Informational Content of Asset Purchase Announcements Under High Uncertainty

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Abstract

In this paper, I present empirical evidence that the effects of asset purchases conducted by the Federal Reserve depend on the state of macroeconomic uncertainty. I find that when aggregate uncertainty is elevated, a tapering of asset purchases has counterintuitive effects: industrial production steadily increases, and unemployment declines. However, in a state of normal uncertainty, a reduction of asset purchases yields expected contractionary outcomes, as industrial production falls, and unemployment exhibits an upward trend. I interpret these empirical findings as reflecting the informational content of the Federal Reserve's announcements on quantitative easing, which becomes particularly relevant in highly volatile economic conditions. By scaling back asset purchases under elevated uncertainty, the Federal Reserve reveals that its own economic outlook has strengthened relative to its prior projections. This information improves market expectations and acts as a stimulus to economic activity.

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1 Introduction

Empirical macroeconomic literature originally focused on identifying contemporaneous monetary shocks and estimating their financial and real effects. Subsequently, papers highlighted the informational content and state dependence of monetary announcements regarding changes in the short-term interest rate and its projected path. However, similar considerations applied to asset purchases received less attention in the literature although quantitative easing has become one of the main tools for the monetary policy conduct by major central banks in the environment characterized by interest rates at the zero lower bound.

This paper presents empirical evidence that asset purchase announcements by the Federal Reserve (the Fed for short) have counterintuitive effects on industrial production and unemployment under elevated uncertainty. The same policy announcements that occur at times of low uncertainty, lead to expected responses of real activity and prices, consistent with predictions of standard models. Thus, I show that the effects of asset purchases depend on the state of uncertainty.

These findings suggest that the Fed's quantitative easing announcements may contain the informational content reflecting its own assessment of current and future economic conditions. For example, under heightened macroeconomic uncertainty, the Fed's move to taper asset purchases implies that the economy is performing better than what the Fed initially projected, making the same level of purchases unnecessary to support economic activity.

To make these conclusions, I use the large scale asset purchase (LSAP) shock series estimated by Jarociński (2024) that measures high frequency market surprises of financial assets around Federal Open Market Committee (FOMC) announcements related to the Fed's quantitative easing program. I follow the approach taken by Ramey and Zubairy (2018) and Alpanda et al. (2021), and estimate the impacts of asset purchases in a state-dependent local projection (LP). The state, in turn, is determined by low and heightened uncertainty.

Estimated impulse responses demonstrate that 10 year Treasury yields do not move meaningfully to LSAP surprises when uncertainty is elevated. Thus, changes in financial

conditions are unlikely to drive the effects of unanticipated shifts in asset purchase policy on real activity indicators and prices. However, in the state of normal uncertainty, yields do respond to LSAP surprises in the expected direction, which could explain typical effects predicted by standard monetary models.

I also find that the Fed's decisions regarding quantitative easing can modulate fluctuations in aggregate macroeconomic uncertainty. When it remains at low levels, an unexpected tapering of asset purchases has contractionary effects on the economy and contributes to higher aggregate volatility. In contrast, if the economic environment is marked by substantial uncertainty, the Fed is able to bring it down to lower levels by reversing asset purchases.

This study builds upon a body of literature examining the idea that monetary policy surprises contain information about the central bank's own assessment of the economic outlook. One of the early contributions belongs to Romer and Romer (2000); authors document the information asymmetry between the Fed and the private sector with respect to inflation. Nakamura and Steinsson (2018) find that output growth expectations rise in response to unexpected monetary tightenings, which they explain by the presence of the Fed information effect. Jarociński and Karadi (2020) leverage the comovement of interest rates and stock prices to separately identify contemporaneous monetary policy and information shocks, and show that they have opposite effects. The study of Miranda-Agrippino and Ricco (2021) proposes a new monetary instrument net of information asymmetry effects and shows that it helps resolve several empirical puzzles. I complement this line of research by uncovering the informational content in asset purchase policy, which becomes particularly important under conditions of elevated uncertainty.

