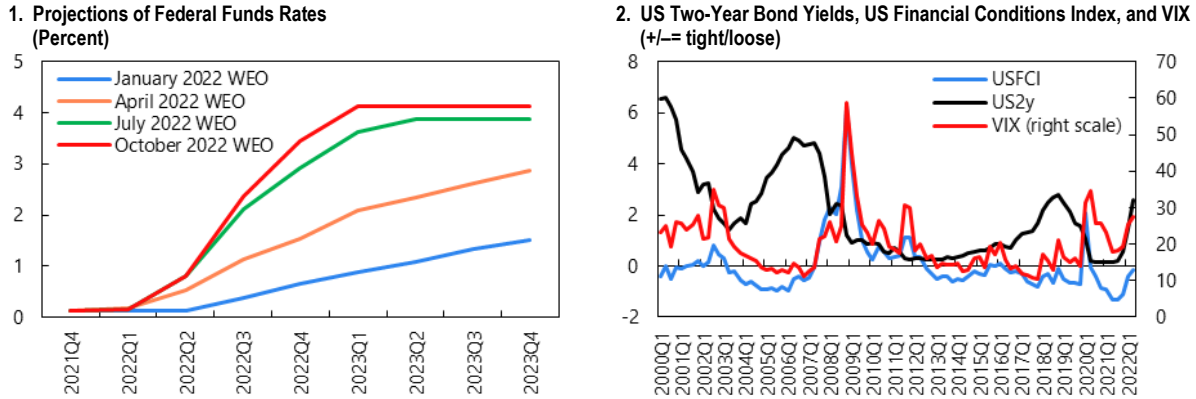
Spillovers of US Monetary Tightening to Latin America[1]
(Background Paper 1)

This chapter studies spillovers of US monetary tightening to Latin America. Historically, tighter US financial conditions generated strong spillovers to financial markets in the region, with broad-based impact on sovereign debt markets. Shifts in US interest rates led to more than one-to-one shifts in US dollar and local-currency yields in Latin America, as well as sizable capital outflows and depreciation pressures on domestic currencies. Financial spillovers also had substantial impact on domestic output—much of which was transmitted through domestic financial conditions—and country fundamentals amplified/mitigated these spillover effects. While some of the region's fundamentals have improved, compared with the previous episodes of global financial tightening, others have deteriorated, painting a mixed picture for the current juncture. Overall, these findings indicate that a tightening of US financial condition could have material impact on Latin America. Finally, while high commodity prices have been an important counterbalancing force to the tightening of external financial conditions so far, the evidence indicates that a tightening of US monetary policy has historically had sizable negative impact on prices of commodities exported by Latin America, indicating that a sharp rise in US interest rates could also spill over to Latin America through lower commodity prices.

Introduction

The current monetary policy tightening in the United States could have sizable impact on global financial conditions. A surge in inflation since last year has prompted monetary tightening in the United States and globally. While the US policy rates are still low from historical perspective and further tightening is expected, its size and speed are subject to considerable uncertainty, as illustrated by the forecast revisions in the US Federal Funds rate in 2022 (Figure 1, panel 1). With ensuing uncertainty about the impact of high interest rates on balance sheets, commodity prices, and the economy more broadly, a sharp tightening of US monetary policy could have a sizable impact on financial conditions and risk appetite globally (Figure 1, panel 2).

Figure 1. US Monetary Policy and Financial Conditions

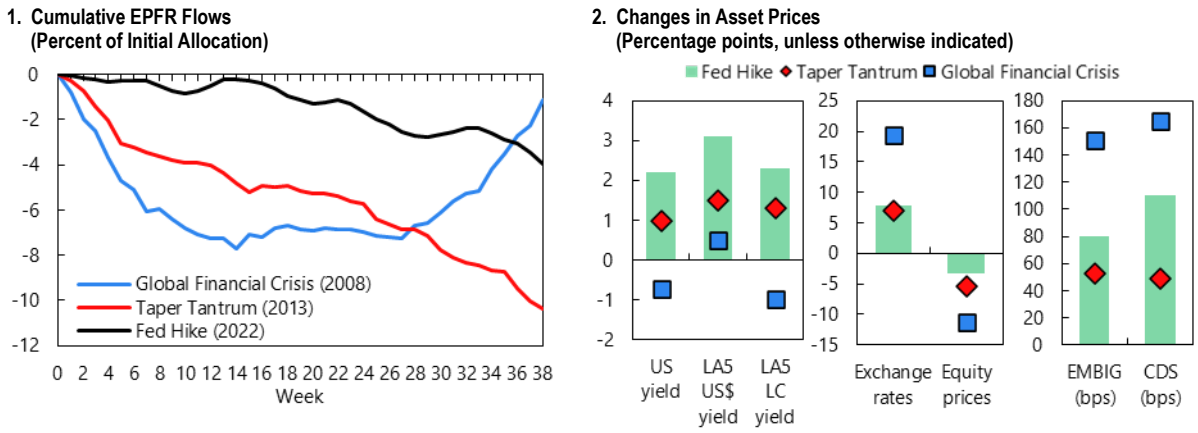


Sources: FRED; IMF, World Economic Outlook database; US Federal Reserve; and IMF staff calculations.
Note: The US financial conditions index follows the principal component analysis in the April 2018 Global Financial Stability Report, using the real short-term interest rate, the interbank spread, the term premium, the corporate local currency spread, equity prices, equity volatility, and real house prices as components. VIX = Chicago Board Options Exchange Volatility Index; WEO = *World Economic Outlook*.

[1]This chapter was prepared by Maximiliano Appendino, Chao He, Takuji Komatsuzaki (lead), and Samuel Pienknagura under the supervision of Gustavo Adler and Anna Ivanovna. Jorge Roldós provided invaluable guidance in the initial phases of this project. It benefitted from excellent research support by Evelyn Carbajal and Genevieve Lindow. The authors are grateful to Rafael Portillo, Aneta Radzikowski and Pedro Rodriguez (all Research Department) for their support with the IMF's Western Hemisphere Module general equilibrium model.

Domestic financial conditions in Latin America have already tightened, in tandem with global conditions, although less than in previous tightening episodes. While monetary and financial shocks in the United States have historically had important global spillovers,[2] so far, financial conditions in Latin America—in terms of portfolio flows and asset prices—have tightened less than in past global tightening episodes (Figure 2). In particular, portfolio outflows have been mild and gradual, compared to the global financial crisis or the taper tantrum episodes, although accelerated somewhat since the early summer of 2022. At the same time, Latin American sovereign bond yields, both in US dollars and local currency, have increased markedly with the US monetary tightening, with increases in risk premiums comparable to those seen during the taper tantrum although smaller than during the global financial crisis. Compared with past episodes, exchange rate depreciations and equity price declines have been smaller.

