HOW TO

NOTES

How to Measure the Monetary Policy Stance

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NOTE 25/03

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NOTE/2025/003

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Cataloging-in-Publication Data
IMF Library

Names: Harrison, Olamide, author. | Nguyen, Vina, author. | International Monetary Fund, publisher.
Title: How to measure the monetary policy stance / Olamide Harrison and Vina Nguyen
Other titles: How to notes (International Monetary Fund).
Description: Washington, DC : International Monetary Fund, 2025. |NOTE/2025/003. | Jan. 2025. | Includes bibliographical references.
Identifiers: ISBN:
9798400298882 (paper)
9798400299322 (ePub)
9798400299391 (WebPDF)
Subjects: LCSH: Monetary policy. | Interest rates. |
Classification: LCC HG230.3.H3 2025

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RECOMMENDED CITATION: Harrison Olamide, and Vina Nguyen. 2025. “How to Measure the Monetary Policy Stance”. IMF How to Note 2025/003, International Monetary Fund, Washington, DC.

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*Prepared by Olamide Harrison and Vina Nguyen with inputs from Anu Verma and Mustafa Caylan, under the guidance of Chris Erceg and David Hofman. We would like to thank departments for insightful comments.

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January 2025

Key Takeaways

- The monetary policy stance is a dynamic and forward-looking concept that captures the gap between the real policy interest rate r_t and the economy's real neutral interest rate r_t^*. The policy stance is accommodative if $r_t < r_t^*$ because it tends to raise output growth above potential and restrictive if $r_t > r_t^*$.
- Although the real neutral rate is a superior benchmark for measuring the policy stance, it is difficult to estimate given that it varies with the state of the economy and unobserved shocks, including financial conditions. Hence, the policy stance is often framed in terms of the gap between the real interest rate and the "natural" real interest rate $\overline{r^*}$, which can be regarded as the steady-state level of the neutral rate.
- Under some conditions, real interest rates may have to rise well above the natural rate $\overline{r^*}$ for policy to be restrictive and ensure a timely closing of the output gap, particularly in case of the following:
  - Financial conditions are relatively loose.
  - Fiscal policy is expansionary.
  - The output gap is initially positive.
  - Monetary policy transmission is weak.
- In open economies, assessments of the policy stance should also consider deviations in real exchange rates from equilibrium levels, the sensitivity of the real economy to such deviations, and global demand developments.
- Judgment is always required in reaching a final assessment of the stance, given model uncertainty and data limitations.

This note outlines a basic framework for assessing the monetary policy stance. It provides a conceptual framework to organize discussions of the appropriateness of the monetary policy stance and presents tools that country teams can employ to measure, report, and evaluate the stance of monetary policy. The note focuses exclusively on aggregate demand considerations—on whether the stance is tight or loose—without considering whether such a stance is appropriate for achieving policy objectives. The latter requires also considering aggregate supply and Phillips curve trade-offs. The note does not cover other macroeconomic policies, such as macroprudential or fiscal measures, which could also have a considerable impact on the effectiveness of monetary policy.

Conceptual Framework

The monetary policy stance stimulates, maintains, or lowers aggregate demand by influencing the cost of financing in the economy. In an interest rate–focused operating framework, the primary instrument is the policy interest rate, which is usually closely linked to an interbank rate or rate on the central bank's deposit facility.[1] A long-standing approach to assessing the policy stance considers the gap between the policy rate and the economy's neutral interest rate, with both expressed in real terms, that is, $r_t - r_t^*$.[2] The neutral rate is typically defined as the level of the real interest rate needed to keep output at potential if the output gap is initially closed. By extension, starting from a zero-output gap, policy is accommodative if the real interest rate r_t is set below r_t^* (so the "interest rate gap" is negative) and restrictive if $r_t > r_t^*$.[3]

The Investment-Saving (IS) curve can serve as a convenient organizing framework for capturing how current and future interest rate gaps affect activity in a dynamic setting in which the output gap may initially be nonzero. The IS curve relates aggregate demand to its past level(s) as well as to current and future borrowing costs in the economy. A workhorse closed-economy version of the IS curve—which can be derived from optimality conditions for households' consumption/savings decisions along with market clearing—is shown in equation (1a):

$$x_t = \rho x_{t-1} - (1 - \rho)\sigma(r_t - r_t^*), \qquad (1a)$$

where x_t denotes the output gap at time t, and the parameters ρ and σ represent aggregate demand momentum and the interest elasticity of demand, respectively. Here, the real interest rate r_t and neutral rate r_t^* should be regarded as a measure applicable over a "medium-term horizon," most relevant for consumption/savings decisions (for example, over the next couple of years).[4,5] Intuitively, current aggregate demand is positively related to past demand pressures and negatively related to the gap between the real interest rate and the neutral rate. The parameters σ and ρ determine the strength and speed of transmission and can be regarded as depending implicitly on structural factors such as the level of financial development and share of private investment and durables in the economy (which tend to be more interest sensitive). The policy stance is accommodative if $r_t < r_t^*$ because it tends to boost output growth above potential (and thus speeds the return of output to potential if the output gap is initially negative), whereas policy is restrictive if $r_t > r_t^*$.

Although the neutral rate is unobservable, it is useful to decompose it into a long-term and cyclical component. A range of models suggest it is useful to decompose the neutral rate into a long-term component $\bar{r}_t^*$ or "natural rate" and a cyclical deviation r_{ct}^* so that $r_t^* = \bar{r}_t^* + r_{ct}^*$. Accordingly, equation (1b) can be expressed as

$$x_t = \rho x_{t-1} - (1 - \rho)\sigma\left(r_t - (\bar{r}_t^* + r_{ct}^*)\right) \qquad (1b)$$

The long-term component or the natural rate $\bar{r}_t^*$ can be regarded as driven by slow-moving forces such as productivity growth and demographics. The cyclical component is driven by temporary factors such as shocks to government spending, to financial conditions, and to autonomous demand (or "animal spirits"). Thus, a temporary rise in government spending would raise r_{ct}^*, consequently boosting aggregate demand unless the interest rate r_t rose commensurately. In addition, an easing of financial conditions would similarly raise r_{ct}^*, reflecting that households and firms would face lower borrowing costs even if the real policy rate r_t were to remain fixed.

[1] Where the operating framework is quantity based, there is a short-term interest rate that is consistent with the targeted level of reserve money (Maehle and King 2022).
[2] To align with the recent literature, we refer to this shorter-term rate as the neutral rate to distinguish it from the long-term natural rates. Previous studies have often used terms such as equilibrium, neutral, and natural real rates interchangeably.
[3] This approach is compatible with submission guidelines for the IMF's Consistent Policy Assessment Toolkit that collects, among others, desk views on the baseline stance and action as well as recommended monetary policy.
[4] A microfounded version of equation (1a) would typically have a forward-looking term $E_t x_{t+1}$ capturing future expectations of aggregate demand, but we have implicitly solved it forward and are interpreting the interest rate terms as capturing current and future rate paths.
[5] In practice, although the central bank can use forward guidance to heavily influence the path of the real interest rate over the medium term, its control is imperfect, and market rates may differ from what the central bank views as consistent with its intended policy stance.

Decomposing the neutral rate into long-term and cyclical components can provide insight into the stance of policy given that the long-term component can be treated as roughly constant. The long-term component is unlikely to move much over the "business cycle" horizon relevant for determining aggregate spending decisions. Hence, it can be treated as essentially constant—say 0.5 percent for the United States as of 2023—or reassessed at less frequent intervals.[6,7] Although the cyclical component is challenging to estimate, it can often be "signed" at least qualitatively. These observations have several useful implications:

- A policy of gradual "normalization"—involving slow convergence of the real rate to its long-term level $\bar{r}_t^*$ from a lower level—can be highly expansionary if the cyclical component is close to zero or positive. As suggested by equation (1a) and illustrated in Figure 1, panels 1 and 2, the output gap can increase persistently under these conditions. Several central banks had indicated that they expected to follow such a course in 2021–22 until surging inflation pushed them to tighten much more quickly. Note that only limited qualitative information about r_{ct}^* is needed to assess if raising the interest rate toward its long-term level delivers the desired stance.

