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Historical evidence for larger government spending multipliers in uncertain times than in slumps

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Abstract

We investigate whether US government spending multipliers are higher during periods of heightened uncertainty or economic slumps as opposed to normal times. Using quarterly data from 1890 onward and local projections, we estimate a cumulative 1-year multiplier of 2 during uncertain periods. In contrast, the multiplier is about 1 in times of high unemployment and about 0.4–0.8 during normal times. While we find positive employment effects in slumps as well as in uncertain times, two transmission channels can explain the higher multipliers in the latter: greater price flexibility leading to short-term inflation (lowering the real interest rate) and diminishing risk premiums.

KEYWORDS

fiscal policy, government spending multiplier, historical data, local projections, slump, uncertainty

JEL CLASSIFICATION

E62, E32, N12

1 | INTRODUCTION

The recent experience of the Great Recession, which was accompanied by large uncertainty in the real and financial sectors, has sparked a debate about the impact of uncertainty on macroeconomic outcomes. At the same time, governments have responded to the crisis with substantial public spending. Likewise, the current Covid-19 crisis is characterized by high uncertainty and simultaneous jumps in unemployment rates. To stabilize the economy, governments respond by increasing public demand. This raises the question of whether fiscal policy is particularly effective in uncertain times or economic slumps such that one additional dollar of government spending increases output by more than one dollar.

Recently, this research question has been explored by a number of authors. On the one hand, Bachmann and Sims (2012), Auerbach and Gorodnichenko (2012a, b), Fazzari et al. (2015) and, in extreme recessions,

Abbreviations: EPU, economic policy uncertainty; GIRF, generalized impulse response function; HU, uncertain times; LTCM, Long-Term Capital Market; NBER, National Bureau of Economic Research; NU, normal times; NVIX, News Implied Volatility Index; OPEC, Organization of the Petroleum Exporting Countries; pp, percentage points; S&P, Standard & Poor's, SVAR, structural VAR; VIX, S&P 500 volatility index; VXO, S&P 100 volatility index; WWI, World War I; WWII, World War II.

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Caggiano et al. (2015) find larger multipliers during economic slumps. On the other hand, Ramey and Zubairy (2018) and Alloza (2019) find small or even negative government spending multipliers in times of slack. Related to the uncertainty level, Arčabić and Cover (2016) as well as, in the long run, Berg (2019) find larger multipliers during uncertain times while Ricco et al. (2016), Alloza (2019), Jerow and Wolff (2020), Belke and Goemans (2021) as well as Fritsche et al. (2021) find lower or negative output multipliers.¹ At the same time, Klein and Linnemann (2019) find evidence for larger output responses during the Great Recession, a situation of large uncertainty in coincidence with economic slump.

With exception of Ramey and Zubairy (2018), all studies mentioned are based on post-World War II (WWII) data. The theory shows that government expenditure multipliers depend on details of the current situation such as the persistence of government expenditure increases, the mode of financing, the degree of financial frictions, the stance of monetary policy as well as the labor market situation.² In addition to first moment effects, second moment effects through uncertainty furthermore complicate this issue.³ The information in post-WWII data may not be sufficient to identify the government expenditure multiplier and thus explain the different findings. Historical data covering multiple wars, financial crises and deep recessions is needed to perform this task.

Against this background, we contribute to the literature by using quarterly US data from 1890 onward to (1) estimate cumulative government expenditure multipliers in uncertain and normal times and (2) distinguish between uncertainty and economic slumps. Using Jordà (2005) local projections and news implied stock market volatility from Manela and Moreira (2017) as our uncertainty indicator, we find a cumulative 1-year multiplier of 2 during uncertain periods and in the range of 0.4–0.8 in normal times. This result is robust to different identification methods and choices of control variables. While we generally find higher multipliers in times of large expected stock market volatility, the 1-year multiplier is close to 1 when the unemployment rate is above 6.5%.

Our third contribution is to provide cumulative multipliers for a wide range of macroeconomic and financial variables in order to explain the higher multipliers in uncertain times compared to slumps. To do so, we extend the dataset of Ramey and Zubairy (2018) with a broad set of further variables. The transmission channels are analyzed by means of multipliers instead of simple impulse responses because those multipliers control for the difference in the dynamics of government spending as if the increase in public expenditure is similar across states. We find that an unexpected increase in government spending has a positive impact on employment levels and the stock market during slumps and uncertain times, with the latter being characterized by stronger effects. In uncertain episodes, expansionary fiscal policy lowers corporate bond spreads/risk premiums and shifts inflation upwards which reduces the real interest rate. These two effects improve the financing conditions of companies and make precautionary saving less attractive, hereby stimulating private spending. These two effects do not occur in times of heightened unemployment, which explains the lower multiplier during slumps.

Our findings deviate from the results of several other contributions. Using the same sample period and the identification of a fiscal policy shock following Blanchard and Perotti (2002), our estimated 1/2-year slump multipliers of about 1 are larger than the 2-year multiplier of about 0.7 in Ramey and Zubairy (2018). This can be explained by different model specifications since Ramey and Zubairy (2018) only include real GDP and government spending while we, in addition, take account of changes in the average tax rate, a corporate bond spread, the real monetary policy rate as well as the change in stock prices. This has several advantages. First, this larger set controls for differences in the fiscal stance, financial constraints as well as the monetary policy response over time. Second, as the Blanchard-Perotti shock is identified as the part of current government spending that is not explained by the other lagged variables, the forward-looking financial variables help us to tackle the fiscal anticipation problem which would bias the estimated fiscal multiplier. Third, as also pointed out in Ramey and Zubairy (2018), the state-dependent (and horizon-specific) constants and lagged variables in the local projection framework will embed information on the average behavior of the economy to transition to the other state at future horizons that are not due to the increase in public spending. In Appendix C, we replicate their results in Figure C1 including only their variables. Thereby, the lower multiplier in Ramey and Zubairy (2018) can be explained by omitted variable bias.

Alloza (2019), Fritsche et al. (2021), Ricco et al. (2016), Belke and Goemans (2021) and Jerow and Wolff (2020) find negative/lower output responses/multipliers during episodes of uncertainty/volatility while we find larger multipliers. Our paper differs from these contributions in using historical data back to 1890 allowing us to include a larger set of variables to avoid the omitted variable bias. Furthermore, this longer sample period contains more extreme events such as the Great Depression as well as more variation in government spending. We show that the difference in multipliers across states increases with the degree of uncertainty above which periods are classified as uncertain. Thereby, an increase in government demand is particularly effective during extremely uncertain episodes. To illustrate the

importance of this relationship for the divergence of our results from Alloza (2019) and Jerow and Wolff (2020), we replicate their lower multipliers in Appendix C with our specification but similar samples and threshold values as in their analysis. Once we focus on more extreme episodes, higher thresholds, we find evidence for positive and large multipliers during uncertain periods. This result is also reflected in the qualitative changes in the responses of some key transmission variables, that is the real interest rate and the corporate bond spread or stock prices. For instance, using a similar threshold as Jerow and Wolff (2020), the corporate bond spread increases in response to the rise in public demand which dampens private investment. In more extreme periods, however, the corporate bond spread instead declines which makes private investment more attractive.

Fritsche et al. (2021) employ a Markov switching in heteroskedasticity structural vector autoregressive model to classify low/high volatility states. Their estimated lower government spending multiplier in the high volatility regime probably reflects a less stable policy environment in which fiscal policy deviated from a policy rule that induces government debt stability (Davig & Leeper, 2011). This unstable fiscal policy environment increases economic uncertainty reflected in larger fluctuations of aggregate variables. This interpretation is in line with the findings of Belke and Goemans (2021) where the GDP response to the public spending shock depends on the response of uncertainty. They find contractionary (expansionary) output effects, if the growth in public demand increases (decreases) uncertainty. This interpretation is further supported by Ricco et al. (2016) who find a muted output response in times of more disagreement amongst US professional forecasters about future government spending.

This paper proceeds as follows. The econometric methodology is explained in Section 2. In Section 3, we show that the fiscal multiplier rises with the degree of uncertainty prevalent in the economy. We also conduct various robustness checks and distinguish between uncertainty and business cycle states. Herein, we consider four combinations: high uncertainty in an economic slump, high uncertainty outside of a slump, low uncertainty in a slump and low uncertainty without an economic slump. Section 4 explores transmission channels that serve to explain the larger multiplier in times of uncertainty. Section 5 concludes.

2 | EMPIRICAL STRATEGY

We estimate state-dependent government spending multipliers using local projections as proposed by Jordà (2005) and as applied in the fiscal policy literature for instance by, among others, Auerbach and Gorodnichenko (2012a), Ramey and Zubairy (2018) as well as Miyamoto et al. (2018). In particular, we are interested in the dynamics of the cumulative government spending multiplier which measures the cumulative change in GDP relative to the cumulative change in government spending up to quarter $t + h$ in response to a government spending shock occurring in period t .⁴

Following Ramey and Zubairy (2018), we estimate the cumulative multiplier directly by a series of regressions at each horizon $h = 0, \dots, 15$ for each state:

$$\begin{aligned} \sum_{j=0}^h y_{t+j} &= I_{t-1}^{HU} \left[\alpha_h^{HU} + \phi_h^{HU}(L)X_{t-1} + m_h^{HU} \sum_{j=0}^h g_{t+j} \right] \\ &+ \left(1 - I_{t-1}^{HU} \right) \left[\alpha_h^{NU} + \phi_h^{NU}(L)X_{t-1} + m_h^{NU} \sum_{j=0}^h g_{t+j} \right] \\ &+ \gamma_{1h}t + \gamma_{2h}t^2 + \gamma_{3h}t^3 + \epsilon_{t+h} \end{aligned} \quad (1)$$

where $\sum_{j=0}^h y_{t+j}$ denotes the sum of real GDP from t to $t + h$ and $\sum_{j=0}^h g_{t+j}$ denotes the sum of real government spending from t to $t + h$ (both in % of potential GDP). The latter consists of government consumption expenditures and gross investment. The α 's denote state-specific constants whereas the t 's capture the effects of deterministic time trends up to a polynomial of order 3, for instance to control for the increasing (and then decreasing) role of the government over time, while X_{t-1} denotes the vector of control variables. I_t^{HU} denotes a dummy variable that indicates periods of elevated uncertainty when the shock takes place. We set $I_t^{HU} = 1$ if the quarter is classified as uncertain times. The regressions include I_{t-1}^{HU} to rule out contemporaneous correlations between fiscal shocks and the state of the economy.

The cumulative government spending multipliers for each state and horizon are then given by m_h^{HU} and m_h^{NU} . Herein, m_h^{HU} (m_h^{NU}) measures the cumulative multiplier in uncertain (normal) times up to quarter $t + h$ to a government spending shock in t . We allow all coefficients of the model to vary with the state of the economy. Furthermore,

note that the local projection method incorporates the average transition of the economy from one regime to another. In other words, if the government spending shock moves the economy from state HU to regime NU, or vice versa, this effect is absorbed into the estimated multipliers.⁵ We normalize output and government spending by potential GDP as in Gordon and Krenn (2010). This allows us to estimate dollar for dollar multipliers without the need to multiply the estimated elasticity multipliers, that would be received from a log-log estimation with real GDP and real government spending, with the ratio of GDP to fiscal spending that varies substantially within the historical sample (Ramey & Zubairy, 2018).

