# Global Economics Analyst
# Tracking EM Financial Conditions—Our New FCIs

- We have unified our financial conditions indices (FCIs) for EM economies, bringing them into line with the recent revamp of the G10 FCIs. Our models are methodologically consistent, which ensures comparability across countries, but we still account for structural differences between them. We cover seventeen EM economies, update the FCIs daily, and publish them on Bloomberg.

- Each FCI is calculated as a weighted average of: a short-term interest rate; a long-term swap rate; a CDS spread; an equity price variable; a trade-weighted exchange rate; and—in economies with large foreign currency-denominated debt stocks—a debt-weighted exchange rate index.

- The new FCIs differ from their G10 counterparts in three areas. First, we introduce a channel to capture currency mismatch. This tightens the FCIs when foreign-denominated liabilities inflate due to an exchange rate depreciation, dampening—and at times offsetting—the easing from the usual terms-of-trade channel. Second, we adjust inputs for inflation, to accommodate the high and volatile inflation rates that have affected some EM economies over the past few years. Third, we use sovereign CDS spreads to proxy for corporate funding costs.

- Differences in weights across economies reflect differences in economic structure, such as openness to trade. In general, the weight on short-term rates is larger in EM economies than in the G10, which reflects a shorter duration of borrowing. And participation in equity markets—whether by households or firms seeking funding—is lower in EMs, which accounts for a smaller weight on equities in the FCIs. The exchange rate tends to be less important in EM economies, although this varies in line with the degree of openness to trade and the degree of mismatch.

- Our FCIs have meaningful predictive power for growth, although typically to a smaller extent than in the G10. They imply that the drag from financial conditions evident for much of the post-crisis period has been unwinding over the past year, and we expect it to provide a positive impulse to growth over the next year. This is consistent with our regional teams' assessments that we will continue to see robust rates of growth in EM economies.

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# Tracking EM Financial Conditions—Our New FCIs

We have long argued that financial conditions are an important driver of the economic and monetary policy outlook, and have developed financial conditions indices (FCIs) that track them in a wide range of countries.[1] Earlier this year we revamped our FCIs for the G10 economies to make them easily comparable, through a consistent modeling approach with similar asset types.[2] Today we apply this philosophy to a range of Emerging Market (EM) economies, namely Brazil, Chile, China, Czech Republic, Hungary, India, Indonesia, Israel, Malaysia, Mexico, Poland, Russia, South Africa, South Korea, Philippines, Thailand, and Turkey.[3]

The EM FCIs are a weighted combination of different asset prices, and we have constructed nominal and inflation-adjusted versions; both are updated on a daily basis and published on Bloomberg. The tickers are reported in Appendix A below.

Exhibit 1 plots the new EM FCIs against the prior versions constructed by country teams and the "EM consistent" FCIs.[4] Although they are similar in some economies, they differ substantially elsewhere, as we have harmonized the choice of FCI components and the method used to calculate their weights. We discuss the major conceptual developments below, and provide an overview of the input variables in a separate box. Exhibit 2 sets out the new input weights; and Appendix B discusses our approach to modeling the economies.

We make the following major changes to the EM FCIs:

- Following the G10 revamp, we apply the **same modeling approach** across all economies, to evaluate the *partial* impact of changes in each financial variable while holding the other variables constant. This avoids giving too much weight to some variables—such as the short-term policy rate—whose effect on GDP actually comes through their impact on other inputs. Given the paucity of EM macroeconomic data series compared with the G10, we adapt the framework we used for DM economies, as described in Appendix B.

- We introduce a channel to **capture currency mismatch**. This tightens the FCIs when foreign-denominated liabilities inflate due to an exchange rate depreciation, dampening—and at times offsetting—the easing from the usual terms-of-trade channel.

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[1] This project has depended on the help of many colleagues in country teams. We are particularly grateful to Claire Cui, Kevin Daly, Clemens Grafe, Sara Grut, Nupur Gupta, Ken Ho, Lorenzo Incoronato, Zhennan Li, Caesar Massry, Paulo Mateus, Andrew Matheney, Alberto Ramos, Alessio Rizzi, Jonathan Sequeira, Yu Song, MK Tang, Andrew Tilton, Kamakshya Trivedi, Murat Unur, Vishal Vaibhaw, and Maggie Wei for their advice and assistance.

[2] See Nicholas Fawcett, Jari Stehn and Jan Hatzius, "Our New G10 Financial Conditions Indices", *Global Economics Analyst*, April 20, 2017.

[3] We preserve the existing monthly FCI in China, which incorporates credit quantity measures, and is therefore complementary to the new daily series, which only includes asset prices.

[4] The "EM-Consistent" FCIs use the same asset types and assume the input weights are the same for all economies; see Kamakshya Trivedi and George Cole, "Assessing the EM selloff through a financial conditions lens", *Emerging Markets Macro Daily*, June 11, 2013 . Our new FCIs allow the weights to vary across countries, in line with differences in economic and financial structure.

■ To accommodate high and volatile inflation rates in some EM economies, we **construct real FCIs** for all seventeen countries, by adjusting nominal interest rates for a measure of trend inflation, and using the real trade-weighted exchange rate.
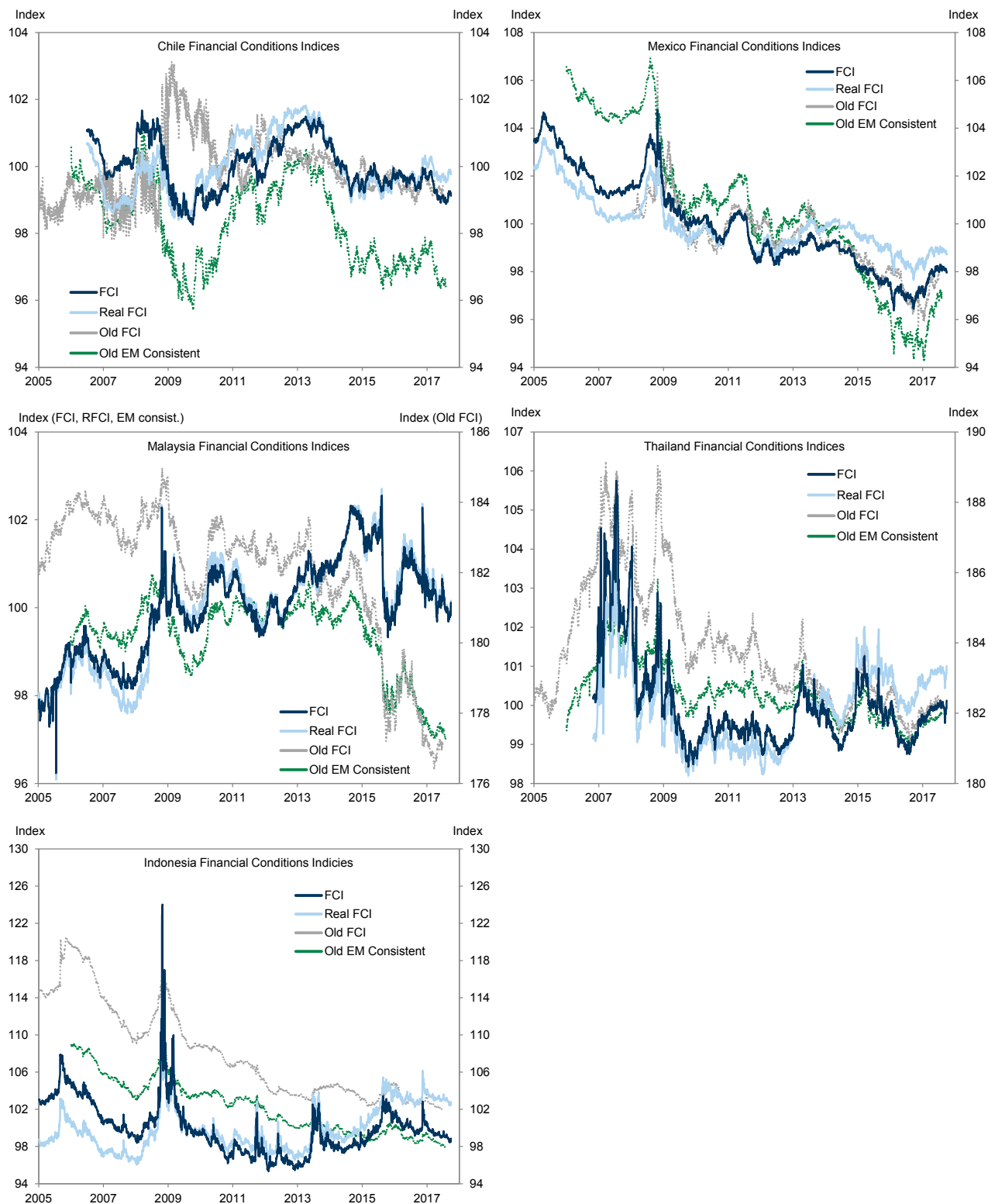
**Exhibit 1: Our New EM FCIs**
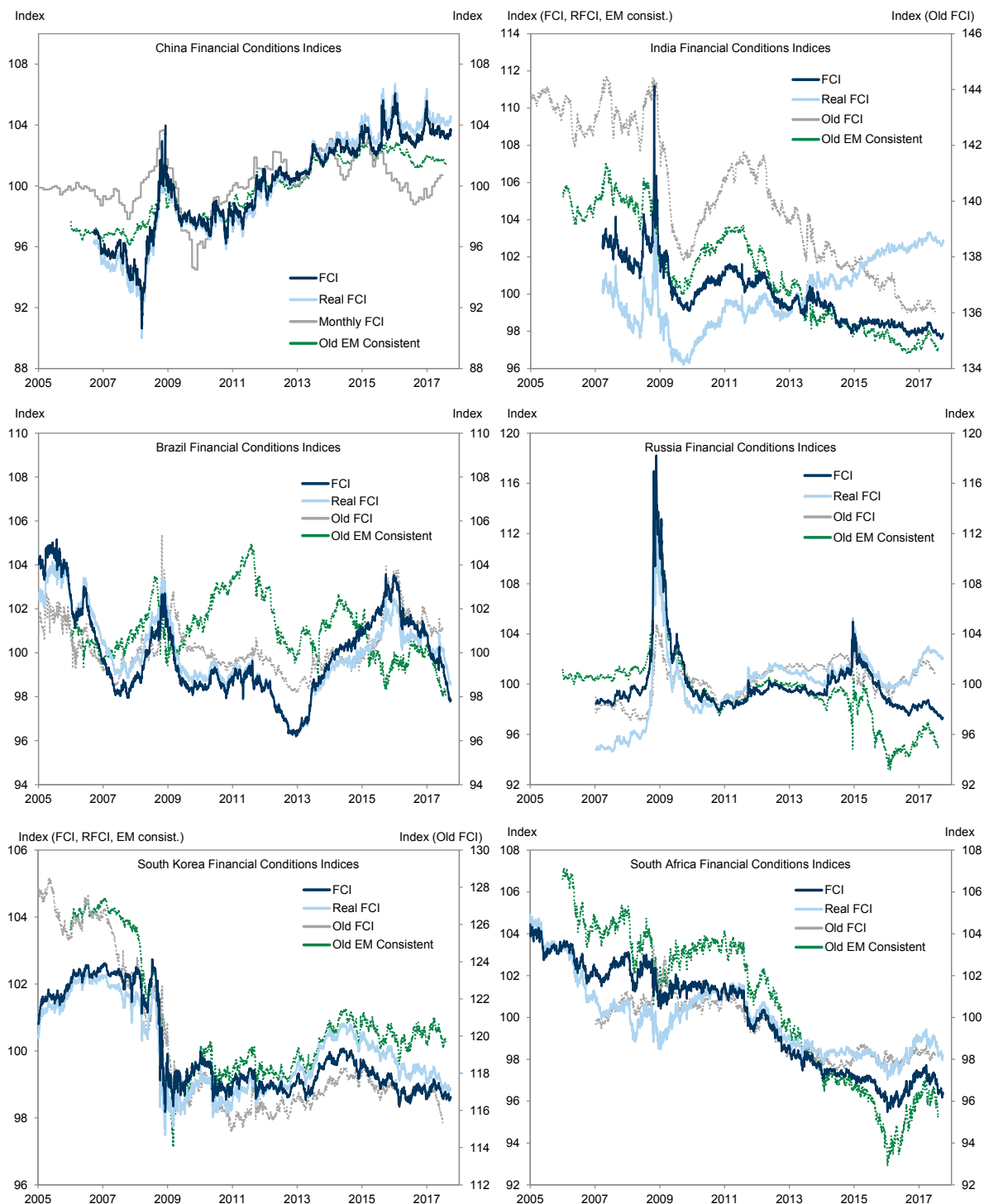


Source: Goldman Sachs Global Investment Research
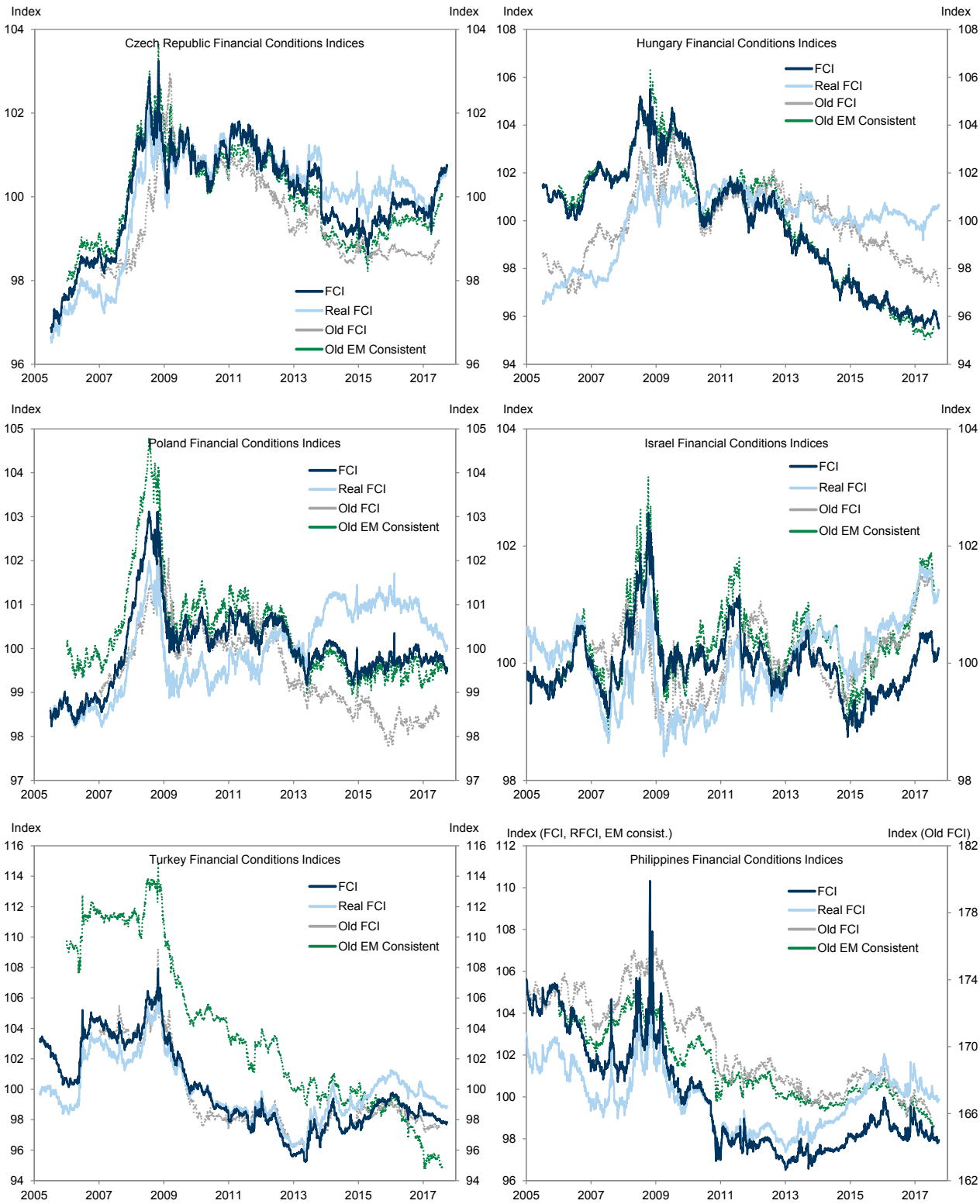
Source: Goldman Sachs Global Investment Research

Source: Goldman Sachs Global Investment Research

■ We have **harmonized the FCI inputs**, dropping variables such as commodity and house prices. This sharpens the focus towards purely *financial* variables for day-to-day moves in financial conditions. That said, in China, credit quantities play an

important role in the financial system, so the new daily FCI we introduce here will complement the existing monthly China FCI, which includes both price and quantity measures.

- Data on corporate credit spreads in EM economies are scarce, so we use **sovereign CDS spreads** as a proxy. Where we do have both credit spreads and CDS, we find that they co-move closely.