Additionally, this paper relates to the literature that explores the state dependent effects of shocks. The most closely related is the work of Castelnuovo and Pellegrino (2018) who find the impact of monetary policy shocks to be weaker under high uncertainty. Tenreyro and Thwaites (2016) focus on the state of the business cycle and present the empirical evidence that monetary policy is more effective during expansions. Alternative forms of state dependence for the transmission of monetary policy are also studied in the literature. For example, Aikman et al. (2016) show that the real

economy is unresponsive to monetary policy disturbances when the credit-to-GDP gap is high. Eichenbaum et al. (2022) document that the effects of monetary policy shocks vary with current interest rates, since rate differentials generate potential savings from mortgage refinancing. Alpanda et al. (2021) investigate how the business cycle, credit and interest rate conditions jointly shape the efficacy of monetary policy. Other papers evaluate whether the size of government spending multipliers varies across phases of the business cycle (Auerbach and Gorodnichenko, 2012; Auerbach and Gorodnichenko, 2013; Ramey and Zubairy, 2018). In contrast to these papers, my analysis focuses on unconventional asset purchase policy, with the state determined by the prevailing level of macroeconomic uncertainty.

2 LSAP Shocks

To evaluate causal effects of LSAP policy, I require exogenous variation that reflects unanticipated surprises to monetary policy. For this purpose, I use LSAP shocks estimated by Jarociński (2024) for the U.S. economy. One of the advantages of his approach is that no sign or zero restrictions are imposed at the beginning of the procedure; instead Jarociński (2024) relies on higher order moments of data to separate the shocks.

Jarociński (2024) employs high-frequency methods[1] and around each FOMC meeting records financial market surprises to monetary policy announcements for the first Fed funds future, 2 year and 10 year Treasury yields along with S&P500. He defines each shock as a linear combination of the four financial market surprises and estimates unknown coefficients leveraging non-Gaussianity of the surprises.

One of the identified shocks is shown to mostly move 10 year Treasury yield, the main target of QE, and there are no significant effects on contemporaneous interest rate or 2 year Treasury yield, thus this shock is given a LSAP label. Since Jarociński (2024) accounts for four possible dimensions of the Fed's monetary policy – contemporaneous monetary actions, Delphic and Odyssean forward guidance, and asset purchases, we

[1]See, for example, early contributions of Kuttner (2001) and Cook and Hahn (1989) and a seminal work by Gürkaynak et al. (2005).

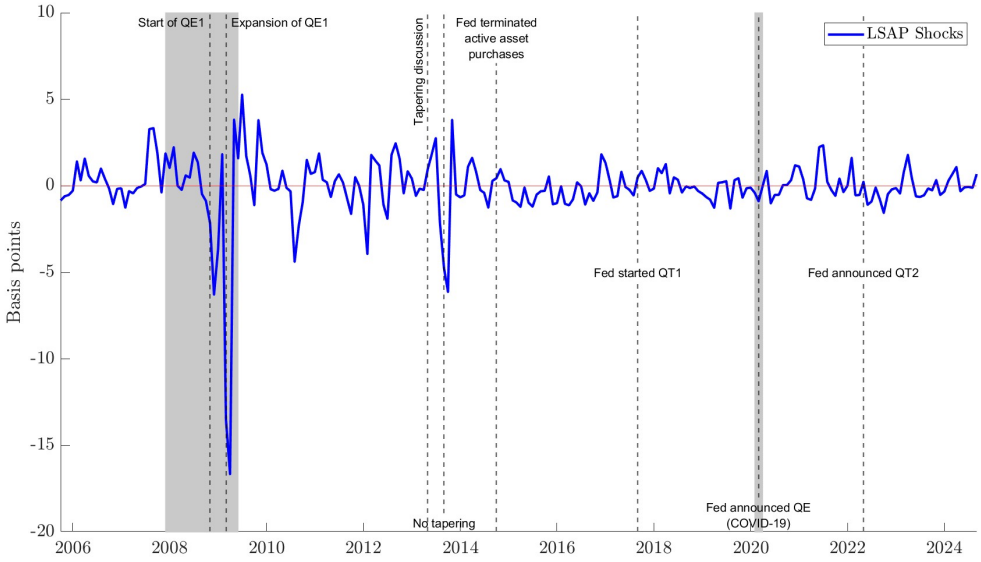

Figure 1: History of LSAP shocks estimated by Jarociński (2024).

