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Mirror, Mirror, on the Wall, Who's the Most Hawkish Central Bank of All

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Mirror, Mirror, on the Wall, Who's the Most Hawkish Central Bank of All¹

Steve Kamin

September 7, 2023

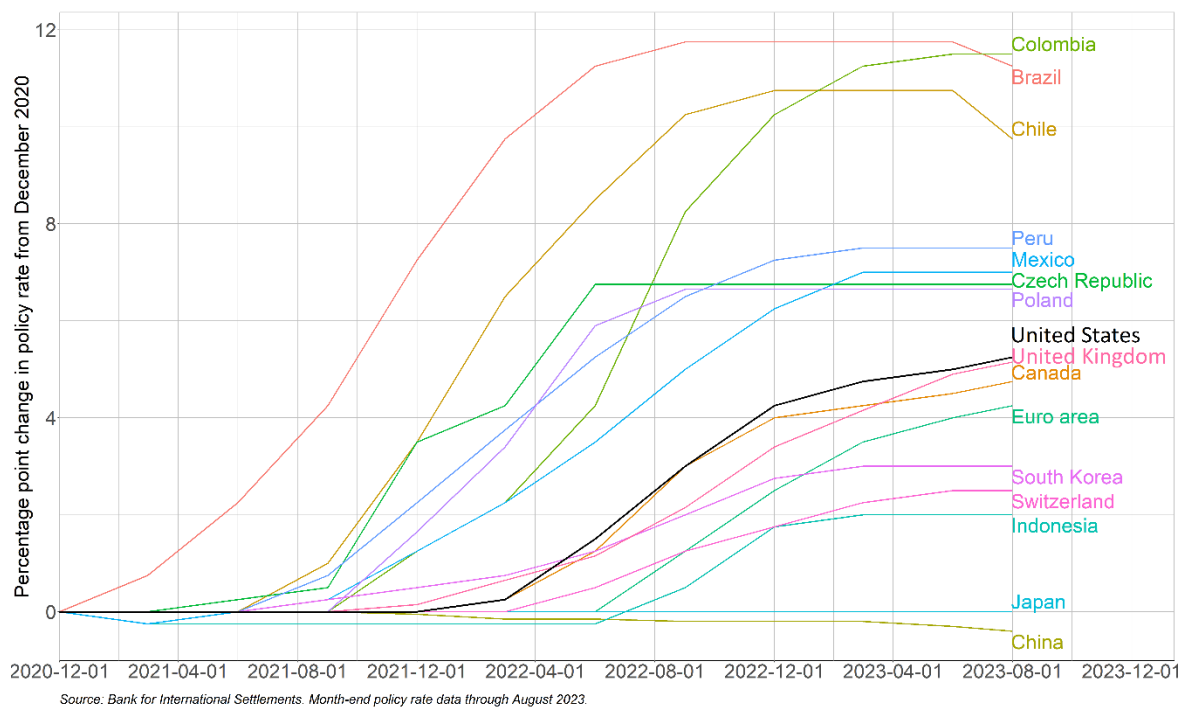
Abstract

This note assesses the relative aggressiveness with which central banks around the world have responded to the post-pandemic surge in inflation. We estimate a “cross-sectional Taylor rule” in which changes in policy interest rates since December 2020 for a range of advanced and emerging market economies are regressed on changes in core CPI inflation and in output gaps. We find that Brazil exceeded the extent of monetary tightening predicted by the estimated Taylor rule by the greatest extent; on the dovish side, Japan exhibited the greatest deviation from prediction. The Federal Reserve’s 5 ¼ percentage point hike in rates is just a little higher than the 4 ¾ percentage points predicted by the model, while both the European Central Bank and the Bank of England have tightened more than 2 percentage points less than predicted. A key determinant of these deviations from the model’s predictions is the level of pre-pandemic inflation: central banks with histories of high inflation (e.g., Brazil) are more likely to over-tighten relative to the model, whereas central banks that had struggled to push inflation up to target (Japan) are more likely to err on the dovish side.

