U.S. Monetary Policy and International Risk Spillovers *

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Abstract

I show that monetary policy divergence vis-a-vis the U.S. has larger spillover effects in emerging markets than advanced economies. The monetary policy of the U.S. affects domestic credit costs in other countries through its effect on global investors' risk perceptions. Capital flows in and out of emerging market economies are particularly sensitive to fluctuations in such risk perceptions and have a direct effect on local credit spreads. Domestic monetary policy is ineffective in mitigating this effect as the pass-through of policy rate changes into short-term interest rates is imperfect. This disconnect between short rates and monetary policy rates is explained by changes in risk perceptions. A key policy implication of my findings is that emerging markets' monetary policy actions designed to limit exchange rate volatility can be counterproductive.

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I. Introduction

A central issue in international macroeconomics regards the transmission of seemingly unrelated events, or "shocks," between countries. International economic and financial spillovers become complicated to understand in an increasingly integrated world, where firms, investors, and entrepreneurs face not only national or industry-specific shocks, but also global risks. As laid bare by the complex nature of the 2008 global financial crisis, policymakers must pursue domestic stabilization mandates in an increasingly interconnected global economy, in which a combination of financial and trade linkages tie domestic outcomes to global factors. Among these factors, U.S. monetary policy developments retain a major influence. As a result, there is a great need for policymakers to understand the consequences of these spillovers, and to incorporate them into their decisions.[1]

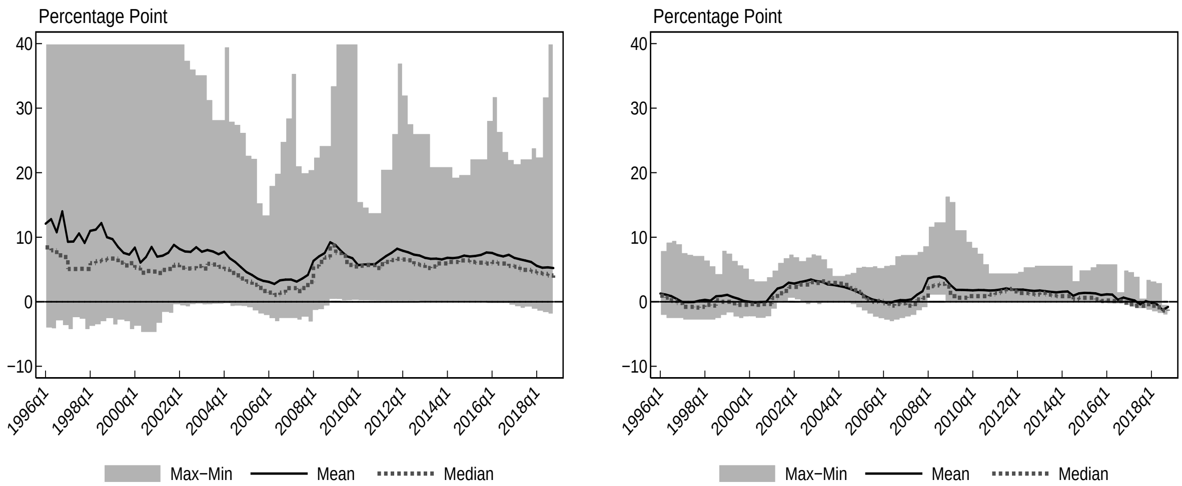
In this paper, I argue that the transmission mechanism for monetary policy spillovers has changed in recent decades, especially for emerging market economies (EMEs) whose policymakers must respond to particularly challenging spillovers. In popular discourse, when the center country—most often the U.S.—runs a contractionary monetary policy, policy rate differentials across the world ($i_{country} - i_{US}$) contract, affecting short-term and possibly long-term market interest rates. Global investors re-balance their portfolio by shifting capital from low interest rate countries to the high interest rate center. When the reverse happens during an expansionary cycle by the U.S. Federal Reserve, interest rate differentials increase and capital flows out of the United States. Global investors' "yield-oriented" nature is the key explanation for these movements in capital flows.

This paper documents a series of patterns that challenge this line of reasoning, particularly for EMEs. I argue that monetary policy divergence vis-a-vis the U.S., reflects sensitivity of capital flows to risk perceptions that are affected by the changes in U.S. monetary policy. These differentials also reflect monetary policy actions of other countries as a response to changes in risk premia. I argue that these actions are not only ineffective, but can also potentially be counterproductive.

Chart 1 shows the considerable policy rate differentials faced by EMEs: In any given quarter, realized policy differentials are much higher and much more dispersed for EMEs than for advanced

[1] Speech by Jerome H. Powell on Monetary Policy in the Post-Crisis Era, at "Bretton Woods: 75 Years Later-Thinking about the Next 75," conference, Banque de France and the French Ministry for the Economy and Finance, Paris, France, July 16, 2019.

Chart 1: Monetary Policy Divergence



(a) Emerging Market Economies

(b) Advanced Economies

Notes: Policy rate differentials are plotted in logs, $log(1+i) - log(1+i_{US})$, where i is the domestic policy rate, and i_{US} is the U.S. policy rate. Policy rates are obtained from International Monetary Fund (IMF), International Financial Statistics (IFS) and Bloomberg and are the last announced rates in a given quarter. I use quarterly observations from 79 emerging markets economies (EMEs) and 13 advanced economies (AEs) excluding hard pegs, which are coded as "1" in the coarse classification of Ilzetzki et al. (2017).

economies (AEs), with an average differential that is consistently positive. Part of the difference reflects higher average inflation rates and more volatile and heterogeneous fundamentals for EMEs.[2] However, the difference also reflects international investors' risk perceptions and endogenous policy responses to associated risk premia. In turn, risk premia play a central role in determining how capital flows respond to a given rate differential and affect domestic spreads, both of which affect the policymakers' decision making.

The first main point is that the relationship between interest rate differentials and capital flows depends on local and global risk perceptions and appetite, especially for EMEs. Global "risk-on" and "risk-off" shocks interact with country-specific risk and result in larger risk premia for EMEs, increasing interest rate differentials.

Second, the assumption that monetary policy will be "on hold" for countries with floating exchange rate regimes when the center country's monetary policy changes is at odds with the facts.

[2] The dispersion in rate differentials for EMEs remains, when I plot real rate differentials. I prefer using policy and/or short-term nominal rates to measure monetary policy divergence. A similar picture emerges, when I plot 3-month government bond rate differentials and 10th-90th percentile range for policy rate differentials. These additional charts can be found in the Appendix.

In practice, other countries' interest rates move in response to the U.S. rate change. I find that in response to an exogenous increase in the U.S. policy rate, AEs interest rates rise, but less than one for one, such that the rate differential declines. Conversely, EMEs interest rates increase more than one for one, resulting in an increase in the rate differential. Although this exercise cannot discern the direction of monetary policy responses, whether countries run contractionary or expansionary monetary policies on average as a response to a contractionary U.S. policy, the exercise confirms that monetary policy in other countries is not "on hold" when monetary policy changes in the U.S.

Third, when domestic monetary policy responds to the effects of capital inflows on local financial conditions, the pass-through to domestic credit costs is less than one-for-one. The incompleteness of this pass-through is a function of risk premia. I document that there is a wedge between domestic policy rates, and the short-term deposit, and loan rates that govern saving and borrowing decisions in EMEs, but not in AEs. Hence, even if domestic monetary policy responds to changes in U.S. rates, contributing to the heterogeneity we see in Chart 1, capital flows still affect spreads. In contrast, in AEs capital flows have no effect on domestic lending spreads when the domestic monetary policy response is taken into account.

To sum up, the dispersion in monetary policy divergence for EMEs results from the fact that capital flows to emerging markets are particularly "risk-sensitive." Risk-sensitivity is affected both by the U.S. policy and country-specific risk, and monetary policies in EMEs respond to this risk-sensitivity.

This mechanism through which monetary policy divergence relates to capital flows complicates the stabilization mandates of EMEs' central banks. Historically, when a positive policy rate differential opened up between a country and the U.S., the resulting capital flows were absorbed by the sovereigns, and these flows affected the private sector only through their indirect effects on government deficits. The composition of capital flows has changed for EMEs in recent decades with a growing share of private sector flows. EMEs, who mostly have bank-based financial systems in which domestic banks have a central role in intermediating capital flows, now have a harder time in dealing with policy spillovers as domestic banks borrow cheaply when U.S. rates and global risks are low. These banks then pass their cheap funding costs through, which become cheap borrowing costs for firms and households. When U.S. rates and global risk aversion rise, the reverse happens and capital flows out, which has a direct effect on economy-wide local credit spreads by forcing banks to provide less credit. I refer to this phenomenon as international risk spillovers.

Can exchange rate flexibility help EMEs in their stabilization mandates? I argue that the case for flexible exchange rates is stronger under international risk spillovers exactly because the domestic monetary policy transmission is imperfect. The exchange rate has a dual role in the transmission of monetary policy spillovers. Standard international macro theory postulates that countries should let their exchange rates carry the burden of adjustment when financial conditions change in the rest of the world. A monetary policy tightening slows down economic activity in the center country, which decreases its external demand. However, the associated appreciation (depreciation in the rest of the world) helps other countries increase their exports to the center, and cut back their imports from the center. If these countries are also net borrowers and experience capital outflows due to tightening of monetary policy in the center, then a depreciating currency is the only force to combat reduced activity by switching external demand to their goods. This channel, known as the expenditure switching channel of the Mundell-Fleming model, highlights the virtue of flexible exchange rates.[3]

The standard justification for flexible exchange rates has been challenged on the basis of the negative effects of excessive exchange rate volatility on countries with extensive debt denominated in foreign currency. Calvo and Reinhart (2002) documented a pervasive "fear of floating," where the "fear" is linked to liability dollarization.[4] In addition, the evidence on the benefits of expenditure switching effects offsetting external shocks is weak.[5] For example, the announcement of the second round of quantitative easing in 2010 caused capital to flow to EMEs, which led to the appreciation of their currencies combined with increased economic activity. Similarly, the Fed's "tapering" announcement in 2013 triggered an outflow of capital from EMEs, leading to depreciations of their currencies combined with slowdowns in their economies. The most recent monetary tightening cycle

[3]For an expansionary monetary policy in the center, increased demand for exports of other countries will be counteracted by appreciating currencies of other countries. This mechanism has been at the center of the "currency wars" debate due to expansionary policies in the U.S. in the aftermath of the 2008 crisis that depreciated the U.S. dollar. The U.S. was accused for waging a currency war on other countries by Brazil's finance minister Guido Mantega in September 2010. Recently, on June 19, 2019, U.S. president Donald Trump, similarly complained to ECB President Mario Draghi that the accommodative policies of the ECB had depreciated the euro, which made it unfairly easier for Europeans to compete against the U.S.

[4]Another argument for preventing exchange rate volatility is the high degree of pass-through into domestic inflation in emerging markets as argued by Burstein and Gopinath (2014).

[5]Expenditure switching might be dampened under dominant currency pricing. Gopinath (2016)'s Jackson Hole paper argues that expenditure switching effects work mostly via imports if trade is invoiced in a dominant currency. See also Gopinath et al. (2019) for international evidence and a model of dominant currency pricing.

in the U.S. is no exception, as it has contributed to volatility in emerging markets most notably Turkey and Argentina, during the summer of 2018. Policymakers argue that capital flows lead to excessive borrowing and overheating in their economies on their way in, and slowdowns on their way out, to justify their interventions into foreign exchange markets.

Rey (2013)'s Jackson Hole paper argues that exchange rate flexibility does not matter for the spillover effects of U.S. monetary policy on other countries; countries with fixed and flexible regimes are all affected by the global financial cycle (GFC). The GFC is defined as synchronized surges and retrenchments in gross capital flows, with associated booms and busts in risky asset prices and leverage and has a common component linked to changes in U.S. monetary policy. Rey (2013) argues that countries' domestic monetary policies cannot undo the effects of U.S. policy spillovers since U.S. monetary policy affects leverage of global banks and credit growth in the international financial system. Monetary conditions are transmitted from the U.S. to the rest of the world through gross credit flows and leverage, irrespective of other countries' exchange rate regimes.

However, if monetary policy spillovers work through changes in risk perceptions, as I argue, exchange rate flexibility might help. The reasoning is as follows. Domestic monetary policy in EMEs is ineffective due to changes in foreign investors' risk perceptions that are correlated with risk premia. The same risk premia also explain the disconnect between exchange rate movements and interest rate differentials, or put differently, deviations from uncovered interest parity (UIP) condition. This means that when U.S. tightens, an emerging market that wants to use monetary policy to limit exchange rate volatility needs to implement a much larger increase in the domestic policy rate since U.S. tightening increases the risk premia. Such a large increase in the policy rate can be counterproductive by increasing credit costs, spreads, and country risk with dire consequences for the real economy even if the exchange rate stabilization is successful, and it may not be.[6] The evidence provided in the paper supports this reasoning as the UIP deviations are correlated with the changes in risk premia, both in EMEs and in AEs, but the source of this correlation differs. In AEs, UIP deviations comove with exchange rate fluctuations, while in EMEs, the deviations comove with interest rate differentials.[7] As most EMEs are managed floats, their exchange rates are not free to pick up the changes in risk premia. I show that free floating EMEs

[6] See Akinci and Queralto (2019) for a model of spillovers with UIP deviations and balance sheet effects that implies much bigger welfare gains under the policy of floating exchange rates.

[7] See Kalemli-Ozcan and Varela (2019).

are much more insulated from U.S. monetary policy driven risk shocks than EMEs with managed floats in a world of international risk spillovers.

In section II, I present stylized facts on the relationship between monetary policy divergence and capital flows, and explain the observed movements with changes in risk perceptions using quarterly data since 1996 for 55 countries. Section III lays out a simple theoretical framework to highlight the risk channel that I propose for monetary policy spillovers. In Section IV, I provide empirical support for this framework by showing the relationship between risk perceptions, imperfect domestic monetary policy transmission, and capital flows. Section V provides additional evidence on the mechanics of transmission by linking monetary policy divergence, risk perceptions, and UIP deviations. Section VI discusses outstanding issues such as the role of the monetary policy of other center countries, and presents robustness analysis. Section VII discusses policy implications. Section VIII concludes.

II. Monetary Policy Divergence, Capital Flows and Risk Premia

In this section, I begin with a set of descriptive findings on monetary policy divergence, capital flows and risk premia implied by changing risk sentiments, which I then complement with more formal panel regression results.

Consistent with the residence principle of balance-of-payments statistics, I use the term "inflows" to refer to changes in the financial liabilities of a domestic country vis-a-vis foreigners (nonresidents). I focus on gross capital inflows, that is what foreign investors bring in and what they take out from a given country, and will not focus on capital outflows by domestic residents. I will use the terms capital inflows and capital flows interchangeably throughout the paper as refereing to actions of foreign investors. In EMEs, net capital flows (capital inflows by foreigners (liabilities) minus capital outflows by domestic residents (assets)—equivalently the current account with a reverse sign) are mainly driven by the actions of foreign investors (Bluedorn et al. (2013), and Avdjiev et al. (2019)). These capital inflows can be positive or negative during any given quarter, as foreign investors can increase or reduce their financial exposures to a given country. Since I am interested in the behavior of international investors, the behavior of domestic residents—capital outflows—is not relevant for my purposes.[8]

I obtain gross capital inflows from the International Monetary Fund's (IMF) Balance of Payments database. Capital inflows are reported both in total and by their components: FDI flows, Portfolio Equity flows, Portfolio Bonds flows, and Other Investment Flows. As shown by Avdjiev et al. (2019), the largest component of capital flows is debt flows (portfolio bond flows and other investment flows), both for AEs and EMEs. In addition, global financial intermediaries have an important role in intermediating capital flows between countries (as opposed to direct access to equity markets in lender countries by borrower countries). For these reasons, I focus on total debt flows.[9]

Although Chart 1 uses policy rate differentials from 79 EMEs and 14 AEs, capital flows data at the quarterly level are much more limited, especially for EMEs. From the IMF, Balance of Payments Statistics and from Avdjiev et al. (2019), I have quarterly data on capital inflows since 1996 on 55 EMEs and 14 AEs. On average, 67 percent of total external liabilities to foreigners are debt flows in AEs, compared to 54 percent in EMEs, over the period 1996–2018.

Chart 2 plots the time series of policy rate differentials and capital inflows during the entire sample period. There appear to be two regimes, pre and post crisis.[10] Between 1996 and 2008q3, capital inflows and policy rate differentials moved largely in tandem for EMEs and were negatively correlated for AEs. The correlations broke down with the onset of the crisis, as capital flows fell to very low levels and stayed low for the next decade, for all countries. Thus, the relationship in panel (a) for all countries is mainly driven by EMEs.

What drives the comovement between policy differentials and capital flows? Historically, sovereign borrowing played a major role, especially for EMEs. The literature on global push factors, capital flows and boom-bust cycles goes back to the influential work of Diaz-Alejandro (1983), Calvo et al. (1993) and Calvo et al. (1996),[11] who argued that interest rate differentials affect the

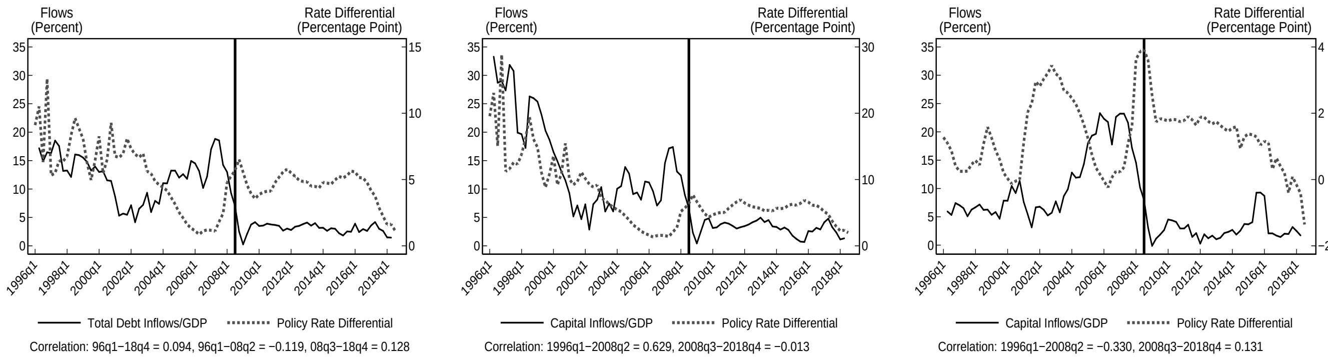
[8]If domestic residents fully offset what foreigners do then this assumption might be problematic. As shown by Avdjiev et al. (2019) this is never the case for EMEs. Even for AEs, where outflows by domestic residents might offset some of the inflows by foreigners, different domestic sectors behave differently. We show that the strong correlation between capital inflows and outflows in AEs that is found in the literature is due to banking sector inflows and outflows.

[9]Section VI shows additional results with total capital flows including equity.

[10]The crisis period starts in 2008q3 with the collapse of Lehman Brothers. Some countries with capital flows data have missing policy rate data, which is why this chart has fewer observations than 55 emerging markets and 14 advanced countries. Country-quarter observations with hard pegs are dropped as in Chart 1.