Notes: Shock series is aggregated to monthly frequency following the approach of Gertler and Karadi (2015) and normalized to represent changes in 10 year Treasury yield (in basis points). Major events in LSAP policy in the U.S. are indicated by vertical dotted lines. Grey shaded areas represent NBER recessions.

can be confident that LSAP shocks accurately capture market reactions to the Fed's announcements about unconventional QE.

2.1 Historical Relevance of Shocks

Figure 1 plots a history of LSAP shock realizations from October 2005 until September 2024 at monthly frequency along with grey shades representing NBER recession dates. Jarociński (2024) shows that positive LSAP shock increases 10 year Treasury yield and is thus considered contractionary. Figure also denotes major events in LSAP policy in the U.S. by vertical dotted lines, and a shock time series is well aligned with them. For example, very large negative realizations of LSAP shock are observed in March and April of 2009 - months when the Fed announced asset purchases for the first time.

Similarly, shock realizations are positive in June and July 2013 following a discussion of asset purchase tapering a few months before. When the market processed the announcement made in September 2013 that no tapering is going to happen, negative LSAP shocks were recorded in the same and next months. Thus, it lends support to interpretation of these shocks as those measuring surprises around the LSAP policy.

3 Econometric Methodology

I use local projection (Jordà, 2005) as a direct method to estimate impulse responses of macro quantities to LSAP shocks. The original approach proposes a linear model, but the purpose of this paper is to establish uncertainty-dependence of the effects of asset purchases by the Fed. Thus, the model becomes state-dependent, and the original approach needs to be modified.

To this end, I adopt a state-dependent version of local projection that has been employed, for example, by Auerbach and Gorodnichenko (2013) to analyze dependence of fiscal multipliers on the state of the economy, and Tenreyro and Thwaites (2016) to explore whether conventional monetary policy is more effective in recessions or expansions.

I rely on the version of local projection that was used by Ramey and Zubairy (2018) and Alpanda et al. (2021). However, instead of imposing dependence on the business cycle stage, I condition the effects of LSAP policy on the level of macroeconomic uncertainty prevailing in the economy. At each horizon $h \in \{0, 1, \ldots, H\}$, I estimate a series of regressions with the following specification

$$y_{j,t+h} = \alpha_{jh} + \beta_{1,jh}\varepsilon_t + \beta_{2,jh}\varepsilon_t \mathbb{1}\{MEU_{t-1} > 1\} + \gamma_{jh}^{\mathsf{T}}\boldsymbol{x}_{t-1} + u_{t+h}, \tag{1}$$

where $y_{j,t+h}$ is a response variable j at horizon $t+h$, ε_t is LSAP shock observed at time t, and $\mathbb{1}\{MEU_{t-1} > 1\}$ is an indicator variable that equals one when lagged standardized macroeconomic uncertainty (MEU) exceeds one standard deviation, and zero otherwise. Measure of macroeconomic uncertainty is provided by Jurado et al. (2015). I choose a three months ahead uncertainty version to use in estimation.[2] Note

[2] In Appendix section A, I show that the results are robust to using uncertainty measures at horizons

that LSAP shock occurs at time t, but I include uncertainty measured from last period to avoid simultaneity and endogeneity issues. To account for serial correlation in error term u_{t+h}, HAC standard errors (Newey and West, 1987) are estimated, and the lag length is set equal to horizon h in each regression. Vector $\boldsymbol{x}_{t-1}$ collects p lags of control variables, which serves to replicate the structure of VAR. I do not interact control variables and intercept with an uncertainty indicator because otherwise, a small sample size will not allow to obtain parameter estimates.

