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Evaluating monetary policies in the face of the "forward guidance puzzle"

Following the 2008 financial crisis, many central banks used forward guidance to influence aggregate demand via expectations of future policy rates, in addition to making changes to short-term rates. The strategy was in keeping with the teachings of New Keynesian models. However, in baseline versions of these models, expectations of future interest rates have an unrealistically large effect, a phenomenon known as the "forward guidance puzzle". To be realistic, and hence useful for monetary policy, the models need to incorporate new assumptions that dampen the effect of future rates. Assuming that expectations are boundedly rational appears to be the most promising approach.

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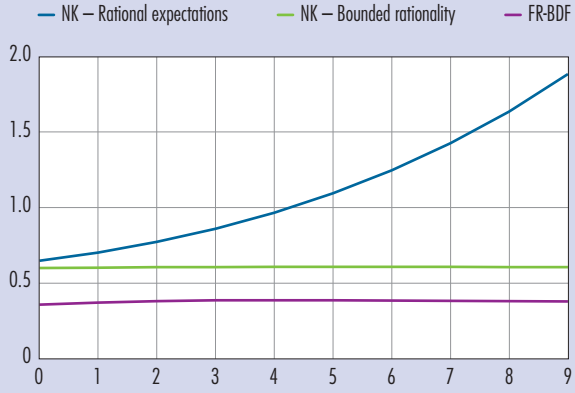
"Forward guidance" seeks to influence expectations of future policy rates

The "forward guidance puzzle" refers to the gross overestimation of the impact of forward guidance in baseline models

Boundedly rational expectations yield more consistent effects of forward guidance

Effect on aggregate demand of the announcement of a 1 percentage-point future cut in interest rates, depending on the horizon of the cut

(x-axis: horizon of the announced cut (-100 basis points) in quarters; y-axis: percentage points (deviation from stationary state))



Source: Author's calculations; see Dupraz et al. (2024) and Lemoine et al. (2019).
Guide: The central bank announces in t = 0 that the annualised level of policy rates will be lowered by 100 basis points in period t + k (k = 0 to 9), and will then be determined by its standard monetary policy (Taylor rule).

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1 The forward guidance puzzle

From the early 2000s onwards, central banks significantly increased their communication on monetary policy decisions. In particular, announcements about the future direction of monetary policy – known as forward guidance – began to be used as a tool in their own right. Following the global financial crisis of 2008, when policy rates were stuck at their effective lower bound, forward guidance was one of the main unconventional policy tools used to stimulate the economy.[1] Forward guidance stems from a key intuition of New Keynesian models:[2] monetary policy not only influences aggregate demand through current policy rates but also through expectations of future policy rates. Savings and investment decisions typically depend on long-term yields, which depend heavily on expectations of future policy rates. In baseline New Keynesian models, aggregate demand y_t depends on expectations of future real interest rates r_{t+k} through the dynamic IS curve, which represents equilibrium in the goods and services market[3]

$$y_t = -\sigma \sum_{k=0}^{\infty} E\,(r_{t+k})$$

where σ is the intertemporal elasticity of substitution and $E_t\,(r_{t+k})$ is the expectation at time t of the real interest rate at time $t+k$.

In terms of **real** interest rates, the IS curve stipulates that the expected short-term rate r_{t+k} at any time horizon k has the same effect on current aggregate demand as the current short-term rate r_t..

However, the impact of future rates becomes much stronger when we consider **nominal** short-term rates, i.e. those that the central bank controls directly and on which it can communicate or make a commitment. The real rate r_{t+k} which is the one that matters for aggregate demand, is the nominal rate i_{t+k} minus expected inflation $E_t\,(\Pi_{t+k+1})$. If the central bank commits to lowering its policy rate by 1 percentage point in one year's time before raising it again, aggregate demand and hence inflation will rise in the subsequent year. If households and firms anticipate this higher inflation – which they are assumed to do under rational expectations – the real interest rate will fall, even if the policy rate remains unchanged. Due to this inflation expectations channel, future policy rates have a larger effect than current policy rates, through the future nominal rate and through future inflation.

