

## Summary

**H**ow much influence do countries retain over their domestic financial conditions in a globally integrated financial system? This question has recently been attracting increased interest in policy and academic circles alike. Financial conditions broadly refer to the ease of obtaining finance, and measuring them can be valuable for appraising the impact of policy and economic prospects.

Greater financial integration can complicate the management of domestic financial conditions in several ways. First, policymakers may need to take external factors into greater consideration when pursuing domestic objectives. Second, global financial integration may make it harder for domestic policymakers to control financial conditions at home—for example, it may hamper the transmission of monetary policy.

This chapter examines the evolving importance of common global components of domestic financial conditions. It develops financial conditions indices (FCIs) that make it possible to compare a large set of advanced and emerging market economies. It finds that a common component (global financial conditions) accounts for about 20 to 40 percent of the variation in countries' domestic FCIs, with notable heterogeneity across countries. Its importance, however, does not seem to have increased markedly over the past two decades.

Global financial conditions loom large, but evidence suggests that, on average, countries still appear to hold sway over their own financial conditions—specifically, through monetary policy. Nevertheless, the rapid speed at which foreign shocks affect domestic financial conditions may also make it difficult to react in a timely and effective manner, if deemed necessary. Given that global financial conditions tend to account for a greater fraction of FCI variability in emerging market economies, these countries, in particular, should prepare for the implications of global financial tightening. Governments can promote domestic financial deepening to enhance resilience to global financial shocks. In particular, developing a local investor base, as well as fostering greater equity- and bond-market depth and liquidity, can help dampen the impact of external financial shocks.

## Introduction

To what extent can individual countries steer domestic financial conditions in a globally integrated financial system? This question has recently been attracting increased interest in policy and academic circles alike. The concern is that global factors' greater potential impact on domestic asset prices and credit leave policymakers little room to influence their countries' financial conditions according to domestic objectives (Rey 2013). More narrowly, substantial research has focused on whether monetary policy has lost its ability to independently guide domestic interest rates, even in countries with floating exchange rate regimes.<sup>1</sup>

Financial conditions broadly reflect how easy it is to obtain financing. Going beyond short-term interest rates, they summarize information about the price and nonprice (such as terms and conditions) costs of credit for various agents in the economy. Other definitions of financial conditions look at how financial variables relate to economic decision making and therefore future economic activity.

Financial conditions can be especially valuable for evaluating the impact of policy and the economic outlook:

- Monetary policy, for example, “works its magic through its effect on financial conditions” (Dudley 2010). It largely seeks to influence inflation and output through its effects on financial market variables (including bank credit volumes, collateral valuations, and term premiums), along with direct effects through policy rates. Consequently, measuring financial conditions can be informative for policymakers because doing so can capture the

effects through these various transmission channels. At the same time, if the mapping from policy rates to this range of financial variables is not unique or stable, then tracking financial conditions can be helpful in predicting the impact of monetary policy (Dudley 2010).

- Furthermore, measures of financial conditions have been shown to be reliable predictors of economic activity (Hatzius and others 2010; Gilchrist and Zakrajšek 2012; Koop and Korobilis 2014, among others). Indices of financial conditions have also proved useful in predicting downside risks to GDP growth (Adrian, Boyarchenko, and Giannone 2016) and helpful in detecting the buildup of financial vulnerabilities (Adrian and Liang 2016). Empirically, financial conditions indices (FCIs) are typically built from a broad range of financial variables aiming to capture, directly or indirectly, the cost of funding for various agents in the economy.

Because financial conditions can spill across countries, it is important to distinguish between two different effects:

- First, as countries become more integrated into the global economy, their financial conditions are more likely to be affected by external shocks. Accordingly, policymakers must respond to a broader range of developments, complicating their task. But this alone does not constitute a loss in policy “autonomy” for steering domestic financial conditions (Disyatat and Rungcharoenkitkul 2016).
- Second, global financial integration may weaken the transmission channels of monetary policy. For example, if longer-term bond yields are increasingly set in international markets, their responsiveness to short-term interest rates set by central banks may decline. This situation would also expose countries to the types of shocks that are unwarranted by economic fundamentals, such as shifts in investor sentiment.

This chapter examines the importance of common global components of domestic financial conditions, the evolving role of these global factors over time, and their key drivers. It explores country characteristics that influence the extent to which domestic financial conditions move with global factors and the ability of monetary policy to influence domestic financial conditions. For this purpose, it develops new FCIs that are comparable across a large set of advanced and

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<sup>1</sup>Rey (2016) argues that in a world of freely flowing capital, exchange rate flexibility alone cannot guarantee monetary autonomy, because U.S. monetary policy shocks spill over and affect domestic financial conditions—even in inflation-targeting economies with large financial markets. Likewise, Rey (2013) concludes that fluctuating exchange rates cannot insulate economies from the global financial cycle when capital is mobile. Rey contends that the Mundell-Fleming trilemma has morphed into a dilemma: independent monetary policy is possible if and only if the capital account is managed, regardless of the exchange rate regime. In contrast, Kamin (2010), Obstfeld (2015), and Klein and Shambaugh (2015), for example, argue that exchange rate flexibility does allow for monetary autonomy. See also Caceres, Carriere-Swallow, and Gruss (2016). Disyatat and Rungcharoenkitkul (2016) conclude that domestic financial conditions remain in the domain of policymakers.

emerging market economies—in itself a contribution to the literature.

These are the chapter's highlights:

- The new FCI measures appear to signal downside risks to GDP well. In particular, economic contractions are more clearly associated with a preceding change in financial conditions in contrast to expansions.
- A single factor, “global financial conditions,” appears to account for a large share of variation in domestic financial conditions around the world. This factor moves in tandem with the U.S. FCI and measures of global risk, such as the Chicago Board Options Exchange Volatility Index (VIX).
- There is no conclusive evidence, however, that this global factor has gained significant influence over the past two decades.
- Financial linkages (such as cross-country investments) are the most reliable indicator of global financial conditions' influence on local FCIs. At the same time, greater financial development can reduce the sensitivity of domestic FCIs to global financial shocks.
- About 20 to 40 percent of the variation in domestic FCIs across countries can be attributed to global financial conditions, with domestic factors accounting for the rest. However, the importance of global financial shocks for domestic financial conditions varies notably across countries. Importantly, monetary policy shocks account for about 15 percent of the variation across countries with flexible exchange rates, suggesting that amid exposure to external factors, changes in the monetary policy stance still can matter for domestic financial conditions.

Even with a sizable impact from global financial shocks, evidence suggests that, on average, countries appear to be able to influence their own financial conditions. In particular, the analysis indicates that they generally have scope to use monetary policy. However, given that local financial conditions react more rapidly to global financial shocks than to changes in domestic policy rates, timely policy responses may often be difficult. Emerging market economies, in particular, clearly need to guard against the risks associated with sharp changes in global financial conditions. Countries can resort to other policies to protect themselves against destabilizing shocks. For example, macroprudential measures can contain potentially lingering vulnerabil-

ities that leave domestic financial conditions sensitive to external shocks. When disruptive outflows threaten financial stability, capital flow management measures could have a temporary role, as noted in IMF (2016). By promoting financial deepening, countries can help protect against global financial shocks. Specifically, developing a local investor base (both banks and non-banks) can help soften the blow of financial shocks.

## An Overview of Financial Conditions

*This section examines the concepts surrounding financial conditions, their transmission across countries, and their measurement.*

### Financial Conditions: Main Concepts

Financial conditions generally refer to the ease of obtaining financing. The literature offers several complementary definitions of financial conditions. For instance, Hatzius and others (2010) define them as the current state of financial variables that influence economic behavior and thereby the future of the economy, while Carlson, Lewis, and Nelson (2012) connect them to price and nonprice costs of credit. This chapter focuses on a notion of domestic financial conditions that seeks to gauge the costs, conditions, and availability of domestic funds to the local economy. In addition to interest rates and asset price valuations, financial conditions are influenced by risk appetite and, for example, agents' willingness to hold illiquid assets.

Financial conditions play a central role in the transmission of monetary policy to the broader economy. In particular, monetary policy influences the rest of the economy mainly by altering financial conditions, and the transmission channels can be classified into two broad categories:

- The first comprises the “traditional,” or New Keynesian, channels of monetary policy. The emphasis is on changes in (short-term) policy rates and how expectations about those changes alter longer-term rates and thereby consumption and investment decisions. Effects on trade through exchange rate movements also belong to the list of traditional channels.
- The second category predominantly comprises imperfections in credit supply arising from institutional constraints on financial intermediaries and from informational asymmetries (Boivin, Kiley, and

Mishkin 2010). Examples include the balance sheet channel (Bernanke and Gertler 1989; Kiyotaki and Moore 1997), the bank capital channel (Van den Heuvel 2002), and the risk-taking channels (Adrian and Shin 2011; Adrian and Boyarchenko 2012), as discussed in greater detail in Adrian and Liang 2016 and Chapter 2 of the October 2016 *Global Financial Stability Report* (GFSR).

Many of these “nontraditional” monetary transmission channels feature both incomplete markets and heterogeneous agents, which lead to differences in the pricing of risk over time. As a result, the risk-free rate is not an adequate statistic for funding costs or for assessing the impact of monetary policy on the real economy.<sup>2</sup> FCIs thus aim to distill information from a broad array of financial variables—including measures of risk taking and various kinds of financial frictions—ideally capturing the prevalence of credit constraints and the magnitude of external financing premiums. FCIs can only capture some measure of average funding costs, although different agents may face large variations in funding costs and conditions. Naturally, as financial systems evolve, the most relevant variables for tracking financial conditions may change.

Empirically, measures of financial conditions can be more helpful in predicting economic activity than indicators of current and past real economic activity. Studies including Hatzius and others (2010) and Koop and Korobilis (2014) argue that FCIs are good predictors of future economic activity. Likewise, Adrian, Boyarchenko, and Giannone (2016) show that FCIs are particularly useful in flagging future economic contractions.

Financial conditions are driven only partly by policy. Changes in uncertainty about the exposures of major financial players, shocks to the net worth of borrowers not triggered by policy actions, runs on financial institutions, changes in risk perception, and shifts in investor sentiment triggered by idiosyncratic events can all influence access to funding in an economy.

<sup>2</sup>As underscored by Dudley (2010), financial conditions are explicitly taken into account in the conduct of monetary policy. In the United States, he notes that this is evident in the transcripts of the Federal Open Market Committee meetings and minutes going back more than a decade. Even before the global financial crisis, Bernanke (2007) highlighted links between financial conditions and growth. More recently, Yellen (2016) drew attention to the relevance of financial conditions for the economic outlook and the stance of monetary policy.

The extent to which global factors affect domestic financial conditions is a question this chapter attempts to decipher. Accordingly, the FCIs consist of domestic financial variables such as corporate, interbank, and term spreads; equity and house price returns; equity return volatility; and credit growth. An attempt is made to purge the FCIs of (contemporaneous) macroeconomic conditions. That way, in principle, it is possible to assess how much “unwarranted” global financial shocks affect domestic financial conditions.

### The Transmission of Financial Conditions across Countries

Financial conditions can be transmitted across countries through different channels. A significant strand of the literature has focused on the degree of monetary independence in setting interest rates. A central principle guiding monetary policy in open economies is the so-called Mundell-Fleming “trilemma.” It states that policymakers can seek to achieve only two out of the three following objectives: (1) fixed exchange rates, (2) free international capital mobility, and (3) monetary autonomy.<sup>3</sup> However, financial conditions can be transmitted across countries through other mechanisms as well, in ways that usually cannot be fully offset by movements in exchange rates (Obstfeld 2015). In fact, exchange rate movements also typically induce changes in financial conditions in small open economies, and can be sizable (Kearns and Patel 2016). Changes in financial conditions can further spill over from originating countries to other economies through several interrelated channels. For example, changes in credit volumes and other types of capital flows can have powerful cross-border effects. Another transmission channel works through comovements in risk premiums, which can affect collateral valuation and thereby borrowing constraints (Obstfeld 2015).