The local projection specification above implies that the effect of one unit positive LSAP shock on response variable y_j in low uncertainty environment is given by $\beta_{1,jh}$, and captured by $\beta_{1,jh} + \beta_{2,jh}$ when macroeconomic uncertainty is elevated. Thus, one may explore the statistical significance of estimated coefficient $\beta_{2,jh}$ at given horizon to form an early assessment of whether uncertainty dependence is present in the data.

4 Discussion of Empirical Results

This section discusses results of local projection estimation that accounts for level of macroeconomic uncertainty at the time of LSAP shock. For the local projection specification, I set the lag length $p = 12$.

As was noted in the previous section, it is instructive to examine estimated coefficients for the non-linear term representing interaction effects.[3] I plot these coefficients with corresponding 68% and 95% confidence intervals in Figure 2. Estimate for IP is statistically significant starting from the very impact, and remains so at most horizons. The unemployment coefficient becomes statistically different from zero with a lag of around five horizons, and a similar pattern holds for consumption and prices. Non-linear effects of a non-trivial magnitude are also observed for macroeconomic uncertainty. Thus, a quick examination of statistical significance of estimated parameters suggests that the effects of LSAP policy depend on macroeconomic uncertainty conditions.

Motivated by the findings above, I explore the uncertainty-dependent impacts of

of one and twelve months ahead.

[3] In Appendix section A, Figure 4 shows coefficients for the linear term, which represents the effects of LSAP shocks in a low uncertainty environment.

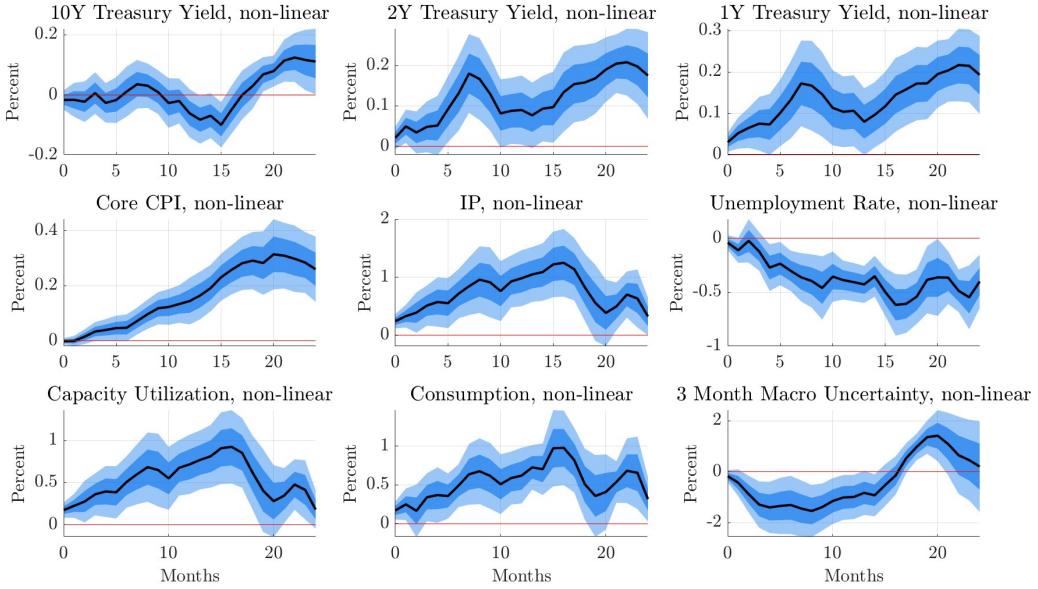

Figure 2: Coefficients for Non-linear Term in Local Projection with LSAP Shocks.

