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GLOBAL TRANSMISSION OF FED HIKES:
THE ROLE OF POLICY CREDIBILITY AND BALANCE SHEETS

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ABSTRACT

Contrary to historical episodes, the 2022–2023 tightening of US monetary policy has not yet triggered financial crisis in emerging markets. Why is this time different? To answer this question, we analyze the current situation through the lens of historical evidence. In emerging markets, the financial channel–based transmission of US policy historically led to more adverse outcomes compared to advanced economies, where the trade channel fails to smooth out these negative effects. When the Federal Reserve increases interest rates, global investors tend to shed risky assets in response to the tightening global financial conditions, affecting emerging markets more severely due to their lower credit ratings and higher risk profiles. This time around, the escape from emerging market assets and the increase in risk spreads have been limited. We document that the historical experience of higher risk spreads and capital outflows can be largely explained by the lack of credible monetary policies and dollar-denominated debt. The improvement in monetary policy frameworks combined with reduced levels of dollar-denominated debt have helped emerging markets weather the recent Federal Reserve hikes.

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Contrary to many analysts' expectations, emerging markets have not spiraled into a debt crisis. This can be partly attributed to central banks' decision to reject populist policy proposals in favor of a modern iteration of macroeconomic orthodoxy—Ken Rogoff (2023).

1 Introduction

In stark contrast to the 1980s and 1990s, emerging markets have demonstrated resilience in the face of monetary policy tightening in advanced economies, notably the United States, during the post-COVID-19 era. Historically, sharp increases in policy rates in the United States have led to falling currencies elsewhere combined with capital outflows—the so-called sudden stops—which often resulted in widespread financial stress and crises in emerging markets and developing economies. The 1982–1983 debt crisis in Latin America, following the Federal Reserve hikes during disinflation under Paul Volcker, remains the classic example, but there are also other instances such as the 1994 tightening of US monetary policy paving the way to Asian crisis and the infamous taper tantrum of 2013. However, the recent tightening cycle has unfolded differently. This time, the majority of emerging markets have effectively navigated the most significant tightening in the United States in several decades without much damage to their economies.

What explains this newfound resilience to the US monetary policy shocks? We argue that the resilience of emerging markets comes largely from their improved monetary policy credibility, combined with a reduction in dollar borrowing. Monetary policy credibility and debt denominated in foreign currencies (FX), mostly dollars, are domestic vulnerabilities that are often linked. Weak private and public sector balance sheets due to the dollar debt and local currency assets can force central banks to defend the currency to avoid local currency depreciations, which would otherwise increase the debt burden and defaults.[1] An inflation-targeting central bank can lose its credibility by responding to exchange rate fluctuations through policy rates without a clear framework, since such behavior could entail a deviation from the "do what you say, say what you do" rule that captures the essence of monetary policy credibility. [2] Our new credibility index quantifies these types of deviations within an existing framework, where most of the frameworks are centered on inflation targeting. Thus, credibility is measured through transparency, coherency, and consistency among policy tools and objectives.

While the benefits of central bank independence and inflation-targeting frameworks have been extensively highlighted in the literature using cross-country data, it is rare to quantify the improvements in policy credibility for a given country over time. We use a brand-new data set based on a narrative approach from Unsal, Papageorgiou and Garbers (2022) to quantify the monetary policy frameworks, and hence the credibility improvements in countries over time that are exogenous to both the US monetary policy shocks and other domestic policy changes within countries. This data set is hand-collected from thousands of central bank legal documents from fifty countries over 2007–2021, to characterize the monetary policy making across three pillars of independence and accountability: policy, operational strategy, and communications. Even though the changes in domestic monetary policy rate could be endogenous to US monetary policy and other policy and institutional changes in the country, our measure is orthogonal to such changes since it is designed to capture policy design and

[1]Since most of the foreign currency debt in emerging markets and developing economies is in US dollars, reducing the extent of foreign currency debt means they borrow less in dollars relative to the 1980s and 1990s (McCauley, McGuire and Sushko (2015))

[2]There could be reasons to intervene in the exchange rate market. Our point is that, if not done correctly with a clear framework, monetary policy credibility could be jeopardized. An increasing number of emerging markets have moved toward approaches where multiple tools are employed in pursuit of multiple objectives related to financial stability, exchange rate stability, and capital flow management. See Basu et al. (2020) on how an "integrated" approach helps provide macroeconomic and financial stability in the face of risk-off shocks.

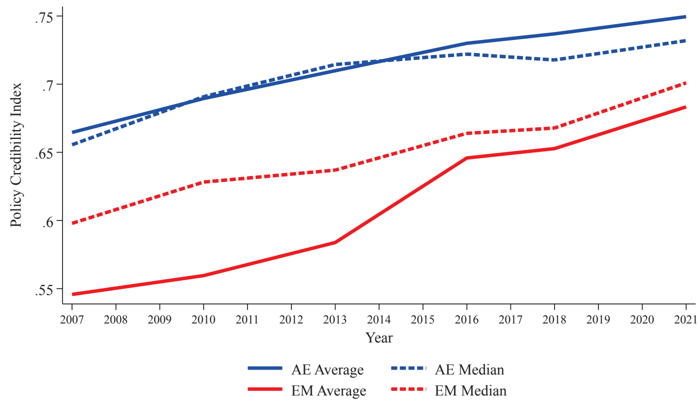
implementation features that enable and guide the conduct of monetary policy, rather than specific endogenous monetary policy actions at any point in time.[3]

Empirical literature on the central bank independence focuses on the political independence by constructing cross-country measures and relating them to inflation and inflation expectations.[4] The theoretical underpinning of this idea that delegating monetary policy to an independent body mitigates the inflationary bias comes from Rogoff (1985). Separately, there is a strand of literature starting with the work of Sargent and Wallace (1981) that studies structural models of monetary-fiscal interactions. In this line of work, fiscal dominance is interpreted as low monetary policy credibility since politicians can get central banks to finance deficits through inflation. However, there remains a gap in both theoretical and empirical literature regarding how improvements in monetary policy credibility affect emerging markets over time, especially when they face external shocks with considerable impact on their exchange rates, such as the changes in US monetary policy.

[3]The policy credibility index goes far beyond classifying countries' monetary or exchange rate regimes. For example, in addition to checking whether a country has a numerical target (on inflation) or not, the assessment metric considers whether the numerical target is a viable nominal anchor by encapsulating various key elements such as how the target is set and by who, the time horizon, and whether objectives and the numerical target in communications are consistent with the ones in policy and operational strategy. See the table in appendix A1 for an illustration of how transparency, coherence, and consistency principles underpin our credibility metric, using the criteria on the numerical targets of monetary policy as an example.

[4]See, for example, Alesina and Summers (1993), Dincer and Eichengreen (2014)

Figure 1: Policy Credibility over Time



Notes: Our measure of policy credibility is the monetary policy frameworks index (IAPOC, Unsal, Papageorgiou and Garbers (2022)). The graph shows the average and median policy credibility in advanced economies (AEs) and emerging markets (EMs) from 2007–2021.

The new credibility index is plotted in figure 1. The index is between zero and one, where a value of one indicates perfect credibility. It reveals that the monetary policy credibility substantially improved in emerging markets, for both the average and median countries. In contrast, advanced countries, which already had high monetary policy credibility in 2007, showed only minimal improvement over time.

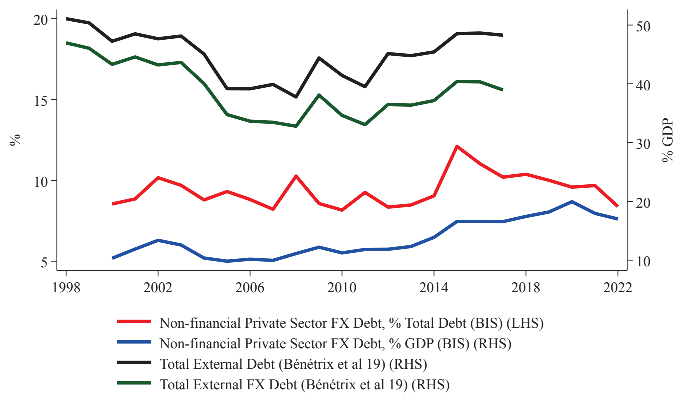
This advancement in credibility among emerging markets is paralleled by a decrease in dollar-denominated debt. Figure 2 plots the ratio of total external debt to gross domestic product (GDP) and the ratio of total external debt in FX to GDP. These series show some decline at first, from around 50 percent to 38 percent of GDP between 1998 and 2008, but both increased afterward during the quantitative easing in advanced economies following the global financial crisis that drove capital flows to emerging markets. As explained above, historically, what triggered central banks in emerging markets to defend their currencies in the face of Fed hikes was the FX debt related vulnerabilities in their non-financial private sectors. Hence, we also plot in figure 2 the FX debt of the non-financial private sector (household and corporate) both as a percentage of GDP and as a percentage of total debt. Unfortunately, the time series for these data is only available after 2000. What is remarkable is that the non-financial sector FX debt is below 20 percent of GDP and around 10 percent of total debt. This is a huge reduction given the historical values before the 2000s as shown in the table. There are some countries such as Turkey and Argentina, where the shares of corporate sector FX debt are still similar to the historical values, hovering around 50 percent of GDP or total debt (Di Giovanni, Kalemli-Özcan, Ulu and Baskaya (2022), Das, Kalemli-Özcan, Damien and Varela (2020)). But these countries would be outliers rather than the norm as of 2020. We do not analyze the FX debt of financial institutions since this debt is hedged by several regulatory restrictions. By now these ensure the FX mismatches on bank and financial intermediary balance sheets are fully hedged or minimal (IMF (2022)).

There is extensive literature on the international transmission of US monetary policy, starting with Diaz-Alejandro (1983), Calvo, Leiderman and Reinhart (1993), Calvo, Leiderman and Reinhart (1996) that emphasize the impact of interest rate differentials between a given country and the United States on the demand for government bonds.[5] Consistent with this early literature's focus on the interest rate differentials, more recent literature on the US monetary policy spillovers to other countries has shifted attention to the financial channel of US policy transmission—switching demand of assets between the United States and the rest of the world—from the trade channel—switching demand for goods produced in the United States to those produced in the rest of the world (e.g. Rey (2013); Kalemli-Özcan (2019); Degasperi, Hong and Ricco (2023); Chari, Dilts Stedman and Lundblad (2021); Di Giovanni and Rogers (2023)).

A prevailing finding in this body of research is the link between the changes in US monetary policy and the cross-border correlations of macro-financial conditions,

[5] See also Eichengreen and Portes (1987), Reinhart and Reinhart (2009) and Reinhart and Rogoff (2009)

Figure 2: Foreign Currency Debt in Emerging Markets



	FX debt/total debt 1995-2002, private sector
Argentina	0.61
Brazil	0.28
Chile	0.30
Colombia	0.25
Hungary	0.21
Mexico	0.60
Peru	0.50
Turkey	0.55

Notes: In the figure, credit in U.S. dollars to non financial private sector is estimated as the total credit in U.S. dollars minus international debt securities for government and financial institutions. We normalize by total debt and by annual GDP. This data is from BIS. Bénétrix et al. (2019) data is total external debt and total external FX debt as percent of GDP. We plot averages for the EMs and use a balanced panel in each series. The table shows data from Di Giovanni, Kalemli-Özcan, Ulu and Baskaya (2022), Salomao and Varela (2022), Kamil (2004), Kalemli-Özcan, Kamil and Villegas-Sanchez (2016), Aguiar (2005) and Kalemli-Özcan (2022) that are all based on confidential data of each central bank, as reported in these papers.

that is, the global financial cycle proxied by global-level risk indicators, like the CBOE Volatility Index (VIX), the broad US dollar index, and the US excess bond premium (e.g. Bekaert, Hoerova and Duca (2013), Rey (2013), Miranda-Agrippino and Rey (2020), Bruno and Shin (2015), and Obstfeld and Zhou (2023)). Hence, the underlying factors for the financial transmission channel of US monetary policy are changes in risk-taking incentives and the associated risk premia. Central to this discussion is the role of time-varying deviations from the uncovered interest parity (UIP)—the country-level risk premia priced by international investors—which has been identified as crucial in understanding the deteriorating macro conditions in emerging markets with risk-sensitive capital flows (Kalemli-Özcan (2019), Di Giovanni, Kalemli-Özcan, Ulu and Baskaya (2022)).[6] Based on this empirical literature, recent theoretical works focusing on optimal policies for emerging markets single-out the UIP wedge as the key factor to be stabilized to maximize welfare (Basu, Boz, Gopinath, Roch and Unsal (2020), Bianchi and Lorenzoni (2022), Itskhoki and Mukhin (2022)).

The financial channel is more pronounced in distinguishing the impact of US monetary policy tightening on advanced economies versus emerging markets. This is primarily due to global investors moving away from risky assets in response to tighter global financial conditions. Emerging markets, typically considered riskier investments in any portfolio, are particularly affected by this shift. This risk-based channel underscores the significance of domestic vulnerabilities in emerging markets. We argue that the literature on the international transmission of US monetary policy overlooked a key domestic vulnerability, that is, the role of monetary policy credibility, while focusing solely on the exchange rate or the monetary policy regime. The choice of the

[6]See also quantitative models, where exogenous UIP deviations take center stage, such as Dedola, Rivolta and Stracca (2017), Akinci and Queralto (2018), Gourinchas (2018) for contractionary effects of the U.S. monetary policy on real outcomes of other countries. Kalemli-Özcan and Varela (2021) investigates the empirical determinants of endogenous UIP deviations and Akinci, Kalemli-Özcan and Queralto (2021) model such deviations in a global general equilibrium framework.

exchange rate regime is endogenous to policy credibility: countries lacking monetary policy credibility often opt to peg their currency to the US dollar as an alternative nominal anchor. In addition, since the late 1990s, most emerging markets have moved away from pegged exchange rate regimes. Comparing countries with fixed versus floating regimes over time will identify the impact of US monetary policy on a select set of countries suffering from a time-varying selection bias.[7]

There are other variables that are likely to be endogenous to improved monetary policy credibility such as capital flows, UIP premia, inflation, exchange rates, and current accounts. We also investigate these outcomes, recognizing that many of them depend on the presence of dollar-denominated debt. Therefore, our analysis differentiates countries not only by their monetary policy credibility, but also by their levels of dollar-denominated debt, following Kalemli-Özcan (2019).

Our broad analysis covers fifty-nine countries using quarterly data from 1990:Q1 to 2019:Q4. We analyze the recent 2021–2023 period separately. We show that, historically, the worse effects of the Fed hikes such as declining GDP, depreciating exchange rates, higher risk spreads, and higher UIP premia combined with capital outflows, can be explained by lower monetary policy credibility and higher levels of FX debt in the corporate sector. [8] We show that the improvement in these two key domestic vulnerabilities has led to a minimal impact of the Fed hikes on emerging markets so far.

The paper is composed of six sections. Section 2 lays out the broader literature and shows descriptive evidence. Section 3 details the data. Section 4 undertakes the

[7]Dedola, Rivolta and Stracca (2017) point out that one reason why they do not find a strong role for exchange rate regimes in driving the international spillovers of US monetary policy shocks is that none of the countries in their sample has been in a peg all the time. Iacoviello and Navarro (2019) also find exchange rate regimes inconsequential when considering higher US interest rates on economic activity.

[8]Kalemli-Özcan (2019) shows similar results for the detrimental effects of US monetary policy and risk-off shocks in high FX debt countries.

empirical analysis that shows the heterogeneous effects of the U.S. monetary policy. Section 5 analyzes the recent post-pandemic inflation episode and the effects of FED hikes during this period. Section 6 concludes.

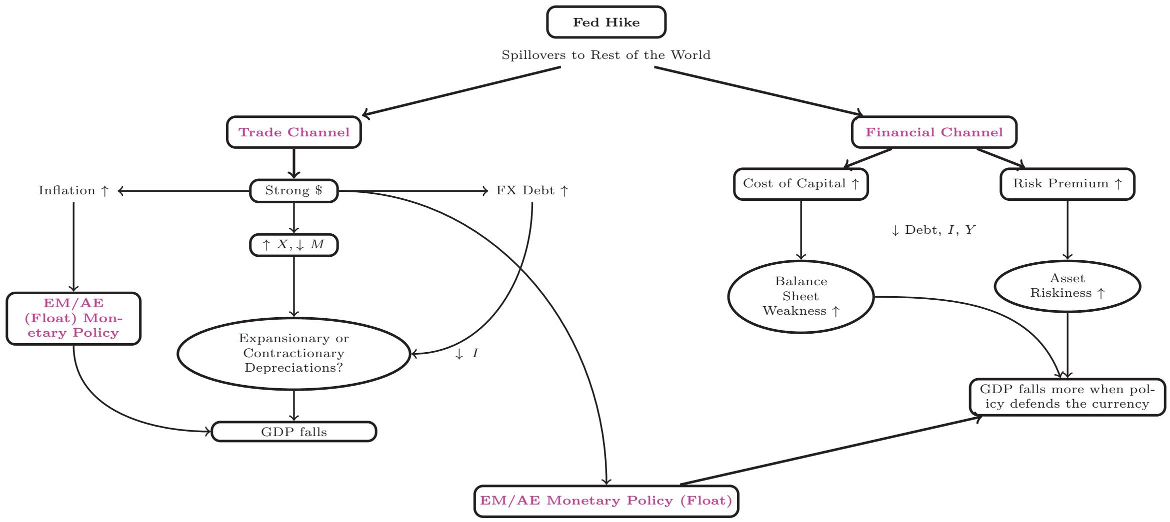
2 The Narrative within the Broader Literature

For the transmission of US monetary policy, trade and finance linkages represent two critical channels that have garnered significant attention among academics and policy-makers. Figure 3 illustrates these channels and the way the literature evolved in trying to understand these channels both theoretically and empirically.