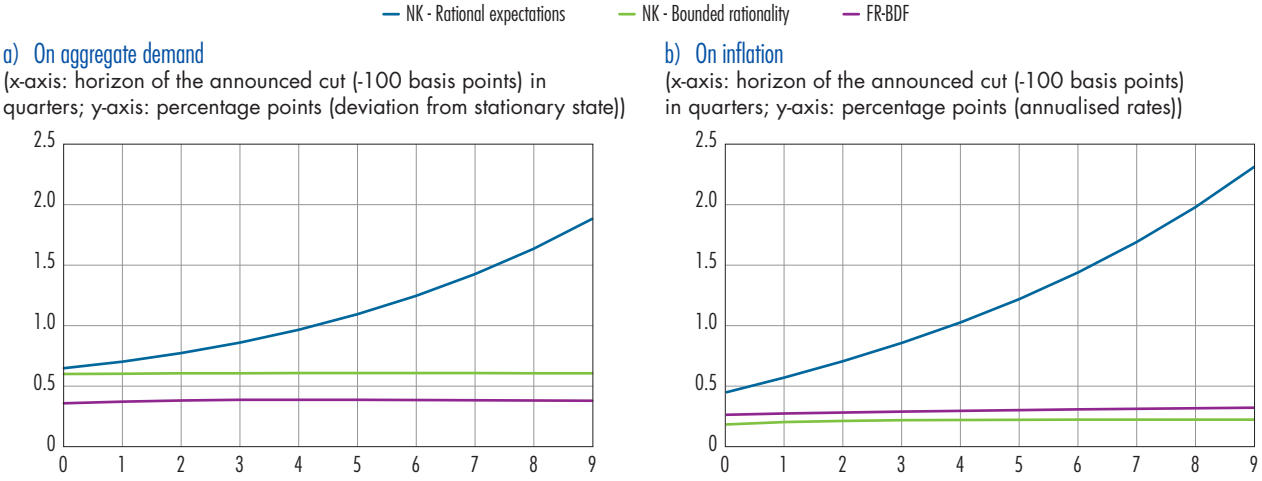
Worse still, the longer the horizon of the announced rate cut, the more powerful the inflation expectations channel: expected inflation reduces a larger number of future real rates. This is represented by the blue curves in the chart on the next page, which shows the impact on aggregate demand and inflation of an announced future rate cut, depending on the horizon of the cut. The impact rises sharply as the horizon increases and quickly diverges to become infinitely powerful: the announcement of a cut in **nominal** rates at an infinite future horizon has an infinitely strong impact on current aggregate demand and inflation. Although the announced rate cut is a one-off, transitory event, it affects the entire sequence of real rates through expected inflation, up to the time the cut actually takes effect.

1 Forward guidance can take the form of a mere intention about future policy – known as Delphic forward guidance – or an explicit commitment to a future policy – Odyssean forward guidance (Evans et al., 2012).

2 New Keynesian economics is a school of thought that emerged in the 1980s and revised many of the ideas of 1950s-60s Keynesian economics, especially the role of nominal rigidities and aggregate demand.

3 Baseline New Keynesian models are linear and ignore term premia.

Impact of a forward guidance announcement on aggregate demand and inflation under different models



Source: Author's calculations; see Dupraz et al. (2024) and Lemoine et al. (2019).
Guide: The central bank announces in t = 0 that the annualised level of policy rates will be lowered by 100 basis points in period t +k (k = 0 to 9), and will then be determined by its standard monetary policy (Taylor rule).
Note: The "NK – rational expectations" model is a baseline New Keynesian model.
The "NK – bounded rationality" model is a New Keynesian model based on Dupraz et al. (2024), where firms and households have boundedly rational expectations, but financial markets have rational expectations.
We use the FR-BDF version with model-consistent expectations, and the results shown are those for GDP and the market-sector value-added deflator (Lemoine et al., 2019).

Baseline New Keynesian models grossly overestimate the impact on aggregate demand and inflation of announcements of future rate changes. In an empirical analysis, Del Negro, Giannoni and Patterson (2012 and 2023) estimate that the US Federal Reserve's three main forward guidance announcements (August 2011, January 2012 and September 2012), which lowered rate expectations for the eight subsequent quarters by up to 15 basis points, increased aggregate demand and inflation by 10 and 15 basis points respectively. In comparison, in a baseline New Keynesian model, the effects on inflation and aggregate demand are respectively nearly 10 and 30 times stronger.

