Fiscal Events and Anchored Inflation Expectations

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Abstract

With inflation surging worldwide, some commentators have speculated whether inflation expectations have become unanchored. This policy note presents a framework to evaluate whether an inflationary spike is due to temporary shifts in policy or the real economy on one hand, or due to an unanchoring of inflation expectations. The model is a conventional "textbook" model, but accommodates many of the views of unanchored expectations in the existing literature. I then review several economic shocks of the past few years through the lens of the conceptual framework, with a particular focus on fiscal and other policy shocks. I find little to suggest that inflation expectations have become unanchored in the US, the UK, or Japan, although expectations are stubbornly below the central bank's target in Japan, and above the target in the UK. In contrast, inflation expectations show substantial signs of unanchoring in some emerging market economies, particularly Brazil and Turkey.

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1 Introduction

Global inflation has risen dramatically and in concert across high income countries reaching rates not seen since the 1980s (Figure 1). Commentators have expressed concern that this may have lead to a "de-anchoring" of inflation expectations. If inflation expectations deviate substantially from central banks' long-run targets, these expectations may be self-fulfilling as firms increase prices and workers demand wage hikes in the mere anticipation of higher prices in the future. This form of inflation complicates central banks' operations because it is not merely in the realm of demand management, but also in the more complicated world of market psychology. It is far more difficult to re-bottle the inflation genie once it is released and this may involve an even tighter monetary policy stance than otherwise necessary, in order to regain the central bank's credibility.

In a Liberty Street blog post, several Federal Reserve economists define unanchored inflation expectations as a circumstance when long-run inflation expectations drift away from the central bank's target in response to short-run events–a short run bout of inflation, for example. Concerns that inflation expectations may have become unanchored have been heard from market observers (see this Seeking Alpha blog post), and even economists at the Federal Reserve have estimated an elevated risk that expectations have become unanchored (Cascaldi-Garcia *et al.* 2022). Wage-price spirals are a particular manifestation of unanchored expectations. With industrial action increasing in countries around there world, concerns of such a spiral have resurfaced (see press coverage in the Guardian in the UK and CNBC for the US; Lorenzoni & Werning 2023 provide a recent academic treatment of wage-price spirals. A Planet Money podcast episode discusses the related concern of a profit-price spiral.) The IMF, in its April World Economic Outlook (International Monetary Fund 2023), reassures that concerns of a wage-price spiral are premature. Carvalho & Nechio (2023) show that inflation expectations may already be unanchored in Brazil, using methodology developed by Cecchetti *et al.* (2002). Even Federal Reserve Chair Jay Powel acknowledged concerns of unanchored inflation expectations in his 2022 Jackson Hole address, stating that the Fed was "taking forceful and rapid steps to moderate demand so that it comes into better alignment with supply, and to keep inflation expectations anchored."

A particular reason why inflation expectations may become unanchored was suggested in the very same Jackson Hole conference. Building on the fiscal theory of the price level (FTPL), Bianchi & Melosi (2022) claim that recent inflation in the US is almost entirely explained by fiscal excesses. Specifically, the large support payments to household and firms during covid-19 lead to such high public debt that the public began to believe that the Fed may eventually monetize the debt. In my response (Ilzetzki 2022a), I noted that this hypothesis was inconsistent with both cross sectional variation in inflation and data on inflation expectations, as I will elaborate below. Similarly, when the UK faced its infamous "mini-budget" fiscal crisis in late 2022, many commentators evoked

similar fiscal theories to explain the erratic market dynamics that followed. I have provided a rebuttal to this view too (Ilzetzki (2022b)).

This policy note gives a conceptual framework to evaluate the nature of inflation expectations and whether it is likely that they are un-anchored. The framework will be based on a simple version of the New Keyensian model that is the backbone of models for policy evaluation used by central banks, academics, and the private sector participants worldwide. I will evaluate why households and business might expect inflation to surge. Some scenarios will be natural reactions of expectations to economic shocks that may lead to transient inflation. Others can be classified as inflation expectations that are "un-anchored". This may be because the public no longer trusts the central bank to bring inflation down to target, or because the public believe that government debt is so high that the central bank has lost control of inflation.

I then use this conceptual framework to evaluate the dynamics of inflation and interest rate expectations during recent events in five countries. We will evaluate whether these dynamics are more consistent with transitory shocks or with unanchored inflation expectations. Around these episodes, we will look at market-based expectations, as read off of the prices of financial assets, primarily government inflation-protected and nominal bonds. Using market based expectations data has two important advantages. First, positing that expectations are unanchored is a statement about private sector expectations. These can be evaluated separately from the dynamics of actual macroeconomic outcomes. For example, according to the fiscal view of recent inflation, inflation was caused because the very investors who are pricing these assets require compensation for risk that the central bank will inflate away their nominal assets. If this is true, these investors would flock to inflation-protected securities and these concerns would be directly evident in market prices of financial assets. Inflation expectations are in the minds of the economic agents forming these expectations. A surge in inflation due to unanchord expectations would appear in these expectations first and foremost. It is therefore sensible to look at data on expectations rather than indirect evidence in macroeconomic aggregates in search of unanchored inflation expectations. Second, in contrast to surveys of inflation expectations that are typically available at monthly frequency at best, asset prices are available at daily or even sub-daily frequency, so that it is easier to evaluate how they responded to a specific event.

2 Conceptual Framework

We begin by positing that agents form expectations that are consistent with an economic model. Specifically, we restrict attention to expectations that are consistent with a bare-bones New Keynesian Model, as developed in Galí (2015), for example. This model distills the economy into three equations in three unknowns: the (current and expected future) inflation rate π_t, output gap $\tilde{y}_t$,

and nominal interest rate i_t. The subscript t indicates the quarter in which the variables are measured. The three equations determining the dynamics of these variables are:

$$\pi_t = \beta E_t \{\pi_{t+1}\} + \kappa \tilde{y}_t + u_t \qquad \text{(Phillips Curve)}$$

$$\tilde{y}_t = -\frac{1}{\sigma} \sum_{k=0}^{\infty} E_t \left\{ r_{t+k} - r^n_{t+k} \right\} + \epsilon_t. \qquad \text{(Euler Equation)}$$

$$i_t = \rho + \phi_\pi \left(\pi_t - \bar{\pi} \right) + \phi_y \tilde{y}_t + v_t. \qquad \text{(Taylor Rule)}$$

The first equation represents the supply side of the economy and is determined by firms' price setting choices. E_t represents expectations. Inflation is forward looking, with expected inflation potentially feeding in to current inflation Inflation is also higher when the economy is operating above its long-run potential, i.e. there is a positive output gap. This leads to a Phillips curve, with a positive relationship between inflation and the output gap, with an underlying trade off between low inflation and high employment. u_t represents a supply side, or "cost-push" shock. This shock could arise from a shock to global oil prices or a shortage of microchips, to give two recent examples.

The second equation represents the demand side of the economy and is determined by households' consumption choices. Consumption is affected by the (ex-ante) real interest rate $r_t = i_t - E_t \{\pi_{t+1}\}$. A positive output gap emerges when the (current or future expected) real rate of interest is above its natural rate r^n_t. This natural rate is determined by long-run productivity (or in a richer models also demographic and other long-run factors). ϵ_t represents a demand shock, for example a fiscal stimulus.

Finally, the third equation represents the central bank's policy rule, the Taylor rule. The central bank raises the nominal policy interest rate when inflation is above its target $\bar{\pi}$ and lowers the rate when there is a negative output gap (or high unemployment). The ϕ parameters are the weights on inflation and the output gap in the policy rule and v_t represents a monetary policy shock, i.e. an unexpected deviation by the central bank from its policy rule. The literature provides conditions on the parameters ϕ that distinguish passive monetary policy that is unable to anchor inflation (or its expectations) and active monetary policy, where the central bank stabilises inflation. Put simply, active monetary policy requires that the central bank raise the nominal interest rate more than one to one with inflation, so that the ex-post real interest rate rises as well.

The only distinction between this system of equations and the standard New Keynesian model is that all variables, parameters, and shocks are evaluated in the subjective model that investors in financial assets have in their minds. Expectations need not be rational, in the sense that parameters and expectations may differ from the correct model of the world. For example, if investors incorrectly believe that the central bank has a higher inflation target than does in reality, they will

be repeatedly surprised by higher interest rates than they expected. In other words, they will view these higher interest rates as a sequence of monetary policy shocks: positive values of v_t. While expectations might not be rational, I do require that expectations be consistent and model based, in the sense that expectations must be formed in accordance with the system of equations above.