In the traditional models and empirical work, the focus was on the currency depreciations of other countries vis-à-vis dollar appreciations, akin to the Mundell-Fleming model. A currency depreciation has the potential to stimulate net exports, creating an expansionary effect, but it can also trigger inflation through exchange rate pass-through (Burstein and Gopinath (2014), Forbes, Hjortsoe and Nenova (2018)), potentially requiring monetary tightening that might lead to a contraction. When the Federal Reserve hikes the federal funds rate and the US dollar appreciates, the demand for goods switches from the now expensive US goods to the goods from the rest of the world, which suffer from a local currency depreciation but can enjoy an increase in output thanks to higher net exports. Existing evidence on this issue goes against the notion of an expansionary effect when countries' currencies depreciate and capital flows out during Fed hikes.

Figure 3 shows this as the trade channel, depicted on the left side of the diagram. The failure to find an expansionary effect of currency depreciations has been justified by the models and evidence showing the dollar pricing of exports (Gopinath (2016)) or negative balance sheet effects due to currency mismatch involving unhedged dollar debt and local currency assets (Krugman (1999), Schneider and Tornell (2004), Aghion,

Figure 3: Fed Hike



Notes: Own elaboration

Bacchetta and Banerjee (2001), Cook (2004), Céspedes, Chang and Velasco (2004), Aguiar (2005), Kalemli-Özcan, Kamil and Villegas-Sanchez (2016)). Even though there is an increase in net exports as capital flows out on net, such expenditure switching fails to initiate an expansion in output, leading to a contraction in GDP (Mendoza and Yue (2012), Gopinath and Neiman (2014)) via lower investment. Consistently, Miranda-Agrippino and Rey (2020) and Obstfeld (2015) argue that the flexible exchange rates fail to fully absorb external shocks through expenditure switching. Hence, even though the trade channel is not responsible for the worse outcomes in emerging markets (falling output and capital outflows) resulting from Fed hikes, it is not smoothing out these effects either.[9]

[9]At the same time, countries with fixed exchange rate regimes are shown to be more sensitive to global risk shocks and a strong dollar due to higher US interest rates rather than flexible regimes, so flexible exchange rates must be doing some smoothing (Obstfeld and Zhou (2023)). Kalemli-Özcan (2019) shows that this smoothing is from risk-absorbing properties of the floating exchange rates. Since the exchange rate depreciates, vis-à-vis the US dollar, the risk premia, measured as the UIP premia, on emerging market assets do not have to go up as much, limiting capital outflows and contractionary effects. Similarly, Fukui, Nakamura and Steinsson (2023) show that exchange rate depreciations can be expansionary, not due to expenditure switching linked to higher net exports, but rather through

Currency mismatches in balance sheets have often pushed policymakers to defend the currency (Calvo and Reinhart (2002), Reinhart (2000), IMF (2022)) by mimicking the Fed hikes, which might intensify the contraction in their own economies. Kalemli-Özcan (2019) shows that countries that hike the policy rate to defend their currencies experience deeper recessions.

The financial channel is depicted on the right side of figure 3. The US interest rate increase not only results in higher safe rates globally, increasing the cost of capital, but also leads to higher risk premia toward inherently riskier assets such as emerging markets. As the balance sheets of US/global financial intermediaries weaken (Gertler and Kiyotaki (2010)) with the Fed hikes—recently witnessed during the banking stress of 2023 (Jiang, Matvos, Piskorski and Seru (2023))—they may not want to bear more risk by being exposed to emerging market assets, which are likely to depreciate. Thus, global investors want to dump risky assets, given higher risk aversion and a risk-off sentiment, inducing risk premia shocks for emerging markets combined with dollar appreciations.[10] As a result, asset riskiness and balance sheet weakness can go hand in hand in limiting international financial intermediation (Gabaix and Maggiori (2015)).

As discussed in the earlier literature starting with the work of Diaz-Alejandro (1983), capital flows are central to both channels in the context of Fed hikes. Any resiliency to these hikes has to come from the fact that, when the Federal Reserve hikes the interest rates, emerging markets do not experience sudden stops or capital outflows; and if they do, resilience means that the extent is much smaller such that it does not affect their domestic economies. During the 1980s and 1990s, the main form of borrowing by other countries involved their sovereigns issuing dollar bonds. As

the financial channel, when the country experiences a boom financed with capital inflows, implying a lower UIP premium.

[10]See models formalizing this financial channel endogenously, Jiang, Krishnamurthy and Lustig (2021), Bianchi, Bigio and Engel (2021), Akinci, Kalemli-Özcan and Queralto (2021), Devereux, Engel and Wu (2023). Gourinchas and Rey (2022) model this story as a rise in risk aversion and Kekre and Lenel (2021) as flight to safety.

shown by Alfaro, Kalemli-Özcan and Volosovych (2014), and Kalemli-Özcan (2019), since the early 2000s, there has been a compositional change from sovereign to private sector borrowing in emerging markets, while many developing economies still rely heavily on sovereign borrowing, which dominates their capital flows (Avdjiev, Hardy, Kalemli-Özcan and Servén (2022)). Also, the currency of borrowing has evolved, as shown by Du and Schreger (2016) and Hofmann, Patel and Wu (2022), such that the emerging market sovereigns are increasingly borrowing in local currency, whereas the private sector, especially the non-financial corporations, can still only access foreign funding in US dollars as they cannot issue bonds in local currency, unlike their governments.[11] Thus, the transmission mechanism of US monetary policy might also have changed, as private capital flows are generally more sensitive to the global risk aversion. Forbes and Warnock (2012) study the total gross flows as the sum of private sector and government borrowing, and show the increasing importance of global risk factors after the mid-1990s. Avdjiev, Hardy, Kalemli-Özcan and Servén (2022), Avdjiev, Du, Koch and Shin (2019) show that this risk sensitivity in gross flows is driven by private capital flows.

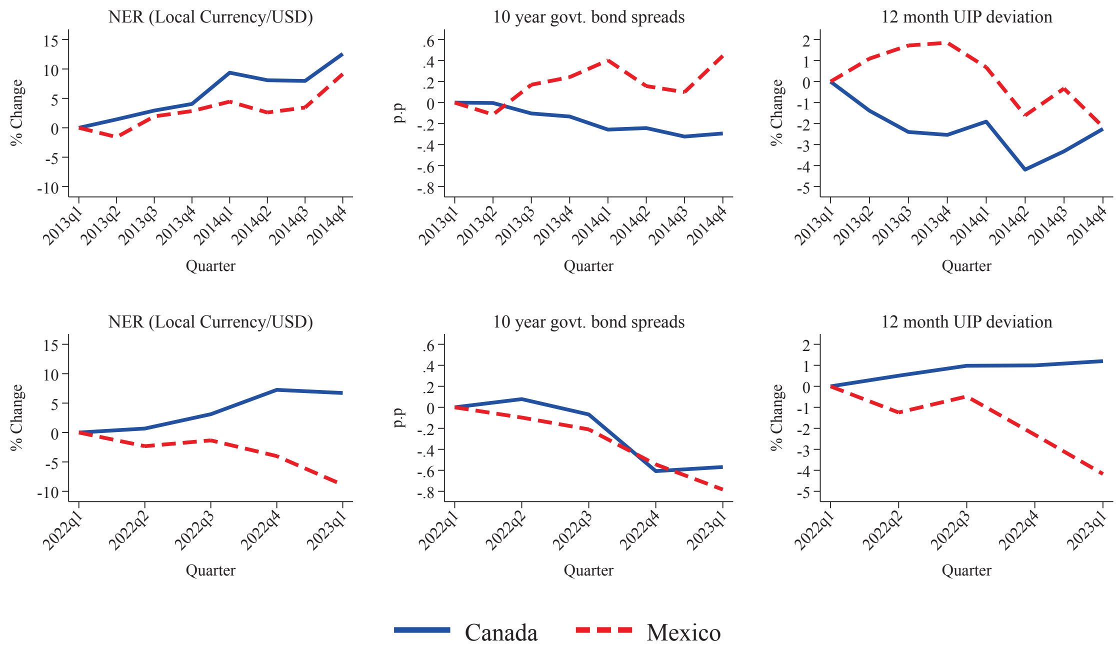
2.1 A Tale of Two Countries: Mexico and Canada

To illustrate, we use the two trading partners of the United States, Canada and Mexico, as case studies. These are both small open economies with important differences relevant to our analysis. From the perspective of the trade channel for US monetary policy transmission, the distinction between Mexico and Canada is less important; however, from the perspective of the financial channel, failing to distinguish between a small open economy and an emerging market/developing economy is detrimental.

[11]These changes may indicate the shift of “original sin” from sovereigns to corporations, a term referring to the inability to issue external debt in domestic currency, coined by coined by Eichengreen and Hausmann (1999), Eichengreen, Hausmann and Panizza (2005).

Figure 4 documents a specific US monetary policy tightening episode, known as the taper tantrum, in May 2013, during which the Federal Reserve signaled the end of quantitative easing and an anticipated earlier increase in interest rates. Mexico and Canada, both neighboring the United States under a trade agreement, should observe a similar impact through the trade channel given both of their currencies depreciate vis-à-vis the US dollar: the nominal exchange rate depreciations, shown for Mexico and Canada, are similar. However, the risk spreads show stark contrast. During this period, the long-term risk premium in Mexico experienced a sharp increase and remained elevated for a prolonged period, captured by the ten-year government bond spreads. The short-term risk premium also rose sharply, captured by the twelve-month UIP premium. Both spreads remained mainly flat for Canada, with a slight decrease in the UIP premium. Notice that the long-term government bond spreads can capture the dollar premium via default risk if issued in dollars, or the term premium if issued in local currency. The short-term UIP premium captures the local currency premium, that is, the excess currency returns due to currency risk. The UIP premium is measured in logs as follows: $(i_{mex/can} - i_{US}) - (\Delta E(s))$, where the interest rate differential term between Mexico/Canada and the United States uses the twelve-month government bond rates in local currency, and the second term is the expected change in the peso/dollar (or Canadian dollar to US dollar) exchange rate (s) in the next twelve months.

Figure 4: Canada and Mexico after FED Hikes: Taper Tantrum vs COVID



Notes: The top row of the figure shows the evolution of variables relative to pre-Taper Tantrum (2013q1). The bottom row of the figure shows the evolution of variables relative to the recent FED Hikes (2022q1). 10 year government bond spreads are calculated with respect to the U.S., and the plot shows the percentage point difference. 12 month UIP deviations are calculated as explained above and the plot shows the percentage change. Nominal exchange rate (NER) is defined as local currency per U.S. dollar, and the plot shows the percentage change.

The increase in the UIP premium for Mexico can be driven by three different channels: (1) an expected appreciation captured by a fall in the second term, $\Delta E(s)$, as currency depreciated on impact with the Federal Reserve's actions; (2) an increase in the interest rate differential above and beyond the movements in the expected exchange rate, driven by the possible response of the Mexican central bank hiking its own interest rates more than the Federal Reserve to defend the currency; or (3) a higher risk premium reflected in the interest rate differential demanded by global investors of risky Mexican assets. Kalemli-Özcan (2019), Kalemli-Özcan and Varela (2021), De Leo, Gopinath and Kalemli-Özcan (2022) show that it is the third channel that drives the higher UIP premium in emerging markets as a response to the US monetary policy shocks and risk-off shocks.[12]

As shown in figure 4, for 2022:Q1–2023:Q1, the recent experiences of Canada and Mexico are very different from the earlier episode. Now both countries behave in a similar way in terms of risk spreads. The Mexican exchange rate appreciated during the recent Fed hikes, implying an expected depreciation in the future. Hence, the UIP premium fell in Mexico more than in Canada, implying a lower risk premium for Mexico by global investors to hold on to the Mexican assets. The long-term risk spreads fell for both countries.[13]

2.2 A Tale of Won and Lost Credibility: The Case of Turkey

Next, we conduct a within-country analysis to understand the changes of monetary policy credibility over time and how this could relate to macroeconomic performance, with a specific focus on Turkey. Figures 5 and 6 plot the key macro variables together with inflation dynamics, risk spreads, and changes in our policy credibility measure. Turkey serves as an effective case study for understanding the exogeneity of our policy credibility measure and its time series changes being orthogonal to the domestic and US policy changes.

After the triple crises in 2001 (balance of payments, sovereign, and banking), Turkey successfully moved to a floating exchange rate regime within an inflation-targeting framework. This framework had been in place since 2002 and during the entire period we look at; however, the implementation of inflation targeting is what drives the time

[12] The UIP premium decline for Canada is explained by the fact that the interest rate differential term went down more than the expected appreciation since Canada did not change the policy rate at the time. Capital flows also showed different patterns: there were capital outflows from Mexico, whereas Canada received capital inflows (these results are available upon request).

[13] Note that with a slight depreciation and an expected appreciation of the Canadian dollar, there is a slight increase in the UIP premium for Canada.

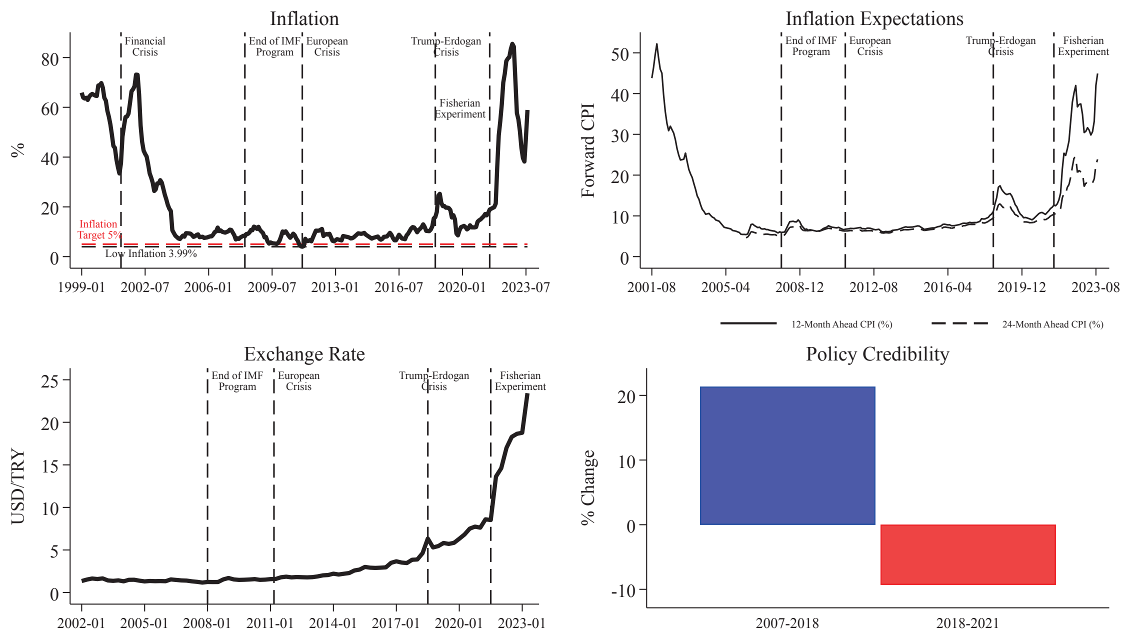
variation in our credibility measure.

As shown in figure 5, the inflation and inflation expectations came down around 2004–2005 and stayed low (with inflation sometimes even below the target of 5 percent) until Turkey started an unorthodox monetary policy experiment, known as the Fisherian experiment, in late 2020.[14] This late period of 2018–2021 is when our credibility measure shows a deterioration of almost 10 percent, whereas the early period of 2007–2018 picks up an improvement of 20 percent (recall that the credibility index is between zero and one). In Turkey's case, the fluctuations in monetary policy credibility correlate increasingly well with inflation and inflation expectations, which act as lagging variables due to their nature as endogenous outcomes to changes in monetary policy credibility. Additionally, the nominal exchange rate depreciation, which began during the 2018 political crisis, further intensified in the later period, marked by a decline in policy credibility post-2020.[15]

[14] Economist (2020); Project Syndicate article (2020)

[15] Tensions between Turkey and the United States soared as President Trump ordered new sanctions in 2018, following the political dispute over Turkey's continued detention of an American pastor who was jailed after a failed coup in Turkey. Tariffs on imported Turkish steel and aluminum were doubled to 50 percent and 20 percent, respectively (Tankersley, Swanson, and Phillips 2018).

