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## Government Spending in Uncertain and Slack Times: Historical Evidence for Larger Fiscal Multipliers<sup>\*</sup>

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#### Abstract

We investigate whether US government spending multipliers are higher during periods of heightened uncertainty or economic slack as opposed to normal times. Using quarterly historical data and local projections, we estimate a cumulative one-year multiplier of 2 during uncertain periods. In contrast, the multiplier is about 1 in times of high unemployment and about 0.5 - 0.7 during normal times. While we find positive employment effects in economic slack as in uncertain times, two transmission channels can explain the higher multipliers in the latter: greater price flexibility leading to short run inflation (lowering the real interest rate) and diminishing risk premiums.

*Keywords:* Fiscal policy, government spending, fiscal multiplier, uncertainty, economic slack, local projections, historical data *JEL:* E62, E32

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#### 1. Introduction

The recent experience of the Great Recession, which was accompanied by great uncertainty in the real and financial sectors, has sparked a debate about the impact of uncertainty on the macroeconomic outcomes. At the same time, governments have responded to the crisis with substantial public spending. Likewise, the current Corona Crisis is characterized by high uncertainty and simultaneous jumps in unemployment rates. Governments raise public spending to stabilize the economies. This raises the question of whether this behavior is particular effective in uncertain or economically bad times such that one additional dollar of government spending increases output by more than one dollar?

Recently, this research question has been explored by a few authors. On the one hand Bachmann and Sims (2012), Auerbach and Gorodnichenko (2012a,b), Fazzari et al. (2015) and Caggiano et al. (2015) find larger multipliers during economic bad times. On the other hand, Ramey and Zubairy (2018) and Alloza (2018) find no large or even negative government spending multipliers in times of slack. Ricco et al. (2016), Arčabić and Cover (2016) as well Berg (2019) find larger multipliers during uncertain times while Alloza (2018) finds negative output effects. At the same time, Klein and Linnemann (2018) find evidence for larger fiscal multipliers during the Great Recession, a situation of large uncertainty in coincidence with economic slack.

With exception to Ramey and Zubairy (2018), all studies mentioned are based on post-World War II data. The theory shows that government expenditure multipliers depend on details of the current situation such as the persistence of government expenditure increases, financing, the degree of financial frictions, the stance of monetary policy as well as the labor market situation.<sup>1</sup> In addition to first moment effects, second moment effects through uncertainty complicate this issue furthermore.<sup>2</sup> The information in post-World War II 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 can do the job.

This paper contributes to the literature by using quarterly US data from 1890 onward to (1) estimate government expenditure multipliers in uncertain and normal times and (2) distinguish between uncertainty and economic bad times. Using Jordà (2005) local projections and news implied stock market volatility from Manela and Moreira (2017) as uncertainty indicator, we find a cumulative one-year multiplier of 2 in uncertain times and about 0.5 - 0.7 during normal times. This result is robust to different identification methods and choices of control variables. While we generally find higher multipliers in times of high stock market volatility, the one-year multiplier is close to 1

<sup>&</sup>lt;sup>1</sup>Ramey (2011a) and Ramey (2019) provide good reviews of the government spending literature.

<sup>&</sup>lt;sup>2</sup>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; Dixit 1989; Pindyck 1991; Bloom 2009), precautionary savings (lowering consumption) (see e.g. Leland 1968; Lusardi 1998; Challe et al. 2017) and higher financial risk premiums (extending financial constraints) (see e.g. Christiano et al. 2014). Bloom (2014) as well as Fernndez-Villaverde and Guerrn-Quintana (2020) are good reviews of this literature.

when the unemployment rate is above 6.5%.

Our contribution (3) to the literature is providing impulse responses to a wide range of macroeconomic and financial variables to explain the higher multipliers in uncertain as opposed to economic slack times. We find that an unexpected increase in government spending has a positive impact on employment levels and the stock market in economic slack and uncertain times, with the latter shaped by stronger effects. However, in uncertain times, expansionary fiscal policy lowers corporate bond spreads 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, so stimulating private spending. These two effects do not occur in times of heightened unemployment, which explains the lower multiplier.

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 regimes. Herein, we consider four regimes: high uncertainty with slack, high uncertainty without slack, low uncertainty with slack and low uncertainty without slack. Section 4 explores transmission channels that can explain the main result. Section 5 concludes.

#### 2. Empirical strategy

We estimate regime-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) and Miyamoto et al. (2018). In particular, we are interested in the dynamics of the cumulative government spending multiplier, where which measures the cumulative change in GDP relative to the accumulative change in government spending up to quarter t + h in response to a government spending shock occurring in period t.<sup>3</sup>

Following Ramey and Zubairy (2018), we can estimate the cumulative multiplier directly by a series of regressions at each horizon h = 0, ..., 20 for each regime:

$$\sum_{j=0}^{h} y_{t+j} = I_{t-1}^{hu} \left[ \alpha_h^A + \phi_h^A(L) X_{t-1} + m_h^A \sum_{j=0}^{h} g_{t+j} \right] \\ + \left( 1 - I_{t-1}^{hu} \right) \left[ \alpha_h^B + \phi_h^B(L) X_{t-1} + m_h^B \sum_{j=0}^{h} g_{t+j} \right]$$
(1)
$$+ \gamma_{1h} t + \gamma_{2h} t^2 + \gamma_{3h} t^3 + \epsilon_{t+h}$$

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. The latter consists of government consumption expenditures and gross investment. The  $\alpha$ 's denote regime-specific constants whereas the t's catch up 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

<sup>&</sup>lt;sup>3</sup>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. This is also shown in the similarities between Figure 3 and Figure B.12. Therefore, we calculate multipliers without discounting.