Figure 2. LA5: Recent Financial Developments—Current vs Past Episodes



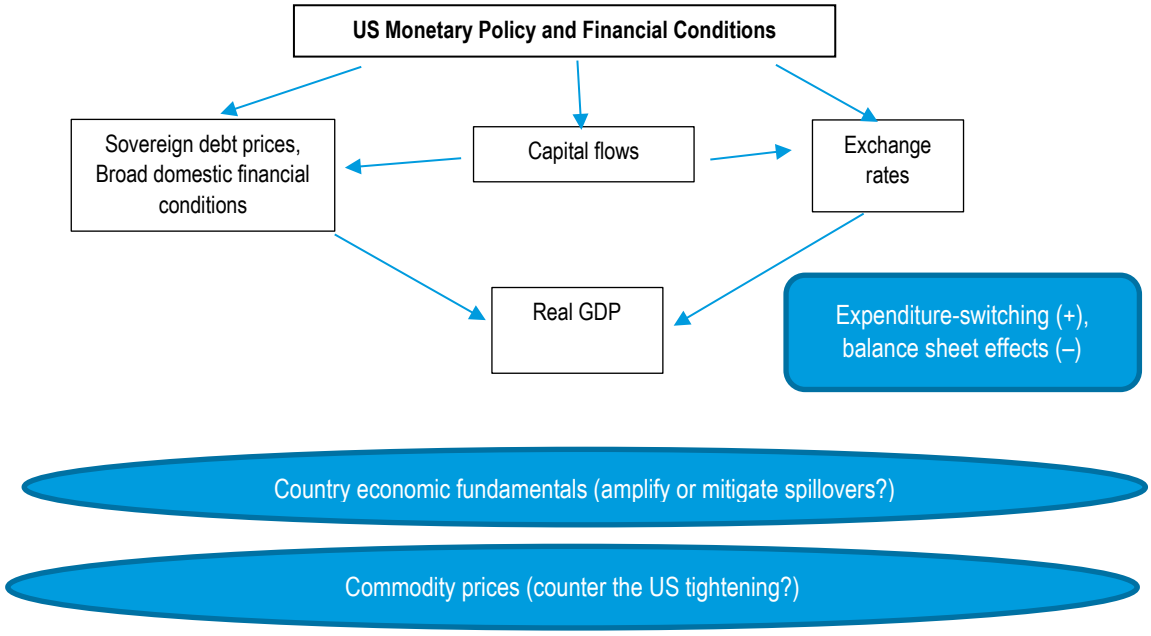
Sources: Bloomberg Finance L.P; Emerging Portfolio Fund Research (EPFR) database; Haver Analytics; and IMF staff calculations.
Note: Panel 1: Starting point for respective episodes are: global financial crisis (9/10/2008); taper tantrum (5/22/2013); and Federal Reserve hike (1/5/2022). Panel 2: global financial crisis (September 15, 2008 to March 31, 2009); taper tantrum (May 22 to September 30, 2013); and Federal Reserve Hike (January 3 to September 30, 2022). Indicators refer to the average of LA5 countries. For exchange rates, an increase denotes a depreciation. CDS = credit default swap; EMBIG = J.P. Morgan Emerging Markets Bond Index Global; LA5 = Latin America 5 (Brazil, Chile, Colombia, Mexico, Peru); LC = local currency.

Booming commodity prices may have played an important mitigating role during the ongoing episode. The rebound of commodity prices from early pandemic lows, further propelled by the impact of the Russian invasion of Ukraine in February 2022, supported activity and asset prices in Latin America 5 (LA5; Brazil, Chile, Colombia, Mexico, Peru) economies, most of which are commodity exporters. Exchange rates and risk premiums were particularly stable in the first few months after the invasion. However, commodity prices have started to weaken recently and, thus, this mitigating factor may be fading.

The prospect of a further tightening of US monetary policy and financial conditions, amid weaker commodity prices, raises questions about the likely impact of this constellation of shocks on Latin America. Specifically: (1) How important historically have been the spillovers from US monetary and financial conditions tightening on Latin America? (2) Are these spillovers amplified or mitigated by economic fundamentals? And, if so, is the region better placed today than in the past episodes to withstand the US monetary tightening? (3) Will high commodity prices be an important counterbalancing force (Figure 3)? The rest of the chapter addresses these questions.

[2]See Bruno and Shin (2015); Miranda-Agrippino and Rey (2020); Dedola, Rivolta, and Stracca (2017).

Figure 3. Transmission Channels from US Monetary Policy and Financial Conditions to LA5



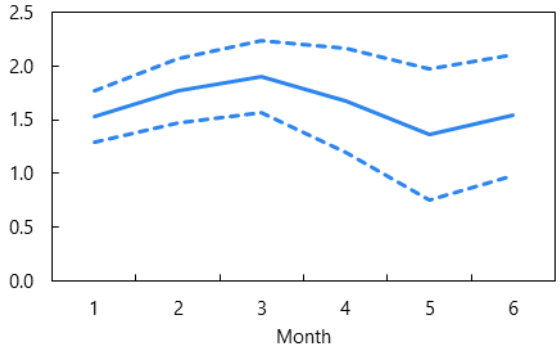
Source: IMF staff.
Note: LA5 = Latin America 5 (Brazil, Chile, Colombia, Mexico, Peru).

Spillovers to Domestic Financial Markets

As a first step toward quantifying the spillover effects from the US monetary policy on Latin America, this section estimates the impact of changes in US interest rates on LA5 sovereign debt yields. The impact is estimated using the local projection method (Jordà 2005) based on monthly data for the period 2010-19, using changes in the two-year Treasury bond yields, which capture monetary policy changes including when policy rates are at zero lower bound (Hanson and Stein 2015), as a measure of US interest rate shocks, while controlling for two lags of the shock and outcome variables, lags of domestic inflation and economic activity consensus forecasts (to control for expected domestic conditions) as well as the Chicago Board Options Exchange Volatility Index, and country fixed effects. Results are generally robust to variations in data frequency, sample periods, control variables, and shock specification (see further details in Annex 1).

US monetary and financial tightening typically entails strong spillovers to LA5 sovereign debt markets. The spillovers are broad-based, affecting both short- and long-term, as well as local- and foreign-currency- denominated bond yields. Moreover, the impact is sizable. An increase in US two-year bond yields has a substantially more than one-to-one impact on LA5's US dollar-denominated sovereign yields—that is, a sizable impact on US dollar spreads (Figure 4). Spillovers are also strong on

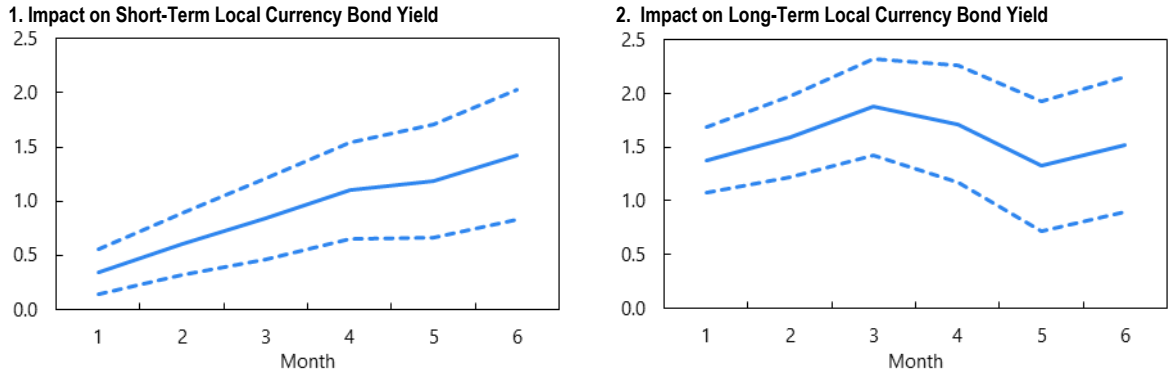
Figure 4. LA5: Impact of US Two-Year Bond Yield Increase on US Dollar (Long-Term) Sovereign Yields
(Percentage points)



Sources: IMF staff calculations.
Note: Point estimates (solid line) are impulse responses to 1 percentage point change in the US two-year bond yield on LA5's ten-year US dollar-denominated sovereign yields. 90 percent confidence intervals (dashed lines) are also reported. See Annex 1 for further details. LA5 = Latin America 5 (Brazil, Chile, Colombia, Mexico, Peru).

local currency yields of LA5 economies, both short and long term (Figure 5). Long-term bond yields respond more than one-to-one, and immediately, to changes in US rates, while the effect on short-term yields is somewhat smaller in the short term and materializes more gradually. The strong impact on local currency bonds suggests that, despite the floating exchange rates, domestic financial conditions are heavily influenced by US monetary policy —see Rey (2013), and Miranda-Agrippino and Rey (2020). This means that central banks in Latin America may have limited control of their yield curves, complicating their policy calibration. The sensitivity of domestic currency yields to US interest rates also has financial stability implications as it implies that, even in the absence of currency mismatches, balance sheets of domestic financial institutions are vulnerable to fluctuations in US rates through their holdings of domestic currency instruments.