For the past couple of years, the policy responses of central banks around the world to surging inflation have been under the microscope. But evaluating the appropriateness of monetary policymaking is difficult. To be sure, the initial timing of the monetary tightening cycle by some central banks can be criticized: as indicated by the chart below, Latin America’s major central banks, as well as those in Eastern Europe, were surprisingly proactive in their response to inflation, whereas the advanced economies appear to have been behind the curve.

¹Beatrice Lee and Aatman Vakil provided excellent research assistance on this note. All errors, including responsibility for the title, are my own.

Figure 1: Increases in Selected Policy Interest Rates Since December 2020



But beyond the timing of the start of the tightening cycle, there is no reliable guide to how quickly rates should be raised, to what level, or for how long. In part this reflects the unusually opaque nature of the global inflationary surge. It is unclear exactly what drove inflation upwards and, more recently, what's been driving it downwards. It is also unclear how much economic slowing will be needed to push inflation the rest of the way down to its target and how tight monetary policy must be to achieve that slowing. Economists often complain that their models have stopped working in the post-pandemic era, but these models were *never* precise enough to tell monetary policy committees exactly how much to tighten and how quickly to loosen.

In light of these uncertainties, this note does not compare the post-pandemic monetary policies of central banks around the world to an objective standard of optimal policy. Instead, it assesses how hawkish or dovish central banks have been relative to each other. This involves

more than merely determining which bank has raised rates the most, in which case, of the countries shown in Figure 1, Brazil wins. Rather, we seek to assess policies relative to their standard, Taylor-rule determinants – inflation and output gaps – as indicated in the standard equation for a central bank reaction function:

$$i_t = r^* + \pi_t + \beta(\pi_t - \pi^T) + \gamma(y_t - y_t^*)$$

where i is the policy interest rate, r^* is the real equilibrium interest rate, π represents year-over-year inflation, π^T the inflation target, y the level of real GDP, and y^* the level of potential GDP. In particular, we estimate a “cross-sectional Taylor rule” in which changes in policy rates since December 2020 are regressed on changes in core CPI inflation and changes in output gaps ($y - y^*$) over the same period.²

Our findings are as follows:

- The estimated cross-sectional Taylor rule explains 50 percent of the variation in increases in policy rates across central banks. Central banks have responded both to changes in inflation and in output gaps, but much more strongly to the former.
- Relative to their standard Taylor-rule determinants, Latin American central banks, and especially those of Brazil and Chile, have been most aggressive in raising rates.
- On the other side of the coin, the Bank of Japan (BOJ) stands out for having raised policy rates the least (not at all!) despite the estimated Taylor rule calling for a 6 percentage point hike. The Bank of England and the European Central Bank (ECB) are shown to also be behind the curve, by more than 2 percentage points, but much less than the BOJ.
- The Fed’s 5 ¼ percentage point hike since last year is just a little more than the 4 3/4 percentage point prediction of the estimated Taylor rule.
- The behavior of different central banks relative to their Taylor rule determinants is not random. Central banks of countries with higher pre-pandemic inflation have tended to raise interest rates by more, all else equal, than central banks of lower-inflation

²For reasons of parsimony in this simple exercise, we do not take into account changes in central bank balance sheets (quantitative tightening); it is unclear how such tightening maps into an equivalent change in policy interest rates, and it is doubtful that such mapping would be uniform across countries.

countries. But even taking that into account, Brazil and Chile stand out as being unusually hawkish and the BOJ for being unusually dovish.

I. Components of the cross-sectional Taylor rule

To start the analysis, Figure 2 focuses on the inflation component of the Taylor rule. The horizontal axis shows how much core inflation has increased in each country since December 2020, just before inflation started picking up worldwide. (Core inflation, which excludes the effect of volatile energy and good prices, is generally considered to be a more reliable indicator of underlying inflation pressures; for that reason, the Fed and other central banks tend to pay it special attention.) The vertical axis measures each country's increase in policy interest rate over that period. The equation at the top of the chart presents the intercept and slope of the regression line indicated in blue.