In the following section, we will look at the response of asset prices to various shocks–mostly fiscal in nature–in several countries. Nominal and inflation-protected bonds will give us a view of how inflation expectations and expected real interest rates, as perceived by financial market participants, responded to these events. We will then use the framework provided here to back out the nature of these shocks, as perceived by financial markets, if financial market participants viewed the world through the lens of the conventional model presented here. To interpret these asset price movements, I analyze the movement of two key prices (inflation expectations and the real interest rate) at two different horizons (short- and long-run).

We will entertain the possibility that inflation expectations have become unanchored, but it is useful to begin from the premise that the economy faced a run-of-the-mill shock and see how asset prices would respond to each of them. These are evaluated in sections 2.1 to 2.3. In all these scenarios, we assume the central bank is sufficiently active to ensure that long-run inflation converges to its target. We then turn to two interpretations of un-anchored inflation expectations.

2.1 Supply shock

With energy prices surging, many economists have posited that recent inflation merely reflects the natural tendency of prices to rise when firms face higher real costs of production. The Taylor rule above allows a trade-off between inflation and unemployment and therefore allows central banks to partly accommodate supply-side shocks. Inflation may therefore temporally surge above its long-run target.

Table 1 shows the model's predictions for inflation expectations and real interest rate expectations to a variety of scenarios. We investigate how these expectations respond in both the short- and the long-term, where the short run is interpreted through the lens of model as "one period ahead", and the long run as expectations for longer horizons, in most cases the new steady state to which the model converges.

In the model, a cost-push shock is represented by a positive realization of u_t. Here and in future experiments we allow for the possibility that shocks are persistent, but transitory, in the sense that future shocks converge back to zero in the long run. Beginning from a steady state with inflation at its target and a zero output gap, the cost-push shock leads to higher inflation, $\pi_t > \bar{\pi}$. The central bank now faces an inflation-unemployment trade off. Raising the nominal rate sufficiently to increase the real interest rate would create a negative output gap, by lowering demand, as

shown in the Euler equation. Because the Taylor rule represents a "dual mandate", this widening and negative output gap would have the central bank raise interest rate by less than it would if it had a single mandate. In other words, optimal policy accommodates inflation to some extent.

This discussion gives clear predictions for the first variables in the Table 1. Short run inflation expectations rise and the real interest rate increases if the shock is perceived to be a supply shock. In the long run, however, the model requires that market participants expect inflation to return to its long-run target. Further, the model requires that the real interest rate converge to its natural rate in the long run. Nothing in the real economy will have changed in the long run so that the real interest rate also remains unchanged.

In summary, in response to a cost-push shock, short-run inflation expectations should increase and the expected (ex-ante) real interest rate should rise. However, if inflation expectations are anchored in the sense that market participants believe the central bank's long-run commitment to its target is credible, and the shock is perceived to be temporary, long run inflation expectations and real interest rates should remain unchanged.

2.2 Demand shock

A surge in aggregate demand is represented by a positive ϵ_t realization in the system of equations presented above. This surge could occur because of an increase in consumer confidence, for example. (If the increase in consumer confidence is due to positive expectations about income growth, this would reflect in an increase in $E_t\{\tilde{y}_t\}$, with similar implications). In a richer model than the one presented here, the increase in demand could be the consequence of a fiscal stimulus involving government transfers to households or tax cuts. (In the model presented here, such stimuli would have negligible or no effects as households save most of these transfers due to the permanent income hypothesis and Ricardian equivalence. In a richer model, such as Galí *et al.* (2007) or Kaplan *et al.* (2018) some households are "hand to mouth" or liquidity constrained and government transfers can increase demand in the short run.)

Increased demand leads to a positive output gap $\tilde{y}_t$ in the Euler equation that leads in turn to increased inflation through the Phillips curve. The central bank, seeing both inflation and GDP increasing, is unambiguously predicted to increase nominal and real interest rates, because both of its dual mandates point in the same direction. Accordingly, short-run inflation expectations and real interest rates will increase if market participants view inflation as arising from a shock to aggregate demand, for example a fiscal stimulus doesn't lead to an un-anchoring of inflation expectations.

As in the case of a cost-push shock, neither long-run inflation expectations or real interest rates should be affected by a short-term increase in demand. Ultimately the economy will reconverge to

the central bank's inflation target and the natural real interest rate.

The response of expectations to a demand shock is summarized in the second row of Table 1. As noted above, the demand shock leads to inflation in the short run and to rising real interest rates as a response. The following row of the table shows a case where the central bank responds aggressively enough with monetary policy to fully crowd out the demand shock, leading to an immediate resolution to inflation, no increase in inflation expectations, and only a rise in short term interest rates.

2.3 Monetary policy shocks

Over the past several decades central banks have followed implicit monetary policy rules and communicated interest rate changes and their rationale well in advance. Certainly, central banks do their best not to surprise or "rattle" markets. It may seem difficult, therefore, to conceptualize a "monetary policy shock". However, the framework presented here gives clear guidance as how to think about a monetary policy shock as filtered through market participants' expectations. A monetary policy shock is any deviation (v_t) from the market's perception of the central bank's policy rule. For example, if market participants believe that the central bank is delaying its response to an increase in inflation relative to the Taylor rule's edict, it will perceive the central bank as deviating in the short run from the Taylor rule equation and investors will form expectations as though the economy is facing a sequence of negative realizations to v_t.

How do expectations react to a sequence of negative shocks to the policy interest rate? These shocks feed through to the interest rate i_t and from there to the real interest rate r_t. The lower real interest rate stimulates demand through the Euler equation, leading to a positive output gap. This then feeds higher inflation through the Phillips curve. This interest rate shock will therefore lead to an increase in short-term inflation expectations. These higher inflation expectations then imply an even lower real interest rate, for any expected path of the nominal interest rate set by the central bank. The expected short-term real interest rate therefore declines on news of a negative shock to the policy interest rate, for example a delayed monetary response to inflation.

Once again, the pre-shock steady state is restored in the long run, following a monetary policy shock. Therefore neither long run inflation expectations nor long run interest rates are affected. The market response to an expansionary monetary policy shock are summarized in Table 1.

2.4 Shocks to the inflation target

We have analyzed three scenarios where the economy faces a shock but where long-run inflation expectations remain anchored. As we will see in the following scenario, it is difficult to analyze the case of fully "un-anchored" inflation expectations, arising because of a passive central bank.

This leads to indeterminacy and therefore a variety of self-fulfilling inflation expectations and outcomes. It is useful first to analyze an intermediate case where the market perceives the central bank as still credibly committed to an inflation target, but market participants believe that the central bank is more dovish than advertised.

In the context of our framework, we will consider a change in market perceptions of the central bank's inflation target $\bar{\pi}$. Market participants still expect the central bank to stabilize inflation, but have changed their expectations of–and may even potentially misconceive–the central bank's long run target. This may occur because the central bank has indeed changed its target (as the Bank of Japan did in 2013). It may occur because the market perceives a de-facto change in the central bank's target. For example, when the Federal Reserve announced that it will target inflation symmetrically in its monetary policy review of 2019-20, markets may have viewed this would lead to targeting a higher rate of inflation in practice. Finally, the analysis provided here may also be viewed as a proxy for a general view that the central bank will allow inflation to be above its official target on average, but hasn't abandoned its mandate to control inflation entirely.

An "inflation target shock"–a sudden change in perceptions of the central bank's inflation target–is trickier to analyse than the previous shocks. However, we can draw some guidance from the existing literature that analyses the implications of "trend inflation", i.e. a non-zero inflation target. Cogley & Sbordone (2008) show that a substantial portion of US inflation can be ascribed to shocks to (expectations of) trend inflation; see also Ascari & Sbordone (2014). Werning (2022) departs from rational expectations and works through how shocks to expected long-run can feed in to current inflation, making inflation expectations self-fulfilling. He shows that large pass-through from expectations to current inflation are possible. Conversely, Carvalho *et al.* (2023) consider the possibility that current inflation, regardless of its cause, might feed in to expectations of inflation in the long run.

The analysis here follows Ascari & Rossi (2012) and shows the response of the economy presented here to a one-off, unanticipated increase in the inflation target. In Figure 2, I consider an increase from a 0% inflation target to an 8% inflation target. The model is analyzed using non-linear solution methods, so that the responses do not scale down (or up) proportionally for smaller (or larger) shocks. However, the qualitative predictions are similar for smaller shocks.