Figure 5. LA5: Impact of US Two-Year Bond Yield Increase on Local Currency Sovereign Yields
(Percentage points)



Source: IMF staff calculations.
Note: Short-term local-currency bond yields correspond to bonds with three months or shortest available maturity and long-term local-currency bond yields correspond to bonds with 10-year maturity. Point estimates (solid lines) are impulse responses to 1 percentage point change in the US two-year bond yields. Sample is monthly from January 2010 to December 2019. Ninety percent confidence intervals (dashed lines) are reported. See Annex 1 for further details. LA5 = Latin America 5 (Brazil, Chile, Colombia, Mexico, Peru).

Spillovers to the Domestic Economy

To shed light on the broader macroeconomic effects from US monetary policy tightening on LA5 economies, a local projection model is employed to estimate the impact of US monetary policy shocks and broader US financial conditions shocks on real GDP, gross capital inflows (measured by net changes in portfolio liabilities), and exchange rates (expressed in local currency per US dollar) of LA5 economies, using quarterly data for the period 2000–19.[3] The outcome variable is logged real GDP, logged local currency-US dollar exchange rate, or capital flows- to- GDP ratio, and the shock variable is either the changes in US two-year bond yields on the day of the Federal Open Market Committee meetings (monetary policy shock) or the financial conditions index for the United States constructed by the IMF (financial conditions shock). Eight lags of the outcome variable, two lags of the shock variable, US real GDP growth and country-specific commodity terms of trade, country fixed effects, country-specific quadratic time trend, and the global financial crisis dummy for 2008:Q1-09:Q4 are included as control variables. Results are robust to variation of control variables and specification of monetary policy shocks (see further details in Annex 1).

Both US monetary policy shocks and broader changes in US financial conditions have significant macroeconomic impact on LA5 (Figure 6). A tightening of US monetary policy weakens LA5 currencies

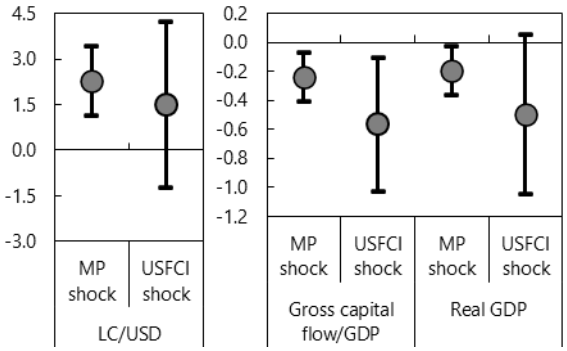
[3]The choice of gross capital inflows rather than net capital inflows is to focus on external drivers of capital flows, following Forbes and Warnock (2012), Rey (2013), and Kalemli-Ozkan (2019). As shown in Bluedorn and others (2013) and Avdjiev and others (2019), net portfolio flows are mainly driven by the action of foreign investors in emerging markets.

substantially, while reducing gross capital inflows and growth.[4] Similar effects are found for a tightening of US financial conditions more broadly. The negative impact on growth, along with the weakening of domestic currencies, suggests that the expansionary expenditure-switching effects from a weaker currency are dominated by the contractionary effects from higher interest rates and weaker balance sheets.

Much of the macroeconomic spillovers to LA5 occur through domestic financial conditions. To explore the role of domestic financial conditions as a transmission channel of US monetary policy and financial conditions shocks to LA5 economies, we re-estimate the previous model adding domestic financial conditions as a regressor. Although it is difficult to identify exogenous variations in the latter, we find that a tightening of domestic financial conditions leads to a sizable contraction in domestic output (Figure 7, panel 1). This, together with the previous results on spillovers from US financial conditions tightening, suggests that these spillovers occur partly through the impact on LA5's domestic financial markets. Indeed, contrasting local projections estimates of the impact of US financial conditions on LA5's output with and without controlling for domestic financial condition indicates that nearly half of the impact on domestic growth comes through this channel (Figure 7, panel 2).[5] The rest captures transmission of the shock through other channels, including balance sheets of various economic agents in LA5.

Figure 6. LA5: Impact of US Monetary Policy (MP) and Financial Condition Index (FCI) Tightening

(Impact at one year, percent; point estimates and 90 percent CI)



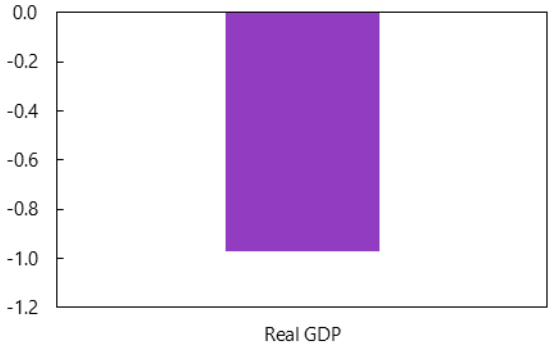
Source: IMF staff calculations.

Note: Monetary policy shock is identified as one-day changes in US two-year bond yields around Federal Open Market Committee meetings, aggregated within each quarter. USFCI shock is identified as quarter-over-quarter changes in USFCI, which is calculated following the April 2018 *Global Financial Stability Report*. Magnitude of shocks is one standard deviation, which is 0.1 percentage point for the monetary policy shock and 1.13 units for the USFCI shock. As a reference, USFCI tightened by 3.1 units in 2008Q4, while it tightened by 0.1 unit in 2013Q2. Impulse responses at quarter 4 are shown. Impact on gross capital flows is measured by percent of GDP. CI = confidence interval; FCI = financial conditions index; LA5 = Latin America 5 (Brazil, Chile, Colombia, Mexico, Peru); LC = local currency; MP = monetary policy.

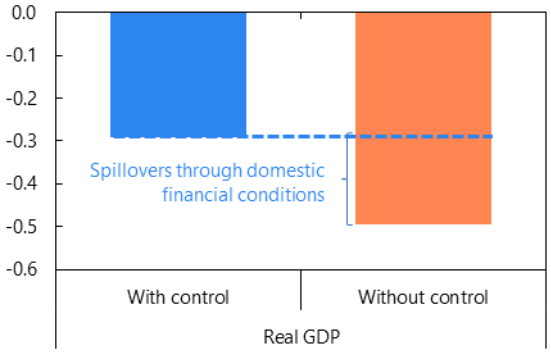
Figure 7. LA5: Spillovers through Domestic Financial Conditions

(Impact at one year, percent)

1. Direct Impact of Tighter Domestic Financial Conditions on Domestic Output



2. Impact of Tighter US Financial Conditions on Domestic Output, With or Without Controlling for Domestic Financial Conditions



Source: IMF staff calculations.