 $X_{t-1}$  denotes the vector of control variables.  $I^{hu}$  denotes a dummy variable that indicates the state of the economy when the shock takes place. We set  $I^{hu}$  to one if the quarter is classified as uncertain times. We include a oneperiod lag of  $I^{hu}$  in the regressions to minimize contemporaneous correlations between fiscal shocks and the state of the economy.

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 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.

The cumulative government spending multipliers for each state and horizon are then given by  $m_h^A$  and  $m_h^B$ . Herein,  $m_h^A(m_h^B)$  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 A to regime B, or vice versa, this effect is absorbed into the estimated multipliers. We normalize output and government spending by potential GDP as in Gordon and Krenn (2010). As stressed by Ramey and Zubairy (2018), this allows us to estimate dollar to 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.

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 and Peters 2010; Ramey 2011b). Others add a series of professional forecasts of government spending to the set of control variables (Auerbach and 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 (Yang 2007; Forni and Gambetti 2010; Beetsma and Giuliodori 2011). In our baseline specification, we follow the latter route and include stock prices, more exactly the log difference of the S&P 500 index, into the set of our control variables. This route has the advantage of controlling for first moment changes in the stock market, realized stock price changes should not confound our results which focus on expected stock market volatility.<sup>4</sup>

<sup>&</sup>lt;sup>4</sup>We include the log difference since we cannot reject a unit root at conventional significance levels.

Apart from the stock market data, the vector of control variables  $X_t$  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.<sup>5</sup> 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 opposed to. Fernández-Villaverde (2010) and Canzoneri et al. (2016) demonstrate in theoretical models that financial frictions should affect the economic reactions in response to expansive public spending. The appendix provides detailed information about the data as well as time series plots.

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.<sup>6</sup>

<sup>&</sup>lt;sup>5</sup>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.

<sup>&</sup>lt;sup>6</sup>The sample end is restricted by the availability of the uncertainty indicator and the military news variable that we use for robustness. Appendix A provides time series figures and a description of all variables.

#### 3. Output multipliers during uncertain and normal times

The estimation of potentially regime-dependent fiscal multipliers with equation (1) is a non-trivial task. Firstly, we have to find a measure of uncertainty that is available over a long-historical range. Secondly, we need to define 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 front-page articles to construct a text-based measure of expected stock market uncertainty back to the end of the 19<sup>th</sup> century. The underlying assumption is that the choice of words by the business press provides a good and stable reflection about the concerns of the average investor. This assumption is consistent with a news firm observing real-world events and emphasizing the most important terms to buildup reputation. To construct the NVIX, they split Wall-Street titles and abstracts to n-grams and use support vector regressions to predict the VXO or VIX from which at least one is available from 1986 onward.<sup>7</sup> Since the news articles are available from 1890, they can use their model to predict the NVIX back to 1890. Furthermore, they demonstrate that the

<sup>&</sup>lt;sup>7</sup>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 shared-returns 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. Examples are the cross-sectional standard deviation of firms' pretax profit growth, a monthly cross-sectional stock return measure, the standard deviation of factor productivity growth within the NBER manufacturing industry data base or the dispersion across macro forecasters over their predictions for future GDP. See also the discussion in Bloom et al. (2007).

Figure 1: Uncertainty through time



NVIX captures concerns about disaster risks and has predicting power for the transition into economic disasters. These features, combined with the long available data availability, turn it to be a good proxy of uncertainty for our analysis.

Figure 1 shows the historical development of the NVIX. It shows significant variation over time and peaks during world wars, financial crises, times of policy-related uncertainty and stock market crashes. Examples for spikes are the railroad speculation that led to the "Northern Pacific Panic" at the beginning of the twentieth century (Noyes 1909), the start of WWI 1914, the stock market crash in 1929 leading to the financial crisis and the Great Depression which became a time of prolonged uncertainty. After WWII, insecurity declined and jumped 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 twenty-first century began with large uncertainty because of the tech bubble and the fight against terrorism in Afghanistan and Iraq. Afterwards, a period of very low uncertainty occurred up to the Financial Crisis. Mishkin and White (2002) describe many stock market crashes in the United States.