**Exhibit 2: New FCI Input Weights**

| FCI Weights | BR | CL | CN | CZ | HU | ID | IL | IN | KR | MX | MY | PH | PL | RU | TH | TR | ZA | G10 ave. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nominal Short Term Rate | 34.4 | 11.0 | 32.3 | 17.1 | 22.7 | 20.5 | 19.9 | 20.7 | 21.4 | 11.0 | 20.4 | 17.3 | 25.4 | 17.0 | 23.0 | 20.6 | 25.6 | **10.0** |
| Nominal Long Term Rate | 37.5 | 55.8 | 34.3 | 44.4 | 37.7 | 46.1 | 46.2 | 45.7 | 43.9 | 55.1 | 39.7 | 50.9 | 40.4 | 47.9 | 35.5 | 44.2 | 40.3 | **49.5** |
| Credit Default Swap | 22.7 | 22.9 | 23.6 | 21.3 | 19.8 | 21.3 | 23.2 | 21.4 | 22.5 | 22.0 | 20.6 | 21.1 | 22.6 | 26.2 | 20.0 | 26.8 | 21.9 | **23.4**** |
| Equity Price | 1.6 | 1.7 | 1.6 | 1.3 | 1.5 | 1.7 | 1.7 | 1.5 | 1.6 | 1.9 | 1.5 | 1.7 | 1.9 | 1.5 | 1.4 | 1.2 | 2.0 | **2.8** |
| Trade-Weighted Exchange Rate | 3.6 | 8.6 | 8.3 | 16.0 | 18.3 | 9.1 | 9.1 | 10.6 | 10.7 | 9.9 | 16.9 | 8.9 | 9.7 | 7.5 | 20.0 | 6.5 | 10.2 | **11.6** |
| Debt-Weighted Exchange Rate* | 0.3 | 0.1 | 0.0 | 0.0 | 0.0 | 1.2 | 0.0 | 0.0 | 0.0 | 0.1 | 0.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.7 | 0.0 | — |

*The Debt-Weighted Exchange Rate Weights are the time invariant weights. ** We use corporate credit spreads in the G10 FCIs.*

Source: Goldman Sachs Global Investment Research

**Box: Data description**

The FCI components cover six areas. Details of all the components are listed by country in Appendix C.

- **Interest rates**. We use the three-month FX-implied rate and the nominal 5-year swap rate.

- **Credit spread**. We use a sovereign CDS spread (where available) to capture the role of credit risk in economies. This differs slightly from the G10 FCIs, which used corporate credit spreads, on account of data availability.

- **Equity prices**. In keeping with the G10 FCIs, we use the ratio of a broad-based equity index to a lagged 10-year average of earnings per share, which has become known as the "Shiller P/E" ratio. This eliminates the artificial trend toward a higher equity variable and easier financial conditions that results from using a nominal equity price index.

- **Trade-weighted exchange rate**. We use the broad GS trade-weighted exchange rate index. This is the trade-weighted average of 36 bilateral exchange rates, with weights that reflect each economy's exports, imports and third-market competition of domestic firms vis-à-vis foreign firms.

- **Foreign exchange mismatch component**. We construct a debt-weighted exchange rate index that is the weighted combination of bilateral exchange rates, with weights reflecting the currency composition of foreign-denominated debt.

Our daily FCIs with the variables above start around 2005, and we set them equal to 100 for the average since then (or the first data point, if later). Deviations of the FCIs from 100 show how far financial conditions have deviated from "normal" since 2005. We also create research versions that typically start in the late 1990s.

As discussed in the main text, we construct an inflation-adjusted real FCI alongside the headline nominal series, which adjusts both short and long interest rates for an estimate of underlying inflation, and uses the real trade-weighted exchange rate.

## Different Weights for Different Economies

The stylized macro models that we developed for the G10 FCIs provide the foundations for our work with the EM economies. A generic version of the model includes a set of long-run behavioral relationships that link the components of GDP—principally consumption, investment, and net exports—to some underlying drivers, including the FCI inputs. We can use each country model to calculate the weights on FCI terms, by shocking each separately and comparing their effect on GDP. In particular, we introduce a permanent shock to one component (a 100bp increase for interest rates and spreads, a 1% fall in equities, and a 1% rise in the TWI) but hold all the other financial variables constant. This gives the cleanest estimate of the direct impact of that component on activity, without inadvertently double-counting effects that come through the other financial variables.

Although we estimated the long-run relationships for each G10 model, we lack detailed data to do so for most EMs. We therefore use the generic model structure and calibrate the most important parameters that govern the long-run response of key variables to changes in individual FCI inputs, using cross-country data on a range of macroeconomic indicators. In this way, we can relate differences in weights across countries to differences in economic and financial structure.[5]  There are three points worth noting:

1. **Interest rate inputs.** The weight on the short rate in most economies is smaller than it was in the previous country FCIs and the EM-consistent counterparts. This reflects data on the average duration of corporate bonds, which we have used in order to pin down the relative weight of the long rate compared with the short rate in our stylized model, as shown in Exhibit 3.

2. **Equity weights**: Equity markets play a less important role in emerging markets than in developed economies; both as a source of financing for firms (see Exhibit 4) and a way for households to invest savings.[6]  For these reasons, on average we assign lower weights to equities in EM FCI compared with the G10 FCIs.

3. **Exchange rate**: In keeping with the G10 FCI weights, we assign a lower weight to the TWI for more closed economies, using the ratio of exports of goods and services to GDP as a measure of openness. Exhibit 5 illustrates the relationship between the two for both EM and G10 economies.

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[5]  By way of comparison, the existing EM-consistent FCIs attach weights of 0.3 to short rates, 0.3 to long rates, 0.23 to the credit spread, 0.02 to equities and 0.15 to the TWI.

[6]  For further details, see Tim Moe, Caesar Maasry and Richard Tang, "EM Equity in Two Decades: A Changing Landscape", *Global Economics Paper*, no. 204, September 8, 2010.

**Exhibit 3: EM FCI Weights on Long Rates Are in Line With the Duration of Corporate Debt**
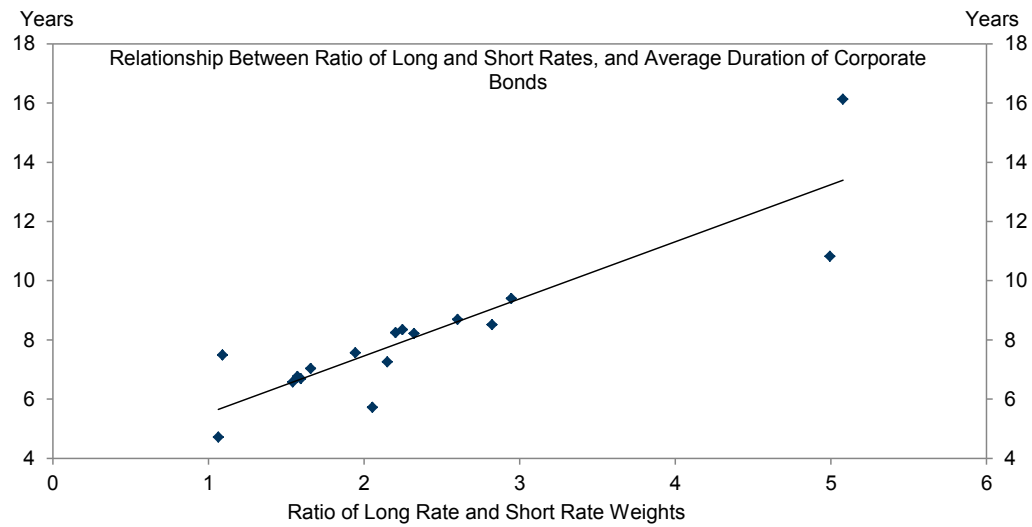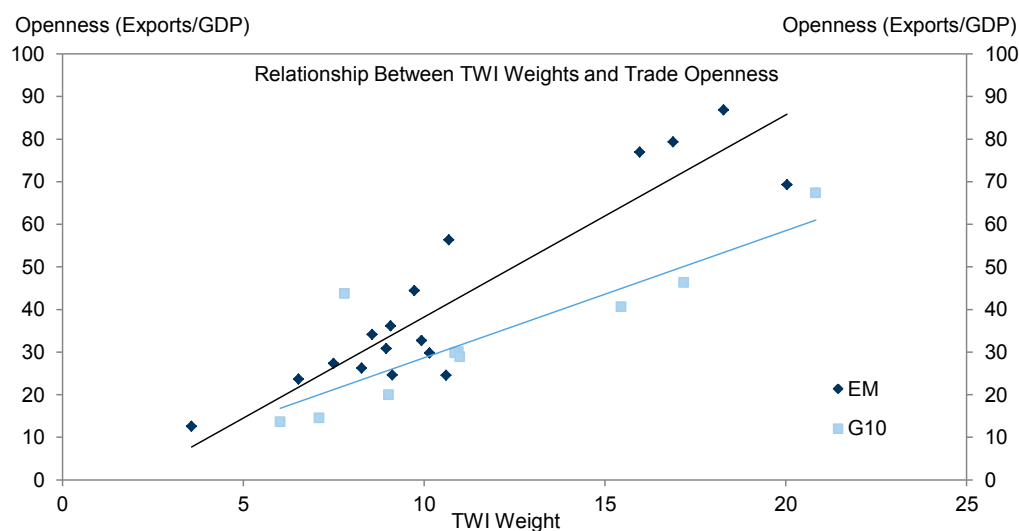


Source: Goldman Sachs Global Investment Research, World Bank

**Exhibit 4: Equity Markets Play a Less Important Role in EM Than in DM Economies**
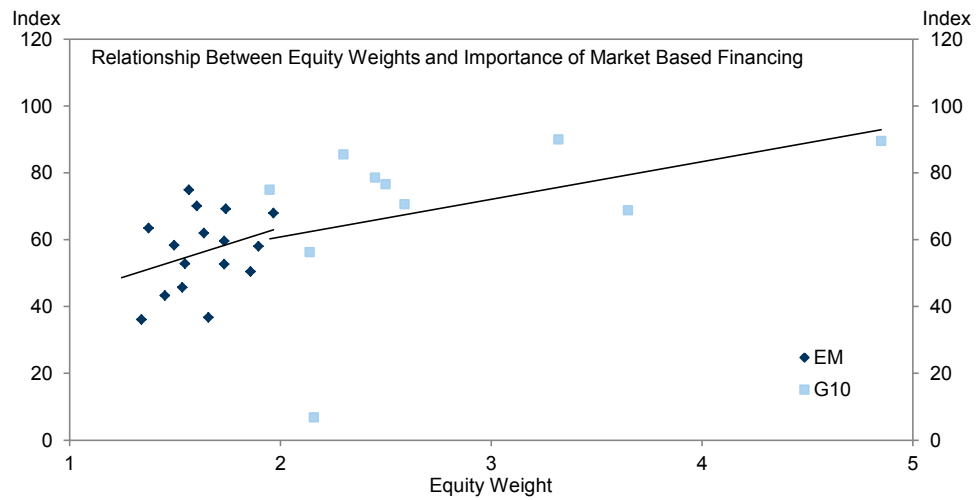


*Index is based on the value of domestically traded equities and the bank credit ratio, see Levine (2002).*

Source: Goldman Sachs Global Investment Research, World Bank

**Exhibit 5: More Open Economies Have Higher TWI Weights**

Openness (Exports/GDP)

Relationship Between TWI Weights and Trade Openness

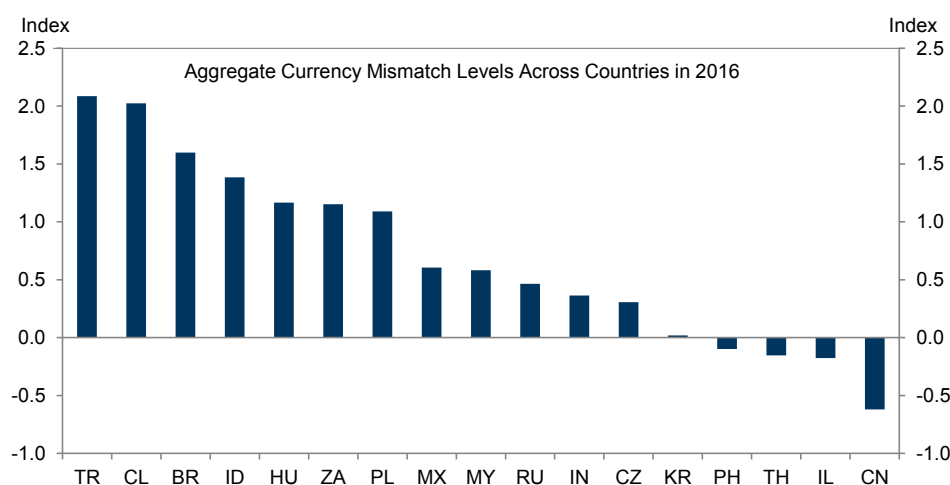*Source: Goldman Sachs Global Investment Research, IMF*

## Capturing Currency Mismatch

The main substantive difference with respect to the G10 FCIs is that we introduce a currency mismatch channel. While G10 economies enjoy an "exorbitant privilege" of being able to borrow in their own currencies, this is a luxury not often extended to EM economies. As a result, an exchange rate depreciation can inflate the value of foreign-denominated debt. This runs counter to the traditional FX channel in which a depreciation marks an easing in financial conditions, through the positive boost it provides to net exports. In severe cases, the drag may be enough to turn a depreciation into a net negative impulse on growth.

We capture FX mismatch by including a debt-weighted exchange rate measure (DWI) as an additional FCI component for the EM economies. Intuitively this is similar to the conventional trade-weighted index, but here we take into account the foreign denomination of debt. To gauge how much it could weigh on growth, we have constructed a measure of FX mismatch for each economy, using an approach we explain in Appendix B. This allows us first to adjust for the fact that the degree of mismatch varies over time and across countries (see Exhibit 6); and second that some countries are less vulnerable than others to a sharp exchange rate movement, for a given level of mismatch.

Combining the DWI component and our constructed mismatch measure, we have a simple means of capturing both the historical impact of FX mismatch, and current vulnerabilities (assuming that there is no change in countries' mismatch from present levels), within our existing FCI framework.[7]

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[7]   We can monitor the degree of mismatch over time, and make adjustments where it becomes more or less of a problem.

**Exhibit 6: Aggregate Currency Mismatch Levels Vary Considerably Across Countries**



*Index scales foreign denominated liabilities to capture their economic relevance, see Appendix B.*

Source: Goldman Sachs Global Investment Research, Haver Analytics, World Bank, IMF, BIS

## Keeping It Real

One of the core applications of FCIs is to assess the impulse that financial conditions are providing to economic growth.  In the EM context, we find that high and volatile inflation rates can drive a wedge between observable nominal variables and their unobservable real counterparts, which economic theory suggests drive households' and firms' decisions in the long run.  To get a cleaner read of the link between growth and financial conditions, we construct a real FCI, which adjusts the long and short rates for inflation, and uses the real trade-weighted exchange rate.   Long-run inflation expectations would be ideal for this adjustment, but in practice only one-year-ahead consensus expectations are available on a consistent basis across countries; and these data are affected by short-term movements in energy prices, among other factors.  We therefore use a Hodrick-Prescott filter to extract a slow-moving underlying trend in inflation.

We use the real FCIs to estimate the impulse from financial conditions to growth, and publish them alongside the headline nominal series.   As Exhibit 1 illustrates, the inflation adjustment can make a large difference to the path of the FCI.  This is most stark in India, where inflation has fallen more rapidly than policy rates over the past few years.  In this case, the progressive easing in the FCI since 2011 provides a false steer of true financial conditions: inflation-adjusted, they have—in reality—tightened over the past four years.

## Weights vs. Importance

The contributions of each financial variable to financial conditions depend not just on the different component weights discussed above, but also on their relative volatility.  Across the G10 FCIs, we found that although their combined weight was small, the equity and FX inputs had a disproportionate effect on FCI movements as they tend to be

more volatile. We examine this for the EM economies by calculating the average contribution of the average absolute monthly changes in each component since 2007, shown in Exhibit 7.

**Exhibit 7: Equities and TWIs Typically Explain Most of the Variation in FCIs**
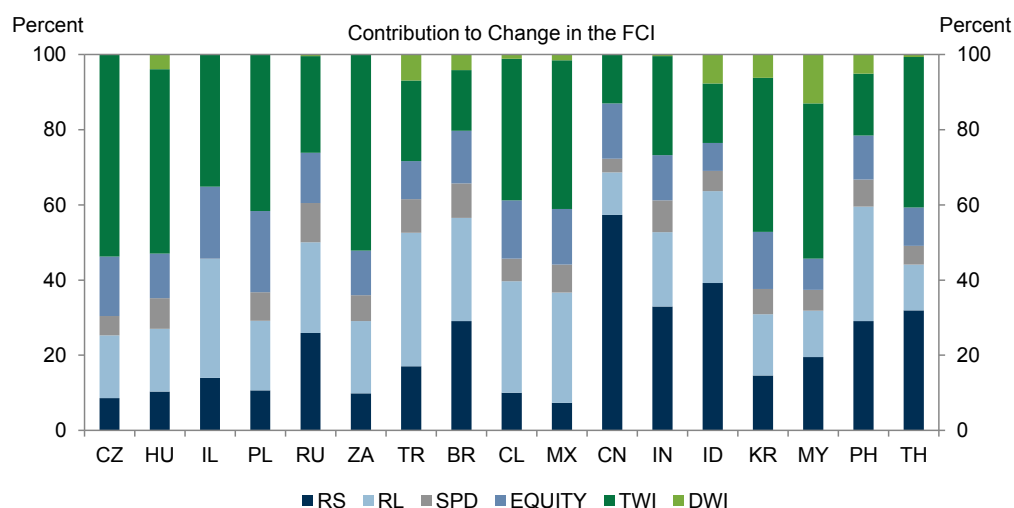


Source: Goldman Sachs Global Investment Research

This echoes the G10 results, suggesting that currency and equity markets typically account for the majority of absolute monthly movements in the EM FCIs. But there are some notable differences, such as China, where changes in the short rate are the most important of the moves in daily asset prices.