Note: Panel 1 shows the direct impact of one standard deviation shock (0.69 unit) to LA5's domestic financial conditions. As a reference, it tightened by 0.2-1.6 units in 2020Q1 for LA5. Panel 2 shows the impulse response of real GDP to one standard deviation shock to the USFCI, with and without controlling for domestic financial conditions. Domestic and US financial conditions shocks are identified as quarter-over-quarter changes in the respective FCIs, calculated following the April 2018 *Global Financial Stability Report*. Impulse responses at quarter 4 are shown. FCI = financial conditions index; LA5 = Latin America 5 (Brazil, Chile, Colombia, Mexico, Peru).

[4]The literature has not converged on the effect of U.S. monetary tightening on output in emerging markets. Degasperi, Hong, and Ricco (2021) find large contractionary effects of U.S. monetary tightening, while Ilzetzki and Jin (2021) report that the increases in US interest rates stimulate the rest of the world economy in recent decades.

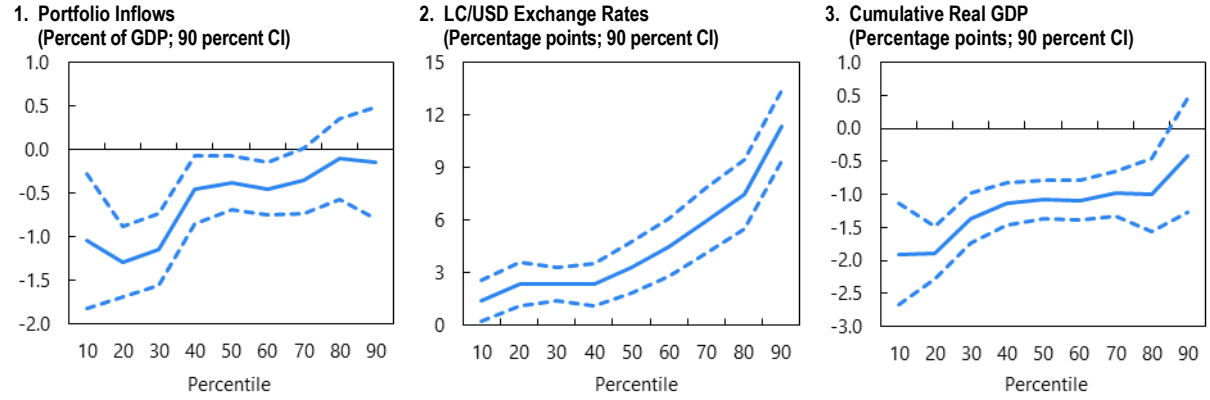
[5]The difference in the impulse response from the two models (with and without controlling for domestic financial conditions) can be interpreted as the spillovers *through* domestic financial conditions.

Beyond Average Effects

The analysis so far has focused on estimating average spillover effects. However, US monetary policy shocks may not only affect average values of the macroeconomic variables, but also their distributions—that is, change the probability of certain outcomes. To explore the latter, this section uses quantile regressions (following Adrian, Boyarchenko, and Giannone 2019), focusing again on exchange rates, gross capital flows, and real GDP as the outcome variables of interest.

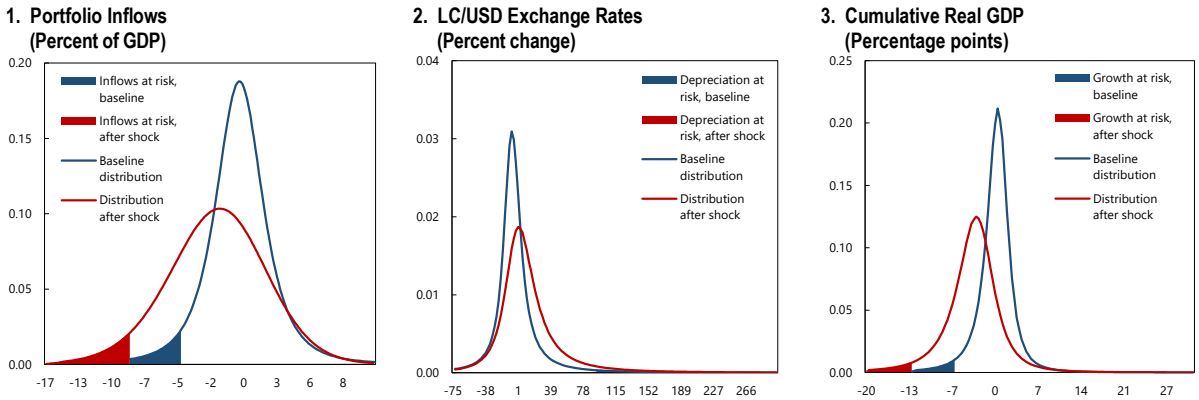
Results highlight large downside risks. The analysis indicates that average effects mask important differences in terms of the distribution of possible outcomes. Specifically, comparing the results at the 10th percentile and 90th percentile of the distribution of a given macro-economic variable, the impact on gross capital flows, exchange rates, and real GDP, are all found to be four to five times larger for the more adverse decile (Figure 8). Reflecting this, a tightening of US financial conditions significantly increases the probability of tail events (Figure 9).

Figure 8. LA5: Impact of US FCI Tightening at Different Percentiles



Source: IMF staff calculations.
Note: Estimates of impact at two quarters after the shock, measured as cumulative differences from the baseline. For technical details see Annex 1. CI = confidence interval; FCI = financial conditions index; LA5 = Latin America 5 (Brazil, Chile, Colombia, Mexico, Peru); LC = local currency

Figure 9. LA5: Implied Distributional Shifts from US FCI Tightening



Source: IMF staff calculations.
Note: Implied distribution of the variables of interest two quarters after the shock, with all control variables taking average values (baseline distribution) and with USFCI tighter by one standard deviation (distribution after shock). For technical details see Annex 1. FCI = financial conditions index; LA5 = Latin America 5 (Brazil, Chile, Colombia, Mexico, Peru).

The Role of Country Fundamentals

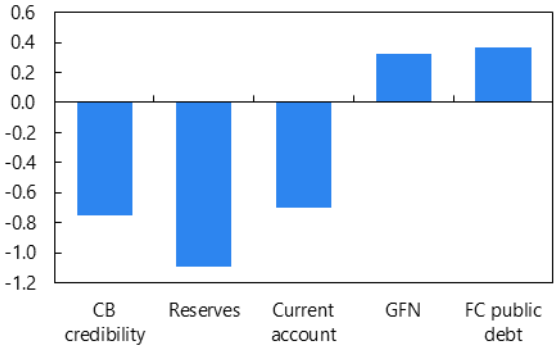
This section explores the role that different country fundamentals play in mitigating or amplifying financial spillovers.

The role of specific fundamentals is studied by splitting the sample of countries between those with low and high values for specific fundamentals, drawing on the existing literature (Shaghil, Coulibaly, and Zlate 2017; Hoek, Kamin, and Yoldas 2022; IMF 2021), and estimating the model with local projections method for each subsample of countries. The list of fundamentals explored includes measures of international reserves levels, the country's current account balance, public gross financing needs, public debt denominated in foreign currency, and a measure of central bank's credibility (that averages the rank of the four metrics of central bank credibility used in the October 2022 *Regional Economic Outlook: Western Hemisphere* Background Paper 2). For each of the indicators, an expanded list of 16 emerging markets in Latin America and the rest of the world was classified into three groups according to the average values of these indicators over the period 2010-19.[6] Then, results from the local projection estimation of the top and bottom groups were compared.

