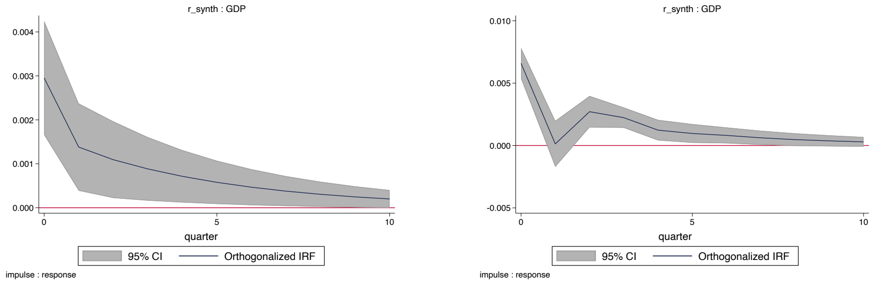
(b) REER on current account, AEs

(c) Current account on output

Figure A.15: Selected orthogonalized impulse response functions for the current account, real effective exchange rate, and output growth in the comprehensive model for advanced economies, during the crisis-cum-post-crisis (2007Q4–2020Q4) period. The current account worsens as the real effective exchange rate appreciates, suggesting that output contractions due to a dollar liquidity shock are indeed due to typical Marshall-Lerner effects.

A.5.2 Alternative dollar liquidity measure

As another robustness check for the baseline, we also replace the dollar liquidity measure CCB with the synthetic dollar interest rate. The estimation results for both the parsimonious and comprehensive models are shown in Figure A.16, implying that output increases when facing higher cost of borrowing dollars. This finding, as a matter of fact, supports the negative impact of dollar liquidity on growth.

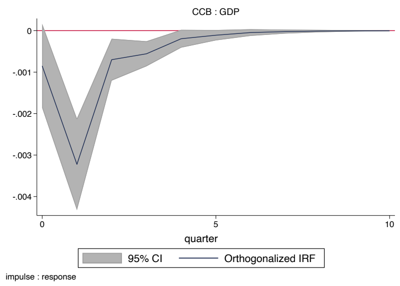


(a) Parsimonious (b) Comprehensive

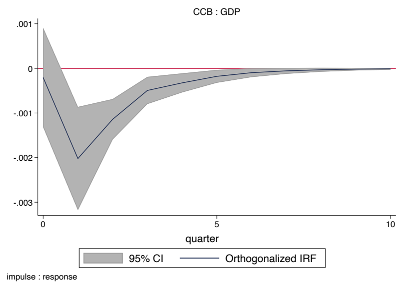
Figure A.16: Orthogonalized impulse response functions for synthetic dollar interest rate on output where the synthetic dollar rate (r_{synth}) replaces dollar liquidity CCB, full sample (2000Q1–2020Q4). The positive responses in output growth followed by innovations in synthetic dollar rate for both parsimonious and comprehensive models confirm that easier access to dollar liquidity does contribute to output slowdown since dollar scarcity promotes growth.

A.5.3 Exclusion of the pandemic period

One objection some may have to including the COVID-19 pandemic period is that the unusual nature of the episode—where the shock emanated from a health, rather than financial, source, and further exacerbated by government policies—may affect our results. As another robustness check of the baseline, we therefore consider restricting the sample period to between 2000Q1 and 2019Q4, which excludes the COVID period. This is to rule out possible effects of government-imposed pandemic control measures on output. The estimation results for both the parsimonious and comprehensive models are shown in Figure A.17, and reveal that output continues to contract when there is an positive impulse on dollar liquidity, consistent with the baseline finding.



(a) Parsimonious

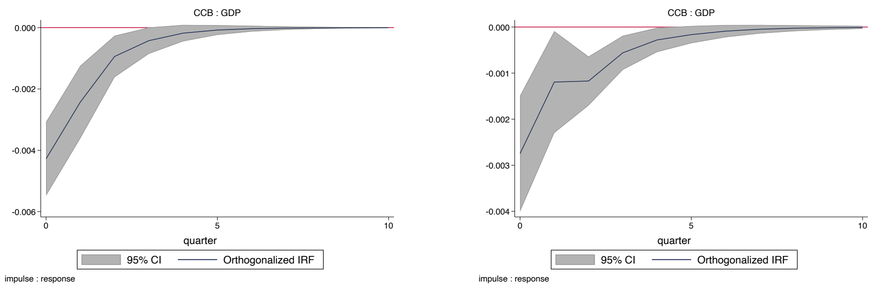


(b) Comprehensive

Figure A.17: Orthogonalized impulse response functions for dollar liquidity on output excluding the COVID (2000Q1–2019Q4). The negative responses in output growth followed by innovations in dollar liquidity for both parsimonious and comprehensive models confirm that easier access to dollar liquidity does contribute to output slowdown.