Despite the complexity of the analysis, the economy's response to a "mis-anchoring" shock are intuitive. On realizing that the central bank has a higher inflation target $\bar{\pi}$, market participants now believe that inflation will converge to a higher rate in the long run and long run inflation expectations will increase. The forward-looking Phillips curve implies that higher inflation expectations will feed partially, but not entirely, in to current inflation. As long as $\beta < 1$, there is some sluggishness in price adjustments (prices are imperfectly flexible) and inflation expectations will

rise in the short run, but less so than in the long run. Put differently, inflation will gradually converge to its new target, but not immediately. This is represented in the corresponding row of Table 1 with the double upward arrow for long-run inflation expectations representing higher long-run expectations relative to the single upward arrow for short term expectations.

The higher (perceived) inflation target is achieved through inflation expectations gradually feeding into current inflation. It is also achieved with a nominal interest rate that rises only gradually to its new long-run value, which leads to a decline in real interest rates in the short run. In the long run, however, the real interest rate remains determined by the real side of the economy and it remains unchanged. The long run nominal interest rate adjusts one-to-one to compensate investors for the higher inflation target.

2.5 Fiscal dominance

The New Keyensian framework gives little guidance on the extreme case of entirely un-anchored inflation expectations. "Explosive" inflationary paths, or what would otherwise be considered "hyper-inflationary" dynamics are ruled out and attention is typically restricted to "stable" paths with finite rates of inflation. A passive central bank–one that raises interest rates less than one-to-one with inflation–leads to indeterminacy. But indeterminacy allows for a large multiplicity of possible outcomes, giving little guidance for empirical evaluation.

However, a particular case of passive monetary policy has been investigated, one where the monetary authority is subjugated by the finance ministry: fiscal dominance. The Fiscal Theory of the Price Level (FTPL) is a framework that analyzes this case and is an extension of the 3-equation model presented above. An elaboration of the fiscal theory can be found in Leeper (1991), Sims (1994), Cochrane (2005), and Cochrane (2023). But the theory can be succinctly described as follows. The economy can operate in two distinct policy regimes: *monetary dominance* and *fiscal dominance*. In the former, the central bank follows a Taylor rule that ensures inflation stability, i.e. raises interest rates sufficiently in response to inflation to bring it to target. Absent inflationary finance, the finance ministry has no choice but to make ends meet by raising tax revenues or cutting public spending to repay the public debt. Under fiscal dominance, in contrast, the finance ministry accumulates debt that is unsustainable absent monetary finance. Further, the monetary authority responds too passively to inflation, a policy that effectively cedes control of inflation to the whims of the finance ministry. Whether consciously or unwittingly, the central bank inflates away just enough of the public debt to ensure its long-run sustainability. In the short run, the finance ministry and the monetary authority may play a game of "chicken" where debt is unsustainable but the monetary authority refuses to use monetary finance. But in the long run, one of the two institutions must give in.

Bianchi & Ilut (2017), Bianchi *et al.* (2022), and Bianchi *et al.* (2022) show how the economy would react if it shifted to fiscal dominance. Inflation rises and real interest rates decline as the central bank eases policy to finance the deficit. Without getting into the technical details of these models, the intuition is that a central bank that is financing the deficit will run looser monetary policy and allow inflation to surge. In the long-run, the real interest rate converges back to its natural rate and the higher rate of inflation merely translates into higher nominal interest rates. However, this transition is very gradual and the real interest rate remains below its natural rate as long as the monetary authority is still accommodating fiscal excesses. Given the politicians are likely to respond opportunistically to a passive central bank, this transition is likely to persist in the medium term. Inflation too eventually decreases, because inflationary finance can't be used indefinitely, but this convergence is slow and medium term inflation remains elevated.

Beyond fully-fledged fiscal dominance, Bianchi & Melosi (2022) and Bianchi *et al.* (2022) analyze intermediate cases where the monetary and fiscal authorities are in conflict, and where the public finds the scenario of fiscal dominance more likely. These cases may are even worse than the scenario described above and can lead to accelerating inflation in the short-term.

The last two rows of Table 1 summarize the case of fiscal dominance. Real interest rates decline and inflation increases in the short term. Inflation is persistent, but real interest rates return to their natural rate in the long term. If the central bank attempts to fight the finance ministry's unsustainable plan, it may raise interest rates in the short run, but this conflict will eventually lead to even higher inflation and low real interest rates in in the medium term.

2.6 Summary

Looking at Table 1 as a whole, a clear pattern emerges when comparing how expectations respond to conventional transitory events compared to unanchored inflation expectations. All events we have considered are inflationary, so all lead to rising short run inflation expectations. None of them change the long-run "fundamentals" of the economy, so the natural real interest rate, and therefore expectations of the long-run interest rate, remain unchanged. The distinction emerges in the remaining two variables. Long run inflation expectations are anchored at the central bank's target when inflation expectations are anchored. In contrast, when inflation expectations become unanchored, long run inflation expectations may rise in tandem with, or even overshoot, short-run inflation expectations, whether the source of the unanchoring is lack of central bank credibility and/or fiscal dominance. Further, with the exception of a monetary policy shock, the short-run real interest rate rises when inflation expectations are anchored, as the central bank fulfills its mandate to combat inflation. In contrast, when inflation expectations are unanchored, real interest rates decline due to the passivity of the central bank, or as the central bank transitions to its new

perceived target.

3 Have recent fiscal and monetary events un-anchored inflation expectations? Five case studies

We now turn to case studies of recent events in five countries ranging from high income to emerging markets. We investigate what happened to inflation and real interest rate expectations in the short- and long-run. We can then evaluate which type of shock these expectations are most consistent with: a run-of-the-mill economic shock or a de-anchoring of inflation expectations.

3.1 United States: The 2021 American Rescue Plan

A week before entering office, the Biden administration began formulating a relief program primarily involving large increases in government transfers to households and firms. The American Rescue Plan (ARP) was a large fiscal impulse by historical standards at $1.9 trillion, nearly 10% of GDP. This came on the heels of the 2020 CARES act, a relief program of similar magnitude. As could be expected, the ARP received praise from some quarters and criticism for others. More pertinent to our discussion, even economists who agree that the ARP impacted inflation in 2021 and 2022 have widely different interpretations of its macroeconomic implications. Jason Furman and Larry Summers have warned of the inflationary impact of the ARP on largely Keyensian grounds: this was a large stimulus hitting an economy with restrained capacity and this can be predicted to lead to inflation. Bianchi & Melosi (2022) and Bianchi *et al.* (2022), in contrast, claim that inflation surged in this period because financial markets increased their expectations that the economy was moving to a state of fiscal dominance.

Figure 3 shows the evolution of market-implied inflation expectations and real interest rates for the US around the announcement and passage of the ARP. In this and later case studies, we consider the 2-year horizon for our short-run analysis and the 10-year horizon for our long-run analysis. 10-year inflation expectations are given in annualized terms so reflect the average expected inflation rate and real interest rate over the following 10-years. The two horizons were chosen due to the liquidity and availability of price data for assets with these durations.

Inflation expectations did indeed increase, although not dramatically over the Fed's 2% inflation target, from late 2020 to mid 2021. However, this increase in expectations well preceded the announcement of the ARP and there is no acceleration in inflation expectations associated with the ARP itself. If anything, the rise in inflation expectations slows down and briefly flattened after the ARP was signed. It is true that inflation expectations begin rising in November 2020, so that it is impossible to reject the hypothesis that market participants anticipated the ARP or a similar

fiscal stimulus. However, if the ARP was the cause for rising inflation expectations, one would expect them to to increase rather than stabilize on implementation, as uncertainty of the legislation's passage is resolved. Further, a lot was happening in late 2020, not least of which was the FDA approval of Covid-19 vaccines and that one should be cautious in attributing causation to a single factor.

Further, short run inflation expectations surged far higher than long-run expectations. This is hardly consistent with unanchored inflation expectations. The long run real interest rate shows little movement during this episode, as anticipated in the framework of the previous section. More troubling, however, is the movement of the short-term real interest rate. The short rate declined alongside rising inflation expectations, implying that markets didn't expect the Federal Reserve would raise interest rates sufficiently to quell this inflation. Short-term real rates did begin increasing in early 2022, as it became apparent that the Fed would begin a tightening cycle. The rise in real, not only nominal rates, indicates that investors expected the Fed would "do its job" of raising interest rates sufficiently to quell inflation. Indeed, short term inflation expectations came down pretty much to target in the first half of 2022, alongside rising real interest rate expectations. According to Bianchi & Melosi (2022), the Fed's attempt to pursue its mandate in face of unsustainable fiscal policy should have been not only futile, but counterproductive. Instead, tighter monetary policy did what tighter monetary policy does: it brought inflation down.

