Discussion of "Monetary Policy, the Financial Cycle, and Ultra-Low Interest Rates"*

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1. Introduction

Several recent papers have documented a trend decline in real interest rates at least since the late 1990s in the United States and other countries (see, e.g., Holston, Laubach, and Williams 2017, among others). While monetary policy has slashed the federal funds rate in the wake of the Great Recession and kept it near zero until the end of 2015, researchers have argued that the low rates reflect in large part a depressed real "natural rate of interest," r^*, i.e., an interest rate that would prevail if output were equal to its potential. Such an interest rate, which abstracts from monetary policy, captures the effects of real forces that affect investment and national saving. The natural rate of interest is often considered as a useful guide for monetary policy. By setting the real policy rate in line with the natural rate, monetary policy tends to accommodate fluctuations in the economy so as to bring output in line with potential output, at least in simple models. Furthermore, to the extent that inflation depends on the output gap, i.e., the gap between output and its potential, monetary policy could in principle stabilize output around its potential as well as inflation.

In their paper "Monetary Policy, the Financial Cycle, and Ultra-Low Interest Rates," Mikael Juselius, Claudio Borio, Piti Disyatat, and Mathias Drehmann (henceforth JBDD) criticize this approach

*The views expressed herein are solely those of the author and do not necessarily reflect those of the Federal Reserve Bank of New York or the Federal Reserve System.

as being too narrowly focused on inflation and the output gap, and as omitting, in their view, a key driver of economic fluctuations: the financial cycle. The paper's contributions are threefold. First, it proposes a thought-provoking account of the U.S. economy's evolution over the past three decades, in which monetary policy has a first-order impact on the financial cycle. Fluctuations in financial variables such as leverage and the debt service burden cause in turn inefficient output booms and busts. This results in large fluctuations in the output gap. Second, the authors revisit the measurement of the natural rate of interest. While r^* is, in popular analyses, the real rate that equates the output with the potential output, JBDD propose an alternative natural rate that accounts for the financial cycle. A key finding of the paper is that the estimate of the proposed natural rate tends to be higher than the more conventional r^* over the past three decades, and furthermore declines considerably less than conventional estimates during the recent Great Recession. The authors conclude from this that actual policy rates have been persistently lower than the natural rate that appropriately adjusts for financial cycles. Furthermore, they conclude that past loose monetary policy caused financial imbalances, output booms, and busts, which in turn led to the recent ultra-low rates. JBDD in turn recommend that monetary policy "lean against the wind" and respond systematically to short-term fluctuations in the financial cycle. They specifically propose a Taylor-type interest rate rule that responds to financial indicators, and argue, using a simple counterfactual experiment, that following such a policy rule would have improved economic and financial stability relative to the actual policy.

The paper raises numerous important questions: in particular, to what extent should policymakers worry about the financial cycle, above and beyond the mandated macroeconomic objectives? This paper provides a valuable contribution to this debate. It is very thought provoking and states important policy implications. The paper deserves attention and careful reading. The analysis is well executed, and the underlying working paper (JBDD 2016) contains important additions, numerous robustness checks, and appendixes. However, while the paper states strong conclusions and unequivocal policy implications, I am not convinced that the evidence provided in the paper supports these conclusions.

In the rest of my comments, I focus on the authors' characterization of the financial cycle, on the interpretation of the "finance-neutral" r^*, and argue that there are good reasons for the policy rate *not* to track the authors' proposed "finance-neutral" r^*. In the end, while I applaud the authors' valuable efforts to merge financial cycle considerations with a macroeconomic and monetary model, I remain unconvinced by the paper's main claim, namely, that policy should have tracked more closely the authors' "finance-neutral" r^*, which is on average higher and has declined less than other popular estimates.