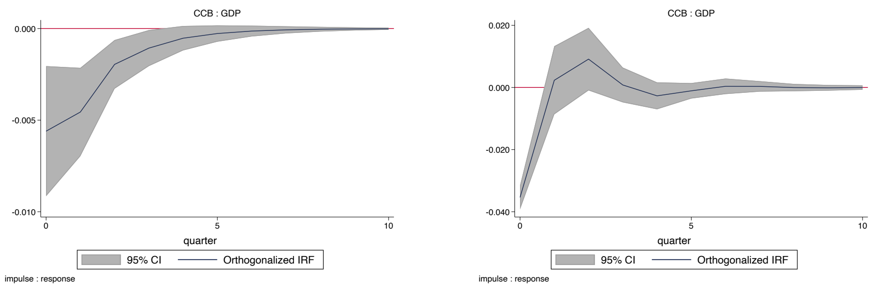
A.5.4 Alternative computations for CLP

The Chilean *peso* (CLP) exhibits an idiosyncrasy in terms of how interest and exchange rates are reported: calculations of the CCB (for example, those reported by Bloomberg) typically rely on interbank interest rates corresponding to an artificial unit of account (the Unidad de Fomento, or UF[62]). To relieve concerns that a different measure of CCB for this particular currency would affect our results, we rerun our baseline estimations by dropping the CLP for both the full and EMs samples. These IRFs are reported in Figures A.18 and A.19, respectively.



(a) Parsimonious (b) Comprehensive

Figure A.18: Orthogonalized impulse response functions for dollar liquidity on output by dropping the CLP, full period(2000Q1–2020Q4). The negative responses in output growth followed by innovations in dollar liquidity for both parsimonious and comprehensive models confirm that easier access to dollar liquidity does contribute to output slowdown.



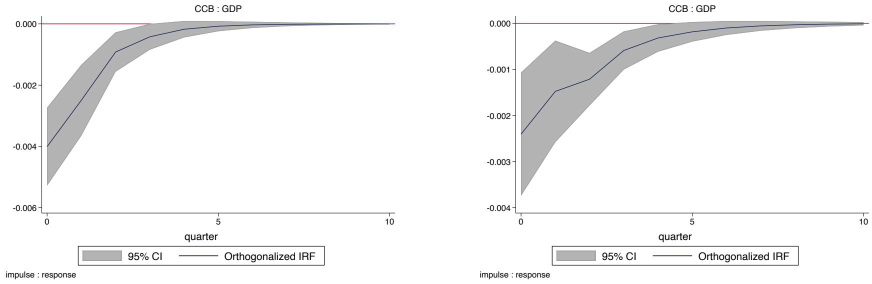
(a) Parsimonious (b) Comprehensive

Figure A.19: Orthogonalized impulse response functions for dollar liquidity on output by dropping the CLP for the emerging markets, during the crisis-cum-post-crisis (2000Q1–2020Q4) period. The negative responses in output growth followed by innovations in dollar liquidity for both parsimonious and comprehensive models confirm that easier access to dollar liquidity does contribute to output slowdown.

Alternatively, to remain consistent with the computation of CCB for the other currencies—which rely on nominal, market-based rates—we instead collect nominal interbank rates of the CLP from the Chilean benchmark facility, and calculate an alternative cross-currency basis for CLP against USD, which we then replace the original CCB series with before rerunning our estimations. We report the results for both the full and the EM sample in Figures A.20 and A.21, respectively.

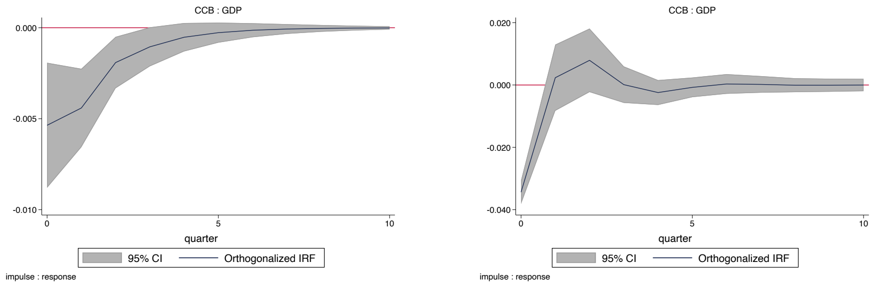
Overall, these exercises find qualitatively (and almost quantitatively) consistent results to the baseline, reassuring any concern that a different measure of CCB for CLP may have inad-

[62]The UF is an officially-recognized currency in Chile. However, it is non-circulating, and has a quoted value of 100 CLP relative to the CPI. That is, the UF interest rate is a *real* interest rate, which adjusts for inflation.



(a) Parsimonious (b) Comprehensive

Figure A.20: Orthogonalized impulse response functions for dollar liquidity on output by dropping the CLP, full period(2000Q1–2020Q4). The negative responses in output growth followed by innovations in dollar liquidity for both parsimonious and comprehensive models confirm that easier access to dollar liquidity does contribute to output slowdown.