Overall, the market movements in late 2020 and early 2021 seem most consistent with market perceptions (whether correct or incorrect) of monetary policy shocks. Indeed, as we look to the end of 2021, the real interest rate rose dramatically, so that the entire episode is very much consistent with a delayed Fed response to inflationary pressures. The ARP may indeed have contributed to inflation or expectations thereof, but there is nothing in Figure 3 that suggests that fiscal dominance is at play in this drama. The timing of the inflationary surge, the international correlations, and the stability of long-run inflation expectations corroborate these impressions. Further, note that movements in inflation expectations were very moderate during this period, with 2-year inflation expectations peaking at 3.2% even as *actual* inflation hit 9%: hardly an inflation panic. Short-term inflation expectations were on average no higher in this period than they were in the decade preceding the global financial crisis, a period generally regarded as the heyday of the "great moderation".

One puzzle does arise in Figure 3, which will recur in the case studies to follow. The long-run real interest rate rises in tandem with the short rate as the Fed begins tightening monetary policy. In standard macroeconomic models, the long run real interest rate is determined by the long run prospects for the real economy and should be entirely unaffected by monetary policy.

Given the current (yet perennial) drama surrounding the debt ceiling, a discussion of the US

would be incomplete without a look at recent events. Figure 4 shows the same market-based expectations variables since the beginning of the year. Signs of acrimony over the debt ceiling began to materialize at the beginning of April, but no shift is visible in inflation expectations or real rates, as one might expect if the US were en-route to default on its debt either outright or through inflationary finance. Markets are so far regarding the debt ceiling negotiations with a yawn.

3.2 United Kingdom: The mini-budget event of 2022

In September 2022, Liz Truss was appointed UK Prime Minister, following Boris Johnson's resignation. Truss entered office with an ambitious program of tax cuts alongside large transfers to households to assist with rising energy prices. The UK government announced its plans in a "mini-budget" announcement on September 23, 2022, with combined tax cuts and transfers to households exceeding 4% of GDP. This sent yields on UK government bonds soaring at a daily rate not seen since November 1988, brought the value of the pound to all-time lows, lead some mortgage providers to suspend lending, and dropped the UK pension system to a liquidity crisis.

I think it is fair to say that the consensus view of this event was that it constituted a sovereign debt crisis. Larry Summers, for example, compared the UK to an "emerging market". Other commentators claimed that this was a prefect example of "fiscal dominance" unfolding in real time. My analysis in Ilzetzki (2022b) gives a detailed analysis of the event and a counterpoint to this view, which I elaborate here.

Figure 5 shows expectations of our key variables around the mini-budget event. The presumption that the UK was facing a sovereign debt crisis was based mostly on the spike in UK nominal bond yields on the day of, and in the days following, the mini-budget announcement. However, changes in nominal yields alone aren't a sufficient statistic to evaluate what the market was thinking. The figure shows that nominal yields were rising in tandem with *real* yields. Inflation expectations barely budged on the announcement (if anything, they declined). Market prices are inconsistent with the notion that market participants expected fiscal dominance or monetization of the debt.

Instead, the market reacted roughly as they would if they viewed the mini-budget as a plain-vanilla demand shock. The Bank of England was expected to respond aggressively with interest rates to the inflation that a large tax cut and fiscal transfer would bring. The Taylor principle requires that the central bank increase interest rate more than one-to-one with inflation, leading to an increase in real, not only nominal, interest rates. At the logical extreme, the central bank would fully crowd-out the inflation caused by the mini-budget and markets reacted as though they believed it would.

Rather than showing a lack of confidence in UK intuitions, markets reacted with great faith in the Bank of England. Neither short- nor long-term inflation expectations increased in response to the mini-budget. Overall, the market reaction is consistent with a model of a highly credible central bank facing a poorly-timed tax cut. (The economy was already at the risk of overheating).

This optimistic view needs to be tempered with the observation that long-run inflation expectations were hovering around 3.5%, above the Bank's 2% target, even before the mini-budget crisis. Inflation expectations remain similarly high to date. One might be concerned that inflation was already mis-anchored at excessively high rates prior to the mini-budget crisis. While this is concerning, this mismatch between the inflation target and inflation expectations is a pittance, compared to inflation expectations in some emerging market, to which we turn next.

3.3 Brazil and Covid-19

Covid 19 was a global pandemic, but it affected Brazil more than most countries, in terms of both the public health emergency and the economic fallout. Beyond the human tragedy and lost lives, Brazil's economy was battered by financial markets, with the Brazilian real falling 30% from December 2019 to May 2020. Like many other economies, the Brazilian government responded with large transfer programs to support households and businesses during the pandemic. At 4.5% of GDP, Brazil's support programs were among the largest in the world, certainly when compared to other developing countries with more restrained fiscal responses. Carvalho & Nechio (2023) give a detailed discussion of these programs and of Brazil's history of anchored and un-anchored inflation expectations.

Figure 6 repeats our exercise for Brazil. Brazil has a de jure inflation targeting regime. The target was 4% for 2020 and was scheduled to decrease by 25 basis points each year, ultimately reaching a long-run 3% target by 2024. The target has a +/-1.5% tolerance band. Prior to the pandemic shock, inflation expectations–short and long–were anchored at around 4%, precisely its target for the following year, but above its long run target. As we have noted, the value of Brazilian financial assets fluctuated wildly during Covid 19 (which leads to some gaps in available bond prices in early 2020). Like most high-income countries, inflation and inflation expectations collapsed at the onset of the pandemic. We therefore focus on the period from mid-2020, following the large emergency aid package.

Since mid-2020, inflation expectations have steadily risen. Importantly, short- and long-run inflation expectations have rise largely in tandem. In fact, expectations of average inflation over the following 10 years peaked at a full percentage point above 2-year inflation expectations and well outside the central bank's tolerance bands. This contrasts sharply with the figures for the US and UK, where short term inflation expectations rose but long-run expectations were rather

stable. In Brazil, the co-movement of long- with short-run inflation expectations, with the former overshooting the latter, indicates some risk that inflation expectations were becoming unanchored. Here it is entirely plausible that the fiscal theory was in play, given Brazil's exceptionally high debt to GDP for an emerging market (at over 70% of GDP at end-2022).

The movement of the real rate is also telling: the short-run real rate declined substantially–by 2 percentage points–simultaneous with the rise in inflation expectations. This is precisely what we'd expect to see if the markets ceased to trust the central bank's long run target, or if expectations were driven by fiscal dominance.

The Central Bank of Brazil faces an unenviable task. It has tightened its Selic policy interest rate aggressively starting in March 2021–well before any high-income central bank responded to the surge in global inflation (Figure 7b). The Selic rate peaked at 13.8%, where it has stayed to date. This has brought 2-year real interest rates to as high as 7% in late 2022. Nevertheless, turning to Figure 7a, 10-year inflation expectations remain stubbornly high, hovering around 7%, and above expectations of shorter-term inflation. Inflation expectations continue to show signs of what may be considered unanchored.

3.4 Turkey: A political shock

Turning from bad to worse, Figure 8 displays the case of Turkey. Turkey doesn't have inflation protected bonds; instead we use surveys of inflation expectations. These are unfortunately at lower frequency. Further, the survey doesn't provide expectations of 10-year inflation in recent vintages. I plot 5-year inflation expectations instead. The survey asks for expectations of the rate of inflation 2- and 5-years ahead. This contrasts with the inflation rates in previous figures that reflect expectations of average annual inflation over the upcoming 2- and 10-years.

Given that realized inflation hit 85% last year, it is hardly surprising that inflation expectations have risen. Further, the culprit for inflation is far more transparent in this case than in others. President Edrogan has pushed the central bank to maintain low interest rates. The vertical line in the figure shows the timing of serial firings of central bank governors by Erdogan. Following this display of political dominance over monetary institutions, inflation expectations surged alongside inflation itself.

It is difficult to conceive of a cost-push or demand shock facing the Turkish economy last year that would have lead to inflation nearing 100% a year. At these rates of inflation, passive monetary policy, whether due to fiscal dominance or other reasons, must be at play. Longer-run (5-year) inflation expectations have risen to 10%, double the central bank's target. Participants in the central bank's survey are optimistic that the worst of inflation is behind them, but their longer term expectations are still far from converging to what might be viewed as anchored at the Bank's inflation

target.

3.5 Mis-anchored inflation expectations: the Japanese version

Evaluating expectations of inflation and real rates in Japan is complicated by the fact that Japan has inflation-protected bonds only at a 10-year maturity. Inflation surveys are also difficult to evaluate, because they are only at quarterly frequency. However, a look at the 10-year expected inflation rates, shown in Figure 9, are telling about the anchoring, or mis-anchoring, of long-run inflation expectations.