Notes: Figure plots point estimates of coefficient $\beta_{2,jh}$ (black lines) for each response variable at each horizon from local projection specification given in (1). Blue shaded areas show confidence intervals at 68% and 95% confidence level. HAC standard errors are calculated (Newey and West, 1987).

LSAP shocks on macroeconomic quantities of interest. Figure 3 plots impulse responses to a one unit positive LSAP shock in low and high macroeconomic uncertainty environment. From the response of IP it is immediately apparent that transmission of LSAP policy is uncertainty-dependent, and there are pronounced differences across states. When uncertainty is low, positive LSAP shocks are contractionary (shown by red lines): I observe a gradual decline in IP, with the trough of almost 0.7%, and a slow-moving rise in unemployment reaching the peak of more than 0.3 percentage point (pp). These adverse effects can be linked to a tightening of financial conditions, as indicated by an initial uptick in the 10 year Treasury yield followed by a more substantial rise over horizons 10-20. Similar downward movements are also reflected in the paths of consumption and capacity utilization.

However, in a setting of elevated uncertainty, positive LSAP shock leads to *expansionary* effects (depicted by dashed blue lines). This is evidenced by a persistent

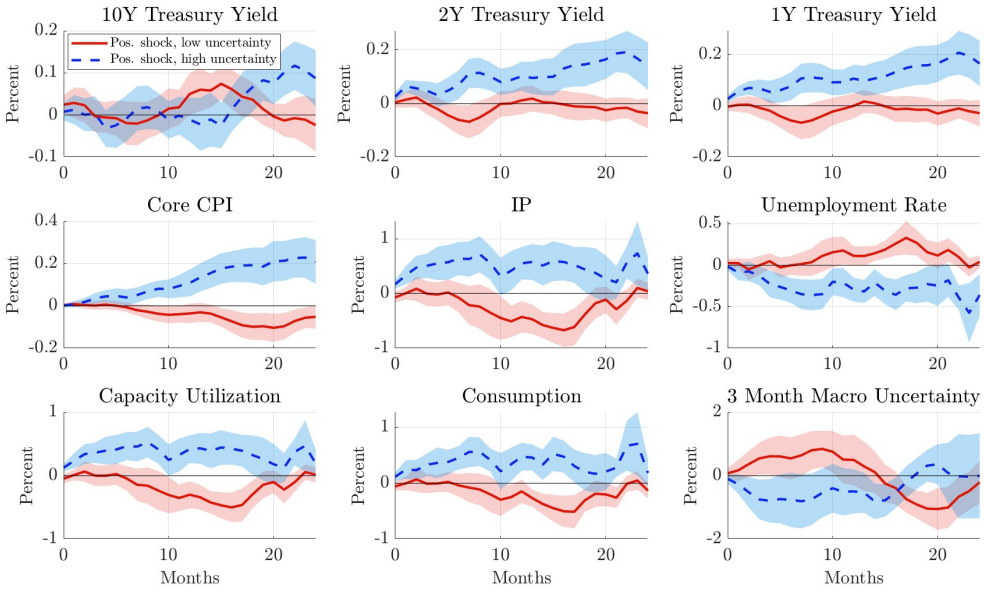

Figure 3: Impulse Responses to LSAP Shocks Under Low and High Uncertainty at 3 Month Ahead Horizon.

Notes: Figure plots point estimates of impulse responses to one unit positive LSAP shock: $\beta_{1,jh}$ under low uncertainty (red solid lines) and $\beta_{1,jh} + \beta_{2,jh}$ under high uncertainty (blue dotted lines), for each response variable at each horizon from local projection specification given in (1). Measure of macroeconomic uncertainty at 3 month ahead horizon. Red and blue shaded areas show confidence intervals at 95% level for corresponding point estimates of impulse responses. HAC standard errors are calculated (Newey and West, 1987).

increase in IP, which starts immediately upon impact and lasts for around 20 horizons. The peak increase is slightly over 0.7%, which is similar to the peak decline observed in periods of normal uncertainty. It is worthwhile to note that the 10 year yields do not move meaningfully in response to LSAP shocks for the first 15 periods upon impact, thus we do not observe an easing of credit conditions, which could explain an expansion of the economy.