## The Link With Growth

Our FCIs have meaningful predictive power for growth, although the extent varies across countries and tends to be smaller than in the G10. We construct a simple vector autoregression model for each country, to estimate the impact of a 100bp FCI tightening on real GDP.[8]  Exhibit 8 shows the impulse responses for China, India, Brazil, and Russia, and Appendix C provides details for all the EM countries. Echoing previous results for DMs, the impact of a tightening builds over time, with the dynamics differing slightly across economies.[9] The peak drag on growth is around 0.4pp in China, 0.3pp in India, and 0.2pp in Brazil and Russia.[10]

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[8]   The VARs use quarterly data and include only the FCI and real GDP, the former specified as the quarter-on-quarter difference and the latter as quarterly percent change. Since it is not clear theoretically how to order the variables when computing the impulse responses—as causation within a given quarter is likely to run in both directions—the exhibit shows an average of the impulse responses for two different orderings, with GDP ordered before FCI in one, and vice versa in the other.

[9]   The shaded areas indicate statistical significance of impulses at the 95% level, suggesting that the Chinese and Brazilian responses are significant.

[10]   The estimates for China relate to a tightening in the daily prices-only FCI, rather than the broader monthly version that includes credit quantities.

**Exhibit 8: Tracing the Impact of a 100bp FCI Tightening**



*Impulses assumes FCI stays at current levels
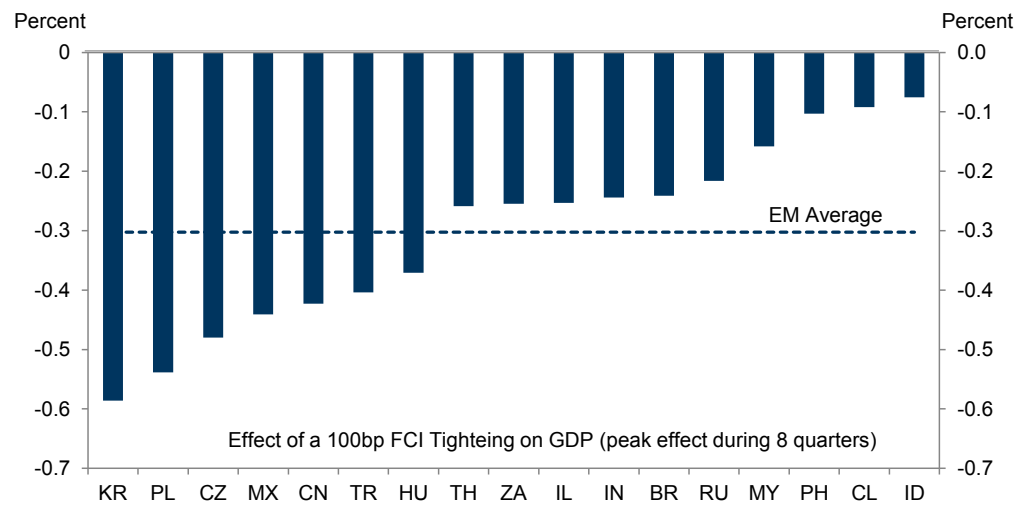**China impulses based on daily FCI series
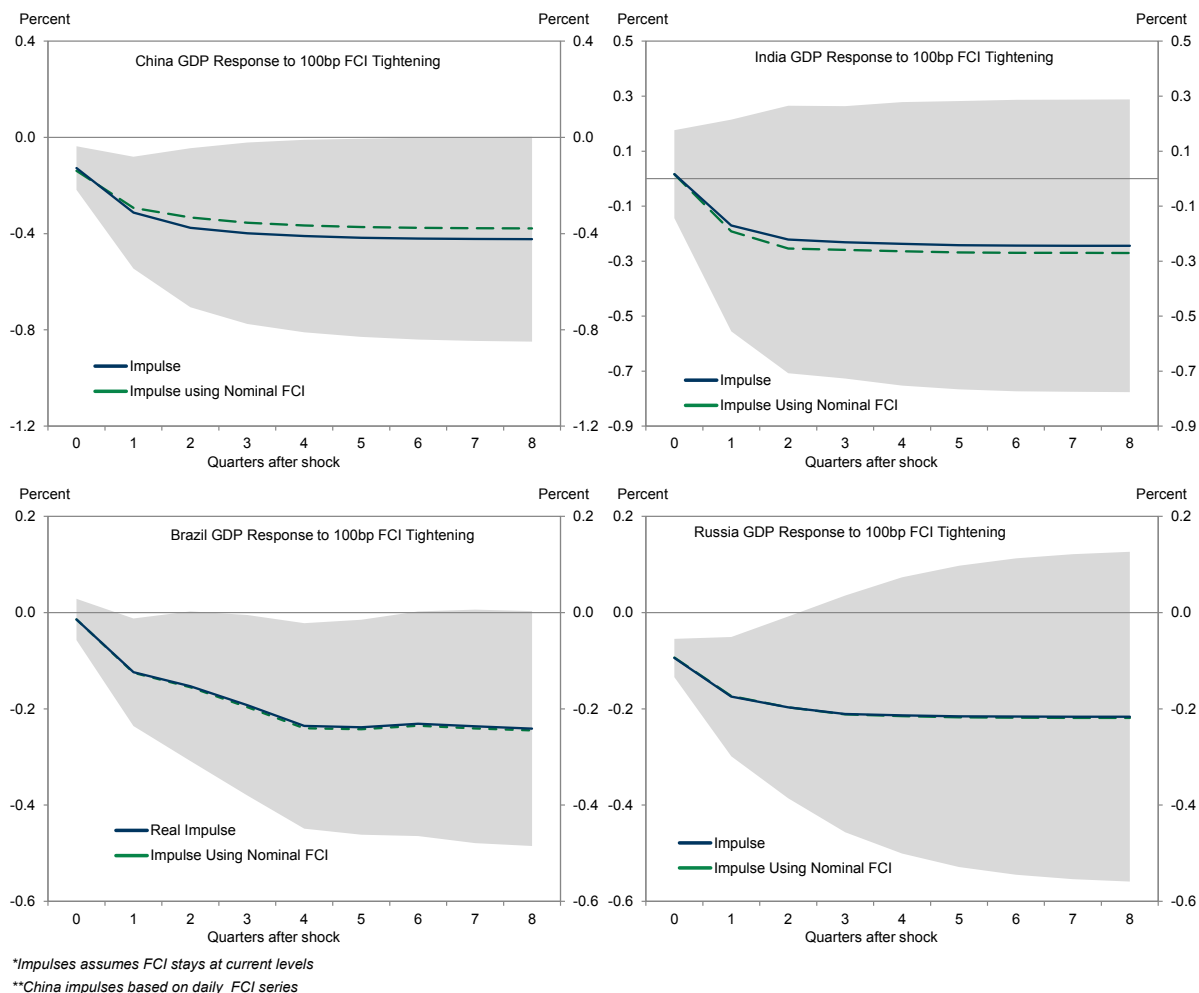
Source: Goldman Sachs Global Investment Research

Summarizing across all the EM economies, Exhibit 9 shows that the peak impact of a 100bp tightening varies markedly across countries.[11] The mean effect of -0.3pp is generally small, compared with a G10 average of -0.8pp found in earlier work. This is consistent with academic literature that suggests supply-side shocks—rather than traditional business cycle factors—have been the major driver of GDP growth.[12]

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[11]  Some of these estimates are affected by comparatively short sample sizes, which introduces a wide margin of uncertainty.

[12]  See Aguiar and Gopinath (2007), "Emerging market business cycles: The cycle is the trend", *Journal of Political Economy*.

**Exhibit 9: The Impact of a 100bp Tightening Varies Across Countries**

Percent

Effect of a 100bp FCI Tighteing on GDP (peak effect during 8 quarters)

EM Average

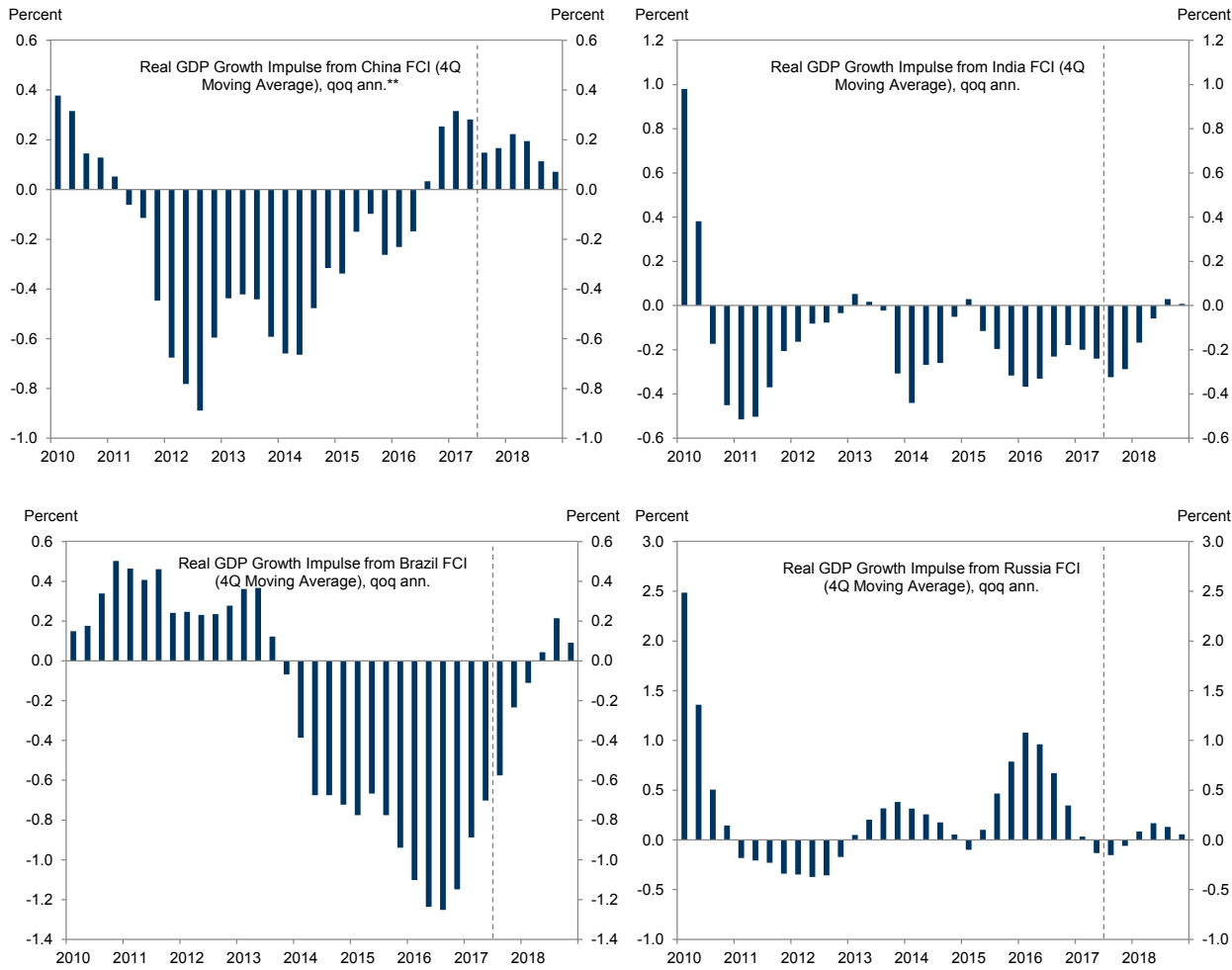KR PL CZ MX CN TR HU TH ZA IL IN BR RU MY PH CL ID

Source: Goldman Sachs Global Investment Research

Using the same framework, we find that the FCI impulses across key EM economies have turned positive on the whole. Looking at the BRICs (Exhibit 10), in China financial conditions—as measured purely by asset prices—were dragging on growth between 2011 and 2015; since then, the drag has switched to a boost to growth, which is projected to persist.[13] The drag on Brazilian growth from financial conditions is beginning to fade, and in India it is projected to do the same. In contrast, the business cycle in Russia has been dominated by swings in commodity prices, and against this backdrop supportive financial conditions have helped attenuate the overall drag on growth.

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[13]  This impulse sheds light only on the impulse from asset *prices* to GDP growth, reflecting the focus of the daily FCI on price measures. The broader impulse from financial conditions including credit quantities is different, as there was a significant easing in quantity measures in 2015-16, followed by a tightening this year.

**Exhibit 10: China Leads The Way: BRIC Impulses Turning Positive...**

Real GDP Growth Impulse from China FCI (4Q Moving Average), qoq ann.**

Real GDP Growth Impulse from India FCI (4Q Moving Average), qoq ann.

Real GDP Growth Impulse from Brazil FCI (4Q Moving Average), qoq ann.

Real GDP Growth Impulse from Russia FCI (4Q Moving Average), qoq ann.

*Impulses assumes FCI stays at current levels; **China impulses based on daily FCI including only asset prices*

Source: Goldman Sachs Global Investment Research

**Exhibit 11: ...As Are EMs on Aggregate**
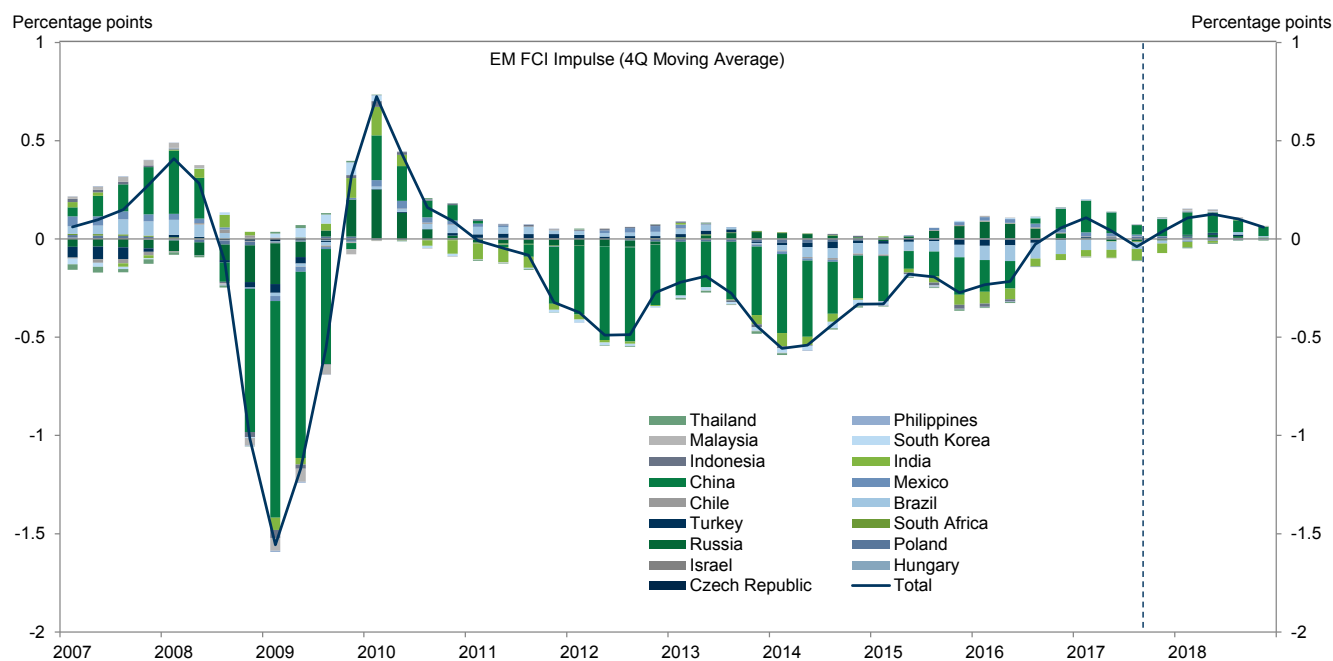


Source: Goldman Sachs Global Investment Research

Taking a step back, the history across the EM economies can be broken down into three phases (Exhibit 11). First, financial conditions weighed on growth materially from 2011 up to 2015; then the drag began to unwind in 2016; and we now expect a positive impulse over the next year. This is consistent with our regional teams' assessments that we will continue to see robust rates of growth in EM economies.

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**Manav Chaudhary**

# Appendix A: Bloomberg Codes

| Country | FCI | Real FCI |
|---|---|---|
| Brazil | GSBRFCI | GSBRRFCI |
| Chile | GSCLFCI | GSCLRFCI |
| China | GSCNFCI | GSCNRFCI |
| Czech Republic | GSCZFCI | GSCZRFCI |
| Hungary | GSHUFCI | GSHURFCI |
| India | GSINFCI | GSINRFCI |
| Indonesia | GSIDFCI | GSIDRFCI |
| Israel | GSILFCI | GSILRFCI |
| Malaysia | GSMYFCI | GSMYRFCI |
| Mexico | GSMXFCI | GSMXRFCI |
| Philippines | GSPHFCI | GSPHRFCI |
| Poland | GSPLFCI | GSPLRFCI |
| Russia | GSRUFCI | GSRURFCI |
| South Africa | GSZAFCI | GSZARFCI |
| South Korea | GSKRFCI | GSKRRFCI |
| Thailand | GSTHFCI | GSTHRFCI |
| Turkey | GSTRFCI | GSTRRFCI |

Note: The tickers are indices in Bloomberg; for example the China FCI is GSCNFCI Index <Go>.  All FCIs listed have a daily frequency

Source: Goldman Sachs Global Investment Research

# Appendix B: Building a Framework for EM Financial Conditions

As discussed in the main text, the stylized macro models that we developed for the G10 FCIs provide the foundations for our work with the EM economies. We lack detailed data for most EMs to estimate each part of the model fully, so instead we use the generic model structure and calibrate the most important parameters that govern the long-run response of key variables—such as consumption, investment and trade—to changes in individual FCI inputs. The structure of the model enables us to vary one input at a time and hold the other inputs fixed, thereby isolating the direct effect of each on GDP.