Japan has had notoriously low inflation over the past two decades and inflation expectations have been accordingly low. In attempt to revitalize inflation, the Bank of Japan began floating the idea of increasing its inflation target from 1% to 2% in 2012. It eventually did so in January 2013. The figure shows that 10-year inflation expectations rose by an entire percentage point and stood at 2% throughout 2013. However, by 2014, expectations were back at 1% and they slid further to near zero rates by the time Covid-19 hit. Here we see a central bank unable to resuscitate inflation expectations: inflation expectations that are mis-anchored from below.

4 Conclusions

This policy note evaluates how well-anchored are inflation expectations in high-income and emerging market economies. I provided a framework through which to evaluate data on inflation expectations and applied it to five countries. In high income countries, inflation expectations appear remarkably anchored–perhaps surprisingly so given the high rates of inflation seen since 2021 and the delayed response of major central banks. In contrast, inflation expectations appear less well-anchored in some emerging market economies. In the case of Turkey, the culprit is obvious. In Brazil, this has occurred despite an early and aggressive response by the Central Bank of Brazil.

The contrast between the high-income and emerging-market experiences also helps contextualize events in high income countries. Having seen what unanchored expectations really look like, the moderate movements in expectations in the US, UK, Europe, and Japan (and indeed other emerging market economies) pale in comparison.

I would not like to leave readers with the impression that "this couldn't happen here". High income countries aren't immune to the possibility of unanchored expectations, as evidenced by many countries' experiences in the 1970s. Instead, the purpose of this note is to provide a framework through which to read inflation expectations to better evaluate whether and when such unanchoring occurs.

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Table 1: Reaction of inflation expectations and real interest rates to various shocks

Shock	$\mathbb{E}_t \pi_{t+1}$	$\mathbb{E}_t \pi_{t+h}$	$r_{t+1\|t}$	$r_{t+h\|t}$
Conventional shocks				
Cost-push	$\uparrow$	$-$	$\uparrow$	$-$
Demand	$\uparrow$	$-$	$\uparrow$	$-$
& strong monetary response	$-$	$-$	$\uparrow$	$-$
Monetary policy	$\uparrow$	$-$	$\downarrow$	$-$
Unanchored expectations				
Higher inflation target	$\uparrow$	$\uparrow\uparrow$	$\downarrow$	$-$
Fiscal dominance	$\uparrow\uparrow$	$\uparrow$	$\downarrow$	$-$
Fiscal-monetary conflict	$\uparrow$	$\uparrow\uparrow$	$\downarrow$	$\uparrow$

Reaction of long- and short-run inflation expectations and real interest rates to a variety of shocks. $t+1$ represents the short run and $t+h$ represent a longer horizon, i.e the medium to long term.

Figure 1: Recent inflation in four economic areas

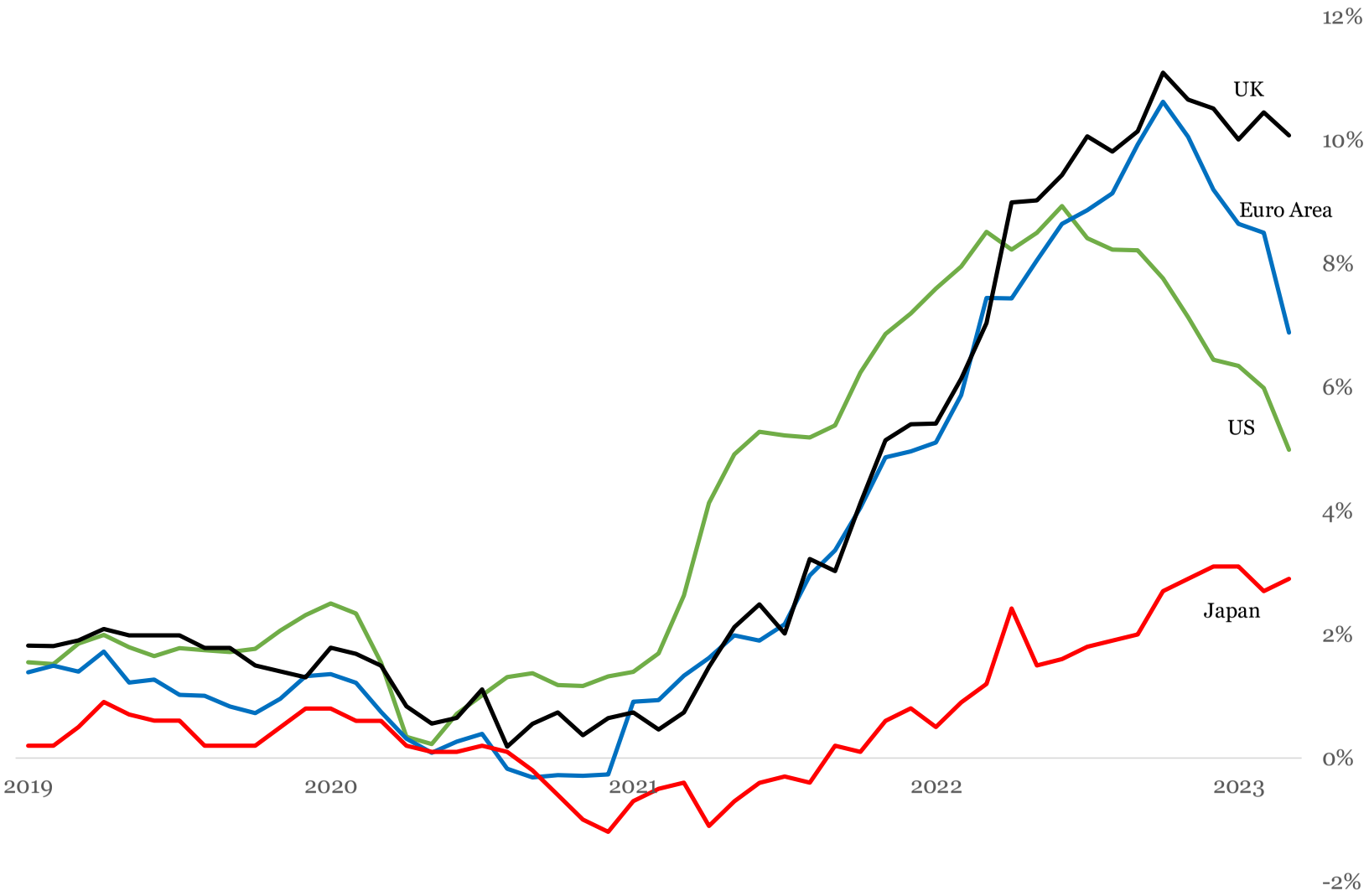
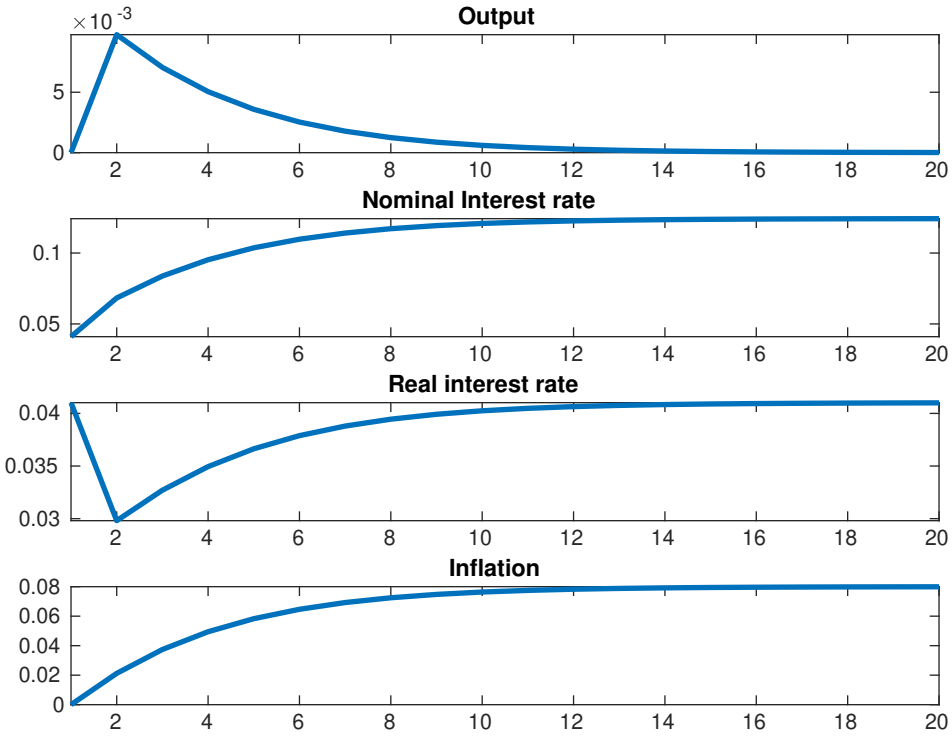
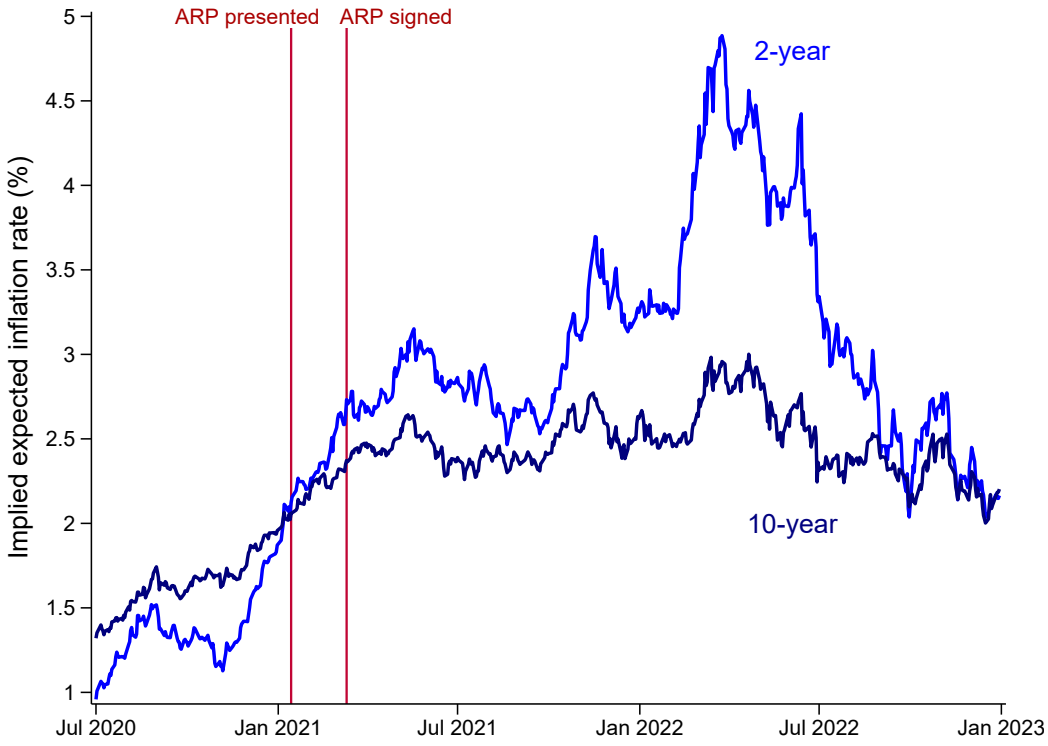