The analysis indicates that certain fundamentals play an important role (Figure 10).[7] In particular, it suggests that financial spillovers are greater on economies with weaker monetary policy frameworks, reflecting that, in these economies, domestic monetary policy rates may need to move in tandem with US policy rates to contain exchange rate movements and the associated pass-through to domestic inflation. Likewise, external sector vulnerabilities (associated with lower reserve levels or lower current account balances) tend to amplify financial spillovers. For example, while a 1 percentage point shock to the US short-term rate leads to a 0.9 percentage point increase in the local currency yield for economies with high reserve levels, the impact reaches 2 percentage points in countries with low reserve levels. Finally, higher gross financing needs and foreign- currency-denominated public debt are also associated with greater spillovers.

Figure 10. Differential Impact of US Two-Year Bond Yield Increase on Local Currency Yield

(Percentage points)



Source: IMF staff calculations.
Note: Columns show the differential impact of a rise of the US two-year bond yield on the local currency yield between emerging market economies with high and low values of the fundamentals mentioned in the x axis. The estimated specification is similar to that in Figure 5, panel 2. Emerging market economies are Brazil, Bulgaria, Chile, Colombia, Hungary, India, Indonesia, Malaysia, Mexico, Peru, Philippines, Poland, Romania, Russia, Thailand, and Türkiye. CB = central bank; FC = foreign currency; GFN = public gross financing needs.

The evolution of key vulnerability indicators paints a mixed picture on how susceptible LA5 economies may currently be to a US financial tightening (Figure 11). There have been steady improvements over time in certain dimensions, such as the reserves-to-GDP ratio, which have been stable or increased over time for all countries.[8] Central bank credibility has also improved. It should be noted that these and the decline in public foreign currency denominated debt reflect broad-based efforts to improve institutions in LA5, such as adoption of inflation targeting regimes, commitment to exchange rate flexibility, and the development of local bond markets. On the other hand, public foreign-currency-denominated debt and gross financing needs are higher today than in 2007 and 2013, partly due to the impact of the pandemic on the fiscal accounts. When benchmarked against

[6]The sample of countries includes LA5 economies, Bulgaria, Hungary, India, Indonesia, Malaysia, the Philippines, Poland, Romania, Russia, Thailand, and Türkiye.
[7]We tested the same state contingencies for macroeconomic variables (gross capital flows, local currency-US dollar exchange rates, and real GDP), but failed to find robust relationships.
[8]They are also augmented by additional multilateral safety nets such as the IMF's Flexible Credit Line and bilateral swap lines with major central banks in some countries.

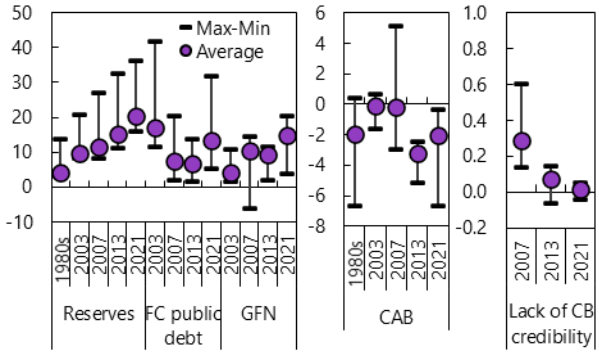
similar emerging markets in the rest of the world, LA5 exhibits more vulnerability on all the analyzed indicators, except for central bank credibility (Figure 12).

Commodity Prices as a Counterbalancing Force

The ongoing tightening of global financial conditions has taken place against a backdrop of high commodity prices earlier in 2022. Can the latter play a role in insulating the region from tighter global financial conditions?

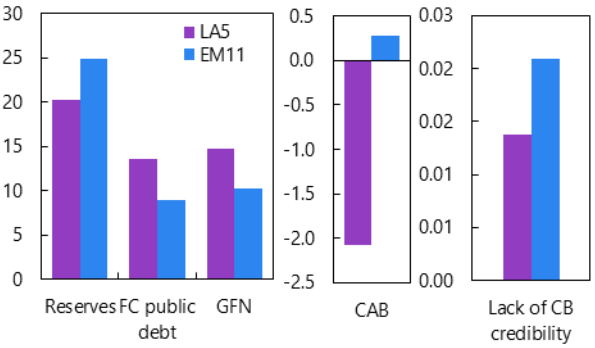
Variations in countries' commodity terms of trade have sizable impact on macro and financial outcomes in LA5 economies (Figure 13).[9] We extend the previous empirical methodology to explore the direct impact of commodity terms-of-trade variations on domestic variables. Results indicate that positive terms-of-trade shocks have only a marginal impact on local currency yields, arguably reflecting that the negative effect on risk premiums is offset by the positive impact on expected monetary policy rate (due to the inflationary pressures associated with higher terms of trade). On the other hand, commodity terms-of-trade shocks have a sizable impact on output and exchange rates. Specifically, 1 percent of GDP commodity terms-of-trade shock is associated with higher real GDP by about 0.4 percent and currency appreciation by 3 percent on impact. This suggests that the rise of commodity prices observed in parallel to the tightening of US financial conditions is likely to have mitigated the negative impact of the latter in the first half of 2022.

Figure 11. LA5: Developments in Selected Vulnerability Indicators
(Percent of GDP, unless noted otherwise)



Sources: IMF, World Economic Outlook database; and IMF staff calculations.
Note: Average is purchasing-power-parity GDP-weighted. Lack of central bank credibility is measured by sensitivity of long-term inflation forecasts to inflation surprises. This is one of the four indicators of central bank credibility that are used in Figure 10. As shown in the October 2022 *Regional Economic Outlook: Western Hemisphere* Background Paper 2, all four indicators have moved in the same direction for LA5. CAB = current account balance; CB = central bank; LA5 = Latin America 5 (Brazil, Chile, Colombia, Mexico, Peru); FC = foreign currency; GFN = public gross financing needs.

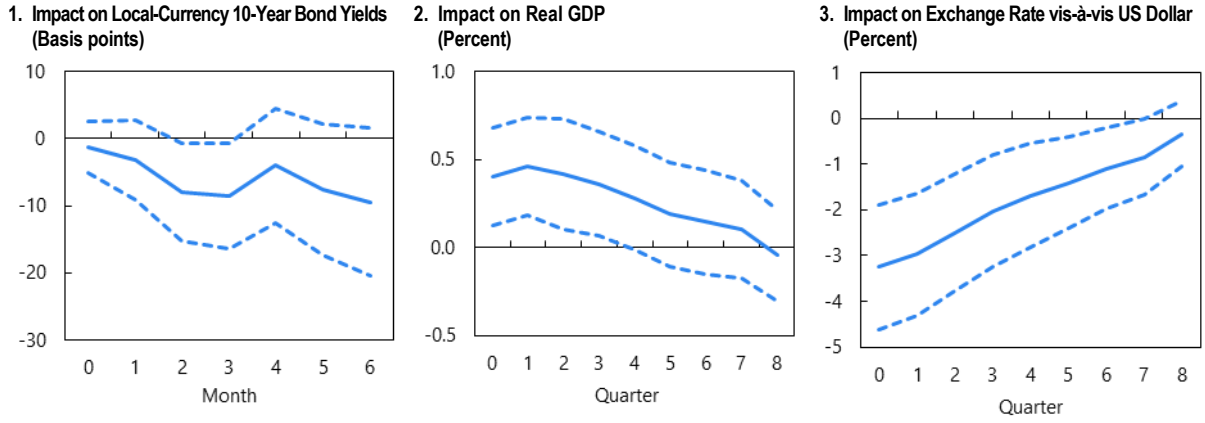
Figure 12. LA5 v. EM11: Selected Vulnerability Indicators
(Percent of GDP, unless noted otherwise)



Sources: IMF, World Economic Outlook database; and IMF staff calculations.
Note: Average is purchasing-power-parity GDP-weighted 2021 values. Lack of central bank credibility is measured by sensitivity of long-term inflation forecasts to inflation surprises. CAB = current account balance; CB = central bank; EM11 = Bulgaria, Hungary, India, Indonesia, Malaysia, Philippines, Poland, Romania, Russia, Thailand, and Türkiye; LA5 = Latin America 5 (Brazil, Chile, Colombia, Mexico, Peru); FC = foreign currency; GFN = public gross financing needs.