## Calculating the FCI Impulse

The FCI impulse is designed to measure the contribution of current and past financial conditions on real GDP growth. It is calculated in four steps:

First, we estimate a statistical model linking changes in financial conditions and real GDP growth using historical data. Specifically, we estimate a vector autoregression model (VAR) which comprises changes in the FCI and qoq annualized real GDP growth. The models use quarterly data, and the sample period and number of lags differ across countries.

Second, we make assumptions on the order in which financial conditions and growth respond to each other. We identify the VAR using a Cholesky decomposition. As it is difficult to take a strong view on the ordering, we consider two orderings, one in which the FCI appears before GDP, and vice versa. The impulse responses show the impact of shocks to financial conditions on real GDP for either ordering.

Third, we assume that the FCI remains at its current (daily) level until the end of the forecast horizon, which enables us to generate a baseline projection for real GDP growth.

Fourth, we use statistical techniques to calculate the historical and projected FCI impulse. We decompose historical and projected real GDP growth into contributions from FCI and growth using the structural shocks calculated in step two above. We calculate the impulse for each of the two possible orderings and define the average as our FCI impulse.

## Measuring Mismatch and pinning down DWI weights

Pinning down the DWI weights involves a three-step process of measuring currency mismatch, calibrating the importance of the mismatch to a given country, and then mapping this to a weight in the FCI.

### Measuring Mismatch

Our measure of mismatch is based on an Aggregate Effective Currency Mismatch (AECM) index:[14]

$$AECM = Net\ foreign\ assets * \frac{Foreign\ currency\ share\ of\ total\ debt}{Exports}$$

Foreign currency share of total debt measures both internal and external debt; this is then scaled by exports to help incorporate the fact that larger exports (all things equal) make it easier to finance foreign liabilities. Multiplying the fraction by net foreign assets (NFA) captures whether (on aggregate) the mismatch is problematic, since countries with net asset positions will find it easier to finance their foreign debt compared with countries that have net liability positions. Owing to NFA being negative for net liability positions, more negative values of AECM indicate higher levels of currency mismatch.

Goldstein and Turner's measure is useful for understanding the evolution of mismatches over time in a given country, but it has two main drawbacks, one practical and the other theoretical. On the practical front, data limitations make it difficult to construct the AECM for our sample of countries. On the theoretical side, the measure ignores several important factors that determine the extent to which mismatch levels are problematic for a given country. For example, the indicator does not factor in the term structure of liabilities, domestic availability of hedging instruments or the funding microstructure; so two countries might have similar AECM levels, but very different exposure to the currency mismatch channel.

To overcome the first problem, we construct a proxy measure for all our countries which closely tracks AECM.[15] We then multiply this measure by minus one, so that an increase in the index corresponds to an increase in the aggregate mismatch level. Our measure for country $i$ in time $t$ is therefore given by:

$$Mismatch_{i,t} = -1 * OSIN1_{i,t} * \frac{Reserve_{i,t} - International\ Debt_{i,t}}{Exports_{i,t}}$$

Where OSIN is 'original sin' as described by academic economist Barry Eichengreen, namely the share of a country's debt denominated in a foreign currency.[16]

### Calibrating Mismatches and Country Fixed Effects

We map our AECM proxy to a time-varying score which takes values between zero and one. The score indicates the importance of the mismatch level for a given country in a given time period. A score of one indicates a country is significantly exposed to the

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[14]  This was developed by Goldstein and Turner (2004), *Controlling currency mismatches in emerging markets,* Columbia University Press.

[15]  We use the measure proposed by Eichengreen, Hausman and Panizza (2007), "Currency mismatches, debt intolerance, and the original sin: Why they are not the same and why it matters", in *Capital controls and capital flows in emerging economies: Policies, practices and consequences*.

[16]  See Eichengreen, Hausmann, and Panizza (2003), "The pain of original sin. Other People's Money: Debt Denomination and Financial Instability", in *Emerging Market Economies.*

mismatch channel, while a score of zero indicates that the mismatch channel has a limited (if any) impact on the economy.

We use the following function to map the transformed mismatch index to our score:

$$\Omega_i\left(mismatch_{i,t}\right) = \begin{cases} 1 & if\ mismatch_{i,t} > \overline{w}_i \\ e^{\frac{mismatch_{i,t}-\underline{w}_i}{(\underline{w}_i-\overline{w}_i)/\ln(2)}} - 1 & if\ \underline{w}_i \leq mismatch_{i,t} \leq \overline{w}_i \\ 0 & if\ mismatch_{i,t} < \underline{w}_i \end{cases}$$

Where there is a lower bound level of mismatch, below which the FX mismatch channel is considered to have no material impact on a country's economy. While the upper bound parameter sets the cut-off above which we assign significant importance to the mismatch channel.

# Appendix C: Country Details

| Brazil: Components | | |
|---|---|---|
| **Variable** | **Description** | **Current Weights** |
| Nominal Short Term Rate | 3 Month FX Implied Yield | 34.4% |
| Nominal Long Term Rate | 5 Year Swap Rate | 37.5% |
| Credit Default Swap | Brazil Government Credit Default Swap | 22.7% |
| Equity Price | IBOVESPA index, Scaled by 10-year Moving Average of Earnings | 1.6% |
| Trade-Weighted Exchange Rate | GS Broad Trade-Weighted Index | 3.6% |
| Debt-Weighted Exchange Rate | Internally Constructed Debt Weighted Index | 0.3% |

Source: Goldman Sachs Global Investment Research
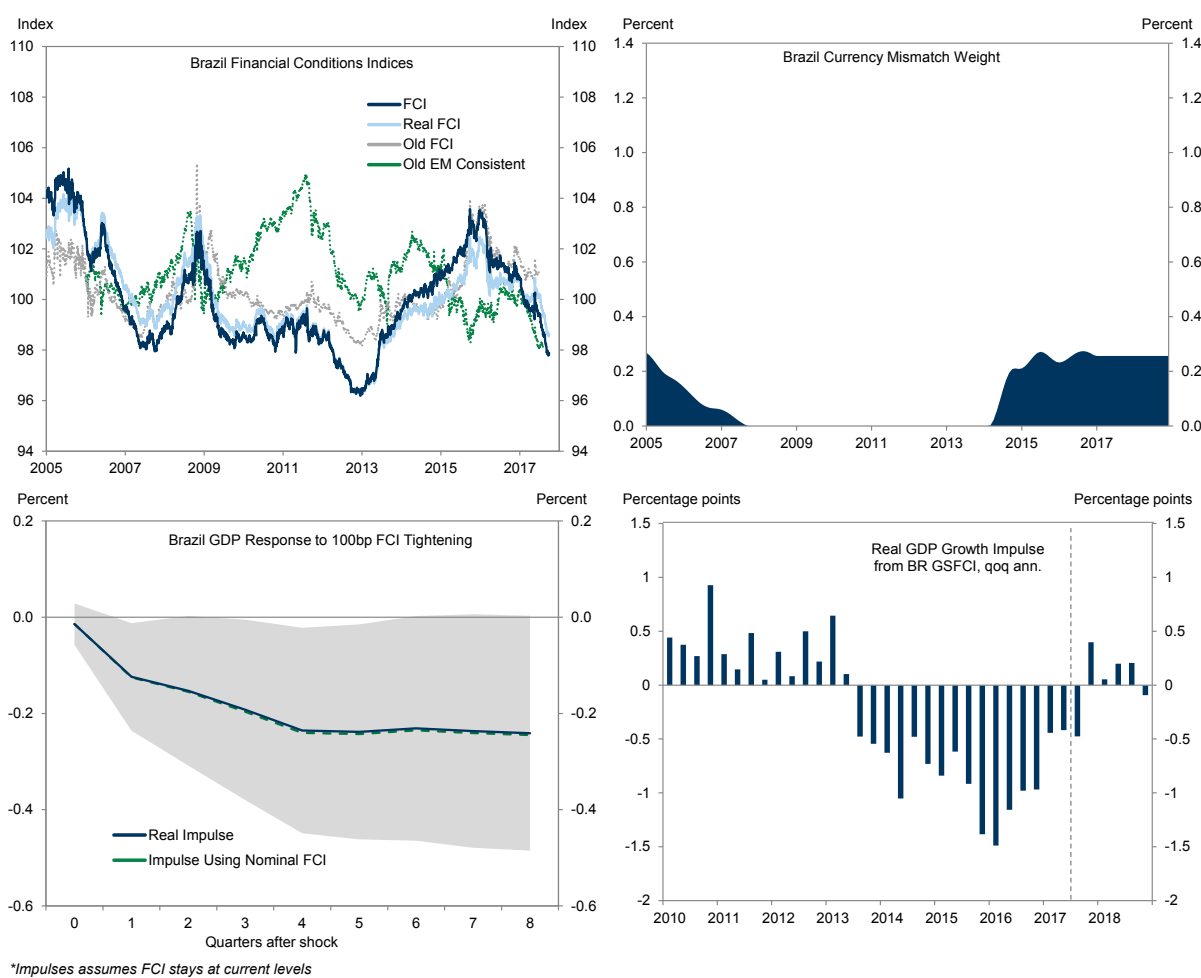


Source: Goldman Sachs Global Investment Research

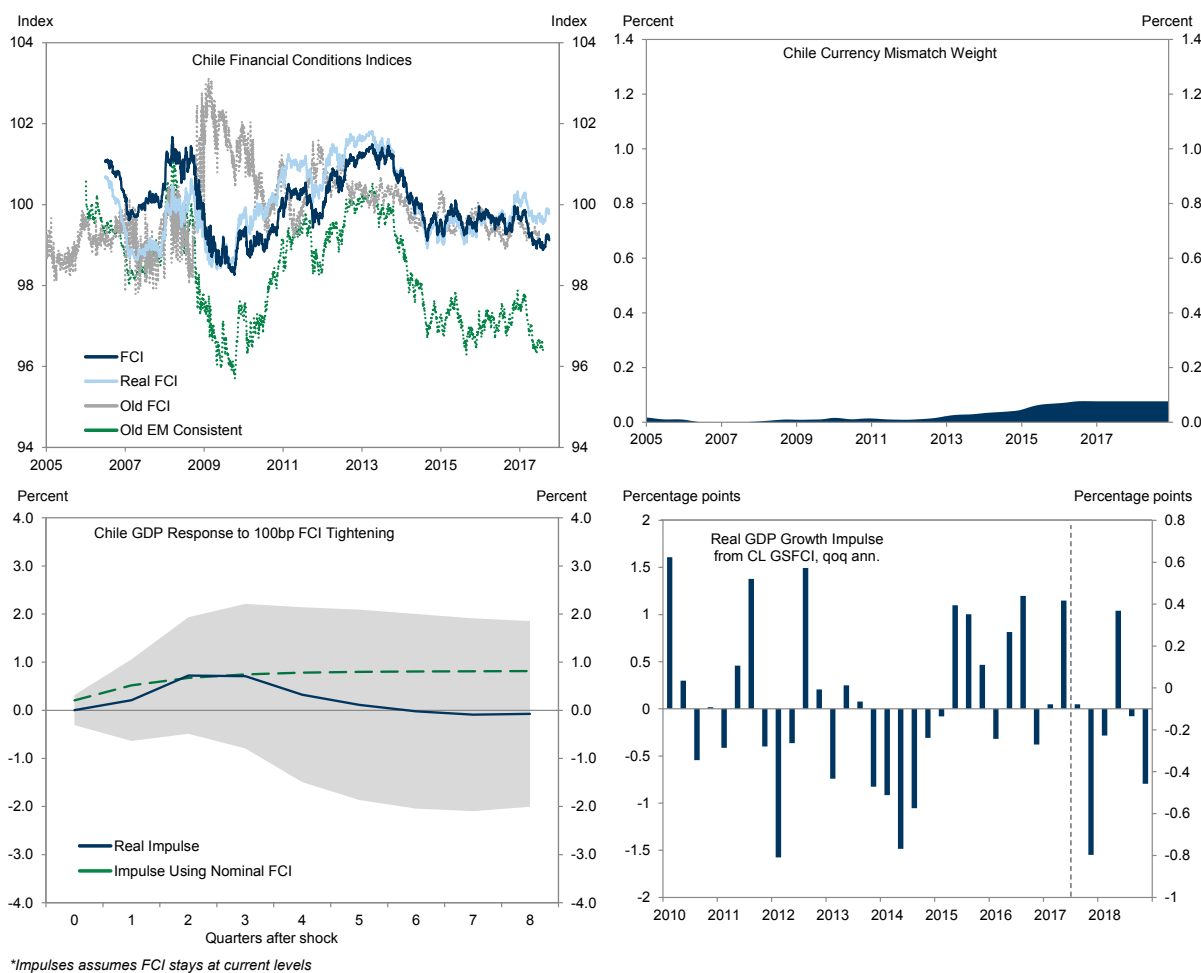| Chile: Components | | |
|---|---|---|
| **Variable** | **Description** | **Current Weights** |
| **Nominal Short Term Rate** | 3 Month FX Implied Yield | 11.0% |
| **Nominal Long Term Rate** | 5 Year Swap Rate | 55.8% |
| **Credit Default Swap** | Chile Government Credit Default Swap | 22.9% |
| **Equity Price** | IPSA Index, Scaled by 10-year Moving Average of Earnings | 1.7% |
| **Trade-Weighted Exchange Rate** | GS Broad Trade-Weighted Index | 8.6% |
| **Debt-Weighted Exchange Rate** | Internally Constructed Debt Weighted Index | 0.1% |

Source: Goldman Sachs Global Investment Research



Source: Goldman Sachs Global Investment Research

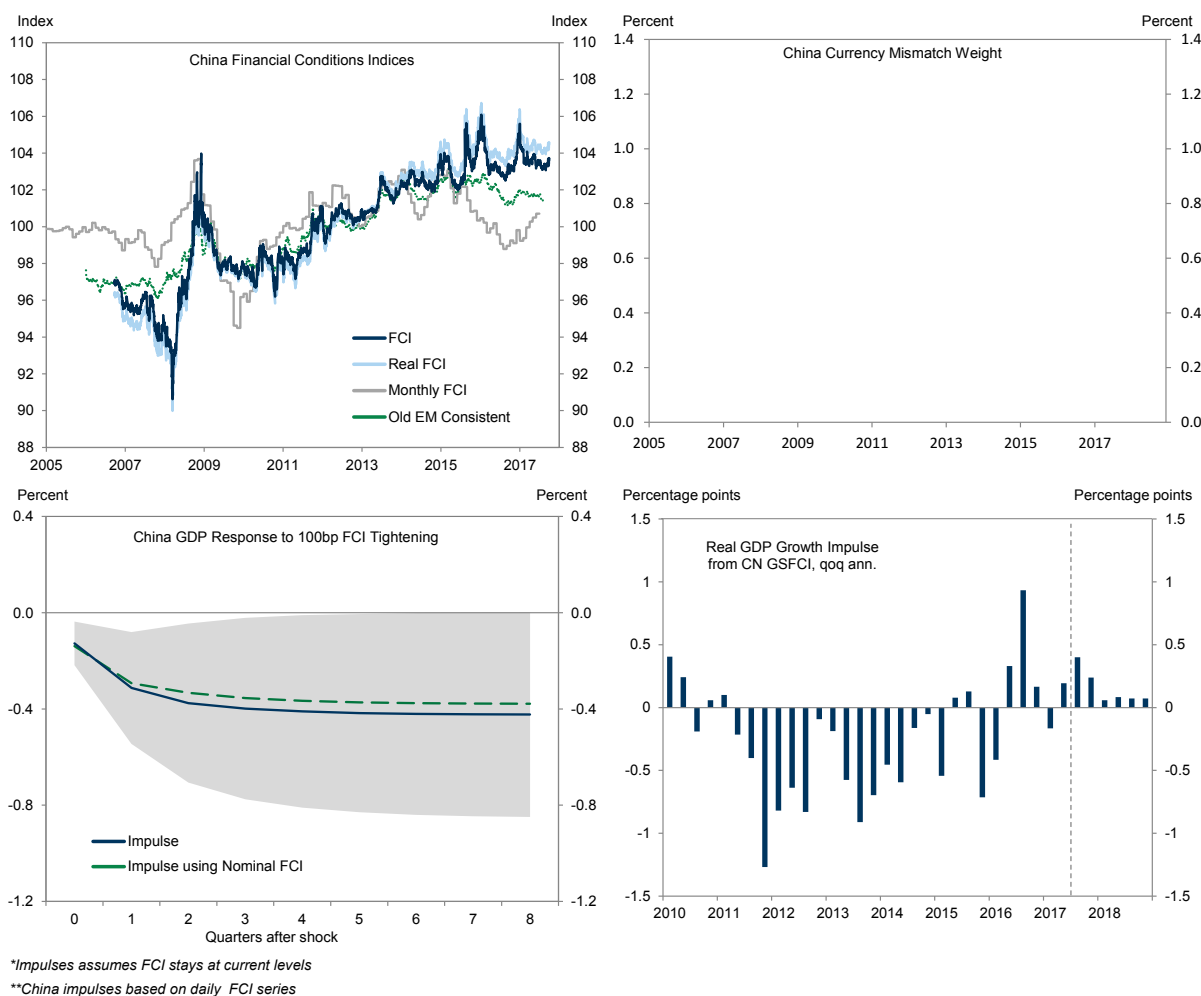| China: Components | | |
|---|---|---|
| Variable | Description | Current Weights |
| Nominal Short Term Rate | 3 Month FX Implied Yield | 32.3% |
| Nominal Long Term Rate | 5 Year Swap Rate | 34.3% |
| Credit Default Swap | China Government Credit Default Swap | 23.6% |
| Equity Price | MSCI China, Scaled by 10-year Moving Average of Earnings | 1.6% |
| Trade-Weighted Exchange Rate | GS Broad Trade-Weighted Index | 8.3% |
| Debt-Weighted Exchange Rate | Internally Constructed Debt Weighted Index | 0.0% |

Source: Goldman Sachs Global Investment Research



China Financial Conditions Indices

China Currency Mismatch Weight

China GDP Response to 100bp FCI Tightening

Real GDP Growth Impulse from CN GSFCI, qoq ann.