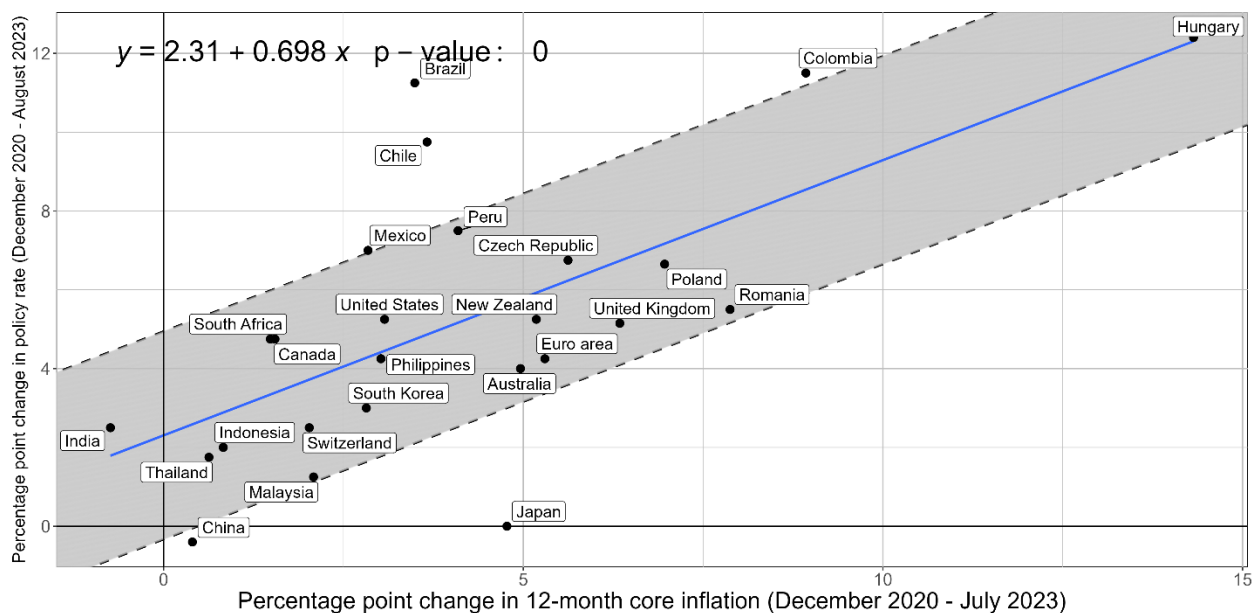
The chart makes clear, first, that countries experiencing larger increases in inflation have boosted policy interest rates by more—the slope coefficient is highly significant. (The p-value shown on the chart indicates the estimated probability that the slope of the trend line is equal to zero.)

Second, the chart identifies differences in central bank responses to inflation. The shaded region indicates increases in policy rates that are one standard deviation above or below the regression line.³ The central banks of Brazil, Chile, and Colombia, whose dots lie above the shaded region, have been especially aggressive in raising rates. Conversely, the central banks of the Eastern European economies, which also raised rates quickly and substantially, all fall near or below the trend line once their very high inflation rates are taken

³ With a normal distribution, this would encompass 68 percent of the observations.

into account. The dot for the Fed is relatively close to the trend line, despite the Fed often being criticized for being especially hawkish in raising rates (once it started). The Bank of England (BOE) and European Central Bank (ECB), on the other hand, fall moderately below the line. Finally, Japan falls well below the trend line, having kept rates unchanged despite moderate increases in inflation.