- Although setting the real interest rate above its long-term value $\bar{r}_t^*$ is often interpreted as "restrictive" (especially in the financial press), this policy can still be expansionary if r_{ct}^* is sizable and persistently positive, so the real interest rate gap $r_t - r_t^*$ is persistently negative (see Figure 1, panels 3 and 4). As suggested by equation (1a), the output gap can persistently increase even under such conditions.

- Conversely, setting the real interest rate to its long-term value can be quite restrictive if r_{ct}^* is persistently negative, as was likely the case during and after the global financial crisis or the European sovereign debt crisis given the sharp tightening of financial conditions.

- If the central bank needs to cool a hot economy quickly $(x_{t-1} >> 0)$, setting the real interest rate to $\bar{r}_t^* + r_{ct}^*$ may not be sufficient if aggregate demand is very persistent (so ρ is high). Such an approach would cause the output gap to narrow only gradually (as illustrated in Figure 1, panels 5 and 6, with the red line showing the case in which aggregate demand persistence is relatively high). A more forceful tightening may be needed that entails boosting r_t well above r_{ct}^* and potentially far above $\bar{r}_t^*$.

Overall, to appropriately calibrate the monetary policy stance, an estimate of the neutral rate r_t^* that incorporates short-to-medium–term deviations, r_{ct}^*, is more relevant. However, if such estimates are not available, estimates of a long-term natural rate $\bar{r}_t^*$ combined with qualitative assessments of the deviations r_{ct}^* based on financial conditions can inform assessments of the monetary policy stance, as will be discussed in the following section. The magnitude of the interest rate gap also needs to be sufficiently large, especially considering the high uncertainty in the estimates of r_t^*. If r_{ct}^* is likely to differ from zero, interest rates would need to change largely to ensure a sufficient interest rate gap. Using various methodologies to estimate r_t^* can enhance confidence in the assessment of the stance.

Although the IS curve only explicitly includes interest rates, the framework can also incorporate other monetary policy instruments. We will discuss different approaches to do so in subsequent sections. For many small open economies, exchange rates and exchange rate regimes play a critical role in affecting the overall monetary policy stance or the transmission of rate hikes. Monetary policy actions affect international relative prices, prompting shifts in expenditure patterns and adjustments in net exports and influencing the real economy and inflation. The IS curve could be modified to include the effective exchange rate as illustrated in Box 1.

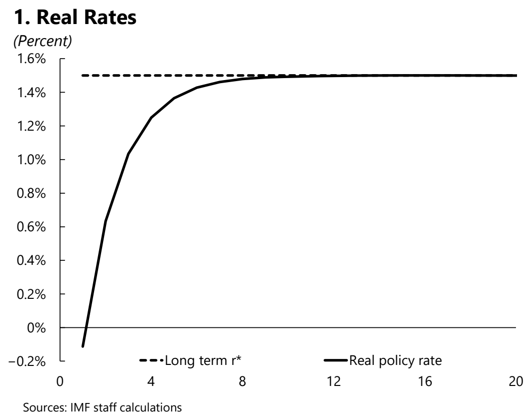
[6] It is worth noting that, in reality, there is not a completely clean separation between the long-term and cyclical components as suggested here (for example, cyclical factors such as a sharp tightening in financial conditions can have long-lived implications on productivity growth). Nonetheless, such differentiation is helpful for characterizing the monetary policy stance.
[7] For example, Del Negro and others (2017) showed a decline in the natural interest rate in the United States, dropping from 2–2.5 percent in late 1990s to around 1 percent in 2016, attributed to an increasing global demand for safe assets.

Figure 1. Illustrative Simulations

(Percent)

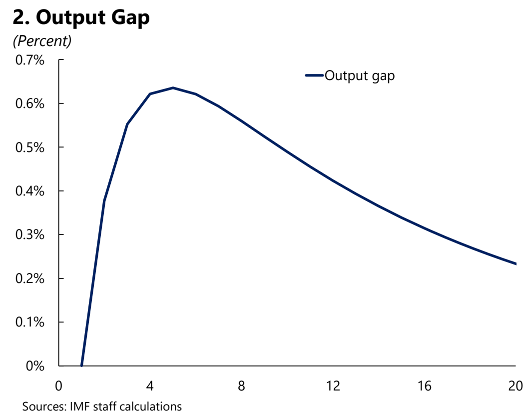
1. Real Rates

A policy of gradual normalization . . .



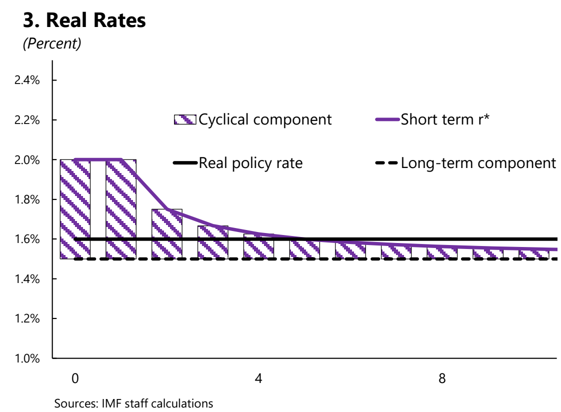
2. Output Gap

. . . can still be expansionary if the cyclical component r_{ct}^{*} is zero or positive.



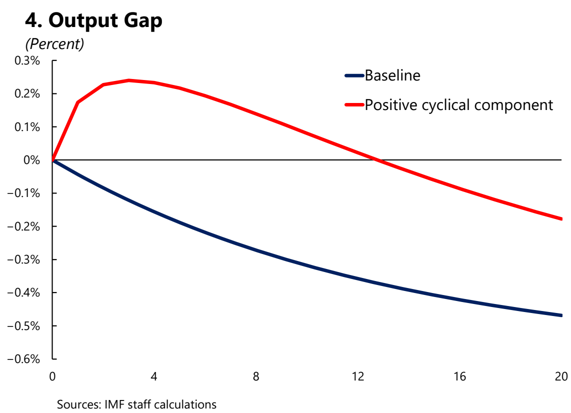
3. Real Rates

Setting the real interest rate above $\bar{r}_t^{*}$ is not sufficiently restrictive . . .



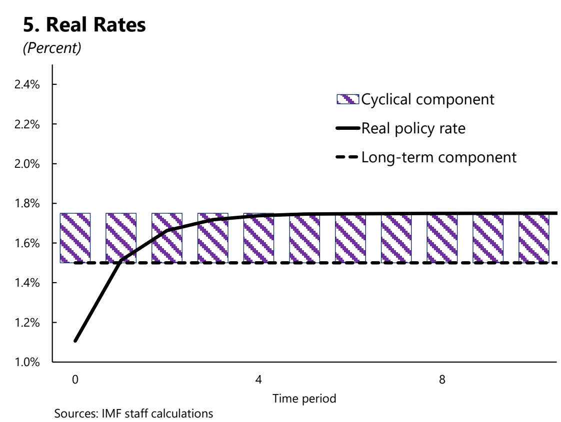
4. Output Gap

. . . if r_{ct}^{*} is large and persistently positive.



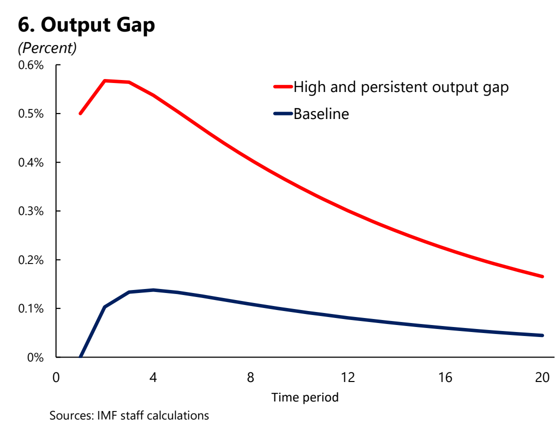
5. Real Rates

Even setting the real interest rate to $\bar{r}_t^{*} + r_{ct}^{*}$ may not be sufficient . . .