The short-dashed line in Figure 1 is the threshold that discriminates uncertain from 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 opposed to. In particular, they show that the impact of uncertainty is only muted close to the median but that the effects can be large at extreme levels of uncertainty (75<sup>th</sup> percentile and 90<sup>th</sup> percentile). Based on this finding and keeping in mind that the impact of government spending finally depends on the response of the private sector, we estimate the difference in fiscal multipliers between uncertain and normal times for each threshold ranging from the 70<sup>th</sup> to the 90<sup>th</sup> percentile of the NVIX distribution. We can do so since the use of historical data provides enough observations even for extreme events.<sup>8</sup>

We can rewrite equation (1) to estimate the difference between cumulative multipliers across states for each horizon h = 0, 1, ..., 20.

$$\sum_{j=0}^{h} y_{t+j} = m_h^{diff} I_{t-1}^{hu} \sum_{j=0}^{h} g_{t+j} + m_h^B \sum_{j=0}^{h} g_{t+j} + I_{t-1}^{hu} \left[ \alpha_h^A + \phi_h^A(L) X_{t-1} \right] + (1 - I_{t-1}^{hu}) \left[ \alpha_h^B + \phi_h^B(L) X_{t-1} \right] + \gamma_{1h} t + \gamma_{2h} t^2 + \gamma_{3h} t^3 + \epsilon_{t+h}$$
(2)

with  $m_h^{diff} = m_h^A - m_h^B$  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 2 shows the estimated difference in multipliers for each threshold with 90% confidence bands. The results show that there is no significant impact difference, however the gap between both regimes in 1 and 2 year multipliers increases non-linearly with the threshold. This is expected from the above finding in Bloom et al. (2007). We choose the  $85^{th}$  percentile of the NVIX distribution as the threshold based on a trade-off between disentangling the difference between both regimes at high levels of uncertainty and low estimation precision due to the low number of observations in the high uncertainty regime for very high thresholds.

<sup>&</sup>lt;sup>8</sup>Our sample includes about 500 quarters. Setting a threshold at the  $80^{th}$  percentile of the NVIX results in 100 observations for the state of heightened uncertainty. Using common samples in the literature starting in 1947 or 1960 would suffer from degree of freedom problems. Less than 60 observations in the high uncertainty regime might not be sufficient to control for enough confounding factors. In result, small changes in the specification can lead to substantial different results.



Figure 2: Difference in regime-dependent fiscal multipliers for different thresholds

Note: Shaded areas depict 90% HAC robust confidence areas.

We now present the estimated cumulative government spending multipliers based on equation (1) and the  $85^{th}$  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.

The upper left panel of Figure 3 shows the cumulative fiscal multiplier with 90% confidence bands for a version of equation (1) without different regimes (henceforth called linear model). Output increases only about forty cents per dollar of government spending on impact. 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 3 shows the cumulative government spending multiplier in uncertain times (in red) versus normal times (in blue). The multiplier during normal times mirrors the one estimated from the linear



Figure 3: Cumulative multiplier for a Blanchard-Perotti shock

Notes: The upper left panel shows the cumulative 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) times. Ninety percent HAC 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.

model.<sup>9</sup> However, the red line shows that fiscal policy can be very effective during times of heightened uncertainty. Over a horizon of one-year, 1 additional dollar of government consumption and investment boosts output about 2 dollars. The lower right panel shows the p-value for the difference in multipliers across uncertainty regimes for each horizon h. Although not significant at the ten percent level on impact, the difference becomes highly significant afterwards.

The lower left panel shows the Olea and Pflueger (2013) effective first stage F-statistic for the state-dependent as well as the linear fiscal multipliers. It can be seen that the Blanchard-Perotti shock has high instrument relevance especially in the short to medium run. Even after two years, the first stage F-statistic in the high uncertainty regime and the linear model is close to twenty. The relevance during normal times is at least above the conventional value of 10.<sup>10</sup> Since the high multipliers in the uncertainty regime correspond to horizons with high instrument relevance (the first two years), we conclude that the high multipliers are not the result of weak instrument relevance.

<sup>&</sup>lt;sup>9</sup>This is expected as with our threshold 85 percent of the sample corresponds to normal times.

<sup>&</sup>lt;sup>10</sup>The F-statistics are from the regression of the sum of real government spending from t to t + h on the shock in t. The regression also includes all the other controls from the second stage. The critical values for a worst case bias of ten percent are 23.109 (19.748) at the 5 (10)% confidence level (Pflueger and Wang 2015). The statistic is capped at a maximum of 50 for readability reasons.

#### 3.1. Robustness

Our baseline results are potentially sensitive to a numerous specification decisions we made like the specific choice of control variables in equation (1), the identification of a government spending shock. In this section, we explore the sensitivity of our findings to those, as well as the issue of sub-sample stability. <sup>11</sup>

We begin by including the real interest rate as control variable for two reasons.<sup>12</sup> It should account for the monetary policy reaction after a government spending shock (e.g. Canova and Pappa 2011; Davig and Leeper 2011). Additionally, Yang (2007) argues that lagged interest rates and price variables might cover information about future fiscal policy. Including the real interest rate might hence help to account for fiscal anticipation as mentioned before. Secondly, we include the unemployment rate since Barro and Redlick (2011) find that it contains important information about the state of the business cycle relative to output data. Thirdly, we include lagged values of the NVIX in the set of our controls. Lastly, we drop the deterministic trends from our specification. Figure 4 shows that our results remain qualitatively and quantitatively similar if we include additional controls or drop the trend. Therefore, we continue with our baseline specification.

<sup>&</sup>lt;sup>11</sup>Appendix B provides additional robustness checks: the use of present value multipliers, different thresholds for the uncertainty regime, the use of different lag length for the control variables and different normalization of output and government spending.

<sup>&</sup>lt;sup>12</sup>We follow Olson and Enders (2012) and proxy 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.