In our baseline specification, we use g_t as an instrumental variable for the cumulative change in government spending $\sum_{j=0}^h g_{t+j}$. Since the set of controls will, among others, include lagged measures of real government spending and real output, this identification strategy is equivalent to the structural VAR (SVAR) identification proposed by Blanchard and Perotti (2002). Hence, we assume that government spending does not contain components that automatically fluctuate with the business cycle and that policymakers need at least one quarter to decide on, approve and implement discretionary changes in fiscal policy.

A potential obstacle for estimating the effects of fiscal shocks is the fiscal foresight problem. It arises when economic agents not only react to actual increases in government spending, but also to news about forthcoming future spending plans. In this case, it is not possible to recover the true unexpected spending shocks because of an information misalignment (Leeper et al., 2013). There are different proposals in the literature to take this problem into account. Some researchers suggest including a fiscal news variable in the empirical model that captures anticipated changes in government spending (Fisher & Peters, 2010; Ramey, 2011b). Others add a series of professional forecasts of government spending to the set of control variables (Auerbach & Gorodnichenko, 2012b). A third strand in the literature proposes to include forward-looking variables as controls since they may capture information about future fiscal policy actions (Beetsma & Giuliadori, 2011; Forni & Gambetti, 2010; Yang, 2007). In our baseline specification, we follow the latter route and include stock prices, more exactly the log difference of the S&P 500 index, to the set of our control variables. This route has the advantage of controlling for first moment changes in the stock market, hence realized stock price developments should not confound our results which focus on expected stock market volatility.⁶

Apart from the stock market data, the vector of control variables X_{t-1} includes four quarterly lags of the following variables: GDP and government expenditures, both normalized by potential GDP, and the change in the average tax rate to account for changes in fiscal finances. The latter is measured by the ratio of federal current receipts to GDP.⁷ Additionally, we include a corporate bond spread measured by Moody's seasoned Baa corporate bond yield relative to yield on 10-year treasury constant maturity. The spread serves as an indicator of financial frictions/risk premiums firms are confronted with. Fernández-Villaverde (2010) and Canzoneri et al. (2016) demonstrate in theoretical models that financial frictions ought to affect the economic reactions in response to expansive public spending. As some authors have shown the importance of the monetary policy reaction (Canova & Pappa, 2011; Davig & Leeper, 2011) for the effects of fiscal policy, we include a real policy rate.⁸ Yang (2007) argues that interest rates and price variables might cover information about future fiscal policy. Thus, including the real interest rate helps to account for fiscal anticipation.

One drawback of the Jordà-method is the serial correlation in the error terms induced by the successive leading of the dependent variable. Thus, we apply the Newey and West (1987) correction to obtain statistics that are robust to serial correlation and heteroskedasticity. Recent excellent econometric treatments of the local projection framework are Stock and Watson (2018) and Plagborg-Møller and Wolf (2020). If not stated otherwise, the estimation period is from 1890Q1 until 2015Q4.⁹ Appendix A provides a description of all variables and corresponding graphs showing the ones employed in estimation.

3 | OUTPUT MULTIPLIERS DURING UNCERTAIN AND NORMAL TIMES

The estimation of state-dependent fiscal multipliers with Equation (1) is a non-trivial task. First, we need an uncertainty proxy that is available over a long time period. Second, we have to decide on a threshold value to distinguish between uncertain and normal times.

Our measure of uncertainty is the news implied VIX (NVIX) from Manela and Moreira (2017). The authors use Wall Street Journal articles to construct a text-based measure of expected stock market uncertainty back to the end of the 19th century. They split titles and abstracts to n-grams (word combinations) and use support vector regressions to predict the VXO or VIX from which at least one is available from 1986 onward.¹⁰ They divide the period where the VXO

is available in two parts: (1) a training sample, 1996–2009, to estimate the dependency between news data and implied volatility and (2) a test sample, 1986–1995, for out-of-sample tests of model fit. Since the news articles are available since 1889, they can use their model to predict the NVIX for a long time period.

Figure 1 depicts the historical development of the NVIX and indicates high unemployment periods. It shows significant variation over time and rises during world wars, financial crises, times of policy-related uncertainty as well as stock market crashes. Examples for spikes are the railroad speculation that led to the Northern Pacific Panic at the beginning of the twentieth century, the start of World War I (WWI) in 1914, and the stock market crash in 1929 leading to the Great Depression which became a period of prolonged uncertainty. There is a decline after WWII until it sharply increases at the stock market crash in 1962, the Black Monday in 1987, the 1990 Iraqi invasion in Kuwait or the Long-Term Capital Management (LTCM) crisis in 1998. The 21st century began with large uncertainty due to the Dot-com bubble and the fight against terrorism. Afterward, uncertainty remained at a low level until it surged due to the Financial Crisis 2008 and its consequences. Mishkin and White (2002) describe many stock market crashes and Walton and Rockoff (2013) provides a very good overview over the economic history of the United States. See also Noyes (1909).

Before we continue with the historical analysis, we compare the NVIX with other uncertainty indicators for overlapping samples. Figure 2 depicts the development of the NVIX, the financial and macroeconomic uncertainty indices (Jurado et al., 2015; Ludvigson et al., 2015), the economic policy uncertainty index (EPU) from Baker et al. (2016) and the VXO. The figure shows the largest similarities among the measures of financial uncertainty (NVIX, financial uncertainty and VXO). However, the NVIX resembles the EPU, especially after the Financial Crisis 2008. Based on the annotations in Figure 1, this can be explained by the fact that the NVIX also captures concerns about sovereign risk. In general, the NVIX shows substantial differences in the 70 and 80s from the macroeconomic uncertainty index which is strongly driven by the OPEC crises. Table 1 confirms these differences. The NVIX is significantly correlated with all uncertainty indicators, but only slightly with macroeconomic uncertainty over the subsample 1960–2015. From 1986 onward, it shows substantial correlation with macroeconomic uncertainty.¹¹ Notably, in contrast to the VXO and the financial uncertainty index, the NVIX is negatively correlated with economic activity. Since the

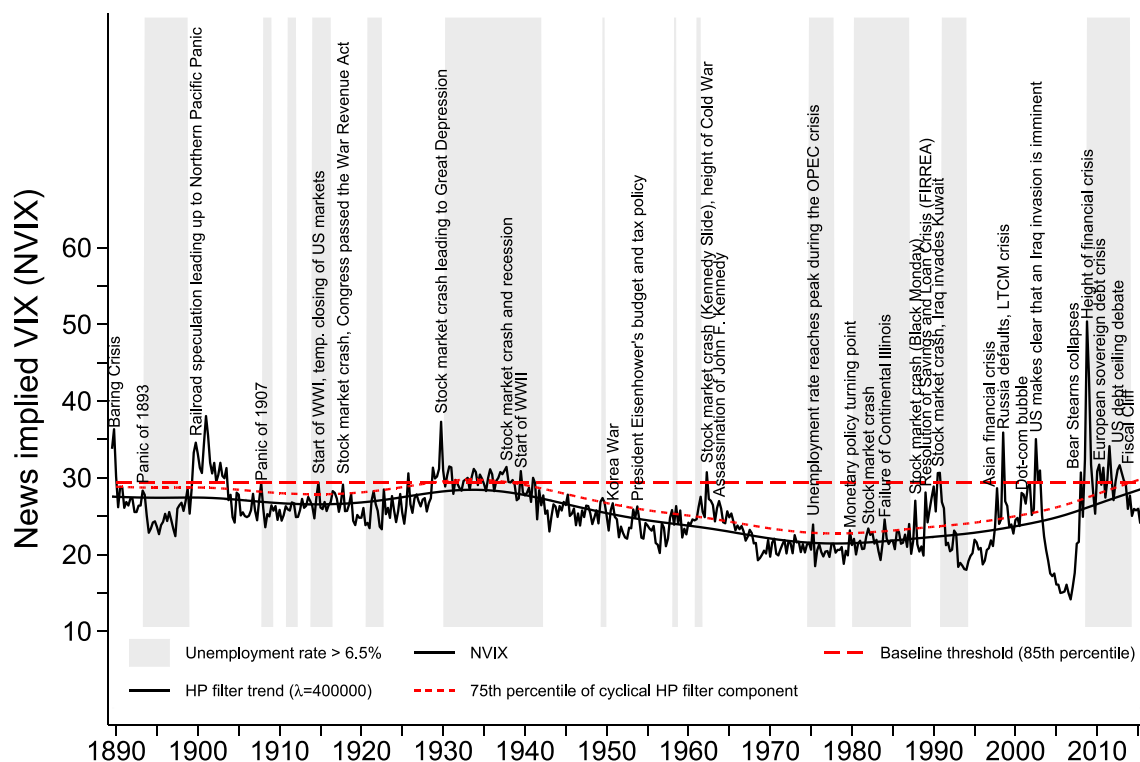


FIGURE 1 Uncertainty through time. The figure shows the NVIX from Manela and Moreira (2017). The red dashed line indicates our baseline threshold to classify periods as uncertain times. The red short-dashed line denotes a threshold that is used in a robustness analysis. The large smoothing parameter is chosen for two reasons: First, Drehmann et al. (2012) emphasize the importance of the medium cycle for some financial variables. Second, it allows us to choose a time-varying threshold without classifying a large fraction of the Great Depression as normal times [Colour figure can be viewed at wileyonlinelibrary.com]

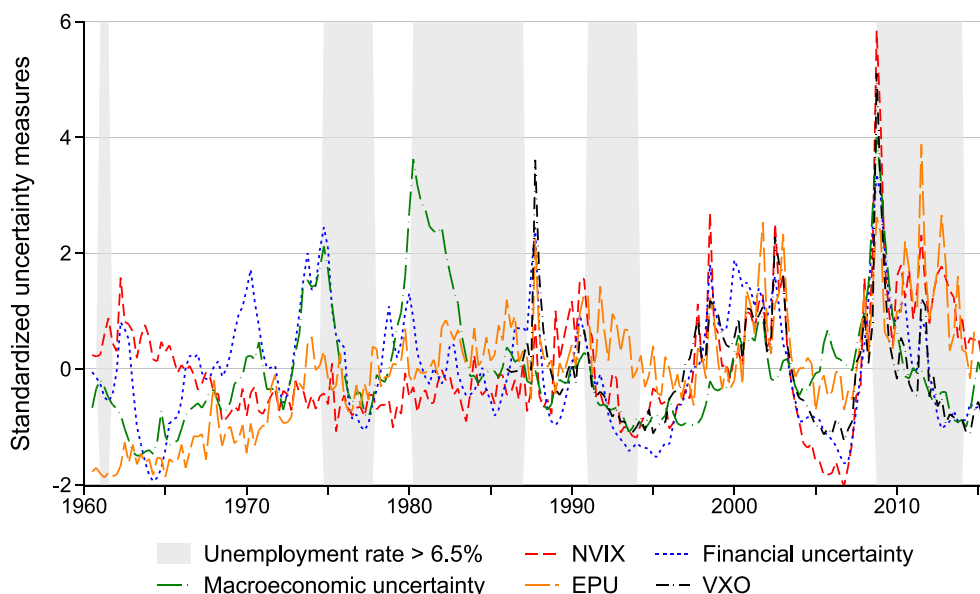


FIGURE 2 Comparison of different uncertainty measures. The uncertainty proxies are made comparable by standardizing to mean 0 and standard deviation 1 over this period [Colour figure can be viewed at wileyonlinelibrary.com]