Figure 5: Case Study: Turkey I



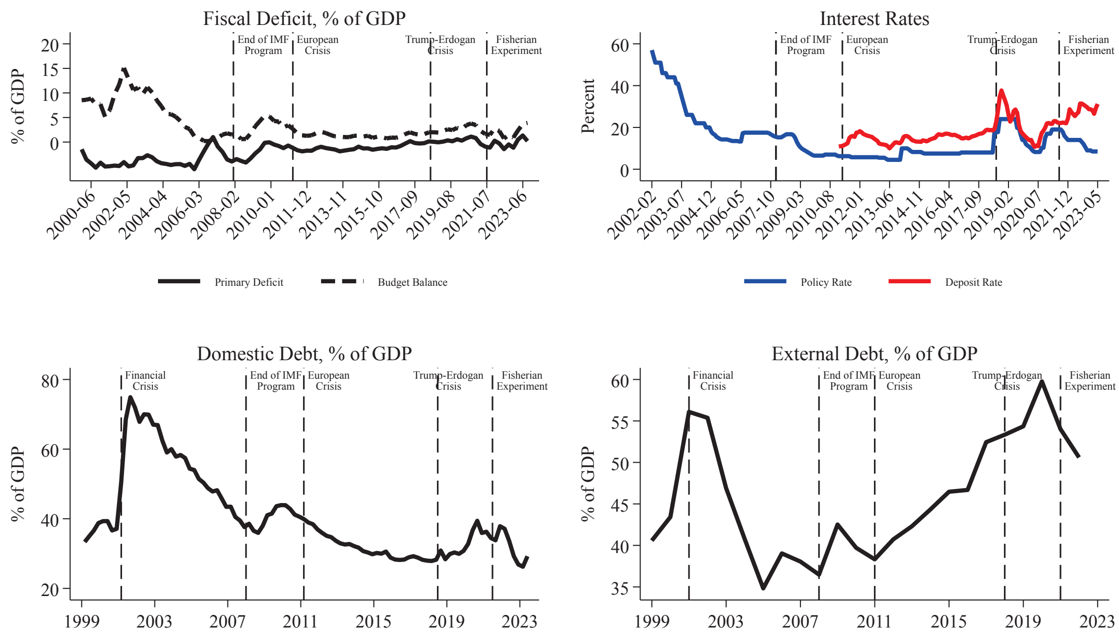
Note: We plot exchange rates for the float regime starting in 2002. Inflation and exchange rate data is from IFS, inflation expectations data is CBRT EVDS database and policy credibility is the IAPOC index.

Figure 6 shows the evolution of interest rates and domestic and external debt in Turkey. Again, the key insight here is not about the deteriorating fundamentals such as the current account deficit or external debt, as would typically be the case, but rather about how such deterioration priced in the risk spreads leads to different dynamics in market rates (short-term deposit rates) versus monetary policy rates, as shown to be the case in the latest episode.[16] Kalemli-Özcan (2019) calls this phenomenon "short-rate disconnect" and shows that emerging markets' domestic monetary policies have been ineffective in general since the 1990s as the policies' pass-through to domestic market rates is always less than one to one with capital flows having an effect on market rates

[16]We only plot external debt to save space as increasing external debt also implies widening current account deficits.

as a function of risk sentiments. The Turkish case after 2020 is an example, with the monetary policy credibility deteriorating and priced in by foreign investors as a risk premium, which is picked up both by the UIP premia and as the difference between domestic market rates and policy rates. The issue is not only the less than one-to-one pass-through of policy rates into market rates, but also having these rates go in totally opposite directions. De Leo, Gopinath and Kalemli-Özcan (2022) study the short-rate disconnect in detail by writing down a model that delivers the wedge between market rates and policy rates as long as the domestic financial intermediaries borrow overseas at a dollar premium. They show that emerging markets pursue counter-cyclical monetary policy; however, the market rates they face go up in bad times and down in good times due to the risk premia inherent in market rates for emerging markets, even though the monetary policy is counter-cyclical in those countries akin to advanced economies.

Figure 6: Case Study: Turkey II



Note: Fiscal Deficit is composed of Primary Deficit and Budget Balance. Primary Deficit data is Central Government's last 12-month primary balance to nominal GDP ratio, and Budget Deficit data is calculated by adding Central Government's last year interest expense share to primary deficit ratio. Domestic Debt to GDP ratio is Public Sector Net Debt to GDP ratio covering total public gross debt stock, unemployment insurance fund net assets, public sector assets, and central bank net assets to last year's GDP. External Debt to GDP ratio is the Gross External Debt Stock to GDP ratio covering short and long term debt stocks of public sector, CBRT, and private sector. Fiscal data comes from Turkey's Ministry of Treasury and Finance statistic webpage. Policy and Deposit Rate data are available from CBRT EVDS database.

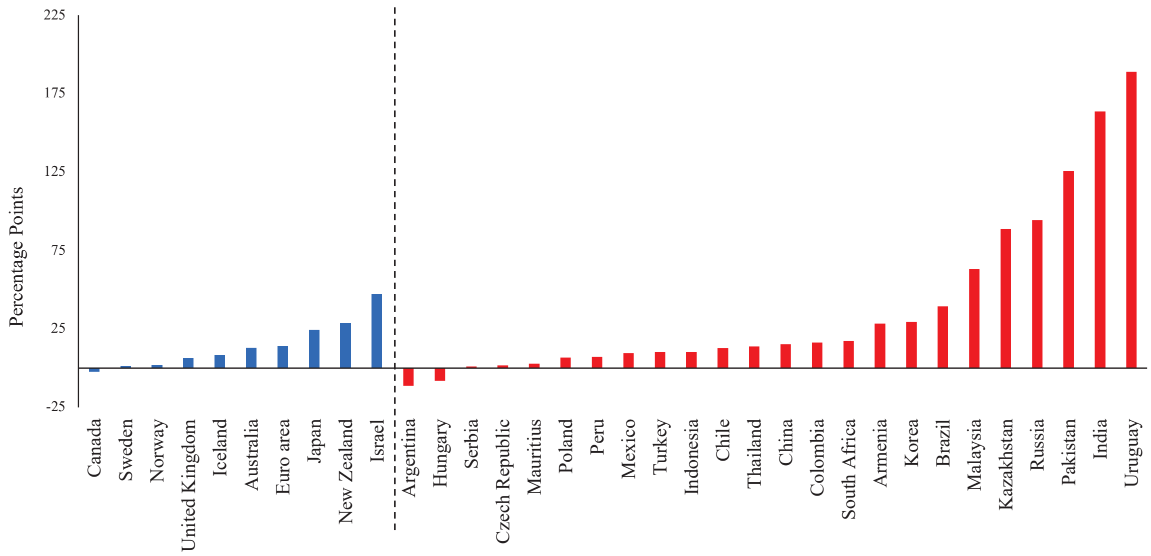
3 Data and Measurement

3.1 Monetary Policy Credibility

Our measure for monetary policy credibility is a new index developed by Unsal, Papageorgiou and Garbers (2022) using a narrative approach similar to Romer and Romer (1989) for fifty countries between 2007 and 2021. This index characterizes monetary policy frameworks across three pillars: independence and accountability (IA), which provide the foundations of monetary policy; policy and operational strategy (PO), which guide the adjustments to policy stance given the objectives, as well as the adjustments to policy instruments to implement the policy stance; and communications (C), which conveys decisions about the policy stance and rationale to the public. To cover these pillars with sufficient clarity and comprehension, 225 criteria were used and assessed against the public information from countries' central banks. Figure 7 shows the detailed cross-country heterogeneity, where countries like Uruguay and India show the maximum improvement.

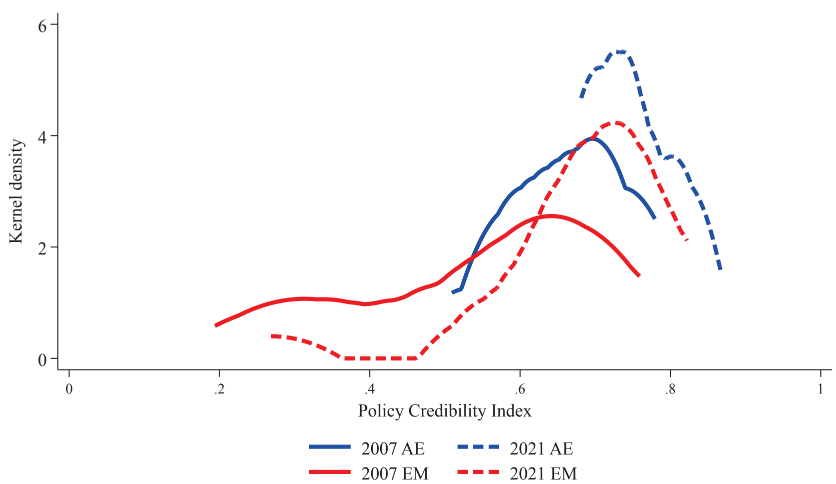
The improvement in monetary policy credibility becomes even more evident when comparing the distributions of the index for 2007 and 2021 in figure 8. The mass has shifted more to the right, keeping the extensive heterogeneity. Advanced economies have a narrower distribution. In particular, in 2007 for emerging markets, the lowest value is 0.194 and the highest is 0.759 (mean of 0.546). In the 2021 distributions, the highest value for emerging markets is 0.822, and the value for advanced economies is only 0.867; so the best monetary policy credibility in emerging markets is almost as good as the best among advanced economies.

Figure 7: Change in Monetary Policy Credibility, 2007-2021



Notes: Percentage change in monetary policy credibility (IAPOC index) of AEs and EMs between 2007 and 2021.

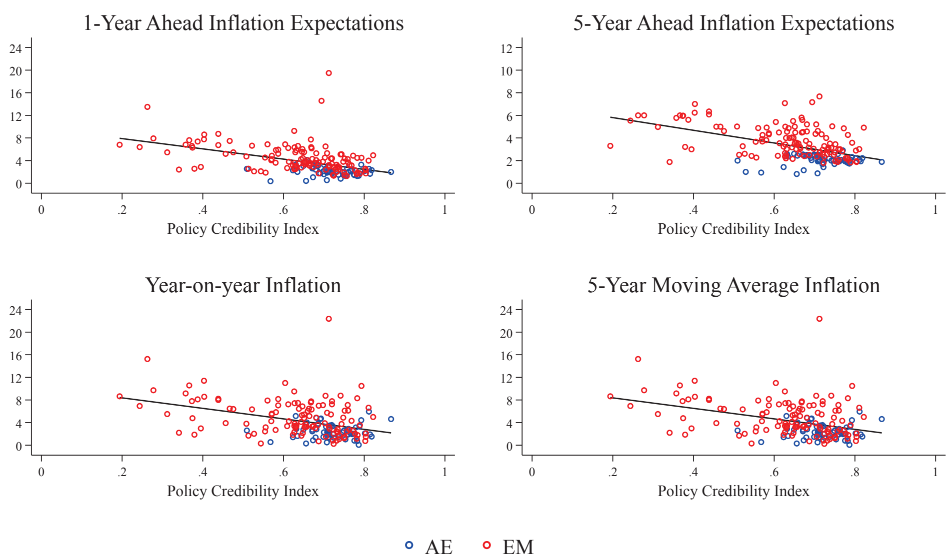
Figure 8: Policy Credibility Distributions



Notes: Distributions of policy credibility (IAPOC) index of AEs and EMs in 2007 and 2021.

The IAPOC index is negatively and significantly correlated with inflation and inflation expectations at different horizons (figure 9). The figure clearly shows that the downward slopes (higher policy credibility, lower inflation, and lower inflation expectations) are mostly driven by emerging markets and not by advanced economies. In fact, this is what makes our policy credibility index stand apart from a large number of existing studies that measure monetary policy credibility with realized inflation or inflation expectations, which are endogenous measures of policy credibility, since the inflation level and expectations might be driven by policy credibility as we show above.[17]

Figure 9: Inflation and Expectations (2007-2021)



Notes: Regression coefficients of 1-year ahead inflation expectations, 5-year ahead inflation expectations, year-on-year inflation and 5-year moving average inflation, on IAPOC. Inflation is headline CPI inflation and seasonally adjusted with ARIMA X13. Inflation data is from IFS while inflation expectations data comes from Consensus Survey and WEO Projections.

[17]For example, Bems, Caselli, Grigoli and Gruss (2021) obtain policy credibility measure from inflation, relying on historical data.

3.2 Balance Sheet Weakness via FX Debt

To study the role of heterogeneity in terms of the balance sheet weakness of countries for the international transmission of US monetary policy, we rely on updated data from Fan and Kalemli-Özcan (2016) and Kalemli-Özcan, Liu and Shim (2021) on the ratio of FX debt to total debt for the private sector in a given country, and we follow the methodology in Kalemli-Özcan (2019). These data come from the Bank for International Settlements (BIS) global liquidity indicators (GLI) database, which provides FX debt exposures for both bonds and loans for the non-financial private sector (non-financial corporations and households) and for governments separately. FX bonds are defined as debt securities issued in the US dollar, euro, or Japanese yen, and issued in international markets by the residents in the non-financial sector of a given economy. FX loans are defined as bank loans extended to the non-bank sector of a given economy by both domestic banks and international banks located outside the economy, and denominated in the US dollar, euro, or Japanese yen.

We work with the ratio of FX debt to total credit for the non-financial sector. Total credit data come from the BIS total credit database, which provides data on total loans and debt securities used for borrowing by the residents in the non-financial sector of a given economy, in both domestic and foreign currencies, and from both domestic and foreign lenders. By dividing the sum of loans and bonds in FX from the GLI data set for the non-financial sector by the sum of total loans and bonds for the non-financial sector from the total credit database, we obtain the country-level non-financial private sector FX debt share. The data are available for the following fifteen emerging economies: Argentina, Brazil, Chile, China, Colombia, India, Indonesia, Malaysia, Mexico, Peru, Philippines, Russia, South Africa, Thailand, and Turkey.

Of course, having FX debt alone does not necessarily indicate a weak balance sheet. To address this issue, we draw upon the extensive literature that documents how, in emerging markets, the financial sector (banks) is often required to hedge currency risk, while corporations, including exporters, tend not to match currency risk on their balance sheets (Di Giovanni, Kalemli-Özcan, Ulu and Baskaya (2022), Alfaro, Calani and Varela (2021)). Governments can act as the lender of last resort for dollars through their reserves, effectively hedging this risk at the national level, and hence we run robustness exercises controlling FX reserves, as reported in the appendix figure A1.

The rationale for utilizing this data set, despite its limitations in terms of sample size, is its ability to focus exclusively on the private sector FX exposure. This is crucial because, as we highlighted in the introduction, emerging market governments are increasingly borrowing in local currency. Even though we showed data from Bénétrix, Gautam, Juvenal and Schmitz (2019) in the introduction, we do not use these data in our regressions as the FX dimension is a proxy in this data set. This is because it uses as input: the currency composition of the main international investment position (IIP) components from the International Monetary Fund (IMF); the IMF's Coordinated Portfolio Investment Survey (CPIS); the portfolio debt data reported to the European Central Bank; and banks' cross-border positions reported to the BIS, available through its locational banking statistics. Thus, corporate and government debt will be mixed, as those are mixed in the IIP and CPIS data sets, and hence the currency composition for the corporate sector cannot be precisely measured unlike our data from BIS.

3.3 Other Variables

Our panel data set includes other variables: GDP, Consumer Price Index (CPI), exchange rates, capital flows, and UIP deviations. We use seasonally adjusted real GDP from the *World Economic Outlook* and complement the missing series using data from central banks, national bureaus of statistics, and the International Financial Statistics (IFS). We use the CPI data from the IFS. For nominal exchange rates, we use the IFS as well. We also use total capital inflows, defined as the sum of bank, central bank, corporate, and government portfolio debt and other investment debt flows (loans) from BIS, originally constructed by Avdjiev, Hardy, Kalemli-Özcan and Servén (2022). These data are identical to the IMF balance of payments data at the annual level but with better quarterly coverage in emerging markets, which is why we prefer them over the standard IMF balance of payments data. The twelve-month UIP deviations are calculated as the difference between log interest rate differentials and the gap between log expected and spot exchange rate, all at the same horizon, as shown in section 2. Log interest rate differentials are the short-term government bond rates vis-à-vis the United States, at twelve months. The log expected exchange rate is the twelve-month ahead expected exchange rate in a given month from the Consensus Economics, and the log exchange rate is the spot rate, both nominal and in terms of local currency per US dollar. From Bloomberg, we get the nominal interest rate data.

Our panel data set also includes other variables that we use as controls: trade balance to GDP, dollar shock, oil price index, and FX reserves to GDP. Data on trade balance to GDP are from the IFS. As for dollar shock, we use the Nominal Major Currencies US Dollar Index from FRED, and we normalize it to 10 percent following Obstfeld and Zhou (2023). Oil prices and FX reserves to GDP data are from the IFS. In our analysis, we drop hard pegs and dual markets exchange rate countries (Ilzetzki, Reinhart and Rogoff (2022) classifications 1 and 6). Thus, we always work with an unbalanced panel composed of managed and pure floats at the time of their inclusion.

Table 1 lists our country sample. We have a total of fifty-nine countries in the big sample. These are all advanced economies and emerging markets that do not have hard pegs and dual markets exchange rates. Similarly, of the fifty countries that are in the IAPOC index sample, we work with thirty-four; we drop the low-income countries, those with hard pegs, dual markets exchange rate countries, and the United States. In the FX debt exercise, we have only fifteen emerging economies, all floating or managed floating countries. The appendix provides more details including descriptive statistics.