[9]Impact of commodity terms of trade can be obtained from the baseline local projections, in which it is used as a control variable.

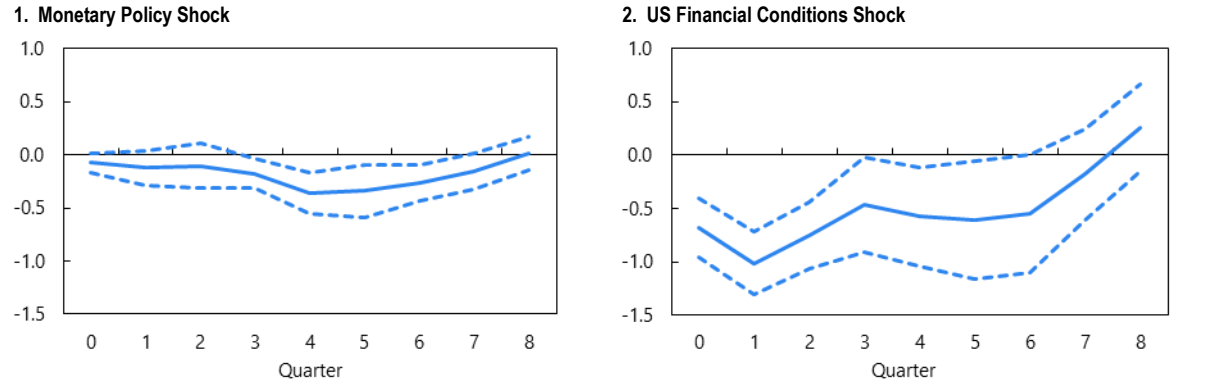
Figure 13. LA5: Impact of Commodity Terms-of -trade Improvement on Domestic Macroeconomic and Financial Variables



Source: IMF staff calculations.
Note: Impulse response functions of 1 percentage point of GDP commodity terms of trade improvement. 90 percent confidence intervals are reported. LA5 = Latin America 5 (Brazil, Chile, Colombia, Mexico, Peru).

However, a central question is whether commodity prices may react to global financial conditions and what their evolution going forward is likely to be. Local projection estimations suggest that a one standard deviation shocks to US interest rates (financial conditions) is followed by a worsening of LA5's commodity terms of trade of up to 0.35 (1) percentage point of GDP, with effects lasting up to two years (Figure 14). This is consistent with previous findings in the literature on the effects of US monetary policy tightening on commodity prices (Frankel 2008). Thus, a tightening of US monetary policy cannot be expected to be mitigated by higher commodity prices going forward, although the already high commodity prices provide some cushion in comparison to past global tightening episodes.

Figure 14. LA5: Impact of US Monetary Policy and Financial Conditions Tightening on Commodity Terms of Trade
(Percentage points of GDP; 90 percent confidence interval)

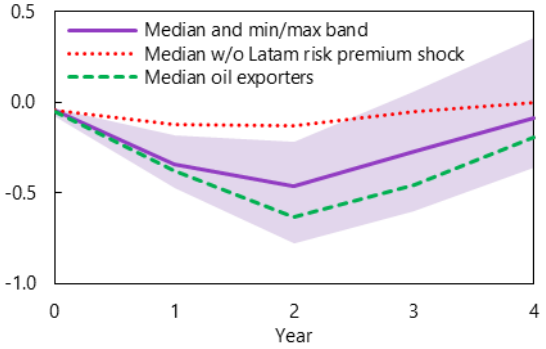


Source: IMF staff calculations.
Note: Impulse response function of one standard deviation shock to US monetary policy (panel 1) and US financial conditions index (panel 2) on commodity terms of trade. Panel local projection identical to Figure 6 is used, using commodity terms of trade as outcome variable. LA5 = Latin America 5 (Brazil, Chile, Colombia, Mexico, Peru).

General Equilibrium Modeling Confirms the Role of Domestic Financial Conditions and Commodity Prices

Results from a general equilibrium model are broadly consistent with the empirical results (Figure 15). The IMF's Flexible Suite of Global Models—calibrated to major Latin American countries and world economies (Western Hemisphere Module)—was used to assess the impact of US monetary policy tightening on Latin American economies.[10] Two layers of shocks are considered: (1) a 100 basis-point larger than expected monetary policy tightening in the United States (in response, for example, to more persistent inflation) and (2) a 100 basis-point additional increase in sovereign risk premium in Latin America due to reduced risk appetite from global investors, which is not captured by the first layer of shocks but is consistent with the empirical evidence on the response of risk premium to US monetary policy tightening shocks. The model indicates that a US monetary policy tightening has negative, although moderate, impact on output in Latin American countries. When a risk premium shock is added, the output impact is substantially amplified because the increase in risk premium and the economic downturn mutually reinforce each other. This result corroborates the previous empirical findings on the importance of domestic financial conditions in amplifying financial spillovers on domestic output. Finally, the model also highlights that a monetary tightening in the US induces lower global oil prices (and, to a lesser extent, food, and metal prices), and, thus, the overall spillover effects on output are larger for oil exporting economies.

Figure 15. Model Simulation of Financial Spillovers on Latin America's GDP
(Percentage points, deviation from baseline)



Sources: IMF staff calculations based on IMF's Western Hemisphere Module general equilibrium model.
Note: Full sample includes Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, Guatemala, Mexico, Panama, Peru and Uruguay. Oil exporters include Brazil, Colombia, Ecuador and Mexico. Solid line shows the median (with both US monetary policy and Latin American risk premium shocks and full sample) and shaded area represents minimum and maximum. Dotted line shows the full sample but without risk premium shocks to Latin America. Dashed line shows response of the oil exporters. Latam = Latin America.

Conclusions

The prospects of a further tightening of US monetary policy and financial conditions, amid weaker commodity prices, raise questions about their likely impact on Latin America.

Historically, tighter global financial conditions generated strong spillovers to financial markets in LA5, with broad-based impact on sovereign debt markets, with shifts in US interest rates leading to more than one-to-one shifts in US dollar and local currency yields, sizable capital outflows and depreciation pressures on domestic currencies. Financial spillovers also had substantial impact on domestic output, much of which was transmitted through the tightening of domestic financial conditions. Moreover, the likelihood of adverse tail events increased significantly with tighter US financial conditions.

While strong fundamentals are found to mitigate these spillover effects, the evolution of key indicators for LA5 over the past two decades paints a mixed picture regarding the resilience of these economies to a tightening of US financial conditions.

Although high commodity prices have been an important counterbalancing force to the tightening of global financial conditions in early 2022, the evidence indicates that US monetary policy has historically had sizable negative impact on prices of commodity exported in Latin America, suggesting that a sharp monetary tightening in the United States could also spill over through lower commodity prices. Model results are broadly consistent with the empirical results.

[10]See Andrle and others (2015) for the description of the Flexible Suite of Global Models.