TABLE 1 Correlation among uncertainty and economic indicators

| | NVIX | VXO | Fin. unc. | Macro. unc. | EPU | Output gap | Unempl. | Corp. bond spread |
|-----------------------------|---------|--------|-----------|-------------|---------|------------|---------|-------------------|
| 1960–2015 | | | | | | | | |
| NVIX | 1 | | | | | | | |
| VXO | 0.68** | 1 | | | | | | |
| Financial uncertainty | 0.43** | 0.85** | 1 | | | | | |
| Macroeconomic uncertainty | 0.15** | 0.59** | 0.58** | 1 | | | | |
| Economic policy uncertainty | 0.44** | 0.54** | 0.32** | 0.36** | 1 | | | |
| Output gap | -0.29** | -0.02 | -0.02 | -0.31** | -0.49** | 1 | | |
| Unemployment rate | 0.19** | 0 | 0.01 | 0.32** | 0.44** | -0.85** | 1 | |
| Corporate bond spread | 0.48** | 0.61** | 0.43** | 0.52** | 0.74** | -0.66** | 0.52** | 1 |
| 1986–2015 | | | | | | | | |
| NVIX | 1 | | | | | | | |
| VXO | 0.68** | 1 | | | | | | |
| Financial uncertainty | 0.67** | 0.85** | 1 | | | | | |
| Macroeconomic uncertainty | 0.50** | 0.59** | 0.66** | 1 | | | | |
| Economic policy uncertainty | 0.72** | 0.54** | 0.46** | 0.36** | 1 | | | |
| Output gap | -0.42** | -0.02 | -0.04 | -0.20** | -0.47** | 1 | | |
| Unemployment rate | 0.36** | 0 | 0.08 | 0.12 | 0.49** | -0.84** | 1 | |
| Corporate bond spread | 0.74** | 0.61** | 0.63** | 0.69** | 0.68** | -0.55** | 0.45** | 1 |

Note: ** indicate that the statistics are significant at the 5% level, respectively. The output gap is based on real potential GDP of the Congressional Budget Office.

NVIX is based on news, it presumably captures a mix of economic and policy uncertainty being relevant for the average investor. The strong correlation with the spread/risk premium indicates that it measures uncertainty with direct effects on firms' financing conditions. Its major advantage is the long availability which allows us to include the Great Depression and other important historical events.

The long-dashed line in Figure 1 depicts the threshold chosen to discriminate between uncertain and normal times in our baseline specification. Bloom et al. (2007) show that the annual firm investment rate declines with the level of sales uncertainty firms are facing. In particular, the impact of uncertainty is only muted close to the median but the effects can be large at extreme levels (75th and 90th percentile). Thereupon, we estimate the difference in fiscal multipliers across uncertain and normal times for each threshold ranging from the 70th to the 90th percentile of the NVIX distribution. This is possible due to the use of historical data which provides enough observations even for extreme events.¹²

We can rewrite Equation (1) to estimate the difference between cumulative multipliers across states for each horizon $h = 0, 1, \dots, 15$:

$$\begin{aligned} \sum_{j=0}^h y_{t+j} &= m_h^{DIFF} I_{t-1}^{HU} \sum_{j=0}^h g_{t+j} + m_h^{NU} \sum_{j=0}^h g_{t+j} \\ &+ I_{t-1}^{HU} [\alpha_h^{HU} + \phi_h^{HU}(L)X_{t-1}] + (1 - I_{t-1}^{HU}) [\alpha_h^{NU} + \phi_h^{NU}(L)X_{t-1}] \\ &+ \gamma_{1h}t + \gamma_{2h}t^2 + \gamma_{3h}t^3 + \varepsilon_{t+h} \end{aligned} \quad (2)$$

with $m_h^{DIFF} = m_h^{HU} - m_h^{NU}$ from Equation (1). As before, we use the Blanchard and Perotti (2002) identification and instrument $\sum_{j=0}^h g_{t+j}$ with g_t and $I_{t-1}^{HU} \sum_{j=0}^h g_{t+j}$ with $I_{t-1}^{HU} g_t$.

Figure 3 shows the estimated difference in multipliers for each threshold together with 90% confidence intervals. In general, the results depict no difference across impact multipliers. In contrast, the difference in multipliers increases non-linearly with the threshold at the 1 and 2 years horizon. This is expected from the above finding in Bloom et al. (2007). We choose the 85th percentile of the NVIX distribution based on a trade-off between disentangling the difference across both states at high levels of uncertainty and low estimation precision due to the low number of observations in the high uncertainty state for very large thresholds.

We now present the estimated cumulative government spending multipliers based on Equation (1) and the 85th percentile of the NVIX distribution as the threshold level. In addition to the state-dependent model, we consider results from the linear model which assumes that multipliers are invariant to the uncertainty level.

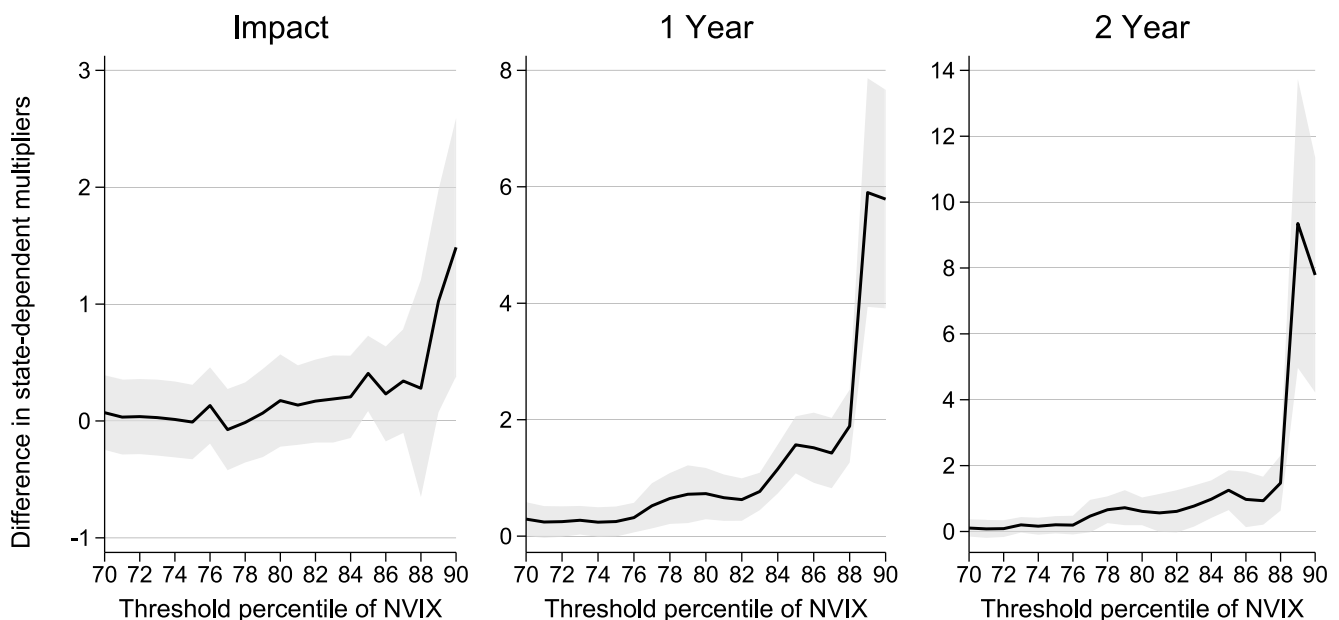


FIGURE 3 Difference in state-dependent government spending multipliers for different thresholds. Shaded areas depict 90% heteroskedasticity and serial correlation robust confidence intervals

The upper left panel of Figure 4 shows the cumulative fiscal multiplier with 90% confidence bands for a version of Equation (1) without different states (henceforth called linear model). On impact, output increases only less than 40 cents per dollar of government spending. Although the fiscal multiplier increases after the shock, it remains significantly below one. Correspondingly, public spending crowds out private expenditures.

The upper right panel of Figure 4 shows the cumulative government spending multiplier in uncertain times (HU, in red) versus normal episodes (NU, in blue with markers). The multiplier during normal times mirrors the one estimated from the linear model.¹³ However, the red line shows that fiscal policy can be very effective during HU periods. Over a horizon of 1 year, a 1 dollar increase in government consumption and investment boosts output by about 2 dollars. The bottom right panel shows that the p -values for the difference between HU and NU multipliers for each horizon h are below conventional levels.

The lower left panel depicts the Montiel Olea and Pflueger (2013) effective first stage F-statistic for the state-dependent as well as the linear fiscal multipliers. The results indicate high instrument relevance for the Blanchard-Perotti shock. Even after 2 years, the first stage F-statistic in the high uncertainty states and the linear model is close to 20.¹⁴ We conclude that the large HU multipliers are not due to weak instruments.