Figure 2: Increases in Core Inflation and Policy Rates Since December 2020



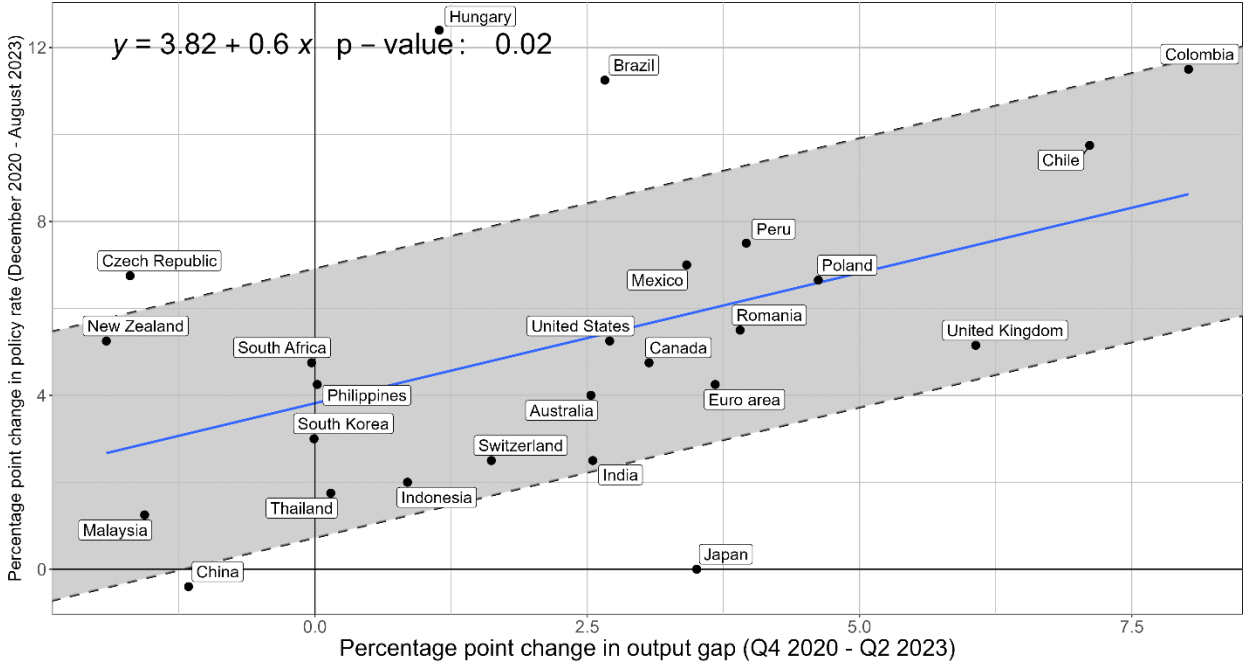
Source: Bank for International Settlements; CEIC; Trading Economics.
Core inflation for Australia and New Zealand through June 2023.

But this is not the end of the story, as it does not account for how changes in each economy’s output gap may have also affected the central banks’ policy decisions. In Figure 3, the horizontal axis now shows how much the output gap in each economy has risen since the end of 2020; the vertical axis, as before, tracks the rise in policy rates since then.⁴ There is still a statistically significant correlation between the two variables, but the relationship is much

⁴For each country, output gaps are calculated as the percent difference between real GDP and trend GDP. To calculate the latter, an HP filter with a smoothing parameter of 1600 was applied to a series comprised of actual GDP through 2019 Q4 and an ARIMA forecast of GDP over the pandemic period.

looser. Notably, as before, Brazil has raised rates much more than would be predicted by the trend line, now joined by Hungary and the Czech Republic, whereas Japan and China remain on the dovish side. The Fed remains very close to the trend line.

Figure 3: Changes in Output Gaps and Policy Rates Since End-2020



Source: Bank for International Settlements; CEIC; Trading Economics. Output gap for Brazil, Canada, India, Mexico, Poland, Romania, South Africa, Australia, and New Zealand through Q1 2023. Output gap for China through Q4 2022.

II. Predictions of the cross-sectional Taylor rule

We now put the information in Figures 2 and 3 together by estimating the following cross-section regression, whose results are shown in the first column of Table 1. The dependent variable is the rise in policy rates in each economy shown on the vertical axes of Figures 2 and 3. The explanatory variables are the changes in inflation and in the output gap shown on the horizontal axes of the above charts. The coefficients are positive and statistically significant, especially the one on inflation.