6. Output Gap

. . . if the output gap is large or aggregate demand is very persistent.



Source: IMF staff calculations.

Box 1. Open-Economy Considerations for Assessing the Monetary Stance

An open-economy version of the framework should account for the effects of global demand pressures and deviations of the real effective exchange rate from its equilibrium level. Monetary policy actions can transmit to the real economy and inflation through changes in international relative prices that trigger expenditure-switching effects and changes in net exports (Gali and Monacelli 2005). To capture both the real interest and exchange rate channels of monetary policy, in equation (I) the real interest rate gap can be substituted with the deviation of a monetary conditions index (MCI), termed mci_t, from its long-term trend:

$$x_t = \rho_x x_{t-1} - \rho_r \, \sigma \text{mci}_t + \rho_f \, x_t^f \text{ (I)}$$

$$\text{mci}_t = \sigma_\text{r} \left(r_t - \left(\bar{r}_t^* + r_{ct}^*\right)\right) - (1 - \sigma_r)(z_t - z_t^*) \text{ (II)}$$

Real exchange rate deviations from equilibrium levels affect monetary conditions and aggregate demand. In equation (II), the real exchange rate z_t is defined as the sum of the log nominal exchange rate s_t and the (log) terms of trade $[p_t^f - p_t]$. The equilibrium level z_t^* can be defined as the level consistent with both internal and external balances in the long term. An appreciating real effective exchange rate relative to its equilibrium level implies tighter monetary conditions, which pass through to aggregate demand. Equation (I) also implies that the foreign output gap, x_t^f, has direct implications for the extent of tightening required to close the output gap. A larger foreign output gap requires tighter monetary policy for longer to achieve price stability objectives. Exchange rates are linked to the interest rate through an uncovered interest parity condition:

$$E_t \, \Delta s_{t+1} = \left(i_t - i_t^f - prem_t\right) \text{ (III)}$$

Expected changes in the nominal exchange rate are linked to nominal interest rate differentials and a country-specific risk premium. Shocks to risk premia, $prem_t$, that induce real exchange rate changes could alter the desired level of short-term nominal rates, depending on the way in which these changes pass through to aggregate demand. More generally, as highlighted by Obstfeld (2023), external balance considerations may have consequences for the assessment of the natural levels of the real exchange rate and the real interest rate. For example, persistently elevated excess savings could push downward domestic neutral rates in search of yield.

The sensitivity of real exchange rates to nominal interest rate differentials between the domestic economy vis-à-vis the world will influence desired interest rate changes. The more real exchange rates respond to changes in short-term rates relative to foreign short-term rates, the less monetary policy would have to adjust to achieve a tighter stance. Conversely, a weaker deviation of real exchange rates from equilibrium levels would imply that monetary policy might need to remain tighter for longer to achieve central bank objectives. Deeper parameters such as the degree of openness will determine the relative sensitivity of output to real exchange rate changes, such that greater openness would imply stronger effects of terms of trade changes on aggregate demand.

For small open economies, the natural interest rate also depends positively on expected world output growth (Clarida, Gali, and Gertler 2001). Higher potential and expected output growth in large trading partners will generally raise the natural rate of interest in small open economies. This has implications for the monetary policy stance: all else equal, higher expected world output growth requires domestic real short-term rates to be higher to maintain a neutral stance.

Despite the usefulness of MCIs in assessing the monetary stance, judgment should always be applied. As highlighted by several authors (for example, Svensson 2001; Laidler 2020), caution is needed in interpreting MCIs when exchange rates move in response to shocks other than monetary policy. These situations are typically characterized by exchange rate depreciations (appreciations) that lead to tighter (looser) domestic financing conditions. A mechanical reading of MCIs with such a depreciation (appreciation) would imply looser (tighter) monetary conditions, even though output declines (rises), and hence suboptimal interest rate policy prescriptions. Eika, Ericsson, and Nymoen (1996) also point to some analytical and empirical properties of methods used to construct MCI weights as other challenges with deploying MCIs for monetary policy analysis.

Measuring Real Short-Term Interest Rates

Measuring the real policy interest rate involves deflating the nominal short-term policy rate by a measure of inflation expectations rather than realized inflation. Accounting for expected changes in prices will reflect more accurately agents' incentives for consumption, savings, and investment (Fisher 1930). This is because consumption, savings, and investment decisions—which depend on real interest rates—are intertemporal and depend on agents' perception of future economic outcomes, including inflation. Inflation expectations can also be seen through temporary volatility, because of commodity price movements. In a general form, r_t is the difference between the nominal interest rate i_t and the corresponding inflation expectations for a given time horizon, as presented in equation (2a):

$$r_t = i_t - E_t\pi_{t+1}, \qquad (2a)$$

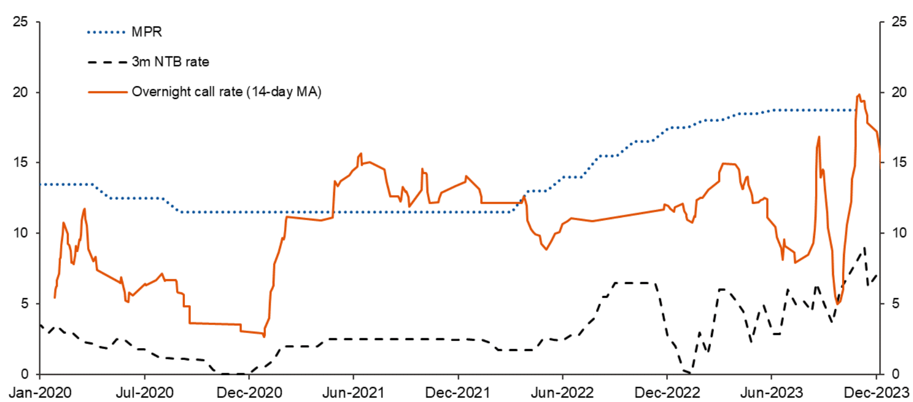
where $E_t\pi_{t+1}$ is the annualized expected percent change in the price level between time t and $t+1$.[8]

The precise definition of the short-term nominal policy rate varies across countries. The designated policy rate could be the interest rate associated with specific central bank instruments—such as the deposit facility rate, marginal lending rate, (reverse) repo rate—or the policy rate could reflect the operational target, such as the overnight interbank lending rate. In many countries, there is a sizable disconnect between the policy rate and other short-term rates, such as interbank market rates or sovereign bond yields, because of the level of liquidity in the financial system, insufficiently developed interbank systems, vulnerabilities in key intermediation counterparties, or the conflicting use of multiple monetary instruments (see Figure 2 for an example of Nigerian short-term rates). In these cases, other more short-term market rates may be a more appropriate gauge of the actual stance than the central bank monetary policy rates. In addition, where the domestic bond markets are developed and monetary policy rates anchor well the sovereign yield curve, the technique described in Box 2 can be used to assess monetary policy stance based on sovereign bond yield data.

Figure 2. Nigeria: Short-Term Interest Rates

(Percent)

The Nigerian banking sector experiences excess liquidity, resulting in a significant disparity between the monetary policy rate (MPR) and the overnight call rate in the interbank market. The wide corridor of the policy rate has also led to volatility in the interbank market. Meanwhile, the authorities actively use Cash Reserve Requirement to manage liquidity and the transmission from the main monetary policy instruments to the bond market is impaired. In this case, some moving averages of the overnight call rate may best reflect the comprehensive monetary policy



Sources: EUROPACE AG/Haver Analytics; and Central Bank of Nigeria.