2. The Financial Cycle

To determine the finance-neutral natural rate of interest, the authors augment the popular Laubach-Williams (2003) model with two variables that they argue characterize well the financial cycle. These variables, initially proposed in Juselius and Drehmann (2015), are the *leverage gap* and the *debt service gap*, each expressed in deviations from a respective long-run cointegrating relationship. The first relationship assumes that the credit-to-GDP ratio is in the long run directly proportional to the real price of assets.[1] The second relationship assumes that the credit-to-GDP ratio moves in the long run one-for-one with the average lending rate on the outstanding stock of credit, which depends on current and past monetary policy. The assumption of these two cointegrating relationships implies that any gap or deviation from these long-run relationships must reverse over time. For instance, JBDD argue that if leverage is below its long-run value (a negative leverage gap), which could be caused by unusually high asset prices, then credit would subsequently tend to rise faster than GDP to restore the leverage back to its "normal" level. A "financial equilibrium" obtains when both leverage and debt service gaps are closed.

While the assumption of cointegrating relationships may be reasonable in many circumstances, it is not innocuous. It does exclude

[1]Juselius and Drehmann (2015) justify this by assuming (i) that leverage (LEV_t) defined as the ratio of nominal credit (CR_t) to the nominal value of assets (A_t) is constant in the long run, and (ii) that the nominal value of assets divided by the nominal price of assets is proportional to real GDP.

permanent changes to a "normal" leverage level (say as a result of securitization, for instance) or to a "normal" debt service. The authors justify the long-run relationships not with theory, but by failing to reject the cointegration between those variables over the past three decades, and by arguing that the parameters involved have remained stable. I find this empirical evidence unconvincing. As Elliott (1998) demonstrated, standard hypothesis tests for cointegration depend heavily on the assumption of exact unit root in the model; for near unit root, these tests have low power to reject no cointegration. Moreover, the assumption of a unit root in interest rates is a priori questionable.

3. The Financial Cycle and the Macroeconomy

Assuming that we have appropriately characterized the financial cycle, the next question is how does it affect the macroeconomy? JBDD consider a variant of the model by Laubach and Williams (2003) composed of a dynamic IS equation of the form

$$y_t - y_t^* = \beta_3 \left(y_{t-1} - y_{t-1}^*\right) - \varphi_{31} \left(i_{t-1} - \pi_{t-1} - r_{t-1}^*\right) \\ - \varphi_{32} \widetilde{lev}_{t-1} + \vartheta_{3t},$$

where y_t is log output, y_t^* denotes log potential output, i_t is the nominal interest rate, π_t is inflation, r_t^* is the real natural rate of interest, $\widetilde{lev}_t$ denotes the leverage gap, and ϑ_{3t} is an exogenous shock; a Phillips curve

$$\pi_t - \pi^* = \beta_5 \left(\pi_{t-1} - \pi^*\right) + \varphi_5 \left(y_{t-1} - y_{t-1}^*\right) + \vartheta_{5t};$$

an equation determining the evolution of the natural rate of interest

$$r_t^* = \beta_6 r_{t-1}^* + (1 - \beta_6) \left(z_t + \rho^{-1} 4 \Delta y_t^*\right) + \vartheta_{6t};$$

and exogenous processes describing the evolution of potential output y_t^* and z_t. This model is reminiscent of the simple New Keynesian model (e.g., Woodford 2003; Galí 2008). However, while the New Keynesian model results from agents' explicit optimization problems, which yield forward-looking relationships, the present model assumes backward-looking relationships that are harder to justify on theoretical grounds. That said, the model expands on the popular

Laubach-Williams (2003) model by adding the leverage gap to the IS equation.

The authors explain that the leverage gap is meant to loosely capture the strength of the credit constraint. A positive leverage gap implies that the credit-to-GDP ratio is high relative to asset prices. Given that the leverage gap is assumed to return to its initial steady state, going forward credit growth is expected to be lower than GDP growth. The authors argue that, somehow, this is meant to depress current GDP ($\varphi_{32} > 0$). While the authors take comfort in estimating a strong negative correlation between their leverage gap variable $\widetilde{lev}_t$ and the output gap $y_t - y_t^*$, I remain skeptical about the setup in the absence of a solid foundation and clear mechanisms justifying their equations.

3.1 On the Dangers of Backward-Looking Models

I have little doubt that the model provides a decent fit of the data. I am, however, concerned that the seemingly benign assumption of backward-looking relationships may have important implications for the interpretation of the results and hence the policy recommendations. This affects both the assessment of the effects of interest rate changes on economic activity and the influence of financial cycles on the economy.