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

Chart 2: Monetary Policy Divergence and Capital Flows



(a) All Countries (b) Emerging Market Economies (c) Advanced Economies

Notes: Policy rate differentials are in logs and vis-a-vis the U.S. Capital flows are normalized by GDP and plotted as three quarter moving averages. All variables are averaged across countries in a given date. Quarterly observations are from 46 EMEs and 13 AEs.

demand for government bonds. Since during 1980s and 1990s, the main form of borrowing/lending, especially for EMEs, involved sovereigns, capital inflows were dominated by sovereign activity. But more recently, this tight link has begun to weaken. As shown in Chart 3, the comovement patterns of total flows only partially reflect sovereigns' external borrowing, where the correlation between sovereign inflows and policy divergence is very different than the one for total flows and policy divergence shown before.[12] Since the late 1990s there has been a compositional change from sovereign flows to private flows, especially for EMEs. These changes made it increasingly likely that the transmission mechanism from policy differentials to capital flows has changed. Private capital flows are generally more sensitive to global risk aversion, proxied by the VIX index, relative to sovereign flows, as shown by Avdjiev et al. (2019).[13]

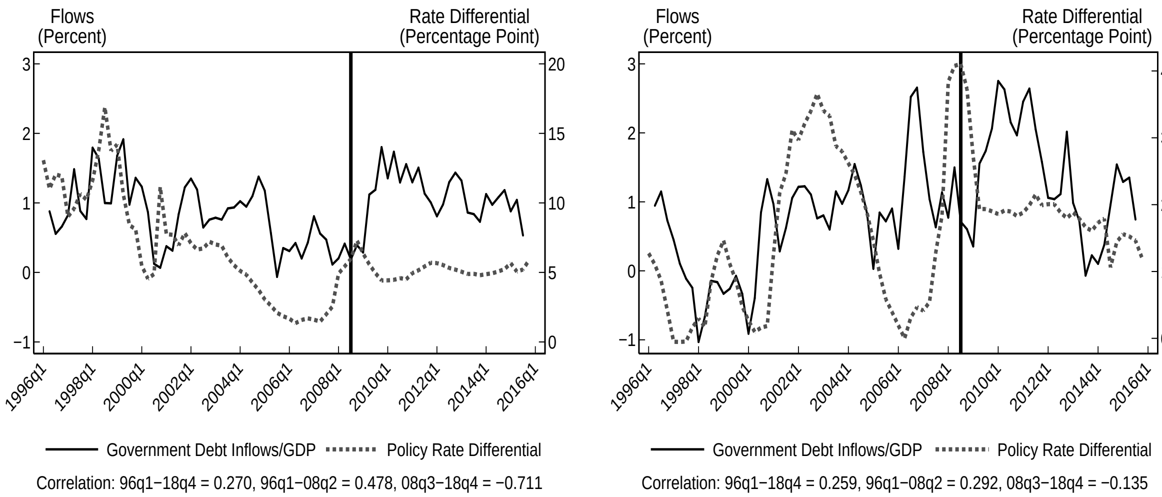
The literature on push factors in general focused on net flows and interest rate differentials with the U.S. Recently, Forbes and Warnock (2012) and Fratzscher (2012) studied total gross flows (the sum of private and sovereign flows) and show the importance of global risk factors for capital flows for the period after 1995. The VIX, a key global factor that captures changes in global risk aversion and uncertainty, has been shown to be related to monetary policy in the U.S. by Bekaert et al. (2013), Miranda-Agrippino and Rey (2019), and Bruno and Shin (2015).[14]

[12]This figure uses data from Avdjiev et al. (2019).

[13]The VIX is a forward-looking volatility index of the Chicago Board Options Exchange. It measures U.S. investors' expectation of 30-day volatility, and is constructed using the volatilities implied by a wide range of S&P 500 index options.

[14]See also Borio and Zhu (2012) who underline the importance of risk perceptions and risk tolerance on the

Chart 3: Monetary Policy Divergence and Sovereign Flows



(a) Emerging Market Economies

(b) Advanced Economies

Notes: Policy rate differentials are in logs and vis-a-vis the U.S. Sovereign inflows are normalized by GDP and plotted as three quarter moving averages. All variables are averaged across countries in a given date. Quarterly observations are from 35 EMEs and 13 AEs. The data on sovereign borrowing is limited to these country-quarters.

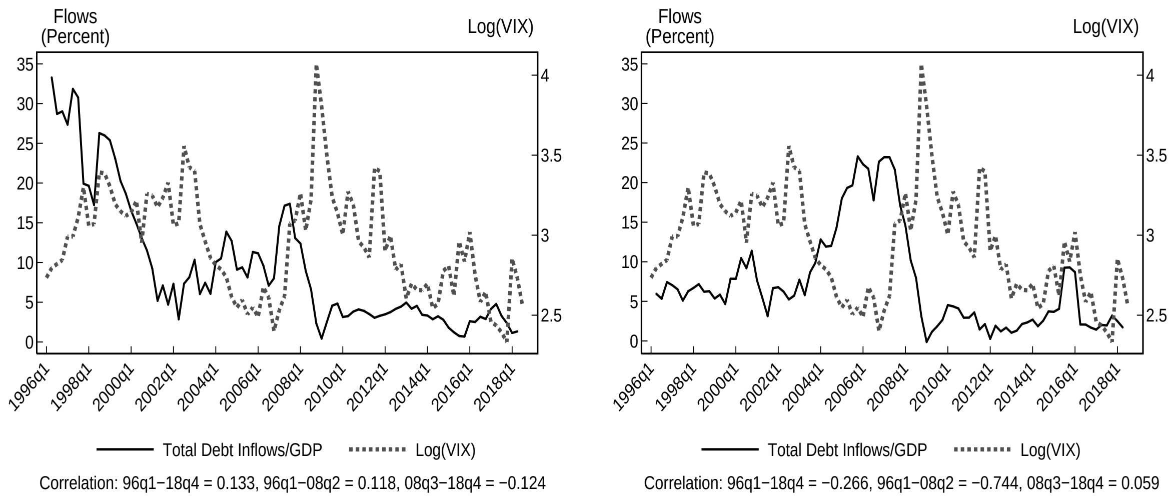
How big of a role do risk considerations play in the transmission mechanism from policy rate differentials to capital inflows? As shown in Chart 4, which plots the relationship between the VIX and capital inflows, while strongly negatively correlated with AE capital flows in general, the VIX has a complicated relationship with capital flows to EMEs. On the one hand, risk aversion drives a flight to safety, while on the other hand, EME sovereign borrowing increases during bad times. As shown by Avdjiev et al. (2019), EME sovereigns borrow in bad times to smooth out shocks, which is why total capital flows to EMEs and the VIX can be positively correlated at times.[15]

The relationships documented so far suggest important linkages, which I explore more formally in the next two sub-sections.

transmission of monetary policy in a closed economy context.

[15]The failure to account for this particular, or any other compositional change, might lead to finding a weak relation between the VIX and capital inflows during a longer sample period and arguing that the strong relation between capital flows and the VIX is a crisis effect. See, for example, Cerutti et al. (2019) who argues that the correlation between the VIX and capital flows is not very strong outside crisis. See also Avdjiev et al. (2017) on a similar emphasis on compositional changes with regards to banking flows.

Chart 4: Risk Sentiments and Capital Flows



(a) Emerging Market Economies

(b) Advanced Economies

Notes: Capital flows are normalized by GDP and plotted as three quarter moving averages, and these flows are averaged across countries in a given date. Quarterly observations from 46 EMEs and 13 AEs are plotted. The figure using quarterly observations from 55 EMEs and 14 AEs looks very similar.

II. A) Risk Sentiments and Capital Flows

I consider a more formal analysis of the changing relationship between monetary policy divergence, risk, and capital flows, using a panel regression framework with country fixed effects. I run the following regression:

$$\left[\frac{\text{Capital Inflows}}{\text{GDP}}\right]_{c,t} = \alpha_c + \beta_1(i^p_{c,t} - i^p_{US,t}) + \beta_2\text{Risk}_t + \beta_3\text{Risk}_{c,t} + \beta_4\text{Fundamentals}_{c,t} + \epsilon_{c,t}$$

I regress capital inflows normalized by country GDP on policy rate differentials vis-a-vis the U.S. using country-quarter observations c, t and country fixed effects (α_c). The sample is composed of 46 EMEs and 13 AEs from 1996q1 to 2018q4. As proxies, I use the VIX index for global and the EMBI index for local risk perceptions, both in logs, to capture changes in investors' risk attitudes. The EMBI index measures the default risk of EMEs and is obtained from J.P.Morgan.[16]

I also control for country fundamentals using the differences in country GDP growth rates, calculated as the quarterly change in a country's log GDP, minus U.S. GDP growth. It is important to

[16]This index is from the Emerging Market Bond Index Global that tracks total returns for traded external debt instruments in EMEs, and is an expanded version of the JPMorgan EMBI. I use country-specific Z spread.

condition on country fundamentals, since the heterogeneous response of EMEs to changes in global shocks is often interpreted as being due to differences in fundamentals. The standard argument is that EMEs with better macroeconomic fundamentals are better insulated from shocks related to U.S. monetary policy and global risk aversion (See Ghosh et al. (2014), Ahmed and Zlate (2014)). I show that this is not the case: even countries with good fundamentals, EMEs and AEs alike, can be affected by risk shocks. Some other papers argue in a similar way that at the business cycle quarterly frequency there is not much insulation from better fundamentals, as witnessed during the "taper tantrum" episode (Aizenman et al. (2015), Eichengreen and Gupta (2017)).[17] Policymakers frequently argue that capital flows can be very fickle, especially in times with heightened stress, even in the presence of unchanging fundamentals during those times such as stable current account deficits, fiscal balances and GDP growth.

Table 1: Monetary Policy Divergence, Capital Flows, and Risk Sentiments

Dependent Variable:	Capital Inflows/GDP$_{c,t}$						
	Emerging Market Economies			Advanced Economies			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$i^p_{c,t} - i^p_{US,t}$	-0.07***	-0.04*	0.28***	0.32	0.63*		
	(0.03)	(0.02)	(0.07)	(0.37)	(0.37)		
$i^{3m}_{c,t} - i^{3m}_{US,t}$						1.14**	1.44***
						(0.53)	(0.54)
Growth Differential$_{c,t}$	0.53**	0.54**	0.17	1.30*	1.28*	1.76**	1.68**
	(0.23)	(0.23)	(0.14)	(0.73)	(0.72)	(0.85)	(0.83)
log(VIX)$_t$		-0.03***	0.01		-0.07***		-0.08***
		(0.01)	(0.01)		(0.02)		(0.02)
log(EMBI)$_{c,t}$			-0.02***				
			(0.00)				
Number of Observations	1838	1838	990	930	930	749	749
Country FE	yes	yes	yes	yes	yes	yes	yes

Notes: ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. Robust standard errors are in parentheses. Regressions use country-quarter observations. Capital inflows to GDP ratios are winsorized. $i^p_{c,t}$ is the domestic policy rate in a given country c, and $i^p_{US,t}$ is the U.S. federal funds rate. $i^{3m}_{c,t}$ is the domestic 3-month government bond rate in a given country c, and $i^{3m}_{US,t}$ is the U.S. 3-month treasury rate. $i^p_{c,t} - i^p_{US,t}$ and $i^{3m}_{c,t} - i^{3m}_{US,t}$ are the log differential. GDP growth is the quarterly log change in GDP, and is winsorized. Growth differentials are calculated as domestic GDP growth minus US GDP growth.

Table 1 shows that the average relation between policy divergence and capital flows is negative in EMEs and zero in AEs during the period 1996–2018, as shown in columns (1) and (4) respectively. These results support the correlations that were presented in Chart 2. The reason for the weak

[17]See Caballero and Simsek (2019) for a model for the sensitivity of capital flows to risk perceptions.

average correlation is the changing nature of investors' risk perceptions over time. To show this, I include the proxies for risk sentiments one by one. For changes in global risk aversion, the VIX is a good proxy, and the relationship between capital flows and policy divergence becomes positively significant in AEs, once the VIX index is included in the regression, as shown in column (5). This means that higher interest rate differentials resulting from policy divergence in advanced countries are positively associated with capital flows only when the negative effect of risk sentiments on capital flows is taken into account since these sentiments themselves are positively correlated with interest rate differentials. When we use 3-month government bond rate differentials instead of policy rate differentials for AEs, then there is a significant positive relation between capital flows and bond rate differentials even without controlling for the VIX as shown in column (6), but the relation becomes much more significant with a larger coefficient in (7) upon controlling the VIX.[18]

The relationship between capital inflows and policy rate differentials remains significantly negative in EMEs even after we control for changes in global risk perceptions in column (2). The relation between policy divergence and capital inflows turns positive in EMEs only when we also account for changes in risk perceptions specific to the country by adding the EMBI index to the regression, as shown in column (3).[19] Although the correlation between these indices, the EMBI and the VIX, is not very high at 30%, inclusion of the EMBI index renders the VIX index insignificant, highlighting the importance of country-specific risk for EMEs, which can be mistaken for global risk perceptions.

The results are economically large. A 10 percentage point (%p) increase in policy rate differential implies 2.8%p increase in flows to GDP in EMEs and 6.3%p in AEs. These numbers represent a 41 and 79 % increase in capital flows over the sample mean. Of course, a 10%p increase in policy rate differential is a large increase, but this exercise meant to show that large differences in policy rate differentials can lead to large movements in capital flows across the borders conditional on the fact that policy rate differentials capture changes in risk premia, especially for EMEs. The regression uses contemporaneous values of the independent variables. It is standard to assume that financial variables respond to changes in monetary policy within the same period, but capital flows might respond with a lag. Lagging all independent variables one quarter and adding inflation differentials

[18]The results for EMEs using the 3-month government bond rate differential are similar so they are not reported.

[19]The EMBI index is available for less countries. Results from the regressions in columns (1) and (2) using the smaller sample of the EMBI index yields identical results and hence not reported.

as an additional control variable produces very similar results.

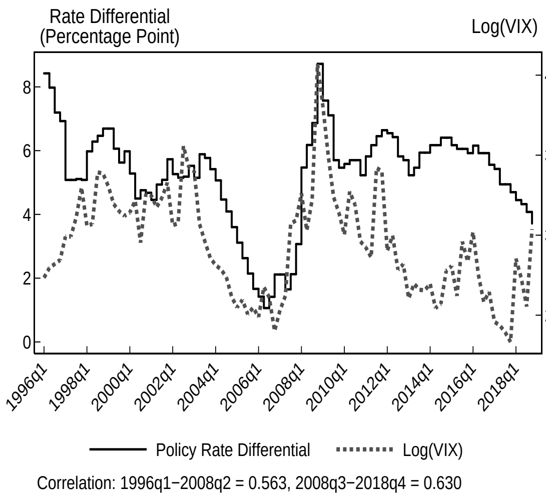
These results can easily be understood in the context of a standard omitted variable bias problem in economics. The effect of the omitted variable "Risk" on capital inflows is negative, as shown in the table, and the correlation between the omitted variable "Risk" and the policy divergence is positive, resulting in a negative bias that biases the estimated coefficients in columns (1) and (4) downwards.[20] Chart 5 shows the strong positive correlation between the VIX and policy rate differentials that underlies the omitted variable bias problem in Table 1. This correlation is 45% in EMEs and 32% in AEs. I plot the median country here to study the behavior of the typical EME and AE but averages look very similar. The correlation is stronger in the second half of the sample for both set of countries. The bottom two panels, (c) and (d), plot the same relation using 3-month government bond rate differentials instead of policy rate differentials, delivering a similar result.

Why is the correlation between monetary policy rate differentials and risk perceptions strongly positive? This correlation can be positive due to shocks to U.S. monetary policy and also shocks to global risk aversion. If risk premia go up due to a tightening of U.S. policy and if domestic policy rates in other countries do not change, then the relationship between policy rate differentials and risk premia should be negative. A positive correlation implies that other countries policy rates react to changes in global risk premia.

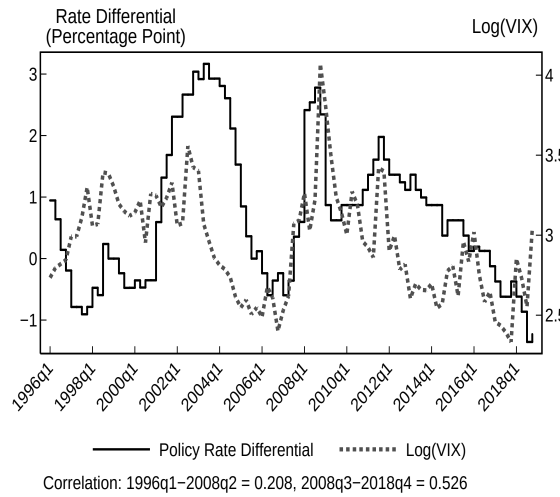
As shown by Bekaert et al. (2013), Miranda-Agrippino and Rey (2019), and Bruno and Shin (2015) a higher U.S. rate increases risk premia. However, as shown by Rey (2013), there is a feedback effect and a higher risk premia induces an expansionary U.S. policy. This means that if a positive shock to global risk aversion increases the VIX and if U.S. policy loosens as a result, then the correlation between the interest rate differentials and the VIX can be positive mechanically without any policy response from other countries. Given the results of table 1, where the correlation between interest rate differentials and capital flows is driven by the changes in risk premia, it is hard to envision a case where there are shocks to risk premia and domestic policy does not react. As clear from the regression results, capital flows move with those shocks to risk premia, which is captured by policy rate differentials that encompass domestic monetary policy responses. In any case, to shed more light on this issue, I examine the effects of *exogenous* shocks to U.S. monetary policy in the next section.

[20] Sign of omitted variable bias= $\beta_2 \times$ cov (Risk, $(i^p_{c,t} - i^p_{US,t})$).

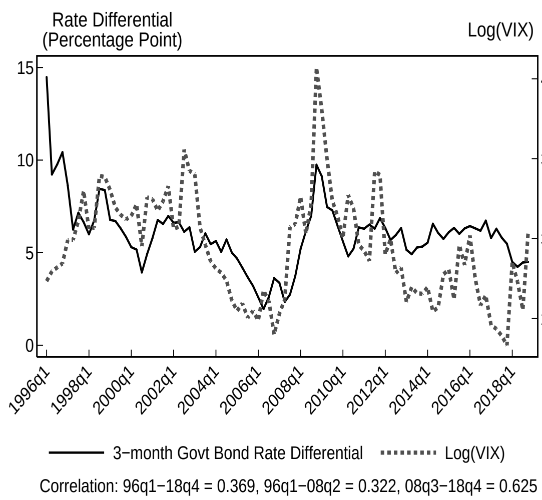
Chart 5: Monetary Policy Divergence and Risk Sentiments



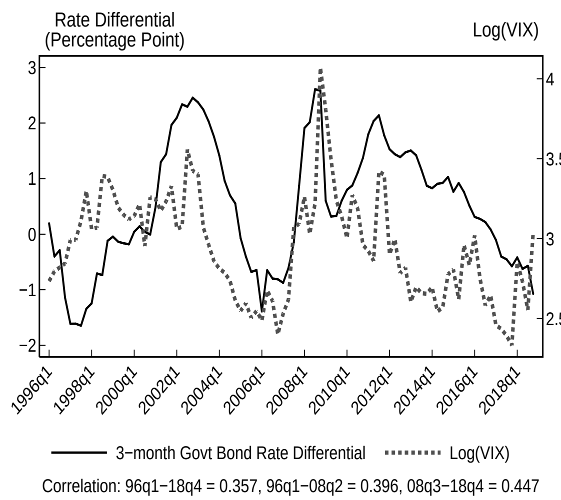
(a) EMEs: Policy Rate Differential



(b) AEs: Policy Rate Differential



(c) EMEs: Govt Bond Rate Differential



(d) AEs: Govt Bond Rate Differential

Notes: Policy rate differentials (top panels) and 3-month government bond rate differentials (bottom panels) in logs vis-a-vis the U.S. These differentials are the median across countries in a given date. Quarterly observations from 79 EMEs and 13 AEs are used. For the bottom panel, there are only 68 EMEs due to missing 3-month government bond rates.

II. B) Exogenous Shocks to U.S. Monetary Policy and Policy Divergence

Monetary policy divergence can occur either because the center country changes its monetary policy or other countries change their monetary policies, which can be also an endogenous response to the changes in the center country policy. I will rely on the recent developments in the closed economy monetary policy transmission literature to measure exogenous changes in U.S. monetary policy.

There is an extensive closed economy literature on monetary policy transmission. The conventional models imply that domestic credit costs should respond to monetary policy actions and this response should depend on the expected path of the central bank's policy instrument, which is the short-term interest rate. There should not be any response of term premia and credit spreads. Gertler and Karadi (2015) argue that, in the presence of financial frictions, the response of credit costs to monetary policy may in part reflect movements in term premia and credit spreads. They also argue that it is important to investigate the role of forward guidance in monetary transmission since when interest rates were at zero lower bound after the 2008 crisis, forward guidance was the only available tool for monetary policy.[21]

Gertler and Karadi (2015) analyze the joint response of economic and financial variables to exogenous monetary policy surprises, including shocks to forward guidance. Following the work of Gurkaynak et al. (2005), they use unexpected changes in federal funds rate and Eurodollar futures on Federal Open Market Committee (FOMC) dates to measure policy surprises. They use these measures as exogenous shocks to monetary policy in a VAR framework to evaluate the immediate response (and persistence) of output, inflation and interest rates to monetary policy shocks. They assume that real variables like output responds to policy shocks with a lag (a month or a quarter), while financial variables respond within the same time period. By using high frequency identification (surprises in fed funds futures occur on FOMC days in a thirty minute window of the monetary policy announcement) they can rule out the simultaneity of economic news and monetary policy.[22]

I will use these U.S. monetary policy surprises in a local projections framework, in order to estimate causal effects running from U.S. monetary shocks to other countries' interest rate differentials. I prefer local projections to a global VAR since I want to be consistent with the panel regressions I have done so far using data from EMEs and AEs. I implement local projections with instrumental variables (LP-IV) following Jorda (2005) and Stock and Watson (2018). I run the following regressions for EMEs and AEs separately:

[21] In conventional models, the transmission mechanism works as follows. The central bank adjusts the current short-term interest rate. Market participants then form expectations about the future path of the short rate and base their actions on these expectations.