Expectations about future short rates also matter for the policy stance. To capture this, it is useful to consider risk-free rates at a one-to-three–year horizon, and probably somewhat longer horizons for some advanced economies. Financial variables and agents' investment, savings, and consumption decisions are affected not only by the current level of the policy rate but, importantly, also by expectations about the future path of policy rates. And central banks can (and do) influence these expectations through their policy communications. Therefore, an arguably more complete measure of the central bank's policy stance can be obtained by looking

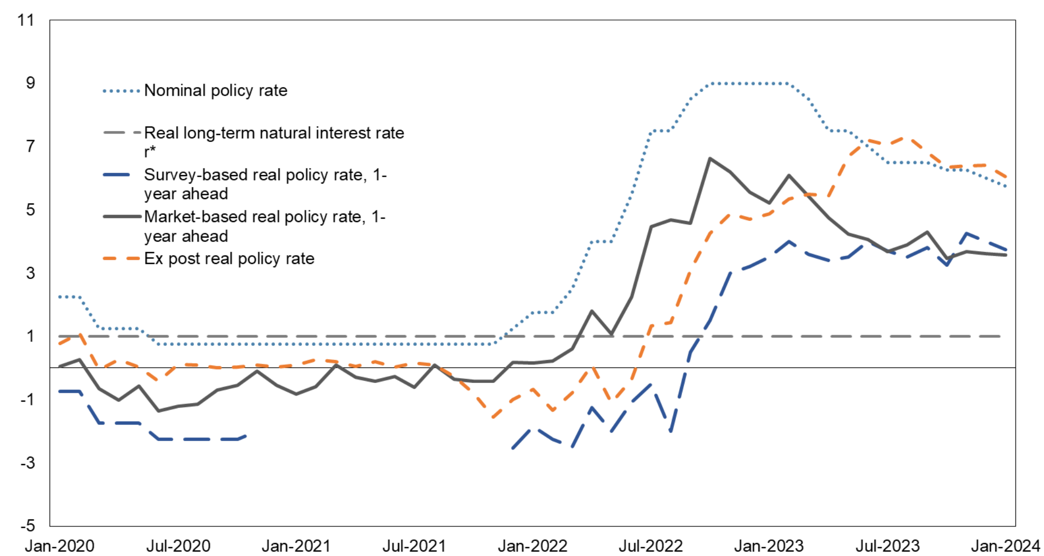
[8] Thus, expected inflation should be interpreted as measured over the same medium-term horizon as the real interest rate.

at somewhat longer (market) rates that reflect agents' expectations about the policy rate's future path. In particular, risk-free rates at a one-to-three–year horizon may often be thought of as suitable measures of where agents expect monetary policy rates to peak (bottom out) during a tightening (loosening) phase, given expectations about the economic outlook and the central bank's reaction function.[9]

To derive real rates, ideally, a range of measures of inflation expectations should be used. The horizon of the inflation expectations should correspond to the horizon of the nominal interest rates.[10] There is no single perfect measure of inflation expectations (see, for example, Reis 2023).[11] Therefore, to the extent possible, reporting real interest rates deflated with different inflation expectation measures is desirable, not least because disagreement about inflation expectations is also informative about underlying price pressures (Mankiw, Reis, and Wolfers 2003). For example, between survey and market-based inflation expectation measures in Costa Rica (see Figure 3), there is a gap of six months regarding when the stance became restrictive. Assessment of the stance should account for this uncertainty. Nonetheless, toward early 2024, there emerges a clearer consensus on the stance based on both measures.

Figure 3. Costa Rica: Nominal and Real Interest Rates

(Percent)



Sources: Banco Central de Costa Rica; Costa Rica Instituto Nacional de Estadistica y Censos; and IMF staff calculations.

Note: The main indicator for assessing the Banco Central de Costa Rica (BCCR)'s monetary stance is the gap between the real policy rate and the real neutral rate. The BCCR estimates that the real neutral rate is 1 percent. Staff define the real policy rate as the nominal policy rate less the one-year ahead median survey-based inflation expectations. Ex post real policy rate is deflated by core inflation.

The frequency, timeliness, reliability, and the correlation between the available measures of inflation expectations and future inflation can inform the selection of the most relevant indicators. However, typically, more weight should be given to survey-based measures if such data are frequent and reliable. Market-based

[9] For economies in which loans tend to be of fixed rate and at longer tenures, say five to ten years or longer, it is desirable to put some weight on the stance of policy at a longer horizon to gauge the overall stance of policy (as well as at a medium-term horizon). Doing so helps capture the effects of quantitative easing, which operates at longer horizon (see the discussion in the "Other Monetary Instruments" section).

[10] There are some exceptions, such as using one-year ahead inflation expectations to deflate very short-term nominal interest rates (less than one year) because of the lack of shorter inflation expectation measures.

[11] Reis (2023) highlights four common mistakes when selecting inflation expectation measures, which are (1) to focus only on firms' expectations because firms set prices, but firms' expectations are also the result of household and financial markets' expectations, who provide the inputs, (2) to focus on the big players because their choices drive aggregates, whereas it is the marginal agent whose expectation deviates the most from forecast that matters, (3) to focus on the measures with smaller forecast errors, whereas it is the transmission from expectation to action that matters, and measurement errors or biases in survey can be addressed, and (4) to focus on the expectations that policy can move, such as financial markets, but they often overreact.

inflation expectations are often more volatile and contain risk premiums (Evans 1998). Meanwhile, survey-based measures permit better identification of the expectations of inflation versus risk premiums, and household inflation expectations could in fact transmit the most to real activity. Information from surveys also captures perceived structural changes that are not well summarized by historical data or econometric equations, such as changes in tax laws, perceived shifts in the long-term inflation goals of policy, or changes in perceptions of policy credibility (Kozicki and Tinsley 2012). Survey-based measures also often exhibit systematic and quantitatively important deviations from full-information rational expectations (Coibion, Gorodnichenko, and Kamdar 2018). Research by the US Federal Reserve (Chan, Clark, and Koop 2018), Bank of Canada (Kozicki and Tinsley 2012), and Reserve Bank of Australia (Cusbert 2017) shows how to construct a composite index of inflation expectations. Given that constructing such an index relies on historical estimates of weights and the correlation among various measures, there will inevitably be estimation errors.

In some cases, it may be useful to consider realized (core) inflation as a deflator. If measures of inflation expectations are unavailable—as is often the case for lower-income countries—core inflation could be a useful alternative for deflating the nominal policy rate. Measures of core inflation that strip out the more volatile components of inflation—thus, better reflecting underlying price pressures—may help forecast future inflation and reasonably proxy agents' inflation expectations. Core inflation is preferred to headline inflation in these cases to "look through" temporary volatility that may not affect near-to-medium–term decision making.

Measuring the Natural and Neutral Real Interest Rates

The terms natural and neutral rates have often been used interchangeably and interpreted in two ways: (1) as a slow-moving medium-to-long–term variable and (2) as a more short-term variable with a substantial cyclical component. The first concept reflects the long-term rate of return on investment and balances desired savings and desired investments. This concept of $\bar{r}_t^*$ is driven by factors such as demographics, inequality, productivity, and financial development, which change only slowly. The recent literature often refers to this rate as the natural real interest rate (Platzer and Peruffo 2022; Obstfeld 2023). The second concept is closer to the original Wicksellian definition in which r_t^* is the real short-term interest rate that would prevail if the output gap were closed and inflation were stable (Wicksell 1936). In this second concept, r_t^* is the rate that maintains an economy in equilibrium during the business cycle (or does not interfere with the autonomous return to equilibrium of an economy initially in disequilibrium). Thus, setting the real policy rate at r_t^* would imply a neutral monetary stance, one that does not interfere with the ongoing dynamics in the economy.

As a benchmark for measuring the monetary policy stance, a short-to-medium–term neutral rate r_t^* is preferable because it incorporates cyclical factors and higher-frequency considerations. Setting the policy rate relative to a short-term concept of r_t^* ensures the interest rate gap moves more proportionally with the output gap measures. As noted in the previous section, abstracting from higher-frequency considerations produces an incorrect assessment of the policy stance when credit risks are high. For example, during the European sovereign debt crisis, a more cyclical measure of r_t^* that accounts for the credit crunch and sharp rise in spreads would be much lower than a long-term measure of $\bar{r}_t^*$.[12] This implies that returning the economy to an equilibrium would require a much lower interest rate and more accommodative monetary policy (see Arena and others 2020). Ignoring such dynamics would result in an overly tight stance.