First, estimates of the parameters entering the IS equation suggest that the leverage gap has a much greater impact on the output gap than interest rates: while the parameters estimates $\varphi_{31} = 0.037$ and $\varphi_{32} = 0.045$ are roughly the same, the leverage gap fluctuates considerably more than the interest rate in relation to the natural rate. Hence, according to the authors, the leverage gap "is one of the main channels through which monetary policy can influence the real economy." Furthermore, they find that the real interest rate is not a very effective tool for controlling the leverage gap itself. Having obtained that result, it is understandable that the authors conclude that a primary focus of monetary policy should be to stabilize the financial cycle instead of attempting to close the output gap directly. However, that argument relies crucially on the finding that interest rates have relatively little impact on output. That result is, however, in contrast with typical estimates of medium-scale dynamic stochastic general equilibrium models (e.g., Smets and Wouters 2007;

Del Negro, Giannoni, and Schorfheide 2015), or studies based on survey of the consumer expectations (Crump et al., 2015), which obtain considerably larger estimates of the intertemporal elasticity of substitution.

One key difference, as mentioned above, is that the proposed IS equation is backward looking. This makes it difficult to infer a structural estimate of the response of output to interest rate changes. To see why, imagine that interest rates have a large effect on output and the central bank sets its policy rate so as to stabilize the output gap next period, given all information available. If the central bank is successful, the interest rate movements should offset any shock that is about to move the output gap one way or the other. As a result, we should observe almost no correlation between the current policy rate and the next period's output gap. In such an environment, one would likely estimate a very low value for φ_{31}, even though interest rates have by assumption a large impact on output: the coefficient φ_{31} would confound both the impact of interest rate on output and the policy response. To address this problem, a structural model that disentangles the two forces is needed.

The second concern with the backward-looking specification refers to the link between the financial cycle and the macroeconomy. The financial cycle involves a potentially powerful feedback loop between the leverage gap, the debt service gap, asset prices, interest rates, and economic activity. It is characterized in the paper by the dynamic equations (8), (9), and (10). While the paper doesn't elaborate on this financial cycle, the underlying working paper (JBDD 2016) and Juselius and Drehmann (2015) illustrate it in more details. They argue that starting from a negative leverage gap (e.g., due to relatively high asset prices, as in the late 1980s or mid-2000s), credit would necessarily grow faster than output. As the credit-to-GDP ratio increases, so does the debt service gap. That ends up slowing down output and asset prices, eventually causing a bust and a potentially drawn-out recession. While these variables are certainly correlated, a natural question is which way does the causality go? The authors assume a priori that the financial cycle causes economic fluctuations. This leads naturally to the policy implications listed in their conclusion. The authors' preferred story has, however, the peculiar implication that leverage predicts future movements in asset prices, which are often thought to be purely forward looking.

An alternative view of the co-movement of financial and economic variables is that the financial cycle reflects economic fluctuations, whereby asset prices and credit are based on the expected future economic conditions. The causality would thus run in the other direction. It would be useful in future work to provide more evidence about the direction of causality.

4. Do "Prevailing" Models Neglect the Financial Cycle?

The authors argue that prevailing models neglect the financial cycle, and thus "present an alternative view of the natural rate, in which financial factors also play a role." It is true that in the simplest New Keynesian model—composed of a dynamic IS equation, a Phillips-curve relationship, and a monetary policy rule—there are no explicit "financial cycle" variables, and the natural rate of interest and of output are functions of real disturbances only. However, New Keynesian models with financial frictions do exist as well (e.g., Bernanke, Gertler, and Gilchrist 1999; Christiano, Motto, and Rostagno 2003, 2014; Cúrdia and Woodford 2009; Del Negro, Giannoni, and Schorfheide 2015; Del Negro et al. 2017, among many others). In such models, entrepreneurs' leverage is a key state variable which affects the spread between the nominal return on capital (the borrowing rate) and the policy rate (the deposit rate), along with shocks to the entrepreneurs' idiosyncratic productivity. In turn, aggregate output depends on the policy rate and credit spread, hence on leverage. But in those models, fluctuations in leverage need not be unsustainable; they can be efficient. It is thus not clear a priori that they need to be stabilized. For example, Del Negro et al. (2017) estimate a medium-scale DSGE model with financial frictions, and in which Treasury securities are valued not only for their pecuniary return but also for their liquidity and safety attributes, so that they carry a "convenience yield," along the lines of Krishnamurthy and Vissing-Jorgensen (2012) and Caballero, Farhi, and Gourinchas (2017). Interestingly, while the resulting natural rate of interest can fluctuate sharply in the short run, the implied medium-term natural rate (i.e., the five-year forward natural rate) resembles closely the estimate obtained by Laubach and Williams, over the past three decades.