In 2012, Del Negro, Giannoni and Patterson labelled this the "forward guidance puzzle". As the name suggests, the puzzle is especially problematic when evaluating the effect of explicit forward guidance policies when policy rates are at the effective lower bound. However, the fact that baseline models overestimate the impact of future interest rates is also a problem when assessing monetary strategies when interest rates are well above the lower bound. For example, one key question during the 2022-23 euro area tightening cycle was whether to raise interest rates to a high peak and then cut them rapidly, or set the peak lower and maintain it for longer (Lagarde, 2023). A model subject to the forward guidance puzzle will give an incorrect response to this question.

2 Main solutions to the forward guidance puzzle

To solve the forward guidance puzzle, we can reduce the importance of future rates by relaxing the strong assumptions underlying the IS curve of the baseline New Keynesian model. The baseline IS curve is derived from the consumption decisions of a representative household with an infinite lifespan and rational expectations. This points to three first solutions: dropping the assumption of infinite lifespans, dropping the assumption of identical

households, or dropping the assumption of rational expectations.[4] Another possibility is to relax the assumption that central bank announcements are perfectly credible.

Finite lifespan

The first solution, proposed in the very paper by Del Negro, Giannoni and Patterson (2012 and 2023), is to drop the assumption that households live forever. This seems an obvious reason why the IS curve gives so much weight to future interest rates. A household that expects to live forever will take interest rates into account over the infinite future, but one that knows its days are numbered will not.[5]

"Death" can be interpreted more extensively to include financial shocks. Indeed, for a household not to care about interest rates beyond a given horizon, it is sufficient that its decisions today should not affect its wealth beyond that horizon. This is what happens when a financial shock reduces a household's wealth to zero. This extended definition of "death" is necessary to obtain quantitatively significant results.

Even with the extended definition, however, the assumption that households are "mortal" does not necessarily mitigate the impact of future rates on aggregate demand. To understand why, it is important to note that the impact of interest rates on aggregate demand in the IS curve includes both direct effects – firms and households borrow more when rates are lower, all else being equal – and indirect effects. The latter include, for example, the fact that lower rates increase aggregate demand, which increases household income and in turn leads to even higher demand, and so on. Finite lifespans reduce the direct effects of future interest rates. But a household with a shorter lifespan also saves less and spends a greater share of its income. The Keynesian multiplier is therefore higher, which amplifies the indirect effects.

In models with finite lifespans, the low impact of future rates on aggregate demand ultimately depends on the amount of assets that households own. If they have zero assets, the impact is the same as in a model with infinite lifespans (Farhi and Werning, 2019). If they have a positive asset stock, the impact of future rates is smaller, but the impact of forward guidance is still overestimated compared with the data (Del Negro, Giannoni and Patterson, 2012 and 2023).

Household heterogeneity and precautionary savings

The assumption that all households are identical downplays a key determinant of households' saving behaviour – precautionary savings. Indeed, it abstracts away the idiosyncratic shocks that households face, such as the risk of losing one's job, which is one of the reasons for building up precautionary savings. If future interest rates had a smaller effect on precautionary savings, household heterogeneity could reduce the impact of future rates on aggregate demand.

Why would future interest rates have a smaller effect on precautionary savings? One idea is that households are subject to borrowing constraints (McKay, Nakamura and Steinsson, 2019). In this case, a household that expects it will be unable to borrow in a year's time has no reason to take account of interest rates more than one year ahead.

4 Regarding the baseline IS curve of New Keynesian models as the root of the forward guidance puzzle, as the majority of the literature does, implicitly focuses the issue on how consumption responds to changes in interest rates, leaving investment aside. See Dupraz (2023) for the dependence of aggregate demand on expectations of current and future policy rates when investment is taken into account.

5 The infinite lifespan assumption is not as absurd as it seems. Rather than implying that humans live forever, it refers to the lifespan of the household, understood as a family. A family where each generation cares about its children's wellbeing as well as its own will behave in the same way as a household with an infinite lifespan, for example by saving with a view to passing its wealth on to future generations.