(a) Parsimonious (b) Comprehensive

Figure A.21: Orthogonalized impulse response functions for dollar liquidity on output by dropping the CLP for the emerging markets, during the crisis-cum-post-crisis (2000Q1–2020Q4) period. The negative responses in output growth followed by innovations in dollar liquidity for both parsimonious and comprehensive models confirm that easier access to dollar liquidity does contribute to output slowdown.

vertently given rise to biased results.

A.6 Variance decompositions

This section collates the full various decompositions for the different specifications. We report the variance decomposition results for the EMs (Table A.9) and AEs (Table A.10). Interestingly, the impulse in dollar liquidity far better explains the variations in output growth than domestic money stock in the EMs, which is actually not the case in the AEs. This corresponds to the finding of Rey (2013) that monetary policy in the center country (and hence dollar access) has become far more important than domestic monetary policy (which alters the local money supply), especially for the EMs. Table A.11 reports the variance decomposition result in the modified comprehensive model where the money stock is replaced by the lending rate for the EMs, and it provides consistent finding albeit with a smaller magnitude. In addition, we also report the variance decomposition results for the modified comprehensive specifications where CPI and money stock are replaced by PPI and lending rate (Table A.12), and nominal exchange rate is further replaced by REER when keeping PPI and lending rate (Table A.13) for the full sample with both EMs and AEs from 2000Q1 to 2020Q4, as we did in our baseline. These results also echo the baseline finding that dollar liquidity explains higher percentages of variations in output than domestic liquidity does despite the smaller magnitude.

Table A.9: Variance decomposition for the EMs group PVAR , parsimonious and comprehensive model, crisis-cum-post-crisis (2007Q4–2020Q4) period (unbalanced)

Response of			*Response to*				
	Parsimonious		**Comprehensive**				
	CCB_t	GDP_t	CCB_t	GDP_t	CPI_t	$M2_t$	ER_t
GDP_{t+10}	0.0152	0.9848	0.1914	0.7080	0.0898	0.0106	0.0002
CCB_{t+10}	0.8350	0.1650	0.5852	0.2661	0.0684	0.0595	0.0208
CPI_{t+10}			0.3732	0.3143	0.2770	0.0233	0.0122
$M2_{t+10}$			0.3064	0.2277	0.0363	0.3822	0.0474
ER_{t+10}			0.0421	0.0090	0.0482	0.0152	0.8855

Share of forecast error variance for predicted variables 10 periods ahead in each row are explained by the variables in each column. The result indicates that the impulse in dollar liquidity (19.14 percentage points) better explains the variations in output growth than domestic money stock (1.06 percentage points). This is also in line with what we have found in the baseline analysis.

Table A.10: Variance decomposition for the AEs group PVAR , parsimonious and comprehensive model, crisis-cum-post-crisis (2007Q4–2020Q4) period (unbalanced)

Response of			*Response to*				
	Parsimonious		**Comprehensive**				
	CCB_t	GDP_t	CCB_t	GDP_t	CPI_t	$M2_t$	ER_t
GDP_{t+10}	0.0112	0.9888	0.0167	0.9004	0.0557	0.0245	0.0027
CCB_{t+10}	0.9937	0.0063	0.8142	0.0375	0.0073	0.0272	0.1138
CPI_{t+10}			0.0148	0.0199	0.8950	0.0511	0.0192
$M2_{t+10}$			0.0117	0.0358	0.3390	0.5430	0.0105
ER_{t+10}			0.0597	0.1538	0.1338	0.0739	0.5788

Share of forecast error variance for predicted variables 10 periods ahead in each row are explained by the variables in each column. The most interesting result is that the impulse in dollar liquidity explains comparative variations in output growth to the domestic money stock, contrasts with the finding in EMs.

Table A.11: Variance decomposition for the EMs group PVAR with lending rate (LR) replacing M2, parsimonious and comprehensive model, 2007Q4–2020Q4 (unbalanced)

Response of	*Response to*						
	Parsimonious		**Comprehensive**				
	CCB_t	GDP_t	CCB_t	GDP_t	CPI_t	LR_t	ER_t
GDP_{t+10}	0.0152	0.9848	0.0375	0.8532	0.0798	0.0194	0.0101
CCB_{t+10}	0.8350	0.1650	0.4564	0.0388	0.0638	0.1908	0.2502
CPI_{t+10}			0.0739	0.2376	0.6436	0.0292	0.0157
LR_{t+10}			0.1749	0.0621	0.0857	0.4822	0.1951
ER_{t+10}			0.0717	0.0084	0.0290	0.0502	0.8407

Share of forecast error variance for predicted variables 10 periods ahead in each row are explained by the variables in each column. The result indicates that the impulse in dollar liquidity (3.75 percentage points) better explains the variations in output growth than domestic lending rate (1.94 percentage points) in spite of the small magnitude of both. This is also in line with what we have found in the baseline analysis.