Although these models incorporate some financial features, they remain very stylized. In particular, they typically do not capture the non-linear effects of high leverage on the economy's vulnerability to adverse shocks, which may trigger financial and economic crises. Model improvements are certainly still badly needed in this area. Recent work by Adrian and Duarte (2017) offers an interesting path forward.

5. On the Interpretation of r^*

When one considers financial frictions, several interest rates come into play, and a spread separates the rate of interest charged to borrowers and the one paid to depositors. Furthermore, rising financial frictions tend to push the borrowing rate up while they tend to depress the deposit rate. Which rate does the natural rate of interest correspond to? To the extent that we are interested in an interest rate relevant for monetary policy, the relevant natural rate is the rate on a short-term riskless, liquid security.

The estimated model yields estimates of the latent variables r_t^* and y_t^* which the authors call "the 'finance-neutral' natural interest rate and potential output—in the sense that the estimates control for the influence of financial factors." JBDD then compare their estimate of r_t^* to that of Laubach and Williams (2003) and find that the "finance-neutral" rate is generally higher than the one estimated by Laubach and Williams (2003) and has also declined less during the Great Recession. The authors imply that the real policy rate should have been higher than implied by Laubach and Williams.

Taking JBDD's model literally, is the authors' "finance-neutral" rate really the rate that policy should track? I don't think so. Looking at the IS equation and the Phillips curve again, and abstracting from exogenous shocks ϑ_{3t} and ϑ_{5t} for simplicity, it is apparent that the central bank could in principle perfectly stabilize both the output gap and inflation around its target, by setting the policy rate to

$$i_t = \pi_t + \left(r_t^* - \frac{\varphi_{32}}{\varphi_{31}} \widetilde{lev}_t \right)$$

at all dates. As a result, in this model, policy should not track the "finance-neutral" r_t^*, but rather the natural rate adjusted by the leverage gap. With a strongly positive leverage gap in the midst of the Great Recession (see figure 2 in JBDD's paper), the model suggests that it was appropriate for policy to lower the interest rate well below the authors' estimate of r^* to stabilize the output gap and inflation. In practice, of course, the effective lower bound on nominal interest rates is likely to prevent the policy rate from tracking $r_t^* - \frac{\varphi_{32}}{\varphi_{31}}\widetilde{lev}_t$, especially given the large fluctuations in the leverage gap. It would be interesting then to compare the adjusted r^* to that obtained by Laubach and Williams (2003). The key point, though, is that JBDD's estimate of r^* is not a reference rate that helps close the output gap and the inflation gap.

What does JBDD's r^* refer to? Equation (8) in the paper reveals that r^* corresponds to the real rate at which policy would have no direct impact on the leverage gap. By tracking fluctuations in the estimated r^*, policy would, however, still indirectly contribute to fluctuations in the leverage gap, as the implied changes in the policy rate would affect the *debt service ratio gap* (see equations (9) and (10) in the paper), which in turn have an effect on the leverage gap.

6. Conclusion

In conclusion, this is a very interesting and thought-provoking paper on a key monetary policy issue. It presents an interesting framework that allows the authors to perform a valuable analysis of the complex interactions between the financial cycle and macroeconomic fluctuations. The paper concludes with strong policy implications. While the motivation for the model is based on observed empirical co-movements between financial and macroeconomic variables, I am concerned that some of the apparently innocuous assumptions affect importantly the results. In particular, I suspect that the conclusions rely heavily on the backward-looking nature of the model. In future work, I would encourage the authors to develop a theoretical justification for their setup or to explore the robustness of their conclusions to other models. I also remain unconvinced that the natural rate estimated by the authors provides a good guide for policy. That said, this paper provides an important contribution to the literature on macroeconomic and financial stabilization, and I expect it to remain a valuable reference.

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