Figure 4: Robustness to including additional control variables

Notes: The figure shows cumulative fiscal multipliers from a linear model (in black) and in uncertain (in red) as well as normal (in blue) times. Ninety percent confidence intervals are shown in all cases. All statistics are robust to heteroskedasticity and serial correlation.

In Figure 5, we check robustness to different identification methods of a government spending shock as well as excluding World War II (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 that are linked to political and military events since these changes are most likely independent of the state of the economy. The news 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  $news_t$  (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 differs in two aspects. The most obtrusive feature are the larger multipliers during normal times and the linear model. However, since this corresponds with very weak first stage F statistics, the large short-run multiplier during tranquil times should be doubted. Furthermore, the linear and normal-times multipliers attenuate to the baseline results as the first stage F statistics increase. As is well-known, instrumental variable estimation can be given a local average treatment effect interpretation. In our case, from 504 observations, the military news shock differs from zero in only 108 quarters. This problem becomes more severe if state-dependence is under consideration. The news variable shows variation in only 12 during uncertain and 96

quarters in normal times. This of course also explains the large standard errors as compared to the baseline results in Figure 3.

Complementary, we also include the military news variable in the set of controls but use the Blanchard-Perotti interpretation. The government spending shock can then be interpreted as orthogonal to news about military spending. As shown in the second row of Figure 5, the government expenditure multiplier now becomes larger in times of heightened uncertainty. As argued in Perotti (2014), a raise in military spending might have very different effects from impacts of 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 of Figure 5 where we exclude world war two from our estimation.<sup>13</sup> As can be seen, the multiplier during uncertain times 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 robustness is provided by exploiting an idea from Ramey and

<sup>&</sup>lt;sup>13</sup>When we exclude WWII, 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. We also exclude those periods in the calculation of the threshold to ensure that 15 percent of the observations are classified as uncertain times. 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 percent 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 A.10.



Figure 5: Different identification methods and excluding WWII

Notes: The figure shows cumulative fiscal multipliers from a linear model (in black) and in uncertain (in red) as well as normal (in blue) times. Ninety percent confidence intervals are shown in all cases. All statistics are robust to heteroskedasticity and serial correlation.

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 5 and are very similar to the baseline results. Although it is not totally clear how this shock can be interpreted, this experiment provides two benefits. Firstly, the instrument relevance remains high beyond two years after the shock occurs. Secondly, since we now have two instruments for one endogenous variable in each regime, we can use the Sargan-Hansen test of overidentifying restrictions. Although in general, we cannot reject the latter at the five percent level based on equation (1), we further examine robustness based on Caldara and Kamps (2017).<sup>14</sup>

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. Based on this idea, we use

$$\tilde{g}_t = g_t - (I_{t-1}^{hu}\mu^{hu} + (I - I_{t-1}^{hu})\mu^{lu})y_t$$
(3)

and  $news_t$  as instruments. We experiment with different values and choosing  $\mu^{hu} = 0$  and  $\mu^{lu} = -0.18$  results in p - values > 0.1 for the Sargan-Hansen test.<sup>15</sup> The results are shown in the bottom panel of Figure 5. The regime dependent results are very similar to the baseline findings. Note, however the increase multipliers in the linear model and normal times regime that are now significantly above 0.5. Nevertheless, we continue with our baseline specifi-

<sup>&</sup>lt;sup>14</sup>Only for h = 5, the Sargan-Hansen test has a p-value of 0.049.

<sup>&</sup>lt;sup>15</sup>We also estimated equation (1) for each regime separately. With  $\mu^{hu} = 0$ , the p-value in the *HU* regime is always above 0.1. The problem only occurs in the linear and normal times *LU* estimation. However, the problem vanishes with  $\mu^{lu} = -0.18$ . In the linear model, we use  $\mu = \mu^{lu}$ .

Figure 6: Sample stability



Notes: The figure shows cumulative fiscal multipliers from a linear model (in black) and in uncertain (in red) as well as normal (in blue) times. Ninety percent confidence intervals are shown in all cases. All statistics are robust to heteroskedasticity and serial correlation.

cation and set  $\mu^{hu} = \mu^{lu}$  and stick to the Blanchard-Perotti identification for the rest of our analysis.

Figure 6 shows that our results are robust over different sub samples. Firstly, we only consider the period between 1914 and 2015. The reason is that the FED system has been established in this year, so we want to check if our results are driven by institutional differences in the period before. We estimate multipliers very similar to our baseline but the standard errors are smaller. Interestingly, the instrument relevance of the Blanchard-Perroti shock becomes very strong with increased horizon in the heightened uncertainty regime. This reinforces our assumption that our higher multipliers during uncertainty times are not driven by weak instruments.

The lower panel of Figure 6 shows the results from when we start our sample in 1947. Interestingly, there is now a large difference on impact across

regimes that is not observed if we use the whole sample period. In this period, a one dollar increase in government spending raises GDP by about two 2 on impact. However, the difference vanishes very quickly and the standard errors are very large. These results are mainly driven by the recent financial crises for which Klein and Linnemann (2018) find significantly higher fiscal multipliers. The standard errors in this specification are larger than in the baseline so that the multiplier during tranquil times in general covers the very broad range from slightly below 0 to above 1. This strengthens our belief that historical data provides useful information for the identification of fiscal multipliers. This is especially important if regime-dependence is under consideration.