Table A.12: Variance decomposition for the full sample with PPI and LR, comprehensive model, 2000Q1 - 2020Q4 (unbalanced)

	CCB_t	GDP_t	PPI_t	LR_t	ER_t
GDP_{t+10}	0.0049	0.9564	0.0123	0.0007	0.0257
CCB_{t+10}	0.6563	0.0138	0.0335	0.2617	0.0347
PPI_{t+10}	0.0460	0.1306	0.7625	0.0035	0.0574
LR_{t+10}	0.0437	0.0271	0.0216	0.8878	0.0198
ER_{t+10}	0.0044	0.0270	0.0031	0.0232	0.9422

Share of forecast error variance for predicted variables 10 periods ahead in each row are explained by the variables in each column. The dollar liquidity explains (0.49 percentage of) the variations in output more than the lending rate (at 0.07 percentage point), although both are at smaller magnitude.

Table A.13: Variance decomposition for the full sample with PPI, LR and REER, comprehensive model, 2000Q1 - 2020Q4 (unbalanced)

	CCB_t	GDP_t	PPI_t	LR_t	$REER_t$
GDP_{t+10}	0.0052	0.9796	0.0093	0.0002	0.0057
CCB_{t+10}	0.9495	0.0039	0.0033	0.0099	0.0334
PPI_{t+10}	0.0635	0.0289	0.8604	0.0400	0.0072
LR_{t+10}	0.0174	0.0367	0.0801	0.8609	0.0049
$REER_{t+10}$	0.0072	0.0215	0.0185	0.0456	0.9072

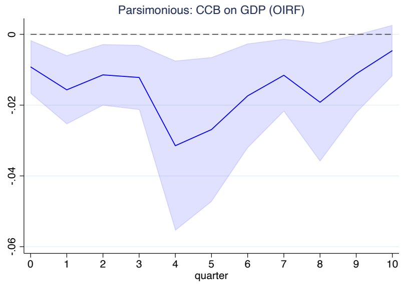
Share of forecast error variance for predicted variables 10 periods ahead in each row are explained by the variables in each column. The dollar liquidity explains (0.52 percentage of) the variations in output more than the lending rate (at 0.02 percentage point), although both are at smaller magnitude.

A.7 Additional results for local projections

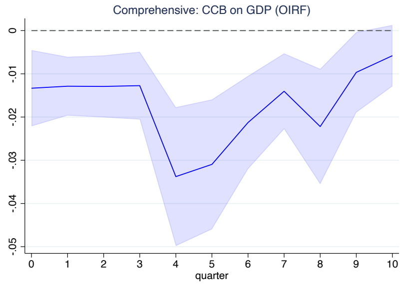
This section reports further results related to local projections: orthogonalized IRFs, and first-stage regression results for the IV variants.

A.7.1 Orthogonalized IRFs for local projections

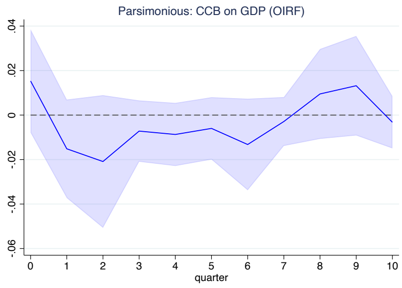
In the paper, we presented cumulative IRFs for the robustness check using instrumented local projections. Here, we report the orthogonalized equivalents, with the set of instruments including both (lagged) domestic monetary policy shocks and the synthetic rate, for both the parsimonious and comprehensive models (Figure A.22).



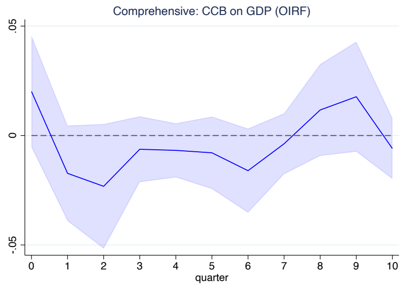
(a) Synthetic rate only, parsimonious model



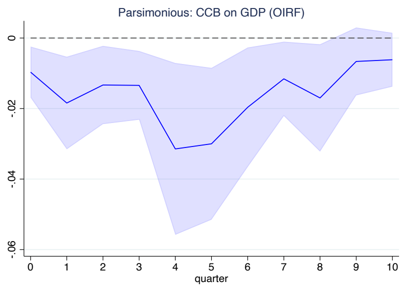
(b) Synthetic rate only, comprehensive model



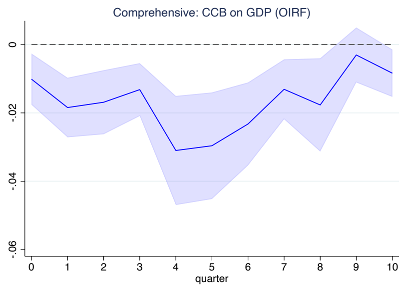
(c) Domestic shocks only, parsimonious model