[22] The surprises also include shocks to forward guidance since instrument set includes fed funds futures for contracts that expire at a subsequent date in the future. These surprises reflect beliefs on FOMC dates about the future path of short-term rates.

$$(i_{c,t+h} - i_{US,t+h}) = \alpha_c + \beta_h \hat{i}_{US,t} + \beta_h^w W + \epsilon_{c,t+h}, \quad h = 0, 1, 2, 3...$$

where $(i_{c,t+h} - i^{US}_{t+h})$ is the 12-month government bond rate differential at time $t + h$ in a given country c, vis-a-vis the U.S. α_c is a country fixed effect, $\hat{i}_{US,t}$ is the estimated exogenous U.S. monetary policy shock at time t, and β_h is the associated impulse response coefficient.

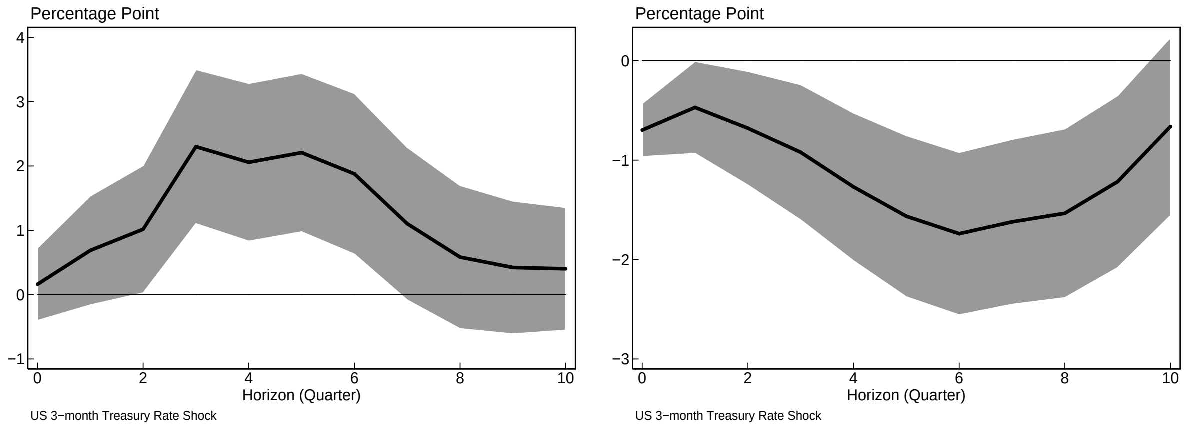
Since I have $\hat{i}_{US,t}$ as an independent variable and $i_{US,t}$ as part of the dependent variable in the local projection, I estimate $\hat{i}_{US,t}$ using a first-stage regression of 3-month U.S. treasury rates on the instrument Z_t. The instrument is the surprise in 3-month ahead U.S. Fed fund futures obtained from Gertler and Karadi (2015). β_h has the same interpretation as the usual impulse response coefficients estimated by SVAR-IV (structural vector autoregression with instrumental variables). W is the set of control variables. W includes 4 lags of the dependent variable, the instrumented variable, fundamentals (growth differentials and inflation differentials), and domestic monetary policy response of country c, proxied by the 3-month government bond rate.[23]

Chart 6 presents the response of interest rate differentials to U.S. monetary policy shocks. In EMEs, the 12-month government bond rate differentials increase by 2.5%p after three quarters in response to a 1%p increase in U.S. monetary policy rate. In contrast, in AEs, we see the opposite. The government bond rate differentials decrease by about 0.5%p after one quarter and 1.7%p after six quarters and exhibit more persistent responses. This result suggests that country-specific investment risk increases in EMEs' assets after a contractionary U.S. monetary shock regardless of EMEs' policy response, while this does not happen in AEs.

We can also use the 12-month U.S. treasury rate as the policy instrument for $\hat{i}_{US,t}$, instead of 3-month U.S. treasury rate, instrumented by the same Gertler-Karadi surprise. The results are of similar magnitude: In EMEs, the government bond rate differentials increase by 2.0%p after three quarters in response to a 1%p increase in U.S. monetary policy rate, in contrast, in AEs, the

[23]I chose a lag length of 4 following Stock and Watson (2018). Another advantage of LP-IV is that the estimates are robust to misspecification of the lag length, which is due to the nature of local projections as opposed to the global nature of SVAR-IV. Including lags of the instrumental variable allows us to satisfy the 'lead-lag exogeneity' condition that the instrument should be uncorrelated with past and future shocks, as shown in Stock and Watson (2018). As shown in the notes to the figures, the first-stage F-statistic far exceeds the rule-of-thumb cutoff 10 for weak instruments. Clustering at country level does not change results. Local projection regressions control for 4 lags of monetary policy responses of countries outside the center, and these controls are information available up to $t - 1$. However, this does not mean that these regressions control for the current and future policy responses. Thus, the responses of government bond rate differentials are affected by all changes in financial conditions that include policy reactions of countries, and these changes are induced by the unexpected U.S. monetary policy shocks.

Chart 6: Responses of 12-month Government Bond Rate Differentials I

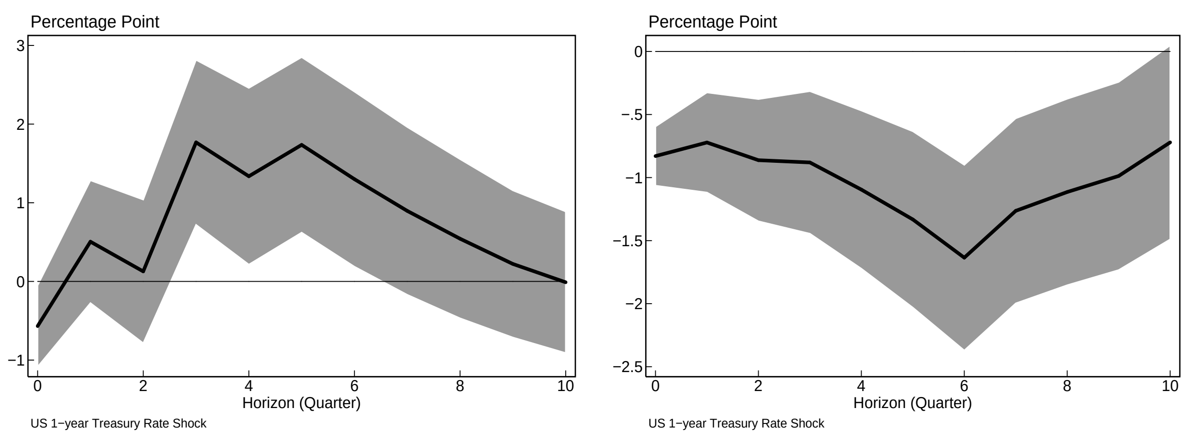


(a) Emerging Market Economies (b) Advanced Economies

Notes: Impulse responses of 12-month government bond rate differentials are obtained from panel local projections of 79 EMEs and 14 AEs. 95 percent confidence intervals (calculated using Newey-West standard errors) are shown by the shaded areas. The U.S. policy (3-month treasury rate) is instrumented by Gertler-Karadi shock FF4 (estimated from surprises in 3-month Fed fund futures). The domestic monetary policy response of country c is controlled. The first-stage effective F-statistic of Olea and Pflueger (2013) is 188 for EMEs and 112.4 for AEs.

differentials decrease by about 1.6%p after six quarters.

Chart 7: Responses of 12-month Government Bond Rate Differentials II

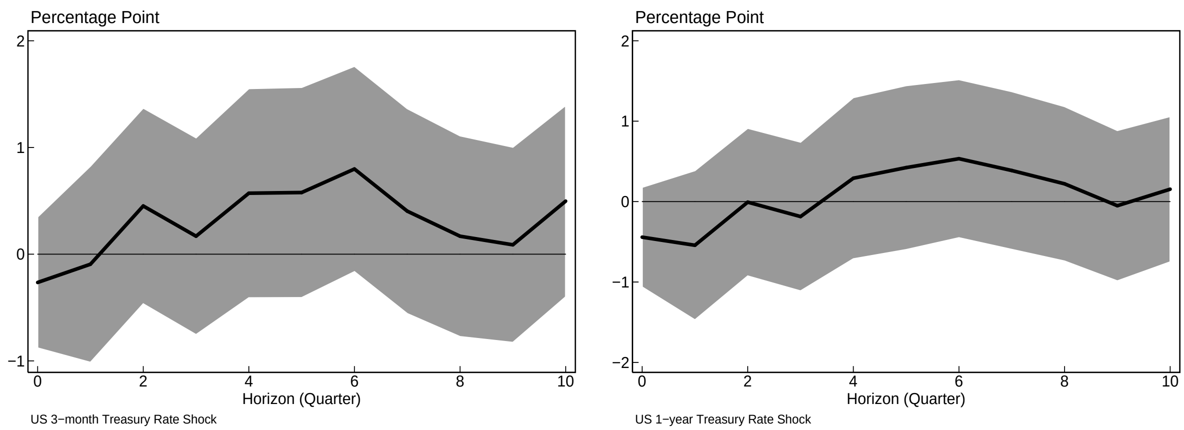


(a) Emerging Market Economies (b) Advance Economies

Notes: Impulse responses of 12-month government bond rate differentials are obtained from panel local projections of 79 EMEs and 14 AEs. 95 percent confidence intervals (calculated using Newey-West standard errors) are shown by the shaded areas. The U.S. policy is proxied by 12-month treasury rate and is instrumented by Gertler-Karadi shock FF4 (estimated from surprises in 3-month Fed fund futures). The domestic monetary policy response of country c is controlled. The first-stage effective F-statistic of Olea and Pflueger (2013) is 170.1 for EMEs and 92 for AEs.

In Chart 8, I add the proxies for global and local risk perceptions. Adding the VIX, although dampen the effects, did not render the impulse responses insignificant, whereas adding the EMBI index made the response of interest rate differentials to exogenous U.S. shocks in EMEs insignificant. Chart 8 shows the EMEs results after risk perceptions are accounted for using shocks to both policy instruments: 3-month and 12-month U.S. rates in panels (a) and (b) respectively.

Chart 8: Responses of 12-month Government Bond Rate Differentials III—Role of Risk Premia



(a) Emerging Market Economies

(b) Emerging Market Economies

Notes: Impulse responses of 12-month government bond rate differentials are obtained from panel local projections of 79 EMEs. 95 percent confidence intervals (calculated using Newey-West standard errors) are shown by the shaded areas. The U.S. policy is proxied by the 3-month treasury rate in first panel and the 12-month treasury rate in the second panel, both instrumented by Gertler-Karadi shock FF4 (estimated from surprises in 3-month Fed fund futures). The domestic monetary policy response of country c is controlled. The VIX and EMBI are controlled. The first-stage effective F-statistic of Olea and Pflueger (2013) is 149.6 and 117.8 for two panels respectively.

In section IV, I show that risk premia captured by the response of 12-month government bond rate differentials in EMEs to shocks to U.S. monetary policy, affects domestic monetary policy transmission in EMEs, creating a disconnect between domestic monetary policy rates and domestic credit spreads for private agents.

III. A Simple Framework

The study of monetary policy and related spillovers in open economies is a vast literature that started with the seminal work of Obstfeld and Rogoff (1995).[24] Most of the literature assumes

[24] See also Corsetti and Pesenti (2001), Gali and Monacelli (2005), Farhi and Werning (2014), and Corsetti et al. (2018).

frictionless domestic and international markets and no role for risk. The closed economy macro literature on monetary policy transmission, meanwhile mainly works with models of financial frictions such as Bernanke et al. (1999), Gertler and Kiyotaki (2010), and Gertler and Karadi (2015). Recent papers that focus on monetary policy in open economies have also adopted an approach with financial frictions such as Gabaix and Maggiori (2015), Aoki et al. (2016), and Akinci and Queralto (2019).

In this section, I provide a simple framework to evaluate domestic output effects of the foreign monetary policy, incorporating various channels of monetary policy spillovers. The model is similar to Blanchard (2016), Bernanke (2017) and Gourinchas (2017). Over these models, I add a specific role for risk premia as a wedge between the monetary policy rate and the domestic interest rates that govern saving and borrowing decisions.[25]

The are two countries: A small open domestic economy, the emerging market, and a large foreign country, the U.S. All U.S. variables are denoted with a star. The determination of domestic output and foreign output are given by the following set of equations:

$$\begin{aligned} Y &= DD + NX \\ DD &= -cR - fS \\ NX &= (Y^* - Y) + bS \\ Y^* &= DD^* = -cR^* \end{aligned} \tag{1}$$

where parameters (c, f, b) are all weakly positive. The effects of domestic and external demand on output and output differential on external demand are assumed to be one-to-one for ease of exposition.

Domestic output (Y) is determined by domestic demand (DD) and external demand (NX, net exports, or exports minus imports). Domestic demand is a negative function of domestic nominal interest rates (R)— the standard monetary transmission channel—and a negative function of the

[25] A full-fledged dynamic stochastic general equilibrium (DSGE) model with micro foundations, incorporating all channels, including domestic credit spreads, balance sheet effects with foreign currency denominated debt and expenditure switching, can be found in Akinci and Queralto (2019).

nominal exchange rate (S).[26] This negative relation is captured by parameter, f, and represents balance sheet effects. If domestic currency depreciates vis-a-vis the U.S. dollar and if this creates a tightening of collateral constraint for agents who hold dollar denominated debt, then demand for credit will be lower, leading to an investment crunch with negative effects on output. The mechanism is symmetric; an appreciation of the domestic currency vis-a-vis the U.S. dollar, relaxes collateral constraints, allowing higher demand for credit, resulting in an expansionary effect on output.

External demand (NX) is determined by the output differential between the foreign country, the U.S., and the domestic economy, and is a positive function of the exchange rate. Higher U.S. output increases exports from the domestic economy, which are imports into the U.S. Similarly, higher domestic output increases imports into the domestic economy, which are exports of the U.S. The negative effect of the exchange rate is the standard expenditure-switching effect, where a depreciation of domestic currency stimulates net exports by increasing exports and decreasing imports. As a result, a depreciation of the domestic currency vis-a-vis the dollar has an expansionary effect on domestic output.

The three key equations that deliver international risk spillovers are given below. Equation (2), is the level-version of the UIP condition adjusted for the country risk premium (λ), or the "risk-adjusted UIP." There is a vast empirical literature showing that the UIP condition does not hold. This literature shows that deviations from the UIP condition are correlated with time-varying risk premia.[27]

$$S = d(R^* - R) + \lambda \tag{2}$$

where the parameter d is weakly positive.

As in the standard UIP condition, a higher U.S. rate relative to the domestic rate depreciates the domestic currency (similarly, a higher domestic rate appreciates the domestic currency). A higher country risk premium, λ, also depreciates the domestic currency with a coefficient of 1 given the strong relation between country risk and exchange rates in the data.

I assume that the effect of the global financial cycle (GFC) works through two mechanisms.

[26] An increase in S means a depreciation of the domestic currency vis-a-vis the U.S. dollar.

[27] See Engel (2014) for a survey of this literature.

First, in equation (3) given below, λ is directly affected by the global risk premium through U.S. monetary policy. di Giovanni et al. (2018) show that UIP deviations in Turkey, here given by λ, move with the global risk premium. Kalemli-Ozcan and Varela (2019) generalize this result to more EMEs. From the GFC literature, we know that global risk perceptions are strongly affected by U.S. monetary policy changes, as shown by Bekaert et al. (2013), Miranda-Agrippino and Rey (2019), and Bruno and Shin (2015). Hence, I have:[28]

$$\lambda = R^* + \gamma \tag{3}$$

where γ is the domestic country-specific risk premium.

Second, in equation (4), I assume that there is imperfect monetary policy transmission, where the pass-through of monetary policy rates to domestic short-term interest rates is not one-to-one and the wedge is captured by the country risk premium.[29] For the U.S., I assume there is no such friction and hence $R^* = R_p^*$.

$$R = R_p + \lambda \tag{4}$$

The equation (4) represents a similar financial friction to Gertler and Karadi (2015), who assume a wedge between the corporate bond rate and government bond rate, so that corporates pay a premium over the government to borrow from financial markets due to financial frictions. Here, all agents in the economy pay a premium over the government borrowing rate, which equals the policy rate, R_p. The difference in my setup is that this premium is a function of the global financial cycle, since global risk affects the country risk premium. Piazzesi et al. (2019) present a micro-founded model in which there is a wedge between short-term rates and the policy rate (or the government short-term borrowing rate). The reason why this wedge exists in their model is that financial intermediaries value short-term bonds as safe collateral, given their liquid nature, so that

[28]Note that a precise formulation will be $\lambda^{global} = R^* + \epsilon$ and then the domestic risk premium, λ will be given by: $\lambda = \lambda^{global} + \gamma$. The equation (3) is a simplified version of the same relation. See Gopinath and Stein (2018) for a model of endogenous UIP deviations with a central role for the safe U.S. assets.

[29]Obstfeld (2015) argues that under GFC domestic monetary policy will be less effective in stabilizing the output and achieving financial stability simultaneously. His argument is based on the fact that long-term rates will be affected from GFC and hence the effect of monetary policy on the long-term rates will be limited. The short rate disconnect assumed here is a stronger condition that says due to GFC there is a disconnect between policy rates and short rates.

a collateral premium drives a wedge between the policy rate and short-term rates. Thus, in their model, monetary policy does not affect directly the decisions of private agents. Here, I will not get into the micro-foundations of the wedge, but I will provide evidence in the next section on this assumption and how this wedge depends on the fluctuations in country risk premia (composed of global and local risk). Since the country risk premium will be a function of the availability of global liquidity via its global risk component, my evidence is consistent with the framework of Piazzesi et al. (2019).

Solving for equilibrium yields the following equation for domestic output:

$$Y = [(fd - c - bd)R_p + (b - 2c - f)R_p^* + (b + fd - f - c - bd)\gamma]/2 \tag{5}$$

which gives:[30]

$$\frac{dY}{dR_p} = d(f - b) - c \tag{6}$$

If we assume standard domestic policy transmission—a contractionary monetary policy reduces output—that is, $\frac{dY}{dR_p} < 0$, then we have:

$$d(f - b) < c \tag{7}$$

If we also assume that an increase in the country risk premium reduces output, $\frac{dY}{d\gamma} < 0$, then this implies:[31]

$$d(f - b) + b - f < c \tag{8}$$

The effect of U.S. monetary policy on domestic output is given by:

$$\frac{dY}{dR_p^*} = b - f - 2c \tag{9}$$

If $f > b$, that is, if the effect of exchange rate fluctuations on credit demand via balance

[30] All the partial derivatives will be divided by 2, however, since I am interested in the signs of the numerators to sign the derivatives, I ignore this division.

[31] If γ is endogenized as $\gamma = \gamma(R_p)$, then this will deliver theoretical implications on the optimal exchange rate regime.

sheet effects is bigger than the effect of exchange rate fluctuations on net exports via expenditure-switching, then it is easy to see that a contractionary U.S. monetary policy is also contractionary for the domestic economy, as $\frac{dY}{dR_p^*} < 0$.

However, we do not need to assume $f > b$ for $\frac{dY}{dR_p^*}$ to be negative. Even if there are powerful expenditure switching effects, such that $f < b$, contractionary U.S. monetary policy is likely to be contractionary for the domestic economy, as long as equations (7) and (8) hold. To see this, note that the equations (7) and (8) together with the equation (9) imply;

$$\frac{-c}{d} - 2c < \frac{dY}{dR_p^*} < \frac{c}{1-d} - 2c \tag{10}$$

which means $\frac{dY}{dR_p^*} < 0$, that is a contractionary (expansionary) monetary policy in the U.S. is contractionary (expansionary) in the domestic economy, as long as $d > 1$ or $d < 1/2$. I show in Section V that the empirically valid case for this parameter is $d > 1$. When I estimate the "risk-adjusted UIP" equation by using capital flows and/or risk proxies as controls, then the parameter d is estimated to be bigger than 1.[32]

IV. Risk Spillovers and Imperfect Monetary Policy Transmission

In this section and the next section, I provide evidence on the key equations of the framework outlined in the previous section. These equations characterize an environment with "international risk spillovers." The fluctuations in global and local risk sentiments and associated premia can explain both the imperfect pass-through of policy rates to short-term rates and also the relationship between capital flows and local credit spreads.

IV. A) Imperfect Monetary Policy Transmission

I first run the following regression:

$$\text{Short-term Rate}_{c,t} = \alpha_c + \beta i^p_{c,t} + \epsilon_{c,t}$$

[32] If the estimation is done for the level of the exchange rate as implied by the model, this will be the case. If the estimation is done for the change in the exchange rate as typically done in the empirical UIP literature then the d parameter is estimated to be less than 0.5.

where $i^p_{c,t} = R_p$ based on the notation of the framework above, so that $i^p_{c,t}$ is the monetary policy rate in the domestic economy.[33] Note that $\beta = 1$ when there is no risk premia wedge in the short rate equation of the model, that is when $\lambda = 0$ in equation (4).