As indicated by the middle-right subplot in Figure 3, under conditions characterized by heightened uncertainty, the expansionary dynamics of IP are mirrored by unemployment remaining below the steady state level for almost 20 months, while it exhibits a gradual upward trend in the subdued uncertainty state. Comparable dif-

ferential effects are found in responses of consumption and capacity utilization, with the latter characterizing firms' behavior. Furthermore, rising (falling) prices are consistent with the finding that positive LSAP shocks stimulate (dampen) real activity in an environment of elevated (low) uncertainty.

An important point to observe is that LSAP policy surprises also influence volatility of multiple macroeconomic time series summarized by aggregate measure of uncertainty, as is evident from the bottom-right panel in Figure 3. At low levels of uncertainty, positive LSAP shocks lead to larger fluctuations in the macroeconomy and a subsequent rise in aggregate volatility. On the contrary, the Fed is able to bring uncertainty down from elevated to lower levels by unexpectedly reversing asset purchases. In other words, LSAP policy actions that come as a surprise to markets, can modulate fluctuations in macro time series, reducing uncertainty when it remains high, and raising uncertainty when its level is low. In this sense, the Fed's role may also involve smoothing volatility over time.

The results presented above show that positive LSAP shocks under high uncertainty conditions do not exert adverse effects on real activity, but, contrary to expectations, promote economic expansion. One candidate interpretation of this empirical fact suggests that FOMC announcements contain not only information pertaining to the conduct of LSAP policy, but also the Fed's own assessment of current and future economic conditions. The information set of market participants is not larger than that of the Fed. Hence, FOMC announcements regarding unconventional policy represent an opportunity for the market to learn about the state of the economy by interpreting the Fed's moves with respect to asset purchases under normal or high levels of uncertainty.

Discussion of the Fed's information effects goes back to a seminal study by Romer and Romer (2000), and continues in more recent papers, for example, Nakamura and Steinsson (2018) and Jarociński and Karadi (2020). These authors focus on information derived from conventional monetary policy: if the Fed's decision about a short-term interest rate is different from market expectations, this situation may reveal to the private sector new information about its own assessment of the economic outlook. Since the Great Recession, the short-term interest rate in the U.S. hit the zero lower bound, and the Fed became unable to communicate its own economic projections to the public

by setting the rate relative to what market analysts anticipate.

Around the same time, the Fed adopted a new policy of asset purchases, and their role has increased substantially since then. Therefore, the market can infer the Fed's assessment of current economic developments from its actions about quantitative easing policy. The empirical findings presented earlier lend support to this view. If macroeconomic uncertainty stays at high levels, and the Fed announces a tapering of asset purchases, a combination of these events implies that the economy is performing better than what the Fed initially anticipated. This monetary policy intervention results in an improvement of market expectations and acts as a stimulus to economic activity.

5 Conclusion

This paper documents that the effects of asset purchase announcements by the Fed differ across the states of macroeconomic uncertainty. Asset purchases have the expected impact on real activity and prices under normal levels of aggregate uncertainty. However, at times of elevated economic volatility, real quantities and prices respond to unanticipated changes in the quantitative easing program in the direction opposite to what standard models predict.

I interpret these empirical findings through the lens of information effects: the Fed's announcements regarding its asset purchase policy reveal its own assessment of current and future economic conditions. These effects become particularly pronounced during heightened uncertainty when market participants have an opportunity to learn the underlying economic state from atypical monetary moves. A tapering of asset purchases during highly turbulent periods implies that the economy is performing better than the Fed's prior projections, improving market expectations and providing a stimulus to economic activity.

If information effects are indeed present, the market's forecasts of GDP growth, inflation and unemployment must change accordingly after receiving favorable economic news from the Fed. Exploring the responses of market participants' expectations to quantitative easing announcements constitutes the next step in this line of research.