*Impulses assumes FCI stays at current levels

**China impulses based on daily FCI series

Source: Goldman Sachs Global Investment Research

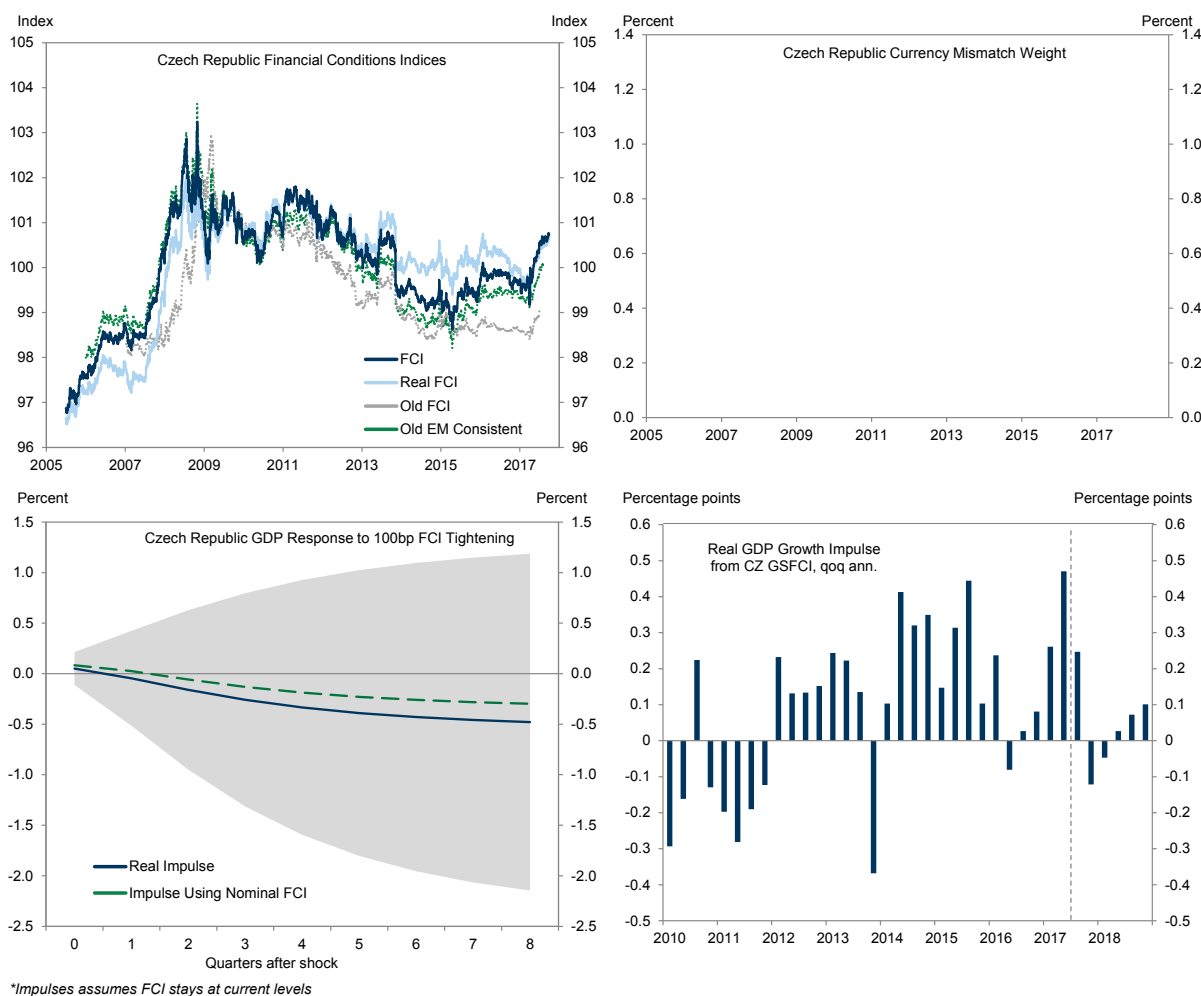| Czech Republic: Components | | |
|---|---|---|
| Variable | Description | Current Weights |
| Nominal Short Term Rate | 3 Month FX Implied Yield | 17.1% |
| Nominal Long Term Rate | 5 Year Swap Rate | 44.4% |
| Credit Default Swap | Czech Republic Government Credit Default Swap | 21.3% |
| Equity Price | PX 50, Scaled by 10-year Moving Average of Earnings | 1.3% |
| Trade-Weighted Exchange Rate | GS Broad Trade-Weighted Index | 16.0% |
| Debt-Weighted Exchange Rate | Internally Constructed Debt Weighted Index | 0.0% |

Source: Goldman Sachs Global Investment Research



Source: Goldman Sachs Global Investment Research

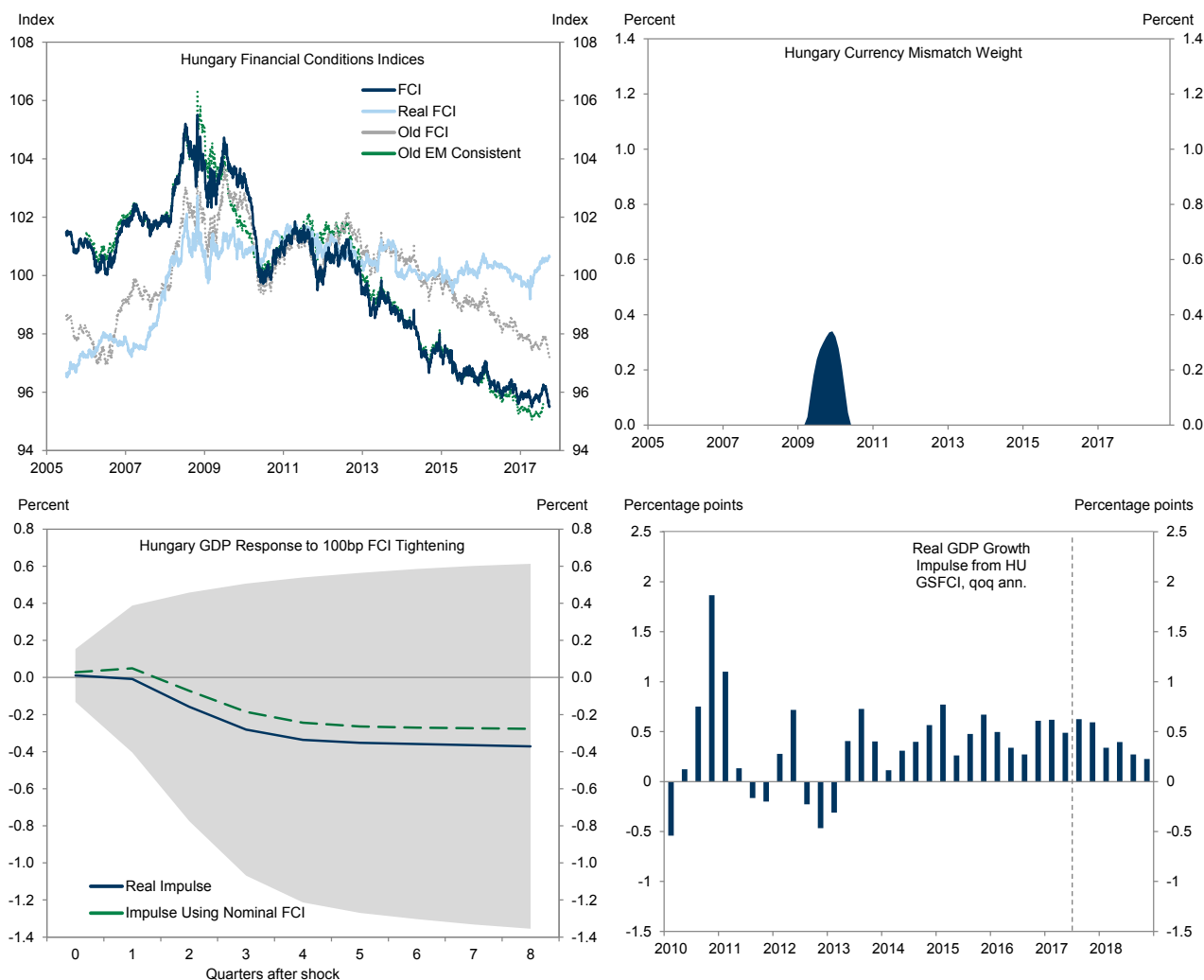| Hungary: Components | | |
|---|---|---|
| **Variable** | **Description** | **Current Weights** |
| **Nominal Short Term Rate** | 3 Month FX Implied Yield | 22.7% |
| **Nominal Long Term Rate** | 5 Year Swap Rate | 37.7% |
| **Credit Default Swap** | Hungary Government Credit Default Swap | 19.8% |
| **Equity Price** | BUX Large Cap, Scaled by 10-year Moving Average of Earnings | 1.5% |
| **Trade-Weighted Exchange Rate** | GS Broad Trade-Weighted Index | 18.3% |
| **Debt-Weighted Exchange Rate** | Internally Constructed Debt Weighted Index | 0.0% |

Source: Goldman Sachs Global Investment Research



Hungary Financial Conditions Indices



Hungary Currency Mismatch Weight



Hungary GDP Response to 100bp FCI Tightening

*Impulses assume the FCI stays at current levels*



Real GDP Growth Impulse from HU GSFCI, qoq ann.

Source: Goldman Sachs Global Investment Research

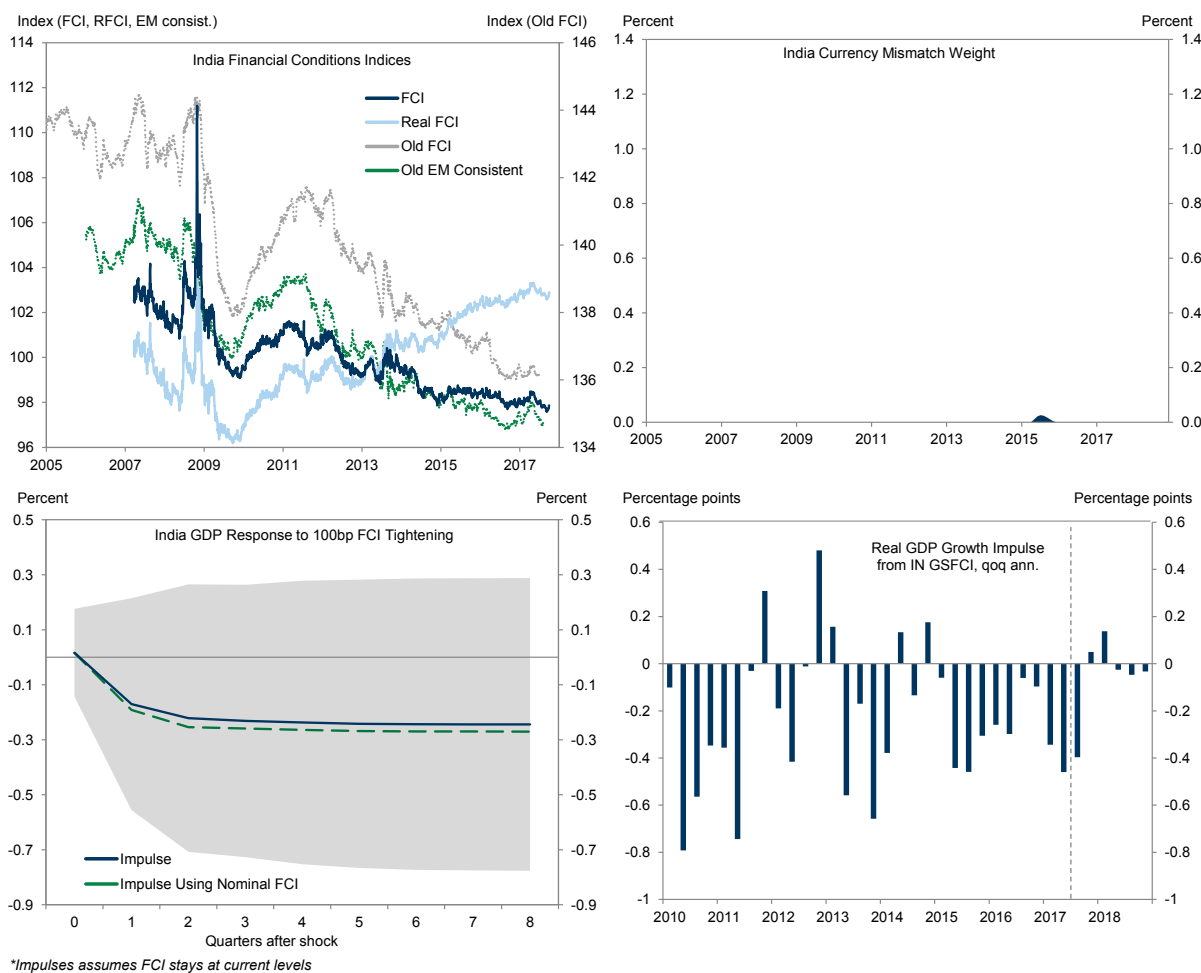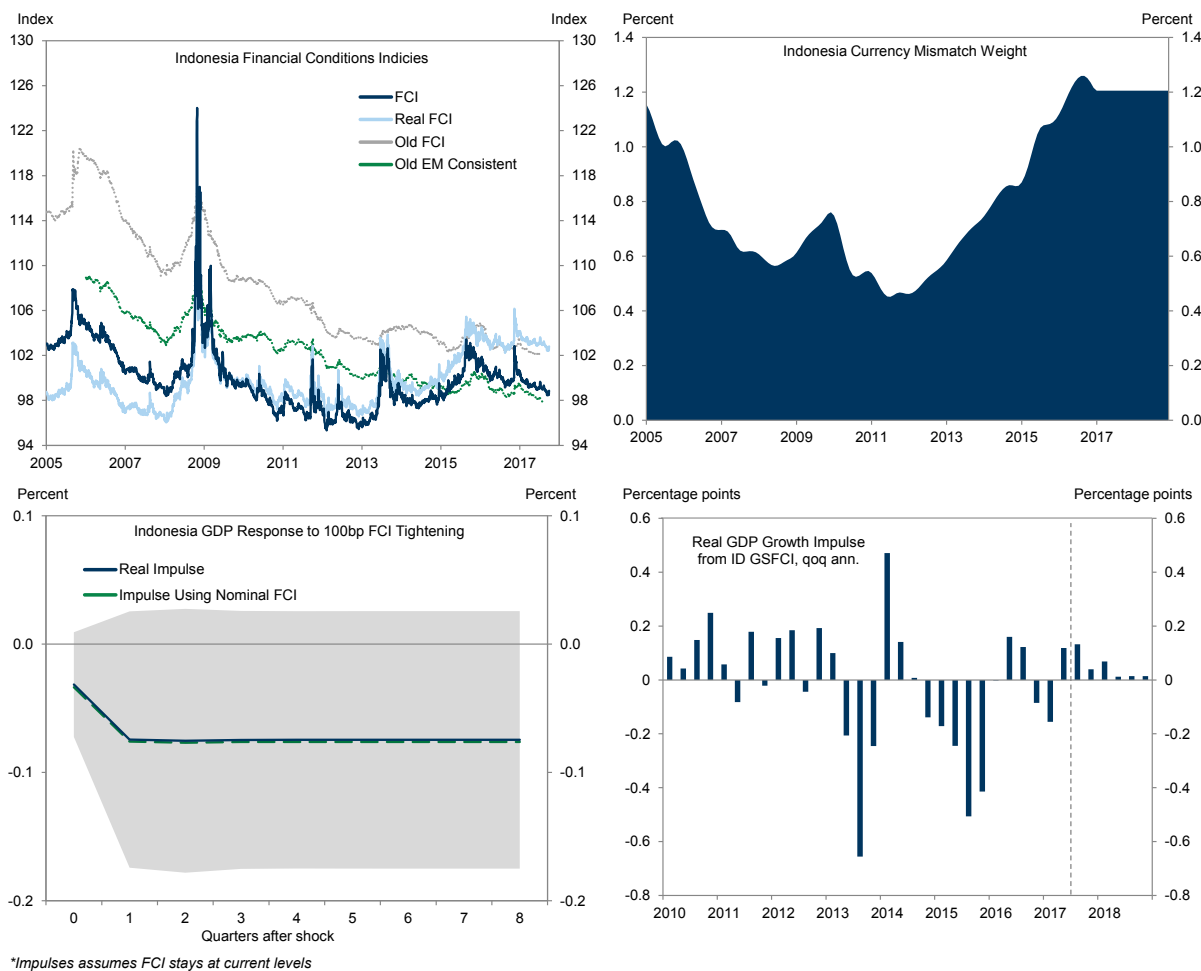| India: Components | | |
|---|---|---|
| **Variable** | **Description** | **Current Weights** |
| **Nominal Short Term Rate** | 3 Month FX Implied Yield | 20.7% |
| **Nominal Long Term Rate** | 5 Year Swap Rate | 45.7% |
| **Credit Default Swap** | State Bank of India Credit Default Swap | 21.4% |
| **Equity Price** | BSE 200, Scaled by 10-year Moving Average of Earnings | 1.5% |
| **Trade-Weighted Exchange Rate** | GS Broad Trade-Weighted Index | 10.6% |
| **Debt-Weighted Exchange Rate** | Internally Constructed Debt Weighted Index | 0.0% |