We expect to estimate a coefficient of $\beta = 1$ from such a regression if monetary policy transmission is perfect. I use three types of short-term rates: 3-month and 12-month deposit rates and lending rates (rates on bank loans with less than or equal to 12-month maturity), for both EMEs and AEs. Deposit rates are banks' funding costs domestically and lending rates will reflect their international funding costs.[34] All rates are obtained from IMF IFS and Bloomberg. Unfortunately, lending rates are available for fewer countries than our benchmark sample. If I limit the sample for other types of short-term rates to this smaller sample, where lending rates are available, I get similar results.

Table 2 shows the results. In EMEs, the estimated coefficients on short rates are far from 1. They are 0.7, 0.5 and 0.8 respectively and the null of $\beta = 1$ is rejected. In contrast, in AEs, I estimate a coefficient of 0.9 or 1.0 for all types of short-term rates and it cannot be rejected in general that the coefficient is different than 1.[35]

Table 2: Monetary Policy Pass-Through

	Emerging Market Economies			Advanced Economies		
Dependent Variable:	$i_{c,t}$(3m deposit)	$i_{c,t}$(12m deposit)	$i_{c,t}$(12m lending)	$i_{c,t}$(3m deposit)	$i_{c,t}$(12m deposit)	$i_{c,t}$(12m lending)
	(1)	(2)	(3)	(4)	(5)	(6)
$i^p_{c,t}$	0.7***	0.5***	0.8***	0.9***	0.9***	1.0***
	(0.02)	(0.02)	(0.03)	(0.02)	(0.01)	(0.01)
Observations	1448	1448	1111	850	745	694
Country FE	yes	yes	yes	yes	yes	yes

Notes: ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. Robust standard errors are in parentheses. All interest rates are winsorized.

Next, I add proxies for global and local risk perceptions, as:

$$\text{Short-term Rate}_{c,t} = \alpha_c + \beta_1 i^p_{c,t} + \beta_2 \text{Risk}_t + \beta_3 \text{Risk}_{c,t} + \epsilon_{c,t}$$

I proxy global risk sentiments using the VIX and local risk perceptions using the EMBI, as

[33] Results are similar when we use 3-month government bond rates and/or when we use a log-log specification.

[34] See di Giovanni et al. (2018) who showed that domestic banks in Turkey pass through low funding costs in the international markets during episodes of abundant global liquidity to firms as low lending rates.

[35] In AEs, the null of $\beta = 1$ is also rejected for 3-month deposits.

before. The aim here is to test whether the degree of monetary policy pass-through can be explained by risk premia in EMEs. If the proxies for risk sentiments are omitted, then they create a wedge. If the wedge between monetary policy rates and borrowing/lending rates is explained by the risk premia, as predicted by the simple framework outlined above, then the regression including these variables should deliver coefficients on the policy rate close to 1 in EMEs. Although in AEs the policy transmission is already close to perfect, for completeness, I run the regression including risk variables for both set of countries.

Table 3 shows that this is indeed the case for EMEs.[36] Both proxies for risk perceptions enter with positive signs in most cases, as expected, implying tightening credit conditions in EMEs when global risk and country risk premia go up. Moreover, the estimated coefficients on the policy rate rise to 0.9 for all types of short-term rates. For AEs, although risk measures enter to the regression with a positive sign, there is no effect on the relation between the policy rate and short-rates. All regressions were run contemporaneously since policy rates should affect short-term rates within the same period. The versions of these regressions with lagged policy rates deliver similar results.

Table 3: Monetary Policy Pass-Through: The Role of Risk Premia

	Emerging Market Economies			Advanced Economies		
Dependent Variable:	$i_{c,t}$(3m deposit) (1)	$i_{c,t}$(12m deposit) (2)	$i_{c,t}$(12m lending) (3)	$i_{c,t}$(3m deposit) (4)	$i_{c,t}$(12m deposit) (5)	$i_{c,t}$(12m lending) (6)
$i^p_{c,t}$	0.9*** (0.02)	0.9*** (0.04)	0.9*** (0.03)	0.9*** (0.01)	0.9*** (0.02)	1.0*** (0.01)
$\log(\text{VIX})_t$	0.01*** (0.00)	0.01* (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)	0.01*** (0.00)
$\log(\text{EMBI})_{c,t}$	-0.00 (0.00)	0.01** (0.00)	0.01*** (0.00)			
Number of Observations	1000	817	748	850	745	694
Country FE	yes	yes	yes	yes	yes	yes

Notes: ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. Robust standard errors are in parentheses. All interest rates are winsorized.

These results imply that risk perceptions and domestic monetary policy are negatively correlated in EMEs. Given the positive effect of global and country risk on short-term rates, the downward biased coefficients in the absence of risk variables in columns (1)-(3) of Table 2 imply that the correlation between the omitted risk variables and monetary policy rates is negative. This means

[36]One might prefer to run these regressions in first-differences by regressing quarterly log changes in short-term rates on quarterly log changes in policy rates. The interpretation of the coefficient is not that clear in that case but the qualitative results are the same. The coefficient on each type of short-term rate is around 0.4 in EMEs and 0.9 in AEs in a regression of first-differences. Once risk premia are added, the coefficients go up to be around 0.88 for EMEs. Including time fixed effects in levels regressions does not change the estimated coefficients.

that, on average, countries loosen the monetary policy when investors' risk perceptions are high (risk-off shocks) and tighten it when risk perceptions are low (risk-on shocks).

Is there an inconsistency between these results and the results shown before in Chart 6? There, I show that as a response to a contractionary monetary policy in the U.S., 12-month government bond differentials go up in EMEs and go down in AEs. This does not mean, on average, EMEs run a contractionary policy mimicking the U.S policy. It can easily be that EMEs loosen the policy but the policy is not effective in reducing the risk premia which is reflected in 12-month rate differentials. In fact, as shown in Chart 8, once we account for global and local risk perceptions, the response of 12-month government bond differentials to a contractionary U.S. policy becomes insignificant.

IV. B) Risk Spillovers, Capital Flows and Domestic Spreads

In section II, I show that capital inflows are correlated with foreign investors' changing risk perceptions, and this is why the relationship between monetary policy divergence and capital inflows varies over time and by country. Based on the results shown above on policy effectiveness, together these results imply that capital inflows should have a direct effect on domestic lending spreads.

To investigate this, I run the following regression with country and time fixed effects. It is important to use domestic lending spreads on short-term loans, instead of corporate bond spreads, for several reasons. First, in EMEs, loans are a much larger share of corporate sectors' liability portfolio.[37] Second, domestic banks have an important role in the intermediation of capital flows.[38] Third, domestic lending spreads also reflect the funding cost of cross-border bank loans, that is rates on external borrowing by domestic banks and firms from foreign banks.[39] In addition, domestic lending spreads on loans are correlated with corporate bond spreads for firms' domestic borrowing.[40]

$$\text{Lending Spread}_{c,t} = \alpha_c + \tau_t + \beta \text{Capital Inflows}_{c,t} + \epsilon_{c,t}$$

[37] See BIS Credit Database.

[38] See di Giovanni et al. (2018) and Baskaya et al. (2017).

[39] See Bruno and Shin (2014), Cetorelli and Goldberg (2011), and Kalemli-Ozcan et al. (2013) on the role of foreign banks in intermediating capital flows and transmitting shocks.

[40] Corporates' direct external borrowing might involve much higher spreads and be less related to domestic monetary policy. For most EMEs, this type of borrowing is in general limited to large corporations who can access international bond markets.

Table 4 shows the results. Capital inflows have a direct effect on lending spreads, defined as the log difference between short-term loan rates and 3-month government bond rates. With an increase in capital inflows, lending conditions get easier, as spreads go down. This is the case both in EMEs and AEs, as shown in columns (1) and (3). The difference between the two sets of countries is the fact that, once we control for monetary policy, the effect of capital flows is still present for EMEs, as shown in column (2), but the negative effect disappears for AEs, as shown in column (4). This evidence shows the imperfect monetary policy transmission in EMEs in the presence of capital inflows that pick up fluctuations in global and country risk premia.

The inclusion of time fixed effects in this regression is important since these effects control for the common effect of the global risk aversion (the VIX index), so that capital inflows pick up both the local risk perceptions and the country-specific sensitivity to global risk. The results show the contemporaneous effect of capital inflows on lending spreads, assuming capital inflows pick up both risk premia that affect spreads within the same period. Section VI shows that we obtain similar results if we use one quarter lagged capital inflows and also control for fundamentals through growth and inflation differentials vis-a-vis the U.S. Note that an alternative specification is to "instrument" capital inflows with the VIX index and the EMBI index, in-effect predicting capital inflows based on these risk proxies and using those country-by-country predicted values. However, the time fixed effects cannot be used in those instrumental variables regressions.[41]

Chart 9 shows the results of Table 4 visually. There is a strong positive correlation between average lending differentials and the VIX.

Taking stock, the results so far provide a detailed picture of how monetary policy spillovers occur. Although there has been an explosion of research on international spillovers of monetary policy,[42] empirical evidence is still lacking on the transmission mechanism, that is how the domestic credit creation process is affected by capital flows. One exception is the work by di Giovanni et al. (2018). In that paper, we study how the GFC, as proxied by the fluctuations in the VIX, affects domestic credit market conditions at the *microeconomic level* for a large EME, Turkey, and find

[41] Results of these instrumental variables regressions are as follows: For EMEs the coefficient corresponding to the regression in column (2) on predicted inflows is -0.029 and for AEs the coefficient corresponding to column (4) is -0.0015, with similar standard errors.

[42] See Dedola et al. (2017), Iacoviello and Navarro (2019), Miranda-Agrippino and Rey (2019), Bruning and Ivashina (2019) that show the effect of the U.S. monetary policy and GFC on global asset prices, cross-border flows and global banks leverage. Some of this work also look at the effects on other countries GDP. A comprehensive overview of all possible spillover channels can be found in Ammer et al. (2016).

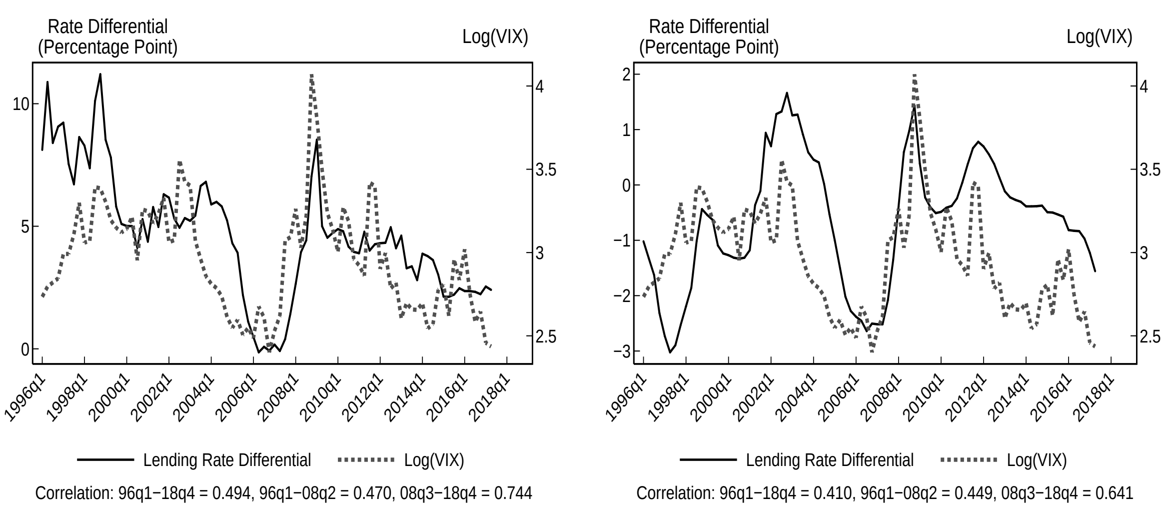
Table 4: Capital Flows and Bank Lending Spreads

Dependent Variable:	$i_{c,t}$(Loan)$-i_{c,t}$(3m Government Bond)			
	Emerging Market Economies		Advanced Economies	
	(1)	(2)	(3)	(4)
Capital Inflows/GDP$_{c,t}$	-0.025***	-0.027***	-0.012***	-0.001
	(0.009)	(0.010)	(0.004)	(0.003)
Policy Rates	no	yes	no	yes
Observations	645	625	557	483
Country FE	yes	yes	yes	yes
Time FE	yes	yes	yes	yes

Notes: ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. Robust standard errors are in parentheses. Capital inflows to GDP ratios are winsorized. Monetary policy variable is the domestic policy rate in country c and is winsorized. The spread between the loan rates (loans with maturity less than or equal to 12 months) and the 3-month government borrowing rates is in log differences.

an important role for the VIX in firms' borrowing costs due to a "pass-through" effect of domestic banks' funding costs. Domestic banks fund themselves cheaply in international markets during boom periods (risk-on shocks) and pass through these lower costs as lower borrowing rates to firms. The evidence shown in this section provides further support for this channel. Using macro data for many countries, I establish a strong link between global (VIX) and country (EMBI) risk perceptions, capital flows and domestic credit spreads.

Chart 9: Risk Sentiments and Divergence in Lending Rates



(a) Emerging Market Economies

(b) Advanced Economies

Notes: Average lending rate (on loans with maturity less than or equal to 12-months) differentials are in logs.

V. Risk Premia and Interest Rate-Exchange Rate Disconnect

In this section, I investigate the response of exchange rates to monetary policy divergence. As shown in the simple framework of section III, the nature of the relationship between exchange rates and interest rate differentials is important for international risk spillovers. A natural way to think about the relationship between interest rate differentials and exchange rate determination in open economies is the UIP condition. The simple framework of section III postulates that this condition has to be adjusted to account for risk premia in an environment that is characterized by international risk spillovers.

V. A) Deviations from Uncovered Interest Parity

The standard UIP condition can be stated as follows:

$$E_t[S_{t+h}](1 + i_{US,t}) = S_t(1 + i_{c,t}), \tag{11}$$

where t denotes time and h is the horizon considered. S_t and $E_t[S_{t+h}]$ are the spot exchange rate at time t and the expected (as of time t) exchange rate for h months ahead, respectively. The exchange rate is denominated in units of local currency per U.S. dollar, as before. $i_{c,t}$ and $i_{US,t}$ are the domestic and U.S. interest rates with the same time horizon for maturity of the debt as the expected exchange rate. Using equation (11), we express the UIP deviation in logs as,

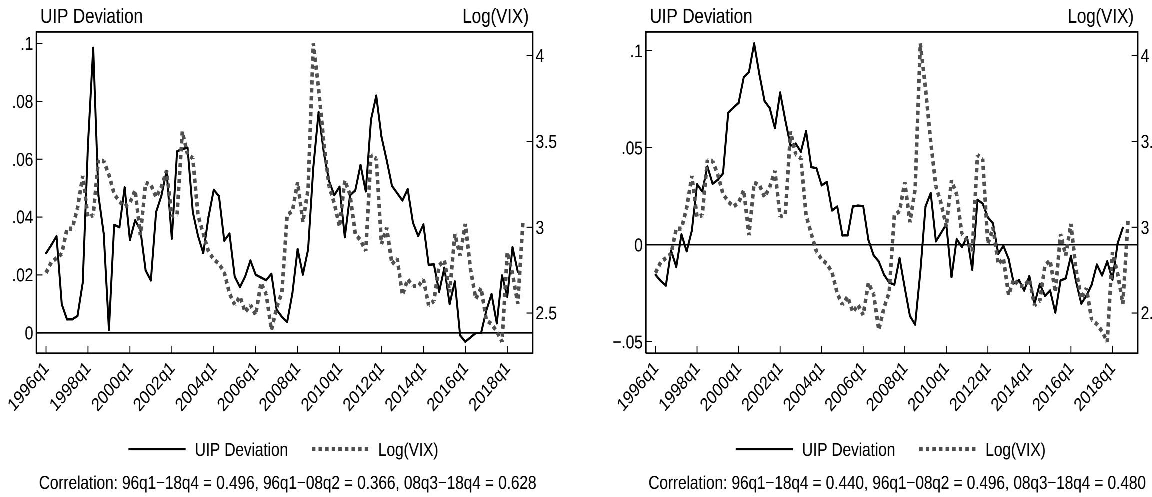
$$\lambda_t \equiv i_{c,t} - i_{US,t} - [s^e_{t+h} - s_t], \tag{12}$$

where λ_t denotes the UIP deviation for the domestic currency with respect to the U.S. dollar. Under this specification, a λ_t equal to zero implies that the UIP condition holds and interest rate differentials and expected exchange rate movements offset each other fully. Otherwise, if there are positive UIP deviations, there are positive expected excess returns on the domestic currency.

Chart 10 plots the median UIP deviation, λ, using policy rates for both EMEs and AEs, and shows that it moves with changes in the VIX.[43]

[43] Average deviations look similar to median. The deviations calculated using the 12-month government bond rate differentials also look similar. As cited above, di Giovanni et al. (2018) show that UIP deviations move with global risk sentiments in Turkey and Kalemli-Ozcan and Varela (2019) generalize this fact to more countries. Chart 10 shows the same fact for the country-quarter observations used in this paper. See also Cormun and Leo (2019) who

Chart 10: Risk Sentiments and UIP Deviations



(a) Emerging Market Economies

(b) Advanced Economies

Notes: The figure plots UIP deviations using quarterly observations from 22 EMEs and 12 AEs excluding hard pegs. The sample size is lower than the benchmark sample due to availability of data on expectations of exchange rates, which are obtained from Consensus Forecast. The UIP deviation is calculated as the difference between log interest rate differentials and the gap between log expected and spot exchange rate. Log interest rate differentials are the policy rate differentials vis-a-vis the U.S. 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.

However, if international risk spillovers are stronger for EMEs, then the sources of UIP deviations should differ in EMEs and in AEs. This is exactly what is shown in Kalemli-Ozcan and Varela (2019): in EMEs UIP deviations move with country risk, which is captured by interest rate differentials, while in AEs they move with global risk, captured by exchange rate fluctuations. To show this, let me re-write the UIP deviation as a decomposition following Kalemli-Ozcan and Varela (2019):

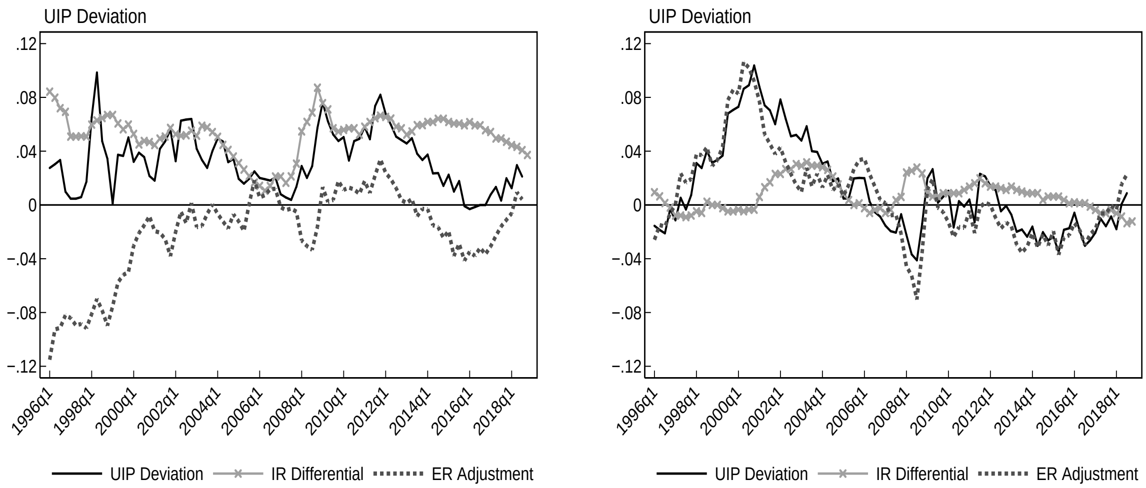
$$\lambda_t \equiv \underbrace{i_{c,t} - i_{US,t}}_{\text{IR Differential}} + \underbrace{s_t - s^e_{t+h}}_{\text{ER Adjustment}}. \tag{13}$$

Chart 11 plots each part of this decomposition. The sources of the UIP deviations differ greatly between AEs and EMEs: in the former, exchange rate adjustments move closely with UIP deviations, while in the latter interest rate differentials play a key role.