Table 1: Country Sample

Albania	Costa Rica	India*$	Mexico*$	Singapore
Argentina*$	Croatia	Indonesia*$	Morocco	Slovak Republic
Armenia*	Czech Republic*	Ireland	New Zealand*	South Africa*$
Australia*	Denmark	Israel*	Norway*	Spain
Azerbaijan	Euro Area*	Italy	Pakistan*	Sweden*
Belarus	Ecuador	Japan*	Paraguay	Switzerland
Brazil*$	Egypt Arab	Kazakhstan*	Peru*$	Thailand*$
Bulgaria	Finland	Korea	Philippines*$	Tunisia
Canada*	Germany	Latvia	Poland*	Turkey*$
Chile*$	Guatemala	Malaysia*$	Romania	United Kingdom*
China*$	Hungary*	Malta	Russian Federation*$	Uruguay*
Colombia*$	Iceland*	Mauritius*	Serbia*	

Note: * indicates that we have the monetary policy credibility index (IAPOC) for this country
$ indicates that we have the direct measure of FX debt exposure of the private sector for this country
Red text indicates a country is an emerging market

4 Empirical Analysis

4.1 FED Hikes and Risk Premia in Financial Markets

We want to capture the exogenous component of US monetary policy that constitutes a surprise for the financial markets, which in turn has an impact on their risk sentiment, after a Federal Reserve announcement. Not every Fed hike needs to involve a change in the risk sentiments of investors, but if there are enough Fed hikes that do change the risk sentiments, then our identification of the risk channel of US monetary policy's international transmission is valid. We are also relying on the fact that a large body of literature shows a high correlation between the Fed hikes and common measures of risk sentiments (e.g. VIX and the excess bond premium). We also use such measures for robustness in addition to our exogenous US monetary policy measures.[18]

The US monetary policy is endogenous to the US business cycle and financial markets since markets price in the expected actions of the Federal Reserve before the actual change in the policy rate. The common approach to dealing with the endogeneity of monetary policy in the literature is to measure the monetary policy surprises. These surprises are obtained from high-frequency changes in interest rates around central bank policy announcements. The key identifying assumption is that the monetary policy is predetermined over the event window and hence not affected by the financial market reaction. Using such surprises, the macro finance literature estimates the causal effect of US monetary policy both on financial markets (e.g. Kuttner (2001), Gürkaynak, Sack and Swanson (2004)), and on macro variables (e.g Stock and Watson (2018), Gertler and Karadi (2015)).

Recently, this literature has been debating some puzzling effects. Forecasts respond in the wrong direction when a high-frequency monetary policy surprise indicates, say, a tightening of monetary policy. Not only do output, employment, and inflation respond positively to tightening (Nakamura and Steinsson (2018)), but similar positive responses are observed in the stock market as well (e.g Miranda-Agrippino and Ricco (2023), Cieslak and Schrimpf (2019), Jarociński and Karadi (2020)). The common explanation for these puzzling results is the "Federal Reserve information effect," that is, the Federal Reserve announcements convey private information about the economy and therefore directly affect the beliefs about economic fundamentals. If, for example, a tightening surprise is interpreted as a signal that the Federal Reserve thinks the economy is stronger, then the survey forecasters will revise their outlook upward and the stock market will boom. As a result, monetary policy surprises are not exogenous but contaminated with information that will prevent them from identifying the causal

[18]Results with the VIX, excess bond premium, and a new measure of risk-on-risk-off (RORO) sentiment from Chari, Stedman and Lundblad (2020) are available upon request.

effects of monetary policy.

There is also the additional problem of relevance. This problem is about the fact that the surprises are small. In fact, Obstfeld and Zhou (2023) argue that the US dollar exchange rate is a better measure than the monetary policy shocks for tracing the risk-based international transmission from the United States to the rest of the world, since the dollar exchange rate picks up much more variation in risk sentiment variables such as the VIX and the excess bond premium. Consistently, others argue that the most important driver of the global financial cycle is not the US monetary policy per se, but rather the precise measures of risk sentiments such as the excess bond premium (Rogers, Sun and Wu (2023)) and volatility in macroeconomic news (Boehm and Kroner (2023)). Unfortunately, all of these, the dollar exchange rate, VIX, excess bond premium, and macroeconomic news, are endogenous to the US monetary policy changes since they are all endogenous to financial markets' risk sentiment changes that depend largely on US monetary policy.

For example, when the Federal Reserve hikes the rates, the global financial conditions get tighter, which results in a higher excess bond premium, flight to safety, and an appreciation of the US dollar together with more macroeconomic news on higher earning volatility and uncertain outlook. For our purposes, we want the US monetary policy surprises that are exogenous to the US economy and financial markets but still relevant for financial markets, relevant enough that the surprises will change financial markets' risk sentiments. We do not want our policy surprises to be contaminated by the Federal Reserve or the financial markets' reaction to public news that is available before the Federal Reserve announcement. Rather, we want to measure the new information that financial markets learn from the Federal Reserve's announcement and changes their risk sentiments and international portfolios differentially across emerging markets versus advanced economies.

Bauer and Swanson (2023) solve these types of endogeneity issues. They show

Table 2: Weak Instrument Test

	Cragg-Donald Wald F statistic		Kleibergen-Paap rk Wald F statistic	
Depvar	EM	AE	EM	AE
GDP	370.261	248.115	370.297	248.320
Capital inflows to GDP	175.319	74.783	175.251	74.716
Exchange Rate	440.293	257.478	440.532	257.772
12m UIP deviation	144.371	111.145	144.376	111.096

Note: We show the weak instrument test results, for the baseline regression (specification 1 below) and for $h = 1$. We show the Cragg-Donald Wald F statistic and the Kleibergen-Paap rk Wald F statistic. They are all above the Stock-Yogo weak ID test critical values of 10% maximal IV size, which in this case is equal to 16.38.

that the key endogeneity problem lies in the omitted variable of economic news, where all—survey forecasters, markets, and the Federal Reserve policy—respond to macroeconomic news. Bauer and Swanson (2023) show that there is no information effect in the Federal Reserve's announcements, but rather that the predictability of the monetary policy surprises is due to learning about the Federal Reserve's policy during the announcements. Hence, the publicly observable macro data and the omitted news can help solve the endogeneity issue together with the relevance issue. Bauer and Swanson (2023) compute the orthogonalized monetary surprises as residuals from regressing monetary surprises on six macro and financial variables. As a result, we use monetary policy surprises from both Gertler and Karadi (2015) and Bauer and Swanson (2023) in our analysis. We use Gertler and Karadi (2015) in a two-step IV approach using the surprises, calculated as the movements in the prices of short maturity (three-month) federal funds futures contract in a thirty-minute window surrounding the Federal Open Market Committee announcement, as instruments for the policy rate (the twelve-month T-bill rate). We use Bauer and Swanson (2023) surprises in reduced form. Following Bauer, Bernanke and Milstein (2023), we re-scale the Bauer and Swanson (2023) surprises to gauge the effects of a 10 basis point surprise (the standard deviation of the original surprises is about 9 basis points).

The monetary policy shocks from Gertler and Karadi (2015) comfortably pass the weak instrument tests, and hence they are relevant in capturing the exogenous changes in US monetary policy, as we show in table 2 (regressions of the US policy rate on policy surprises).

4.2 Historical Evidence: The Impact of FED Hikes on Emerging Markets vs Advanced Countries, 1990q1–2019q4

To uncover the asymmetric effects of Fed hikes, we rely on local projections, as proposed by Jordà (2005). The local projection method provides a flexible framework and is easy to implement. Moreover, it is well documented that local projections have several advantages over the vector autoregression (VAR) models. Above all, local projections are more robust to possible misspecifications, at least under a finite lag structure (e.g. Kilian and Lütkepohl (2017) and Plagborg-Møller and Wolf (2021)). They allow us to parsimoniously model the asymmetric effects of US monetary policy on emerging markets versus advanced economies, on countries with high versus low policy credibility, and also on countries with high versus low debt denominated in US dollars. The local projections estimation also saves degrees of freedom relative to a multivariate approach: even though we lose observations from adjusting for leads and lags, our set of control variables on the right-hand side is relatively sparse as we do not need to describe the dynamics of the endogenous variables conditional on the shock.

Local projections regress the dependent variable at different horizons $t + h$ for $h = 1, 2, ..H$, conditional on an information set that consists of a set of control variables. In the linear case, the regression equation reads:

$$y_{t+h} = \alpha_h + \beta_h \text{ Shock}_t + \gamma X_t + \varepsilon_{t+h}$$

where y_{t+h} is the variable of interest at horizon h, X_t is a vector of control variables, contemporaneous and lagged as long as they are supposed to have an effect on the endogenous variable y_{t+h}, independently from the identified structural shock, 'Shock$_t$'.

These control variables in X_t deserve discussion. The international transmission literature uses the specification below in general (e.g. Rey (2013), Degasperi, Hong and Ricco (2023), Miranda-Agrippino and Rey (2020), Kalemli-Özcan (2019), and others):

$$y_{c,t+h} = \alpha_c + \beta_h \hat{i}_t^{US} + \sum_{i=1}^{i=4} \omega_i X_{t-i} + \sum_{i=1}^{i=4} \eta_i x_{c,t-i} + \varepsilon_{c,t+h} \tag{1}$$

where $y_{c,t+h}$ is a vector of macro and financial variables of country c at horizon h, α_c are country fixed effects that absorb institutional differences across countries including slow-moving fundamentals.

There are two sets of controls, all of which enter lagged: X_{t-i} are lags of the global controls for the shock (lags of monetary policy rate, $\hat{i}_t^{US}$, and lags of monetary policy surprises that instrument the policy rate); and $x_{c,t-i}$ are lags of dependent variable and lags of country-specific controls that have an independent effect but are correlated with the past and anticipated US policy changes. These are inflation rate differentials and GDP growth differentials for the given country with the United States. These controls are essential since the inflation rate differentials are key for the financial channel of policy transmission, and GDP growth differentials are key for the trade channel. Investors switching demand for assets or consumers switching demand for goods between countries as a result of the past or anticipated changes in US policy and other global shocks are captured directly by these variables.

What then remains to be captured by the identified US monetary policy shock is the transmission via the financial channel driven by endogenous changes in the risk premium affecting the current and future interest rate differentials. Policy transmission via the trade channel will be captured by the endogenous appreciation of the dollar affecting the current and future GDP growth differentials. We investigate the impact of identified US shocks on both risk premia and exchange rates. When $y_{c,t+h}$ is GDP and shows improvement, the trade channel should be dominant; whereas, if GDP deteriorates, then the financial channel is the dominant channel of international transmission. Notice that two of the other endogenous outcomes we focus on—capital flows and exchange rates—cannot separate the channels of transmission since both channels will imply capital flows out on net (or net exports increase) and exchange rate depreciates vis-à-vis the dollar. But the falling GDP and rising risk premia (UIP) can identify the financial channel dominating over the trade channel.

Last but not least, $\hat{i}_t^{US}$ denotes the instrumented twelve-month US Treasury rate, where the first stage regresses the Treasury rate on monetary policy surprises from the three-month federal funds futures contract prices, following Gertler and Karadi (2015) as we explained in the previous section. As we also showed before, the instrument passes the relevance test, meaning the Gertler-Karadi shocks we use are not weak instruments for the US monetary policy changes.

Although we believe that the parsimonious specification given in equation (1) is all that is needed to identify the asymmetric effects of US policy on emerging markets versus advanced economies, to ease the worries about robustness, we also run equation (2) to control for additional global variables contemporaneously. This exercise will show that we do not need to control for additional variables as none of our results based on equation (1) will change qualitatively, and conditional on the equation (1) variables, additional variables from equation (2) will not have much explanatory power.

For this exercise, we follow Obstfeld and Zhou (2023) and run the following specification with additional global controls, allowing both contemporaneous and lagged relation between these variables and the identified US monetary policy shock:

$$y_{c,t+h} = \alpha_c + \beta_h \hat{i}_t^{US} + \gamma X_t + \sum_{i=1}^{i=4} \omega_i X_{t-i} + \sum_{i=1}^{i=4} \eta_i x_{c,t-i} + \varepsilon_{c,t+h} \qquad (2)$$

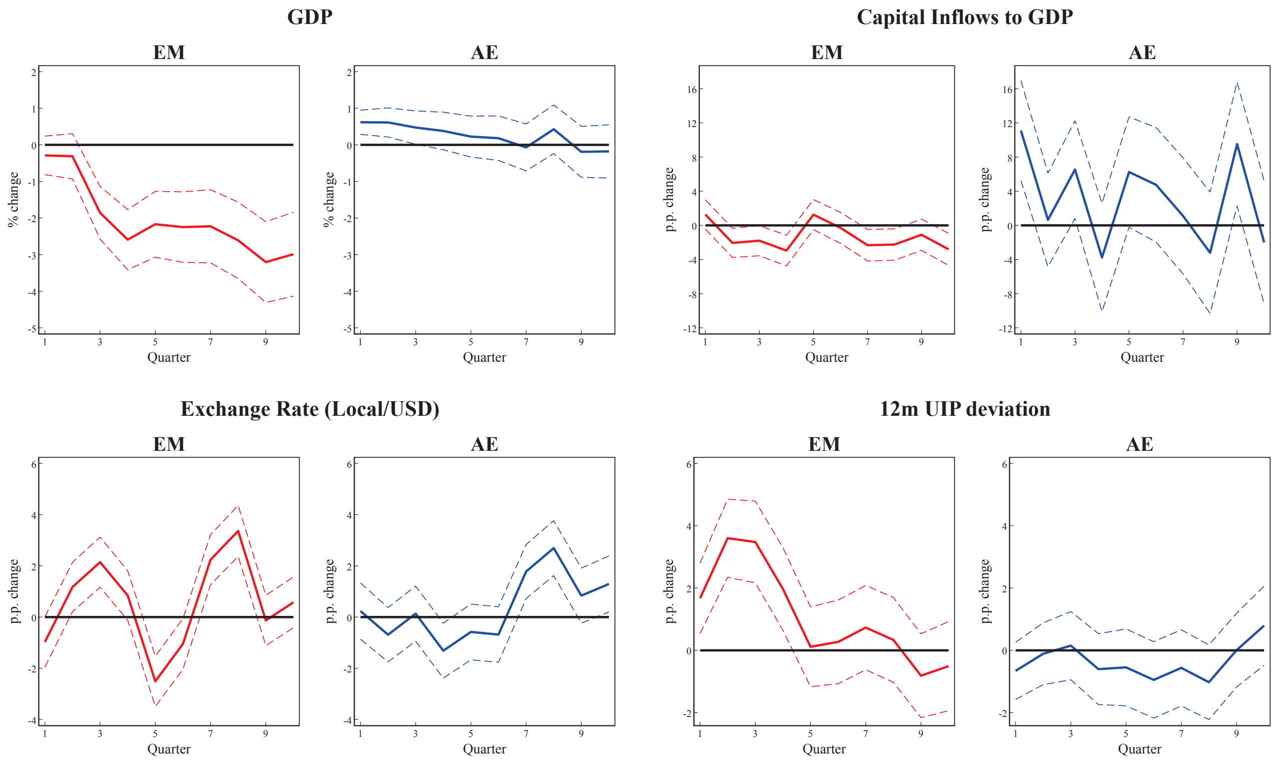
The variable X_t is a vector of global controls including the US dollar shock from Obstfeld and Zhou (2023), defined as the appreciation of the US dollar vis-à-vis euro area, Canada, Japan, United Kingdom, Switzerland, Australia, and Sweden, the oil price index, and the median country trade balance. When we run regressions for emerging markets and advanced economies separately, we use the median trade balances specific to those aggregate groups. The variable X_{t-i} includes the lags of all these global controls.

4.3 Benchmark Results

Figure 10 displays the differential impact of the US monetary tightening on advanced economies and emerging markets, based on equation (1) where we run this in the two samples of countries. The US monetary policy shock results in a significant and persistent decline in output in emerging markets but not in advanced economies: a 1 percentage point increase in the US policy rate leads to a 2 percent decline in output by the third quarter and a 3 percent decline by the ninth quarter in emerging markets. The stark difference between the output results implies that the financial channel dominates the trade channel in emerging markets.

The dominance of the financial channel of US policy transmission for emerging markets can also be seen from the large nominal exchange rate depreciation observed in quarters two to four (whereas advanced economies' exchange rates do not respond significantly) combined with the large increase in UIP: 3.5 percentage points for a 1 percentage point shock by the third quarter. Given the mean UIP deviation for emerging markets, this implies a large change: moving from a country that is in the 25th percentile to a country in the 75th percentile of the UIP wedge distribution, which would be moving from Chile to Argentina. Recall that a higher UIP premium means higher expected excess returns to local currency vis-à-vis the dollar.