Source: Goldman Sachs Global Investment Research



Source: Goldman Sachs Global Investment Research

| Indonesia: Components | | |
|---|---|---|
| **Variable** | **Description** | **Current Weights** |
| **Nominal Short Term Rate** | 3 Month FX Implied Yield | 20.5% |
| **Nominal Long Term Rate** | 5 Year Swap Rate | 46.1% |
| **Credit Default Swap** | Indonesia Government Credit Default Swap | 21.3% |
| **Equity Price** | JCI, Scaled by 10-year Moving Average of Earnings | 1.7% |
| **Trade-Weighted Exchange Rate** | GS Broad Trade-Weighted Index | 9.1% |
| **Debt-Weighted Exchange Rate** | Internally Constructed Debt Weighted Index | 1.2% |

Source: Goldman Sachs Global Investment Research



Source: Goldman Sachs Global Investment Research

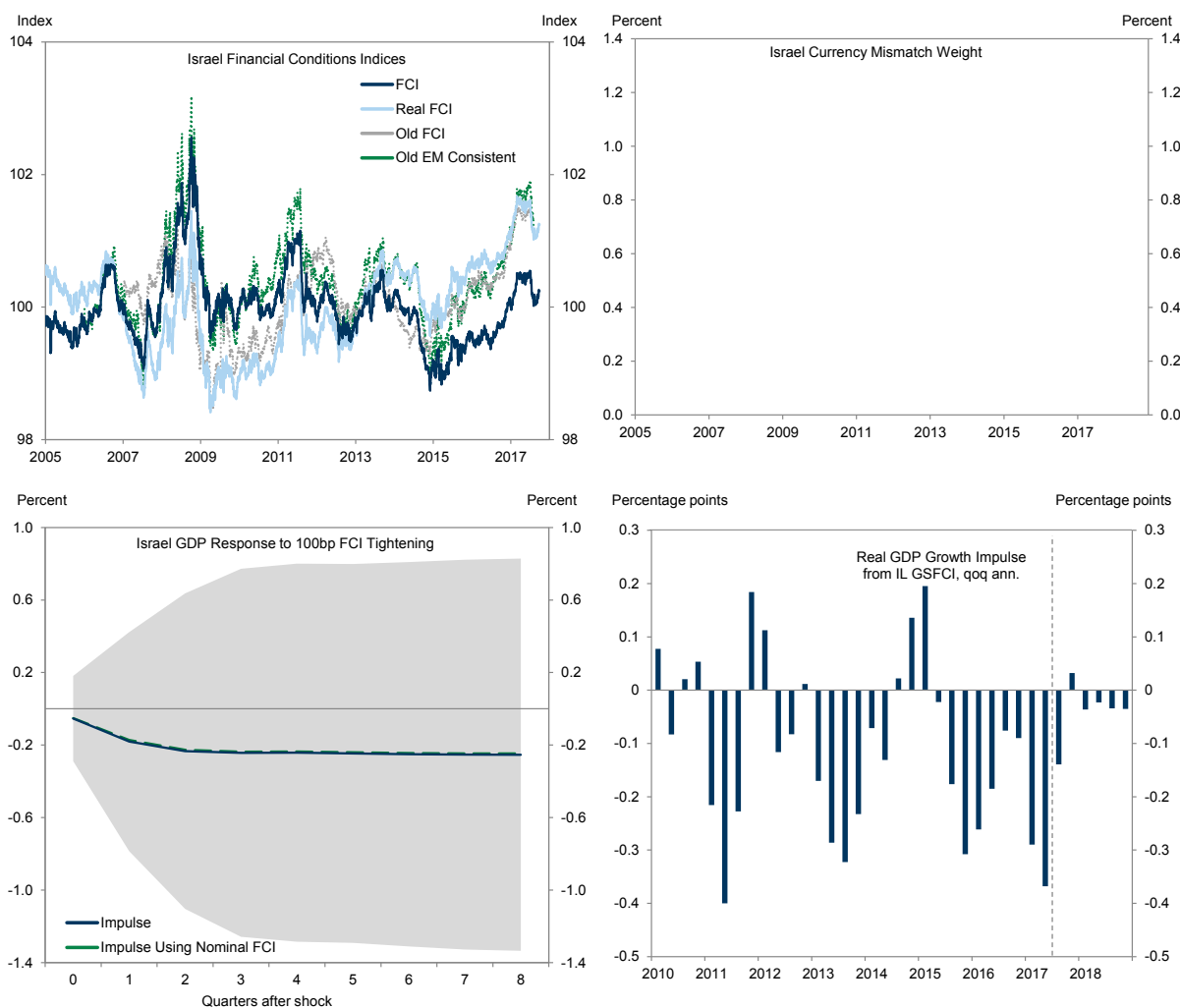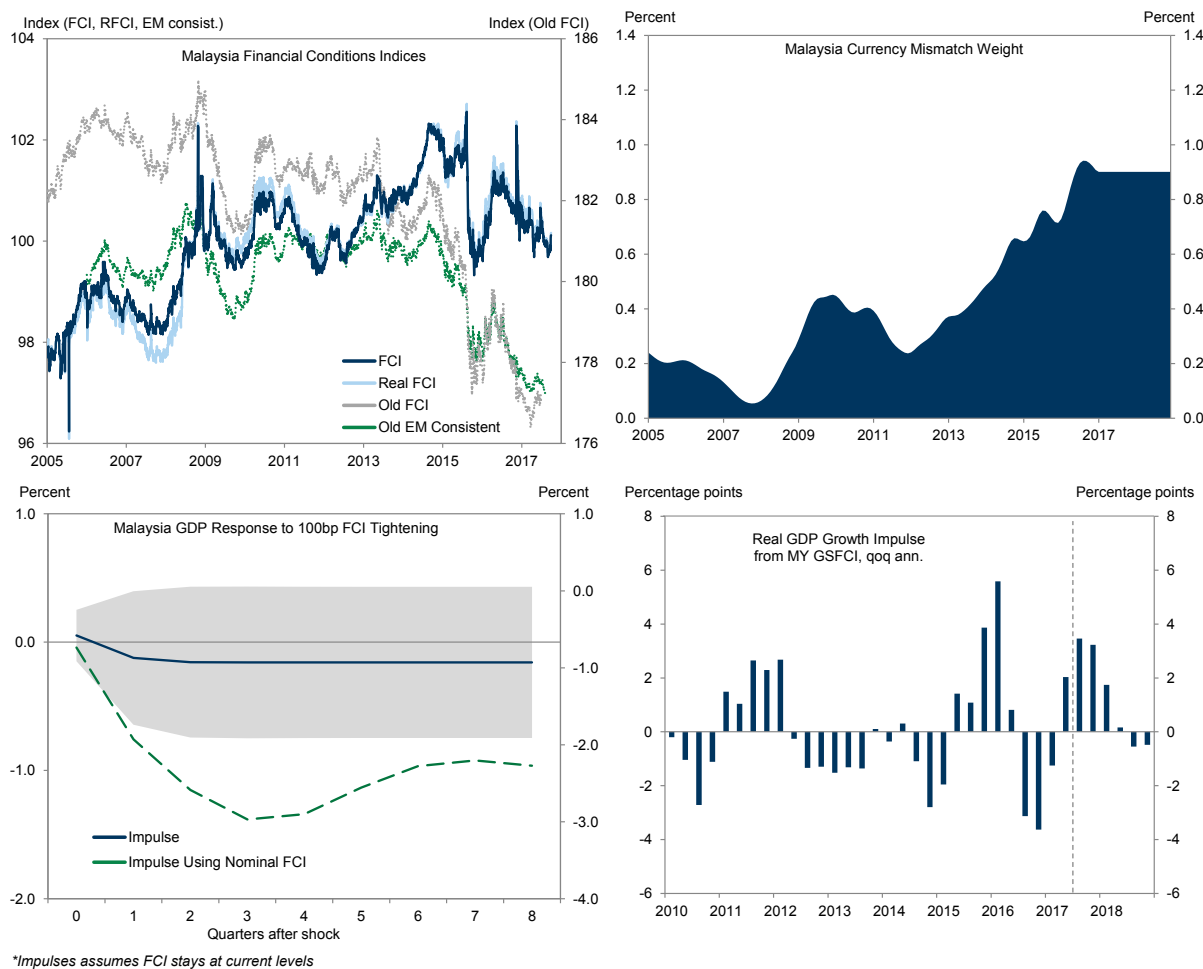| Israel: Components | | |
|---|---|---|
| **Variable** | **Description** | **Current Weights** |
| **Nominal Short Term Rate** | 3 Month FX Implied Yield | 19.9% |
| **Nominal Long Term Rate** | 5 Year Swap Rate | 46.2% |
| **Credit Default Swap** | Israel Government Credit Default Swap | 23.2% |
| **Equity Price** | TA-25 INDEX, Scaled by 10-year Moving Average of Earnings | 1.7% |
| **Trade-Weighted Exchange Rate** | GS Broad Trade-Weighted Index | 9.1% |
| **Debt-Weighted Exchange Rate** | Internally Constructed Debt Weighted Index | 0.0% |

Source: Goldman Sachs Global Investment Research



Israel Financial Conditions Indices



Israel Currency Mismatch Weight



Israel GDP Response to 100bp FCI Tightening

*Impulses assumes FCI stays at current levels



Real GDP Growth Impulse from IL GSFCI, qoq ann.

Source: Goldman Sachs Global Investment Research

| Malaysia: Components | | |
|---|---|---|
| Variable | Description | Current Weights |
| Nominal Short Term Rate | 3 Month FX Implied Yield | 20.4% |
| Nominal Long Term Rate | 5 Year Swap Rate | 39.7% |
| Credit Default Swap | Malaysia Government Credit Default Swap | 20.6% |
| Equity Price | FTSE Bursa Malaysia Index, Scaled by 10-year Moving Average of Earnings | 1.5% |
| Trade-Weighted Exchange Rate | GS Broad Trade-Weighted Index | 16.9% |
| Debt-Weighted Exchange Rate | Internally Constructed Debt Weighted Index | 0.9% |

Source: Goldman Sachs Global Investment Research



Source: Goldman Sachs Global Investment Research

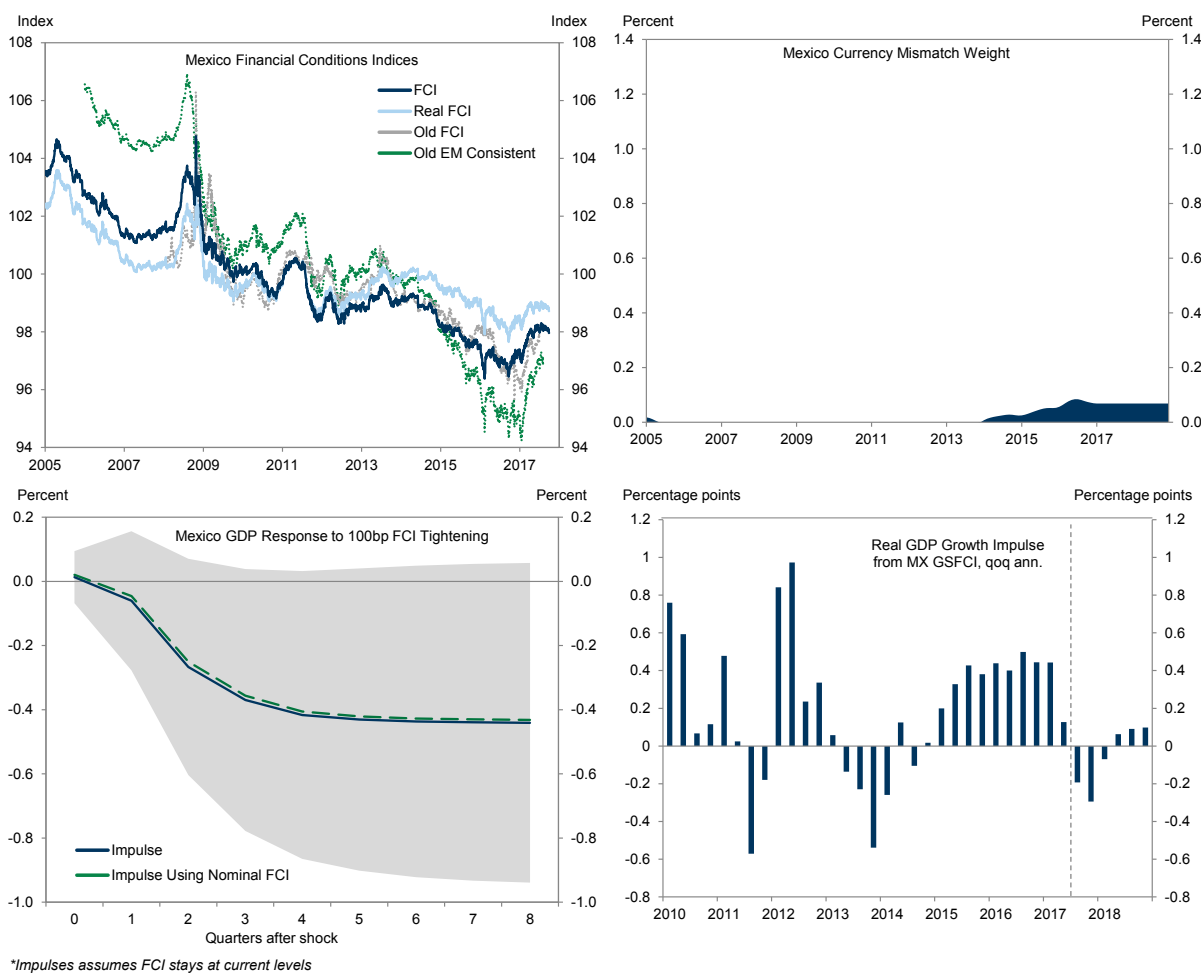| Mexico: Components | | |
|---|---|---|
| **Variable** | **Description** | **Current Weights** |
| **Nominal Short Term Rate** | 3 Month FX Implied Yield | 11.0% |
| **Nominal Long Term Rate** | 5 Year Swap Rate | 55.1% |
| **Credit Default Swap** | Mexico Government Credit Default Swap | 22.0% |
| **Equity Price** | S&P/BMV IPC, Scaled by 10-year Moving Average of Earnings | 1.9% |
| **Trade-Weighted Exchange Rate** | GS Broad Trade-Weighted Index | 9.9% |
| **Debt-Weighted Exchange Rate** | Internally Constructed Debt Weighted Index | 0.1% |