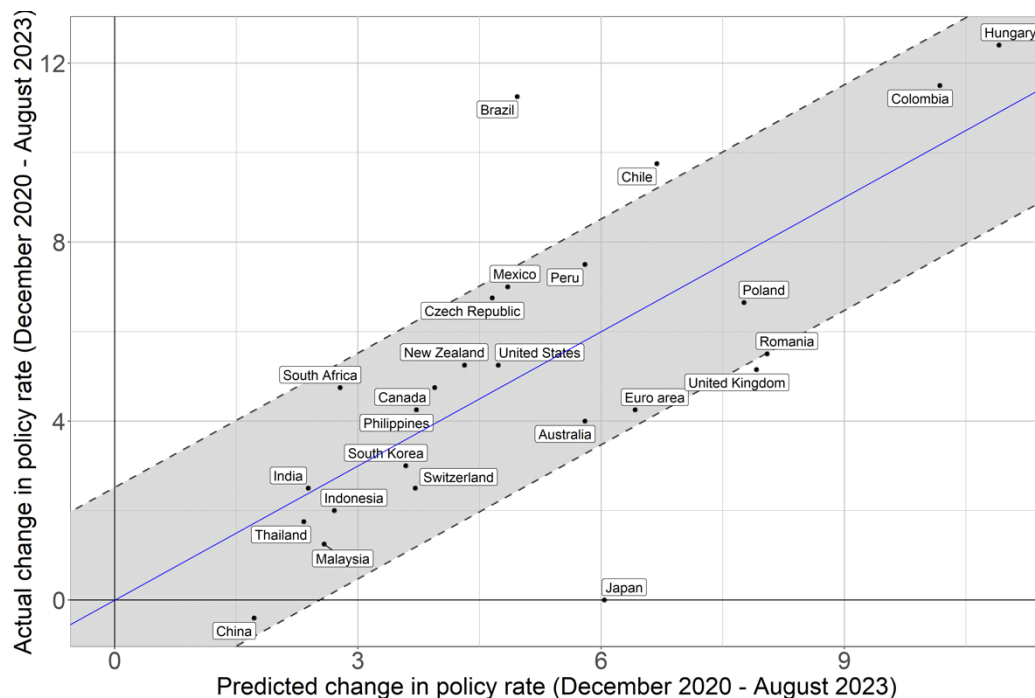
Table 1: Cross-sectional Taylor Rule Regression for Policy Interest Rates

	Change in Policy Rate December 2020-August 2023	Change in Policy Rate December 2020-August 2023
Change in core inflation December 2020-July 2023	0.60 ^{***} (0.17)	0.72 ^{***} (0.14)
Change in output gap Q4 2020- Q2 2023	0.36 [*] (0.20)	0.23 (0.17)
2010-19 core inflation		1.02 ^{***} (0.29)
Intercept	1.90 ^{**} (0.85)	-0.76 (1.03)
R ²	0.50	0.69
Adj. R ²	0.46	0.64
Num. obs.	25	25

*** p < 0.01; ** p < 0.05; * p < 0.1

Figure 4 below puts together Figures 2 and 3 by comparing the predicted increases in interest rates, based on the estimates shown in column 1, to the actual increases in rates. The blue line is not a regression line, but a 45-degree line where predicted and actual increases in interest rates are equal to each other. The shaded area encompasses plus or minus the standard error of the regression. The chart confirms that the Brazilian central bank has raised rates higher, relative to the cross-sectional Taylor rule, than any other central bank in the sample, whereas Japan stands out for being the most dovish. The Fed remains near the center of the predicted distribution. The BOE and ECB are quite dovish, with rates undershooting their predicted level by more than 2 percentage points.