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Appendices

A Additional Figures

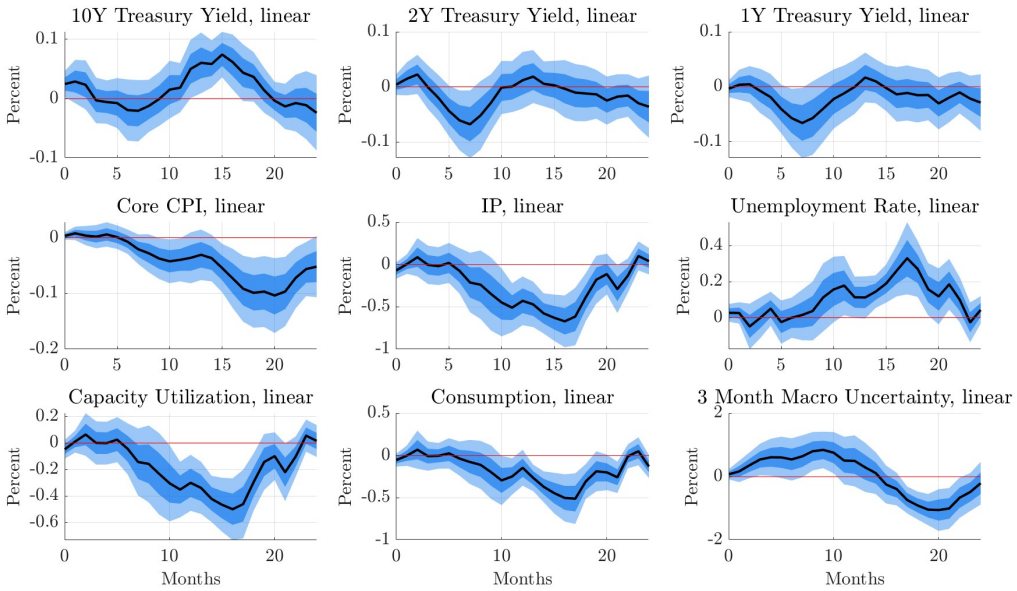

Figure 4: Coefficients for Linear Term in Local Projection with LSAP Shocks.

Notes: Figure plots point estimates of coefficient $\beta_{1,jh}$ (black lines) for each response variable at each horizon from local projection specification given in (1). Blue shaded areas show confidence intervals at 68% and 95% confidence level. HAC standard errors are calculated (Newey and West, 1987).