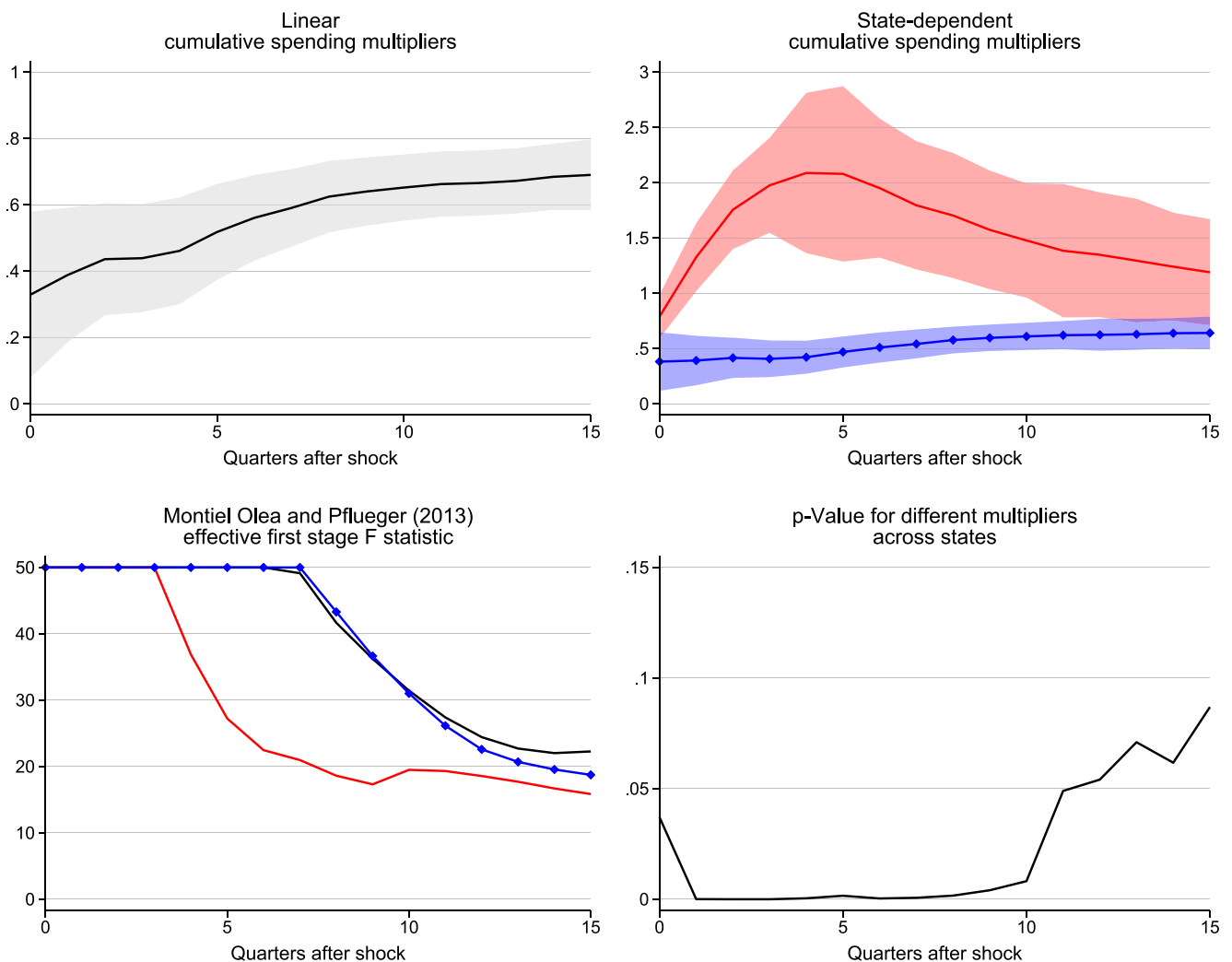


FIGURE 4 Cumulative multipliers to a Blanchard-Perotti shock. The upper left panel shows the cumulative government spending multipliers for each horizon in the linear model (in black). The upper right panel shows the state-dependent multipliers during uncertain (in red) and normal (in blue with markers) times. 90% heteroskedasticity and serial correlation robust confidence intervals are shown in all cases. The bottom left panel shows the first stage F statistic that is robust to heteroskedasticity and serial correlation. The bottom right panel shows the p -value for different multipliers across states [Colour figure can be viewed at wileyonlinelibrary.com]

3.1 | Robustness

Our baseline result of larger HU multipliers is potentially sensitive to numerous specification decisions we made like the specific choice of control variables in Equation (1) or the identification of a government spending shock. In this section, we explore the sensitivity of our findings to those specification decisions as well as the issue of subsample stability.¹⁵

We first include the unemployment rate because it might contain important information about the state of the business cycle relative to output data (Barro & Redlick, 2011). Second, we include the NVIX in the set of our controls. Lastly, we drop the deterministic trends from our specification. Figure 5 shows that our results remain qualitatively and quantitatively similar if we include additional controls or drop the trend components. Therefore, we continue with our baseline specification.

In Figure 6, we investigate robustness with respect to different identification methods of a government spending shock as well as to excluding WWII from our estimation. The upper panel shows the multiplier to a military news shock as in Ramey (2011b) and Ramey and Zubairy (2018). The series is based on newspaper readings and focuses on changes in government spending due to political and military events since these changes are most likely independent of the state

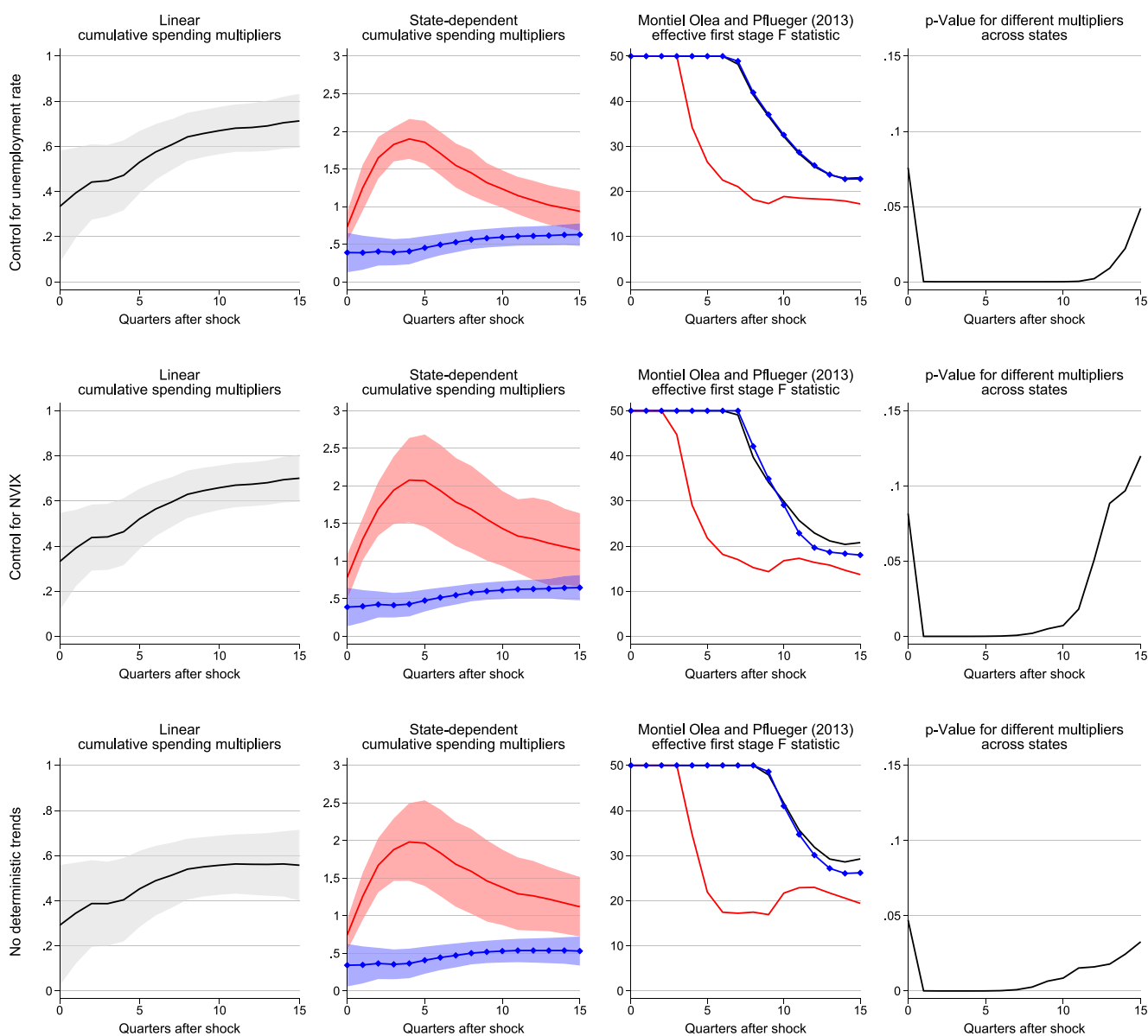


FIGURE 5 Robustness to including additional control variables. The figure shows cumulative government spending multipliers to a Blanchard-Perotti shock from a linear model (in black) and in uncertain (in red) as well as normal (in blue with markers) times. 90% confidence intervals are shown in all cases. All statistics are robust to heteroskedasticity and serial correlation [Colour figure can be viewed at wileyonlinelibrary.com]

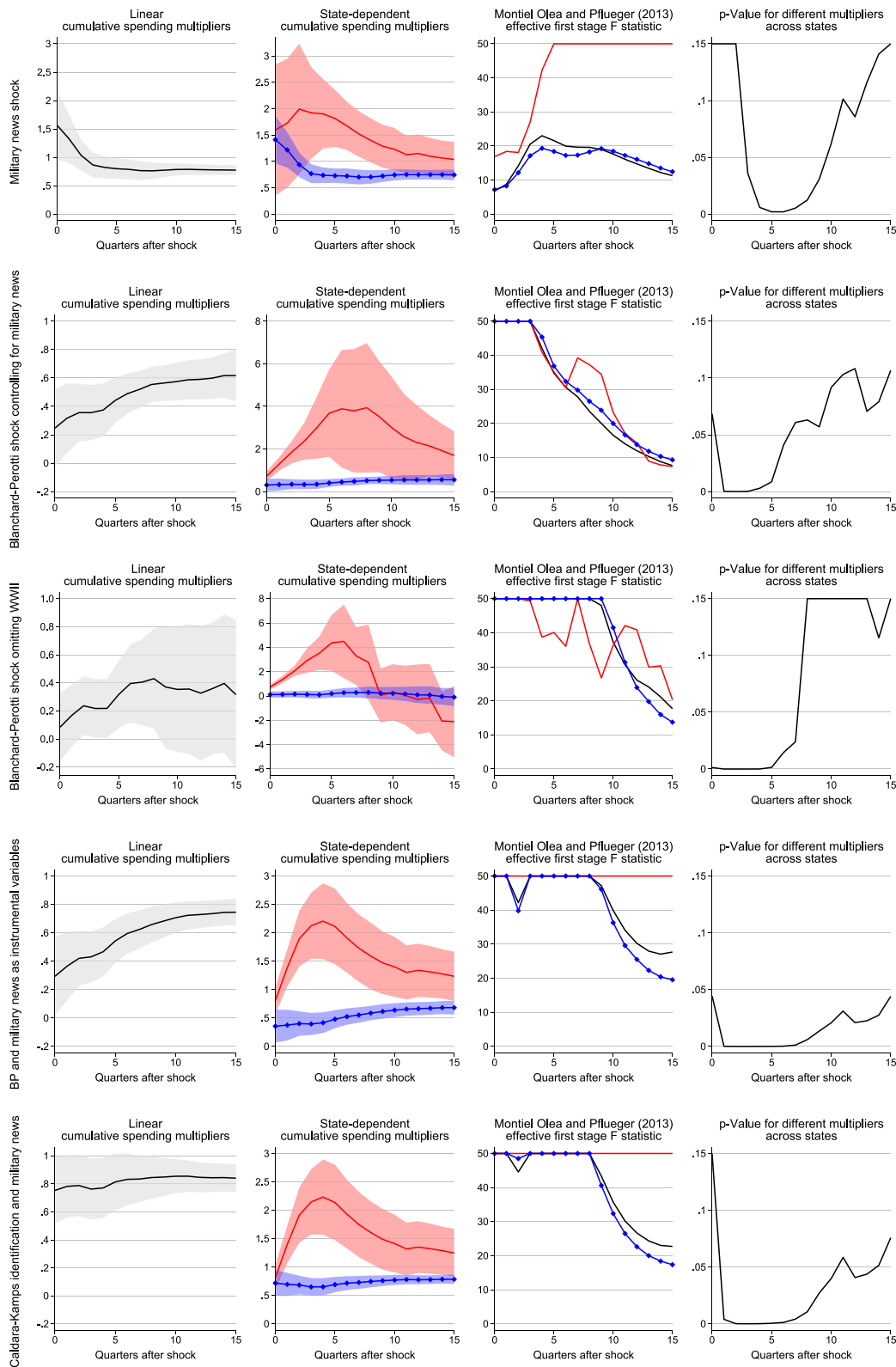


FIGURE 6 Robustness across identification methods and excluding WWII. The figure shows cumulative government spending multipliers from a linear model (in black) and in uncertain (in red) as well as normal (in blue with markers) times. 90% confidence intervals are shown in all cases. All statistics are robust to heteroskedasticity and serial correlation [Colour figure can be viewed at wileyonlinelibrary.com]

of the economy. This series is constructed as changes in the expected present discounted value of government spending to account for the fact that defense expenditures might be anticipated long before they show up in NIPA tables. Ramey (2016) describes the underlying narrative.