(d) Domestic shocks only, comprehensive model



(e) Synthetic rate and domestic shocks, parsimonious model

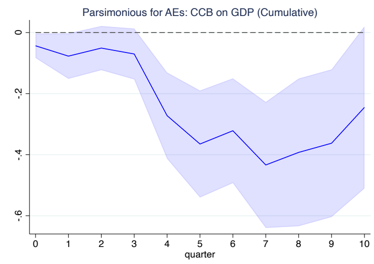


(f) Synthetic rate and domestic shocks, comprehensive model

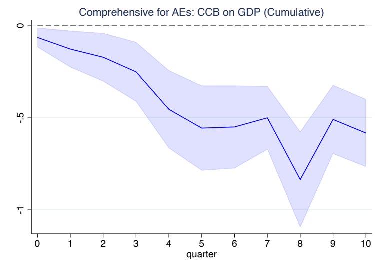
Figure A.22: Orthogonalized impulse response functions for CCB on GDP estimated via local projections, full sample (2000Q1–2020Q4). Local projections for the parsimonious (left column) and comprehensive (right column) models are estimated via GMM, with standard errors clustered at the country level, and instrumented with 1 quarter lag of the variables listed in the subcaptions. For a one standard-deviation innovation, the evolution 10 quarters after the shock is reported. The light blue areas indicate the 90 percent confidence intervals. While more volatile, the initial negative effect of dollar liquidity on growth tends to be sufficiently large that on impact and in the subsequent few quarters (especially when the instrument set includes the lagged synthetic rate), resulting in the cumulative negative effect as reported in the main text.

A.7.2 Cumulative IRFs for local projections by AE and EM

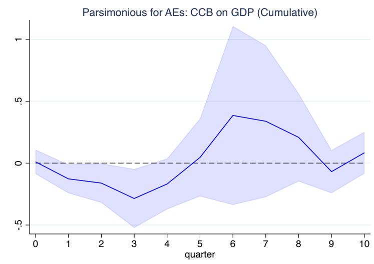
In the paper, we presented cumulative IRFs for the instrumented local projections using the full sample of currencies. As indicated, the results remain qualitatively unchanged for either AE (Figure A.23) or EM (Figure A.24) subsamples. This is the case for the set of instruments including either or both the domestic monetary policy shock and synthetic rate, for both the parsimonious and comprehensive models, although there is some variation in the instrument lags (these are documented in the figure caption), to ensure that the test statistics for instrument validity are satisfied as much as possible.



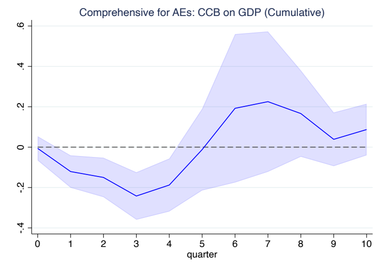
(a) Synthetic rate only, parsimonious model for AEs



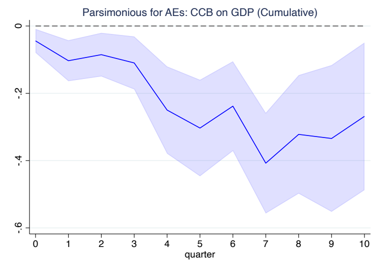
(b) Synthetic only, comprehensive model for AEs



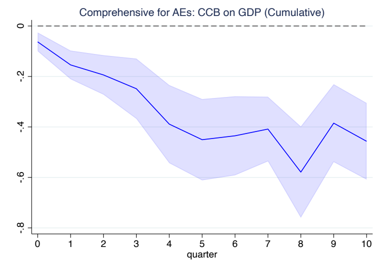
(c) Domestic shocks only, parsimonious model for AEs



(d) Domestic shocks only, comprehensive model for AEs

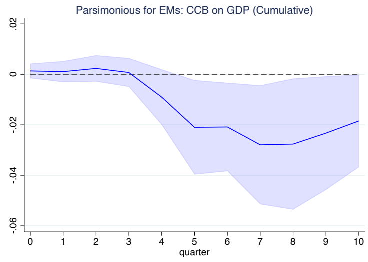


(e) Domestic shocks and synthetic rate, parsimonious model for AEs

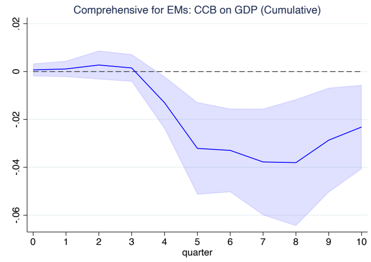


(f) Domestic shocks and synthetic rate, comprehensive model for AEs

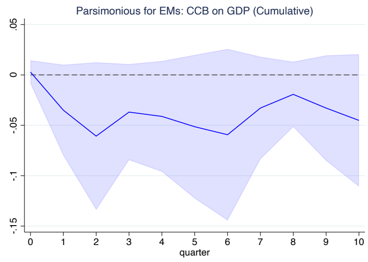
Figure A.23: Orthogonalized impulse response functions for CCB on GDP estimated via local projections for the AEs, crisis-cum-post-crisis period (2007Q4–2020Q4). Local projections for the parsimonious (left column) and comprehensive (right column) models are estimated via GMM with standard errors clustered at the country level, and instrumented with 1 through 2 quarter lags of synthetic rate and 4 quarter lag of domestic liquidity shocks in specifications as listed in the subcaptions. For a one standard-deviation innovation, the evolution 10 quarters after the shock is reported. The basis is measured in percentage points in the estimation. The light blue areas indicate the 90 percent confidence intervals. While more volatile than the uninstrumented PVARs, the cumulative effect of dollar liquidity on growth remains negative on impact in AEs (especially when the instrument set includes the lagged synthetic rate), attaining its long-run effect after 4 quarters, and is significant up to 10 quarters.