Global financial integration can complicate the management of domestic financial conditions in at least two distinct ways. First, as countries integrate more into the global economy, policymakers may need to take external factors into greater consideration when pursuing domestic objectives. However, this complica-

<sup>3</sup>Broadly consistent with the predictions of the trilemma, studies have typically found that greater exchange rate flexibility does provide some degree of flexibility in steering short-term interest rates (Klein and Shambaugh 2015; Obstfeld 2015).

tion does not, by itself, imply that countries lose their ability to steer their domestic financial conditions.<sup>4</sup> Second, global financial integration may indeed make it harder for domestic policymakers to control domestic financial conditions—for example, by hampering the transmission of monetary policy or limiting the effectiveness of prudential policies. The speed at which foreign shocks affect local financial conditions also makes it difficult to react in a timely and effective manner.<sup>5</sup> In particular, the efficacy of financial stability policies can be weaker in an open economy (Shoenmaker 2013).<sup>6</sup>

Various studies suggest that financial conditions around the world are heavily influenced by global factors. Building on earlier work by Calvo, Leiderman, and Reinhart (1996), many studies emphasize the important role of global “push factors,” such as the VIX, as drivers of financial variables (see, for example, Bruno and Shin 2013; IMF 2014a; Fratzscher 2012; Baskaya and others 2017). Miranda-Agrippino and Rey (2015) argue that prices of risky assets (equities, corporate bonds) across countries can be summarized by a single global factor, the “global financial cycle,” which is driven by U.S. monetary policy shocks. Therefore, as argued by Rey (2016), U.S. monetary policy shocks spill over and affect domestic financial conditions even in inflation-targeting economies with large financial markets. Longstaff and others (2011) find that three factors account for more than 50 percent of the variation in credit default swap spreads across countries, and Adrian, Stackman, and Vogt (2016) estimate a highly significant price of risk that forecasts global stock and bond returns as a nonlinear function of the VIX.<sup>7</sup>

Evidence of global factors’ greater influence, however, is not by itself proof that policymakers are losing

control over domestic financial conditions. Financial conditions that move together across countries may be a natural reflection of comovement in fundamentals because of greater trade and financial integration and could, therefore, be optimal from a domestic standpoint. For example, for a globally integrated economy whose business cycle is highly correlated with the rest of the world, raising domestic interest rates in response to a rise in world interest rates may be the best decision from a domestic perspective. But some changes in financial conditions have nothing to do with macroeconomic factors and may arise from financial frictions (including changes in investor sentiment, the effects of herd behavior, risk management constraints, or regulations). Conceptually, in an extreme case, empirically domestic financial conditions being predominantly influenced by such spillovers not driven by fundamentals (and therefore likely to be undesirable) would suggest a “lack of control” by policymakers. The reason is that policymakers will most likely attempt to counteract such shocks. Accordingly, these spillovers still featuring prominently in domestic financial conditions would be an indication that policymakers do not have the tools to react in an effective or timely manner to offset them. Empirically, the distinction between fundamentals-driven versus other types of spillovers is not easy to derive (see Disyatat and Rungcharoenkitkul 2016 for an effort in this regard). This chapter seeks to address this issue by focusing on measures of financial conditions that are purged of macroeconomic fundamentals, acknowledging the difficulties and limitations inherent to such an endeavor.

### Constructing Financial Conditions Indices across Advanced and Emerging Market Economies

Previous studies have constructed FCIs mainly for selected advanced economies, using various methods, each with its strengths and limitations. FCIs are unobservable (latent) variables that are estimated using a wide range of financial variables so as to best reflect the financial conditions faced by domestic end users, such as firms and households. The literature has concentrated primarily on developing FCIs for the United States and, occasionally, for major economies of the Organisation for Economic Co-operation and Development (Box 3.1). However, previous studies have not developed a consistently estimated set of FCIs for both major advanced and emerging market economies.

<sup>4</sup>For example, as trade becomes more important, monetary policy may work more through exchange rates and net exports and less through its effects on domestic demand.

<sup>5</sup>Global financial integration could also worsen the trade-offs authorities face when pursuing financial stability objectives along with more standard macroeconomic stabilization goals (Obstfeld 2015). This is because greater openness to international financial markets would likely diminish the effectiveness of macroprudential tools, which would suffer more from leakage problems (IMF-FSB-BIS 2016).

<sup>6</sup>According to the “financial trilemma” put forward by Shoenmaker (2013), only two of the following three goals can be achieved simultaneously: (1) national autonomy over financial policies, (2) international financial integration, and (3) financial stability.

<sup>7</sup>See also Kennedy and Palerm 2014; and Bekaert and others 2016, among many others.



This chapter goes beyond existing studies and develops FCIs for major advanced and emerging market economies. For the purposes of this chapter, latent FCIs are extracted from an array of financial variables while taking account of growth and inflation. In particular, a time-varying parameter factor-augmented vector autoregression model based on the work of Koop and Korobilis (2014) is used to estimate the FCIs.<sup>8</sup> This method jointly considers the dynamic interactions of the FCI and macroeconomic fundamentals, and has two notable advantages. First, the method aims to purge the FCI of the effects of macroeconomic conditions.<sup>9</sup> Although empirically difficult, conceptually this purging is desirable—ideally, the estimated FCIs would therefore entail primarily exogenous shifts in financial conditions that are distinct from the endogenous reflection of macroeconomic fundamentals. Second, because the parameters are allowed to change, the model can account for the evolving relationships between macroeconomic and financial variables over time.<sup>10</sup>

In principle, the range of possible financial variables to include in an FCI is vast. In practice, however, only a few studies use a large array of financial variables. For example, the Organisation for Economic Co-operation and Development develops FCIs for six major advanced economies using seven variables. Even for the United States, the Kansas City Financial Stress Index is based on 11 variables. Although Hatzius and others (2010) use up to 45 variables, and the Federal Reserve Bank of Chicago uses more than 100 in its U.S. factor models,

Boivin and Ng (2006) emphasize that including more data does not always yield better results.

In this chapter, the choice of variables used for the construction of the FCIs is guided by two considerations, one conceptual and the other practical. Conceptually, since the chapter focuses on how global factors affect financial conditions in domestic markets, variables measuring the ease of access to finance on international markets are not included.<sup>11</sup> With regard to practical considerations, the choice of variables should be consistent across countries and reflect as many segments of the financial system as possible. Accordingly, the FCI should include the equity, housing, bond, and interbank markets so as to capture the various channels through which monetary and macroprudential policies can influence the broader economy. Following the literature, the financial variables used include various interest rates and spreads (for example, changes in longer-term interest rate, corporate, interbank, and term spreads), asset price returns (equity and house price returns), equity return volatility, and credit growth. Where available, survey-based information (lending standards) can provide additional information about financial frictions (Annex 3.1). Naturally, as the structure of, and products in, financial systems evolve, the variables most relevant for tracking financial conditions may change. This chapter estimates comparable monthly FCIs for 43 advanced and emerging market economies during 1990–2016, depending on data availability.

## Financial Conditions around the World

*This section presents key stylized facts about financial conditions in selected countries and around the world.*

<sup>8</sup>Roughly speaking, the model decomposes the main patterns across a broad range of variables into a measure of financial conditions, the FCI, and a business cycle component (as captured by macroeconomic conditions such as growth and inflation).

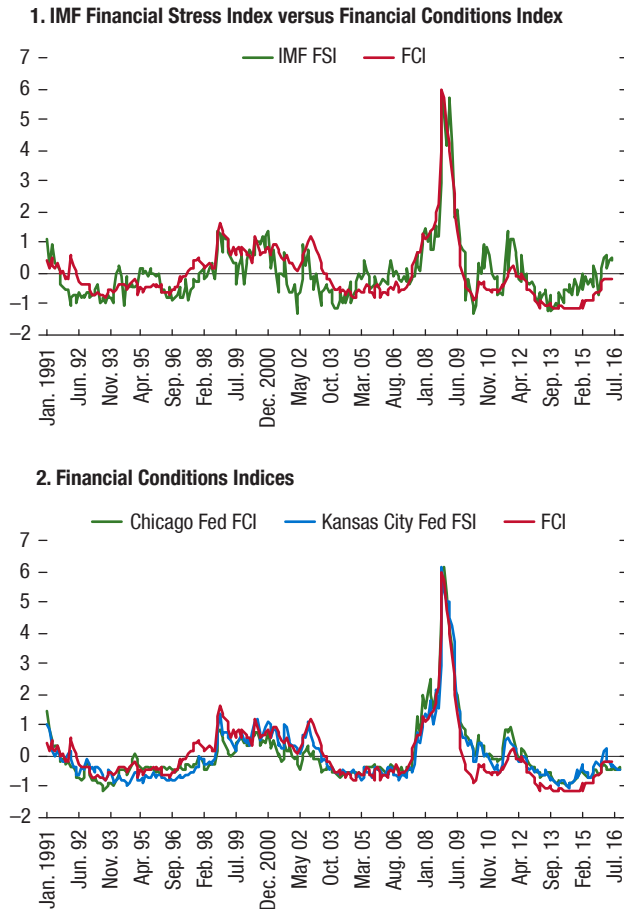
<sup>9</sup>Initially, the FCIs are purged only of the effect of current macroeconomic conditions. However, financial variables can also reflect expectations of future macroeconomic developments. The FCIs are not purged of these expectations about the future in the baseline estimations to the extent that these expectations cannot be captured by the past and current behavior of macroeconomic variables. This is an issue common to all FCIs. As a robustness check, professional forecasts of macroeconomic variables were considered as controls in the case of the United States (based on data availability), which did not result in any material changes to the FCI (consistent with Koop and Korobilis 2014).

<sup>10</sup>Another advantage of the time-varying parameter factor-augmented vector autoregressive model (TVP-FAVAR) is that the time-varying parameters help account for changes in (policy) regimes and, for example, financial-accelerator-related dynamics. Similarly, the TVP-FAVAR recognizes that financial shocks in various periods can be transmitted to the real economy with varying intensity.

<sup>11</sup>For financially open economies, financial conditions encompass the ease of access to funding in both the domestic jurisdiction and across borders. When firms rely more on international markets for funding, global factors are expected to have a larger direct impact on their financing conditions. For the purposes of this chapter, the more indirect channel is considered, whereby global factors are potentially a driver of domestic financial conditions. Similarly, the exchange rate is not included in the FCI. As mentioned earlier, exchange-rate movements may influence domestic financial conditions, for example, by altering the net worth of borrowers and thereby their terms of access to finance. The analysis aims at measuring these indirect effects. Including the exchange rate directly in the FCI would overstate the influence of global conditions on domestic financial conditions, for example, in economies where exchange rate movements have little effect on domestic financial conditions or where they effectively serve as an insulating buffer.

**Figure 3.1. United States: Financial Conditions Indices, 1991–2016**  
(Standard deviations)

Estimated U.S. financial conditions seem to reflect key financial events well.



Sources: Federal Reserve Bank of Chicago; Federal Reserve Bank of Kansas City; IMF, Global Data Source database; and IMF staff estimates.

Note: Higher values indicate tighter-than-average financial conditions. The IMF FSI aims to identify episodes of acute financial stress, when financial intermediation is impaired, similar to the Kansas City Fed FSI. The Chicago Fed FCI summarizes U.S. financial conditions in money markets and debt and equity markets and in the traditional and shadow banking systems (see Box 3.1 for details). FCI = financial conditions index; Fed = Federal Reserve Bank; FSI = financial stress index.