#### 3.2. Uncertainty vs. economic slack

We have found evidence of significant differences in government spending multipliers in uncertain versus normal times. Ramey and Zubairy (2018), on the other hand, do not find significant differences in the government expenditure multiplier over the business cycle with the same historical data. This raises the question of whether economic uncertainty is more important than the degree of slack for the effects of government spending on the economy and whether a distinction can be made between the two. While this hardly seems possible with post-war data, it might be with more than a hundred years covering a broad range of events. To answer this question, we extend our model as follows:

$$\sum_{j=0}^{h} y_{t+j} = I_{t-1}^{hu} I_{t-1}^{slack} \left[ \alpha_h^A + \phi_h^A(L) X_{t-1} + m_h^A \sum_{j=0}^{h} g_{t+j} \right] \\ + I_{t-1}^{hu} (1 - I_{t-1}^{slack}) \left[ \alpha_h^B + \phi_h^B(L) X_{t-1} + m_h^B \sum_{j=0}^{h} g_{t+j} \right] \\ + (1 - I_{t-1}^{hu}) I_{t-1}^{slack} \left[ \alpha_h^C + \phi_h^C(L) X_{t-1} + m_h^C \sum_{j=0}^{h} g_{t+j} \right]$$

$$+ (1 - I_{t-1}^{hu}) (1 - I_{t-1}^{slack}) \left[ \alpha_h^D + \phi_h^D(L) X_{t-1} + m_h^D \sum_{j=0}^{h} g_{t+j} \right]$$

$$+ \gamma_{1h} t + \gamma_{2h} t^2 + \gamma_{3h} t^3 + \epsilon_{t+h}$$

$$(4)$$

Herein,  $I^{hu}$  is equal to one if the period belongs to the high uncertainty state and  $I^{slack}$  is set to one if the period belongs to economic slack times. Since there is no universal approach to discriminate between economic good and bad times, the table shows results for different methods to separate periods along the economic cycle. Due to the large amount of parameters to estimate in this specification, we reduce our uncertainty threshold to the  $80^{th}$  percentile of the NVIX distribution and use only three lags. Besides of the shortened lag length, the control variables are the same as in the baseline specification. This leads to smaller multipliers in the high uncertainty regimes.<sup>16</sup>

The first two classifications are based on the unemployment rate. Fol-

<sup>&</sup>lt;sup>16</sup>Remind from Figure 2 that the difference between regime-specific multipliers increases with higher uncertainty thresholds. Furthermore, Figure B.15 shows a decline in the multiplier in the uncertain times regime with three lags of the controls and the  $85^{th}$ percentile of the NVIX as threshold.

lowing Owyang et al. (2013), in the upper panel, we set  $I^{slack}$  to one if the unemployment rate is above 6.5%. They chose the value in accordance with the Federal Reserve's use during this period. The second panel follows a robustness analysis in Ramey and Zubairy (2018) and assumes a threshold value of eight percent, as state-dependent effects may be found more likely at higher degrees of slack.

The bottom three classifications of economic performance, by contrast, are based on the development of real GDP. Panel 3 sets  $I^{slack}$  to one during NBER recession periods, panel 4 if real GDP is below the CBO potential and the bottom panel uses the Hamilton (2018) filter to determine a time-varying threshold.

The results are as follows. The two right columns indicate that the government spending multiplier is below 1 in times of normal uncertainty equally for economic good and bad times. Interestingly, the second column from the right shows low multipliers during times of slack for some indicators although with large standard errors. As noted before, this is in line with crowding out of private spending. In contrast, the government crowds in private demand during times of heightened uncertainty.

The upper panel shows that the impact effect of a fiscal easing shock is substantial higher in uncertain times without economic slack as opposed to slack periods. However, in general we find government spending to be most effective in situation with soared uncertainty and a high degree of economic slack. In the appendix, we provide graphs for the estimated multipliers across different measures of economic slack. Figure B.17 shows that it is hard to find significant differences in multipliers across economic good and bad times.