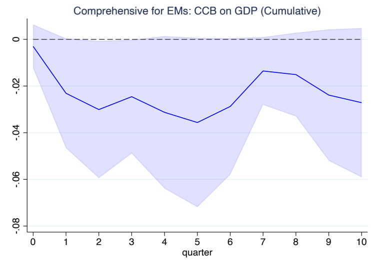
(a) Synthetic rate only, parsimonious model for EMs



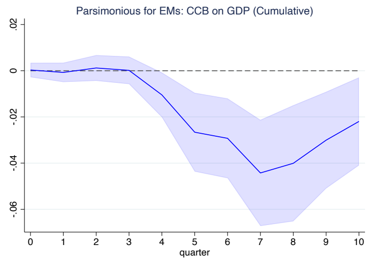
(b) Synthetic only, comprehensive model in EMs



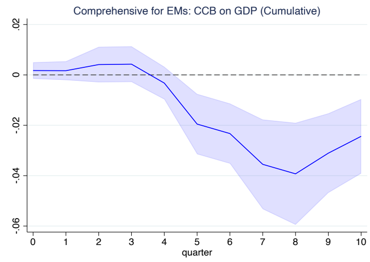
(c) Domestic shocks only, parsimonious model for EMs



(d) Domestic shocks only, comprehensive model for EMs



(e) Domestic shocks and synthetic rate, parsimonious model for EMs



(f) Domestic shocks and synthetic rate, comprehensive model for EMs

Figure A.24: Orthogonalized impulse response functions for CCB on GDP estimated via local projections for the EMs, crisis-cum-post-crisis period (2007Q4–2020Q4). Local projections for the parsimonious (left column) and comprehensive (right column) models are estimated via GMM with standard errors clustered at the country level, and instrumented with 1 through 2 quarter lags of synthetic rate and 3 through 4 quarter lags of domestic liquidity shocks in specifications as listed in the subcaptions . For a one standard-deviation innovation, the evolution 10 quarters after the shock is reported. The basis is measured in percentage points in the estimation. The light blue areas indicate the 90 percent confidence intervals. While more volatile than the uninstrumented PVARs, the negative cumulative effect of dollar liquidity on growth becomes significant after 4 quarters in EMs (especially when the instrument set includes the lagged synthetic rate), attaining its long-run effect thereafter despite the insignificant effect on impact.

A.7.3 First stage regressions for IV local projections

This section reports the first stage of instrumental variable regressions used to obtain the local projections in Section 6.3. These correspond to the top (columns 1 and 4), middle (columns 2 and 5), and bottom (columns 3 and 6) of Figure 21 of the main text, respectively, where the instruments included only the (one period lagged) synthetic interest rate ($r_{synth,t-1}$), unexpected monetary policy shocks (MPS_{t-1}), and both (via an overidentified 2SLS regression).

The results, which correspond to estimates with one lag each, yield statistically significant coefficients, which also exhibit signs in the expected directions (negative for the synthetic rate, such that increases in the synthetic rate encourage substitution into domestic local-currency assets,[63] and positive for the monetary policy shock, consistent with how a positive shock improves dollar liquidity). Diagnostic tests for the quality of instruments, while imperfect (the underindentification tests suggest that relevance is not guaranteed for the parsimonious model, and the weak instrument test suggests that specifications with only the synthetic rate alone may suffer from a weak instrument problem). Still, the overall thrust of the first stage results, especially for the fullest specification in the comprehensive model, appears to be sound.

Other specifications, with differing lag structures (we considered up to 4 lags), yield IRFs that a qualitatively similar. These are available on request.