Figure 2: Transition to higher inflation target: theoretical response

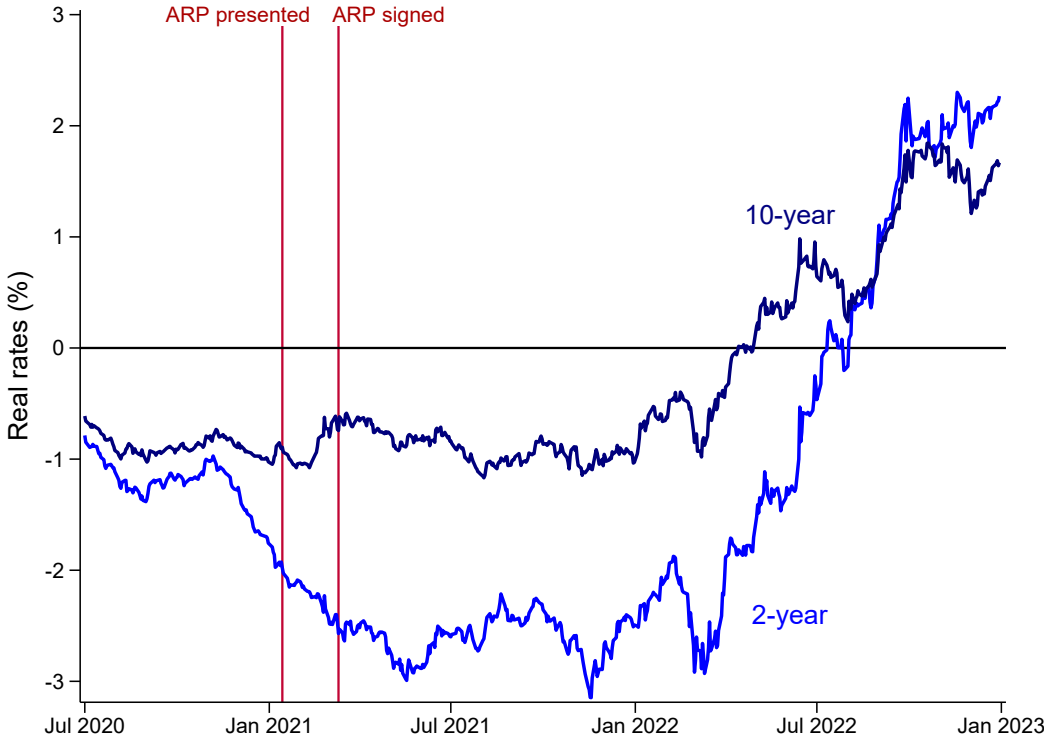


Note: Responses of macroeconomic variables to an unanticipated change in the inflation target from 0% to 8%. The model is a simple New Keyensian model in the spirit of Galí (2015) and following Ascari & Rossi (2012). The X-axis gives quarters since the change in policy.