There are various structural and market-based approaches to estimate r_t^*, including those allowing for financial condition measures. Structural approaches rely on economic relationships, whereas market-based approaches reveal what market participants assume r_t^* to be. In all model-based approaches, the real short-term interest rate fed into the estimation procedure should be consistent with the real rate that best reflects the policy stance. The following list is not exhaustive:

- Reduced-form models such as variations of the seminal Laubach and Williams (2003) framework produce medium-term equilibrium estimates. The intuition of these models is that the interest rate gap mirrors the changes in inflation gap and output gap in the IS and Phillips curves. These models, therefore, first derive estimates of the output gap from the inflation gap and subsequently infer the interest rate gap. By using the short-term nominal rate and the near-term inflation expectations, the model then backs out the estimates for r_t^*. Following up on the Laubach and Williams (2003) paper, Holston, Laubach, and Williams (2017, 2023) provide real-time estimates of r^* for the United Kingdom, the United States, the euro area (https://www.newyorkfed.org/research/policy/rstar), and previously Canada.[13] In the context of small open economies or emerging markets, it is important to account for (external) financial variables such as credit spread and the exchange rates. In the Laubach and Williams framework, this can be accomplished by modifying the equation for the gap z_t between trend growth and r_t^*. Instead of assuming that z_t follows an autoregressive process, it can be driven by additional financial variables (see Pescatori and Turunen 2015; Arena and others 2020). See Box 1 for discussions on r^* considerations for small open economies.

- Many central banks rely on semistructural models for forecasting and policy analysis that can estimate r_t^*. Some country teams have also developed semistructural models and use them to support their own

[12] A long-term average of return on capital includes duration and credit risks. Increasing spreads between the rate of return on capital and the risk-free rate reduce desired investment. If these risks are large and excluded, a risk-free short-term natural rate *r** should be much lower. During the European sovereign debt crisis, the yields on sovereign bonds in some member states experienced a substantial increase, leading to a short-term estimate of *r** that was lower in comparison to its long-term counterpart.

[13] Estimates were paused during the pandemic but have since resumed (with modifications to account for the large pandemic shock).

forecasting and policy analysis. See Pranovich and others (2021) for a reference list of published semistructural quarterly projection models, supported by Fund technical assistance.

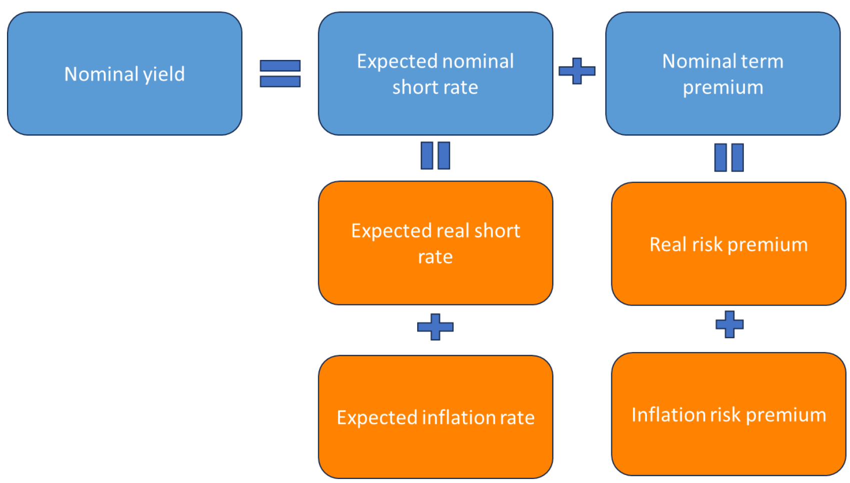
In practice, because a short-term r_t^* may be difficult to estimate, a long-term $\bar{r}_t^*$ can also be used. Using $\bar{r}_t^*$ is less data-intensive and less fraught with estimation challenges. It is also easier to communicate, rendering it possibly less contentious for policy dialogue. Nonetheless, accounting for the deviation between short-term r_t^* and long-term $\bar{r}_t^*$ (with the gap denoted as r_{ct}^*) is important to accurately measure the stance. As noted in the previous section, measures of financial conditions can provide information on the sign of current deviation. At the onset of the COVID-19 pandemic, many economies suffered from massive supply shocks, which would imply a drop in r_t^* even though it was difficult to estimate r_t^* precisely owing to limited data availability. Keeping policy rates and other monetary policy instruments the same would have resulted in a tighter stance for a brief period.

Long-term $\bar{r}_t^*$ measures can be derived in a few simple ways:

- Central bank long-horizon forecasts or surveys of market participants can be used as a measure of $\bar{r}_t^*$, or it may be derived from financial markets. Some central banks publish forecasts of the policy rate path at longer horizons (say five or more years); coupled with the central bank's inflation target, this can provide a measure of long-term $\bar{r}_t^*$. Such information can also often be gleaned from surveys of market participants (for example, the European Central Bank Survey of Monetary Analysts). Alternatively, financial market data can be used to assess the market's implicit "views" on the future path of r_t^*. Where such markets exist and are sufficiently liquid, the forward swap market on government debt can provide an indication of the future path of short rates. Concretely, the three-month government bond yield five years ahead, adjusted for the corresponding inflation expectations, can be used to determine the market expected $\bar{r}_t^*$.

- Term structure models can be used to fit the yield curve of sovereign bonds to derive the implied long-term path of real short rates. The long-term sovereign bond yield consists of two components: the expected path of the nominal short-term rate and the nominal term premium. The former can be further decomposed into expected inflation and the expected real short rate, whereas the latter consists of the real term premium and inflation risk premium (Figure 4). All four components can be estimated jointly as in Hördahl and Tristani (2014) or Abrahams and others (2015). Alternatively, most term structure models, including the Nelson-Siegal model (Christensen, Diebold, and Rudebusch 2011) and the ACM model developed by Adrian, Crump, and Moench (2013), can be used to back out the expected nominal short-rate path. Deflating this measure with the corresponding market- or survey-based inflation expectations provides a market-based measure of r_t^*. At a 5-to-10–year horizon, this can be a good proxy for $\bar{r}_t^*$ (see Box 2).

Figure 4. Decomposition of Nominal Bond Yield



Source: Staff illustration.

- Factor models proposed by Del Negro and others (2017, 2019) require few variables to produce a long-term trend estimate of the real short-term rate r_t as a proxy for $\bar{r}_t^*$. Using short-term rates, long-term rates, and (expected) inflation, these models extract $\bar{r}_t^*$ as a deep trend of real short-term interest rates.[14] The 2019 version of the model allows for a common factor across countries. This methodology is relatively simple to apply if there are long time series of the three variables mentioned in the earlier section although it requires calibrating the priors for the Bayesian estimation.

- $\bar{r}_t^*$ can also be approximated with an estimate of long-term potential growth. This approach rests on optimal conditions for savings being linked to trend growth and a balanced growth path in standard neoclassical growth models (Ramsey 1928; Solow 1956). For certain parameterizations of the neoclassical growth model, the natural rate is equal to the sum of the growth rate of per capita consumption and population growth, which in turn tracks potential income growth. Under this condition, the economy grows at its potential growth rate without any inflationary pressures or underutilization of resources. The degree of fluctuations in the estimate of potential growth will determine how slow-moving $\bar{r}_t^*$ is. Judgment should be applied about whether there are factors creating a gap between $\bar{r}_t^*$ and potential growth.

- The list of secular factors driving global $\bar{r}_t^*$ in Rachel and Smith (2017)[15] can be a good starting point for cross-country comparisons. Platzer and Peruffo (2022) provide a unified framework to quantify the contributions of these long-term factors in a heterogeneous overlapping generation model. An overview of this framework can be found in Chapter 2 of the April 2023 *World Economic Outlook*. A subsequent paper by Grigoli, Platzer, and Tietz (2023) applies this methodology to estimate long-term $\bar{r}_t^*$ for five advanced and three emerging market economies.