Figure 10: International Transmission of FED Hikes: Emerging vs. Advanced Economies (GK surprises)



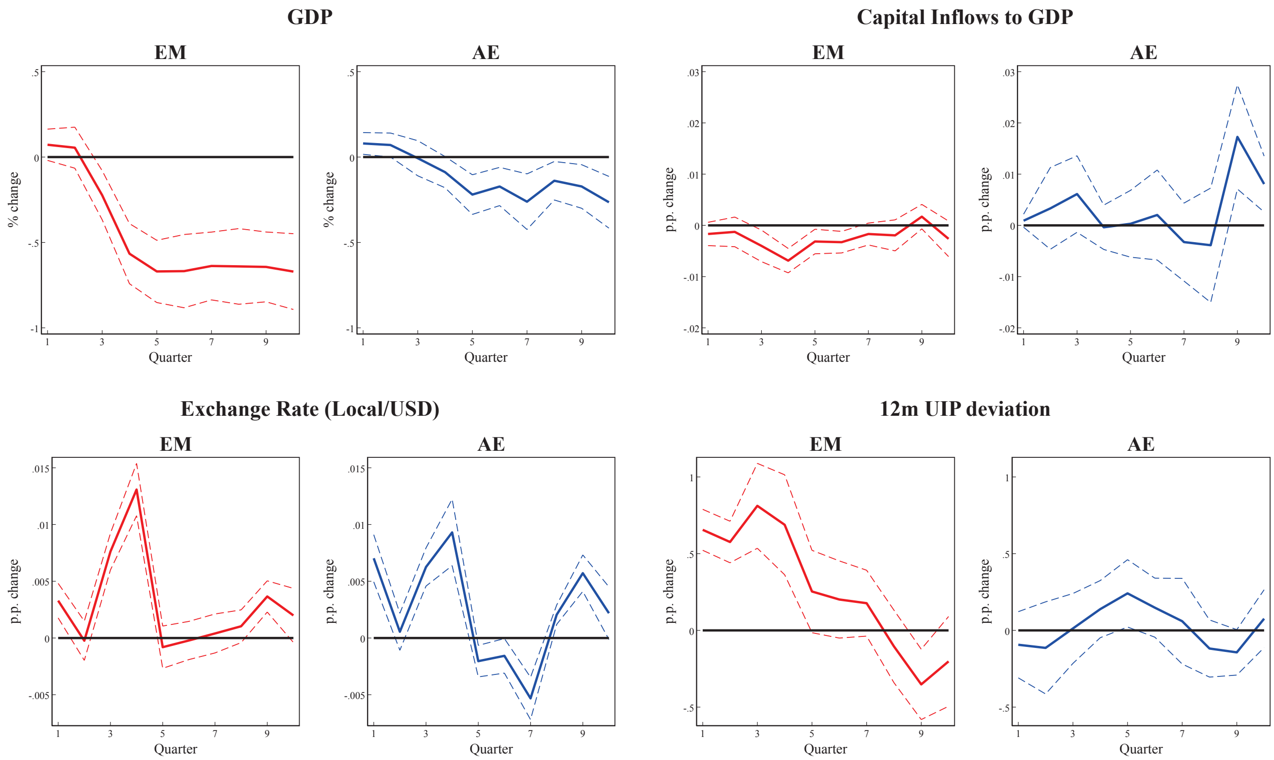
Notes: Impulse responses of 12-month US treasury rate instrumented by monthly weighted raw surprises in 3-month Fed Fund Futures (FF4) from Gertler and Karadi (2015) are obtained from panel local projections. 90% confidence intervals (calculated using Newey-West standard errors) are shown by the shaded areas. Controls include four lags of the: dependent variable, U.S. 12-month treasury rate, output growth and inflation differentials with the U.S., and the instrument. We also add FX reserves to GDP as control in figure A1, where AEs' exchange rates also show some depreciation. Dependent variables include: real GDP in logs, quarter-to-quarter nominal exchange rate growth (domestic currency/U.S. dollar), UIP deviations which are defined as 12m interest rate (government bond) differentials vis-à-vis the U.S. minus the expected changes in the exchange rate, and the ratio of total capital inflows to GDP. We also run this specification for our smallest country sample (FX debt EM sample) in figure A2.

It can happen if investors expect the emerging market's currency to appreciate in the future since there is a depreciation on impact with the Fed hike, or the emerging market's interest rate differentials with the United States increase as a result of higher risk premium, or both.[19] Consistent with higher UIP premia, capital inflows go down (meaning international investors leave) by 2 percentage points around the third quarter before reverting back. All these variables are insignificant for advanced economies.

We next run equation (1) in reduced form, using the monetary policy surprises in Bauer and Swanson (2023). Figure 11 shows results that are similar for emerging markets with more significant capital outflows. In particular, a 10 basis point shock results in a 0.2 percent decline in output by the third quarter and 0.6 by the ninth quarter in emerging markets. Similarly, the dominance of the financial channel is shown by an increase in UIP of 0.8 percentage points by the third quarter for emerging markets, while there is no effect at all for advanced economies. What is interesting is that now we also have a decline in output for advanced economies combined with currency depreciation. Hence, even for advanced economies, the financial channel dominates the trade channel, but the impact is much milder on output since there is no response of UIP wedge and capital outflows to the US shocks in advanced economies.

[19] This result is not due to higher policy rates in emerging markets, as shown by De Leo, Gopinath and Kalemli-Özcan (2022)

Figure 11: International Transmission of FED Hikes: Emerging vs. Advanced Economies (BS surprises)

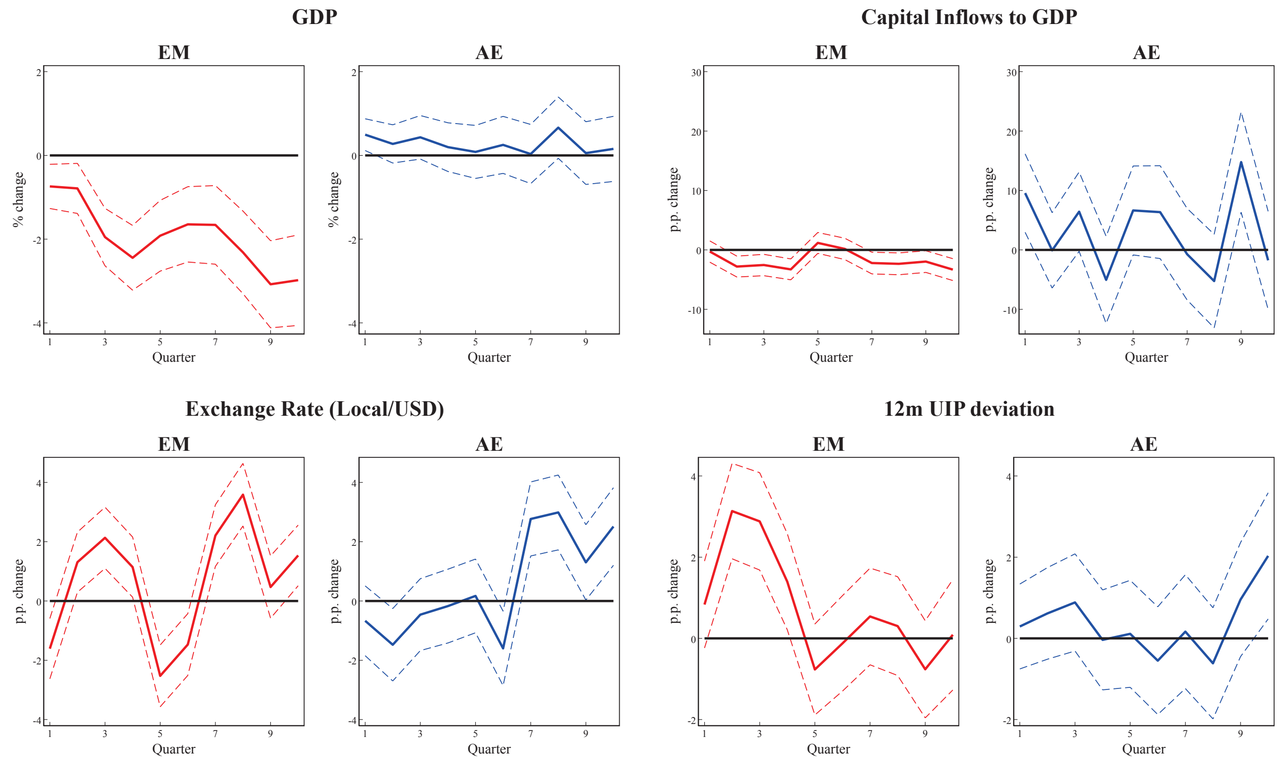


Notes: Impulse responses of Bauer and Swanson (2023) US monetary policy surprises, scaled to a ten basis point surprise, are obtained from panel local projections. 90% confidence intervals (calculated using Newey-West standard errors) are shown by the shaded areas. Controls include four lags of the: dependent variable, U.S. 12-month treasury rate, output growth and inflation differentials with the U.S., and the shock. Dependent variables include: real GDP in logs, quarter-to-quarter nominal exchange rate growth (domestic currency/U.S. dollar), UIP deviations which are defined as 12m interest rate (government bond) differentials vis-à-vis the U.S. minus the expected changes in the exchange rate, and the ratio of total capital inflows to GDP.

In figure 12, we show the results of equation (2), which includes global controls that might be correlated with the US policy shocks. Results are consistent with our previous findings. In figure A3 in the appendix, we re-run this exercise, dropping commodity exporters, and find that the results hold with the exception that now we also have some delayed depreciation in the advanced economies' exchange rates.

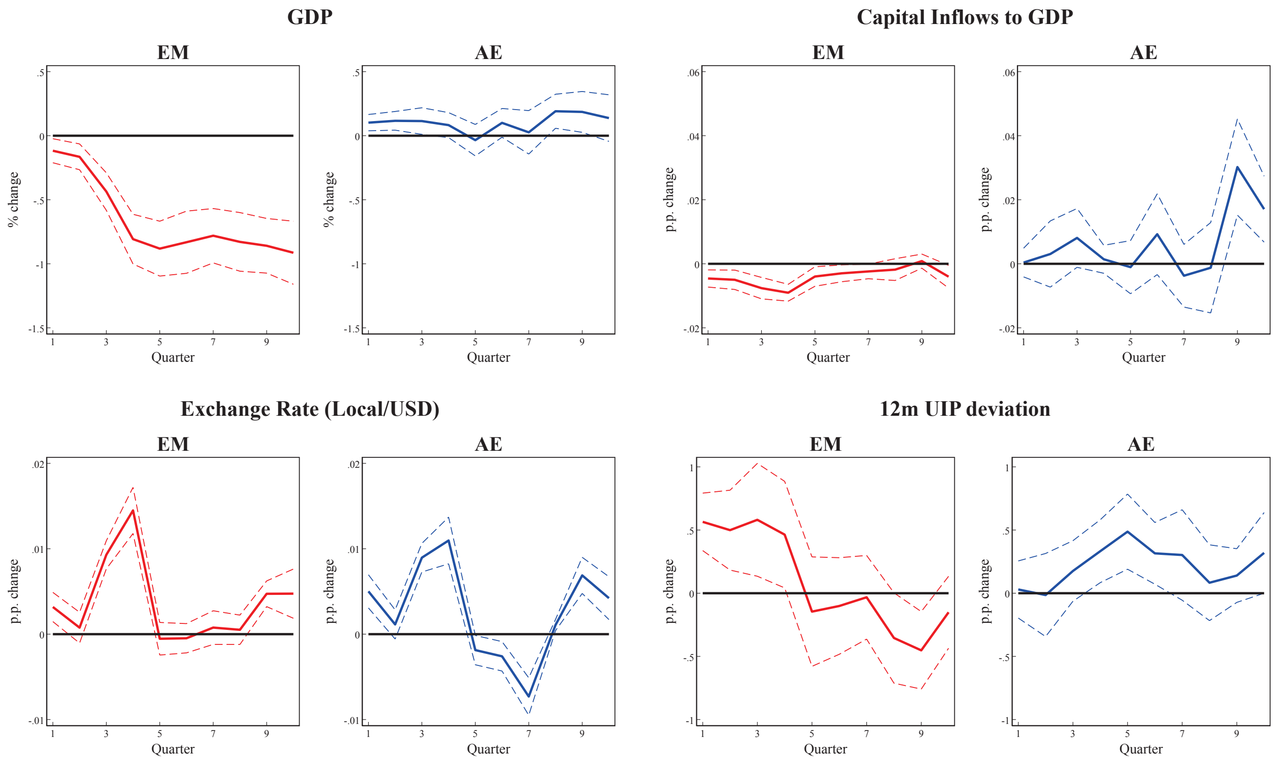
In figure 13, we show the results of running equation (2) in reduced form using the monetary policy shocks from Bauer and Swanson (2023). We do not find large differences relative to our findings in figure 11, which highlights the strength of the results. The only change is that now the previous, mild decline on advanced economies' GDP goes away, and in fact, there is a weak small increase in GDP together with currency depreciation, which would support the trade channel via expenditure switching. The problem is that by the third quarter, when currency depreciates, the output effect becomes insignificant.

Figure 12: International Transmission of FED Hikes: Emerging vs. Advanced Economies with Global Controls (GK surprises)



Notes: Impulse responses of 12-month US treasury rate instrumented by monthly weighted raw surprises in 3-month Fed Fund Futures (FF4) from Gertler and Karadi (2015) are obtained from panel local projections. 90% confidence intervals (calculated using Newey-West standard errors) are shown by the shaded areas. Controls include four lags of the: dependent variable, U.S. 12-month treasury rate, output growth and inflation differentials with the U.S., the instrument, dollar shock, average oil price index, and median trade balance. Global controls (the last three) also enter contemporaneously. Dependent variables include: real GDP in logs, quarter-to-quarter nominal exchange rate growth (domestic currency/U.S. dollar), UIP deviations which are defined as 12m interest rate (government bond) differentials vis-à-vis the U.S. minus the expected changes in the exchange rate, and the ratio of total capital inflows to GDP.

Figure 13: International Transmission of FED Hikes: Emerging vs. Advanced Economies with Global Controls (BS surprises)



Notes: Impulse responses of Bauer and Swanson (2023) US monetary policy surprises, scaled to a ten basis point surprise, are obtained from panel local projections. 90% confidence intervals (calculated using Newey-West standard errors) are shown by the shaded areas. Controls include four lags of the: dependent variable, U.S. 12-month treasury rate, output growth and inflation differentials with the U.S., monetary policy shocks, dollar shock, average oil price index, and median trade balance. Global controls (the last three) also enter contemporaneously. Dependent variables include: real GDP in logs, quarter-to-quarter nominal exchange rate growth (domestic currency/U.S. dollar), UIP deviations which are defined as 12m interest rate (government bond) differentials vis-à-vis the U.S. minus the expected changes in the exchange rate, and the ratio of total capital inflows to GDP.

4.4 The Role of Policy Credibility

Why are emerging markets affected worse from Fed hikes (at least historically, during the period we study: 1990:Q1–2019:Q4)? To shed light on this question, we extend our local projections framework to analyze the differential impact of the US monetary policy shocks depending on the monetary policy credibility of countries, where we rely on the IAPOC index by Unsal, Papageorgiou and Garbers (2022). In particular, we augment equation (2) in the following way:

$$y_{c,t+h} = \alpha_c + \beta_{1,h}\hat{i}_t^{US} + \beta_{2,h}\hat{i}_t^{US} * IAPOC_{c,2007} + \gamma X_t + \sum_{i=1}^{i=4}\omega_i X_{t-i} + \sum_{i=1}^{i=4}\eta_i x_{c,t-i} + \varepsilon_{c,t+h} \tag{3}$$

where $IAPOC_{c,2007}$ is time in-varying and takes the 2007 initial value for each country.

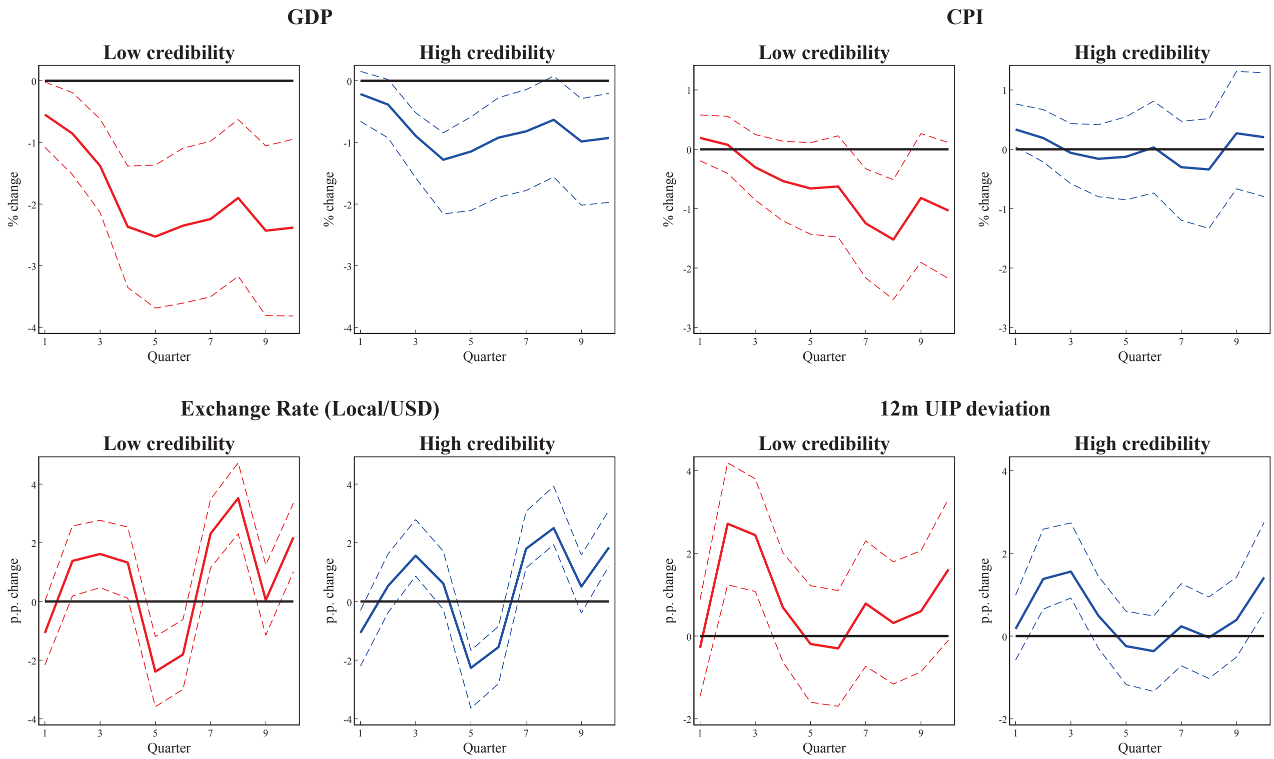
To calculate the effect of the US monetary policy shock on countries with high versus low policy credibility, we calculate the marginal effect of a US monetary policy shock as:

$$\frac{\partial y}{\partial \hat{i}} = \beta_{1,h} + \beta_{2,h} * IAPOC_{2007} \tag{4}$$

and we evaluate equation (4) at the 25th percentile of the 2007 IAPOC index distribution for the low-credibility country and at the 75th percentile for the high-credibility country.