### Financial Conditions Indices: Selected Countries

Given its central role in the global financial system, the United States is a natural starting point for appraising the usefulness of the FCIs developed here. In addition, because many FCIs have been developed for the United States, several benchmarks can facilitate comparisons across complementary approaches. It is reassuring that the pattern of the U.S. FCI developed in this chapter closely tracks counterparts developed by the IMF and

other institutions, such as the Federal Reserve Banks of Chicago and Kansas City during 1990–2016 (Figure 3.1).<sup>12</sup> At the same time, the fluctuations in the FCI appear to capture key U.S. financial events quite well.<sup>13</sup> After a period of relative tranquility in the early 1990s, financial conditions tightened as stock markets, in particular, were rattled by the collapse of Long-Term Capital Management, a hedge fund, in 1998. The FCI remained elevated because of the dot-com crash in 2000, when stock market declines were led by the technology sector. Then around 2002, the demise of accounting firm Arthur Andersen and the bankruptcy of telecommunications corporation WorldCom (the largest in U.S. history at the time), among other events, resulted in tighter financial conditions. After a period of favorable conditions, the global financial crisis broke out in 2008, resulting in an unprecedented spike in the FCI. More recently, the FCI has been on a gradual uptrend, although still indicating broadly accommodative conditions.

The FCIs in selected small open economies seem to reflect their financial histories well. For instance, in Russia, the FCI tightened dramatically during 1998 as a consequence of the acute financial distress experienced by the country at the time, with the degree of tightening outpacing that encountered 10 years later during the global financial crisis (Figure 3.2). By contrast, financial conditions in Korea were tighter during the global financial crisis than they were during the Asian financial crisis (1997–98). Likewise, for Chile, the global financial crisis represents the sharpest spike in the FCI over the past two decades. Last, for a small open euro area economy, the Netherlands, financial conditions tightened to almost the same extent during the euro area crisis and the global financial crisis.<sup>14</sup>

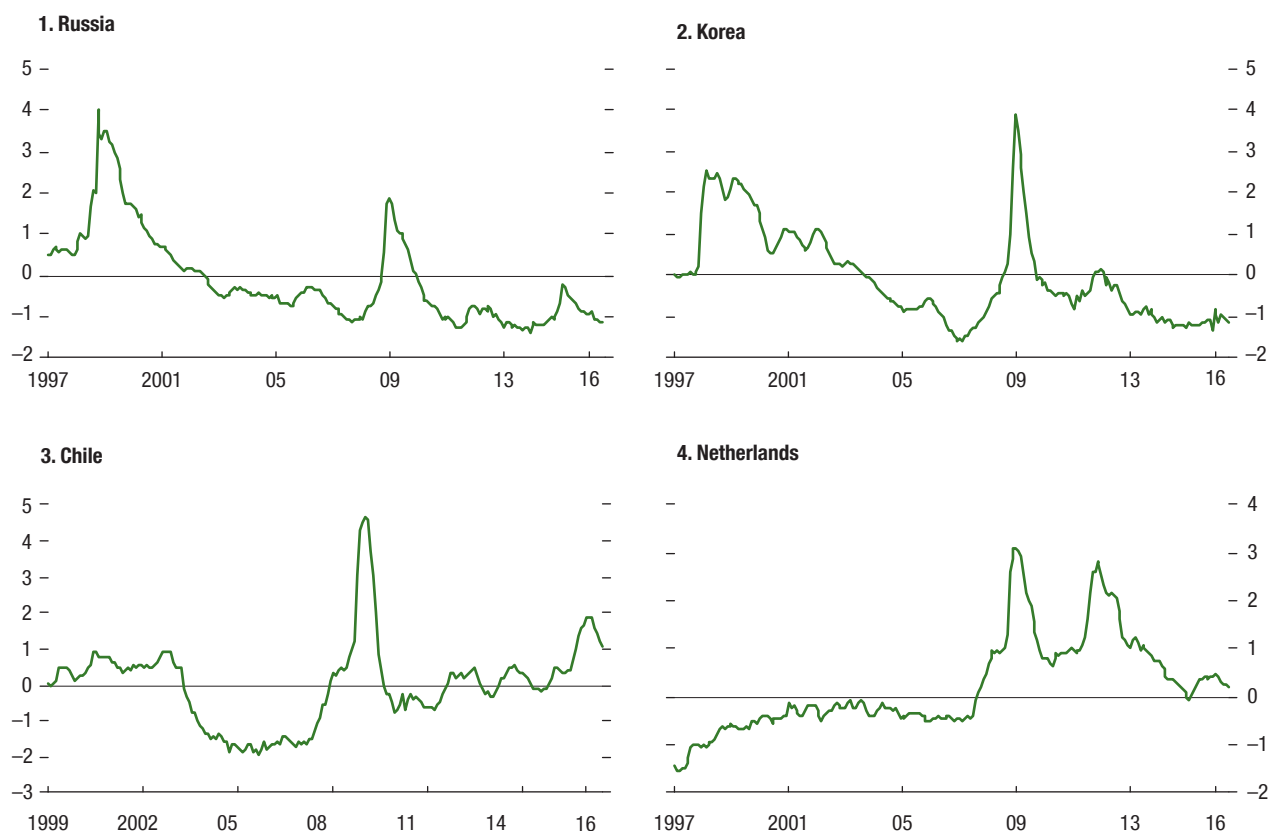
<sup>12</sup>The IMF financial stress indices (FSIs) seek primarily to identify episodes of acute financial stress—that is, when financial intermediation is impaired (extreme events are typically considered outright crises). In practice, FSIs and FCIs can display broadly similar patterns. Here, the IMF FSIs are entirely price based, partly explaining why they tend to be more volatile. For further details on FCIs, see Box 3.1, which includes a discussion of different methods for constructing FCIs.

<sup>13</sup>Positive (negative) values of the FCI indicate that financial conditions are tighter (looser) than on average, which corresponds, for example, to higher- (lower-) than-average corporate spreads and lower- (higher-) than-average credit growth.

<sup>14</sup>The FCIs shown in Figure 3.2 track the patterns in the corresponding IMF FSIs. Interbank and corporate spreads, equity return volatility, and changes in house prices are at the top of the list of the underlying financial variables contributing to countries' FCIs. This result is broadly consistent for advanced and emerging market economies and in line with those in Hatzius and others (2010).

**Figure 3.2. Selected Advanced and Emerging Market Economies: Financial Conditions Indices**  
(Standard deviations)

Major financial developments appear to be captured by the financial conditions indices across selected economies.



Source: IMF staff estimates.

Note: Higher values indicate tighter-than-average financial conditions.

### Financial Conditions and GDP Growth

The financial conditions indices developed in this chapter tend to signal downside risks to GDP. Domestic FCIs are significant predictors of future GDP growth across countries; however, this relationship changes depending on the state of the business cycle (Figure 3.3). In particular, the inverse relationship between FCIs and future GDP growth is stronger for economic contractions (the lower percentiles of the growth distribution) than for expansions (the upper percentiles of the growth distribution). For example, at the one-year-ahead horizon, the negative coefficient at the 10th percentile (when growth is well below  $-1/2$  percent) is about three times as large in absolute terms relative to the coefficient corresponding to the median (when growth is about  $3/2$

percent).<sup>15</sup> These findings confirm and extend the conclusions of Adrian, Boyarchenko, and Giannone (2016). They show that the lower quantiles of GDP growth (recessions) are more closely linked to financial conditions than upper quantiles (economic expansions) for the United States.

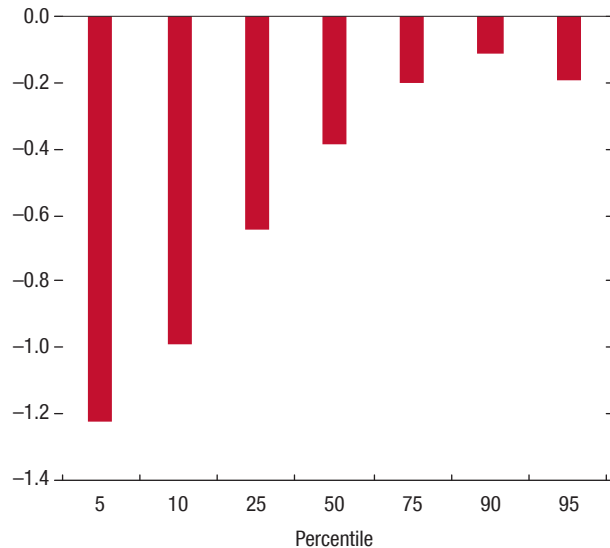
Historical examples highlight the predictive power of FCIs for future economic downturns. Two dates are considered as an illustration: the second quarter of 2006 and the third quarter of 2008, broadly corresponding to the precrisis expansion and the onset of the global financial crisis, respectively. Figure 3.4 shows the conditional distribution of growth

<sup>15</sup>A one standard deviation increase in the FCI (corresponding to tighter financial conditions) is associated with a 0.4 percentage point decrease in median future GDP growth at a one-year horizon.



**Figure 3.3. Future GDP Growth and Financial Conditions: Quantile Regressions**  
(Percentage points)

Financial conditions indices can flag downside risks to growth.



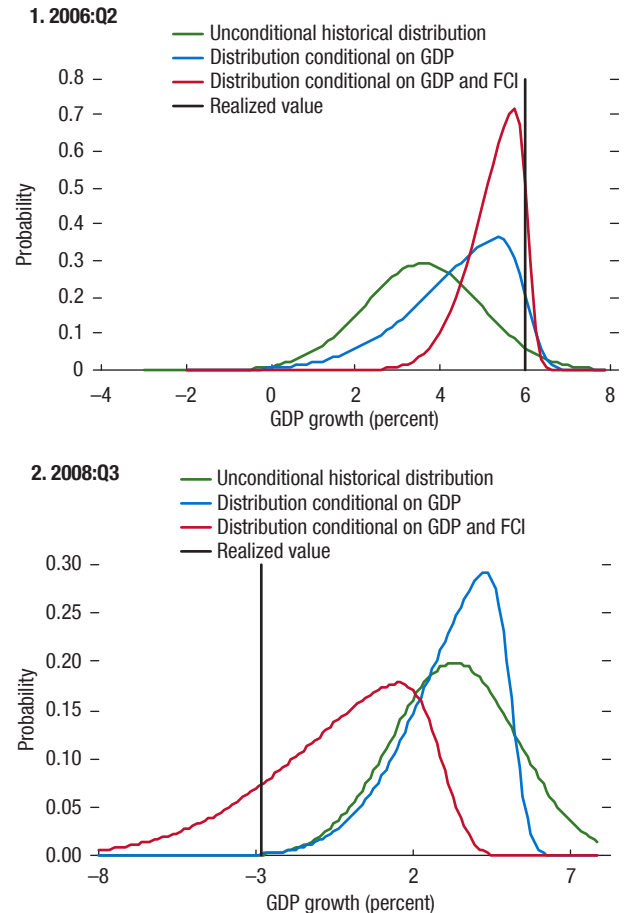
Source: IMF staff estimates.

Note: The figure shows the sensitivity of future growth to financial conditions at various quantiles. For all countries in the sample, growth at the one-year-ahead horizon across selected quantiles is regressed against countries' financial conditions indices.

one year ahead based on two empirical forecasting models: one in which current and past growth rates are used as predictors and one that augments the first model by including FCIs. The idea is to gauge the extent to which additional information from the FCIs helps improve forecast accuracy. Based on the information available as of the second quarter of 2006, the model with the FCIs attributes approximately a 45 percent probability to the actual growth outturn in one year (6 percent), which is more than twice the probability generated by the model that uses only growth rates (Figure 3.4). The distributions using information up to the third quarter of 2008 differ to an even greater extent. The long left tail in the distribution associated with the model with the FCIs (as opposed to the simple forecast model) assigns a higher probability to economic downturns, more starkly signaling the actual GDP contraction in the third quarter of 2009. FCIs appear to contain valuable information about the future state of the economy and can be particularly useful in flagging downside risks to economic activity.