Source: Goldman Sachs Global Investment Research

Source: Goldman Sachs Global Investment Research

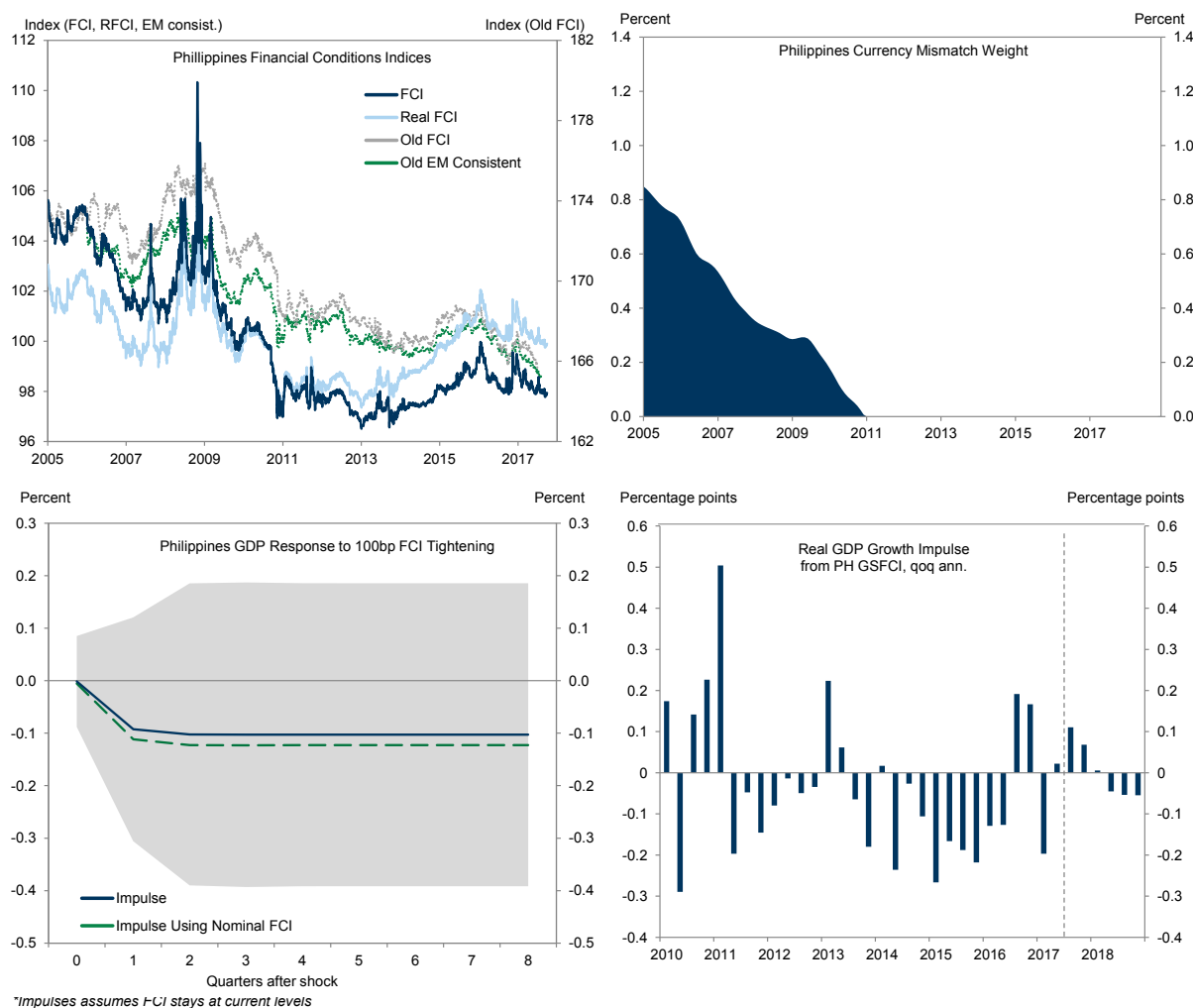| Philippines: Components | | |
|---|---|---|
| Variable | Description | Current Weights |
| Nominal Short Term Rate | 3 Month FX Implied Yield | 17.3% |
| Nominal Long Term Rate | 5 Year Swap Rate | 50.9% |
| Credit Default Swap | Philippines Government Credit Default Swap | 21.1% |
| Equity Price | PSEi Index, Scaled by 10-year Moving Average of Earnings | 1.7% |
| Trade-Weighted Exchange Rate | GS Broad Trade-Weighted Index | 8.9% |
| Debt-Weighted Exchange Rate | Internally Constructed Debt Weighted Index | 0.0% |

Source: Goldman Sachs Global Investment Research



Source: Goldman Sachs Global Investment Research

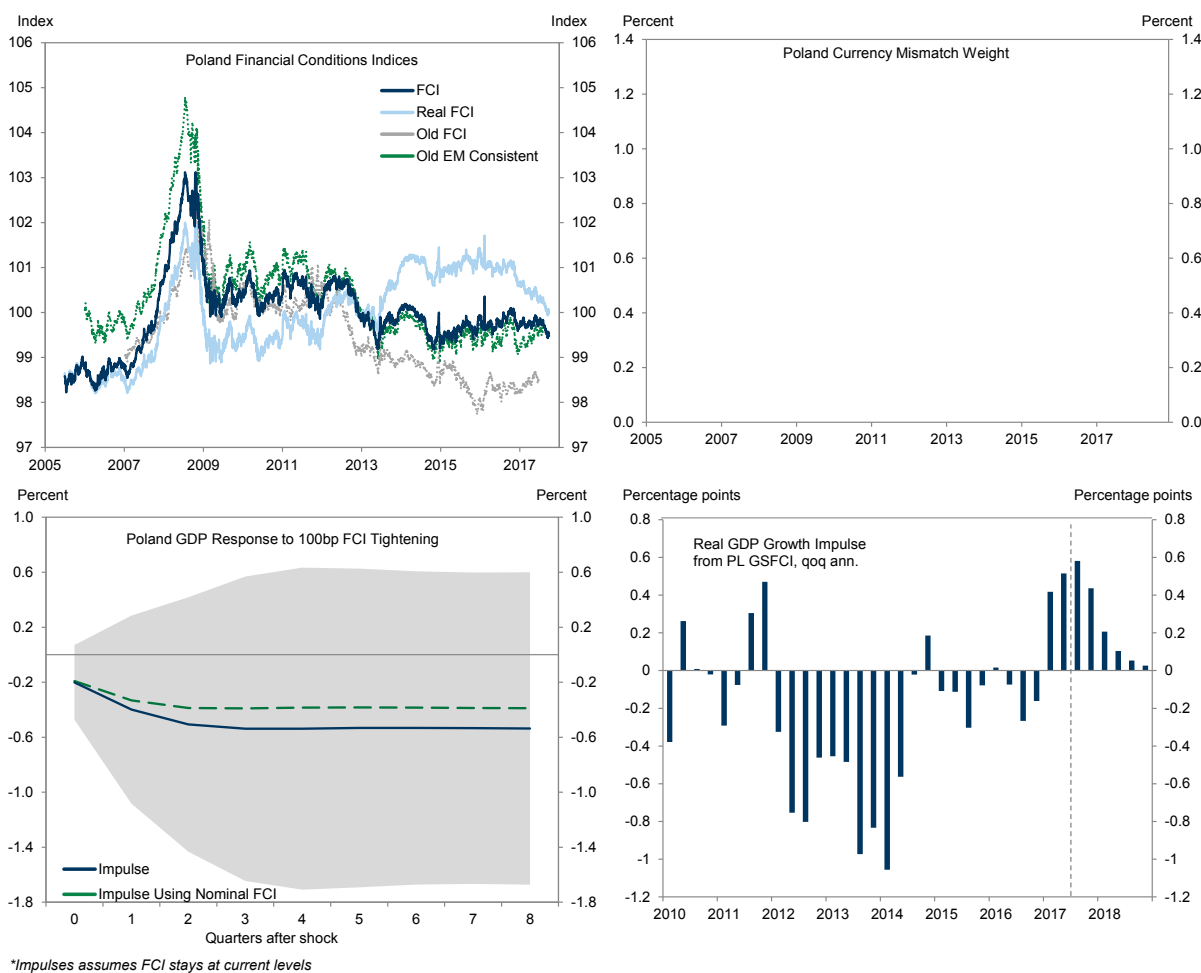| Poland: Components | | |
|---|---|---|
| **Variable** | **Description** | **Current Weights** |
| **Nominal Short Term Rate** | 3 Month FX Implied Yield | 25.4% |
| **Nominal Long Term Rate** | 5 Year Swap Rate | 40.4% |
| **Credit Default Swap** | Poland Government Credit Default Swap | 22.6% |
| **Equity Price** | WIG 20, Scaled by 10-year Moving Average of Earnings | 1.9% |
| **Trade-Weighted Exchange Rate** | GS Broad Trade-Weighted Index | 9.7% |
| **Debt-Weighted Exchange Rate** | Internally Constructed Debt Weighted Index | 0.0% |

Source: Goldman Sachs Global Investment Research



*Impulses assumes FCI stays at current levels

Source: Goldman Sachs Global Investment Research

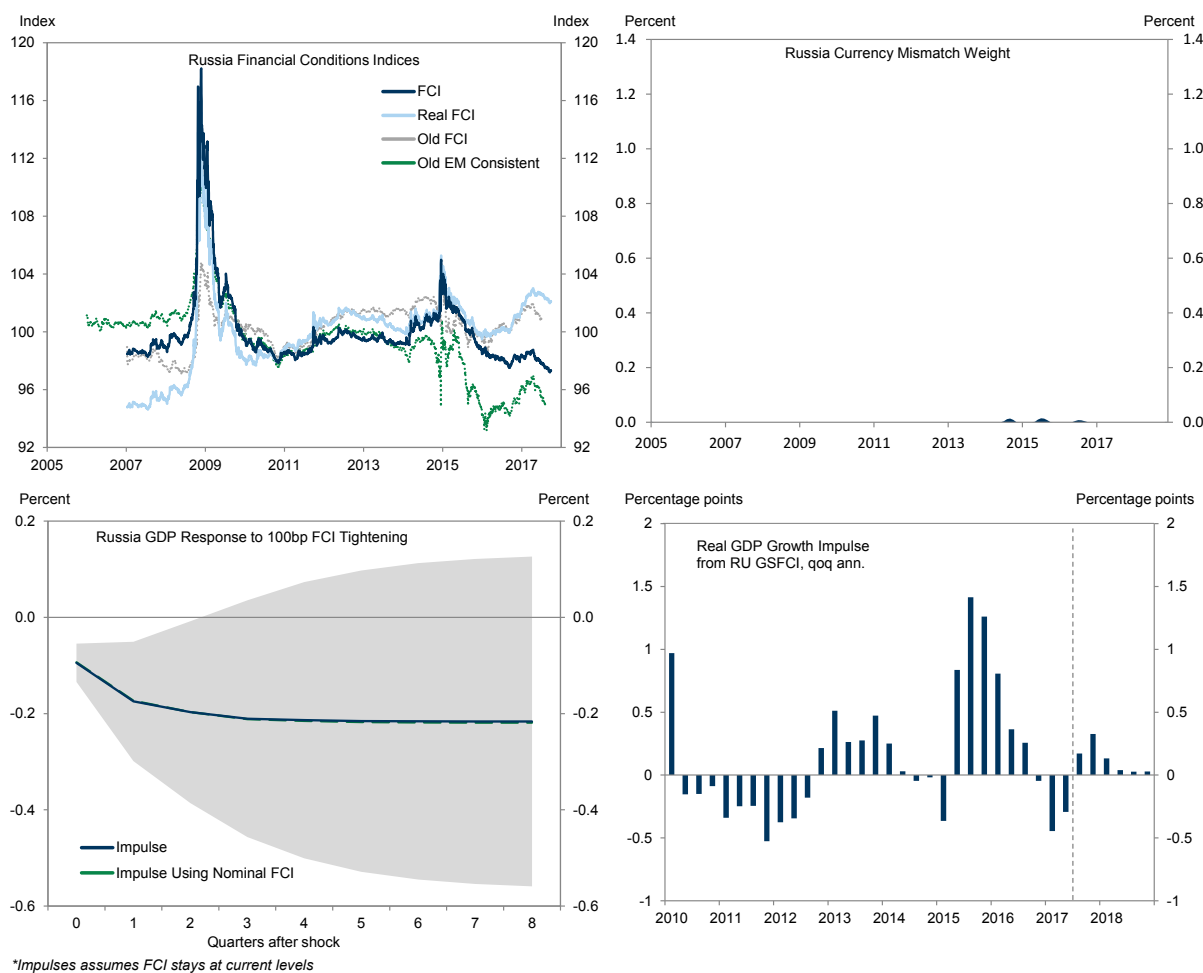| Russia: Components | | |
|---|---|---|
| Variable | Description | Current Weights |
| Nominal Short Term Rate | 3 Month FX Implied Yield | 17.0% |
| Nominal Long Term Rate | 5 Year Swap Rate | 47.9% |
| Credit Default Swap | Russia Government Credit Default Swap | 26.2% |
| Equity Price | RTS Index, Scaled by 10-year Moving Average of Earnings | 1.5% |
| Trade-Weighted Exchange Rate | GS Broad Trade-Weighted Index | 7.5% |
| Debt-Weighted Exchange Rate | Internally Constructed Debt Weighted Index | 0.0% |

Source: Goldman Sachs Global Investment Research



Russia Financial Conditions Indices



Russia Currency Mismatch Weight



Russia GDP Response to 100bp FCI Tightening

*Impulses assumes FCI stays at current levels



Real GDP Growth Impulse from RU GSFCI, qoq ann.

Source: Goldman Sachs Global Investment Research

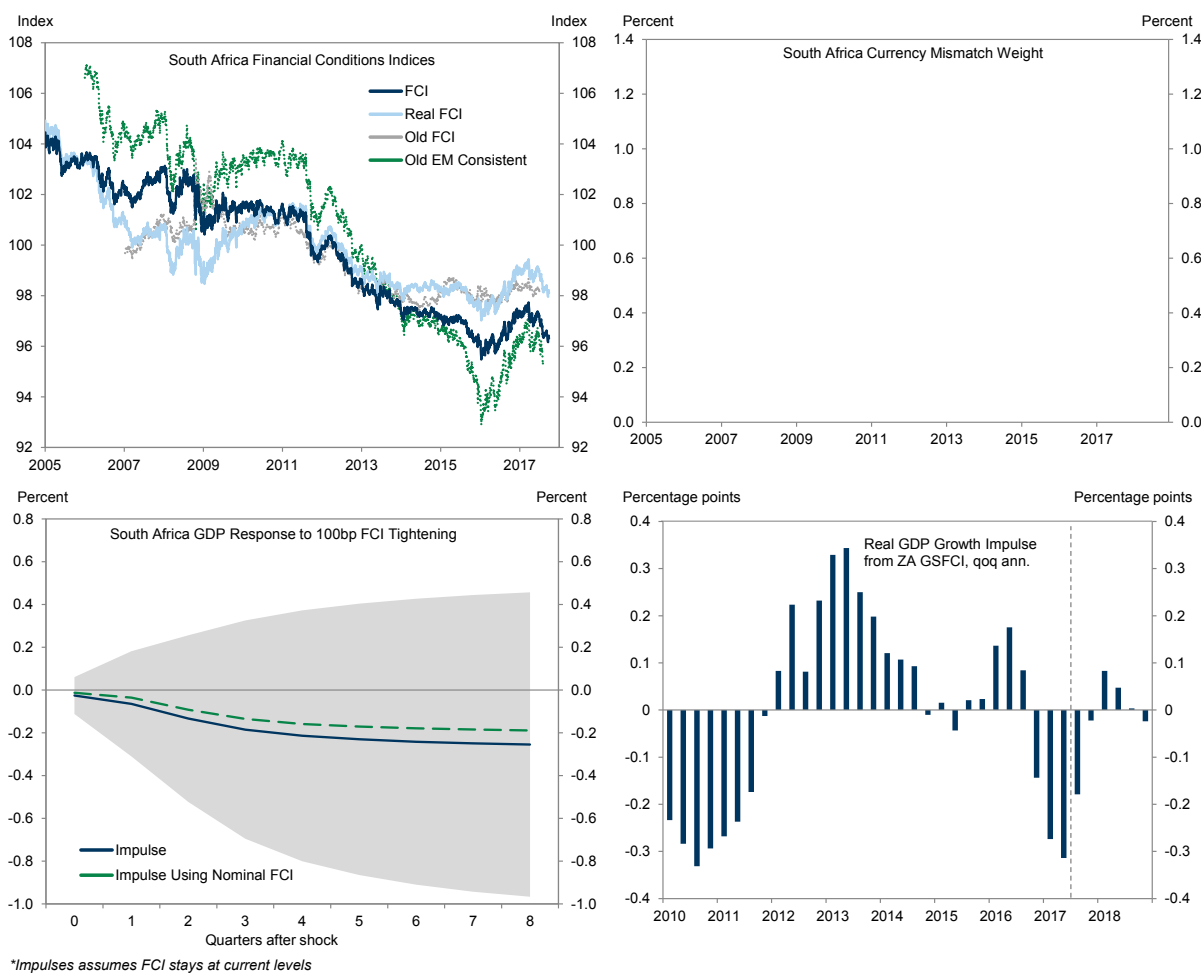| South Africa: Components | | |
|---|---|---|
| **Variable** | **Description** | **Current Weights** |
| **Nominal Short Term Rate** | 3 Month FX Implied Yield | 25.6% |
| **Nominal Long Term Rate** | 5 Year Swap Rate | 40.3% |
| **Credit Default Swap** | South Africa Government Credit Default Swap | 21.9% |
| **Equity Price** | JSE Africa TOP40 IX, Scaled by 10-year Moving Average of Earnings | 2.0% |
| **Trade-Weighted Exchange Rate** | GS Broad Trade-Weighted Index | 10.2% |
| **Debt-Weighted Exchange Rate** | Internally Constructed Debt Weighted Index | 0.0% |