Figure 14 shows the impulse response functions, which are striking. As shown, countries with low monetary policy credibility experience sharper contractions in output and higher UIP deviations, even though the extent of nominal exchange rate depreciations is similar among low and high credibility countries. We also plot inflation response where, interestingly, the low credibility countries have declining inflation, reflecting the severe contraction of the economy. In fact, given the high exchange rate pass-through in countries with low credibility, it can be that the central banks increase interest rates, which would further slow down growth and increase the UIP wedge. Instead, central banks with high credibility can afford to support the economy by lowering interest rates after the shock.

Figure 14: International Transmission of FED Hikes: The Role of Policy Credibility with Global Controls (GK Surprises)



Notes: Impulse responses of 12-month US treasury rate instrumented by monthly weighted raw surprises in 3-month Fed Fund Futures (FF4) from Gertler and Karadi (2015) are obtained from panel local projections. 90% confidence intervals (calculated using Newey-West standard errors) are shown by the shaded areas. Controls include four lags of the: dependent variable, U.S. 12-month treasury rate, output growth and inflation differentials with the U.S., instrument, dollar shock, average oil price index, and median trade balance. Global controls (the last three) also enter contemporaneously. Dependent variables include: real GDP in logs, CPI in logs, a quarter-to-quarter nominal exchange rate growth (domestic currency/U.S. dollar), and 12m UIP deviations which are defined as before. See text for the definition of high and low credibility countries.

4.5 The Role of Balance Sheet FX Vulnerabilities

Another reason why EMs were affected worse from the FED hikes historically can be their sizeable external debt that is financed with persistent current account deficits and largely denominated in US dollars. Such debt creates balance sheet vulnerabilities hindering investment and growth, especially when the cost of servicing this debt goes up with Fed hikes where assets on balance sheets are largely in local currency, as shown by Kalemli-Özcan (2019).

We extend our local projections framework to allow the impact of the US monetary policy shocks to differ based on FX (US dollar) debt of the private non-financial sector. We augment our equation (2) in the following way:

$$y_{c,t+h} = \alpha_c + \beta_{1,h}\hat{i}_t^{US} + \beta_{2,h}\hat{i}_t^{US} * FXdebt_{c,2000} + \gamma X_t + \sum_{i=1}^{i=4} \omega_i X_{t-1} + \sum_{i=1}^{i=4} \eta_i x_{c,t-i} + \varepsilon_{c,t+h} \tag{5}$$

where $FXdebt_{c,2000}$ is a time-invariant variable equal to the initial 2000 value of FX debt.

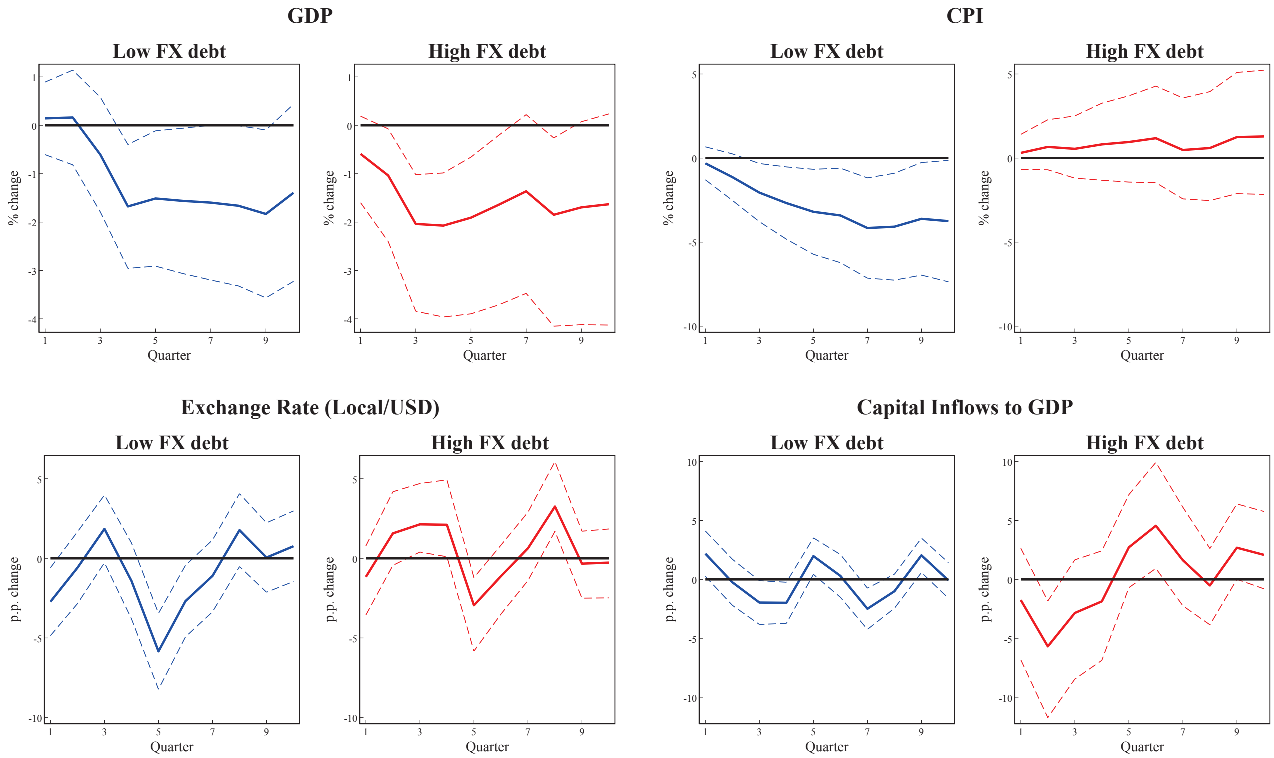
To calculate the effect of the US monetary policy shock on high versus low FX debt countries, we calculate the marginal effect of a US monetary policy shock as:

$$\frac{\partial y}{\partial \hat{i}} = \beta_{1,h} + \beta_{2,h} * FXdebt_{2000} \tag{6}$$

For the low FX debt country, we evaluate equation (6) using the minimum value of the 2000 FX debt distribution; and for the high FX debt country, we evaluate the same equation using the maximum value of that initial distribution.

We summarize the impulse response functions in figure 15. Countries with high FX debt go through sharper contractions in output on impact together with longer depreciations, higher inflation, and capital outflows, though given the small sample size, the statistical significance is lower for these variables compared to the strong drop in output on impact. The cumulative effect on output is similar between high and low FX debt countries. In appendix A5, we use time-varying variables for IAPOC index and FX debt, getting similar results.

Figure 15: International Transmission of FED Hikes: The Role of Balance Sheet FX Vulnerabilities with Global Controls (GK Surprises)



Notes: Impulse responses of 12-month US treasury rate instrumented by monthly weighted raw surprises in 3-month Fed Fund Futures (FF4) from Gertler and Karadi (2015) are obtained from panel local projections. 90% confidence intervals (calculated using Newey-West standard errors) are shown by the shaded areas. Controls include dollar shock, average oil price index, and median trade balance and four lags of the: dependent variable, U.S. 12-month treasury rate, output growth and inflation differentials with the U.S., and instrument. In this case we did not add 4 lags of dollar shock, average oil price index, and median trade balance because of the limited sample. Global controls also enter contemporaneously. Dependent variables include: real GDP in logs, CPI in logs, a quarter-to-quarter nominal exchange rate growth (domestic currency/U.S. dollar), and capital inflows to GDP ratio. See text for the definition of high and low FX debt countries.

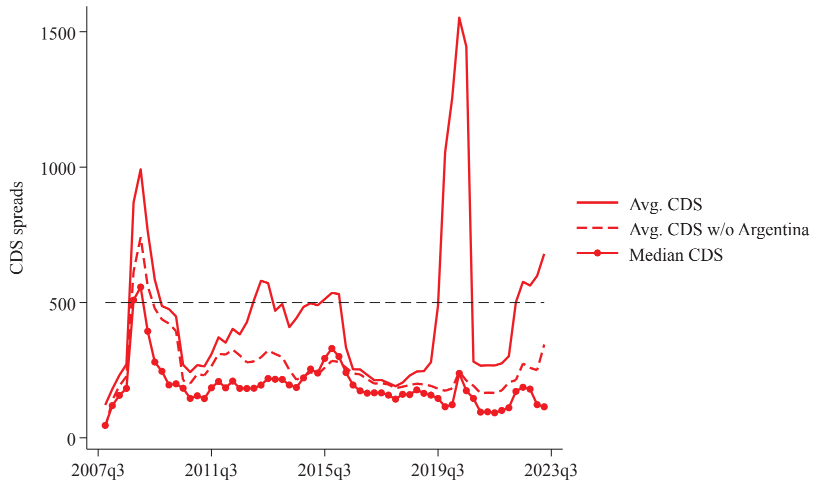
5 The Recent Episode: 2022–2023 Fed Hikes

"Resilience" is the buzz word for 2022–2023. While it is often used in the context of the US economy, which has avoided a recession despite experiencing the steepest interest rate hikes in decades, the story of emerging markets is even more remarkable. Projections for global growth in 2023 are primarily fueled by emerging markets, and impressively, the top twenty-five emerging markets all surpassed their 2022 forecasts (IMF, 2023).

As is widely acknowledged, and as we confirm in this paper, rising US interest rates historically created challenges for emerging markets. This time is different as most emerging markets managed to establish monetary and financial discipline, marked by credible monetary policies and reduced FX debt, as shown in figures 1 and 2 respectively. In the recent period, they began raising rates ahead of advanced economies as soon as the COVID-19 inflation hit their economies. This shows improved monetary policy credibility since the monetary policy is responding to their own inflation rather than to the US policy or the exchange rate developments. Their statements were clear on why they were raising interest rates: not to mimic the US policy for currency defense, but rather to re-anchor the rising inflation expectations (Carvalho and Nechio (2023)).

The first piece of evidence for this time being different is that the main risk spread, the credit default swaps (CDS), did not move at all for emerging markets, as shown in figure fig:CDS. Compared to 2008 when the CDS spreads spiked for both average and median emerging markets, this time around they actually went down for the median emerging market. For the average emerging market, there was a huge spike totally driven by Argentina in 2020 when the pandemic started. In 2022 when the Federal Reserve started hiking, the median emerging market spread went down and the average emerging market spread (without Argentina) went up very little, less than what happened in the taper tantrum. The CDS spread captures the default risk of governments on dollar-denominated bonds. Clearly this risk was very low.

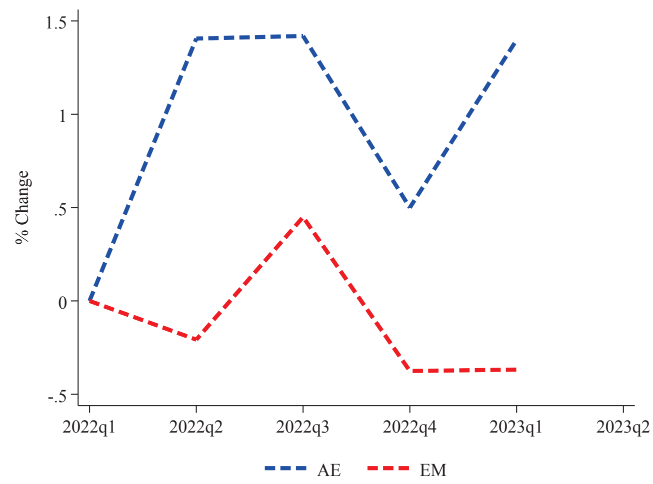
Figure 16: CDS in the recent episode



Notes: This figure plot Credit Default Swaps (CDS) for 15 EMs: Argentina, Egypt, Guatemala, India, Kazakhstan, Korea, Malta, Mexico, Morocco, Pakistan, Serbia, Singapore, Slovak Republic, Thailand and Uruguay. The solid line shows the simple average in each quarter, the dashed line excludes Argentina. The dotted line shows the median. Source: Refinitiv Datastream.

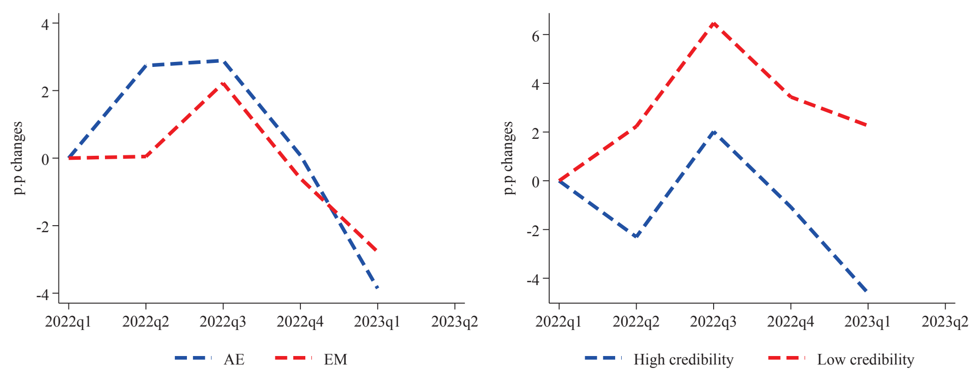
Figure 17 shows, relative to the first quarter of 2022, the change in the twelve-month UIP deviations for advanced economies and emerging markets. Investigating UIP spread on top of the CDS spread is useful since the UIP risk spread captures the risk premium due to currency depreciations and passes through the domestic lending rates one to one. Relative to our findings in previous sections, changes in the UIP premia are much smaller for emerging markets than advanced economies. Consistently, figure 18 shows similar exchange rate movements in advanced economies and emerging markets and in high and low credibility countries. This is because there is not much difference now between these countries given the improvement in monetary policy credibility, where the low value is 0.51 and the high value is 0.6.

Figure 17: UIP During 2022–2023 FED Hikes



Notes: This figure shows the percentage change in 12 month UIP deviations relative to 2022q1, for AEs and EMs. UIP deviations are calculated as explained in the data section.

Figure 18: Exchange Rates During 2022–2023 FED Hikes



Notes: This figure shows the growth rate of nominal exchange rate (domestic currency/U.S. dollar) with respect 2022q1.

We do not have enough observations to run local projections with the US monetary policy shocks starting in 2022:Q1. We have run an alternative panel regression to nail down this point that emerging markets became resilient to sudden stops related to Fed hikes, as follows:

$$y_{ct} = \alpha_c + \delta_{year} + \gamma_1 Q_1 + \gamma_2 Q_2 + \gamma_3 Q_3 + \gamma_4 Q_4 + \varepsilon_{ct} \tag{7}$$

where y_{ct} is the dependent variable and includes exchange rate depreciation (year-on-year), real GDP growth (year-to-year), real investment growth (year-to year) and trade balance/GDP. All variables are in percentage. Controls include country fixed effects (α_c), year fixed effects (δ_{year}) and four dummies. The first dummy takes value one when quarter 0 is the sudden stop and so on ($\{Q_i\}_{i=1}^{4}$). We run equation (7) in two recent time periods in Panels B and C of Table 3, and show historical results for the same regression in Panel A from Eichengreen and Gupta (2017). Panel A covers 46 sudden stops during the period 1991-2015 for 20 EMs in 1991, 28 in 1995, and 34 from 2000 onwards. Panel B covers the only sudden stop in March 2020 for our EMs. Panel C covers the Fed Signal of Hikes as of December 2021 also for our EMs. Panels B) and C) don't include year fixed effects. As Table 3 clearly shows, sudden stop of March 2020 and signal of FED hike in December 2021 markedly differ from previous sudden stop episodes. Notably, there was a much lower currency depreciation, a less persistent drop in GDP and investment, and negligible impact on the trade balance. Historically, sudden stops are linked with current account reversals, typically evident by the third quarter. However, even in the fourth quarter following the Fed's rate hike signal, while there was a reversal, it did not significantly affect output and investment, indicating a newfound resilience to such shocks which may plausibly be ascribed to enhanced monetary policy credibility and reduced foreign exchange debt.