**Figure 3.4. Probability Distributions of One-Year-Ahead GDP Growth**  
(Probability)

Financial conditions improve the ability to predict future economic downturns.



Source: IMF staff estimates.

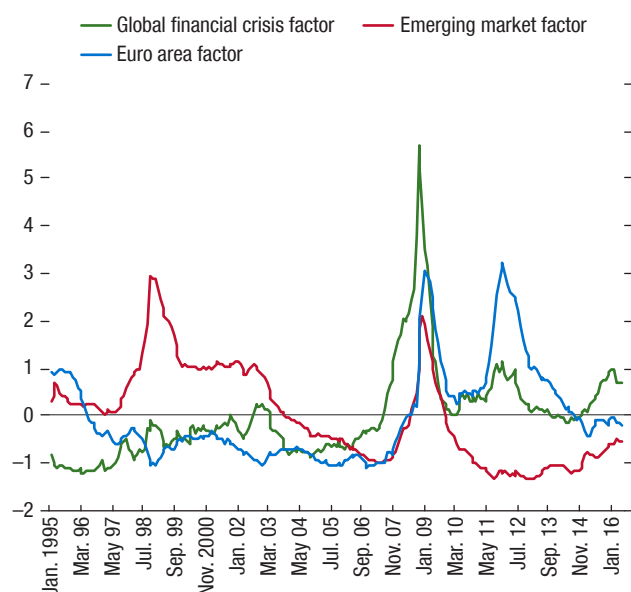
Note: The figure displays conditional probability distributions of one-year-ahead real GDP growth for a panel of 43 countries based on quantile regressions. In particular, it includes unconditional historical distributions and two conditional distributions (of growth) based on two forecasting models that use either growth or growth and FCIs to predict future growth (in 2007:Q2 or in 2009:Q3). The figure also includes realized values (average actual GDP growth). FCI = financial conditions index.

### The Evolution of Financial Conditions around the World

Three global factors seem to capture the dynamics of financial conditions across countries. A statistical dynamic factor model is used to generate multiple unobservable (latent) factors that summarize the main patterns across countries' financial conditions. Although these factors can be subject to various interpretations, an interesting story emerges. It appears that the financial conditions around the world can be summarized by three

**Figure 3.5. Three-Factor Model Based on Financial Conditions Index, 1995–2016**  
(Standard deviations)

Financial conditions around the world seem to be characterized by three global factors.



Source: IMF staff estimates.

Note: Higher values indicate tighter-than-average financial conditions. Based on a dynamic factor model, the figure displays three latent factors that summarize the main patterns across countries' financial conditions indices.

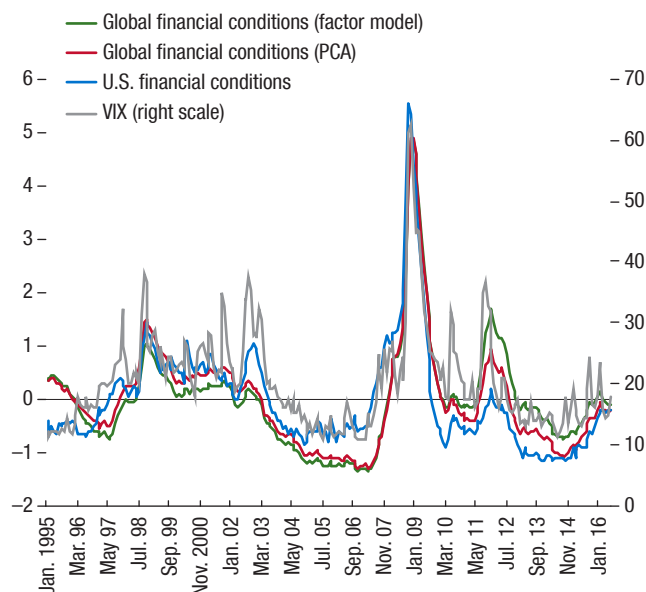
factors, which can be characterized by the three main historical crisis episodes over the past two decades. In particular, there seems to be an “emerging market” factor, a “euro area” factor, and a “global financial crisis” factor (Figure 3.5). Although each factor spikes during the global financial crisis, the emerging market and euro area factors also depict markedly tighter financial conditions during the late 1990s and around 2012, respectively.

Nevertheless, a single global factor adequately summarizes financial conditions across countries. Such a factor is consistent with the notion of a global financial cycle discussed in Miranda-Agrippino and Rey 2015. This single factor (the global financial factor or global financial conditions) closely tracks the movements in the U.S. FCI and the VIX (Figure 3.6).<sup>16</sup> This is in line with Rey's (2013) argument that global financial conditions are strongly driven by the United States, the key country in the international monetary system. Part of the reason

<sup>16</sup>The average correlation between the U.S. FCI and the two measures of global financial conditions and the VIX is 82 percent.

**Figure 3.6. Single Factor versus Principal Component Analysis, 1995–2015**  
(Standard deviations)

Evidence suggests that global financial conditions move in lockstep with the U.S. financial conditions index and the VIX.



Sources: Haver Analytics; and IMF staff estimates.

Note: The figure displays two measures of global financial conditions derived from a factor model (global financial cycle) or from principal components analysis, the U.S. FCI, and the VIX. Higher values indicate tighter-than-average financial conditions. FCI = financial conditions index; PCA = principal component analysis; VIX = Chicago Board Options Exchange Volatility Index.

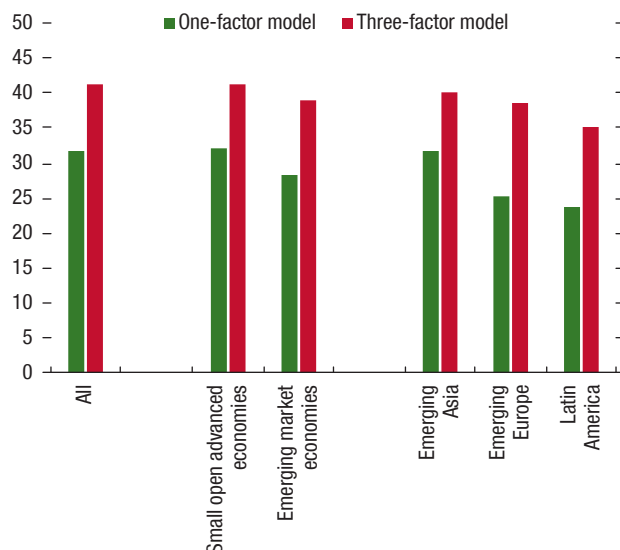
for this predominance is that the U.S. dollar takes center stage as an international currency with important roles in invoicing, issuance of financial assets, and commodity trading, among others (see also IMF 2014a).

A sizable share of fluctuations in countries' financial conditions is attributable to global financial shocks. On average, global financial conditions account for about 30 percent of the variation in financial conditions across countries, and though not shown, reaches almost 70 percent in several economies (Figure 3.7). As would be expected, the proportion of FCI variability explained by the three-factor model is larger than its single-factor counterpart and is greater than 40 percent.<sup>17</sup> Relative to emerging market economies, it appears that financial conditions in small open advanced economies are more synchronized with global financial conditions.

<sup>17</sup>These magnitudes are larger than those in Miranda-Agrippino and Rey (2015), for example, who report that a measure of global financial conditions accounts for about 21 percent of the variation across risky asset prices.

**Figure 3.7. Variance Accounted for by One- and Three-Factor Models**  
(Percent)

An appreciable fraction of fluctuations in countries' financial conditions is attributable to global financial conditions.



Source: IMF staff estimates.

Note: The figure displays the share of countries' FCI attributable to global factors based on a one- or three-factor model—specifically, the R-squared from panel regression models in which countries' FCIs are regressed on measures of global financial conditions based on the one- or three-factor model. Simple averages are used. FCI = financial conditions index.

However, no clear evidence indicates that the importance of global financial conditions has been markedly increasing over the past two decades. The share of variation across FCIs accounted for by global financial conditions displays some cyclical patterns, especially during the global financial crisis, but portrays a broadly flat trajectory when viewed over the past 20 years (Figure 3.8).<sup>18</sup> These developments may reflect that the effect of greater financial linkages across countries has been partly offset by financial deepening that has been taking place in parallel.<sup>19</sup> Although FCIs encompass various asset classes, these patterns are consistent with Bekaert and others (2016), who document that equity return correlations display

<sup>18</sup>The patterns related to the FCIs are robust to Forbes and Rigobon 2002-type adjustments, which correct for heteroscedasticity. As an example of an additional robustness exercise, the average  $R^2$  statistics based on 36- and 60-month rolling regressions of countries' FCIs on global factors reveal broadly similar patterns.

<sup>19</sup>Chapter 2 of the April 2017 *World Economic Outlook* finds that the relative importance of external financial conditions for emerging market and developing economies' medium-term growth outcomes has increased over time.

**Figure 3.8. Variance Attributable to Global Financial Conditions, 1995–2016**  
(Percent)

The share of countries' FCI variability accounted for by global financial conditions does not appear to display a pronounced upward trend.



Source: IMF staff estimates.

Note: The figure displays how the share of countries' FCI variability attributable to global financial conditions changes over time. Specifically, it presents the total variance explained by the first principal component across countries' FCI using either a 36- or 60-month rolling window. FCI = financial conditions index.

an upward trend from the end of the 1990s through the global financial crisis, but then decline notably.<sup>20</sup>

### Country Characteristics and Sensitivity to Global Financial Conditions

Country characteristics are likely to influence how sensitive domestic financial conditions are to global financial shocks. Given the prominence of the United States in the international monetary system, the U.S. FCI is taken as a proxy for global financial conditions, based on the findings discussed earlier.<sup>21</sup> Key country characteristics

<sup>20</sup>Carriero, Chaieb, and Errunza (2013) argue that emerging markets are not yet effectively integrated with global markets.