Table A.14: First stage relationship between CCB and its instruments[†]

	Parsimonious			**Comprehensive**[‡]		
	(1)	(2)	(3)	(4)	(5)	(6)
	MPS only	r_{synth} only	Both instr.	MPS only	r_{synth} only	Both instr.
$r_{synth,t-1}$	-0.37***		-0.29***	-0.23***		-0.24***
	(0.08)		(0.08)	(0.06)		(0.06)
MPS_{t-1}		0.31**	0.34***		0.38***	0.37***
		(0.15)	(0.10)		(0.14)	(0.11)
Observations	3,592	3,283	3,266	3,495	3,205	3,189
Estimation	IV	IV	2SLS	IV	IV	2SLS
Cragg-Donald F	841.29	1.84	146.50	360.60	5.31	177.43
Kleibergen-Paap $rk\ LM$	1.76	2.25	4.60	3.99**	3.54*	5.27*
p-value	0.184	0.133	0.100	0.046	0.060	0.072
Hansen J			0.03			0.16
p-value			0.855			0.691

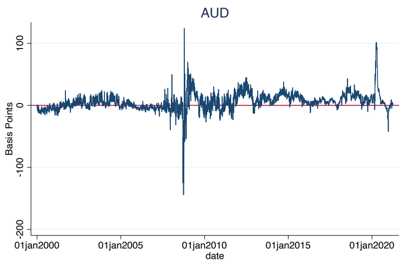
[†] This table reports the first-stage results for local projections performed with instrumental variables. Test statistics for instrument quality are the Cragg-Donald Wald F statistic, Kleibergen-Paap $rk\ LM$ statistic, and Hansen J statistic, corresponding to tests for weak identification, underidentification, and overidentification (where relevant), respectively. Statistical significance: $^{*}\ p < 0.1$, $^{**}\ p < 0.05$, $^{***}\ p < 0.01$.

[‡] The comprehensive model includes the contemporaneous CPI, M2, and ER as controls.

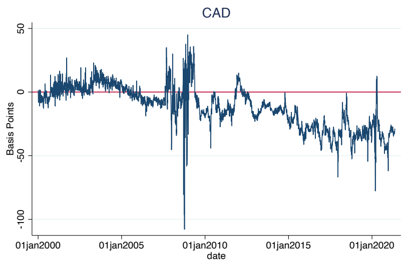
[63] This also aligns with the correlation between CCB and r_{synth}, as reported in the main text.

A.8 Plots for cross-currency basis by currency

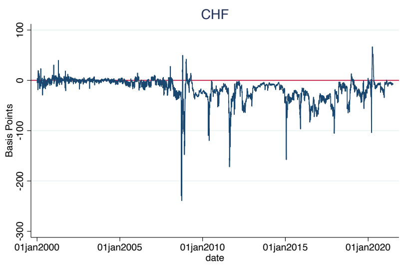
In this section, we plot the CCBs for each currency in our sample, at the three-month tenor. The CCBs for G10 and non-G10 currencies are shown in Figures A.25 and A.26, respectively.