In this case, $\sum_{j=0}^h g_{t+j}$ is instrumented with the military news variable *news*, (also normalized by potential output) and the set of controls is extended with four lags of this variable to capture serial correlation among news. Although we still find state-dependent multipliers over some horizons, the results differ in two respects. The most remarkable feature are the larger linear and NU multipliers. However, since this corresponds with very low first stage F statistics, the large short-run multiplier during tranquil times should be doubted. Furthermore, the linear and NU multipliers attenuate to the baseline results as the first stage F statistics increase. The other feature is related to the variation in military news. In our case, from 504 observations, military news differs from zero in only 108 quarters. This problem becomes more severe if state-dependence is considered. The news variable shows variation in only 12 during uncertain and 96 quarters in normal times. This explains the large standard errors compared to the baseline results in Figure 4.

Complementary, we also include the military news variable in the set of controls but use the Blanchard-Perotti identification. The government spending shock can then be interpreted as being orthogonal to news about military spending. The second row of Figure 6 depicts larger HU multipliers of about 4. Perotti (2014) argues that additional military spending might have very different effects on the economy compared to increases in civilian government expenditures which not only crowd out resources from the private sector but also provide benefits to society. This reasoning is in line with the third row where we exclude WWII from our estimation.¹⁶ As can be seen, the HU multipliers are very similar in both panels. However, the standard errors become large when dropping this special period characterized by large variation in public expenditures.

Further evidence of robustness is provided by exploiting an idea from Ramey and Zubairy (2018) who instrument $\sum_{j=0}^h g_{t+j}$ with g_t and $news_t$. We show the results in the fourth row of Figure 6 which are very similar to the baseline results. Although it is not totally clear how this shock can be interpreted, this experiment provides two insights. First, the instrument relevance remains high beyond 2 years after the shock occurs. Second, since we now have two instruments for one endogenous variable in each regime, we can use the Sargan-Hansen test of overidentifying restrictions and combine this with an idea from Caldara and Kamps (2017).

Caldara and Kamps (2017) show that different fiscal multipliers in the literature (based on various identification approaches) can be explained by different assumptions on a simple rule that relates government spending to output. Thereupon, we use

$$\tilde{g}_t = g_t - \left(I_{t-1}^{HU} \mu^{HU} + \left(I - I_{t-1}^{HU} \right) \mu^{NU} \right) y_t \quad (3)$$

and *news*, as instruments. We experiment with different values and choosing $\mu^{HU} = 0$ and $\mu^{NU} = -0.18$ results in *p*-values larger than 0.1 for the Sargan-Hansen test. In the linear model, $\mu^{LIN} = -0.2$ results in *p*-values larger than 0.1. The bottom panel of Figure 6 resembles our baseline conclusions. Note, however, the increase of linear and NU multipliers. Nevertheless, we continue with our baseline identification and set $\mu^{HU} = \mu^{NU} = \mu^{LIN} = 0$ for the rest of our analysis.

Figure 7 examines the robustness of the larger HU multipliers across different subsample periods. First, we only consider the period between 1914 and 2015. This serves to ascertain whether our finding is the result of institutional differences after establishing the Federal Reserve system. The estimated multipliers are similar to the baseline. Interestingly, the instrument relevance of the Blanchard-Perroti shock in the HU state remains very strong at longer horizons. This reinforces our confidence that the higher multipliers during uncertain times are not an artifact of weak instruments.

The second panel shows the results from a post-WWII analysis. The impact HU multiplier increases to 2, but after 2 years it decreases to the level of the NU multiplier. Due to the increase in standard errors, the NU multiplier is within an interval between slightly below 0 to above 1. This reinforces our belief that historical data provide useful information for the estimation of fiscal multipliers. This is especially important if state dependency is under consideration.

As mentioned in the introduction, some authors reported evidence for lower or even negative HU multipliers. Since some uncertainty proxies are only available from 1960 onward, we check the robustness of our results for this time period in the bottom three panels. Indeed, the results in the third row provide evidence for lower HU multipliers in the medium term. One reason might be that the government itself has become a driver of uncertainty. This view would be supported by soared uncertainty, for instance due to the fiscal cliff after the Financial Crisis 2008 in Figure 1 (see also Davig & Foerster, 2019). However, this finding could also have another cause. Figure 3 shows that large multipliers mainly materialize in times of strongly heightened uncertainty. While the 85th percentile for the entire historical sample and 1914–2015 period is above 29, it is below 28 for the subsample starting in 1960. To test the impact of the lower threshold for classifying uncertain periods, we re-estimate the model using the 90th percentile (29.5) for this subsample. Since that threshold only classifies 23 quarters as uncertain periods, estimation with the baseline specification is not feasible. For this reason, we first use the control variables from the baseline specification but with only two

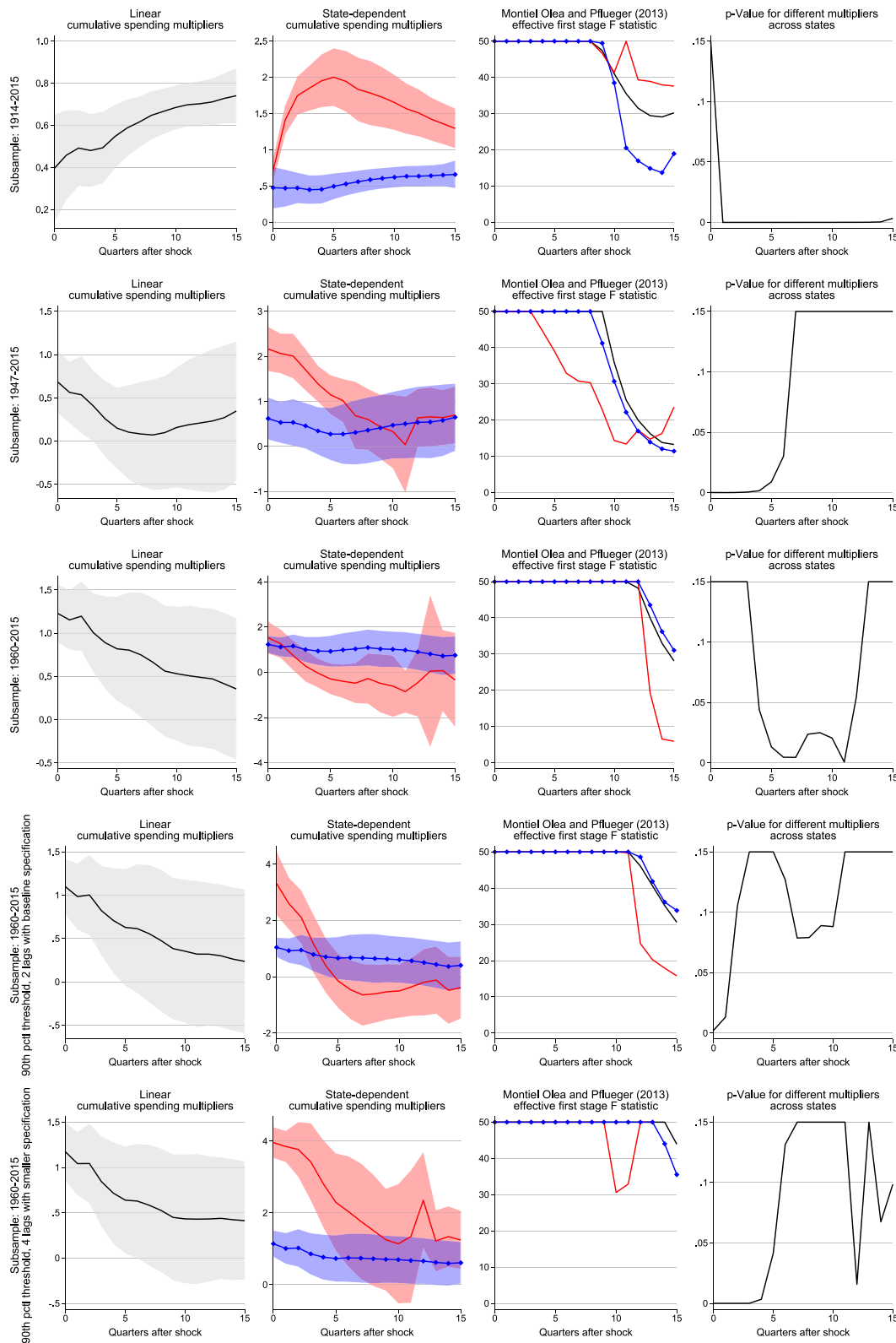


FIGURE 7 Robustness across subsamples. The figure shows cumulative government spending multipliers to a Blanchard-Perotti shock from a linear model (in black) and in uncertain (in red) as well as normal (in blue with markers) times. 90% confidence intervals are shown in all cases. All statistics are robust to heteroskedasticity and serial correlation [Colour figure can be viewed at wileyonlinelibrary.com]

lags. The second specification contains controls only for government spending, GDP, taxes and stock returns, but with 4 lags. Both results indicate higher multipliers in uncertain times. This shows that the lower HU multiplier in the third panel is not the result of structural breaks. Rather, we interpret the findings for the 1960–2015 period as evidence for the

need of longer time series since the results for this space of time are not robust. We provide two reasons for this. As shown in Figure A1 of Appendix A, this subperiod includes less variation in output as well as government spending. Most importantly, it has the drawback of omitting the Great Depression, a period of large and secular uncertainty.

3.2 | Uncertainty versus economic slumps

We provide historical evidence for substantially different government spending multipliers in uncertain compared to normal times. Ramey and Zubairy (2018), on the other hand, do not find larger multipliers across recessions and expansions with historical data. An interesting research question is to what extent uncertainty is a more important determinant of the effects of fiscal policy and to what extent a distinction can be made between the state of the economic cycle and the degree of uncertainty.

To answer this research question, we extend our model as follows:

$$\begin{aligned}
 \sum_{j=0}^h y_{t+j} = & I_{t-1}^{HU} I_{t-1}^{SLUMP} \left[\alpha_h^A + \phi_h^A(L) X_{t-1} + m_h^A \sum_{j=0}^h g_{t+j} \right] \\
 & + I_{t-1}^{HU} \left(1 - I_{t-1}^{SLUMP} \right) \left[\alpha_h^B + \phi_h^B(L) X_{t-1} + m_h^B \sum_{j=0}^h g_{t+j} \right] \\
 & + \left(1 - I_{t-1}^{HU} \right) I_{t-1}^{SLUMP} \left[\alpha_h^C + \phi_h^C(L) X_{t-1} + m_h^C \sum_{j=0}^h g_{t+j} \right] \\
 & + \left(1 - I_{t-1}^{HU} \right) \left(1 - I_{t-1}^{SLUMP} \right) \left[\alpha_h^D + \phi_h^D(L) X_{t-1} + m_h^D \sum_{j=0}^h g_{t+j} \right] \\
 & + \gamma_{1h} t + \gamma_{2h} t^2 + \gamma_{3h} t^3 + \epsilon_{t+h}
 \end{aligned} \tag{4}$$

Herein, we set $I_t^{HU} = 1$ if period t belongs to the high uncertainty state and $I_t^{SLUMP} = 1$ if the period is characterized as a slump. Since there are several approaches to distinguish between economically good and bad episodes, we use several indicators. As before, we use the 85th percentile of NVIX as a threshold and four lags of all control variables. However, we drop stock returns as including these would lead to values of the first stage F statistics below 10 (at longer horizons) in at least one specification. With twice the number of states and thus a lower number of observations per state, we consider only 8 quarters after the government spending increase.