These results are consistent with a story where country risk might lead to UIP deviations in

find that movements in global risk premia account for bulk of the deviations from UIP, especially in EMEs with large net foreign liabilities.

Chart 11: Sources of UIP Deviations



(a) Emerging Market Economies

(b) Advanced Economies

Notes: The figure plots UIP deviations and components using quarterly observations from 22 EM and 12 AE excluding hard pegs. The sample size is lower than the benchmark sample due to availability of data on expectations of exchange rates, which are obtained from Consensus Forecast. The UIP deviation is calculated as the difference between log interest rate differentials and the gap between log expected and spot exchange rate. Log interest rate differentials are the the policy rate differentials vis-a-vis the U.S. 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.

EMEs that are reflected in interest rate differentials, and where the monetary policy response to fluctuations in risk premia makes the deviations larger by limiting the extent of exchange rate adjustment. This causes the UIP deviations to be fully reflected in the interest rate differentials.[44]

I argue that the case for flexible exchange rates is stronger under international risk spillovers. Why is this the case? In terms of equation (12), it is easy to see that, when the U.S. interest rates rise, if also risk premia rise, then the domestic monetary policy need to adjust by raising the policy rates by a large margin if the domestic monetary authority also wants to stabilize the exchange rate fluctuations. This will not be the case if UIP holds. If UIP holds, there is no role for risk premia in driving the procyclicality in UIP deviations and although a central bank who wants to stabilize the exchange rates need to increase the policy rate as a response to U.S. tightening, this increase does not have to be that big. By increasing domestic rates by a large margin, domestic monetary policy not only hurts the domestic economy but also has an impact on country risk premium, through

[44] In recent work, Lilley et al. (2019) show that exchange rates are connected to fundamentals through capital outflows from the U.S. during the global financial crisis period. One interpretation of their results is that, since during this period interest rates were at the zero lower bound in advanced economies, the exchange rate part of the UIP condition might be picking up the fluctuations in risk premia proxied by capital flows.

tighter financial conditions, increasing the effects of international risk spillovers.[45] Next, I will investigate the response of exchange rates in domestic economy to monetary policy divergence to highlight the importance of the relation between monetary policy divergence and UIP deviations.

V. B) Response of Exchange Rates to Policy Divergence

In the framework of Section III, the risk-adjusted UIP condition can be tested using the following regression based on equation (2) of the model:

$$s_{c,t+1} = \alpha_c + \omega_t + \beta_1(i_{c,t} - i_t^{US}) + \beta_2 Risk_{c,t} + \epsilon_{c,t+1}$$

where $s_{c,t+1}$ is next period's realized spot exchange rate of a given country vis-a-vis the U.S. dollar in logs. The other variables are defined as before. Recall that based on theory, we expect to find an immediate appreciation with higher interest rate differentials and then an expected depreciation. To test this, I run both the level regression and also the expected change regression, where the dependent variable will be $s^e_{c,t+1} - s_{c,t}$.

The results are shown in Table 5. Column (1) shows that the exchange rate responds positively to higher interest rate differentials in EMEs (depreciation), whereas in AEs, the response of the exchange rate to higher interest rate differentials is an appreciation, as shown in column (5). Column (2) shows that, once we control for changes in risk premia through capital inflows, exchange rate also appreciates as a response to higher interest rate differentials in EMEs. In column (6), controlling for capital inflows leads to a decrease in the magnitude of the response (less appreciation) in AEs. Thus, when capital flows are omitted, the estimate of β_1 is biased upward in EMEs, due to a negative correlation between interest rate differentials and capital inflows, and is biased downward in AEs, due to a positive correlation between capital inflows and interest rate differentials. These correlations are shown before in Section II and clearly they are critical to understand the exchange rate adjustment to capital flows.[46] The simple framework of section III predicts that when the

[45] The correlation between the EMBI index and domestic policy rates is high, 45%.

[46] The sign of the omitted variable bias in both cases follows from the fact that capital inflows appreciate the exchange rate in both set of countries. These regressions control for time fixed effects given the possible non-stationarity in the level of exchange rate. These fixed effects also control for the average affect of the VIX and what is picked up by capital flows is the country-specific response to global risk together with country-specific risk. Results are also robust to including linear and quadratic time trends.

coefficient on interest rate differentials (d in the model) is above 1, then a contractionary policy in the U.S. is also contractionary in EMEs, due to international risk spillovers. I estimate this coefficient to be bigger than 1, once I account for the role of risk premia.[47]

Table 5: Capital Flows and Exchange Rates

	Emerging Market Economies				Advanced Economies			
	Exchange Rate		Expected Change in Exchange Rate		Exchange Rate		Expected Change in Exchange Rate	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$i_{c,t}$-i_t^{US}	1.07***	-2.33***	0.26***	0.38***	-2.68***	-1.94***	0.33***	0.36***
	(0.41)	(0.45)	(0.02)	(0.06)	(0.37)	(0.31)	(0.05)	(0.04)
Capital Flows	no	yes	yes	no	no	yes	yes	no
Risk Premia	no	no	no	yes	no	no	no	yes
Observations	3566	1369	856	556	822	743	683	727
Country FE	yes	yes	yes	yes	yes	yes	yes	yes
Time FE	yes	yes	yes	no	yes	yes	yes	no

Notes: ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. Robust standard errors are in parentheses. The sample is the same as in charts 10 and 11. Interest rate differentials are for the 3-month government bond rates in logs. To calculate the expected change in log exchange rate from t to $t+1$, 3-months ahead expectations are used.

Columns (3) and (7) show the response of expected changes in the exchange rate, using data on 3-month ahead exchange rate expectations from Consensus Forecast. These results show that higher interest rate differentials imply an expected depreciation in both EMEs and AEs, once we control capital flows, as predicted by the risk-adjusted UIP condition. However, the extent of the depreciation is not enough for a full offset, since the estimated coefficient is significantly lower than 1. If we control risk perceptions through the VIX and the EMBI indices instead of capital flows in columns (4) and (8) for EMEs and AEs respectively, removing time fixed effects, then the estimated coefficients in columns (3) and (7) increase more with 1% statistical significance, as shown in columns (4) and (8).

How persistent are these effects? And why is the exchange rate adjustment not enough to compensate for the heightened risk? As I showed in the previous section, UIP deviations in EMEs move with the interest rate differential and not with exchange rate adjustment as they do in AEs. To investigate the persistence of these effects under exogenous U.S. monetary policy shocks, I run the following local projections in a similar way to projections of Section II.B:

[47]The correlation between interest rate differentials and risk premia is time-varying, as shown before, and this exercise is picking up the average effect. See Cormun and Leo (2019) for a structural model and related evidence that shows that accounting for the role of global risk premia correctly identifies the effects of domestic monetary policy on exchange rate fluctuations.

$$\lambda_{c,t+h} = \alpha_c + \beta_h \hat{i}_{US,t} + \beta_h^w W + \epsilon_{c,t+h}, \quad h = 0, 1, 2, 3...$$

where $\lambda_{c,t+h}$ represent the UIP deviation, as defined above and calculated using the 12-month government bond rate differentials and 12-month ahead expectations of the exchange rates. α_c is a country fixed effect, $\hat{i}_{US,t}$ is the estimated exogenous U.S. monetary policy shock at time t, and β_h is the associated impulse response coefficient. I estimate $\hat{i}_{US,t}$ as before by doing a first-stage regression of the 12-month U.S. treasury rate on the instrument Z_t, which is Gertler and Karadi (2015)'s measure of surprises in 3-month ahead U.S. Fed funds futures. W is the set of control variables. W includes 4 lags of the dependent variable, the instrumented variable, fundamentals (growth differentials and inflation differentials), and also domestic monetary policy response of country c, measured using the 3-month government bond rate. Responses are identical if we use 3-month U.S. treasury rates as the policy instrument on the right hand side instead of the 12-month rate.

Chart 12 shows that the UIP deviation, which captures the excess return to domestic currency, increases by about 3%p after 2 quarters in response to a 1%p contractionary U.S. policy rate shock in EMEs, but this not the case in AEs. This result is consistent with the picture so far that country-specific risk in EMEs is important in shaping investors' perceptions, since UIP deviations increase as a response to tighter U.S. policy. The response of the UIP deviations implies that EMEs need to provide additional return to investors to compensate for heightened country risk induced by the contractionary U.S. monetary shock.[48]

VI. Other Issues and Robustness

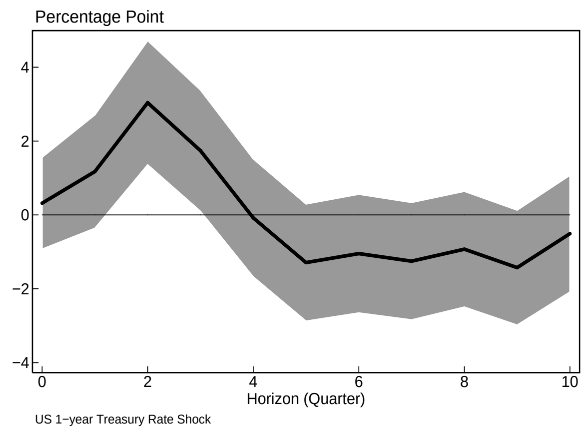
In this section, I discuss some outstanding issues and present additional robustness analysis.

VI. A) Economic Significance

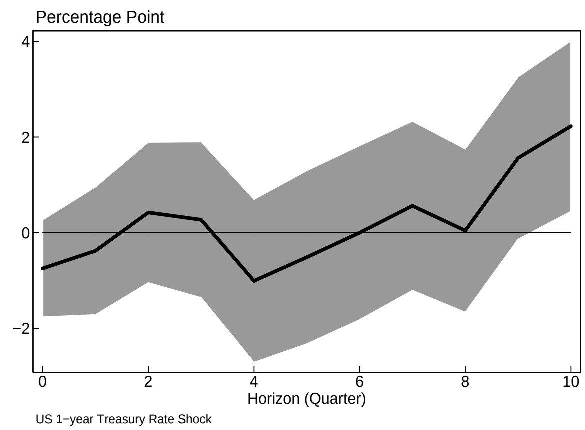
How large are the effects? There is an existing debate on the relationship between the U.S. policy rate and global risk aversion in terms of how much of the variation in the VIX can be explained by the shocks to U.S. policy. Rey (2013) and Miranda-Agrippino and Rey (2019) find that shocks to

[48] As in chart 8, these effects disappear once global and country-specific risk perceptions are accounted for.

Chart 12: Responses of UIP Deviations



(a) Emerging Market Economies



(b) Advanced Economies

Notes: Impulse responses of UIP deviations are obtained from panel local projections. The standard errors are Newey-West and given by the shaded areas. The U.S. 12-month treasury rate is instrumented using the Gertler-Karadi policy shock (estimated from surprises in 3-month Fed funds futures). The first-stage F-statistics are 102.4 and 85.7, respectively for EMEs and AEs. The domestic monetary policy response of country c is controlled.

U.S. policy explains between 4 and 17 percent of the variation in the VIX, whereas Bruno and Shin (2015) find that this share can go up to 30 percent. The numbers vary given the exact specification of the VAR and the horizon considered but clearly are significant. Bekaert et al. (2013) find for horizons longer than seven, U.S. monetary policy shocks can explain over 20 percent of the variance in risk perceptions, which is of course what matters for the international investors' behavior and capital flows.

For the purposes of this paper, as long as U.S policy changes explain part of the variation in the VIX, the U.S. monetary policy will be a powerful force in driving international risk spillovers given the response of interest rate differentials to the VIX combined by country-specific risk. As clearly shown in Charts 6, 7, and 8, a 1%p increase in U.S. policy rate lead to a 2.3%p increase in interest rate differentials in EMEs, in contrast to 0.5%p decrease in interest rate differentials in AEs, after three quarters. The implications of these large effects is a 3%p expected excess return on domestic currency in EMEs after three quarters as a result of an increase in U.S. policy rate as shown in Chart 12 that plots UIP deviations.

In section VII below, I show that there are also large real effects of international risk spillovers on GDP growth.

VI. B) Euro Area Monetary Policy

In the analysis so far, I have defined monetary policy divergence via-a-vis the U.S. Is U.S monetary policy unique? If I plot the interest rate differentials vis-a-vis the ECB policy rate, I similarly get higher dispersion for EMEs and minimal dispersion for AEs (adding U.S. now to the advanced country group). However, the correlation between the VIX and the interest rate differentials vis-a-vis the ECB is not as strong as before, as shown in Appendix Chart 21. The correlation between policy rate differentials—benchmarked to ECB refinancing rate—and the VIX for EMEs goes down to 0.15 from the original 0.45 and the same correlation for AEs goes down to -0.18 from the original 0.35. These findings suggest a special role for U.S. monetary policy in relation to global risk aversion.

VI. C) Total Flows, Lagged Effects and Additional Controls

I have focused mainly on debt flows since the largest part of capital flows is composed of debt liabilities. However, there is an increasing trend during the last decade in equity flows and FDI into emerging markets. Appendix Table 11 replicates the benchmark regressions, using total capital flows rather than just debt flows. The key results are robust.

Another important result from the analysis above concerns the effect of capital flows on domestic credit spreads. This effect can be found both in EMEs and AEs, however, in EMEs it remains even after controlling for the domestic policy rates. In contrast, in AEs, the effect of capital flows on domestic lending spreads disappears once the domestic policy is controlled. Appendix Table 12 runs robustness analysis on these results by lagging capital flows one quarter, since there might be a lagged response of spreads to capital flows. I also add growth differentials and inflation differentials to control for fundamentals in these lending spread regressions. As can be seen from Table 12, the key results are robust.

VI. D) Long-Term Bond Rate Differentials

The literature that studies the effect of unconventional monetary policies in the aftermath of the 2008 crisis, focuses on long-term assets. This literature finds that both nominal and real long-term rates respond to unconventional monetary policy due to changes in term premia. This is the case both domestically in the U.S. and internationally. And the explanation for these findings center on yield-oriented investors searching for better yields in the U.S. and internationally. As unconventional monetary policies signal that short-term rates are going to be at the zero lower bound for a long time, these investors switch to long-term assets yielding higher returns via term premia.

The results that are shown so far prove that international risk spillovers work through short rates, as these rates involve other risk premia. This does not mean that there is no effect on international long-term rate differentials of a U.S. policy shock. Appendix Chart 22 shows the results from local projections done in a similar way as before, where now, I have investigated the effect of U.S. policy shocks on 10-year government bond differentials. I find similar results that long-term differentials increases in EMEs and decrease in AEs as a response to a contractionary U.S. monetary policy shock.

VII. Policy Implications

In this section, I elaborate on the policy implications of international risk spillovers and discuss several policy options. Thus far, I have shown that U.S. monetary policy changes have large spillover effects on EMEs, mediated by global and especially local risk measures. These spillovers manifest themselves through capital flows, domestic borrowing conditions, and movements in exchange rates and UIP deviations. As the integration of EMEs in the global economy continues, and as capital increasingly flows to the private sector in these countries, these spillovers are not likely to weaken. At the same time, domestic monetary policy appears less effective in influencing domestic credit costs for EMEs, as shown by the imperfect pass-through of policy rate changes into short-term interest rates, where policy rate changes themselves are also correlated with risk measures.

How aggressively should policymakers respond to changes in global financial conditions in this context? This is a difficult question, because as I discuss below, being too aggressive may prove to be counterproductive.

VII. A) Managed Floats vs. Free Floats

Consider the case of exchange rate policy when the U.S. tightens monetary policy. If the domestic monetary authority increases policy rates in an attempt to limit the depreciation of its currency, then it has to implement a very large increase. This raises recession risks and feeds back into a higher country risk premium. This line of reasoning implies that fixed exchange rates are harmful in a world characterized by GFCs and risk spillovers.[49]

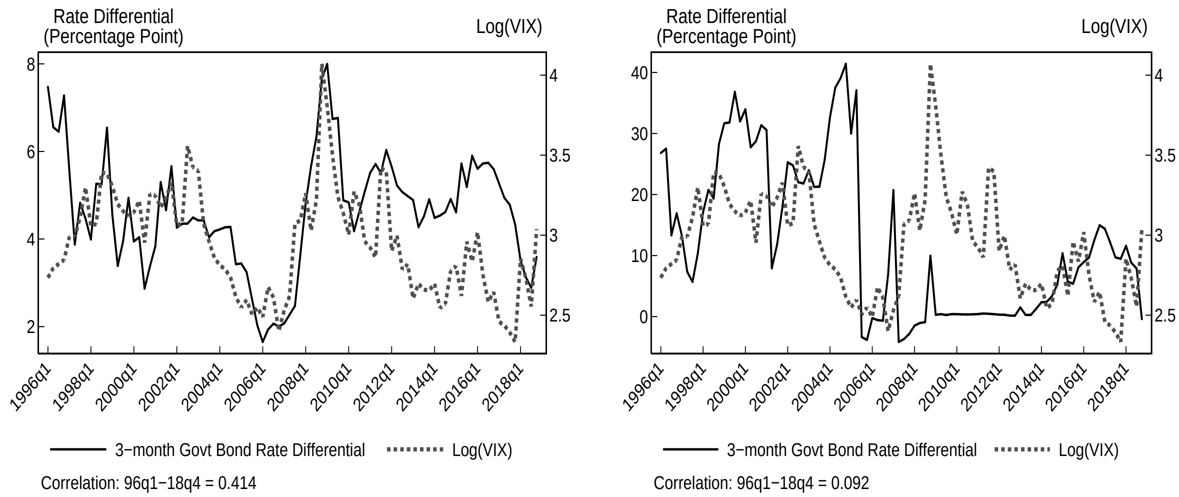
Chart 13 shows that the correlation between changes in risk perceptions and monetary policy divergence is much stronger in country-quarters with managed floats than free floats. Appendix Chart 23 shows the same figure by separating EMEs and AEs, replicating Chart 5 from Section II. Panel (a) shows an "all-country" version of Chart 5, omitting hard pegs (as before) as well as the country- quarter observations on free floats, which are shown instead in panel (b).[50] The overall correlation between risk premia and policy divergence goes from 0.41 to zero when we consider managed floats versus free floats. The other correlations deliver a similar message (charts are not shown due to space considerations). Specifically, the correlation between 12-month government bond rate differentials and the VIX in the regular sample that are 0.43 and 0.36 in EMEs and AEs respectively stay similar for managed floats and become zero for free floats for both set of countries. The correlation of lending rate differentials with risk premia of 0.49 and 0.41 as shown in Chart 9, become zero in both set of countries when observations on free floats are used.

The strong correlation for countries with managed currencies is consistent with a story that when countries use monetary policy to prevent exchange rate movements, movements in risk premia show up in interest rate differentials. Chart 14 tries to shed light on this issue, plotting the responses of the exchange rate to a U.S. monetary policy shock in EMEs and AEs. The responses are

[49] Gourinchas (2017) presents a model, where flexible exchange rates are optimal under certain parameter restrictions. The only time a pegged exchange rate is preferable to float is when GFC spillovers are very strong that exchange rates do not have any insulating power. But this only happens in his model under a "perverse" domestic monetary policy transmission that is when domestic monetary authority rises the policy rates, the effect on domestic output is expansionary. The model of Section III in this paper does not have this possibility as domestic monetary policy transmission can never be "perverse" under the short rate disconnect, where the disconnect is a function of risk premia.

[50] Ilzetzki et al. (2017) de facto exchange rate arrangement classification contains the coarse classification codes that range from 1 to 6, where 1 means a hard peg; 2 means a crawling peg or a crawling band narrower than or equal to +/- 2%; 3 means a crawling band that is wider than +/-2%; 4, 5, and 6 mean freely floating and freely falling. For the entire analysis, I drop country-quarter observations with hard pegs (classification 1). In this section, I group country-quarter observations from classifications 2, 3 into "managed float," and I group country-quarter observations from classifications 4, 5, 6, into "free float".

Chart 13: Risk Sentiments and Policy Divergence: Managed Floats vs. Free Floats



(a) Managed Floats

(b) Free Floats

Notes: I use Ilzetzki et al. (2017) coarse classification to classify observations as managed floats (codes 2 and 3), and free floats (codes 4 to 6).

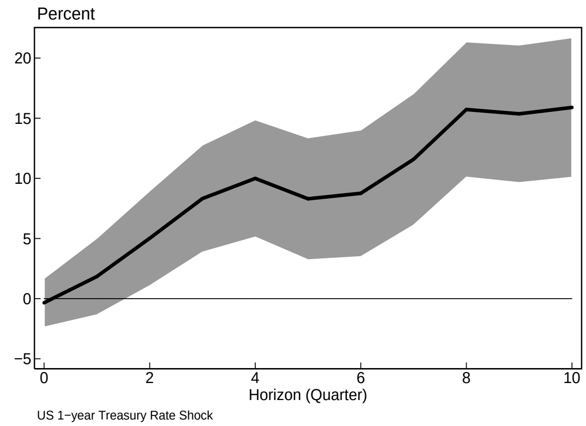
based on local projections, as before. The top panel of Chart 14 shows persistent EME currency depreciations in response to a contractionary shock in U.S. monetary policy: 15.7% depreciation vis-a-vis the U.S. dollar after 8 quarters compared to 6% depreciation at the same horizon for AEs, both as a response to a 1% shock to U.S. policy. This panel does not control for the response of domestic monetary policy in other countries. Once I do that in the second panel, then the currency depreciation fades in roughly four quarters in EMEs, and shows a minimal response in AEs.