<sup>21</sup>Analysis based on Granger causality and convergent cross-mapping confirm the importance of U.S. FCIs relative to other FCIs across countries. The U.S. FCIs provide more statistically significant information about future FCIs in other countries than do other financial centers (including Germany, Japan, and the United Kingdom), with an average  $p$ -value of 7 percent. Analysis using convergent cross-mapping (which complements Granger causality using nonlinear methods as described in Sugihara and others 2012) suggests that U.S. FCIs reduce prediction errors to the greatest extent across countries. Although

considered include financial linkages with the United States (foreign direct investment, banking, and portfolio), financial openness and development, institutional quality, and the exchange rate regime (see Forbes and Chinn 2004; Aizenman, Chinn, and Ito 2015; and Sahay and others 2015). For example, the expectation is that FCIs of countries that are more financially open and that feature stronger financial linkages with the United States should be more sensitive to global financial conditions. Conversely, countries with strong institutional and policy frameworks as well as deep financial markets should display less sensitivity (Chinn and Ito 2007; Alfaro, Kalemli-Ozcan, and Volosovych 2008; Brandão-Marques, Gelos, and Melgar 2013; Chapter 2 of the April 2014 GFSR).<sup>22</sup> Given that an attempt has been made to purge the FCIs of macroeconomic drivers, real economic linkages (such as trade ties) should not be among the determinants that help explain the influence of U.S. financial conditions on local FCIs. Exchange rate regimes may not matter very much for the transmission of financial conditions across countries because financial conditions work through various channels that typically cannot be fully counterbalanced by exchange rate movements alone (Obstfeld 2015). In what follows, the chapter investigates the extent to which FCIs across countries are correlated with the U.S. FCI, using a panel of small open advanced and emerging market economies. It explores how the various country characteristics discussed earlier strengthen or weaken this correlation.<sup>23</sup>

Financial linkages are most closely associated with the extent to which FCIs are influenced by global financial conditions. In particular, FCIs in countries with stronger financial linkages (proxied by foreign direct investment) with the United States tend to be more synchronized with global financial conditions (Table 3.1).<sup>24</sup> Greater financial development in

general, and deeper financial (equity, bond) market depth in particular, are associated with an attenuated impact of global financial shocks on domestic FCIs.<sup>25</sup> This echoes the conclusions in Chapter 2 of the April 2014 and April 2016 GFSRs, which find that a larger domestic investor base and deeper banking systems and capital markets can increase the resilience of emerging market economies to external financial shocks. Trade linkages to the United States do not seem to matter, although trade relationships with the rest of the world appear to play a role—possibly, this variable captures other factors such as indirect financial linkages. No clear pattern emerges regarding the exchange rate regime and capital account openness—results that are broadly consistent with Aizenman, Chinn, and Ito 2015.<sup>26</sup> These findings are generally in line with evidence that exchange rate flexibility allows for considerable independence at the short end of the term structure, but less so when it comes to broader measures of financial conditions, including, for example, longer-term rates (Obstfeld 2015).<sup>27</sup>

## Can Countries Manage Domestic Financial Conditions amid Global Financial Integration?

*This section quantifies the relative share of fluctuations in countries' domestic financial conditions explained by global financial conditions and domestic monetary policy. It finds that despite the importance of global financial shocks, evidence suggests that monetary policy still accounts for a notable share of the variation in domestic financial conditions.*

ment tends to be more permanent, it captures financial linkages better than portfolio and bank linkages.

<sup>25</sup>Along with the overall and financial markets indices developed by Sahay and others (2015), the financial markets depth subindex tends to be statistically significant and robust across specifications. This subindex includes measures of equity and bond market size and liquidity.

<sup>26</sup>Recall that in contrast to a general measure of capital account openness, a more specific measure of financial integration as captured by foreign direct investment linkages with the United States is statistically significant.

<sup>27</sup>Regarding the role of exchange rate regimes, recall that financial conditions can be transmitted across countries through various channels that typically cannot be fully offset by exchange rate movements. Furthermore, relative to the sample in this chapter, which considers 43 advanced and emerging market economies, studies that find that exchange rate flexibility does confer monetary autonomy use larger sets of countries (for instance, Obstfeld [2015] considers 70 countries) that are much more heterogeneous in composition (and include low-income countries and other countries with a variety of exchange rate regimes, which helps uncover the potential role exchange rate flexibility can play).

the U.S. FCI is taken as a proxy for global financial conditions, U.S. financial conditions may also be affected by financial developments in other advanced and emerging market economies; see, for example, Chapter 2 of the April 2016 GFSR.

<sup>22</sup>It is sometimes argued that more liquid markets are more exposed to sell-offs by foreign investors. However, as discussed in Sahay and others 2014, although some emerging market economies with relatively deeper and more liquid financial markets were strongly affected during the taper tantrum in 2013, their more-developed financial markets subsequently facilitated the needed adjustment.

<sup>23</sup>This is done by including the interaction between the U.S. FCI and the various country characteristics in the regressions (Annex 3.3).

<sup>24</sup>Portfolio linkages matter too (and bank linkages to an even lesser extent), but results of their importance are not as robust across various specifications. It may be that because foreign direct invest-

**Table 3.1. Determinants of the Sensitivity of Domestic Financial Conditions to Global Financial Shocks**

Variable	Expected Sign	Estimated Sign	Significance
Direct Effect of U.S. FCI	+	+	***
Interaction with:			
FDI Linkages with the United States	+	+	**
Portfolio Linkages with the United States	+	—	
Banking Linkages with the United States	+	—	
Trade Linkages with the United States	+	+	
Trade Openness	+	+	**
Financial Openness	+	+	
Exchange Rate Flexibility	—	+	
Financial Development	—	—	**
Rule of Law	—	—	

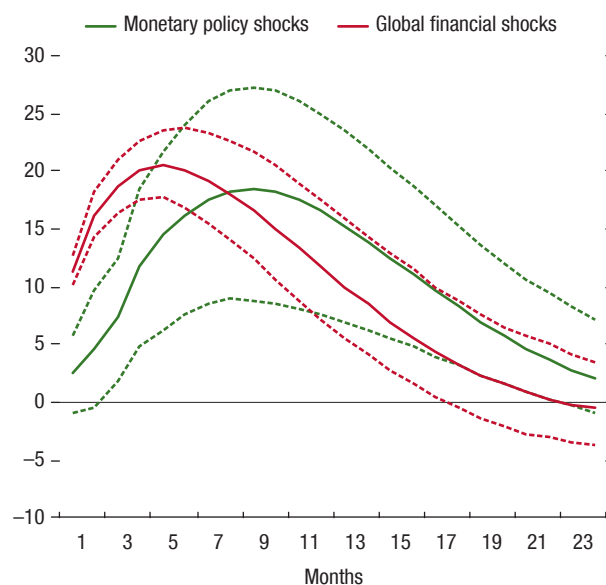
Source: IMF staff estimates.

Note: This table summarizes panel regressions in which countries' domestic FCIs are regressed against a measure of global financial conditions (U.S. FCI), various country characteristics, and their interactions. Regressions include country fixed-effects terms, and standard errors are clustered at the country level. See Annex 3.3 for details on baseline specifications. FCI = financial conditions index; FDI = foreign direct investment. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

Both global financial conditions and policy rates seem to influence domestic financial conditions. Several complementary econometric approaches based on vector autoregression (VAR) models are used. They jointly model output, consumer prices, policy rates, and domestic financial conditions for each country, including a measure of global financial conditions proxied by the U.S. FCI.<sup>28</sup> Using these econometric models, this section investigates the relative magnitude of the influence of global financial and domestic monetary policy shocks in driving domestic financial conditions in small open advanced and emerging market economies with flexible exchange rate regimes. Confirming the previous findings discussed in the chapter, the results based on panel VAR models (Figure 3.9) indicate that global financial shocks have a notable impact on countries' domestic financial condi-

**Figure 3.9. Response of Domestic Financial Conditions to Shocks**  
(Percent, standard deviations)

Global financial and domestic monetary policy shocks appear to affect local financial conditions.



Source: IMF staff estimates.

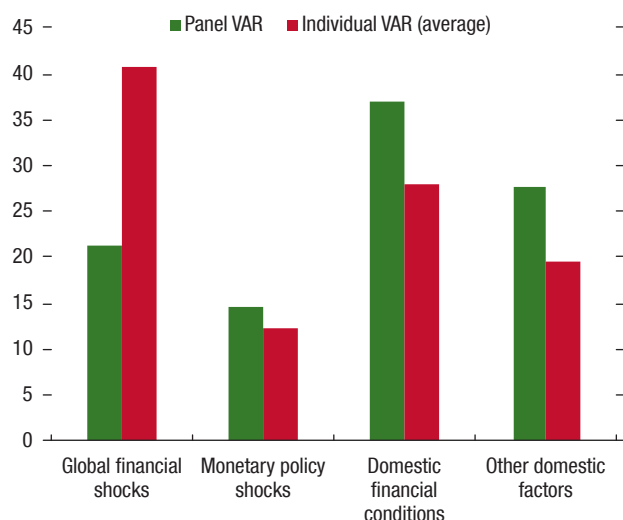
Note: The figure displays the impulse response functions and 90 percent confidence bands of domestic financial conditions indices to global financial or domestic monetary policy shocks for countries in the sample with flexible exchange rates. It is based on a panel vector autoregression model. See Annex 3.4 for details.

<sup>28</sup>Initially, a parsimonious panel vector autoregression (VAR) model is used, in which the variables are ordered as follows: U.S. FCI, industrial production growth, inflation, domestic FCI, and the change in the domestic monetary policy rate (all shocks identified using a Cholesky decomposition); the results are robust to using the level of the variables (Annex 3.4). The results do not change when exchange rate terms are added into the panel VAR as an additional endogenous variable. The results are also robust to inclusion of global industrial production growth, commodity prices, and a measure of global interest rates (proxied using several U.S. shadow rate measures) as exogenous controls. The average responses from VAR models estimated for individual countries result in broadly similar findings. Complementary methods of identifying the monetary policy shocks are discussed later in this section. See also He and McCauley 2013; Chen, Mancini-Griffoli, and Sahay 2014; Chen and others 2015; and Kose and others 2017.



**Figure 3.10. Share of Domestic Financial Conditions Index Fluctuations Attributable to Global Financial and Monetary Policy Shocks (Percent)**

A notable share of domestic FCI fluctuations can be attributed to global financial and domestic monetary policy shocks.



Source: IMF staff estimates.

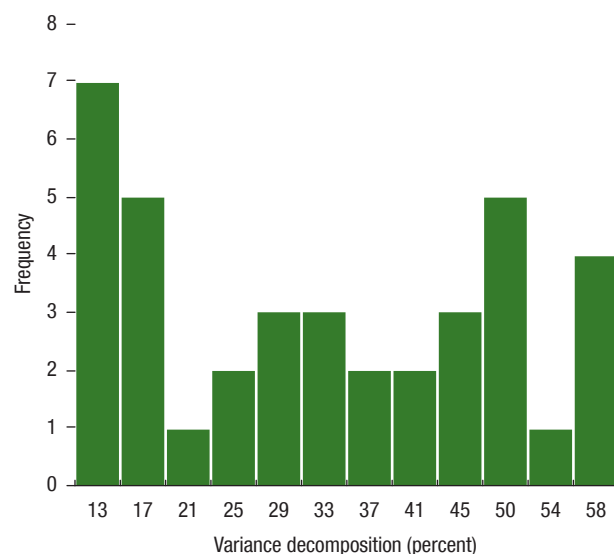
Note: The figure displays the share of domestic FCI fluctuations accounted for by global financial, domestic monetary policy, or domestic financial condition shocks, and shocks associated with other domestic factors for countries in the sample with flexible exchange rates. It is based on the panel VAR model or on VAR models estimated individually for each country. See Annex 3.4 for details. FCI = financial conditions index; VAR = vector autoregression.

tions. However, changes in local policy rates also have an appreciable effect on local FCIs. Notably, it appears that local financial conditions react faster and more strongly to global financial shocks than to changes in domestic policy rates, suggesting timely and effective monetary policy reactions may often be difficult. For example, if monetary policy is intended to offset an unwelcome global shock, it may have to react very quickly and strongly, with potentially undesirable side effects. Examining the subset of emerging market economies shows that their FCIs tend to be somewhat more sensitive to global financial conditions, but less responsive to changes in the domestic monetary policy stance.

A considerable share of domestic FCI fluctuations is attributed to global financial conditions and domestic policy rates. On average, about 21 percent of the variation in domestic FCIs across small open economies with flexible exchange rates is attributed to global financial shocks (Figure 3.10). This implies that the remainder is explained by domestic factors, includ-

**Figure 3.11. Share of Domestic Financial Conditions Index Fluctuations Attributable to Global Financial Conditions (Frequency)**

The importance of global financial conditions varies across countries.



Source: IMF staff estimates.