The first two classifications are based on the unemployment rate. In the upper panel, we follow Owyang et al. (2013) and set $I_t^{slump} = 1$ if the unemployment rate is above 6.5%. They chose the value in accordance with the Federal Reserve's use at this time. The second panel follows a robustness analysis in Ramey and Zubairy (2018) and assumes a threshold value of 8% as state-dependent effects may be found more likely at higher degrees of economic slump. The bottom two classifications of economic performance, by contrast, are based on output. Panel 3 sets $I_t^{SLUMP} = 1$ during National Bureau of Economic Research (NBER) recession periods, and the bottom panel uses the Hamilton (2018) filter to determine a time-varying threshold.

The left column of Figure 8 provides evidence for higher multipliers in an economic crisis only when it is accompanied by a high degree of uncertainty. Accordingly, we find 1-year SLUMP-HU multipliers about 2 while the SLUMP-NU multipliers are below 1. Similarly, the NOSLUMP-HU multipliers in the middle column are mostly above the NOSLUMP-NU multipliers. From the right-hand side, it can be seen that instrument relevance is not a problem, at least for the 1-year multipliers. The punchline of this experiment is that multipliers above 1, even in economically challenging times, materialize in times of high uncertainty.¹⁷

4 | TRANSMISSION CHANNELS

Our results provide evidence for government spending multipliers around 2 in uncertain times, while they are smaller in recessions. This result should be reflected in the channels of transmission of government spending increases.

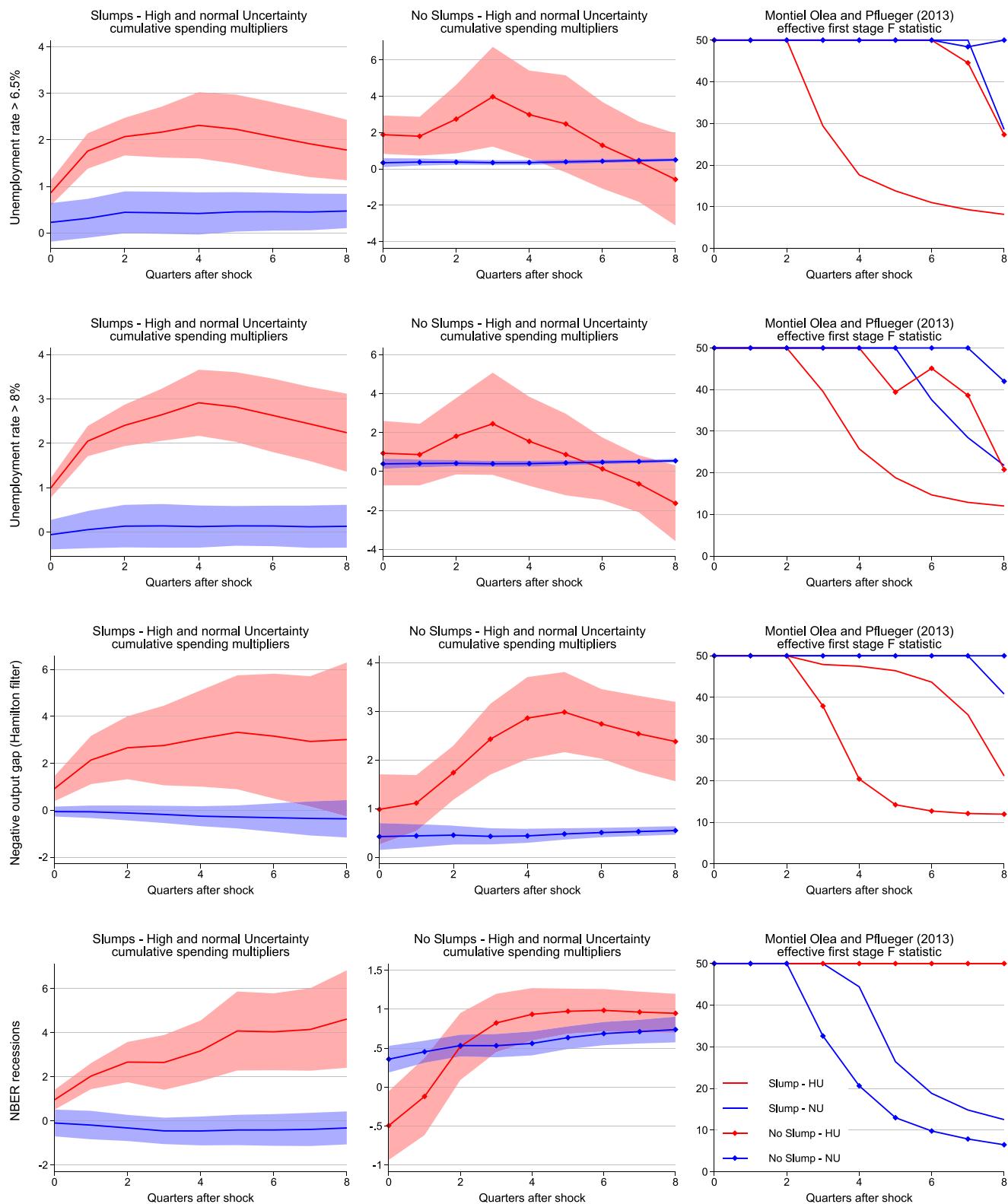


FIGURE 8 Government spending multipliers over the economic cycle—the role of uncertainty. The figure shows the cumulative government spending multipliers to a Blanchard-Perotti shock estimated from Equation (4). 90% confidence intervals are shown in all cases. All statistics are robust to heteroskedasticity and serial correlation [Colour figure can be viewed at wileyonlinelibrary.com]

We, therefore, now focus on the concrete transmission mechanisms and analyze the effects on a number of macroeconomic as well as financial variables, government expenditure funding and the monetary policy response.

Specifically, we estimate state-dependent cumulative multipliers from local projections for each horizon $h = 0, 1, \dots, 15$:

$$\begin{aligned} \sum_{j=0}^h x_{t+j} = & I_{t-1}^A \left[\alpha_h^A + \phi_h^A(L)X_{t-1} + m_h^A \sum_{j=0}^h g_{t+j} \right] \\ & + \left(1 - I_{t-1}^B \right) \left[\alpha_h^B + \phi_h^B(L)X_{t-1} + m_h^B \sum_{j=0}^h g_{t+j} \right] \\ & + \gamma_{1h}t + \gamma_{2h}t^2 + \gamma_{3h}t^3 + \epsilon_{t+h} \end{aligned} \tag{5}$$

where the dependent variable x_t is, respectively, output or private spending (both in % of potential GDP), the unemployment rate, the change in debt as well as tax receipts relative to GDP, the corporate bond spread, the percentage

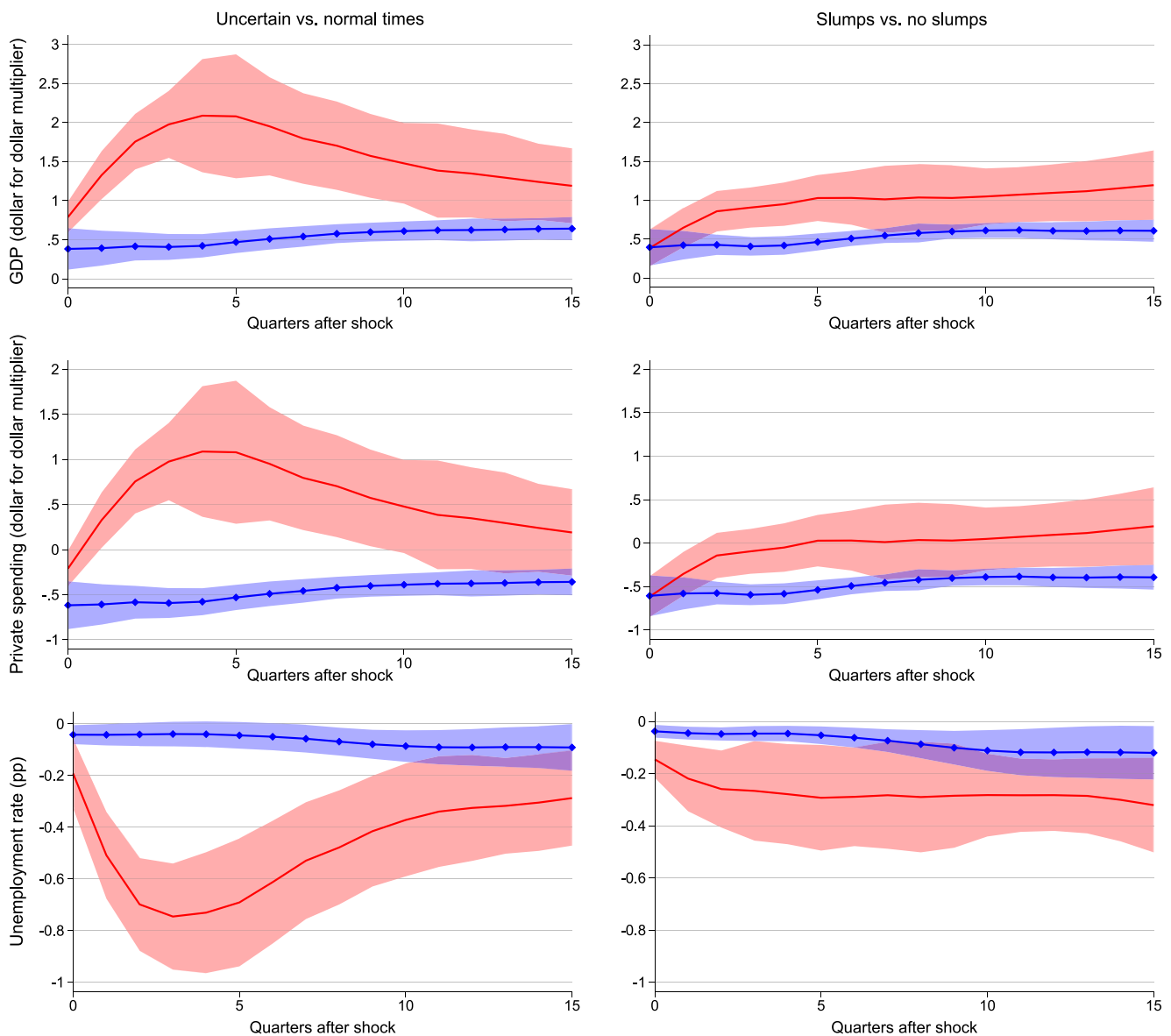


FIGURE 9 Macroeconomic effects in uncertain times and economic slumps. The figure shows cumulative multipliers to a Blanchard-Perotti shock in uncertain or slump (both in red) as opposed to normal times (in blue with markers) together with 90% heteroskedasticity and serial correlation robust confidence intervals [Colour figure can be viewed at wileyonlinelibrary.com]

change of the S&P 500 index, the NVIX, the nominal and real interest rate as well as the inflation rate or a financial stress index.¹⁸ In all cases, we analyze multipliers to a Blanchard and Perotti (2002) shock. X_{t-1} includes four lags of variables used in the baseline specification as well as the dependent variable.¹⁹ Cumulative multipliers control for the difference in the dynamics of government spending as if the increase in public demand is similar across states. For GDP components, these multipliers are dollar to dollar multipliers. In case of the other variables, it is the cumulative change in x divided by the cumulative change in government spending, expressed in percentage points (pp) of potential GDP, at the same horizon. If for example x denotes the unemployment rate, the change is measured in percentage points.