[14] These use a Kalman filter with Bayesian estimation techniques.

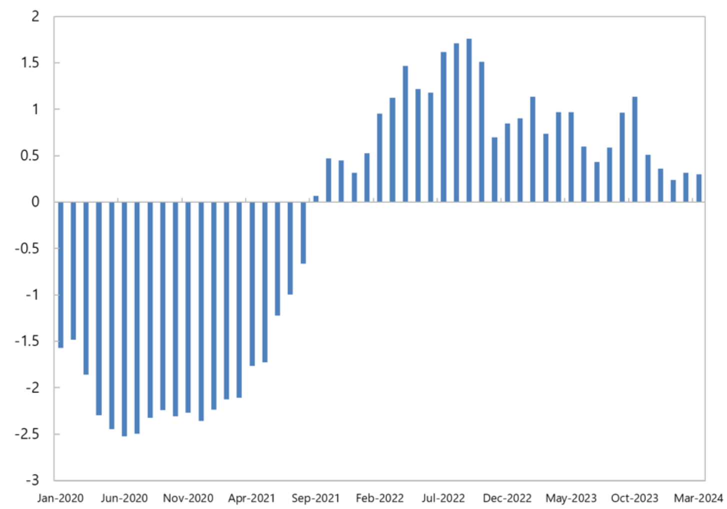
[15] The authors find that the decline in global *r** is difficult to explain only by changes in global growth and that shifts in savings and investment preferences have played a vital role. In their view, negative demographic forces, higher inequality within countries, and increased desired savings by emerging market governments have increased desired saving. And a decline in the relative price of capital, lower public investment projects, and the increasing spread between the rate of return on capital and the risk-free rate have reduced desired investment.

Box 2. Using Yield Curve Slope as an Indicator of the Policy Stance—Example of Chile

As discussed in the previous section, the sovereign yield curve can be decomposed using a term structure model to derive the path of the expected real short rate, providing a market-based estimate of $\bar{r}_t^*$. At the same time, the short-term yield in real terms can proxy for r_t so that, putting the two variables together, the slope of the (risk-adjusted) yield curve provides a market-based estimate of $r_t - \bar{r}_t^*$.

Box Figure 2.1 illustrates this approach for Chile and charts the difference between the risk-adjusted 2-year and 10-year yields, each deflated by inflation expectations at a short- and long-term horizon, respectively. Over the four years shown, the evolution of the yield curve indicated a sharp tightening of the monetary policy stance between the end of 2020 and mid-2022, with a gradual loosening thereafter.

Box Figure 2.1. Chile: Slope of the Risk-Adjusted Real Yield Curve[1]



Sources: EUROPACE AG/Haver Analytics; Bloomberg; and Staff calculations.

[1]Shown here is the difference between (2-year risk-neutral nominal rate minus 1y1y inflation expectations) and (10-year risk neutral nominal rate minus 5y5y inflation expectations). The risk-neutral rate is obtained using ACM (Adrian, Crump, and Moench 2013) term structure model.

Results need to be interpreted carefully. As discussed in the "Conceptual Framework" section and equation (1b), to achieve an appropriate monetary policy stance, central banks need to consider not just the long-term natural interest rate but also the more cyclical component r_{ct}^*. This cyclical component can capture more temporary shocks, including shocks to financial conditions. To the extent that the short-term (three-month, one-year, or two-year) sovereign yield encompasses some of the risk premiums, there will be some overlap between this measure and r_{ct}^*.

Overall, given the considerable uncertainty around any estimates of r^* (including with term structure models), the slope of the risk-adjusted real yield curve can usefully complement other methodologies for a holistic assessment of the stance.

Where data are really constrained, domestic natural rates can be derived from a long-term average of the spread between the country's real interest rate and that of a closely linked advanced economy. This spread could then be added to the available estimates of $\bar{r}_t^*$ for the advanced economy. Regression methods could relate these spreads to country characteristics and generate projections for $\bar{r}_t^*$ with estimated coefficients.

When facing particularly high uncertainty in estimating neutral rates, country teams could usefully report a range rather than just a point estimate. For example, based on a suite of semistructural and univariate methods, estimates of Costa Rica's r_t^* are between 0 and 3 percent, and in 2023, it was deemed to be close to 1 percent (see Wales 2023 [IMF 2023]).[16] In addition, to formulate an appropriate policy response amid an active loosening or tightening cycle, particularly in times of highly uncertain inflation dynamics, there are advantages to adopting a robust approach embodying a "better safe than sorry" philosophy (see Brandao-Marques, Meeks, and Nguyen 2024). In practice, this entails placing greater reliance on r_t^* estimates that require a more proactive monetary policy response to inflation. As outlined in the "'Conceptual Framework" section, considerations such as the economic slack and the speed of transmission will help country teams make a judgment on the necessary policy response.

[16] Recent staff reports also cite various estimates, including Albania 2023, Colombia 2024, and Georgia 2024, among others.

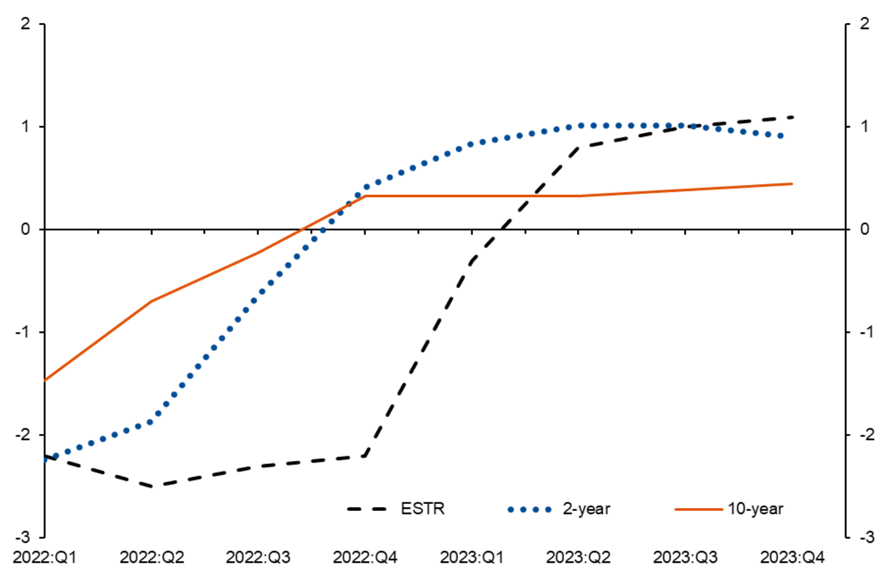
Considerations Related to Transmission

Considering issues related to monetary transmission is also critical to assess the effectiveness of monetary policy and the appropriateness of the stance. There are several channels through which changes in policy rates help reach the ultimate objective of controlling inflation. Without transmission friction, the short-term nominal policy rate should move short-term market rates, which in turn influence long-term rates and overall financial conditions in the economy. Financial conditions, then, will affect investment and consumption decisions and thereby aggregate demand and the output gap. The changes in aggregate demand, in turn, will affect the inflation outlook after some time. How the short-term policy rate affects market rates and long-term interest rates can guide the selection of the appropriate measure of *r* in equation (1a). Next, factors affecting the transmission from interest rates to the output gap can be grouped into two categories: (1) fast-moving changes in financial conditions that are mostly captured by the variable r^{*}_{ct} and (2) more structural country-specific characteristics that influence the strength of the interest rate channel of monetary policy transmission, summarized by parameter σ in equation (1a).

First, it is important to consider the transmission from the policy rate to other market rates. As mentioned in the previous section, even at the overnight maturity, the policy rates and interbank lending rates may diverge because of the liquidity in the system and the use of other monetary tools. Going further out, longer-term interest rates, which often serve as a benchmark for pricing private securities, may also move out of sync with policy rates, including because of the term premium dynamics. If these benchmark long-term rates, for example, sovereign bond yields, are relevant for the real activity, the stance assessment can be complemented with various horizons[17] of longer-term nominal interest rate (see example of euro area in Figure 5). This will also allow for an assessment of how the stance could evolve in the future. In deflating the nominal rate, the horizon of the inflation expectation measures should align with whichever horizon is selected for the nominal rate. This same horizon should be used to estimate either the short-to-medium neutral or natural rate.