VII. B) Flexible Exchange Rates and the Real Economy

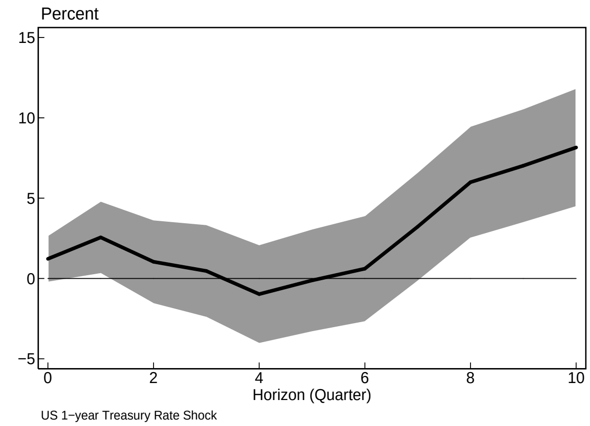
Are there any consequences for the real economy? In Table 6, I run a simple GDP growth regression, separating country-quarter observations across managed and free floats, as done in the previous section. There is a big difference between the effect of risk shocks, captured by the VIX, on countries growth rates depending on whether countries manage their exchange rate or not. The countries that manage their exchange rates tend to have lower growth rates when the VIX increases, while the effect on free floats is barely significant.[51] Once I separate the countries into EMEs and AEs, the effects are even starker as shown in Appendix Table 13. I argue that the driving force for these

[51]Note that I do not have enough observations to run a local projection given the rich lag structure needed by these projections. However, these growth regressions use one quarter lagged VIX.

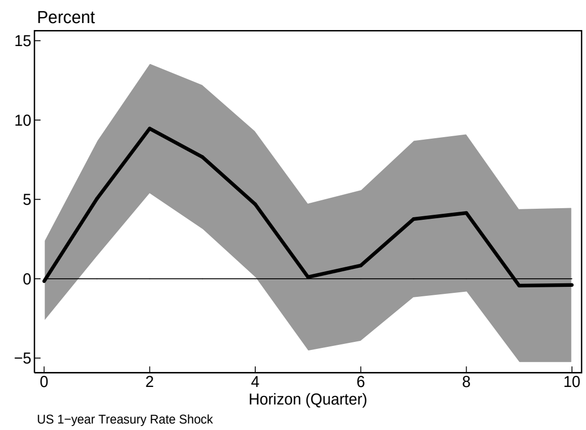
Chart 14: Responses of Exchange Rates



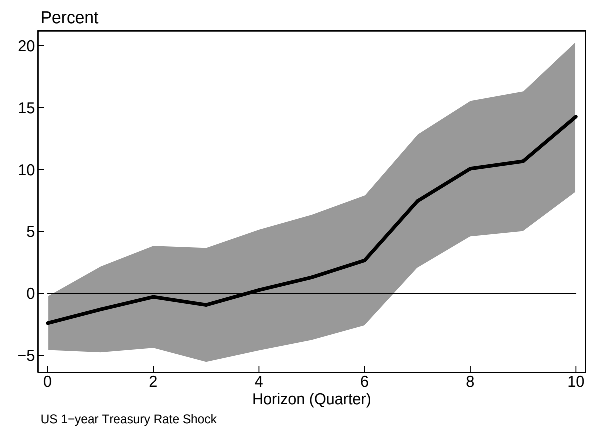
(a) Emerging Market Economies



(b) Advanced Economies



(c) Emerging Market Economies



(d) Advanced Economies

Notes: Impulse responses of exchange rates are obtained from panel local projections. The standard errors are Newey-West and given by the shaded areas. The U.S. 12-month treasury rate is instrumented using the Gertler-Karadi policy shock (estimated from surprises in 3-month Fed funds futures). The first stage F-statistics are 269.1, 206.2, 121.8, and 91.3 in panels a, b, c, and d. The domestic monetary policy response of country c is controlled only in the bottom panels of (c) and (d).

results is the endogenous domestic monetary policy response to risk premia shocks in countries that manage their exchange rates.

These effects are economically large. The estimates suggest that for one standard deviation increase in the VIX the q-on-q growth rate goes down by 0.2 percent in managed floats, while the effect on pure floats is negligible. For a "Lehman-like" increase of 133 percent in the VIX, q-on-q growth goes down by 0.8 percent, again in managed floats. In the case of EMEs with free floats, the effects are completely insignificant as shown in Appendix Table 13.

Table 6: Growth Regression by Exchange Rate Regime

Dependent Variable:	GDP Growth$_{c,t}$		
	(1)	(2)	(3)
	All Floats	Managed Floats	Free Floats
$\log(\text{VIX})_{t-1}$	-0.005***	-0.005***	-0.004*
	(0.001)	(0.001)	(0.002)
Number of Observations	4917	4266	632
Country FE	yes	yes	yes

Notes: ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. Robust standard errors are in parentheses. Regressions use country-quarter observations. GDP growth is the quarterly log change in GDP, and is winsorized.

These results are consistent with Eichengreen and Gupta (2017) who show that since 1996 every tightening episode by the U.S. Federal Reserve has been associated with slower growth in EMEs. The results are also broadly consistent with the empirical literature that studies monetary policy autonomy in fixed versus floating exchange rate regimes. Early examples in this empirical literature are Shambaugh (2004) and Obstfeld et al. (2005). The recent work by Klein and Shambaugh (2015) tests if the correlation between countries short-term rates and the center country short-term rate is 1 in pegs and different than 1 in more flexible regimes. They find that for countries that do not have hard pegs, short-term rates do not move one-to-one with the center country. This is the empirical concept for "monetary autonomy" according to these papers. Klein and Shambaugh (2015) further show that capital controls do not provide monetary autonomy; and Obstfeld et al. (2019) and Obstfeld et al. (2018) show the transmission of global financial shocks to domestic conditions is magnified under fixed exchange rate regimes in EMEs.[52]

Although I do not investigate "monetary autonomy" as defined by this literature and I never compare fixed and flexible exchange rates in my analysis as this literature does, I show that fully flexible exchange rates can help the real economy when there are external shocks. I prefer to compare two different type of floating regimes–managed floats and free floats–as I am interested in the effectiveness of domestic monetary policy (and how it is linked to risk premia and U.S. policy) rather than the existence of monetary autonomy.[53]

[52] They only study EMEs, since the majority of AEs classified as fixed exchange rate regimes are in the euro area, and this is problematic given that these countries currencies float internationally.

[53] Obstfeld et al. (2018) find that intermediate regimes and pure floats behave similarly when faced with risk shocks. I find stark differences between managed floats and free floats in terms of these countries' GDP growth rates in the face of risk shocks.

In a similar way to my paper, the literature above argues that domestic monetary policy might be limited in its ability to counteract the effect of external financial shocks in open economies. However, differently than my paper, this literature does not provide evidence on the mechanism that limits the effectiveness of domestic monetary policy in the face of GFC. Several hypotheses have been presented without any evidence to support them. One possibility is that borrowers substitute between domestic and external financing sources, limiting the impact of changes in domestic interest rates on domestic financial conditions. Alternatively, short-term rates can be set independently from the center (monetary autonomy), but long-term rates tend to be influenced by global forces. And, last but not least, the flexible exchange rate itself may cause boom-bust cycles due to currency mismatch on balance sheets.

I find evidence that the same mechanism that limits the effectiveness of domestic monetary policy also explains why flexible exchange rates can insulate countries from negative effects of monetary policy spillovers. Because in a GFC world, the policy spillovers are in fact risk spillovers, changes in risk premia show up as a wedge for both UIP and short-term rates. This implies that, when a country tries to stabilize a depreciating exchange rate (due to capital outflows for example), the necessary increase in the interest rate is much larger than what is implied by an UIP equation without a risk premium wedge. Since the risk premium goes up with capital outflows, if the exchange rate is not free to adjust, then the shock will be absorbed by the interest rate differentials, which requires a large increase in domestic policy rates. In turn, this creates tight financial conditions in the domestic economy, leading to slower investment and growth. Conversely, a flexible exchange rate can help countries mitigate the undesirable effects of international risk spillovers, not through the standard expenditure switching effects, but rather through dampening shocks to risk premia.

VII. C) Foreign Currency Debt and Corporate Leverage

What about the effects of foreign currency debt? A large literature argues that, in the presence of debt denominated in U.S. dollars and related balance sheet currency mismatches, exchange rate fluctuations provide a powerful channel for monetary policy spillovers from the U.S. to the rest of the world.[54] The empirical literature also showed that in the presence of domestic balance sheet

[54]See Krugman (1999) and Cespedes et al. (2004), who show theoretically how depreciation of home currency can reduce domestic activity through home balance sheet effects. Bruno and Shin (2015), Gabaix and Maggiori (2015), Miranda-Agrippino and Rey (2019), and Jiang et al. (2019) develop models that center on balance sheet currency

currency mismatches, there can be real effects such as a persistent decline in investment and output during large depreciation events (Aguiar (2005), Kalemli-Ozcan et al. (2016)). Contractionary effects also work via imported intermediate inputs that are used in the production and will be more expensive after a depreciation as shown by Mendoza and Yue (2012) and Gopinath and Neiman (2014). The standard justification for policymakers' actions to limit exchange rate volatility is exactly to limit these balance sheet effects on the real economy. These monetary policy strategies in general is referred to as "fear-of-floating" strategies.[55]

How can these potentially large balance sheet-related benefits of limiting exchange rate variability be reconciled with the costs associated with international risk spillovers that I have documented in the previous sections? One possible way forward is to consider a more complete cost-benefit analysis of "fear-of-floating" strategies. Diamond et al. (2018) argue that these strategies can induce moral hazard if agents think that central bank always moderate currency volatility. Akinci and Queralto (2019) formulate this argument in a full-fledge DSGE model, where in an economy with foreign currency denominated debt, when U.S. tightens the policy, the related home currency depreciation have negative effects on output due to standard balance sheet channel. However, with the UIP deviation, there is an additional effect and a two way feedback between the credit spreads and the balance sheet channel. A tightening in the U.S. increases the risk premium and deteriorates the balance sheets with currency mismatch in domestic economy, but this feeds back to higher spreads and makes the balance sheet effects worse. In addition, since holding foreign currency denominated debt is endogenous, limiting exchange rate volatility increase the share of foreign currency debt in the economy, contributing to the feedback effect.[56] This shows that flexible exchange rates are preferable under UIP deviations driven by risk premia, as I also show in the previous sections.[57] This literature speaks to the fact that foreign currency debt itself is a problem indeed but trying to limit the exchange rate volatility can make this problem worse in terms of its

mismatches of global financial intermediaries. These models highlight the key role of U.S. dollar in international spillovers.

[55]See Calvo and Reinhart (2002). Even in the case of a high pass-through of exchange rate fluctuations into domestic inflation, it can be shown theoretically that flexible exchange rates remain to be the welfare maximizing policy, see Devereux, Lane, and Xu (Devereux et al.).

[56]Salomao and Varela (2018) develop a model that shows when exchange rate volatility is limited, less productive firms borrow more in foreign currency with negative implications for long-run growth. They also show with increased UIP deviations, there is more foreign currency borrowing using credit registry data from Hungary.

[57]See also Itskhoki and Mukhin (2019) for a model of segmented financial markets, where UIP deviations are endogenous to domestic monetary policy. If the domestic monetary authority tries to limit nominal exchange rate volatility, it affects equilibrium risk premia.

effects on the real economy. As a result, "fear of floating" strategies could amplify real volatility.

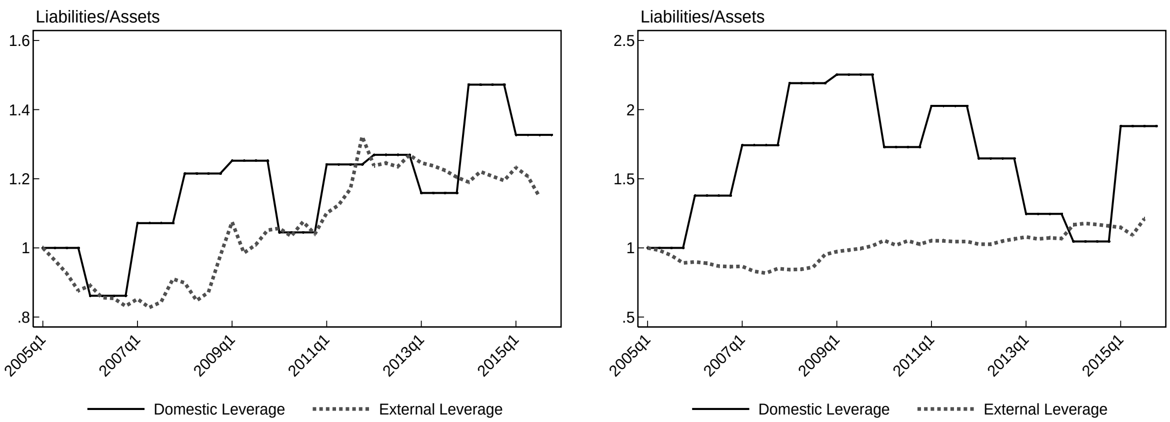
To shed more light on this issue, I use BIS Global Liquidity Indicators (GLI) data covering 42 economies,[58] in order to group countries into those with high and low foreign currency denominated debt. In order to calculate the domestic leverage of the corporate sector in a given economy, I aggregate firm-level leverage, since flow of funds data is lacking in many of these countries. Firm-level data, at the annual level, comes from the ORBIS database and includes balance sheets of private and public firms in these 42 countries. As shown in panel (a) of Chart 15, domestic and external leverage across countries increased together for all countries since 2005, plateauing during the global financial crisis. However, as shown in panel (b), in countries with lower levels of foreign currency denominated debt, domestic leverage grew much faster than external leverage, turning around after 2011, when the international funding costs started getting tighter. Here, domestic leverage is based on domestic liabilities and assets of a given country's corporate sector aggregated from firm-level data. External leverage is based on capital inflows into the corporate sector and capital outflows from the corporate sector calculated in Avdjiev et al. (2019). As a result, domestic leverage is assumed to be denominated in local currency and external leverage in foreign currency, a typical assumption in most of the empirical literature.

di Giovanni et al. (2018) do not have to make such an assumption, as they use administrative data from credit registry of Turkey. They show that local currency credit growth is much faster than foreign currency credit growth in the Turkish corporate sector during 2003—2013, a period that coincides mostly with the boom phase of the GFC with easy funding conditions. Moreover, the share of foreign currency versus local currency denominated debt comoves with global and local risk premia—when risk aversion is high, premium on local currency is high so share of local currency debt declines vis-a-vis the foreign currency debt. Taken from di Giovanni et al. (2018), Chart 16 shows these cases.

These findings imply that cost of funds and credit spreads might be as important as fluctuations in exchange rates, in terms of driving domestic corporate sector leverage, and hence, they can be a powerful force in countries with low levels of foreign currency debt. To do a formal test of the effect of exchange rate fluctuations and risk premia on domestic leverage, I run the following panel

[58] The data is reported in Kalemli-Ozcan et al. (2018), who show that firms' leverage are tied to exchange rate changes in countries with high levels of foreign currency debt.

Chart 15: Corporate Leverage: The Role of Foreign Currency Debt

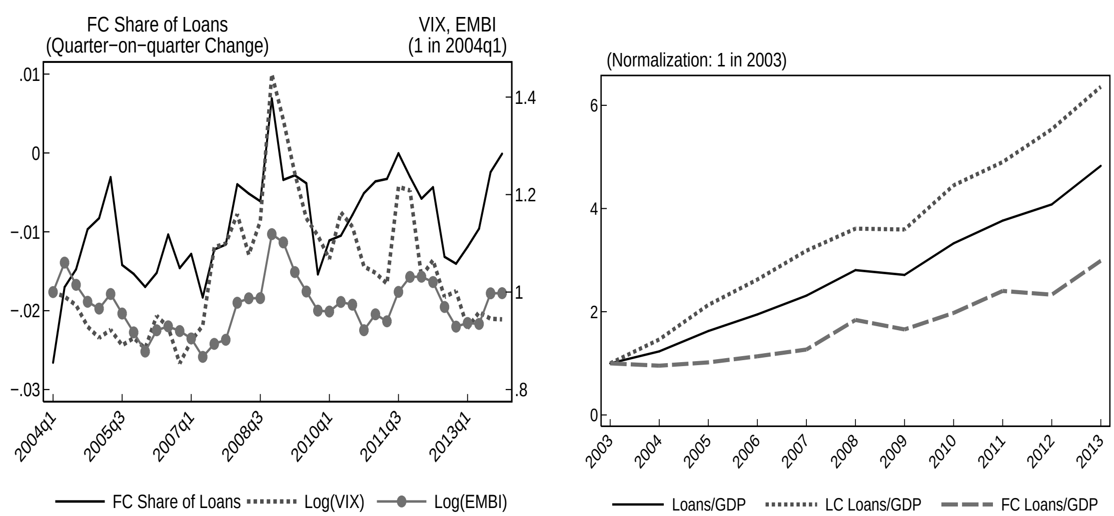


(a) All Countries

(b) Low Foreign Currency Debt Countries

Notes: Leverage is the average liabilities to assets ratios within a country group in a given quarter. Domestic leverage is financial debt to assets ratio, and external leverage is external debt to assets ratio. I normalize leverage measures to 1 in 2005q1. If the share of non-financial sectors' foreign currency debt in total debt is below the 75th percentile of the distribution on average, then the country is in the "Low Foreign Currency Debt" group. The cut-off share is 15 percent. Mean and standard deviation of the domestic leverage are 2.59% and 2.96% for high foreign currency debt countries, and those are 3.52% and 5.06% for low foreign currency debt countries. See Appendix for the list of countries in each group.

Chart 16: Foreign Currency vs. Local Currency Debt: The Case of Turkey, 2003–2013



(a) Cyclicality

(b) Trend

Notes: Taken from di Giovanni et al. (2018). "FC Share of Loans" denote the share of foreign currency loans in total loans in the economy. "LC loans" means local currency loans. All loans are normalized by GDP in the second chart.

regression with firm and country fixed effects using firm-level data from 42 countries at the annual level:

$$\text{Domestic Leverage}_{i,c,t} = \alpha_i + \mu_c + \beta \log(VIX)_t + \gamma \Delta \log S_{c,t} + \epsilon_{i,c,t}$$

where t is at the year level, α_i is a firm-fixed effect, μ_c is a country fixed effect and $\Delta \log S_{c,t}$ is the annual change in the log nominal exchange rate (from t-1 to t) defined as local currency vis-a-vis the dollar. Thus, a positive change is a depreciation.

Table 7: Exchange Rates, Risk Premia and Corporate Sector Leverage

Dependent Variable:	Firm Liabilities/Assets		
	All Countries (1)	High Foreign Currency Debt Countries (2)	Low Foreign Currency Debt Countries (3)
Log(VIX)_t	-0.04***	-0.04***	-0.02***
	(0.009)	(0.004)	(0.004)
Change in Exchange Rate	-0.09***	-0.4***	-0.006
	(0.002)	(0.002)	(0.01)
Observations	5,296,565	2,663,292	2,633,273
Firm Fixed Effects	yes	yes	yes
Country Fixed Effects	yes	yes	yes

Notes: *** indicates significance at the 1% levels. Clustered (firm-year) standard errors are in parentheses. Firm-level data is winsorized. High Foreign Currency Debt countries are the ones whose non-financial sector foreign currency debt share in total debt is above 75th percentile of the distribution for the foreign currency debt shares, on average.

As shown in Table 7, when I regress firm-level leverage in all our countries on the VIX index and the change in the exchange rate, I find a significant negative effect for both. This means that firms increase their domestic leverage when the exchange rate in their home countries appreciates vis-a-vis the U.S. dollar and when the VIX index is low. This is also the case in countries with high foreign currency debt levels on average, as shown in column (2). What is interesting is the fact that in column (3) for the low foreign currency debt countries, it is the global risk that matters for domestic leverage and not the exchange rate movements.