Note: Histogram intervals on the x-axis vary because of rounding. The figure displays the share of fluctuations in domestic financial conditions attributable to global financial shocks based on vector autoregression models estimated individually for all countries in the sample. See Annex 3.4 for details.

ing shocks originating from the local financial sector. Importantly, domestic monetary policy shocks account for about 15 percent of the fluctuations in FCIs. Moreover, complementary analysis, in which a similar VAR model is estimated for each country individually, yields broadly similar results, albeit with a larger estimated influence from global factors.<sup>29</sup>

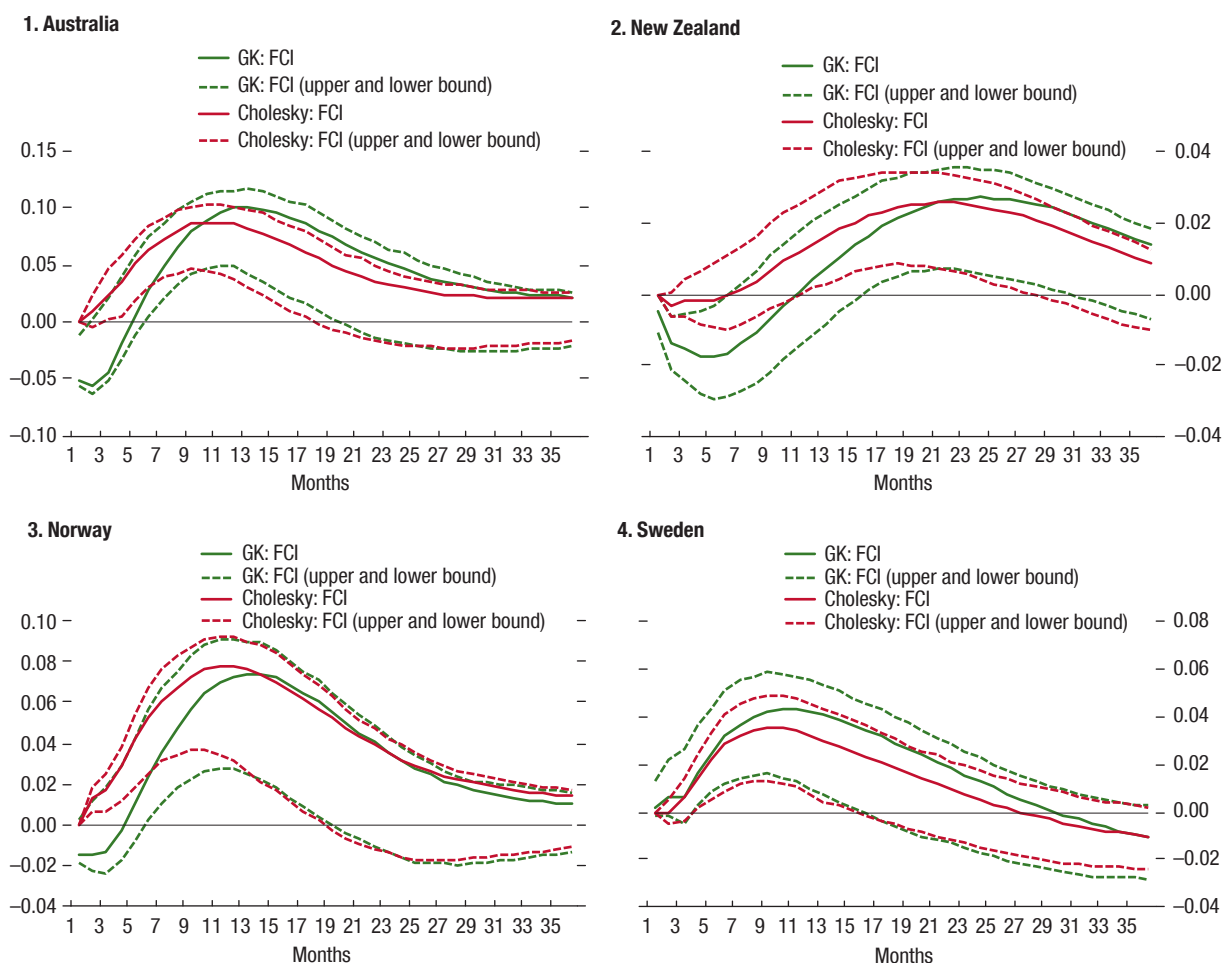
The importance of global financial shocks for domestic financial conditions varies considerably across countries (Figure 3.11). In fact, global financial conditions generally tend to account for a greater proportion of FCI variability in emerging market economies, and in a few cases, this proportion exceeds 60 percent.<sup>30</sup>

<sup>29</sup>In these estimations, shocks to global financial conditions and to monetary policy account for, on average, about 40 percent and 12 percent of countries' domestic FCI variations, respectively. The VAR model contains U.S. FCI, industrial production growth, inflation, domestic FCI, and the change in domestic monetary policy. Robustness exercises that control for global growth and commodity prices and, for instance, various lag lengths, yield broadly similar results. The variance decompositions are statistically significant at the 10 percent level.

<sup>30</sup>These results are based on the country-by-country VAR estimations.

**Figure 3.12. Selected Advanced Economies: Response of Financial Conditions Index to Monetary Policy Shocks**  
(Standard deviations)

Country case studies highlight the influence of domestic monetary policy on domestic financial conditions.



Sources: IMF, Global Data Source database; and IMF staff estimates.

Note: The figure displays the impulse response functions and 90 percent confidence bands of domestic FCIs to domestic monetary policy shocks for countries using two complementary methods to identify the monetary policy shocks. FCI = financial conditions index; GK = Gertler and Karadi.

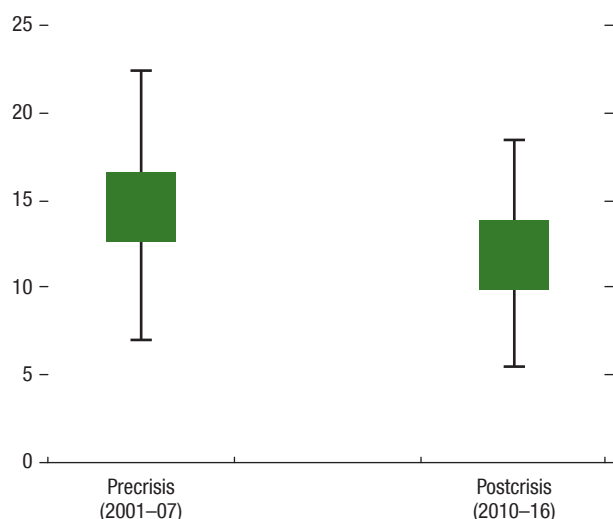
Moreover, in line with intuition, the results indicate that fluctuations in global financial conditions are associated with a greater share of FCI variability in countries that are relatively more financially integrated with the rest of the world, and these differences are greater for emerging market economies.

A closer look at relevant case studies reinforces these results. The identification of shocks can be especially difficult in the context of the VAR models used in the chapter, particularly for monetary policy. Because precisely identifying monetary policy shocks is challenging, recent studies have developed methods that help better pinpoint exogenous

measures of monetary policy shocks. In line with the methodology traced out by Gertler and Karadi (2015), who build on Gürkaynak, Sack, and Swanson 2005, among others, unexpected changes in bond yields on central bank policy announcement dates are used to measure policy surprises. Such shocks are derived for Australia, New Zealand, Norway, and Sweden—four small open advanced economies with floating exchange rate regimes and relatively deep financial markets. In each of the country cases shown in Figure 3.12, VAR models using these better-identified monetary policy shocks yield results similar to those examined earlier, lending further credence to

**Figure 3.13. Share of Domestic Financial Conditions Index Fluctuations Attributable to Global Financial Shocks before and after the Global Financial Crisis (Percent)**

There seems to be no conclusive evidence that the role of global financial conditions has been increasing over time.



Source: IMF staff estimates.

Note: The figure displays the share of domestic financial conditions index fluctuations attributable to global financial shocks (squares) for countries in the sample with flexible exchange rates based on the panel vector autoregression model for the precrisis (2001–07) and postcrisis (2010–16) samples, along with the 90 percent confidence bands (lines). See Annex 3.4 for details.

the empirical findings discussed in this section. The share of FCI variation characterized by fluctuations in global financial conditions and domestic monetary policy is, on average 15 percent and 33 percent, respectively, for these four countries.<sup>31</sup>

Notably, there does not appear to be any discernible change in the importance of global financial conditions in influencing local FCIs over time. The cross-country exercises using the panel VAR models are repeated over the period before (2001–07) and after (2010–16) the global financial crisis to gauge how some of the relationships discussed above may have changed. The share

<sup>31</sup>These findings are based on VARs (similar to the panel VARs discussed earlier) estimated separately for each of the four countries using a Cholesky decomposition to identify the shocks (which, as shown in Figure 3.12, are similar to those based on the methodology developed by Gertler and Karadi [2015]). The impulse response functions of the domestic FCI to global financial and monetary policy shocks—as well as the share of FCI variability attributed to each of these shocks—is statistically significant at the 5 percent level.

of domestic financial conditions attributed to global financial conditions appears to be broadly stable over the two periods (Figure 3.13).<sup>32</sup>

## Conclusions and Policy Implications

This chapter extends previous studies by developing a comparable set of financial conditions indices (FCIs) across a large set of advanced and emerging market economies. FCIs seek to summarize information about price and nonprice costs of credit for agents across the economy. Gauging financial conditions is valuable given their role in the transmission of monetary policy and their informational content about the evolution of future economic activity. In particular, FCIs seem well suited to signaling downside risks to GDP growth. The chapter finds that a single factor summarizes the dynamics of a significant share of financial conditions around the world well: global financial conditions, which move in tandem with the FCI of the United States and standard measures of global risk such as the VIX. However, the fraction of fluctuations in countries' domestic financial conditions attributed to global financial conditions does not appear to have increased markedly over the past two decades. Although stronger financial linkages with the United States increase the sensitivity of domestic financial conditions to global financial shocks, greater financial development can attenuate them.

Despite the significant influence of global financial conditions, the analysis indicates that countries, on average, are still able to steer their domestic financial conditions. However, because domestic financial conditions respond faster and more strongly to global financial shocks than to changes in the domestic monetary policy stance, implementing timely and effective policy reactions may often be challenging. Likewise, given that global financial conditions tend to account for a greater fraction of FCI variability in emerging market economies, these countries in particular should prepare for the implications of global financial tightening. Countries also have other policies at their disposal. For example, macroprudential measures can be used to limit risks from a further buildup of vulnerabilities that increase domestic financial conditions' sensitivity to external financial

<sup>32</sup>The 2001–07 and 2010–16 variance decompositions are not statistically different at the 95 percent level.

shocks (IMF 2014b). Likewise, there may be circumstances that warrant a temporary role for capital flow management measures (IMF 2016).

Governments should prioritize domestic financial deepening to enhance resilience to global financial

shocks. In particular, developing a local investor base that encompasses both bank and nonbank financial intermediaries, as well as fostering greater equity and bond market depth and liquidity, can help dampen the impact of external financial shocks.

### Box 3.1. Measuring Financial Conditions

*This box reviews how financial conditions indices (FCIs) have been developed over time and draws attention to the fact that previous studies have not developed a consistently estimated set of FCIs for major advanced and emerging market economies.*

Research on financial conditions can be traced back to the work on measuring monetary conditions. In pioneering work, the Bank of Canada introduced its monetary conditions index (MCI) consisting of the weighted average of its policy rate and the exchange rate (Freedman 1994).<sup>1</sup> The MCI helped figure out the extent of the adjustment in the policy rate that was needed to offset the macroeconomic effects of a swing in the exchange rate to maintain a desired monetary policy stance.