Figure 5. Euro Area Ex Ante Real Interest Rates

(Percent)



Sources: Bloomberg Finance L.P.; and IMF staff calculations.

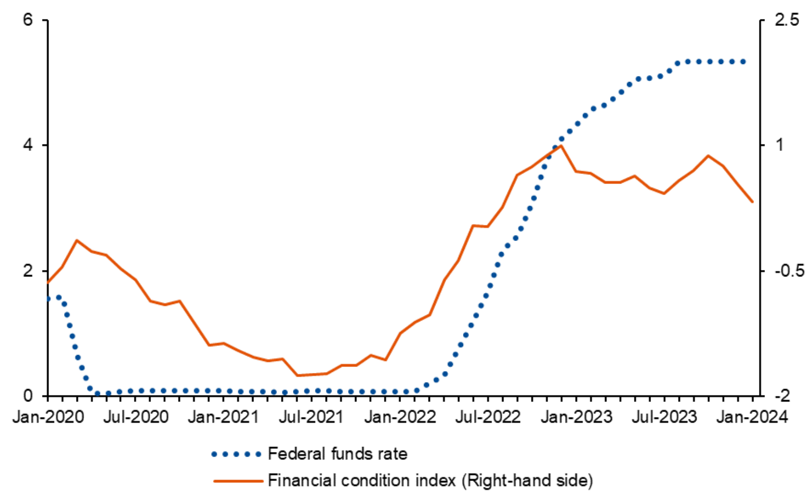
Note: Ex ante real rates are the difference between the euro area Overnight Index Swap (OIS) rates and market-implied inflation expectations for the same time horizon. The ex ante euro short-term rate (ESTR) shown here is deflated by one-year inflation from the Survey of Professional Forecaster.

Second, broader financial conditions are important and can change fast and sometimes disproportionately

[17] In economies with more developed financial systems, a two- to five-year nominal government bond might be the basis for most economy-wide borrowing and lending rates and, therefore, most relevant for real activity. For simplicity, the relevant horizon could be chosen to match country-specific moments of debt maturity. Figure 2.3 of the World Bank Enterprise Surveys show that the average maturity of loans or credit is about two, three, and five years for low-, middle-, and high-income countries, respectively.

compared with changes in policy interest rates. The relationship between financial conditions and policy rates varies based on how financial conditions are defined and measured. Measures that emphasize volatility and risk premiums (Monetary and Capital Markets Department Financial Condition Index [FCI], Adrian, Duarte, and Iyer 2023) are closely tied to the concept of financial frictions. In such scenarios, the effect of financial conditions can be asymmetric: when financial frictions are present, the appropriate policy rate is lower than the natural rate $\bar{r}_t^*$, all else equal (De Fiore and Tristani 2013). Conversely, in a frictionless market, the policy rate naturally aligns with the natural rate (again absent other shocks). Other measures of financial conditions can be broader, capturing various drivers of financial liabilities in the economy (Borraccia and others 2023), and the relationship with monetary policy stance is more symmetrical. Most measures of financial conditions aim to capture the dynamics of prices and quantities of risk in the economy, including shifts in market sentiment. Swings in market sentiment have the potential to either dampen or magnify the impact of interest rate adjustments. For example, when uncertainty about the outlook or the central bank's reaction function intensifies, risk premiums typically increase. This, in turn, escalates the financing costs for households, firms, and governments. The initial adjustment in interest rates can unexpectedly and significantly affect the overall financing conditions. Vice versa, even as central banks continue to raise interest rates, more clarity on the outlook may lower risk premiums, offsetting the intended tightening effect. It is important to consider such developments in financial conditions because looser-than-intended conditions may require further policy tightening (see example of the United States in Figure 6). This said, it is important to realize that risk premiums could change much faster than the transmission of policy rate changes. Box 3.1 in Chapter 3 of the April 2017 *Global Financial Stability Report* (https://www.imf.org/-/media/Files/Publications/GFSR/2017/April/ch3.ashx) provides a nice summary of the evolution of FCIs in the literature. Although monetary policy should not respond directly to every change in FCIs, considerations of how FCIs affect the transmission of interest rates to the real economies are crucial. Persistent divergence between FCIs and the direction of interest rate changes may require adjusting the stance. Empirically, FCIs can be incorporated into the measure of the short-term r_t^* through methods that capture the impact of FCIs on output and inflation gaps (see "Measuring the Natural and Neutral Real Interest Rates" section).

Figure 6. United States: Federal Funds Rate and Financial Condition Index



Source: Federal Reserve Board.

Exchange rate movements can also play a key role in the transmission of monetary policy, especially in small open economies and emerging market and developing economies. Indeed, in many low-income countries, the exchange rate is the primary channel through which monetary policy affects the economy (Brandao-Marques and others 2020). In gauging the effective monetary policy stance, it is, therefore, important to also assess movements in the exchange rate and how these affect the economy. Monetary conditions indexes (MCIs) can provide a useful summary measure of the combined economic influence exerted by interest rates and the exchange rate. Such indexes represent a weighted average of the short-term interest rate and the exchange rate, enabling central banks to proactively respond to exchange rate fluctuations. Several small open-economy central banks, such as the Bank of Canada and the New Zealand Reserve Bank, have historically used such indexes in the calibration of their policy stance, and several other central banks continue to use MCIs for monitoring purposes.

Finally, there may be slow-moving structural factors that affect the transmission of monetary policy to the real economy to be considered. Such factors include, for instance, the credibility of the central bank, central bank solvency and profitability concerns, the functioning of the banking sector with potentially uneven liquidity distribution, shallow and fragmented money markets, the presence of shadow banking or parallel exchange rates, the strength of private sector balance sheets, the lack of access to credit, the average interest rate–fixation periods on long-term borrowing such as mortgages, the bank–sovereign nexus, and fiscal dominance.[18] Within the framework outlined in the previous section, such considerations can be subsumed into parameter σ in equation (1a), which can be estimated for the whole sample period or for specific intervals after significant structural breaks.

[18] For example, Brandao-Marques and others (2020) show that monetary policy frameworks play a crucial role in determining the strength of transmission. Also, countries with inflation-targeting regimes, greater central bank independence, and transparency tend to have more robust transmission.

Other Monetary Instruments

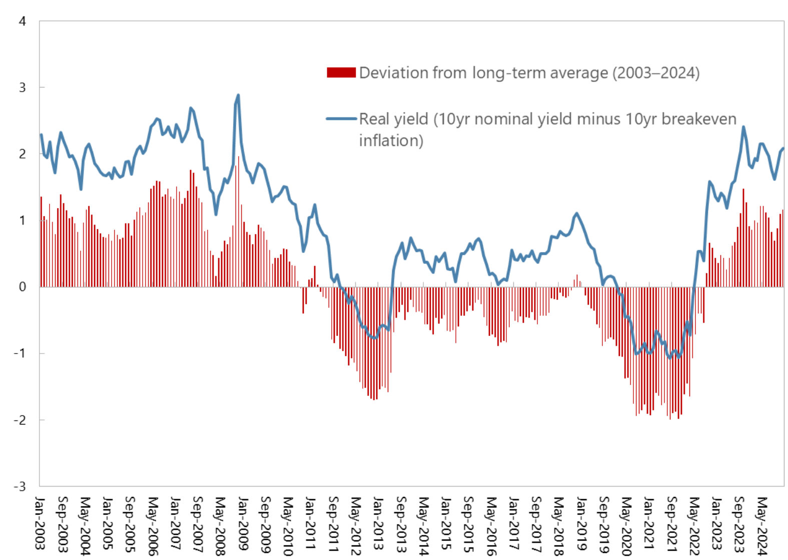
In some cases, other monetary policy tools than interest rates need to be considered to accurately gauge the overall policy stance. These other instruments often have dual objectives: they can be used either to adjust the stance as a complement to the policy rate or to mainly improve monetary policy transmission. For example, large-scale asset purchases or quantitative easing (QE) can ease financial conditions and depress long-term yields, implying an easing of monetary policy when the policy rate approaches its effective lower bound. QE can also improve monetary policy transmission in case of an excessive increase in sovereign bond risk premiums. Similarly, reserve requirements and other instruments such as foreign exchange interventions (FXI) can affect the policy stance and the transmission of the policy rate. In practice, these two objectives are not orthogonal to each other because better transmission allows for smaller interest rate adjustments. Although these instruments and their objectives are connected, they also exhibit some level of substitutability, where the increased use of one may diminish the necessity of the other.