Source: Goldman Sachs Global Investment Research

Source: Goldman Sachs Global Investment Research

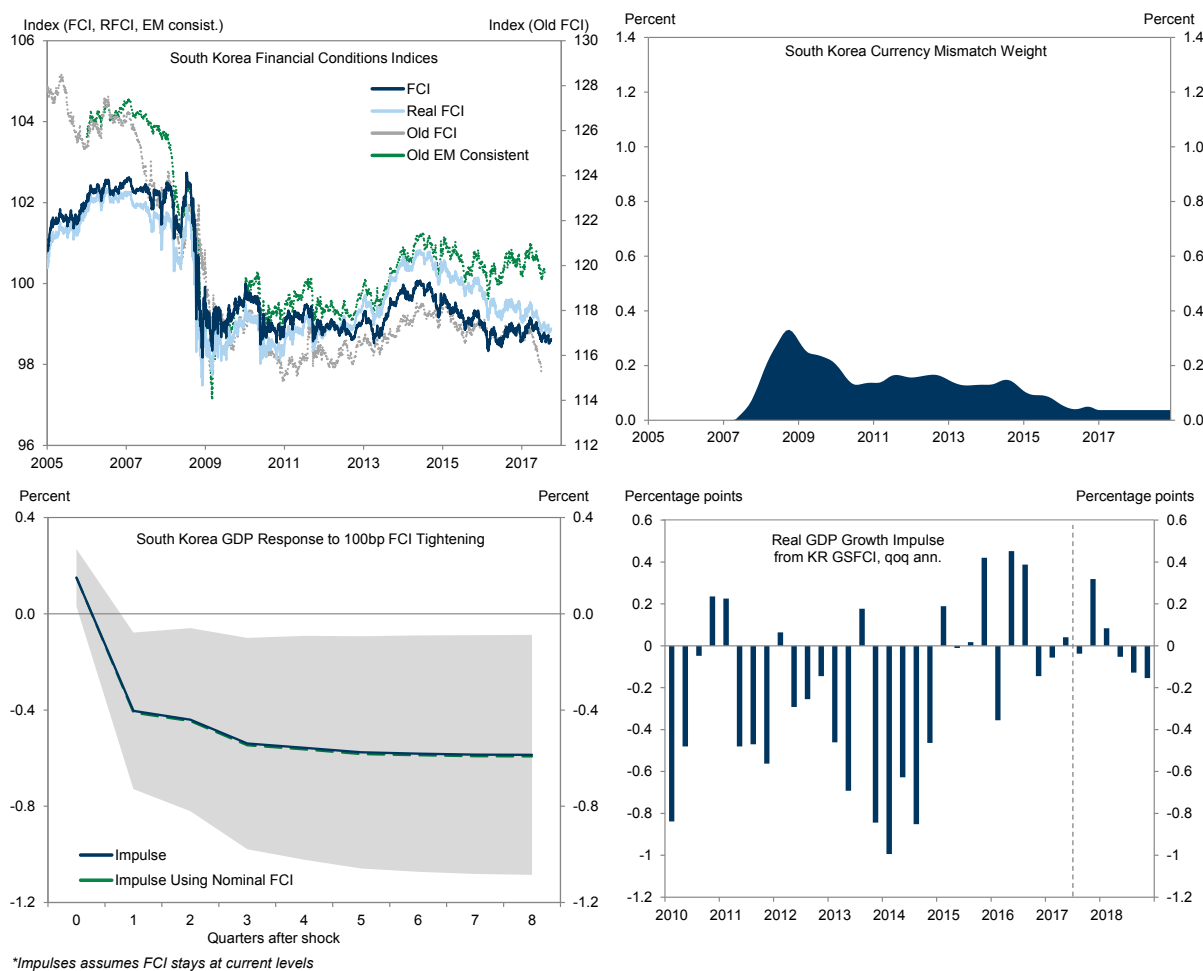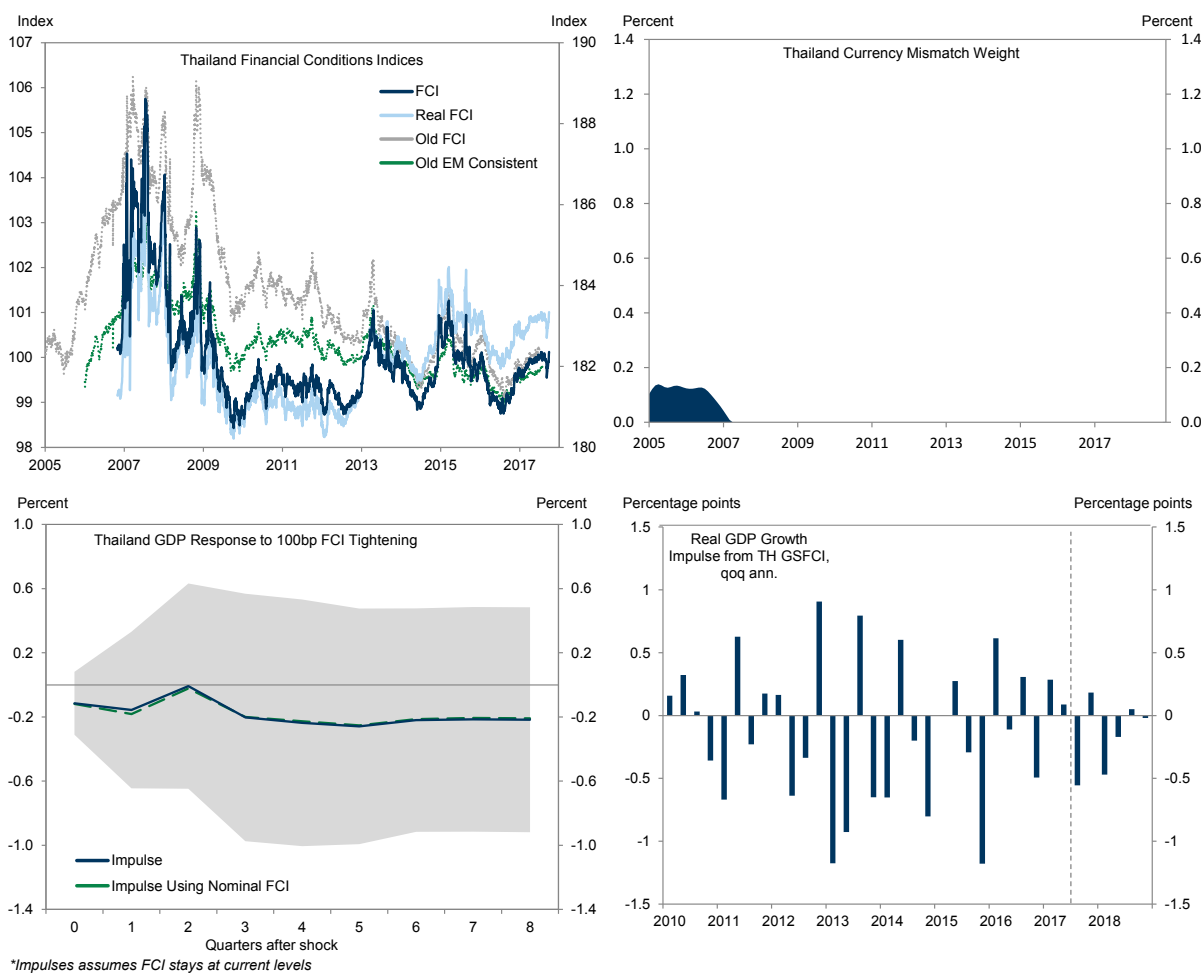| South Korea: Components | | |
|---|---|---|
| **Variable** | **Description** | **Current Weights** |
| **Nominal Short Term Rate** | 3 Month FX Implied Yield | 21.4% |
| **Nominal Long Term Rate** | 5 Year Swap Rate | 43.9% |
| **Credit Default Swap** | South Korea Government Credit Default Swap | 22.5% |
| **Equity Price** | KOSPI 200 Index, Scaled by 10-year Moving Average of Earnings | 1.6% |
| **Trade-Weighted Exchange Rate** | GS Broad Trade-Weighted Index | 10.7% |
| **Debt-Weighted Exchange Rate** | Internally Constructed Debt Weighted Index | 0.0% |

Source: Goldman Sachs Global Investment Research

South Korea Financial Conditions Indices



South Korea Currency Mismatch Weight



South Korea GDP Response to 100bp FCI Tightening

*Impulses assumes FCI stays at current levels



Real GDP Growth Impulse from KR GSFCI, qoq ann.

Source: Goldman Sachs Global Investment Research

| Thailand: Components | | |
|---|---|---|
| Variable | Description | Current Weights |
| Nominal Short Term Rate | 3 Month FX Implied Yield | 23.0% |
| Nominal Long Term Rate | 5 Year Swap Rate | 35.5% |
| Credit Default Swap | Thailand Government Credit Default Swap | 20.0% |
| Equity Price | SET Index, Scaled by 10-year Moving Average of Earnings | 1.4% |
| Trade-Weighted Exchange Rate | GS Broad Trade-Weighted Index | 20.0% |
| Debt-Weighted Exchange Rate | Internally Constructed Debt Weighted Index | 0.0% |

Source: Goldman Sachs Global Investment Research



Source: Goldman Sachs Global Investment Research

| Turkey: Components | | |
|---|---|---|
| **Variable** | **Description** | **Current Weights** |
| **Nominal Short Term Rate** | 3 Month FX Implied Yield | 20.6% |
| **Nominal Long Term Rate** | 5 Year Swap Rate | 44.2% |
| **Credit Default Swap** | Turkey Government Credit Default Swap | 26.8% |
| **Equity Price** | XU100 index, Scaled by 10-year Moving Average of Earnings | 1.2% |
| **Trade-Weighted Exchange Rate** | GS Broad Trade-Weighted Index | 6.5% |
| **Debt-Weighted Exchange Rate** | Internally Constructed Debt Weighted Index | 0.7% |

Source: Goldman Sachs Global Investment Research
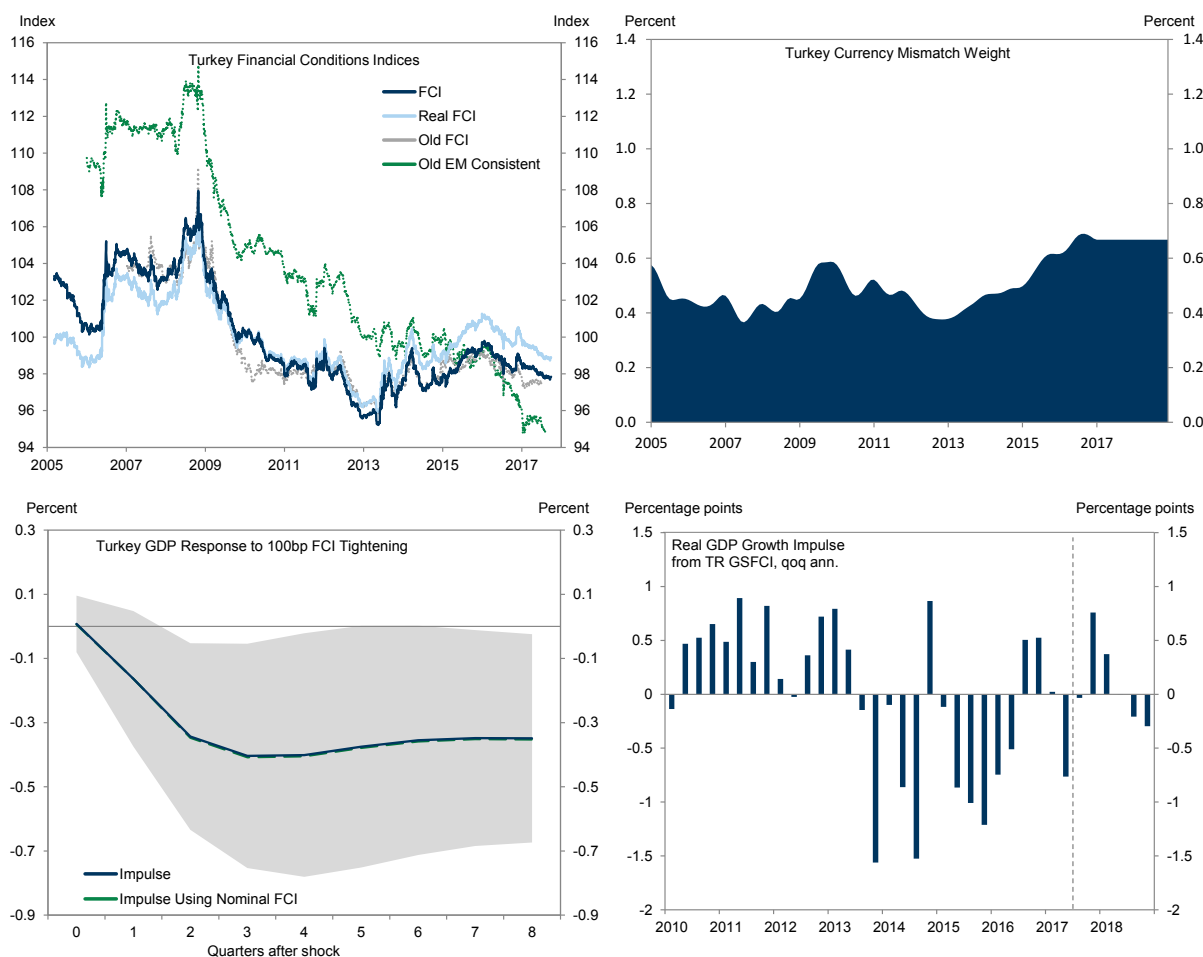


*Impulses assumes FCI stays at current levels

Source: Goldman Sachs Global Investment Research

# Global Economic Forecasts

| Real GDP Growth (YoY) | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|
| World | 3.2 | 3.7 | 3.9 | 3.9 |
| Advanced Economies | 1.7 | 2.2 | 2.1 | 1.8 |
| Emerging Markets | 4.7 | 5.2 | 5.3 | 5.5 |
| **G3** | | | | |
| United States | 1.5 | 2.1 | 2.4 | 1.7 |
| Euro area | 1.7 | 2.2 | 1.8 | 1.6 |
| Germany | 1.9 | 2.3 | 1.9 | 1.6 |
| France | 1.1 | 1.6 | 1.7 | 1.6 |
| Italy | 1.0 | 1.4 | 0.9 | 0.9 |
| Spain | 3.2 | 3.1 | 2.5 | 2.3 |
| Japan | 1.0 | 1.5 | 1.2 | 1.3 |
| **Advanced Economies** | | | | |
| Australia | 2.5 | 2.5 | 3.0 | 2.9 |
| Canada | 1.5 | 2.7 | 2.3 | 1.8 |
| New Zealand | 3.1 | 2.6 | 3.2 | 2.6 |
| Norway | 1.0 | 2.1 | 2.4 | 2.3 |
| Sweden | 3.1 | 3.0 | 3.0 | 2.6 |
| Switzerland | 1.4 | 0.6 | 1.6 | 1.8 |
| United Kingdom | 1.8 | 1.6 | 1.2 | 2.0 |
| **Asia** | | | | |
| China | 6.7 | 6.8 | 6.3 | 6.1 |
| India | 7.9 | 6.3 | 7.4 | 8.0 |
| **CEEMEA** | | | | |
| Russia | -0.2 | 2.5 | 3.3 | 2.9 |
| Turkey | 2.9 | 5.0 | 3.5 | 3.5 |
| **Latin America** | | | | |
| Brazil | -3.6 | 0.9 | 2.1 | 2.7 |
| Mexico | 2.3 | 2.1 | 2.5 | 3.5 |

| Core CPI Inflation (YoY) | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|
| **G3** | | | | |
| United States (core PCE) | 1.8 | 1.5 | 1.8 | 2.1 |
| Euro area | 0.8 | 1.2 | 1.3 | 1.3 |
| Germany | 1.1 | 1.6 | 1.5 | 1.4 |
| France | 0.5 | 0.6 | 1.0 | 1.2 |
| Italy | 0.5 | 0.9 | 1.1 | 1.2 |
| Spain | 0.7 | 1.3 | 1.5 | 1.6 |
| Japan (ex food & energy) | -0.3 | 0.4 | 0.6 | 1.0 |
| **Advanced Economies** | | | | |
| Norway | 3.1 | 1.6 | 2.2 | 2.2 |
| United Kingdom | 1.3 | 2.4 | 2.1 | 2.0 |

| Policy Rate (%) | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|
| **G3** | | | | |
| United States | 0.1 | 0.1 | 0.2 | 0.5 |
| Euro area | 0.3 | 0.1 | 0.1 | 0.0 |
| Japan | 0.1 | 0.1 | 0.1 | -0.1 |
| **Advanced Economies** | | | | |
| Australia | 2.7 | 2.5 | 2.1 | 1.7 |
| Canada | 1.0 | 1.0 | 0.5 | 0.5 |
| New Zealand | 2.5 | 3.5 | 2.5 | 1.8 |
| Norway | 1.5 | 1.3 | 0.8 | 0.5 |
| Sweden | 0.8 | 0.0 | -0.4 | -0.5 |
| Switzerland | 0.0 | -0.3 | -0.8 | -0.8 |
| United Kingdom | 0.5 | 0.5 | 0.5 | 0.3 |
| **Asia** | | | | |
| China | 5.3 | 4.5 | 2.4 | 2.6 |
| India | 7.8 | 8.0 | 6.8 | 6.3 |
| **CEEMEA** | | | | |
| Russia | 5.5 | 17.0 | 11.0 | 10.0 |
| Turkey | 7.8 | 11.3 | 10.8 | 8.5 |
| **Latin America** | | | | |
| Brazil | 10.0 | 11.8 | 14.3 | 13.8 |
| Mexico | 3.5 | 3.0 | 3.3 | 5.8 |

Source: Goldman Sachs Global Investment Research

# Disclosure Appendix

## Reg AC

We, Jan Hatzius, Sven Jari Stehn, Nicholas Fawcett and Manav Chaudhary, hereby certify that all of the views expressed in this report accurately reflect our personal views, which have not been influenced by considerations of the firm's business or client relationships.

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