	High uncertainty Slack	High uncertainty No slack	Normal uncertainty Slack	Normal uncertainty No slack
	Unemployment rate above 6.5 percent			
Impact $(h=0)$	0.43	1.29	0.12	0.46
1 X (1 0)	(0.165)	(0.277)	(0.159)	(0.192)
1 Year $(n=3)$	1.27	1.32	0.43	(0.41)
$2 \operatorname{Voor}(h-7)$	(0.197)	(0.144)	(0.199)	(0.112)
2 Teal (II- $1$ )	(0.108)	(0.91)	(0.220)	(0.04)
Observations in each state	(0.198) 54	(0.233) 46	(0.220) 128	276
	Unemployment rate above 8 percent			
Impact (h=0)	0.68	0.66	-0.55	0.48
,	(0.105)	(0.212)	(0.271)	(0.166)
1 Year $(h=3)$	1.78	0.71	-0.30	0.46
	(0.135)	(0.196)	(0.495)	(0.094)
2 Year $(h=7)$	1.71	0.79	-0.10	0.57
	(0.196)	(0.276)	(0.564)	(0.057)
Observations in each state	46	54	60	344
	NBER Recessions			
Impact $(h=0)$	0.92	-0.04	-0.05	0.49
	(0.288)	(0.181)	(0.388)	(0.058)
1 Year $(h=3)$	3.52	0.54	-0.17	0.58
	(1.421)	(0.181)	(0.301)	(0.087)
2 Year $(h=7)$	7.75	0.62	0.16	0.69
	(2.856)	(0.258)	(0.324)	(0.057)
Observations in each state	42	58	103	301
	Real GDP below potential GDP based on CBO potential			
Impact $(h=0)$	0.43	-0.06	0.19	0.52
	(0.127)	(0.820)	(0.242)	(0.145)
1 Year $(h=3)$	1.06	0.55	0.26	0.49
	(0.272)	(0.456)	(0.333)	(0.087)
2 Year $(h=7)$	1.31	0.94	0.03	0.62
	(0.258)	(0.392)	(0.319)	(0.049)
Observations in each state	70	30	203	201
	Real GDP below potential based on Hamilton-filter			
Impact $(h=0)$	0.41	0.44	0.05	0.52
	(0.194)	(0.237)	(0.181)	(0.138)
1 Year $(h=3)$	1.05	1.16	-0.35	0.49
	(0.264)	(0.270)	(0.258)	(0.087)
2 Year $(h=7)$	2.07	1.06	-0.49	0.60
~ ~ ~ ~	(0.779)	(0.184)	(0.447)	(0.048)
Observations in each state	54	43	170	229

Table 1: Uncertainty versus economic slack

Notes: The table reports cumulative multiplier estimates and HAC robust standard errors in parenthes.

#### 4. Transmission channels

Our results indicate that the government spending multiplier differs with the degree of uncertainty the economy is facing whereas the level of economic activity is less important. It is natural to expect that the difference should be reflected in the responses of output and other variables related to the transmission of government spending shocks.

Specifically, we estimate state-dependent impulse responses from local projections for each horizon h = 0, 1, ..., 20

$$x_{t+h} = I_{t-1} \left[ \alpha_h^A + \psi_h^A(L) z_{t-1} + \beta_h^A g_t \right] + (1 - I_{t-1}) \left[ \alpha_h^B + \psi_h^B(L) z_{t-1} + \beta_h^B g_t \right]$$
(5)  
$$\gamma_{1h} t + \gamma_{2h} t^2 + \gamma_{3h} t^3 + \omega_{t+h}$$

where the dependent variable  $x_t$  is, respectively, government spending, output, the unemployment rate, the change in debt as well as tax receipts to GDP in Figure 7. Figure 8 shows the impulse responses for the corporate bond spread, the change in the S&P 500, the NVIX, the real interest rate as well as the inflation rate. In all cases, we consider the responses to a Blanchard and Perotti (2002) shock as in the baseline specification.<sup>17</sup>

The local projections include our baseline set of control variables, e.g. four lags of government spending and GDP (both normalized by potential output), the change in tax receipts to GDP and the percentage change in the S&P 500 index between two quarters as well as the lagged dependent

<sup>&</sup>lt;sup>17</sup>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), we use  $\sum_{j=0}^{h} x_{t+h}$  as dependent variable to estimate the level effects directly (Stock and Watson 2018).

variable. As before, we use 90 percent HAC robust confidence bands.

The red line in Figure 7 depicts the impulse response during the high uncertainty (or economic slack) regime while the blue line covers the reaction during normal times.<sup>18</sup> We observe clear state-dependent effects of fiscal policy during uncertain times in accordance with evidence for a regimedependent government spending multiplier. The output increase is larger during uncertain times even in the short run albeit the increase in government spending is muted compared to normal times. In presence of soared uncertainty, a one percent increase of government spending (% of potential output) lowers the unemployment rate by 1% while there is almost no effect during normal times. On the government finance side, the fiscal easing is self-financing until two years after the shock. However, at longer horizons, the strong increase in government spending soars fiscal debt and forces the government to raise taxes.

Figure 8 indicates interesting explanations for the large output and unemployment effects during uncertain times. The government spending shock lowers financial risk premiums firms have to pay. Thereby, it crowds in private investments in a situation, where firms might have difficulties to finance their businesses. This channel is supported by a substantial reduction in the real interest rate that, on the one hand, furthermore reduces investment costs. On the other hand, it makes precautionary savings less attractive due to the lower interest payments. The bottom panel shows that the reduction

 $<sup>^{18}</sup>$  Uncertain times are classified as in the baseline with periods where the NVIX is above the  $85^{th}$  percentile. Slack times correspond to periods with an unemployment rate above 6.5%.

Figure 7: Transmission channels



Notes: The figure shows impulse responses to a government spending shock in uncertain or slack (both in red) as opposed to normal times (blue) together with 90% HAC robust confidence bands.

Figure 8: Transmission channels



Notes: The figure shows impulse responses to a government spending shock in uncertain or slack (both in red) as opposed to normal times (blue) together with 90% HAC robust confidence bands.

of the real interest rate follows almost one-to-one the rise inflation and is not driven by very accommodative monetary policy. Government demand may save the economy from a deflationary spiral.<sup>19</sup> Vavra (2013) shows that price flexibility increases in times of higher volatility which explains the strong short-run effect here. It also hints why we don't observe this feature during slack times.