Figure 3: USA: American Rescue Plan

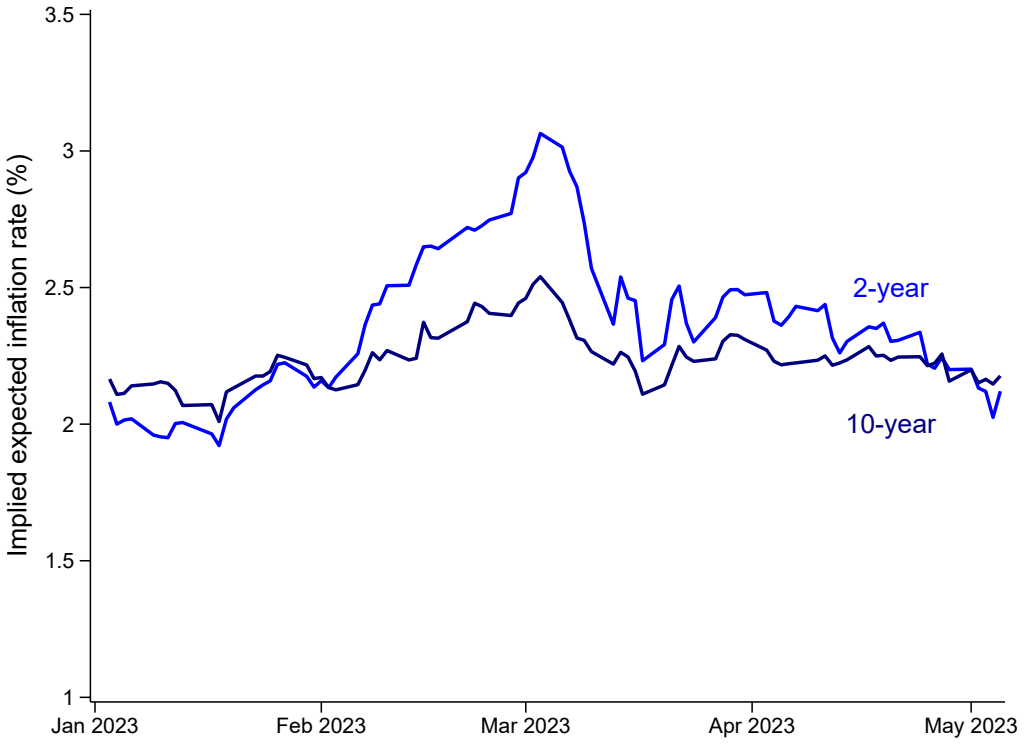


(a) Inflation expectations

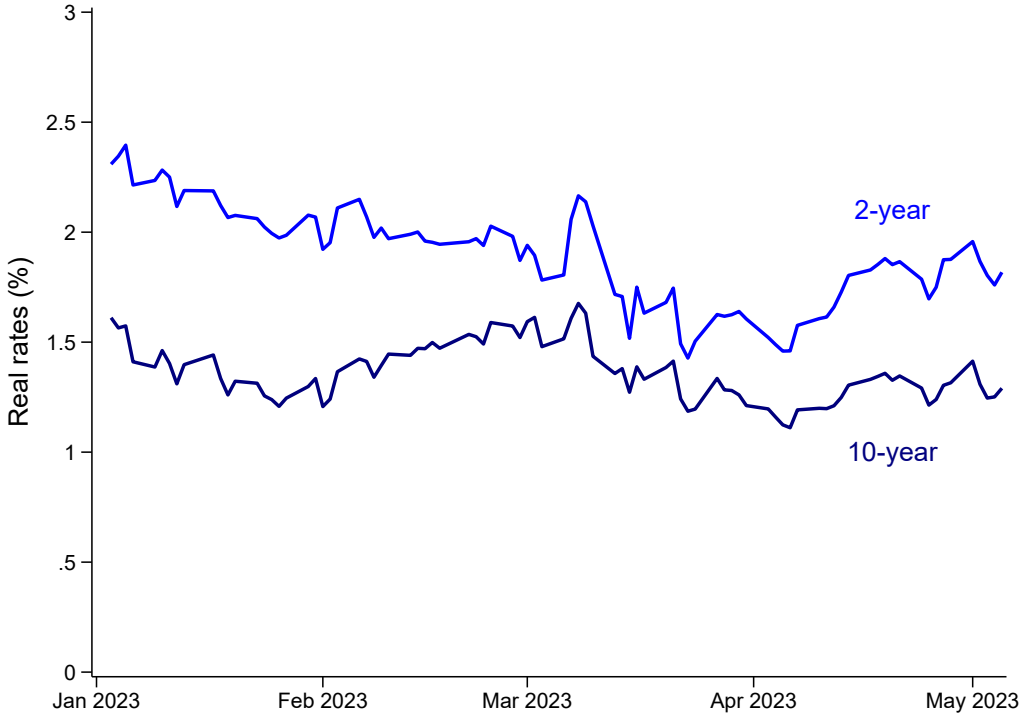


(b) Real interest rates

Figure 4: USA: Debt Ceiling

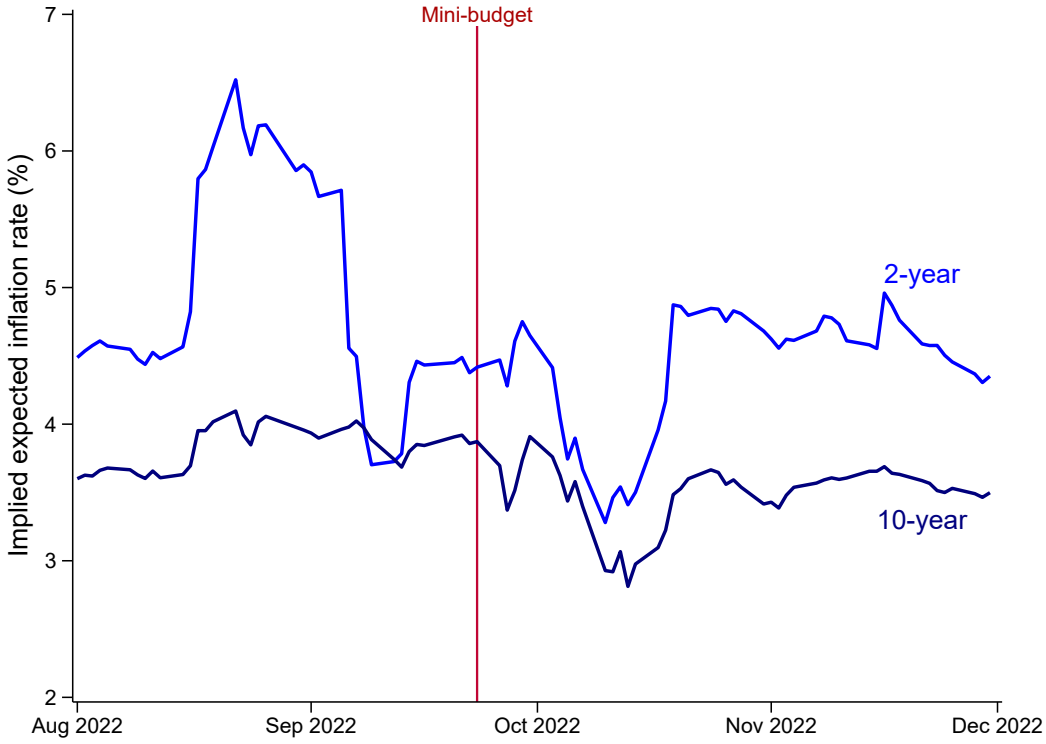


(a) Inflation expectations

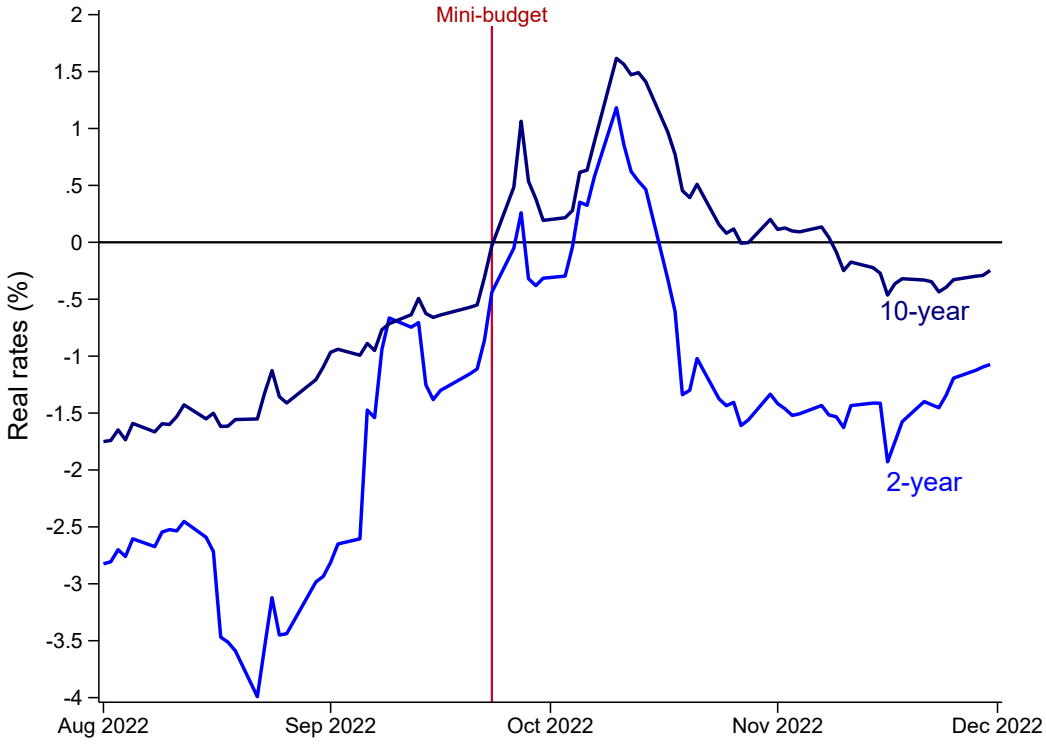


(b) Real interest rates

Figure 5: UK: Minibudget

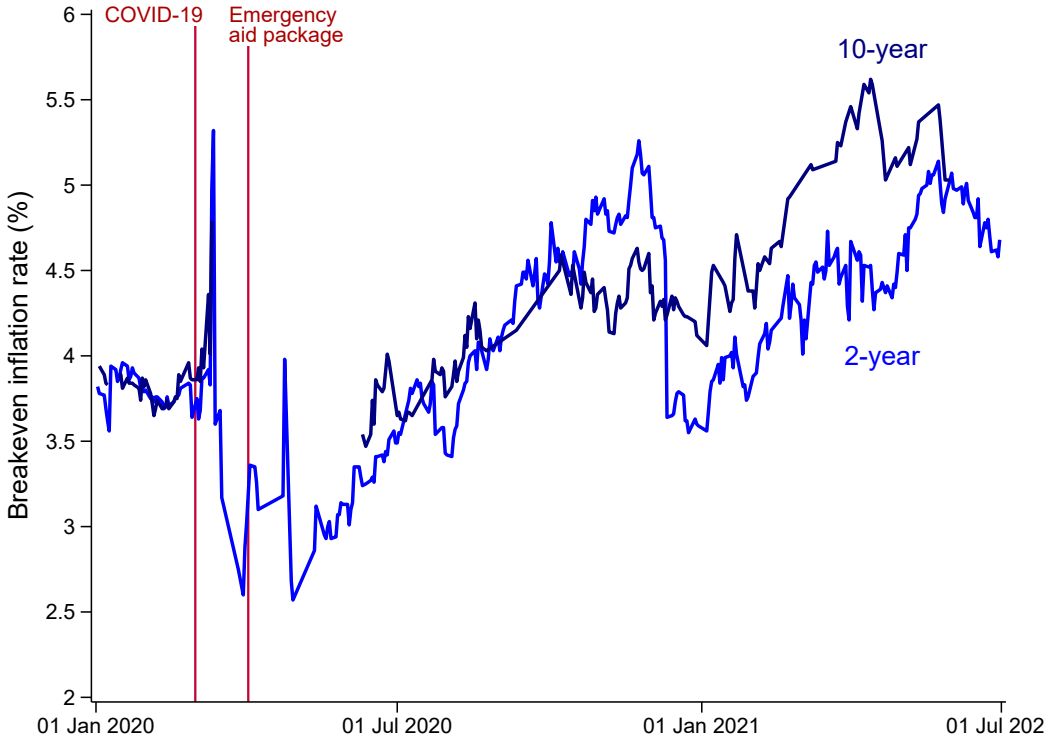


(a) Inflation expectations



(b) Real interest rates

Figure 6: Brazil since Covid-19