However, precautionary savings do not necessarily diminish the impact of future interest rates on aggregate demand. Here again, this is due to indirect effects. True, a household that knows it will not be able to borrow in a year's time pays little attention to the future level of rates. But it will also spend a higher share of its income, which increases the indirect effect of future rates. These stronger indirect effects may completely offset the smaller direct effects. They may even amplify the impact of future interest rates, exacerbating the forward guidance puzzle (Bilbiie, 2020 and Werning, 2015). The impact of precautionary savings is therefore more complex than might be intuited based on direct effects alone. Borrowing constraints turn out not to be essential (Acharya and Dogra, 2020).

Bounded rationality

A more promising avenue is to depart from the assumption that expectations are rational.[6] The role of expectations appears intuitive: given that what matters for aggregate demand today is the expectation of future policy rates, assuming that expectations are less forward-looking than under the rational expectations assumption can lower the impact of future rate announcements. Gabaix (2020) and Woodford (2019) propose resolving the forward guidance problem in this way, by assuming that agents cannot perfectly anticipate how announcements will affect the economy in the long run, and instead expect the economy to be similar to how it was in the past.

However, it is important to distinguish between expectations of policy rates on the one hand, and expectations of inflation and activity on the other. In survey data, households' and firms' expectations of inflation and activity respond little to forward guidance announcements (Coibon et al., 2020). But expectations of future policy rates, as reflected in asset prices – especially long-term interest rates – are very sensitive to forward guidance (Gürkaynak et al., 2005 and Swanson, 2021). Models that dampen expectations of all economic variables equally, such as Gabaix (2020) and Woodford (2019), fail to capture this effect. They solve the forward guidance puzzle by assuming away the possibility that central bank communication can affect long-term rates.

The expectations of future policy rates reflected in long-term interest rates are those of financial market professionals, and not directly those of most firms and households. Yet they are the ones that matter most, since long-term rates are what influence firms' and households' savings and investment decisions. Therefore, assuming that firms' and households' expectations are boundedly rational while those of market professionals are rational solves the forward guidance puzzle, while also taking account of the impact of monetary policy on asset prices (Dupraz et al., 2024). The green curves in the previous chart show the impact of a future rate cut announcement under this dual assumption. The impact no longer diverges into an infinite effect for announcements with an infinitely long-term horizon; the forward guidance puzzle has disappeared.

Imperfect credibility

Another way to solve the forward guidance puzzle is to assume that central banks are not perfectly credible (Campbell et al., 2019, Coenen et al., 2023). In this case, announcements of future rate changes carry less weight – even though the weight of rate expectations themselves remains unchanged.

As a solution to the forward guidance puzzle, however, imperfect credibility has two important limitations (Dupraz et al., 2024). The first is the same as in bounded rationality models that modify expectations of all variables equally: the assumption fails to capture the strong response of asset prices to announcements on future rates. Second, imperfect credibility models continue to imply that forward guidance announcements would have an extremely powerful impact if central banks managed to resolve their credibility issue. Therefore, bounded rationality currently appears to be the most promising solution.

6 It seems at least difficult to avoid departing from the assumption of rational expectations with complete information. Dispersed information can provide a solution that retains rational expectations (Angeletos and Lian, 2018).

Semi-structural models

While structural New Keynesian models are the main models used to analyse monetary policy in the academic literature, central banks rely on several model types. One of these is semi-structural models. Compared with structural models, these link the dynamics of macroeconomic aggregates less closely to the behaviour of individual firms and households. Instead, they focus more on capturing statistical properties at the aggregate level. In particular, the structural relationships between household and firm behaviour and macroeconomic variables are used only to describe the long-term dynamics of the economy. Consequently, semi-structural models play a vital role in short and medium-term forecasting exercises.

The main semi-structural model used at the Banque de France is FR-BDF (Lemoine et al., 2019). Thanks to its detailed description of the statistical behaviour of the economy, FR-BDF is not subject to the forward guidance puzzle. In the chart, the purple curve shows the impact of the announcement of a future rate cut in FR-BDF. The impact does not diverge for announcements of rate cuts at long horizons, and the effects of announcements are comparable with those in New Keynesian bounded rationality models (green curves).

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