Figure 4: Predicted and Actual Increases in Policy Rates Since December 2020

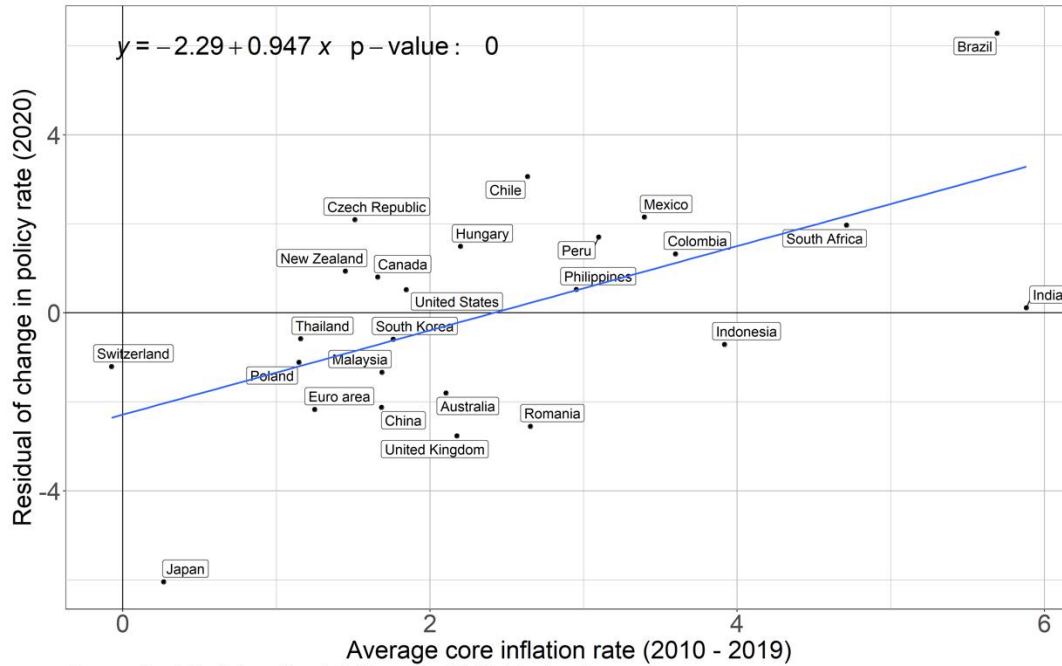


III. What accounts for deviations from the cross-sectional Taylor Rule?

Finally, we ask what accounts for the hawkishness or dovishness of the central banks shown in Figure 4 – is it just random? No. Figure 5 below plots the residuals from the estimated cross-sectional Taylor rule against the average core inflation in each country in the preceding decade. There is a very significant relationship. Not surprisingly, Brazil is at the high end of both the estimated residual and the central banks’ inflation history and Japan is at the low end. The reason for this is not mysterious. Central banks with legacies of high inflation are more likely to “overperform” in their response to rising inflation, both because they are more likely to want to avoid the mistakes of the past and because inflation expectations are likely to be less well-anchored in countries with histories of high inflation. By the same token, central banks that have struggled to push inflation up to target, such as the BOJ, are likely to be less

inclined to tighten, both because they welcome increases in inflation and because inflation expectations are likely to be slower to rise.

Figure 5: Pre-pandemic Inflation and Residuals from Cross-Sectional Taylor Rule Equation



Source: Bank for International Settlements; CEIC; Trading Economics.
Average core inflation for India from 2012-2010 and for Malaysia from 2016-2019.

Once one takes into account the role of pre-pandemic inflation, there is less variation around the cross-sectional Taylor rule predictions for policy rates. The second column in Table 1 above adds the pre-pandemic core inflation rate to the equation. As expected, it is highly significant, and it boosts the R^2 substantially. Figure 6 below repeats the exercise in Figure 4, now comparing the predicted rise in interest rates from column 2 to actual. Notably, the most extreme deviations from prediction remain: Brazil and Chile at the hawkish end and the BOJ at the dovish end. The Bank of England continues to undershoot the predicted rate by a notable margin. However, the ECB now moves closer to the trend line, reflecting its history of lower pre-pandemic inflation.

Figure 6: Predicted and Actual Increases in Policy Rates Since December 2020, Including Pre-Pandemic Inflation as an Explanatory Variable