These effects are also quite large economically. A 1 standard deviation depreciation in the exchange rate decreases leverage by 2%, whereas a 1 standard deviation increase in the VIX decreases leverage by 1.3% in countries with high levels of foreign currency denominated debt. The same increase in the VIX decreases leverage by 0.6% in countries with low levels of foreign currency debt and exchange rate changes have no effect on leverage in these countries. A “Lehman- like” increase in the VIX of 133 percent, decreases leverage by 5.3% in countries with high levels of foreign currency denominated debt and 2.6% in countries with low levels of foreign currency denominated debt. Thus, although the countries with high levels of foreign currency denominated debt suffer more, as expected, the negative effects of risk shocks are also significant in other countries.

The findings here show a powerful result that international risk spillovers can affect domestic financial conditions and leverage even in the absence of balance sheet effects. The implication is such that by limiting the foreign currency exposure of the liabilities in an economy, a country cannot be insulated from international risk spillovers.

VII. D) Macroprudential Policies and Institutions

Rey (2013) argues that cross-border capital flows and leverage of global financial intermediaries transmit monetary conditions from the U.S. to the rest of the world, even under floating exchange-rate regimes. The global financial intermediaries are at the center of cross-border capital flows as their lending capacity move with the U.S. dollar. When the U.S. loosens its monetary policy, the associated depreciation of the dollar strengthens the balance sheets of global intermediaries in the presence of extensive dollar denominated debt, which leads to higher leverage of intermediaries and cross-border flows, which fosters higher credit growth and economic activity in other countries. Similarly, when the U.S. tightens, the balance sheets of global intermediaries take a hit when the dollar appreciates, which leads to lower leverage and disrupts cross-border intermediation.

It is indeed the case that even countries with flexible exchange rates will be affected from the GFC related spillovers, but a fully flexible exchange rate can help if GFC spillovers are risk spillovers stemming from changes in U.S. policy. The key to this observation is the fact that the attempt to damp the effects of exchange rate volatility using domestic monetary policy turns out to be counterproductive. This is because under risk spillovers there are UIP deviations that are endogenous to domestic monetary policy, implying that an increase in the domestic policy rate has a smaller effect on the exchange rate and a larger effect on the real economy, relative to a case where there are no UIP deviations. As a result, trying to manage the exchange rate will not only be counterproductive due to its effect on tighter financial conditions, but it can also make the balance sheet effects worse by increasing the extent of foreign currency denominated debt in the economy. In the data used in this paper, the share of foreign currency debt in total corporate sector debt in countries who manages their exchange rate often is 14.3%, whereas the same number in countries with free floating regimes is 1.9%. In addition, as cited above, there are papers showing that lower productivity firms borrow more in foreign currency during risk-off shocks. Hence, limiting the exchange rate volatility exactly during sudden stops can have negative and long lasting implications that will hurt long-run growth rate of the country.

What other policy options are available to countries to deal with the effects of risk spillovers related to changes in U.S. monetary policy? Countries can act on the transmission channel cyclically by limiting credit growth and leverage during the booms and doing reverse during downturns. This can be achieved by the use of macroprudential policies. In the case of EMEs, the policies that limit un-hedged foreign currency denominated liabilities not only in the financial sector but also in the non-financial corporate sector must be a priority. The rationale for these policies is to provide insulation from spillovers that arise from balance sheet effects of exchange rate fluctuations with large levels of un-hedged foreign currency denominated debt. Given my results, it is better to deal with this debt directly, with the help of macroprudential polices, rather than to try to use a relatively blunt instrument like monetary policy.

However, dealing with excessive credit growth and foreign currency denominated debt may not be enough. A significant component of international risk spillovers for EMEs is related to country-specific risk, as shown in this paper. A long-term objective that would act on the transmission channel structurally entails reducing this inherent country risk. As shown by Alfaro et al. (2008), countries institutional quality is the most important causal factor for capital flows in the long-term. In the short-term, even if high growth EMEs receive capital flows, these flows will be sensitive to changes in risk perceptions exactly because most of the high growth EMEs lack high quality institutions.[59] Long run improvements in the quality and transparency of institutions will reduce idiosyncratic country risk and reduce the sensitivity of capital flows in EMEs to global risk premia and to foreign investors risk perceptions. Policies aimed at strengthening the protection of property rights, reducing corruption, and increasing government stability, bureaucratic quality, and law and order should be a priority for policymakers seeking not only to increase capital inflows but also to reduce the sensitivity of capital flows to U.S. monetary policy. They will also help

[59] Asian EMEs that experienced high growth and ran current account surpluses at the same time before the 2008 crisis reflect the fact that capital outflows from high growth Asian EMEs were driven by sovereign flows, while these countries imported private capital on net as shown by Alfaro et al. (2014) and Gourinchas and Jeanne (2013).

EMEs get the most out of capital flows in terms of sustainable growth, tilting capital flows towards longer maturity debt, and foreign direct investments. Finally, strong institutions will also provide the needed credibility for implementing desirable macroprudential policies, to dampen the severe effects of financial cycles.

VIII. Conclusion

This paper shows that monetary policy spillovers from the U.S. to the rest of the world operate through changes in risk premia. This risk channel implies larger effects on EMEs than AEs due to EMEs country-specific risk. The case for flexible exchange rates is stronger in a world of international risk spillovers since exchange rate adjustment can smooth out shocks to risk sentiments. Trying to limit exchange rate volatility can be counterproductive as this policy response requires a large change in domestic interest rates, turning a nominal exchange rate volatility into real output volatility in terms of lower GDP growth.

In order to achieve higher GDP growth and mitigate volatility related to monetary policy spillovers, countries need to decrease the risk-sensitivity of capital flows through reducing inherent country risk by improving institutional quality. A collective reform agenda aimed at improving transparency, governance, accountability, fighting with corruption, protecting institutional integrity, and improving bureaucratic quality with an emphasis on central bank independence will be beneficial in terms of attracting long-term stable capital flows. These policies reduce the sensitivity of capital flows to changes in the center country monetary policy and associated risk sentiments.

My findings do not imply EMEs will always be more vulnerable than AEs to monetary policy spillovers. Monetary policy actions have the potential to spill-over to any country as long as international investors' risk perceptions change with changes in monetary policy. Central bankers are increasingly confronted with the need to better understand and respond to fluctuations related to shifts in risk sentiments, which can lead to disruptive financial conditions. As a consequence, international *risk* spillovers present a serious challenge going forward for monetary policy making across the world.

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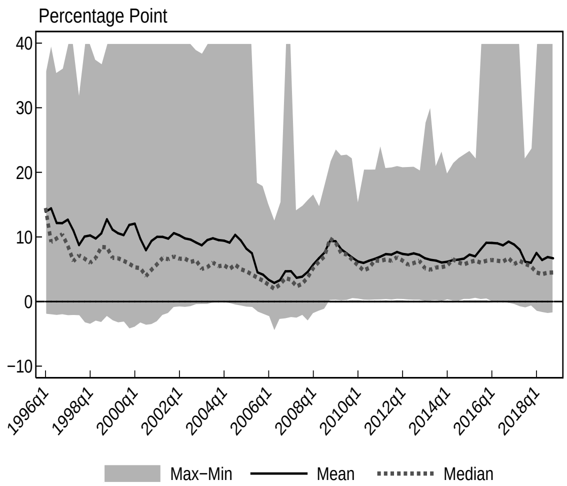
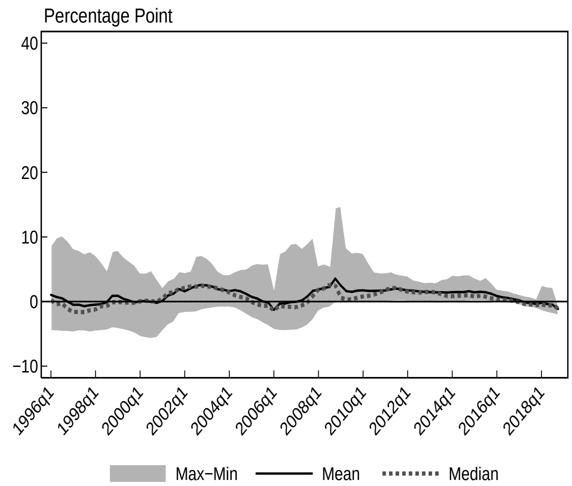
Appendix

A) Additional Charts on Monetary Policy Divergence

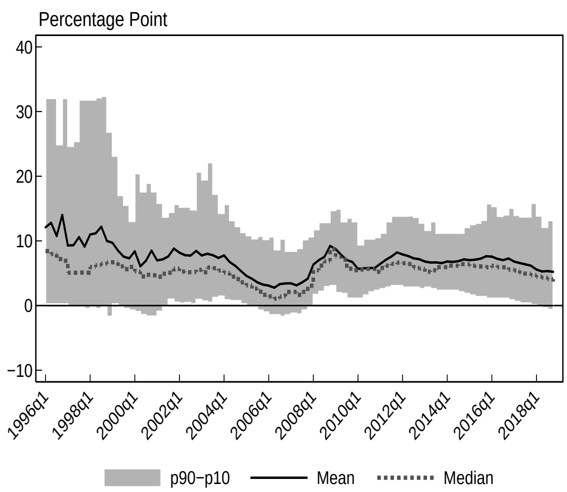
Chart 17: Monetary Policy Divergence: 3-month Government Bond Rate Differentials and 10-90th percentile in Policy Rates



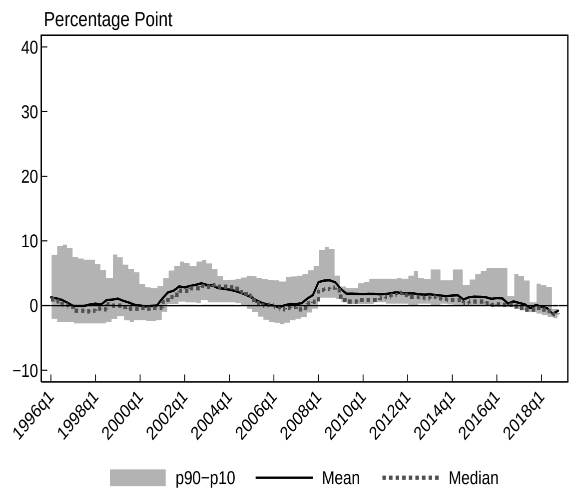
(a) EMEs: 3-month Bond Differential



(b) AEs: 3-month Bond Differential



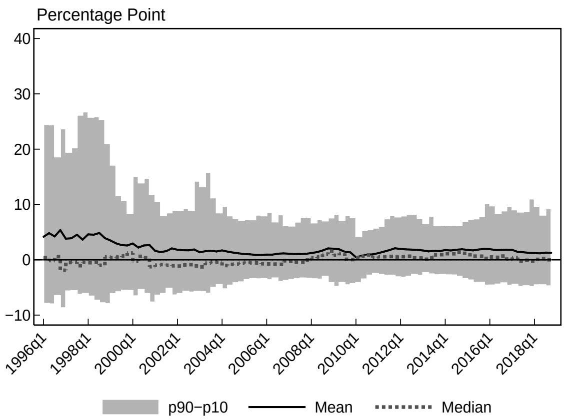
(c) EMEs: Policy Differential



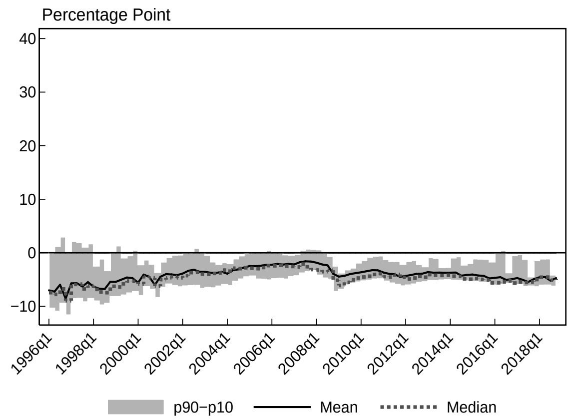
(d) AEs: Policy Differential

Notes: The rate differentials are in logs.

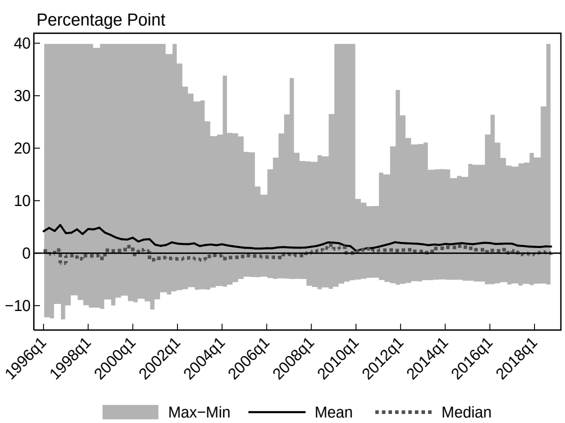
Chart 18: Monetary Policy Divergence vis-a-vis the Rest of the World



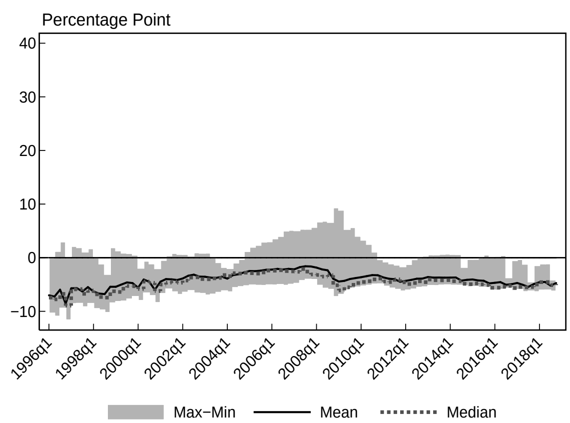
(a) EMEs: Policy Differential



(b) AEs: Policy Differential



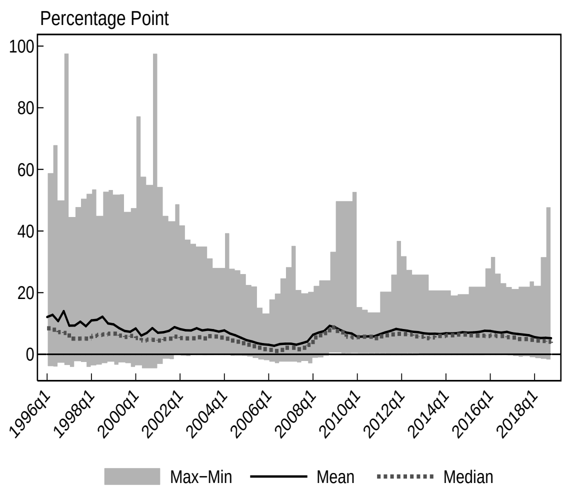
(c) EMEs: Policy Differential



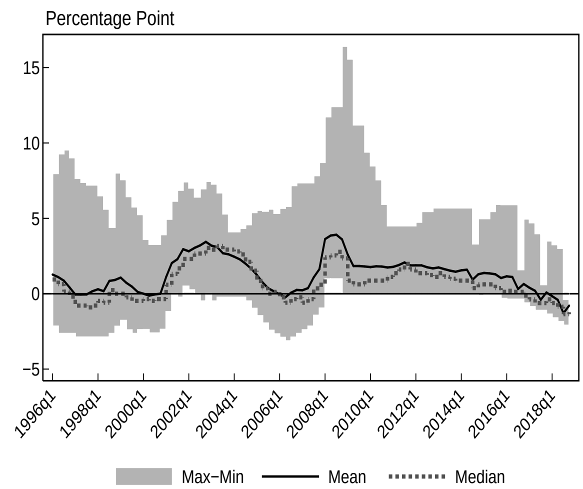
(d) AEs: Policy Differential

Notes: The rate differentials are in logs vis-a-vis the rest of the world (ROW) defined as all the countries in the sample except the country that the differential is calculated for.

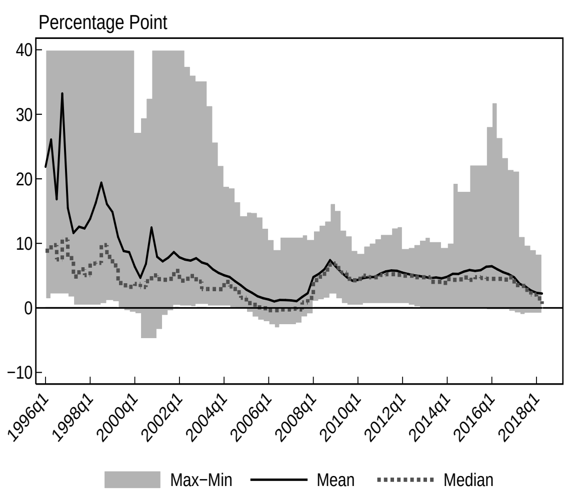
Chart 19: Monetary Policy Divergence: Unrestricted Scale and Small Sample



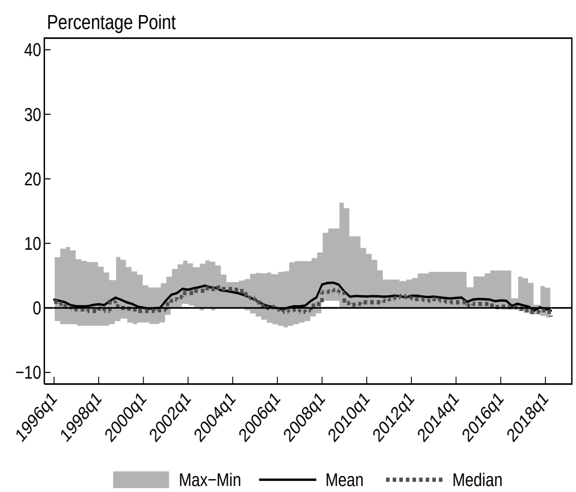
(a) EMEs: Policy Differential



(b) AEs: Policy Differential



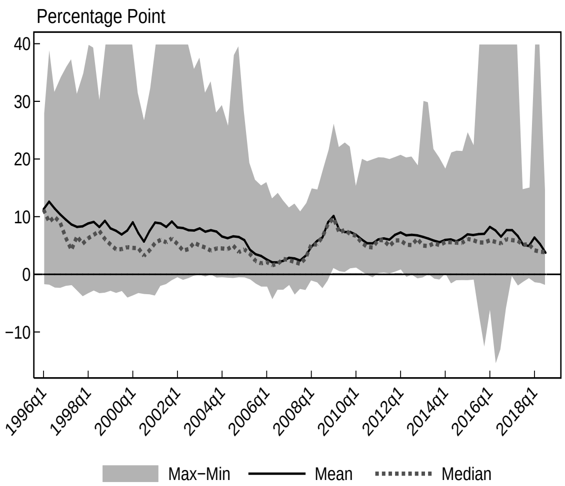
(c) EMEs: Policy Differential



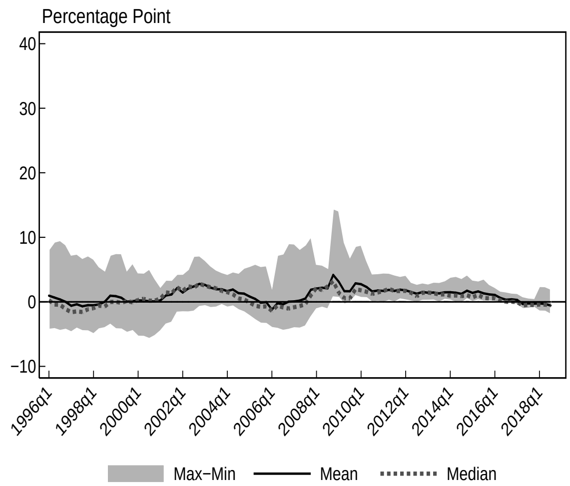
(d) AEs: Policy Differential

Notes: The rate differentials are in logs. The top panel does not restrict the y-axis scale. The second sample plots the differentials for the small sample that is used in most of the regressions due to data availability on other regressors.