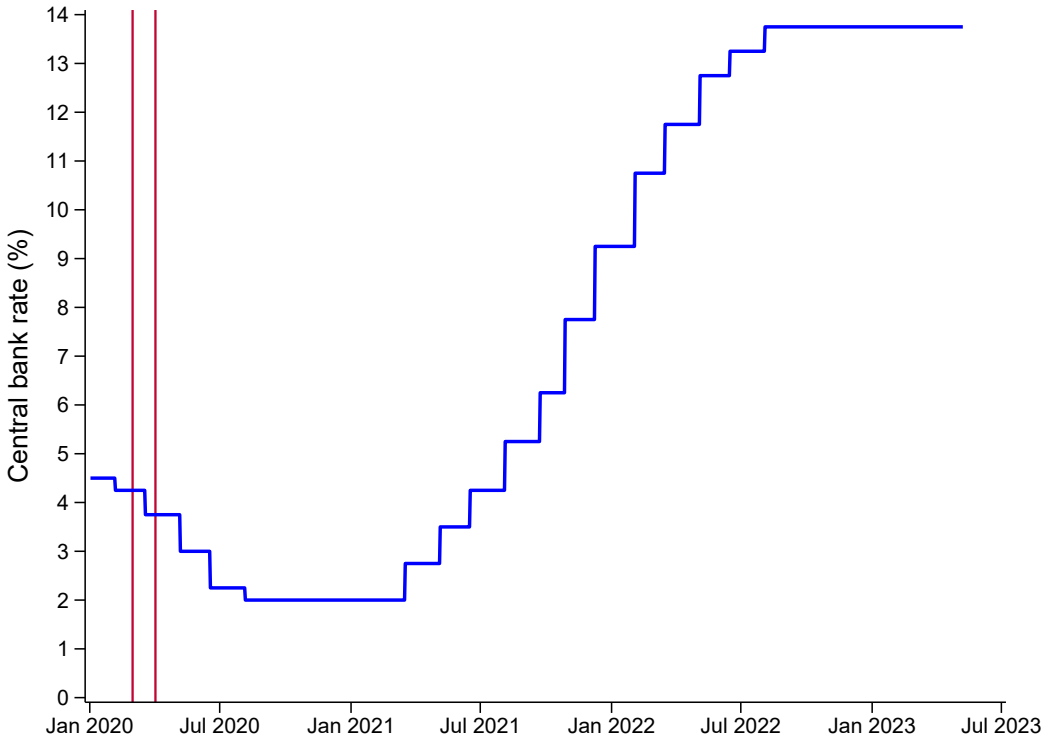


(a) Inflation expectations

(b) Real interest rates

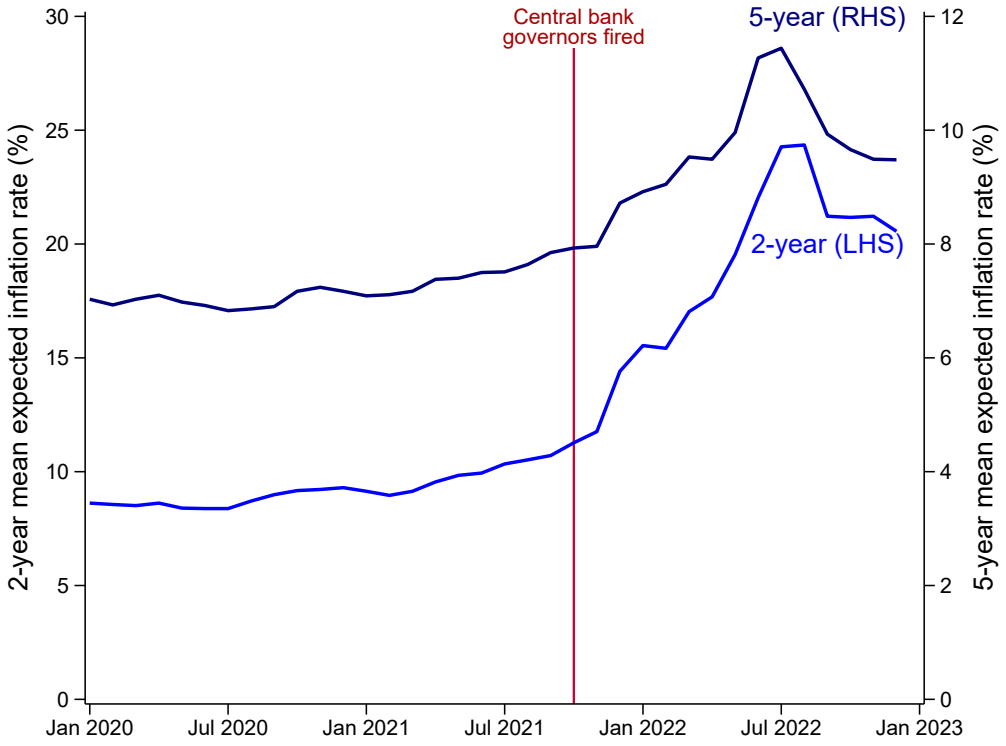
Figure 7: Brazil: Inflation expectations vs. monetary policy in 2023

(a) Inflation expectations

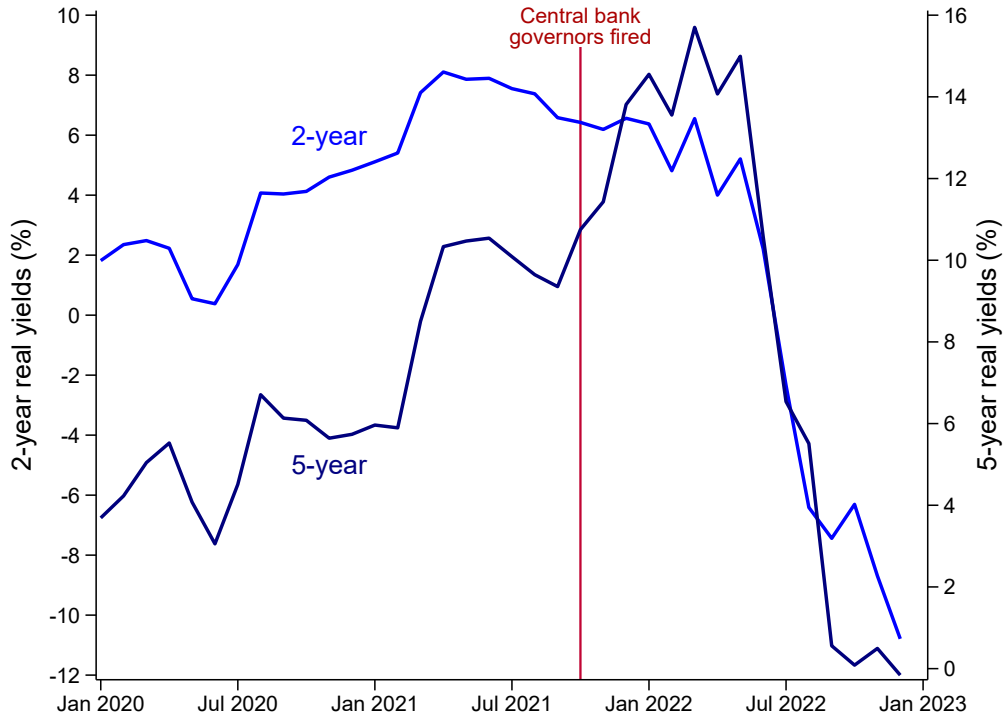


(b) Brazil: Monetary policy (Selic) rate.

Figure 8: Turkey: Political dominance



(a) Inflation expectations



(b) Real interest rates

Figure 9: Japan: Mis-anchored inflation expectations