Figure 9 depicts the estimated multipliers for a range of macroeconomic variables. The red lines indicate multipliers for the high uncertainty (or economic slump) state while the blue line with markers depicts the normal times multipliers. Periods with the NVIX above the 85th percentile are classified as uncertain. Slump episodes correspond to periods with an unemployment rate above 6.5%. One year after the shock, the output multiplier is as high as 2 during uncertain times, in slumps, however only around 1. This is in line with the crowding in of private consumption and investment during uncertain times as shown in the second row. During slumps, public spending does not crowd out private expenditures but it does not crowd it in, either. Leduc and Liu (2016) interpret uncertainty shocks as negative aggregate demand shocks. In times of elevated uncertainty and reduced private spending, the government is able to increase demand and employment, shown by the significant decline in the unemployment rate in the bottom panel. Without the increase in public demand firms would not hire new workers due to the real option channel.

Figure 10 examines whether the larger HU multipliers are due to different forms of public funding. In normal times, the increase in government spending is tax-financed in the short term whereas the debt ratio rises after 1 year. Furthermore, the results indicate a combination of spending increases with tax cuts during uncertain times which are, however, not significant. The most interesting finding is the negative debt multiplier due to the large output multiplier in uncertain times. In contrast, the short-run debt ratio increases during slumps.

Figure 11 examines whether the higher multipliers in uncertain times are due to accommodative monetary policy. The real interest rate decreases significantly in the HU state, while it decreases only slightly during elevated unemployment. Although the second row shows a more accommodative monetary policy in uncertain times, the real interest rate falls primarily due to the rise in inflation. Government demand may save the economy from a deflationary spiral

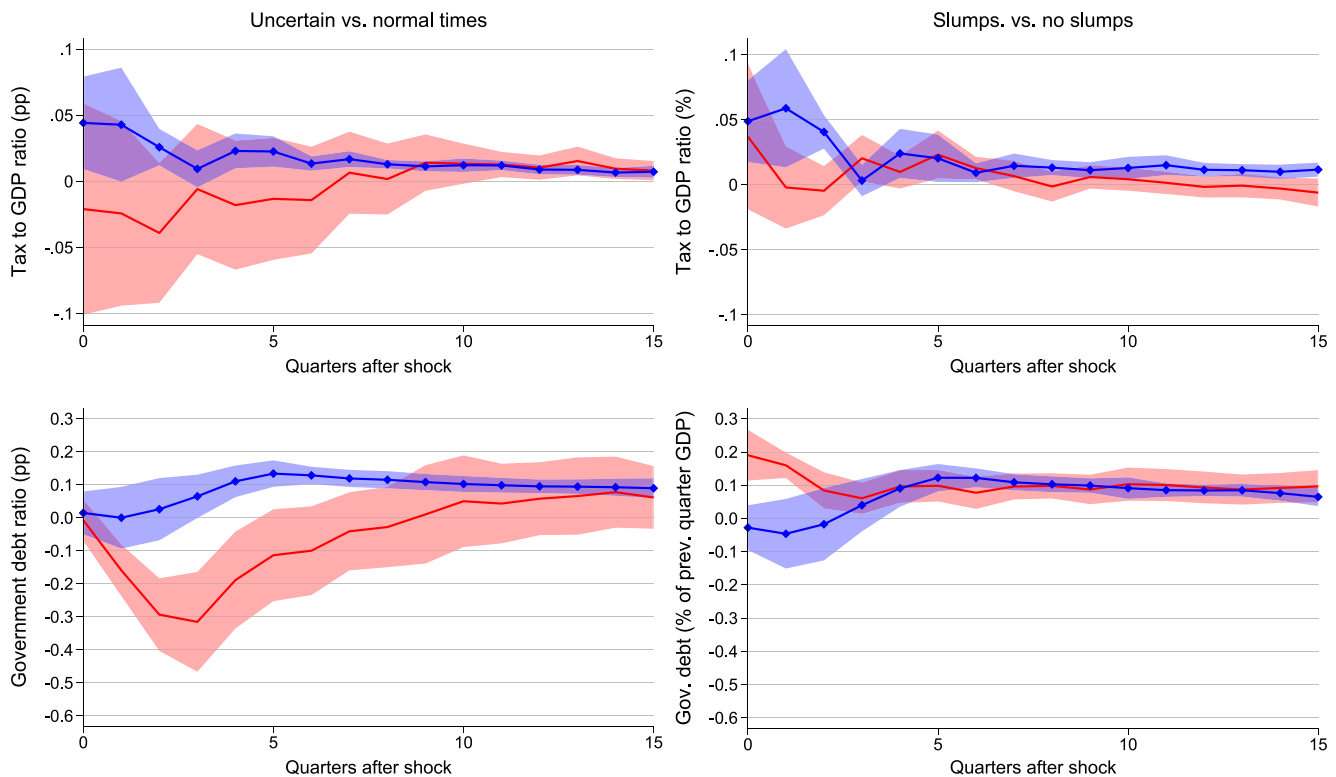


FIGURE 10 Public finances in uncertain times and economic slumps. The figure shows cumulative multipliers to a Blanchard-Perotti shock in uncertain or slump (both in red) as opposed to normal times (in blue with markers) together with 90% heteroskedasticity and serial correlation robust confidence intervals [Colour figure can be viewed at wileyonlinelibrary.com]

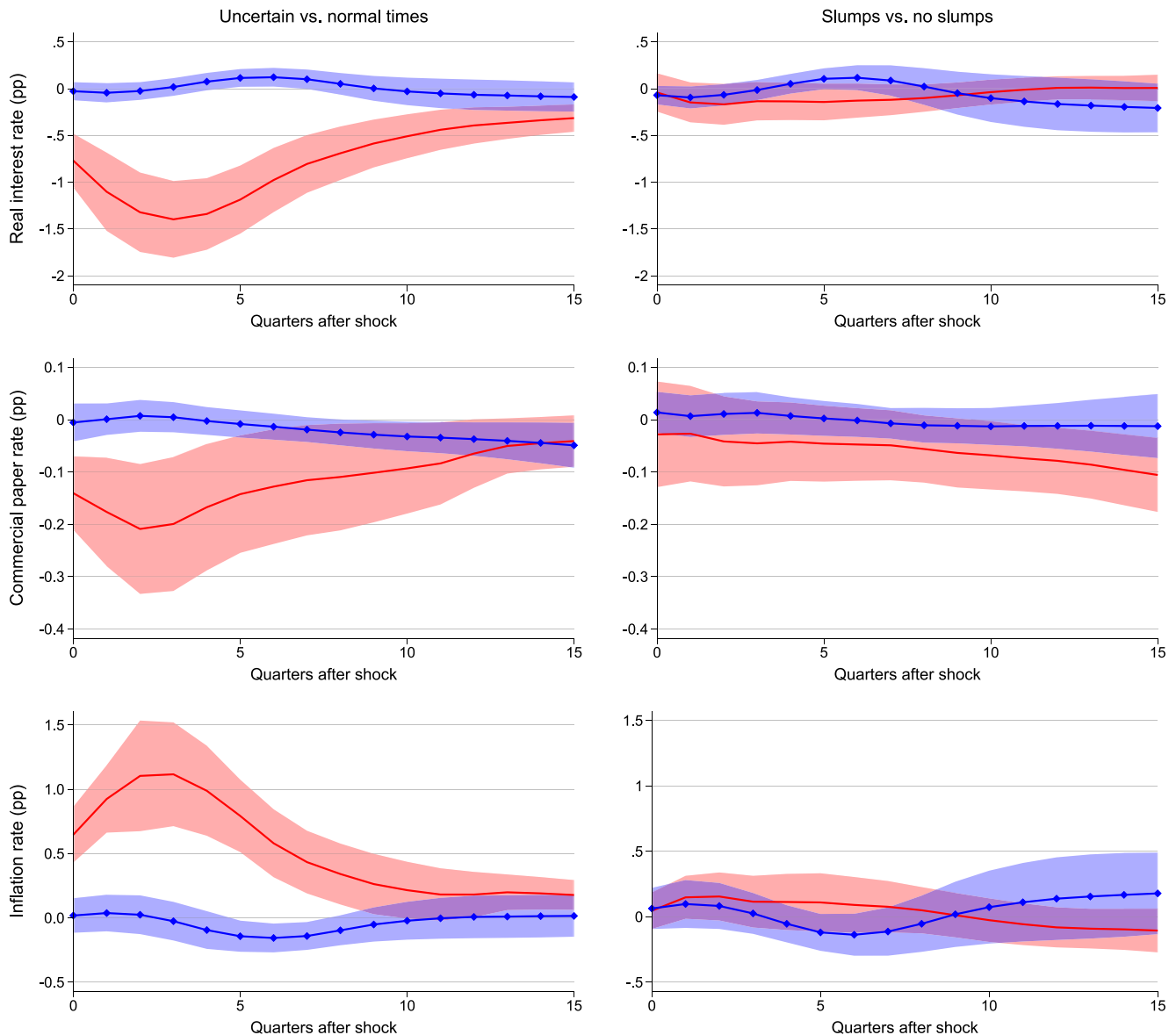


FIGURE 11 Monetary policy response in uncertain times and economic slumps. The figure shows cumulative multipliers to a Blanchard-Perotti shock in uncertain or slump (both in red) as opposed to normal times (in blue with markers) together with 90% heteroskedasticity and serial correlation robust confidence intervals [Colour figure can be viewed at wileyonlinelibrary.com]

due to the decline in private spending.²⁰ Vavra (2013) shows that price flexibility increases in times of high volatility, which can also explain the strong price increase in the short run, which we do not observe in times of elevated unemployment. The impact of decreased real interest rates is twofold. On the one hand, investments become more attractive; on the other hand, precautionary saving becomes less attractive because the interest yield declines.

Figure 12 shows the estimated multipliers for a number of financial market variables. In times of high uncertainty, the increase in government spending significantly lowers risk premiums firms have to pay. Thereby, it crowds in private investments when firms have difficulties to finance their activities. In combination with lower real interest rates, investment now becomes more attractive for companies. This effect can outweigh the decline through the real option channel. Furthermore, the figure depicts an increase in stock prices in times of high uncertainty and recessions. This is in line with the confidence channel of government spending in Bachmann and Sims (2012). Additionally, it gives us confidence that the findings are not the result of fiscal foresight. Stock prices are forward-looking by their very nature and if the government spending shock is anticipated, we should not find significant multipliers. Fiscal policy might also directly reduce stock market uncertainty. However, the NVIX multiplier turns out to be insignificant at all horizons. The bottom panel shows the multiplier for the financial stress index of Püttmann (2018). The decline of financial stress is in line with lower risk premiums in times of intense uncertainty in response to the rise in public demand.