In part motivated by the rapid run-up in equity prices, Dudley and Hatzius (2000) developed one of the earliest FCIs. FCIs augmented MCIs by including other financial variables, such as longer-term interest rates, spreads, and stock market indicators. Although the variables included in various FCIs may differ, they have some elements in common. Most FCIs include selected interest rates and spreads and measures of equity market performance. Some include quantity indicators (such as credit), and a few include survey-based data (lending surveys).<sup>2</sup>

FCIs are constructed in four broad ways. First, a few studies have estimated FCIs based on reduced-form textbook investment-saving curves (Goodhart and Hofmann 2001). Financial variables are linked, for example, to the output gap used in constructing an FCI. One limitation of this approach is that it assumes that the financial variables are exogenous to measures of economic activity, whereas in reality, the financial sys-

tem responds to the economic cycle. Second, FCIs have been developed using large macroeconomic models (for example, Beaton, Lalonde, and Luu 2009). Although a more structural approach can mitigate econometric issues, including possible identification problems, the financial system in such models tends to be rudimentary (Gauthier, Graham, and Liu 2004). Third, FCIs have been constructed using impulse response functions based on vector autoregression (VAR) models (for instance, Swiston 2008). Fourth, principal components analysis and more sophisticated variants, such as dynamic factor models, have been used to extract a common factor from a large array of financial variables.

Most of the literature has generally focused on developing FCIs for a few advanced economies. Many FCIs for the United States have been developed, including by academics, Federal Reserve Banks, investment banks, and other institutions.<sup>3</sup> Relatively long time series facilitate the tracking of U.S. financial markets, which include more developed segments covering corporate bonds, commercial paper, asset-backed securities, and mortgage markets. FCIs are also available for a few selected advanced economies, typically those in the Group of Seven, and sometimes for the euro area as well.<sup>4</sup> In contrast, FCIs for emerging market economies are rare.<sup>5</sup> Despite the dramatic transformation in their financial markets in recent decades, greater variety across emerging market economies and relatively short times series for monitoring their financial segments have made it difficult to develop FCIs for these economies. Moreover, there is not a set of comprehensive and consistently estimated FCIs that facilitate cross-country analysis for both major advanced and emerging market economies.<sup>6</sup>

The author of this box is Selim Elekdag.

<sup>1</sup>Using structural models, the weights were determined by each variable's relative impact on GDP. For Canada, a relatively open economy, the exchange rate received a weight about one-third that of the policy rate.

<sup>2</sup>Financial stress indices (FSIs)—which should not be confused with financial soundness indicators—can be constructed with similar variables and methods as FCIs. FSIs aim to identify episodes of acute financial stress, when financial intermediation is impaired (extreme events are typically considered outright crises). In practice, FCIs and FSIs can display similar dynamics in part because they can include similar financial variables (such as selected spreads) and because they may be constructed with similar methods. For the United States, the patterns of the Kansas City FSI resemble those of the FCIs developed by the other Federal Reserve Banks (for example, Chicago and St. Louis) where all indices capture the accommodative conditions before and the sharp tightening in conditions during the global financial crisis.

<sup>3</sup>See Hatzius and others 2010; Matheson 2012; Koop and Korobilis 2014; Brave and Butters 2011; Hakkio and Keeton 2009; Carlson, Lewis, and Nelson 2012; Kliesen, Owyang, and Vermann 2012; Oet and others 2011.

<sup>4</sup>See Illing and Liu 2003; Davis, Kirby, and Warren 2016; Moccero, Darracq Paries, and Maurin 2014; Guichard, Haugh, and Turner 2009; Hollo, Kremer, and Lo Duca 2012; Dattels and others 2010; Schüler, Hiebert, and Peltonen 2016.

<sup>5</sup>Exceptions include Brandão-Marques and Perez-Ruiz forthcoming; Gumata, Klein, and Ndou 2012; and Kara, Ozlu, and Unalmis 2012; for Chile, South Africa, and Turkey, respectively.

<sup>6</sup>Chapter 4 of the October 2008 *World Economic Outlook* and Cardarelli, Elekdag, and Lall (2011) develop FSIs for 17 advanced economies, and Chapter 4 of the April 2009 *World Economic Outlook* and Balakrishnan and others (2009) for major emerging market economies. Osorio, Unsal, and Pongsaparn (2011) develop FCIs for 13 selected Asian economies; see also IMF (2015).



**Annex Table 3.1.1. Country Coverage**

Argentina	Czech Republic	Israel	Philippines	United Kingdom
Australia	Denmark	Italy	Poland	United States
Austria	Finland	Japan	Portugal	Vietnam
Belgium	France	Korea	Russia	
Brazil	Germany	Malaysia	South Africa	
Bulgaria	Greece	Mexico	Spain	
Canada	Hungary	Netherlands	Sweden	
Chile	India	New Zealand	Switzerland	
China	Indonesia	Norway	Thailand	
Colombia	Ireland	Peru	Turkey	

Source: IMF staff.

### Annex 3.1. Estimating Financial Conditions Indices<sup>33</sup>

The financial conditions indices (FCIs) are estimated for 1990–2016 at monthly frequency for 43 advanced and emerging market economies (see Annex Table 3.1.1) using a set of 10 financial indicators.<sup>34</sup> The length of the FCIs varies depending on data availability (see Annex Table 3.1.2). The FCIs are estimated based on Koop and Korobilis 2014 and build on the estimation of Primiceri's (2005) time-varying parameter vector autoregression (TVP-VAR) model and dynamic factor models of Doz, Giannone, and Reichlin (2011).<sup>35</sup> This approach has two advantages: first, it can purge financial conditions of (current) macroeconomic conditions; second, it allows for a dynamic interaction between the FCIs and macroeconomic conditions, which can also evolve over time. The model takes the following form:

<sup>33</sup>The author of this annex is Dulani Seneviratne.

<sup>34</sup>The vector of financial variables includes corporate spreads, term spreads, interbank spreads, sovereign spreads, the change in long-term interest rates, equity and house price returns, equity return volatility, the change in the market share of the financial sector, and credit growth. Various additional financial variables were also used as robustness checks. For instance, lending standards were included in the case of the United States, based on data availability, resulting in a broadly similar FCI. Sovereign spreads were included to account for the fact that the short-term sovereign yield may not be a good proxy for the risk-free rate during crises. For example, during the euro area crisis, short-term sovereign yields shot up more than corporate yields (which may reflect illiquidity in the corporate bond market) resulting in a counter-intuitive decrease in the corporate spread. Likewise, the sovereign spread is often a good proxy for financing conditions for domestic firms—particularly in emerging market economies, where data on corporate spreads are scarcer (the FCIs are generally robust to their exclusion, however).

<sup>35</sup>The FCIs are estimated using Koop and Korobilis' (2014) code (<https://sites.google.com/site/dimitriskorobilis/matlab>).

$$x_t = \lambda_t^y Y_t + \lambda_t^f f_t + u_t$$

$$\begin{bmatrix} Y_t \\ f_t \end{bmatrix} = B_{1,t} \begin{bmatrix} Y_{t-1} \\ f_{t-1} \end{bmatrix} + B_{2,t} \begin{bmatrix} Y_{t-2} \\ f_{t-2} \end{bmatrix} + \dots + \varepsilon_t \quad (\text{A3.1.1})$$

in which  $x$  is a vector of financial variables,  $Y_t$  is a vector of macroeconomic variables of interest (including growth in industrial production and inflation),  $\lambda_t^y$  are regression coefficients,  $\lambda_t^f$  are the factor loadings, while  $f_t$  is the latent factor, interpreted as the FCI.

### Annex 3.2. Factor Model Analysis<sup>36</sup>

The chapter extracts common latent factors from the financial conditions indices (FCIs) across a panel of 43 countries. The factors represent the unobserved common dynamics across financial conditions from 1995 to 2016. The chapter uses the time series factor analysis (TSFA) methodology described in Gilbert and Meijer (2005), which does not require independent and identically distributed observations. The chapter fits both one- and three-factor TSFA models. On average, the one- and three-factor models explain about 30 percent and 41 percent of the variance of the FCIs in the sample, respectively, and can vary notably across countries. The factor model is as follows:

$$FCI_{c,t} = \lambda_{1,c} x_{1,t} + \lambda_{2,c} x_{2,t} + \lambda_{3,c} x_{3,t} \quad (\text{A3.2.1})$$

in which  $x_{1,t}$  and  $\lambda_{1,c}$ , for example, represent the first common time-varying factor and the country-specific loading associated with it ( $c$  and  $t$  denote country and time, respectively). The extraction of three factors allows for a more accurate decomposition of the common dynamics across countries and recognizes regional dynamics apart from global financial conditions. These regional dynamics play an important role in explaining countries' financial conditions during

<sup>36</sup>The author of this annex is Romain Lafarguette.

**Annex Table 3.1.2. Data Sources**

Variables	Description	Source
<b>Domestic-Level Variables</b>		
Term Spreads	Yield on 10-year government bonds minus yield on three-month Treasury bills	Bloomberg L.P.; IMF staff
Interbank Spreads	Interbank interest rate minus yield on three-month Treasury bills	Bloomberg L.P.; IMF staff
Change in Long-Term Real Interest Rate	Percentage point change in the 10-year government bond yield, adjusted for inflation	Bloomberg L.P.; IMF staff
Domestic Policy Rates	Policy-related interest rate of the country	Bloomberg L.P.; Haver Analytics
Corporate Spreads	Corporate yield of the country minus corporate yield of the benchmark country. JPMorgan CEMBI Broad is used for emerging market economies where available.	Bloomberg L.P.; Thomson Reuters Datastream
Equity Returns (local currency)	Log difference of the equity indices	Bloomberg L.P.
House Price Returns	Percent change in house price index	Bank for International Settlements; IMF staff
Equity Return Volatility	Exponential weighted moving average of equity price returns	Bloomberg L.P.; IMF staff
Change in Financial Sector Share	Percentage point change in market capitalization of the financial sector to total market capitalization	Bloomberg L.P.
Credit Growth	Percent change in the depository corporations' claims on private sector	Haver Analytics; IMF, International Financial Statistics database
Sovereign Spreads	Yield on 10-year government bonds minus the benchmark country's yield on 10-year government bonds	Bloomberg L.P.; IMF staff
Real GDP Growth	Percent change in the GDP at constant prices	IMF, World Economic Outlook database
Industrial Production Growth	Percent change in the industrial production index	Haver Analytics; IMF, Global Data Source database
Inflation	Percent change in the consumer price index	Haver Analytics; IMF, International Financial Statistics database
Current Account Balance	Current account balance to GDP	IMF, World Economic Outlook database
Commodity Price Growth	Bloomberg commodity price index	Bloomberg L.P.
FDI Linkages with the U.S.	Stock of bilateral direct investment position with the United States to GDP	IMF, Coordinated Direct Investment Survey
Portfolio Linkages with the U.S.	Stock of bilateral portfolio investment position with the United States to GDP; Source II: previous year's average of total flows (purchases plus sales) of foreign securities between U.S. investors and domestic investors (TIC data) to GDP	IMF, Coordinated Portfolio Investment Survey; Source II: U.S. Department of the Treasury
Banking Linkages with the U.S.	Bilateral BIS locational claims (residency basis) of the United States to GDP	Bank for International Settlements
Trade Linkages with the U.S.	Bilateral imports into the United States to GDP	IMF, Direction of Trade Statistics database
Trade Openness	Exports plus imports to GDP	IMF, Direction of Trade Statistics database; IMF, World Economic Outlook database
Financial Openness	Foreign assets plus foreign liabilities to GDP	Lane and Milesi-Ferreti data set (2007; updated)
Capital Account Openness	Chinn-Ito index measures a country's degree of capital account openness	Chinn and Ito data set (2006; updated)
Exchange Rate Stability	Annual standard deviations of the monthly exchange rate between the home country and the base country	Aizenman, Chinn, and Ito data set (2010; updated)
Exchange Rate Flexibility	Degree of exchange rate flexibility	Ilizetki, Reinhart, and Rogoff data set (2017)
Financial Development	Based on financial institutions' and markets' access, efficiency, and depth	Sahay and others (2015)
Rule of Law	Reflects perceptions on the quality of contract enforcement, property rights, the police, the courts, and the likelihood of crime and violence	World Bank, World Governance Indicators database
<b>Global-Level Variables</b>		
VIX	Chicago Board Options Exchange Market Volatility Index	Bloomberg L.P.
Global Real GDP Growth	PPP-weighted average of real GDP growth	IMF, World Economic Outlook database
Global Industrial Production Growth	PPP-weighted average of industrial production growth	IMF, Global Data Source database

(continued)

**Annex Table 3.1.2. Data Sources (continued)**

Variables	Description	Source
<b>Variables Used as Benchmarks</b>		
IMF Financial Stress Index	Defined as a period during which the financial system of a country is under strain and its ability to intermediate is impaired. The index relies primarily on price movements relative to past levels or trends to proxy for the presence of strains in financial markets and on intermediation.	Cardarelli, Elekdag, and Lall data set (2009; updated) accessed via IMF, Global Data Source database
Chicago Fed Financial Conditions Index	Adjusted National Financial Conditions Index isolates a component of financial conditions uncorrelated with economic conditions to provide an update on the U.S. financial conditions relative to current economic conditions.	Federal Reserve Bank of Chicago
Kansas City Fed Financial Stress Index	A measure of stress in the U.S. financial system based on 11 financial market variables	Federal Reserve Bank of Kansas City

Source: IMF staff.