The effects of QE should be mostly captured by the real yield on longer-term government bonds. QE lowers long-term bond yields through the signaling and portfolio rebalancing channels. The former acts through forward guidance about the expected path of the short-term interest rates, whereas the latter compresses term premium. To see this formally, it is helpful to express the real yield on long-term bond r_t^L in terms of two components, the expected real policy rate path and the term premium denoted as ϕ:

$$r_t^L = E_t \frac{1}{L}\left\{\sum_{j=0}^{L-1}\left(i_{t+j} - \pi_{t+1+j}\right) + \phi_{t+j}\right\} \qquad (2b)$$

When QE is actively used by a central bank, actual financing costs are lower than what is suggested by the policy rate, and the overall policy stance is more accommodative (and indeed, even maintaining a large portfolio of long-term government bonds on the central bank balance sheet should push in this direction by removing duration risk). To take account of the effects of QE, it is helpful to consider the real interest rate gap not only at a medium-term horizon as suggested in "**Considerations Related to Transmission**" section but also at longer horizons such as 10 years. The latter can be measured by comparing the current real yield on a government bond with its "steady-state" average value, which includes the average level of the term premium (see example of the United States in Figure 7).[19] By doing so, we are assuming that (1) the expected real short rate will return to its equilibrium by the end of this horizon and (2) the equilibrium r^* remains unchanged.[20] Intuitively, QE coupled with forward guidance provides policy stimulus when it

Figure 7. United States: 10-Year Treasury Real Yield and Deviations



Sources: Federal Reserve Economic Data and Staff calculations.

[19] As suggested earlier in footnote 6, although central banks may influence longer-term yields through forward guidance and asset purchases, their control is clearly limited (for example, other factors such as the fiscal stance may markedly affect term premiums).

[20] Given that $\bar{r}_t^*$ can exhibit a long-term trend, it would be more appropriate to use a more recent period that captures both before and after QE to calculate the historical averages of real bond yields.

depresses both the expected policy path and the term premium substantially below their steady-state values.[21]

The use of other tools can affect the policy stance:

- FXI and capital flow management are supporting tools that affect financing conditions in the economy and may be used to help insulate the economy from external shocks and potentially improve policy trade-offs (even though their effects may be temporary and limited).[22] In principle, their effects should also be incorporated to assess the stance, including by using an MCI as discussed in the "Considerations Related to Transmission" section and Box 1. Even so, their effects can be complicated to assess. For example, one effect of FX sales is to appreciate the exchange rate for a given real interest rate path, which would, all else equal, be contractionary for aggregate demand: in terms of equation (1b), it would lower r_{ct}^*. But these sales—especially if driven by capital outflows—could have a substantial effect in easing financial conditions, which would boost r_{ct}^*. The overall impact would depend on the relative strength and persistence of these channels (which could vary depending on the country and economic context).

- Reserve requirement and other quantitative instruments can have a direct influence over the monetary stance even as quantifying their effect can be difficult. The Reserve Requirement can serve multiple objectives such as to impose liquidity buffers on financial institutions (microprudential), to increase systemwide resilience against systemic risks (macroprudential), and to implement monetary policy in different operational frameworks (Della Valle, King, and Veyrune 2022). Moreover, central banks can also directly extend or restrict on-lending activities or provide guidance to banks on the additional lending room. These credit interventions are more challenging to capture in the basic framework, likely requiring some ad hoc assessment. One approach entails examining changes in banks' lending rates to the broader economy as a proxy indicator. Capturing this channel through the FCIs may be more feasible.

[21] There is also an established literature on estimating shadow rates—counterfactual interest rates that would be consistent with observed longer-term yields even when policy rates are not changing (Wu and Xia 2016; Krippner 2012, 2013, 2020). These shadow rates can proxy for the policy rates during the effective lower bound period.

[22] FXI can improve the policy trade-off faced by a central bank where a large exchange rate depreciation may de-anchor inflation expectations or where sustained appreciation may prove deflationary. Capital flow management tools can tame large and sudden flows that would cause large movements in exchange rates as well as financial stability risks.

Considerations Related to Estimation Uncertainty

Policymakers have sometimes questioned the usefulness of the neutral rate in guiding monetary policy, especially in periods of high uncertainty. Estimating the neutral rate in real time can be challenging, even if sound and comprehensive data are available. In particular, estimates can be volatile and subject to ex post revisions, as has notably been the case during the pandemic period. Given the large modeling and estimation uncertainty surrounding the neutral rate, some have argued for a data-dependent approach, placing more weight on observed inflation than on uncertain estimates of the neutral rate (for example, Benigno and others 2024). Forecasting teams at many inflation-targeting central banks take this approach in practice, evaluating the various interest rate paths that would be consistent with guiding inflation to target within the policy horizon.

Yet classic rationales for inflation-forecast targeting arguably support giving more weight to the neutral rate when the strength and speed of monetary transmission are uncertain. Even when policymakers and their forecasting teams do not refer explicitly to neutral rate estimates in assessing the stance, such estimates do effectively guide the conditional forecasts that inform policy deliberations. First, when information is imperfect—for example, because of transmission lags or measurement challenges—expressing policy rules in terms of the forecasts of target variables rather than ex post realization becomes necessary (Svensson 1997; Clarida, Gali, and Gertler 2001; Woodford 2007). Second, such inflation forecasts should ideally be based on a structural model to ensure robustness to the Lucas critique (Lucas 1976).[23] Third, most quantitative structural models used to produce forecasts—including both semistructural and richer, dynamic, stochastic general equilibrium models—require steady-state natural or neutral rates as equilibrium prices through either estimation or calibration.

In any event, because of the uncertainties surrounding the estimation of neutral rates, for robustness, it is useful to complement the assessment of the policy stance with other metrics, particularly, as follows:

- An assessment of the stance relative to historical patterns can complement the assessment based on the neutral rate. Given that $\bar{r}_t^*$ is unobservable and difficult to estimate precisely, the $r - \bar{r}^*$ gap assessment can be complemented with an analysis of deviations of actual policy rates from predicted rates based on an estimated short-term policy rate rule. This is particularly helpful if there is an estimated policy rule that is sensible economically and also fits past policy rate developments reasonably well.

- Another variant of the Taylor rule such as the first-difference rule can circumvent challenges in estimating unobservable variables. The first-difference rule does not require knowledge of the neutral real policy rates or potential output to adjust interest rates from one period to another. The seminal paper by Orphanides and Williams (2002) has argued in favor of this rule's effectiveness, at least before the global financial crisis. However, without long-term anchors, this rule could have drawbacks, for example, it would imply a significant tightening of policy rates up to 12 percent during 2024–26 in the United States (Cleveland Fed Simple Monetary Policy Rules).[24]

- Alternatively, country teams can derive inflation projections under various interest rate assumptions to evaluate the adequacy of the current stance in achieving inflation targets. However, as discussed in the previous section, this approach still requires an understanding of the steady state and monetary policy transmission, along with some degree of confidence in the models used for inflation projections.

[23] Lindé (2001) demonstrates the quantitative importance of the Lucas critique in practice.

[24] The template on this Cleveland Fed website (https://www.clevelandfed.org/indicators-and-data/simple-monetary-policy-rules) helpfully allows users to customize their own Taylor rule.

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