Annex 1. Description of Empirical Methodologies

Financial Spillovers

Financial spillovers are studied using the following (main) specification, estimated in a panel setting for Latin America 5 (LA5; Brazil, Chile, Colombia, Mexico, Peru) economies and using local projection methods à la Jordà (2005):

$$\boldsymbol{r_{i,t+h}} - r_{i,t-1} = \boldsymbol{\beta_h} r_t^* + \sum_{j=0}^{2} \gamma_{h,(j)} X_{(i),t-j}^{(*)} + \alpha_{i,\,h} + \varepsilon_{i,\,t+h} \quad \forall h = 1, \ldots, 6 \qquad \text{(A. 1.)}$$

The parameter of interest is $\boldsymbol{\beta_h}$, which captures the impact at horizon h of the US interest rate r_t^*, on the domestic variable of interest, $\boldsymbol{r_{i,t}}$. For the former, the US two-year bond yields is used as a measure of short-term rates, which is key for the zero lower bound period (see the April 2021 *World Economic Outlook*). For the latter, various measures are used, including the local currency short-term rate, the local currency long-term rate, and the US dollar long-term rate. The regressors X_{t-j}^* include two lags of $\boldsymbol{r_{i,t}}$ and r_t^*, two lags of domestic inflation and economic activity consensus forecasts to control for expected domestic conditions, as well as Chicago Board Options Exchange Volatility Index, to control for the level of risk and country fixed effects, $\alpha_{i,\,h}$. The identification assumption (as in Chapter 3 of the October 2015 *Regional Economic Outlook: Western Hemisphere*) is that developments in LA5 are not likely to impact financial conditions in the United States.[1] Results are robust to the inclusion of economic growth in the United States and country-specific commodity terms of trade.

The sample is composed of monthly data for the period January 2010 to December 2019, although the main results are robust to alternative frequencies and sample periods. Using data of monthly frequency allows the specification to control for domestic expectations for output and inflation. The selected sample period presents three characteristics: (1) US short-term rates were close or at the zero lower bound for much of the sample; (2) major shocks, such as the global financial crisis and the pandemic, are not covered by the sample; and (3) LA5 countries display stable degrees of integration into international financial markets.

Results of the baseline specification are presented in the main text of the chapter. Annex Figure 1.1. presents alternative estimates of the specification in equation (A.1.) for the spillovers to local currency long-term rates and US dollar long-term rates. First, panel 1 shows that the same fixed effects specification as in (A.1.) but with daily data, excluding controls, leads to an impulse response function well aligned with Figure 5, panel 2 although with slightly smaller effects. Second, panel 2 presents the same impulse response estimates as in the baseline specification but for the sample period starting in January 2000—the earliest time period for which Consensus Forecast data are available—and the estimates present wider confidence intervals and are somewhat less persistent than with the original sample. This smaller co-movement with the US interest rates could possibly be due to a weaker integration of local currency debt markets in LA5 into the global financial cycle in the earlier part of the sample period.[2] Since US dollar-denominated bonds in LA5 have been more

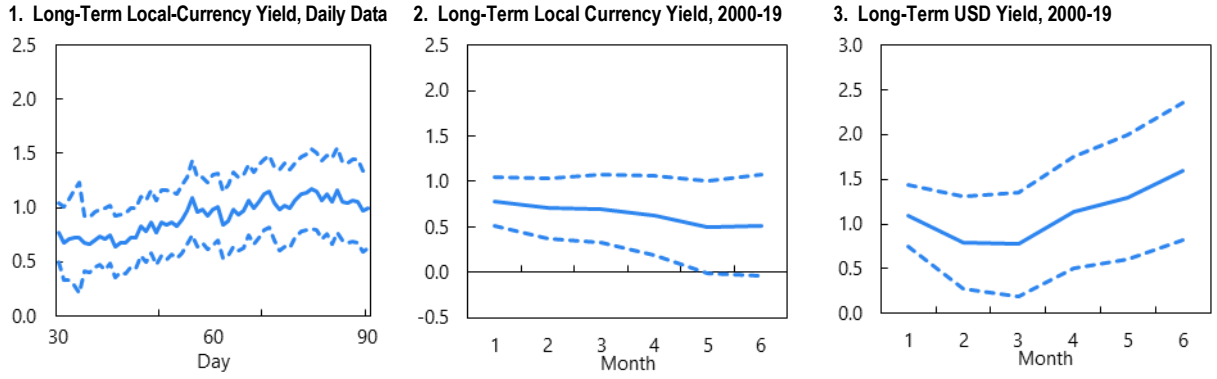
[1]Chapter 4 of the April 2021 World Economic Outlook followed a high frequency identification strategy correlating the changes of the same yields around Federal Open Market Committee meetings. After regressing changes in US two-year bond yields around Federal Open Market Committee meetings against the same LA5 yields with country fixed effects, we found qualitatively similar co-movements with this high frequency alternative specification. After aggregating the changes in US two-year bond yields around Federal Open Market Committee meetings to a monthly frequency and using this variable as r_t^* in (A.1.), point estimates are similar although statistical significance is somewhat smaller than in the main results. Instrumenting the original r_t^* in (A.1.) with the aggregation of the changes in US two-year bond yields around Federal Open Market Committee meetings to a monthly frequency yields similar results with somewhat stronger statistical significance than the previous robustness check but still smaller than the main results.

[2]The fact that foreign investors participation in local currency bond markets as a percent of GDP more than doubled in every LA5 country over the last decade further supports this hypothesis. That said, short-term rates were above the zero lower bound before the global financial crisis and, therefore, transmission from US two-year bond yields may have been weaker than over the next decade-- estimates of (A.1) with r_t^* equal to the federal funds rate present statistically significant $\boldsymbol{\beta_h}$ before the global financial crisis but insignificant afterwards.

stably integrated into global financial markets over the past two decades, LA5's long term US dollar yields present more similar impulse responses for the same two samples –panel 3 is similar to Figure 4.

Annex Figure 1.1. LA5: Impact of US Short-Term Rates on LA5 Long-Term Sovereign Debt Yields. Alternative Estimations

(Percentage points)



Source: IMF staff calculations.

Note: Long-term LC rates are yields of local currency long-term bonds (10-year maturity) and long-term USD rates are yields of USD-denominated long-term bonds (10-year maturity). Point estimates are the panel local projections' impulse responses over one to six months where each of the previous financial variables for LA5 are shocked with US 2-year bond yields 1pp at month zero conditional on domestic and international controls in Figures 2 and 3, but the estimates in Figure 1 do not include domestic and international controls and shock is at day zero. Sample is daily from Jan-10 to Dec-19 in Figure 1 and sample is monthly from Jan-00 to Dec-19 in Figures 2 and 3. 90 percent confidence intervals are reported. LA5 = Latin America 5 (Brazil, Chile, Colombia, Mexico, Peru); LC = local currency; USD = US dollar.

To study the role of country fundamentals in amplifying or mitigating spillovers, we compare the spillovers across an extended sample of sixteen emerging markets. The overall sample includes Brazil, Bulgaria, Chile, Colombia, Hungary, India, Indonesia, Malaysia, Mexico, Peru, Philippines, Poland, Romania, Russia, Thailand, and Türkiye. Countries are ranked according to the variable of interest: gross reserves as a percent of GDP, current account balance as a percent of GDP, public gross financing needs as a percent of GDP, public external debt as a percent of GDP, and central bank's credibility. Equation (A.1.) is estimated for the five countries with highest and lowest values of the variable of interest. Differences between the impulse responses of the two groups are reported in Figure 10.