On the stock market side, we observe substantial increases during uncertain times. On the one hand, this is in line with the confidence channel of government spending in Bachmann and Sims (2012). On the other hand, the stock market might simply react positively to the increase in demand. This view is supported by the rise at larger horizons during normal times. Importantly, the S&P 500 response gives us confidence against the fiscal anticipation problem. Stock prices are forward-looking and if the government spending shock is anticipated, we should see no significant impulse responses. Fiscal policy might also directly reduce stock market uncertainty. Albeit we notice a reduction in the NVIX during uncertain times, the confidence bands are large so that the decrease is not significant over most horizons.

The right panels in Figures 7 and 8 show that the differences between slack and normal times regimes are more muted, explaining the smaller difference in multipliers (compare Figure B.17). The increases in government spending as well output are smaller and the decrease in unemployment is muted as opposed to the left panel. The most important differences between uncertain and slack times are the reactions of the corporate bond spread and

<sup>&</sup>lt;sup>19</sup>Indeed, the inflation rate has a mean about 0.6 in the high uncertainty regime and 2.8 during normal times.



Figure 9: Private spending response during uncertain, slack and normal times

Notes: The figure shows impulse responses to a government spending shock in uncertain or slack (both in red) as opposed to normal times (blue) together with 90% HAC robust confidence bands.

the inflation rate. The substantial lower spreads and the rise in inflation vanish during slack periods. As a result, the government spending increases overall demand, but does not improve the financing conditions of enterprises or reducing precautionary saving incentives. This does not lead to a strong crowding out of private demand (excepting the very short-run), but it does not strongly strengthen private demand either as Figure 9 shows.<sup>20</sup> As expected, private spending is crowded out during normal times.

#### 5. Conclusion

We have investigated whether government spending multipliers vary depending on the degree of uncertainty and slack the economy is opposed to. In order to maximize the amount of variation in the data to reveal regime-

 $<sup>^{20}</sup>$ To calculate private spending, we substract government spending from output. In the estimation, we then replace real GDP with private spending.

dependence, we used historical quarterly data spanning more than 120 years in the United States.

Using local projections, we find that the cumulative government multiplier rises with the uncertainty level prior to the fiscal easing. During uncertain times, the one-year cumulative multiplier in government spending is about 2. This result is robust over a broad range of specifications and identifying assumptions about the government spending shock. Hence, the public expenditures crowd in private demand. According to the uncertainty theory, firms postpone investment as well as hiring decisions and consumers increase their precautionary savings in times of soared uncertainty. The consequence is a sharp drop in private demand. In this situation, the government can effectively intervene. Consistent with this reasoning, we find significant declines in unemployment as well as rising 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 reinforced through diminished risk premiums firms have to pay.

Apart from the increase in employment, we do not find these effects in economic slack times. The inflation/real interest rate and risk premium channel can explain why government spending leads to an increase in private spending during uncertain times, whereas in economically bad times it does not displace it, but it does not strengthen it either.

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## Appendix A. Data appendix

Variable	Source / Construction		
Nominal government consumption and gross investment	Ramey and Zubairy (2018)		
Nominal GDP	Ramey and Zubairy (2018)		
GDP deflator	Ramey and Zubairy (2018)		
Real government consumption and gross investment	Nominal government consumption and gross investment divided by GDP deflator.		
Real GDP	Nominal GDP divided by GDP deflator.		
Military news	Ramey and Zubairy (2018). The underlying narrative is available in Ramey (2016).		
Nominal Federal current receipts	Ramey and Zubairy (2018), NIPA accrual basis.		
Real potential GDP	CBO real potential GDP is available from 1949Q1. We regress the logarithm of real GDP $$		
	on a cubic trend for the period from $1989Q1$ to $1956Q4$ . We then spliced the predicted		
	real GDP with the CBO potential when it's available. Choosing $1956\mathrm{Q4}$ as the end of the		
	regression leads to a very smooth transition between both series. For the robustness check,		
	we regress the logarithm of real GDP on a 6-polynomial trend from 1989Q1 to $2015\mathrm{Q4}$ and		
	apply the exponential function to the fitted values as an estimate of potential real GDP.		
News implied VIX	Manela and Moreira (2017). We take quarterly averages of monthly values. The news implied		
	VIX is not available in 1892Q1 and 1892Q2. We replace these missing values with nearest		
	neighbour interpolation.		
S&P 500	Homepage of Robert Shiller. We take quarterly averages of monthly S&P 500 price index.		
	In the estimation, we use the log difference between two quarterly values and multiply this		
	with 100.		
Commercial paper rate	1875-1983: Balke and Gordon (1986):1875-1889: commercial paper rate in New York City,		
	1890-1980: 4-6m prune com. paper from Gordon "Price inertia", 1981-83: 6m com. paper		
	from various issues of the FED, from 1984: 6-m treasury constant maturity rate (FRED).		
Baa corporate bond yields	1875-1983: Balke and Gordon (1986), FRED afterwards. 1875-1918: yields on railroad		
	bonds, 1919 onwards: yields on Baa corporate bonds. During WWI, the market was closed		
	in 1914Q3 and 1914Q4 resulting in missing values. Since the yields have been 6.5 $\%$ before		
	and afterwards, we used this value to replace the missing data.		
10-year treasury constant maturity rate	Homepage of Robert Shiller. We take quarterly averages of monthly values.		
Corporate bond spread	Baa corporate bond yields minus 10-year treasury constant maturity rate.		
Year over year inflation rate	Log-difference of the GDP deflator from quarter $t$ and $t - 4$ multiplied by 100.		
Real interest rate	Commercial paper rate minus year over year inflation rate.		
Tax receipts to GDP	Nominal federal current receipts divided by nominal GDP and multiply this by 100. In the		
	estimation we use the change between two quarters.		
Government debt	Ramey and Zubairy (2018). Nominal federal debt in the hands of the public, cash basis.		
Government debt to GDP	Government debt divided by nominal GDP in the previous quarter.		
NBER recession indicator	Ramey and Zubairy (2018)		
Civilian unemployment rate	Ramey and Zubairy (2018)		