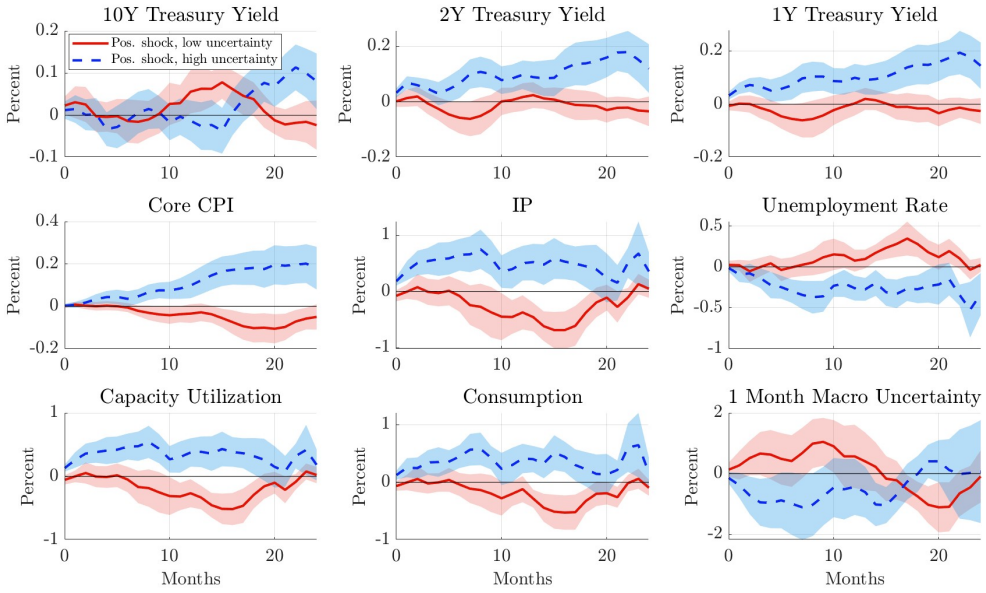

Figure 5: Impulse Responses to LSAP Shocks Under Low and High Uncertainty at 1 Month Ahead Horizon.

Notes: Figure plots point estimates of impulse responses to one unit positive LSAP shock: $\beta_{1,jh}$ under low uncertainty (red solid lines) and $\beta_{1,jh} + \beta_{2,jh}$ under high uncertainty (blue dotted lines), for each response variable at each horizon from local projection specification given in (1). Measure of macroeconomic uncertainty at 1 month ahead horizon. Red and blue shaded areas show confidence intervals at 95% level for corresponding point estimates of impulse responses. HAC standard errors are calculated (Newey and West, 1987).

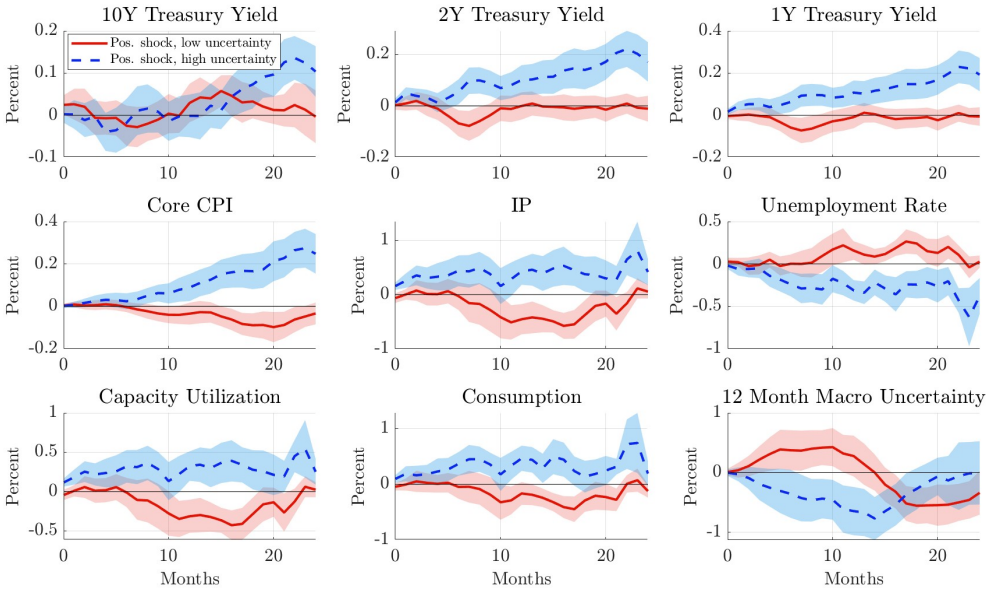

Figure 6: Impulse Responses to LSAP Shocks Under Low and High Uncertainty at 12 Month Ahead Horizon.

Notes: Figure plots point estimates of impulse responses to one unit positive LSAP shock: $\beta_{1,jh}$ under low uncertainty (red solid lines) and $\beta_{1,jh} + \beta_{2,jh}$ under high uncertainty (blue dotted lines), for each response variable at each horizon from local projection specification given in (1). Measure of macroeconomic uncertainty at 12 month ahead horizon. Red and blue shaded areas show confidence intervals at 95% level for corresponding point estimates of impulse responses. HAC standard errors are calculated (Newey and West, 1987).