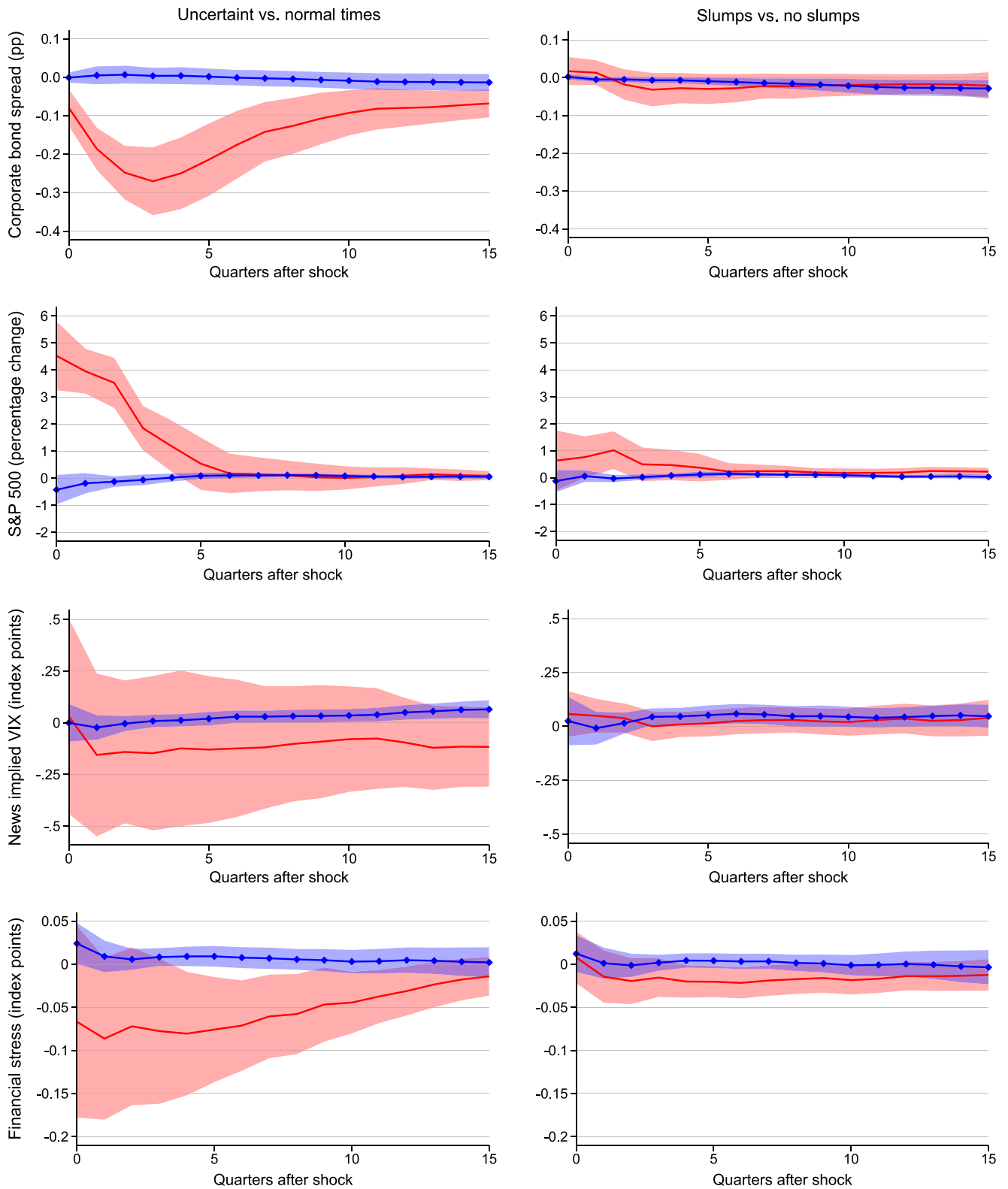


FIGURE 12 Financial effects in uncertain times and economic slumps. The figure shows cumulative multipliers to a Blanchard-Perotti shock in uncertain or slump (both in red) as opposed to normal times (in blue with markers) together with 90% heteroskedasticity and serial correlation robust confidence intervals [Colour figure can be viewed at wileyonlinelibrary.com]

5 | CONCLUSION

We investigate whether government spending multipliers vary depending on the degree of uncertainty and slump in the economy. We use quarterly data spanning more than 120 years for the United States to maximize the amount of variation in the data in order to reveal state-dependent multipliers. To do so, we extend the dataset from Ramey and Zubairy (2018) with a broad set of macroeconomic and financial variables.

Using local projections, we find that the cumulative government spending multiplier rises with the uncertainty level prior to the fiscal easing. During uncertain times, the 1-year government spending multiplier is about 2. This result is robust across a broad range of specifications and identifying assumptions about the government spending shock. Hence, public expenditures crowd in private demand during uncertain episodes. At first sight, this comes as a surprise. According to the uncertainty theory, firms postpone investment as well as hiring decisions and consumers increase their precautionary savings faced with prevalent uncertainty. Indeed, Bloom et al. (2018) model fiscal policy as a wage subsidy and show that the effects of such a policy is smaller when implemented at the time uncertainty first hits the economy but slightly larger when the policy is conducted 1 year later.

However, Leduc and Liu (2016) interpret an uncertainty shock as an aggregate demand shock as it increases unemployment and lowers inflation. The economy faced with sharply increased uncertainty, we find that expansive public spending lowers unemployment and raises inflation which on the one hand prevents a deflationary spiral and on the other hand generates additional investment incentives by effectively lowering the real interest rate. The latter also reduces precautionary saving incentives. The finance conditions are further improved through diminished risk premiums for firms. Moreover, we find an increase in stock prices consistent with the confidence channel in line with Bachmann and Sims (2012). By tackling the effects of uncertainty, increasing public demand turns out to be more effective, not less as suggested by other empirical studies which tend to focus on shorter historical data excluding for example, the Great Depression.

With respect to the economic cycle, we find slightly larger multipliers than Ramey and Zubairy (2018) around 1 in periods of increased unemployment. Our analysis shows that the expansive public spending increases employment as well as confidence in the economy, witnessed by the positive response in stock prices. However, there is neither evidence for a substantial rise in inflation, lowering the real interest rate, nor do we find decreasing risk premiums. Both channels have primary effects on economic decisions and can explain why government spending crowds in private demand during uncertain episodes. Contrary to this, in economic slumps, public spending does not displace it, but it does not strengthen it either.

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ENDNOTES

¹ Strictly speaking, Arčabić and Cover (2016) do not systematically test for larger multipliers in uncertain versus normal times. Instead, they estimate a threshold VAR and calculate generalized impulse response functions (GIRFs) where the responses of the variables depend on the lagged uncertainty level. Afterward, they choose three dates which refer to large (2008Q4), medium (1987Q3, close to their threshold) and low (2005Q3) levels of uncertainty. Based on the responses at these three dates, instead of calculating the average response above/below the chosen threshold level, they claim to find larger output effects of a government spending shock in uncertain times.

² Ramey (2011a) and Ramey (2019) provide good reviews of the government spending literature.

³ For instance, Bloom et al. (2018) classify recessions as the coincidence of a negative first moment (level) with a positive second moment (volatility) shock. According to the theoretical uncertainty literature, higher volatility diminishes private demand through a real-option channel (increasing the option value of waiting, reducing investment and hiring) (see e.g., Bernanke, 1983; Bloom, 2009; Dixit, 1989; Pindyck, 1991), precautionary savings (lowering consumption) (see e.g., Challe et al., 2017; Leland, 1968; Lusardi, 1998) and higher financial risk premiums (extending financial constraints) (see e.g., Christiano et al., 2014). Bloom (2014) as well as Fernández-Villaverde and Guerrón-Quintana (2020) provide good reviews of this literature.

- ⁴ Mountford and Uhlig (2009) proposed the use of present value cumulative multipliers $m_h = \frac{\sum_{j=0}^h (1+i)^{-j} y_{t+j}}{\sum_{j=0}^h (1+i)^{-j} g_{t+j}}$. As argued in Ramey (2019), different interest rates i (including $i = 0$) for discounting result in nearly identical multipliers because the timing of the government spending and output responses are very similar. We also find evidence for this. The results are available on request.
- ⁵ We use the terms “state” and “regime” interchangeably.
- ⁶ We include the log difference since we cannot reject a unit root at conventional significance levels.
- ⁷ We include the change instead of the level since we cannot reject a unit root at conventional significance levels due to permanent shifts around war periods. Normalizing tax revenues with potential output instead of GDP to be more consistent with the Gordon-Krenn transformation gives almost identical results.
- ⁸ We follow Olson and Enders (2012) and proxy the monetary policy with a short-term commercial paper rate. To calculate the real interest rate, we then subtract the year-over-year inflation rate. Using the annualized quarterly inflation rate gives similar results.
- ⁹ The sample end is restricted by the availability of the uncertainty indicator and the military news variable that we later use for robustness checks.
- ¹⁰ The VXO (VIX) measures the option implied annualized standard deviation of S&P 100 (S&P 500) returns. Bloom (2009) proposes to use the VXO (VIX) as an uncertainty proxy due to the fact that the implied stock return volatility is the canonical measure of uncertainty in financial markets. He also shows that time series stock market volatility is highly correlated with a number of cross-sectional measures of uncertainty. See also the discussion in Bloom et al. (2007).
- ¹¹ A plausible reason for this is the training sample period starting in 1996 which does not cover any OPEC crises. See Hamilton (2011) for a description of historical oil shocks.
- ¹² Our sample includes about 500 quarters. Setting a threshold at the 85th percentile of the NVIX results in 75 observations for the state of heightened uncertainty. In contrast, frequently used samples from 1960 onward would contain as few as 35 uncertain quarters.
- ¹³ This is expected since the threshold classifies 85% of the sample as normal periods.
- ¹⁴ The F-statistics are from the regression of $\sum_{j=0}^h g_{t+j}$ on the shock in t . The regression also includes all the other controls from the second stage. A common rule of thumbs is that a first-stage F-statistic less than 10 indicates that the instruments are weak (Stock & Watson, 2020, Chapter 12). However, heteroskedasticity and serial correlation can affect instrument strength (Montiel Olea & Pflueger, 2013). The critical values for a worst case bias of 10% are 23.109 (19.748) at the 5 (10)% confidence level (Pflueger & Wang, 2015). The statistic is capped at a maximum of 50 for readability reasons.
- ¹⁵ Figure B1 in Appendix B also investigates the effects of different thresholds.
- ¹⁶ We follow Ramey and Zubairy (2018) and do not use observations when either the dependent variable, the shock or the lagged control variables occur during WWII. They classify the period 1941Q3–1945Q4 on rationing and capacity reasons. However, we follow Gorodnichenko (2014) and start WWII after the German invasion into Poland (1939Q3) and add a few quarters (until 1946Q4) to get rid of the period with massive demobilization. For instance, the military news variable is about 29% of potential GDP in 1940Q2, and 38 in 1941Q2. These are some of the largest military shocks in the sample as can be seen from Figure A1 in Appendix A. We also exclude those periods in the calculation of the threshold to ensure that 15% of the observations are classified as uncertain periods.
- ¹⁷ In Figure B2 of Appendix B, we provide graphs for the estimated multipliers across different measures of economic slack without distinguishing across uncertainty states. We find multipliers close to 1 in periods of high unemployment.
- ¹⁸ To calculate private spending, we subtract government spending from output. In the estimation, we then replace real GDP with private spending.
- ¹⁹ For the x_{t+h} variables in differences (the change in debt to GDP, the change in tax receipts to GDP, the percentage change of the S&P 500 index), the multiplier at horizon h denotes the change in levels from period $t - 1$ to $t + h$.
- ²⁰ Indeed, the inflation rate has a mean of about 0.6 in the high uncertainty regime and 2.8 during normal times.

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