### Table A.2: Data description

Figure A.10: Real variables through time





Figure A.11: Financial variables through time

### Appendix B. Further robustness checks



Figure B.12: Cumulative present value multipliers

Notes: The figure shows present value cumulative fiscal multipliers as in Mountford and Uhlig (2009) from a linear model (in black) and in uncertain (in red) as well as normal (in blue) times. Ninety percent confidence intervals are shown in all cases. All statistics are robust to heteroskedasticity and serial correlation. We use the sample average real commercial paper rate (2.03% *p.a.*) to discount the sums in equation (1).



Figure B.13: Choosing a time-varying threshold for uncertain times

Notes: The figure shows the news implied VIX together with a very smooth HP-filter trend and a time varying threshold to discriminate between the uncertain and normal times. The threshold classifies periods as uncertain times if the NVIX value is more than 0.6 standard deviations above the trend. The values were chosen to have enough observations in both regimes due to the standard deviation of the NVIX in the historical sample. The chosen threshold classifies 83 quarters (roughly 16 percent) as uncertain times.



Figure B.14: Cumulative multipliers considering different thresholds

Notes: The figure shows cumulative fiscal multipliers from a linear model (in black) and in uncertain (in red) as well as normal (in blue) times. Ninety percent confidence intervals are shown in all cases. All statistics are robust to heteroskedasticity and serial correlation.

![](_page_47_Figure_0.jpeg)

Figure B.15: Robustness to different lag length of controls

Notes: The figure shows cumulative fiscal multipliers from a linear model (in black) and in uncertain (in red) as well as normal (in blue) times. Ninety percent confidence intervals are shown in all cases. All statistics are robust to heteroskedasticity and serial correlation.

In the main part, we followed Gordon and Krenn (2010) and normalized all government spending and output variable with an estimate of potential GDP. This puts both variables in the same units, so that one can estimate the dollar to dollar multiplier directly. In the baseline case, we proxy potential GDP with Congressional Budget Office (CBO) potential output and a cubic trend in log real GDP for the period where the latter is not available. In their historical analysis, Ramey and Zubairy (2018) use a 6 polynomial trend estimate. The upper panel in Figure B.16 shows that the results are very similar.

An alternative transformation is the one used by Hall (2009) and Barro and Redlick (2011). In this case, equation (1) becomes

$$\sum_{j=0}^{h} \frac{Y_{t+j} - Y_{t-1}}{Y_{t-1}} = I_{t-1}^{hu} \left[ \alpha_h^A + \phi_h^A(L) X_{t-1} + m_h^A \sum_{j=0}^{h} \frac{G_{t+j} - G_{t-1}}{Y_{t-1}} \right] \\ + \left( 1 - I_{t-1}^{hu} \right) \left[ \alpha_h^B + \phi_h^B(L) X_{t-1} + m_h^B \sum_{j=0}^{h} \frac{G_{t+j} - G_{t-1}}{Y_{t-1}} \right] \\ + \gamma_{1h} t + \gamma_{2h} t^2 + \gamma_{3h} t^3 + \epsilon_{t+h}$$
(B.1)

where  $\frac{Y_{t+j}-Y_{t-1}}{Y_{t-1}}$  is the percentage change in real GDP between time t-1 and time t+j and.  $G_t$  denotes real government consumption and investment. The set of controls includes four lags of the log-difference of real GDP as well as government spending, the log-difference in S&P index, the change in the average tax rate as well as the corporate bond spread. However, we instrument  $\sum_{j=0}^{h} \frac{G_{t+j}-G_{t-1}}{Y_{t-1}}$  with the log-difference of real government spending between two quarters  $\Delta G_t$ .

The lower panel shows that this transformation also leads to similar re-

![](_page_49_Figure_0.jpeg)

Figure B.16: Different normalization

Notes: The figure shows cumulative fiscal multipliers from a linear model (in black) and in uncertain (in red) as well as normal (in blue) times. Ninety percent confidence intervals are shown in all cases. All statistics are robust to heteroskedasticity and serial correlation.

sults. Note however, that instrumental relevance of the latter transformation seems to be lower after some quarters which indicates advantages of the Gordon-Krenn transformation for longer horizons.

![](_page_50_Figure_0.jpeg)

Figure B.17: Cumulative multipliers over the business cycle

Notes: The figure shows cumulative fiscal multipliers from a linear model (in black) and in uncertain (in red) as well as normal (in blue) times. Ninety percent confidence intervals are shown in all cases. All statistics are robust to heteroskedasticity and serial correlation.