Table 3: Sudden Stops in EMs

	(1) ER depreciation	(2) GDP growth (yoy)	(3) Investment growth (yoy)	(4) Trade balance/GDP
Panel A: 1991-2015 (46 Sudden Stops)				
Quarter 1	10.126***	–2.270***	-6.019**	-0.662
	(4.37)	(3.09)	(2.75)	(1.12)
Quarter 2	12.853***	-5.521***	-9.038**	1.045
	(3.40)	(4.97)	(2.17)	(1.14)
Quarter 3	3.514**	-5.845***	-16.643***	2.506*
	(2.39)	(4.51)	(3.83)	(2.32)
Quarter 4	5.621	-5.193***	-14.447**	3.272***
	(1.67)	(2.95)	(2.46)	(2.84)
N	2,658	2,236	2,031	2,076
Adj. R-sq.	0.027	0.07	0.03	0.01
Panel B: 2020-2021 (Sudden Stop of March 2020)				
Quarter 1	3.389***	-11.478***	-19.971***	-1.084
	(3.59)	(8.62)	(5.05)	(1.18)
Quarter 2	-3.608***	-3.702***	-6.291	0.618
	(3.82)	(2.74)	(1.59)	(0.67)
Quarter 3	-2.941***	-1.124	-0.693	-1.412
	(3.11)	(0.83)	(0.18)	(1.53)
Quarter 4	-3.361***	2.053	5.554	-1.142
	(3.56)	(1.52)	(1.40)	(1.24)
N	130	127	110	120
Adj. R-sq.	0.463	0.549	0.409	-0.131
Panel C: 2021-2022 (Fed Signal of 2020 Hikes of December 2021)				
Quarter 1	-0.643	-0.286	-0.521	0.537
	(0.44)	(0.44)	(0.37)	(0.59)
Quarter 2	-1.271	-1.355**	0.339	0.914
	(0.86)	(2.06)	(0.24)	(1.00)
Quarter 3	2.201	-1.406**	0.778	-0.281
	(1.50)	(2.08)	(0.52)	(0.30)
Quarter 4	-0.506	-3.135***	-0.307	2.890***
	(0.34)	(4.64)	(0.2)	(2.84)
N	130	121	104	107
Adj. R-sq.	0.258	0.567	0.371	-0.086

Notes: This table summarizes the panel regression estimates of $y_{ct} = \alpha_c + \delta_{year} + \sum_{k=1}^{4} \gamma_k Q_k + \varepsilon_{it}$, where y_{ct} is the outcome for country c in quarter t, α and δ are country and year fixed effects. Panels B and C don't include year fixed effects. Q_k is a dummy variable that takes value one when t is k quarters after the sudden stop period. Dependent variables include: exchange rate depreciation, real GDP growth (year-to-year), real investment growth (year-to year) and trade balance/GDP. All variables are in percentage. t statistics are in parentheses. *, **, or *** indicate the coefficients are significant at 10, 5 or 1% level of significance, respectively. Panel A) is from Eichengreen and Gupta (2017) and it covers 46 sudden stops during the period 1991-2015 for 20 EMs in 1991, 28 in 1995, and 34 from 2000 onward. Panel B) covers the sudden stop in March 2020 for the EMs studied in this analysis (summarized in Table 1). Panel C) covers the Fed Signal of 2020 Hikes of December 2021 also for the EMs studied in this paper. Data is quarterly.

6 Conclusion

We ask why emerging markets showed resilience in the face of sharp and quick Fed hikes during the last two years. In the 1980s and 1990s, the global transmission of Fed hikes rooted in financial channels, often resulted in adverse repercussions for emerging markets characterized by sudden stops, increased UIP premia, capital outflows, and sharp recessions. In the post COVID-19 era, however, none of these events were observed. We argue that this is due to the improved monetary policy credibility and lower dollar denominated debt in emerging markets this time around compared to historical episodes.

With diminished risk sensitivity and reduced volatility of capital flows, emerging markets seem to be better insulated against the shifts in global investor sentiment and the risk-aversion shocks, which are associated with the Fed hikes. During the last two years, despite the sharply rising US interest rates, emerging market spreads have stayed stable with no major financial crises. Although inflation also rose quite dramatically in emerging markets, inflation expectations have remained largely anchored thanks to their improved monetary policy credibility.

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A Appendix

A.1 Policy credibility (IAPOC) Criteria

Table A1 below demonstrates how the three principles underpin the IAPOC metric, transparency, coherency, and consistency are systematically reflected in the design of the criteria, using the numerical targets of monetary policy as an example. The criteria that capture the availability of information (e.g., whether the body responsible for setting the numerical targets is stated) are related to the transparency principle (T). In turn, the ones that capture desirable policy practices (e.g., the medium-term nature of the numerical target) are related to the coherence principle (CH). Finally, the criteria that capture whether the numerical targets featured in Communications coincide with those identified in Policy and Operational Strategy are related to the consistency principle (CS). For the full set of criteria in the IAPOC metric, see Unsal, Papageorgiou and Garbers (2022).

Table A1: Criteria Related to the Numerical Targets

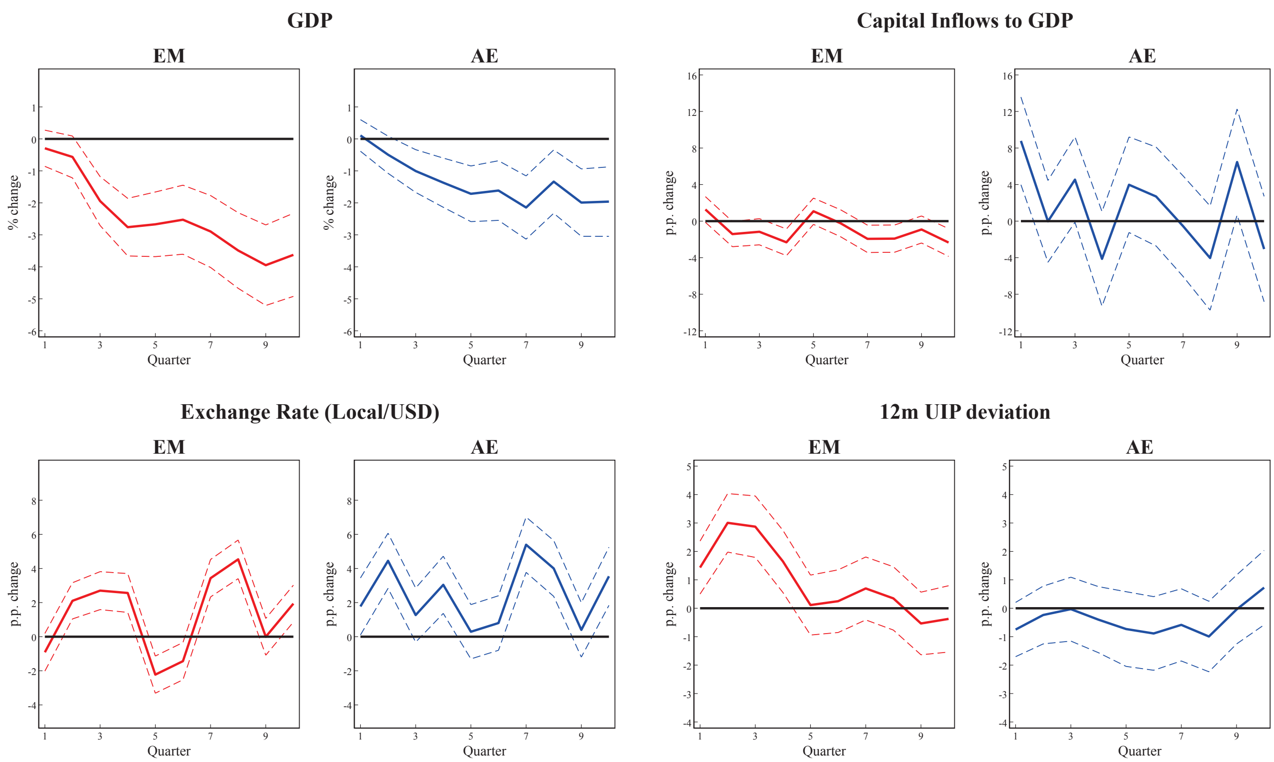
Criterion	Principle	Options and Scoring
INDEPENDENCE AND ACCOUNTABILITY		
2. Mandated Goals and Numerical targets		
2.2. By law, is it stated that there is a numerical monetary policy target?	**T**	Yes—1 No—0
2.2.1. By law, is it stated which body(s) is responsible for setting the numerical monetary policy target(s)?	**T**	Yes—1 No—0
2.2.1.1. By law, who sets the numerical monetary policy target(s)?	**CH**	The central bank and the government through joint consultations—1 The central bank or government alone—0.5 An individual—0
2.2.2. By law, is it stated how frequently the target(s) may be revised?	**T**	Yes—1 No—0
2.2.2.1. By law, how frequently may the target(s) be revised?	**CH**	At a fixed, low frequency, once every five or more years— 1 More Often—0
POLICY AND OPERATIONAL STRATEGY		
2. Numerical Targets		
2.1. Is it stated what the numerical targets are?	**T**	Yes—1 No—0
2.1.1. Does this include an inflation target?	**CH**	Yes—1 No—0
2.1.1.1. Is it stated which indices/data series define these targets?	**T**	Yes—1 No—0
2.1.1.2. Is it stated over which time horizon these targets should be met?	**T**	Yes—1 No—0
2.1.1.2.1. Is the time horizon for the inflation target the medium-term?	**CH**	Yes— 1 No—0
2.1.1.3. Is it stated under which conditions these targets may be revised?	**T**	Yes—1 No—0
2.1.1.3.1. Under which conditions may these targets be revised?	**CH**	Comprehensive review at a fixed frequency—1 Other—0
2.1.1.4. Have any of these targets been revised?	**CH**	No; or through a comprehensive review—1 Not through a comprehensive review—0
2.1.1.5. Is it explained how the objectives map into these targets?	**CH**	Yes—1 No—0
4. Policy Formulation		
4.2. Is it stated which objectives and numerical targets guide policy formulation?	**T**	Yes—1 No—0
4.2.1. Does policy formulation center around the outlook for the objectives and numerical targets, including an inflation target?	**CH**	Yes—1 No—0
4.2.2. If there are multiple objectives and numerical targets guiding policy formulation, is it explained how these, including an inflation target, are balanced?	**CH**	Yes—1 No—0
COMMUNICATIONS		
2. Announcing and Explaining the Policy Stance		
2.1. Is there a statement of monetary policy decisions?	**T**	Yes—1 No—0
2.1.3. Is there a statement explaining policy decisions?	**T**	Yes—1 No, or only when tools are changed—0
2.1.3.1. Are the objectives and numerical targets in the explanation consistent with Policy and Operational Strategy?	**CS**	Yes—1 No—0
2.1.3.1.1. Is there a discussion of the outlook for the objectives and numerical targets, including an inflation target?	**CH**	Yes—1 No—0
2.1.3.1.2. Is there a discussion of the risks to the outlook for the objectives and numerical targets, including an inflation target?	**CH**	Yes—1 No—0

Note: See Unsal, Papageorgiou and Garbers (2022) for the full set of criteria in the IAPOC metric. T, CH, and CS indicate whether the criterion is related to the transparency, coherence, and consistency principle, respectively. "Inflation target" refers to an inflation or price-level target.

A.2 Robustness of Figure 10

We re-run specification (1) and control for FX reserves to GDP. We show results in Figure A1. Results are very close to those in Figure 10, with the exception that now, there is also depreciation in AEs.

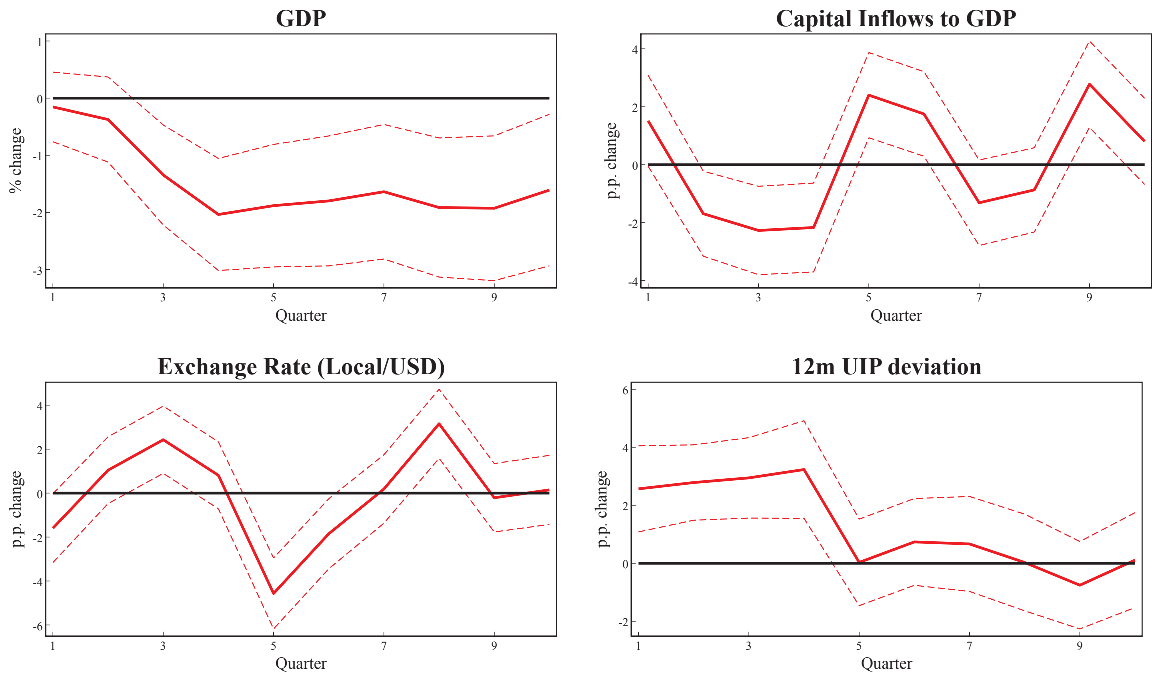
Figure A1: International Transmission of FED Hikes: Emerging vs. Advanced Economies (GK surprises), controlling for FX reserves



Notes: Impulse responses of 12-month US treasury rate instrumented by monthly weighted raw surprises in 3-month Fed Fund Futures (FF4) from Gertler and Karadi (2015) are obtained from panel local projections. 90% confidence intervals (calculated using Newey-West standard errors) are shown by the shaded areas. Controls include four lags of the: dependent variable, U.S. 12-month treasury rate, output growth and inflation differentials with the U.S., the instrument and FX reserves to GDP. Dependent variables include: real GDP in logs, quarter-to-quarter nominal exchange rate growth (domestic currency/U.S. dollar), 12m UIP deviations which are defined as explained above, and the ratio of total inflows to GDP.

We also re-run specification (1) for the smallest sample (only for the 15 countries in the FX debt sample) as a robustness. We show results in Figure A2. Results are very close to those in Figure 10.

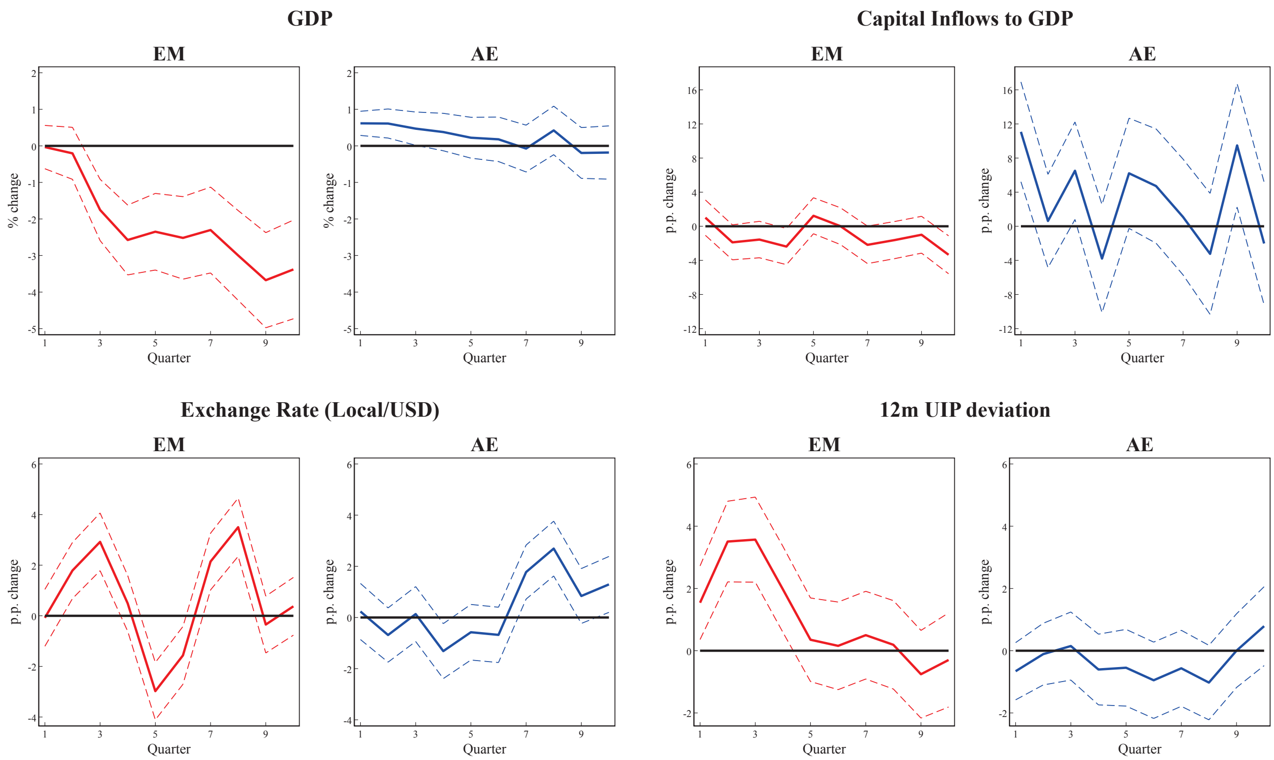
Figure A2: International Transmission of FED Hikes: Emerging Economies (GK surprises), Smallest Sample



Notes: Impulse responses of 12-month US treasury rate instrumented by monthly weighted raw surprises in 3-month Fed Fund Futures (FF4) from Gertler and Karadi (2015) are obtained from panel local projections. 90% confidence intervals (calculated using Newey-West standard errors) are shown by the shaded areas. Controls include four lags of the: dependent variable, U.S. 12-month treasury rate, output growth and inflation differentials with the U.S., and the instrument. Dependent variables include: real GDP in logs, quarter-to-quarter nominal exchange rate growth (domestic currency/U.S. dollar), 12m UIP deviations which are defined as explained above, and the ratio of total inflows to GDP. We run this for the 15 countries in the smallest sample, which all are EMs.