Note: BIS = Bank for International Settlements; CEMBI = Corporate Emerging Markets Bond Index; FDI = foreign direct investment; PPP = purchasing power parity; TIC = Treasury International Capital; VIX = Chicago Board Options Exchange Volatility Index.

particular events as discussed in the chapter. However, over the full sample, the variance gain offered by the two regional factors is limited (about 10 percentage points on average), which suggests that the largest share of common dynamics across countries is actually driven by a single global factor, which moves in lock-step with the U.S. FCI.

### Annex 3.3. Panel Regression Analysis<sup>37</sup>

The effect of country characteristics on the sensitivity of countries' domestic financial conditions to U.S. financial conditions is estimated using a panel regression model. The specification is based on other studies in the literature that analyze the relationship between domestic financial variables (for instance, stock returns and sovereign bond yields) and a global driver (typically proxied by the Chicago Board Options Exchange Volatility Index).<sup>38</sup> The sample covers 39 advanced and emerging market economies from 1991 to 2016. Countries that could be main drivers of global financial conditions (Germany, Japan, United Kingdom, United States) are excluded. The model estimated is the following:

$$FCI_{it} = \alpha_i + \beta_1 FCI_t^{US} + \beta_2 CCHAR_{it-1} + \beta_3 FCI_t^{US} \times CCHAR_{it-1} + \beta_4 Z_{it-1} + \varepsilon_{it} \quad (A3.3.1)$$

in which *FCI* denotes domestic financial conditions, and country characteristics (*CCHAR*) include mea-

sures of integration (trade and financial openness), linkages to the United States (FDI, banking, portfolio and trade), exchange rate flexibility, financial development, and rule of law. Additional controls (*Z*) include global variables (commodity price inflation and global growth) and domestic variables (growth, inflation, and current account balance).<sup>39</sup> The model includes country fixed effects, and standard errors are clustered at the country level. Results are generally robust to alternative specifications, such as the inclusion of lags of the global driver and alternative measures of domestic macroeconomic conditions including growth expectations based on Consensus Economics forecasts (see Annex Table 3.3.1 for baseline results).<sup>40</sup>

### Annex 3.4. Panel Vector Autoregression Analysis<sup>41</sup>

The study of the transmission of domestic monetary policy and global financial conditions to domestic financial conditions is based on a panel vector autoregression (panel VAR) model. The system includes the U.S. financial conditions index (FCI), growth,

<sup>39</sup>All variables except the global driver are lagged to mitigate endogeneity concerns.

<sup>40</sup>FCIs are by construction standardized at the country level (to aggregate information from the multiple financial variables). This implies that a one standard deviation change in the FCI can correspond to different changes in, for example, corporate spreads in different countries, which could bias estimation. At the same time, robustness analysis based on individual financial markets (including corporate spreads and equity returns) confirms the dampening role of financial development (see Chapter 2 of the April 2014 GFSR).

<sup>41</sup>The authors of this annex are Nicolas Arregui, Luis Brandão-Marques, and Romain Lafarguette.

<sup>37</sup>The authors of this annex are Nicolas Arregui and Dulani Seneviratne.

<sup>38</sup>See, for instance, Bowman, Londono, and Saprizza 2015; Chapter 2 of the April 2014 GFSR; Passari and Rey 2013; and Rey 2013.

**Annex Table 3.3.1. Domestic Financial Conditions Drivers**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
U.S. FCI (lag = 0)	0.3310*** (0.000)	0.2787*** (0.000)	0.3328*** (0.000)	0.3278*** (0.000)	0.4728*** (0.000)	0.4403*** (0.000)	0.4641*** (0.000)	0.4645*** (0.000)
Real Growth (lag = 1)	-0.0922*** (0.000)	-0.0964*** (0.000)	-0.0939*** (0.000)	-0.0931*** (0.000)	-0.0918*** (0.000)	-0.0959*** (0.000)	-0.0936*** (0.000)	-0.0928*** (0.000)
Inflation (lag = 1)	0.0001 (0.779)	-0.0001 (0.797)	-0.0001 (0.855)	-0.0004 (0.304)	0.0001 (0.794)	-0.0001 (0.777)	-0.0001 (0.845)	-0.0004 (0.295)
Current Account Balance to GDP (lag = 1)	-0.0039 (0.753)	-0.0023 (0.842)	-0.0084 (0.491)	-0.0075 (0.552)	-0.0038 (0.760)	-0.0021 (0.853)	-0.0082 (0.498)	-0.0074 (0.557)
U.S. FCI (lag = 1)	0.0563 (0.188)	0.0757* (0.075)	0.0557 (0.195)	0.0540 (0.210)				
U.S. FCI (lag = 2)	0.2343*** (0.000)	0.2074*** (0.000)	0.2445*** (0.000)	0.2393*** (0.000)				
U.S. FCI (lag = 3)	-0.1480*** (0.004)	-0.1169** (0.029)	-0.1716*** (0.002)	-0.1572*** (0.003)				
Commodity Price Inflation (lag = 1)	-0.5182*** (0.003)	-0.4494*** (0.009)	-0.5072*** (0.003)	-0.5251*** (0.003)	-0.3809 (0.111)	-0.2618 (0.256)	-0.4300* (0.069)	-0.4094* (0.089)
Global Growth (lag = 1)	-0.0321 (0.196)	-0.0317 (0.180)	-0.0282 (0.226)	-0.0328 (0.162)	-0.0391 (0.149)	-0.0439* (0.083)	-0.0306 (0.244)	-0.0380 (0.145)
Capital Account Openness	-0.0635 (0.327)	-0.0926 (0.165)	-0.0626 (0.347)	-0.0745 (0.252)	-0.0642 (0.323)	-0.0922 (0.170)	-0.0638 (0.338)	-0.0753 (0.247)
Capital Account Openness × U.S. FCI	-0.0313 (0.405)	-0.0265 (0.458)	-0.0241 (0.508)	-0.0153 (0.701)	-0.0308 (0.413)	-0.0261 (0.467)	-0.0236 (0.517)	-0.0148 (0.711)
FDI Linkages with the U.S.	0.0331*** (0.000)	0.0294*** (0.000)	0.0336*** (0.000)	0.0319*** (0.000)	0.0331*** (0.000)	0.0294*** (0.000)	0.0336*** (0.000)	0.0319*** (0.000)
FDI Linkages with the U.S. × U.S. FCI	0.0047** (0.022)	0.0041* (0.058)	0.0052** (0.017)	0.0052** (0.018)	0.0047** (0.021)	0.0041* (0.054)	0.0052** (0.017)	0.0052** (0.017)
Trade Link with the U.S.	0.0145 (0.628)		0.0199 (0.500)	0.0227 (0.467)	0.0153 (0.611)		0.0205 (0.490)	0.0234 (0.454)
Trade Link with the U.S. × U.S. FCI	0.0086 (0.216)		0.0070 (0.327)	0.0071 (0.301)	0.0085 (0.215)		0.0070 (0.322)	0.0071 (0.300)
Trade Openness		0.0077* (0.079)				0.0077* (0.079)		
Trade Openness × U.S. FCI		0.0022** (0.010)				0.0022** (0.010)		
Rule of Law Index	-0.6298 (0.130)	-0.5216 (0.213)	-0.6044 (0.145)	-0.4886 (0.229)	-0.6286 (0.131)	-0.5222 (0.213)	-0.6021 (0.147)	-0.4870 (0.230)
Rule of Law Index × U.S. FCI	0.0873 (0.112)	0.0528 (0.301)	0.0813 (0.145)	0.0772 (0.183)	0.0866 (0.114)	0.0529 (0.297)	0.0805 (0.149)	0.0764 (0.187)
Financial Development Index	0.0049 (0.994)	-0.4410 (0.558)	-0.0299 (0.966)	-0.0095 (0.989)	-0.0004 (1.000)	-0.4571 (0.547)	-0.0298 (0.966)	-0.0128 (0.985)
Financial Development Index × U.S. FCI	-0.6577*** (0.005)	-0.5474** (0.010)	-0.5985** (0.019)	-0.6444*** (0.008)	-0.6574*** (0.004)	-0.5523*** (0.009)	-0.5946** (0.020)	-0.6425*** (0.008)
Exchange Rate Stability Index			-0.3965* (0.081)				-0.3913* (0.083)	
Exchange Rate Stability Index × U.S. FCI			-0.1203 (0.376)				-0.1207 (0.368)	
Exchange Rate Flexibility				0.1986*** (0.007)				0.1983*** (0.007)
Exchange Rate Flexibility × U.S. FCI				0.0503 (0.224)				0.0506 (0.221)
Observations	6,920	6,906	6,920	6,920	6,920	6,906	6,920	6,920
R-squared	0.428	0.438	0.432	0.438	0.425	0.434	0.429	0.435
Number of Countries	39	39	39	39	39	39	39	39

Source: IMF staff estimates.

Note: Robust *p*-values in parentheses. FCI = financial conditions index; FDI = foreign direct investment.\*\*\* *p* < 0.01, \*\* *p* < 0.05, \* *p* < 0.1.

inflation, domestic FCI, and the change in domestic monetary policy. Growth is measured by industrial production, and inflation is computed using the consumer price index. Monetary policy is measured with a monetary-policy-related interest rate (usually a central bank discount rate or a short-term money market rate). The sample consists of 25 small open economies with flexible exchange rate regimes and uses monthly data from 2001 to 2016. The panel VAR is estimated with four lags using Pesaran, Shin, and Smith's (1999) mean group estimator, which is consistent in the presence of dynamic heterogeneity. Impulse responses are drawn from Cholesky decompositions under the assumption that domestic interest rates move last and U.S. FCI moves first. All standard errors are estimated using a nonparametric bootstrap

and 1,000 replications. To compare results according to countries' financial openness, an analogous exercise is conducted splitting the sample into two groups based on their relative capital account openness (as measured by the Chinn-Ito index). Results are generally robust to alternative lag specifications and to the inclusion of global industrial production growth, commodity prices, and a measure of global interest rates (proxied using several U.S. shadow rate measures) as exogenous controls. The results do not change when exchange rate terms are added into the panel VAR as an additional endogenous variable. The VAR models estimated individually for each country use the same set of variables and are robust to the inclusion of global controls including commodity prices and world industrial production growth.



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