Chart 20: Monetary Policy Divergence: Real Rates



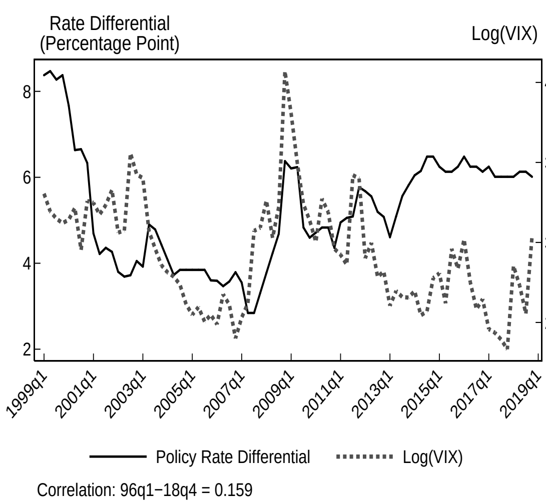
(a) EMEs: Real Rate Differential



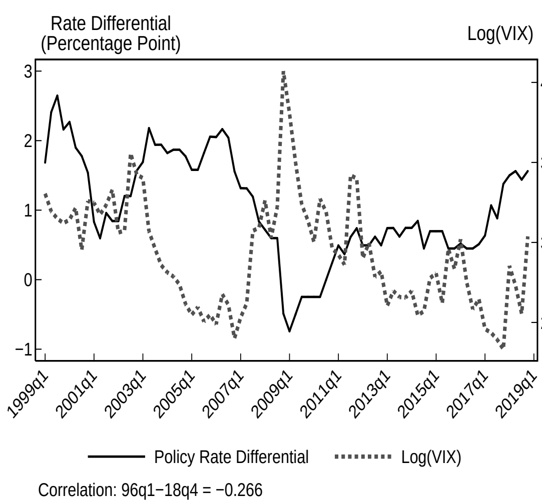
(b) AEs: Real Rate Differential

Notes: The rate differentials are in logs. Following IMF World Economic Outlook April 2014, real interest rates are estimated as the nominal 3-month treasury rate minus the discounted sum of year-on-year quarterly inflation rate over the asset holding horizon (3 months).

Chart 21: Monetary Policy Divergence vis-a-vis ECB and Risk Sentiments



(a) EMEs



(b) AEs

Notes: The policy rate differentials are calculated vis-a-vis the ECB refinancing rate and in logs.

B) Descriptive Statistics

Table 8: Country List

Emerging Market Economies					Advanced Economies
Afghanistan, Islamic Republic of	Croatia†	Kosovo, Republic of†	Paraguay†	Thailand†	Australia†
Albania†	Czech Republic†	Kuwait	Peru†	Tunisia	Canada†
Angola	Dominican Republic†	Kyrgyz Republic†	Philippines†	Turkey†	Denmark†
Argentina†	Ecuador†	Latvia†	Poland†	Uganda	Euro Area†
Armenia, Republic of†	Egypt†	Libya	Romania†	Ukraine†	Germany†
Azerbaijan, Republic of†	Malaysia†	Russian Federation†	Uruguay†	Vietnam	Iceland†
Bangladesh	Gambia, The	Malta†	Rwanda		Israel†
Belarus†	Georgia†	Mauritania	Zambia		Italy†
Bolivia†	Ghana	Mauritius†	Serbia, Republic of†		Japan†
Botswana	Guatemala†	Mexico†	Seychelles†		New Zealand†
Brazil†	Hungary†	Moldova†	Sierra Leone		Norway†
Bulgaria	India†	Mongolia†	Singapore		Sweden†
Cambodia†	Indonesia†	Morocco†	Slovak Republic†		Switzerland†
Chile†	Iraq	Mozambique	Slovenia†		United Kingdom†
China	Jamaica†	Myanmar	South Africa†		
Colombia†	Kazakhstan†	Nepal	Sri Lanka†		
Congo, Democratic Republic of	Kenya	Nicaragua†			
Costa Rica†	Korea, Republic of†	Nigeria†			
		Pakistan			
		Tanzania			

Notes: Countries with quarterly capital flows data with a †. Hard peg country-quarter observations are not included in the analysis.

Table 9: Summary Statistics: 1996q1—2018q4

	Emerging Market Economies						Advanced Economies					
	Mean	Median	Std.Dev.	Max	Min	N_{obs}	Mean	Median	Std.Dev.	Max	Min	N_{obs}
Policy Rate	9.39	7.00	8.34	54.73	0.05	4118	3.64	3.25	3.05	18.00	0.05	944
3-month Government Bond Rate	10.53	7.56	10.69	63.04	0.04	3219	3.04	2.42	2.98	16.53	0.04	824
12-month Government Bond Rate	8.36	7.26	5.73	25.50	0.03	2252	3.13	2.71	2.66	16.18	0.03	787
3-month Deposit Rate	9.07	7.43	8.22	47.33	0.05	3067	3.25	2.86	2.67	18.03	0.05	969
12-month Deposit Rate	7.45	6.09	6.01	29.37	0.11	1966	3.65	3.37	2.77	16.74	0.11	901
12-month Lending Rate	10.80	9.43	7.45	45.70	1.35	1321	4.78	4.17	2.64	17.83	1.35	837
Policy Rate Differentials	6.88	5.23	7.57	97.85	-4.81	4118	1.24	0.62	2.47	16.43	-3.14	944
3-month Government Bond Differentials	7.73	5.75	8.37	45.52	-3.23	3219	0.94	0.31	2.41	14.80	-3.23	824
12-month Government Bond Differentials	6.48	5.64	5.28	21.84	-3.06	2252	0.66	0.23	1.96	9.49	-3.06	787
12-month Lending Rate Differentials	5.43	4.31	5.82	30.76	-3.94	1201	-0.41	-0.33	2.16	8.48	-4.94	795
Lending Spread	2.79	2.75	1.82	8.23	-11.25	820	2.05	1.96	0.69	4.28	0.21	638
UIP Deviation (3 months)	0.10	0.52	3.30	7.20	-22.06	1086	-0.03	-0.10	2.04	5.30	-7.50	675
UIP Deviation (12 months)	2.74	3.02	6.42	18.53	-43.93	992	1.11	0.69	4.20	12.83	-8.87	690
log(Exchange Rate)	3.54	3.35	2.76	23.86	-6.77	8533	1.29	0.43	1.71	7.36	-0.72	1096
Expected Change in log(Exchange Rate)	1.78	0.88	4.27	22.32	-4.37	1908	0.21	0.32	2.14	9.38	-4.37	914
Total Debt Inflows/GDP	6.87	2.04	26.27	180.11	-10.59	2825	7.89	3.07	21.69	180.11	-10.59	945
Government Debt Inflows/GDP	0.88	0.19	2.70	17.34	-7.11	2197	0.82	0.42	3.44	17.34	-7.11	892
Total Capital Inflows/GDP	20.96	5.86	67.65	430.50	-5.39	2947	12.70	6.43	34.90	430.50	-5.39	957
GDP Growth	0.96	1.03	1.94	6.85	-5.68	3306	0.59	0.63	1.04	6.85	-5.68	1084
Growth Differentials	0.35	0.42	2.02	9.04	-10.98	3325	-0.07	0.00	1.16	6.32	-10.83	1095
Inflation Differentials	1.49	0.91	2.51	12.86	-3.54	7886	-0.07	-0.09	0.74	7.53	-2.12	1107
log(VIX)	2.95	2.96	0.33	4.07	2.33	92	2.95	2.96	0.33	4.07	2.33	92
log(EMBI)	5.52	5.62	0.96	8.75	-0.91	2053	n/a	n/a	n/a	n/a	n/a	0

Notes: Interest rates, GDP growth (log difference) and flows to GDP ratios are in percentage, and interest rate differentials, lending spread, UIP deviation, expected change in log(exchange rate), GDP differentials and inflation differentials are in percentage point. Exchange rate, VIX, and EMBI are in logs.

Table 10: Country List by Foreign Currency Debt Share (FX Debt)

Mean and standard deviation of the share of FX debt in the total debt of the non-financial sector are 11.21% and 10.67%, respectively. This FX Debt shares are from BIS and captures both FX loans and FX bonds. IMF Financial Soundness Indicators focus only on FX loans and reports the shares of FX in total loans of the non-financial sector as 27.86% and 25.25%, respectively, for over 100 countries.

High FX Debt Countries	Low FX Debt Countries
Argentina	Australia
Chile	Austria
China, P.R.: Hong Kong	Belgium
Hungary	Brazil
Luxembourg	Canada
Mexico	China, P.R.: Mainland
Philippines	Czech Republic
Russian Federation	Denmark
Singapore	Finland
Turkey	France
United Kingdom	Germany
11 Countries	Greece
	India
	Indonesia
	Ireland
	Israel
	Italy
	Japan
	Korea, Republic of
	Malaysia
	Netherlands
	Norway
	Poland
	Portugal
	South Africa
	Spain
	Sweden
	Switzerland
	Taiwan
	Thailand
	United States
	31 Countries

Notes: The "High FX Debt" countries are those whose FX debt shares in total debt are over the 75th percentile of the distribution on average.

C) Additional Results

Table 11: The Role of Total Capital Flows

Dependent Variable:	Total Capital Inflows/GDP$_{c,t}$				
	Emerging Market Economies			Advanced Economies	
	(1)	(2)	(3)	(4)	(5)
$i^p_{c,t}$-$i^p_{US,t}$	-0.17***	-0.12***	0.41**	0.11	0.87*
	(0.05)	(0.04)	(0.17)	(0.41)	(0.42)
Growth Differential$_{c,t}$	0.82	0.83	0.08	1.99**	1.98**
	(0.56)	(0.56)	(0.19)	(0.89)	(0.88)
log(VIX)$_t$		-0.06**	0.01		-0.08***
		(0.03)	(0.01)		(0.02)
log(EMBI)$_{c,t}$			-0.04***		
			(0.01)		
Observations	1934	1934	990	942	942
Country FE	yes	yes	yes	yes	yes

Notes: ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. Robust standard errors are in parentheses. All variables are defined as before, except capital inflows also include equity flows.

Table 12: Robustness for Lending Spread Regressions

Dependent Variable:	$i_{c,t}$(lending)$-i_{c,t}$(3m treasury)			
	Emerging Market Economies		Advanced Economies	
	(1)	(2)	(3)	(4)
Capital Inflows/GDP$_{c,t-1}$	-0.024**	-0.023**	-0.012***	-0.001
	(0.012)	(0.011)	(0.004)	(0.003)
Monetary policy	no	yes	no	yes
Capital Inflows/GDP$_{c,t}$	-0.032***	-0.027***	-0.012***	-0.001
	(0.009)	(0.010)	(0.004)	(0.003)
Monetary policy	no	yes	no	yes
Growth Diff	yes	yes	yes	yes
Capital Inflows/GDP$_{c,t}$	-0.033***	-0.028***	-0.012***	-0.001
	(0.008)	(0.009)	(0.004)	(0.003)
Monetary policy	no	yes	no	yes
Inflation Diff	yes	yes	yes	yes
Country FE	yes	yes	yes	yes

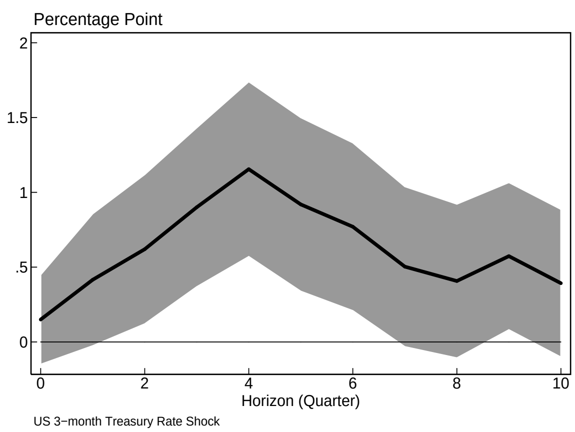
Notes: ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. Robust standard errors are in parentheses. All variables are defined as before.

Table 13: Growth Regression by Exchange Rate Regime

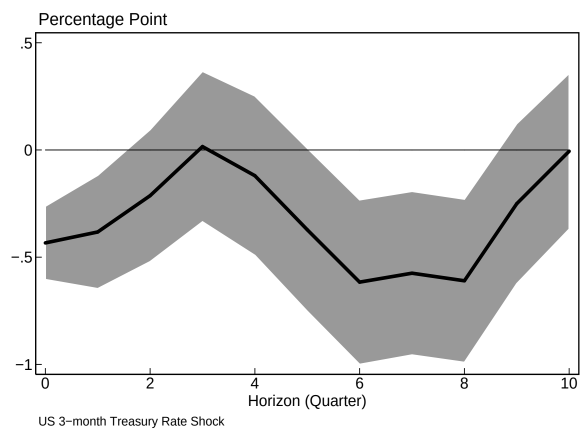
Dependent Variable:	GDP Growth$_{c,t}$			
	Managed Floats		Free Floats	
	EME	AE	EME	AE
	(1)	(2)	(3)	(4)
log(VIX$_t$)	-0.006***	-0.004***	-0.010	-0.002
	(0.001)	(0.001)	(0.008)	(0.001)
Observations	3400	866	258	374
Country FE	yes	yes	yes	yes

Notes: ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. Robust standard errors are in parentheses. Regressions use country-quarter observations. GDP growth is the quarterly log change in GDP, and is winsorized.

Chart 22: Responses of 10-year Government Bond Rate Differentials



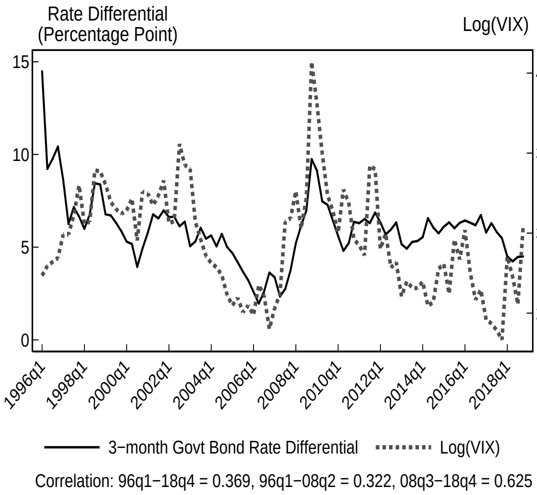
(a) Emerging Market Economies



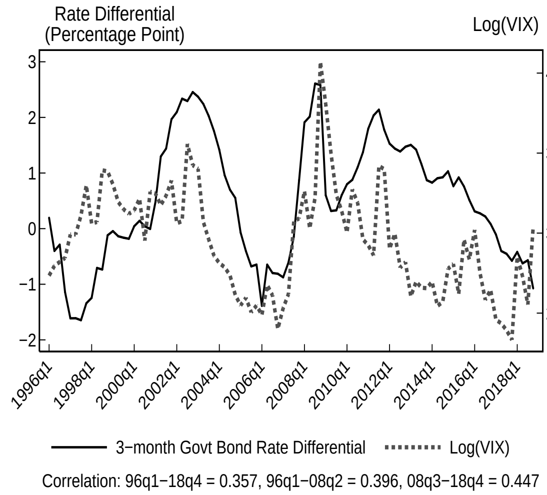
(b) Advanced Economies

Notes: Impulse responses of 10-year government bond rate differentials are obtained from panel local projections of 79 EMEs and 14 AEs. 95 percent confidence intervals (calculated using Newey-West standard errors) are shown in the shaded areas. The U.S. policy (3-month treasury rate) is instrumented by Gertler-Karadi shock FF4 (estimated from surprises in 3-month Fed fund futures). The domestic monetary policy response of country c is controlled. The first-stage effective F-statistic of Olea and Pflueger (2013) is 145.8 for EMEs and 134.3 for AEs.

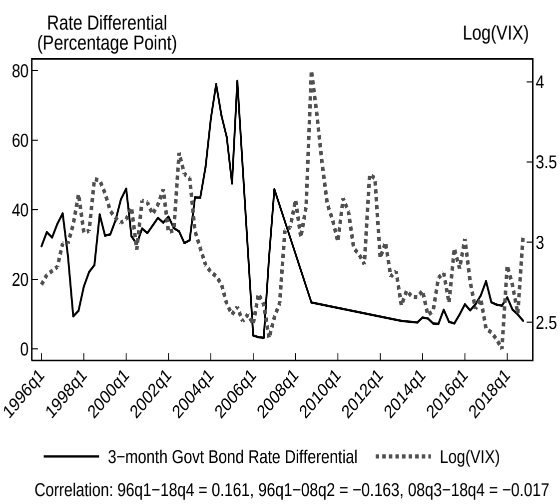
Chart 23: Policy Divergence and Risk Sentiments: Exchange Rate Regimes, EMEs and AEs



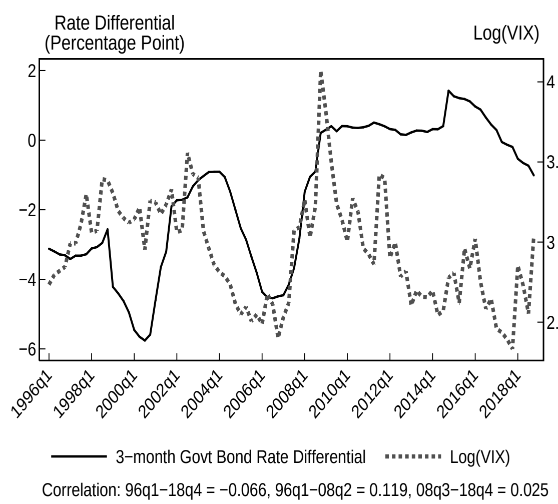
(a) EMEs: All Floats



(b) AEs: All Floats



(c) EMEs: Free Floats



(d) AEs: Free Floats

Notes: The top panel replicates Chart 5, panels (c) and (d) using the original sample of the analysis that excludes hard pegs. The bottom panel uses country-quarter observations only on free floats (Ilzetzki et al. (2017) coarse classification is 4, 5, and 6).

D) Data Sources

In this section, I describe the process of data construction.

Spot Exchange Rate: I obtain spot exchange rate from IMF International Financial Statistics (IFS). Exchange rate is expressed as the price of U.S. dollar in terms of local currency, and I use period average value. Using end-of-period values yield similar results.

Exchange Rate Forecasts: I get exchange rate forecasts from Consensus Economics. I convert forecasts into local currency per U.S. dollar forecasts using appropriate currency forecasts. Exchange rate forecasts are available only at the end of period. Consensus forecast (mean average) at 1 month, 3 months, 12 months, and 24 months from the survey date. More precisely, the survey form which is usually received on the Survey Date (often the second Monday of the survey month), requests forecasts at the end of the month 1 month, 3 months, 12 months and 24 months. Thus the forecast periods may be slightly longer than these monthly horizons.

Interest Rates: I collect market interest rates (deposit rate, government bond rate, and lending rate) from the Bloomberg. For a given country and an interest rate, there are various tickers in Bloomberg. I choose the most reliable and long-spanning ticker after checking whether interest rates are in annual percentage rate with the same maturity and denominated in local currency. As Bloomberg provides daily values for most series, I can get both period end and period average for quarterly frequency. When interest rates are missing from Bloomberg, I obtain data from IMF IFS. Though IFS usually gives interest rates with mixed maturities, some series are with fixed maturity. I refer to country notes of IFS database to check whether the interest rate is of the same maturity, denominated in local currency and calculated as period end or average of daily values. If the IFS data is consistent with this criteria, I add that series to the database. For some interest rate series, only period end of period average data is available. I obtain policy rates from the IFS first and replace missing or short series of a country with Bloomberg data. Policy rates are the central banks' last announced rate in a given period.

Capital Flows: I obtain capital flows from IMF IFS. Capital debt flows by sector (banks, sovereigns, and corporates) are obtained directly from Avdjiev et al. (2019). Capital inflows are available at quarterly frequency.

Aggregate Leverage: I obtain domestic leverage of the corporate sector for my countries by aggregating firm-level leverage data for each country from Orbis database. Domestic leverage is defined as financial debt to assets ratio. External leverage comes from Avdjiev et al. (2019) and defined as external liabilities to external assets ratio.

Firm Leverage: I obtain firm level balance sheets from ORBIS database for 42 countries and calculated firm level leverage using this data.

Exchange Rate Regime Classification: These are from https://www.carmenreinhart.com/data. Classification code ranges from 1 (hard pegs) to 6 (free floats). The main sample drops countries with hard pegs (classification code is 1).

U.S. Monetary Policy Shock: I obtain monetary policy shocks from Gertler and Karadi (2015)

FX Debt: This data is from BIS, Global Liquidity Indicators (GLI) database, which is based on BIS Locational Banking Statistics and BIS International Debt Securities Statistics. Foreign currency bonds are debt securities issued in the U.S. dollar, euro and Japanese yen in international markets by the residents in the non-financial sector of a given economy. Foreign currency loans are bank loans extended to the non-bank sector of a given economy both by domestic banks and by international banks denominated in the US dollar, euro and Japanese yen.

Other Macro Variables Aggregate variables including GDP and current account are downloaded from IMF IFS. For real and nominal GDP, I get both non-seasonally-adjusted and seasonally-adjusted data. When data is missing, I get data from national bureau of statistics. I use seasonally-adjusted real GDP for calculating GDP growth and unadjusted data for calculating flows to GDP ratios. Inflation is obtained as quarter-on-quarter log differentials of consumer price index. I download Chicago Board Options Exchange volatility index (VIX) from Federal Reserve Economic Data (FRED). I obtain country-specific sovereign spreads (Z-spread) for emerging countries from J.P. Morgan Emerging Market Bond Index Global (EMBI Global).