Macroeconomic Spillovers

Macroeconomic spillovers are estimated following Ilzetzki and Jin (2021) with some modifications:

$$y_{c,t+h} = \beta_h x_t + \sum_{i=1}^{I_y} \delta_i^y y_{c,t-i} + \sum_{i=1}^{I_x} \delta_i^x x_{t-i} + \alpha_c + \gamma_{c,t} + \lambda_t + controls + \varepsilon_{c,t}$$

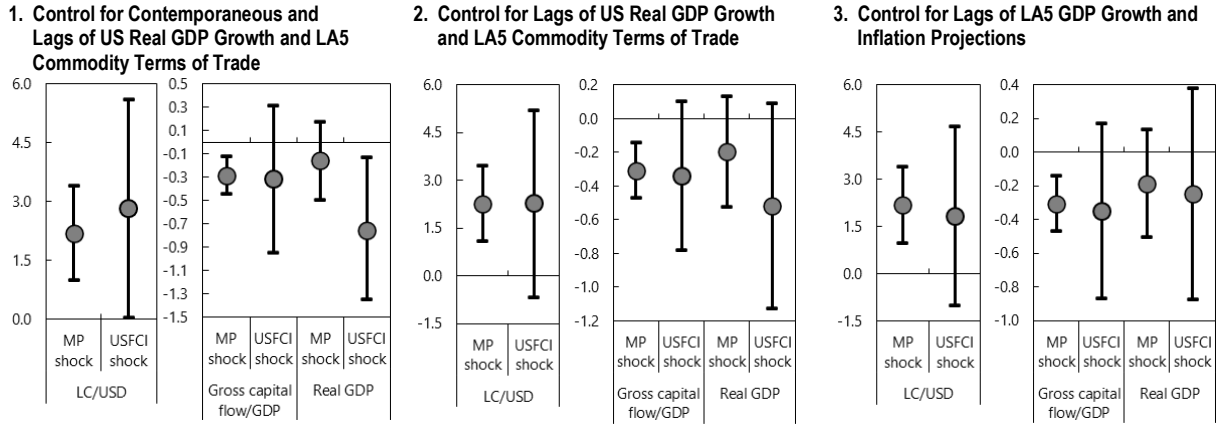
where $y_{c,t+h}$ is the outcome variable for country c at a horizon of h quarters from date t. Outcome variables are logged real GDP, logged local currency-US dollar exchange rate, and capital flows to GDP ratio. x_t is the shock variable, either the changes in US two-year bond yields on the day of the Federal Open Market Committee meetings (monetary policy shock) or the financial conditions index for the United States constructed by the IMF (financial conditions shock). β_h is the coefficient for the impulse response. Lags of y and x are included, with $I_y = 8$ and $I_x = 2$.[3] α_c is the country fixed effect, $\gamma_{c,t}$ is the country-specific

[3]Ilzetzki and Jin (2021) use monthly data and set $I_y = 24$ and $I_x = 6$.

quadratic time trend, and λ_t is the global financial crisis dummy for 2008:Q1-09:Q4. Other control variables in the baseline specification are US real GDP growth and country-specific commodity terms of trade.

Baseline results are robust to variation in control variables. In Annex Figure 1.2, control variables are changed progressively by (1) adding two lags of US real GDP growth and country-specific commodity terms of trade, (2) including two lags of US real GDP growth and country-specific commodity terms of trade but excluding their contemporaneous terms, and (3) further adding two lags of LA5 country-specific GDP growth and inflation projections. Point estimates remain largely unchanged, while some variation in their statistical significance is observed. The same conclusion holds when we replace the specification of the monetary policy shock by using the changes in US two-year bond yields on the day of the Federal Open Market Committee meetings as an instrument to all US two-year bond yield changes.

Annex Figure 1.2. LA5: Impact of US Monetary Policy and Financial Condition Index Tightening: Alternative Specifications
(Impact at one year, percent; point estimates and 90 percent confidence interval)



Sources: IMF staff calculations.
Note: In panel 1, two lags of US real GDP growth and LA5 commodity terms of trade are added to the baseline specification as additional control variables. In panel 2, contemporaneous US real GDP growth and LA5 commodity terms of trade are excluded from the specification in panel 1. In panel 3, two lags of projections of LA5 GDP growth and inflation are added to the specification in panel 2. Monetary policy shock is identified as one-day changes in US two-year bond yields around around Federal Open Market Committee meetings, aggregated within each quarter. USFCI shock is identified as quarter-over-quarter changes in US FCI, which is calculated following April 2018 *Global Financial Stability Report*. Magnitude of shocks is one standard deviation, which is 0.1 percentage point for the monetary policy shock and 1.13 units for the USFCI shock. As a reference, USFCI tightened by 3.1 units in 2008Q4, while it tightened by 0.1 unit in 2013Q2. Impulse responses at quarter 4 are shown. Impact on gross capital flows is measured by percent of GDP. FCI = financial conditions index; LA5 = Latin America 5 (Brazil, Chile, Colombia, Mexico, Peru); LC = local currency; MP = monetary policy.

Quantile Regressions and Calibrated Distributions

To track the impact of a tightening of US financial conditions on the distribution of GDP growth, portfolio inflows, and exchange rates, we estimate quantile panel regressions. Contrary to standard dynamic panel regressions or local projections (Jordà, 2005), which track the average response of a variable of interest in the aftermath of a shock, the quantile regression approach allows study of the impact of the shock at different quantiles (deciles in this case) of the variable of interest.

Methodologically, we follow Gelos and others (2022). The baseline specification is as follows:

$$Q\left(y_{i,t}^{h};\alpha\right) = \gamma_{i,\alpha}^{h} + \delta_{\alpha}^{h} + \beta_{h}^{\alpha} * shock_{i,t} + \theta_{\alpha}^{h} * X_{i,t} + \varepsilon_{i,t} = \rho_{h}^{\alpha} Z_{i,t} + \varepsilon_{i,t} \qquad (1)$$

where $Q\left(y_{i,t}^{h};\alpha\right)$ is the α^{th} quantile of the distribution of the variable of interest, y, h quarters after the shock that hits the economy on period t. The variable that we track is the change between t-1 and t+h of real GDP, the bilateral exchange rate vis-à-vis the US dollar (both in logs), and portfolio inflows (as a share of GDP). The shock variable is the US financial conditions index. The quantile function is assumed to depend on a country fixed effect $\gamma_{i,\alpha}^{h}$, the external shock $shock_{i,t}$, and on a vector $X_{i,t}$ of controls, that include two lags of the quarter-on-quarter change in the variable of interest, y, two lags of the US financial conditions index,

and a country specific quadratic time trend. In the above formulation, ρ_h^α is a vector containing all the coefficients in (1), $\gamma_{i,\alpha}^h, \delta_\alpha^h, \beta_h^\alpha, \theta_\alpha^h$, and $Z_{i,t}$ contains all the regressors.

The coefficient of interest in this case is β_α^h, which is estimated by solving the following minimization[4]:

$$\rho_h^\alpha = argmin \sum_{t=1}^{T-h} \left(\alpha \times \mathrm{I}_{y_{t,t+h} > \rho Z_t} \left| y_{t,t+h} - \rho Z_t + (1-\alpha) \times \mathrm{I}_{y_{t,t+h} < \rho Z_t} \right| y_{t,t+h} - \rho Z_t \right) \quad (2)$$

in which I is an indicator function, α refers to the percentile of the distribution, and the predicted value that results from the quantile regression that minimizes ρ_h^α is given by

$$\hat{Q}_{y_{t,t+h}}(\alpha) = \hat{\rho}_h Z_t \quad (3)$$

Figure 9 in the text presents two calibrated distributions of the variables of interest. The baseline distribution fits the data to a skewed t distribution (for details, see Gelos and others, 2022). The distribution after the shock uses the estimated quantile regressions to calibrate a new skewed t distribution.

[4]For the technical details about quantile regressions see Koenker and Bassett (1978) and Machado and Santos Silva (2019), and references therein.

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