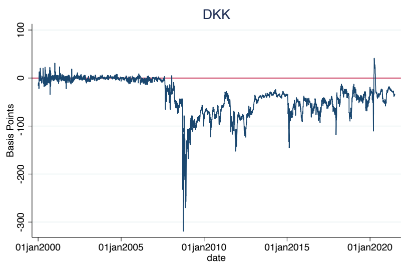
(a) Australian Dollar



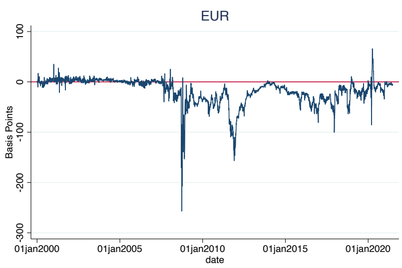
(b) Canadian Dollar



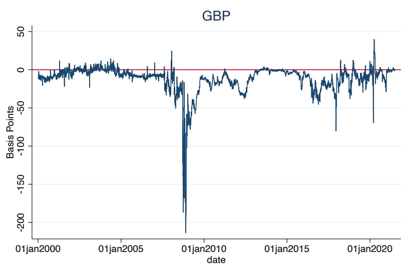
(c) Swiss Franc



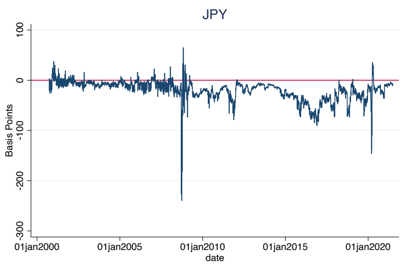
(d) Danish Krone



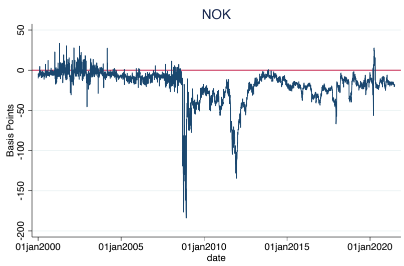
(e) Euro



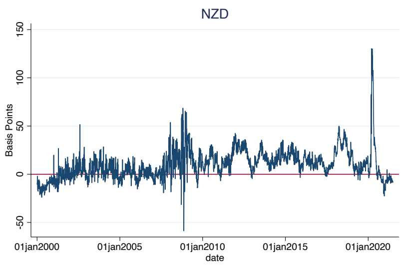
(f) British Pound



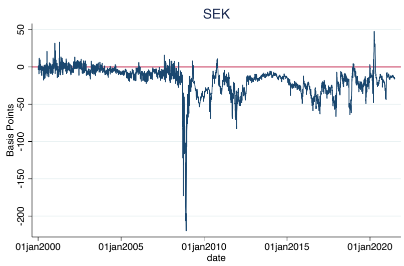
(g) Japanese Yen



(h) Norwegian Krone

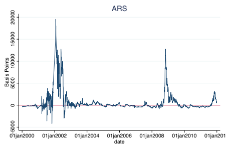


(i) New Zealand Dollar

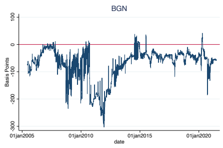


(j) Swedish Krona

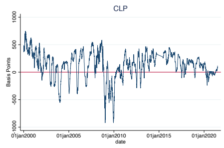
Figure A.25: Cross-currency basis of the currency listed in the subcaptions against the U.S. dollar for the G10 currencies. The bases were close to zero before enlarging since the GFC, when negative bases were witnessed for most currencies except NZD and AUD.



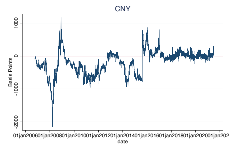
(a) Argentine Peso



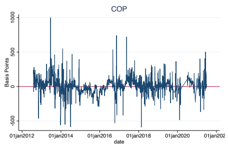
(b) Bulgarian Lev



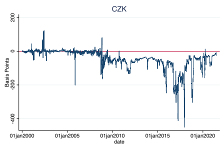
(c) Chilean Peso



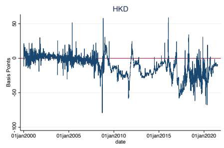
(d) Chinese Yuan



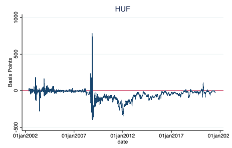
(e) Colombian Peso



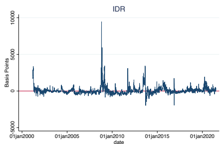
(f) Czech Koruna



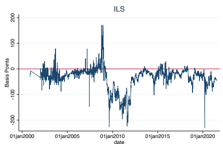
(g) Hong Kong Dollar



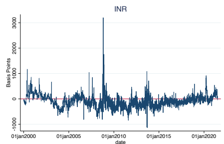
(h) Hungarian Forint



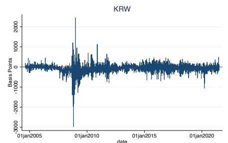
(i) Indonesian Rupiah



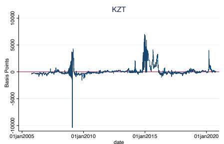
(j) Israeli New Shekel



(k) Indian Rupee

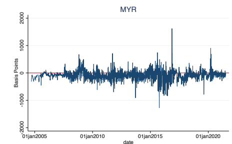


(l) South Korea Won

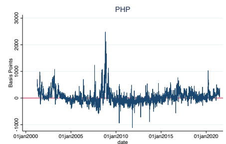


(m) Kazakhstani Tenge

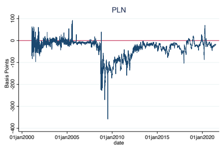
(n) Mexican Peso



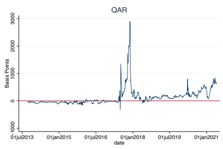
(o) Malaysian Ringgit



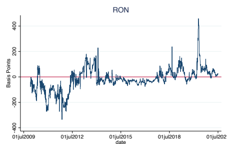
(p) Philippnine Peso



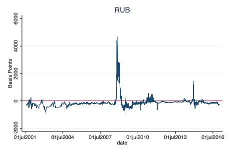
(q) Polish Zloty



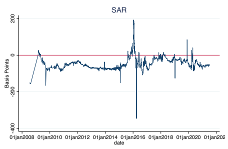
(r) Qatari Riyal



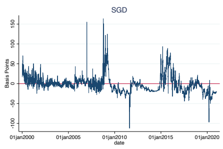
(s) Romanian Leu



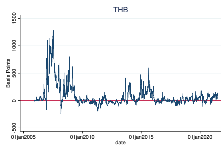
(t) Russian Ruble



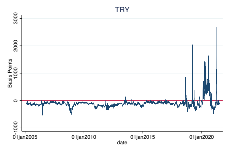
(u) Saudi Riyal



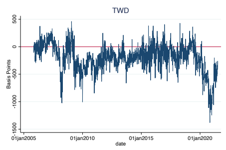
(v) Singapore Dollar



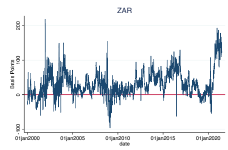
(w) Thai Bhat



(x) Turkish Lira



(y) New Taiwan Dollar



(z) South African Rand

Figure A.26: Cross-currency basis of the currency listed in the subcaptions against the U.S. dollar for the non-G10 currencies. These bases are generally larger in magnitude compared to the G10 ones and might not be close to zero even before the GFC.