In Figure A3 we run specification (2) where we drop commodity exporters. Results are in line with Figure 12.

Figure A3: International Transmission of FED Hikes: Emerging vs. Advanced Economies with Global Controls and Dropping Commodity Exporters



Notes: Impulse responses of 12-month US treasury rate instrumented by monthly weighted raw surprises in 3-month Fed Fund Futures (FF4) from Gertler and Karadi (2015) are obtained from panel local projections. 90% confidence intervals (calculated using Newey-West standard errors) are shown by the shaded areas. Controls include four lags of the: dependent variable, U.S. 12-month treasury rate, output growth and inflation differentials with the U.S., instrument, dollar shock, average oil price index, and median trade balance. Global controls (the last three) also enter contemporaneously. Dependent variables include: real GDP in logs, quarter-to-quarter nominal exchange rate growth (domestic currency/U.S. dollar), 12m UIP deviations which are defined as explained above, and the ratio of total inflows to GDP. We drop commodity exporters, following the World Economic Outlook's classification

A.3 Robustness of Policy Credibility and Balance Sheet FX Vulnerabilities

As a robustness of our exercise of policy credibility, we run the following specification:

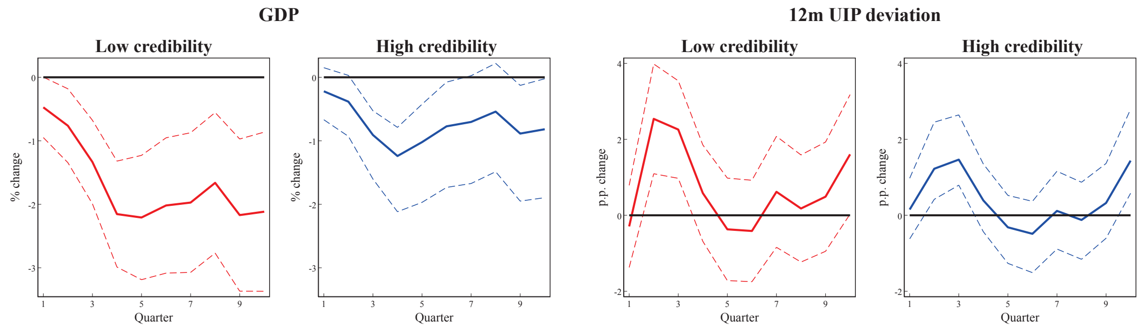
$$y_{c,t+h} = \alpha_c + \beta_{1,h}\hat{i}_t^{US} + \beta_{2,h}\hat{i}_t^{US} * IAPOC_{c,t-1} + \gamma X_t + \theta IAPOC_{c,t-1} + \sum_{i=1}^{i=4} \omega_i X_{t-i} + \sum_{i=1}^{i=4} \eta_i x_{c,t-i} + \varepsilon_{c,t+h} \tag{8}$$

Relative to specification (3), in (8) we use the time varying IAPOC variable, lagged one period. To calculate the effect of the U.S. monetary policy shock on countries with high vs low policy credibility, we calculate the marginal effect of a U.S monetary policy shock as follows:

$$\frac{\partial y}{\partial \hat{i}} = \beta_{1,h} + \beta_{2,h} * IAPOC_{t-1} \tag{9}$$

and we evaluate equation (9) at the p25 of the $IAPOC$ distribution for the low credibility country and at the p75 of the $IAPOC$ distribution for the high credibility country. We show results in Figure A4. Results are robust to what we found in Figure 14.

Figure A4: International Transmission of FED Hikes: The Role of Policy Credibility with Global Controls (GK Surprises), Alternative Specification



Notes: Impulse responses of 12-month US treasury rate instrumented by monthly weighted raw surprises in 3-month Fed Fund Futures (FF4) from Gertler and Karadi (2015) are obtained from panel local projections. 90% confidence intervals (calculated using Newey-West standard errors) are shown by the shaded areas. Controls include four lags of the: dependent variable, U.S. 12-month treasury rate, output growth and inflation differentials with the U.S., instrument, dollar shock, average oil price index, and median trade balance. Global controls (the last three) also enter contemporaneously. Dependent variables include: real GDP in logs and 12m UIP deviations which are defined as before. See text above for the definition of high and low credibility countries.

We do a similar exercise for the balance sheet FX vulnerabilities by running:

$$y_{c,t+h} = \alpha_c + \beta_{1,h}\hat{i}_t^{US} + \beta_{2,h}\hat{i}_t^{US} * FX_{c,t-1} + \gamma X_t + \theta FX_{c,t-1} + \sum_{i=1}^{i=4} \omega_i X_{t-i} + \sum_{i=1}^{i=4} \eta_i x_{c,t-i} + \varepsilon_{c,t+h} \tag{10}$$

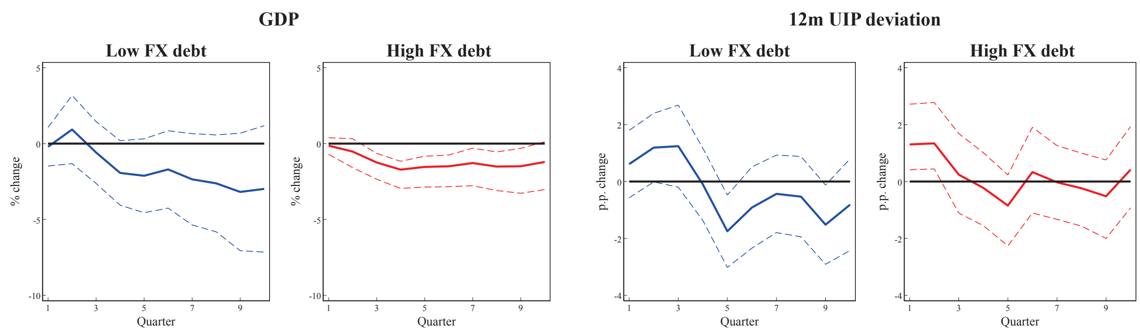
Relative to specification (5), we now use a time varying measure of FX debt, lagged. In particular, we use Bénétrix, Gautam, Juvenal and Schmitz (2019) measure of total external debt to GDP as measure of FX debt in this case.

To calculate the effect of the U.S. monetary policy shock on countries with high vs low FX debt, we calculate the marginal effect of a U.S monetary policy shock as follows:

$$\frac{\partial y}{\partial \hat{i}} = \beta_{1,h} + \beta_{2,h} * FX_{t-1} \tag{11}$$

and we evaluate equation (11) at the p25 of the FX distribution for the low FX debt country and at the p75 of the FX distribution for the high FX debt country. We show results in Figure A5, which are in line with our findings of Figure 15.

Figure A5: International Transmission of FED Hikes: The Role of Balance Sheet FX Vulnerabilities with Global Controls (GK Surprises), Alternative Specification



Notes: Impulse responses of 12-month US treasury rate instrumented by monthly weighted raw surprises in 3-month Fed Fund Futures (FF4) from Gertler and Karadi (2015) are obtained from panel local projections. 90% confidence intervals (calculated using Newey-West standard errors) are shown by the shaded areas. Controls include the dollar shock, average oil price index, and median trade balance and four lags of the: dependent variable, U.S. 12-month treasury rate, output growth and inflation differentials with the U.S., and the instrument. In this case we did not add 4 lags of dollar shock, average oil price index, and median trade balance because of the limited sample. Dependent variables include: real GDP in logs and 12m UIP deviations which are defined as before. See text above for the definition of high and low FX debt countries.

A.4 Variables

In this section we describe the variables used in the paper, how they are constructed, their country coverage and their sources.

Local projections. The dependent variables we use are as follows:

1. GDP: real seasonally adjusted

2. CPI: period average

3. Nominal exchange rate: defined as domestic currency/U.S. dollar, period average
4. Capital inflows to GDP: defined as the sum of bank, central bank, corporate and government portfolio debt and other investment debt flows (loans) to GDP ratio
5. 12m UIP deviation: calculated as the difference between log interest rate differentials and the gap between log expected and spot exchange rate, all at the same horizon. Log interest rate differentials are the short-term government bond or policy rate differentials vis-à-vis the United States. The log expected exchange rate is the 12-month ahead expected exchange rate as of month t and the log exchange rate is the spot rate, both nominal and in terms of local currency per U.S. dollar.

The global and country specific controls we use:

1. Median trade balance to GDP: within quarter median trade balance to GDP for each group of countries (EM and AEs).
2. Dollar shock: nominal major currencies U.S. dollar index
3. Oil price index: crude oil (petroleum) simple average of three spot prices; Dated Brent, West Texas Intermediate, and the Dubai Fateh
4. FX reserves to GDP

The shocks used are:

1. US 12m treasury bill
2. Gertler and Karadi (2015) shock: averaged monthly weighted raw surprises in 3-month Fed Fund Futures (FF4) from Gertler and Karadi (2015)

3. Monetary policy surprise from Bauer and Swanson (2023): the first principal component of the changes in the first four quarterly Eurodollar futures contracts (ED1–ED4) around FOMC announcements, which is re-scaled so that a one-unit change in the principal component corresponds to a 1 percentage point change in the ED4 rate.

Two key variables in our analysis are the monetary policy credibility index (IAPOC) and the FX debt to total credit to the non-financial sector:

1. IAPOC: new index that proxies monetary policy credibility developed by Unsal, Papageorgiou and Garbers (2022) using a narrative approach similar to Romer and Romer (1989) for 50 countries between 2007-2021. This index characterizes monetary policy frameworks across three pillars: (i) (IA) Independence and Accountability, which provides the foundations of monetary policy; (ii) (PO) Policy and Operational Strategy, which guides adjustments to the policy stance given the objectives, as well as adjustments to the policy instruments to implement the policy stance; and (iii) (C) Communications, which convey decisions about the policy stance and rationale to the public. In order to cover these pillars at sufficient clarity and comprehension within the IAPOC index, Unsal, Papageorgiou and Garbers (2022) formulate 225 criteria, which are then assessed against the public information from countries' central bank laws and websites.

2. FX debt to total credit to the non-financial sector. Total credit data includes total loans and debt securities used for borrowing by the residents in the non-financial sector of a given economy, in both domestic and foreign currencies and from both domestic and foreign lenders. By dividing the sum of loans and bonds in FX for the non-financial sector by the sum of total loans and bonds for the

non-financial sector from the total credit database, we obtain the country-level non-financial sector FX debt share.

Below we present key descriptive statistics of the variables used in the cross country analysis:

Table A2: Descriptive Statistics (1990q1-2019q4)

	mean	sd	min	max
ln(GDP)	7.583	3.466	0.377	19.034
ln(CPI)	4.121	1.202	-9.602	6.243
12m UIP deviation	0.023	0.042	-0.114	0.158
Exchange rate (% change, q/q)	0.020	0.101	-0.438	2.550
Capital inflows to GDP	0.036	0.093	-0.170	0.690
12m US treasury rate	0.032	0.023	0.001	0.083
GK(15) shock	-0.011	0.030	-0.179	0.056
BS(23) surprise	-0.008	0.091	-0.342	0.214
Dollar shock	-0.005	0.334	-0.850	0.868
Median trade balance	-0.008	0.019	-0.060	0.042
ln(oil price index)	4.435	0.650	3.312	5.478
IAPOC index	0.603	0.147	0.194	0.818
FX debt to total credit to the NFS	0.145	0.146	0.013	0.794
Total external debt to GDP (Bénétrix et al, 2019)	0.730	0.775	0.138	5.268
FX reserves to GDP	15.988	14.865	0.194	113.472
Investment growth (yoy)	3.652	10.164	-83.475	61.967
Trade balance/GDP change	0.021	4.086	-69.465	73.246

Note: this table summarizes the descriptive statistics of the variables used in the cross-country analysis for the period 1990q1-2019q4. Variables are as explained above.

Additional variables used. As an auxiliary variable on FX debt, we rely on the total external debt to GDP from Bénétrix, Gautam, Juvenal and Schmitz (2019) dataset that uses as input the currency composition of the main IIP components from the IMF, as well as IMF's Coordinated Portfolio Investment Survey (CPIS), portfolio debt data reported to the European Central Bank (ECB) and banks cross-border positions reported to the Bank of International Settlements (BIS) available through its

Locational Banking Statistics (LBS).

Primary Deficit data is Central Government's last 12-month primary balance to nominal GDP ratio, and budget deficit data is calculated by adding Central Government's last year interest expense share to primary deficit ratio. Domestic Debt to GDP ratio is Public Sector Net Debt to GDP ratio covering total public gross debt stock, unemployment insurance fund net assets, public sector assets, and central bank net assets to last year's GDP. External Debt to GDP ratio is the Gross External Debt Stock to GDP ratio covering short and long term debt stocks of public sector, CBRT, and private sector.

For Figures 5 and 6 we use fiscal deficit (primary and budget deficits) to GDP, domestic debt to GDP measured as Public Sector Net Debt to GDP ratio covering total public gross debt stock, unemployment insurance fund net assets, public sector assets, and central bank net assets to last year's GDP. External Debt to GDP ratio is the Gross External Debt Stock to GDP ratio covering short and long term debt stocks of public sector, CBRT, and private sector. Monetary policy rates, deposit rates, CPI inflation, nominal exchange rate (Turkish lira/U.S. dollar), 12 month and 24 month ahead inflation expectations, and the change of the IAPOC index for Turkey.

In the following table we summarize the data sources:

Table A3: Data sources

Variable	Source
GDP	WEO, IFS and national bureau of statistics
CPI	IFS
Nominal exchange rate	IFS
Capital inflows to GDP	Avdjiev et al. (2022)
12m UIP deviation	Bloomberg and Consensus Forecast
US 12m treasury bill	Bloomberg
Gertler and Karadi (2015) shock	Updated version of Gertler and Karadi (2015)
Bauer and Swanson (2023) surprise	Bauer and Swanson (2023)
IAPOC	Unsal et al. (2022)
FX debt	BIS, Fan and Kalemli-Özcan (2016) and Kalemli-Özcan et al. (2021)
Total external debt to GDP	Bénétrix, Gautam, Juvenal and Schmitz (2019)
Total external FX debt to GDP	Bénétrix, Gautam, Juvenal and Schmitz (2019)
Trade balance to GDP	IFS
Dollar shock	FRED
Oil price index	IMF
FX reserves to GDP	IFS
Turkey's fiscal deficit	IMF and Turkey's MoF
Turkey's domestic debt	Turkey's MoF and TURKSTAT
Turkey's external debt	Turkey's MoF
Inflation expectations	CBRT EVDS database, Survey of Market Participants

A.5 Countries and Time Coverage

Our data is of quarter frequency, and covers the period 1990q1-2023q1. In our analysis, we drop hard pegs and dual markets exchange rate countries, i.e. classifications 1 and 6 from Ilzetzki, Reinhart and Rogoff (2022). Since this classification goes through 2019, we use the 2019 through 2023. We work with an unbalanced panel composed of managed and pure floats.

We have a total of 59 countries in the big sample which we use to run the EM vs AE exercises. From the 50 countries that are in the IAPOC sample, we work with 34 since we drop LICs+, hard pegs, free falling regimes and the United States. In the FX debt exercise we run it for 15 countries, due to data availability.

The countries in our sample, and the ones we use in each exercise are summarized in the table below.

Table A4: Country Sample

Albania	Costa Rica	India*$	Mexico*$	Singapore
Argentina*$	Croatia	Indonesia*$	Morocco	Slovak Republic
Armenia*	Czech Republic*	Ireland	New Zealand*	South Africa*$
Australia*	Denmark	Israel*	Norway*	Spain
Azerbaijan	Euro Area*	Italy	Pakistan*	Sweden*
Belarus	Ecuador	Japan*	Paraguay	Switzerland
Brazil*$	Egypt Arab	Kazakhstan*	Peru*$	Thailand*$
Bulgaria	Finland	Korea	Philippines*$	Tunisia
Canada*	Germany	Latvia	Poland*	Turkey*$
Chile*$	Guatemala	Malaysia*$	Romania	United Kingdom*
China*$	Hungary*	Malta	Russian Federation*$	Uruguay*
Colombia*$	Iceland*	Mauritius*	Serbia*	

Note: We follow the IMF 2000 World Economic Outlook country groups classification. Because we measure U.S. monetary policy spillovers, we drop the U.S.
* indicates that we have the monetary policy credibility index (IAPOC) for this country
$ indicates that we have the direct measure of FX debt exposure of the private sector for this country
Red text indicates a country is an emerging market