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FISCAL SPACE AND THE SIZE OF THE FISCAL MULTIPLIER

by Luca Metelli* and Kevin Pallara^

Abstract

This paper investigates the interaction between fiscal policy transmission and fiscal sustainability, captured through the concept of fiscal space. In order to measure the evolution of fiscal space over time we propose four indicators, drawing from different concepts available in the literature. We use these indicators to define periods of ample and tight fiscal space. We then estimate the effects of government spending shocks in the United States according to the level of fiscal space, for the period 1929:Q1-2015:Q4. The main finding of the paper is that the fiscal multiplier is above one when fiscal space is ample, while it is below one when fiscal space is tight. Moreover, such difference is always significant. This result is very robust across different identification methods and samples.

JEL Classification: E62, H50, H60.
Keywords: fiscal multipliers, fiscal space, state-dependency, local projection, fiscal sustainability, government spending.
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Contents

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1. INTRODUCTION[1]

Since the Great Recession, the debate on the role of fiscal policy has gained traction, as discretionary fiscal measures have started afresh to serve as policy tools in advanced economies. Large spending plans have been implemented in many advanced economies and especially in the United States. However, growing deficits piled up into unprecedented levels of public debt. The latter, together with stagnant growth and low inflation, raised the attention on the sustainability of public finances and called into question whether the effects of fiscal policy as well might depend on fiscal sustainability considerations. According to this view, fiscal policy can prove to be a powerful tool in certain situations while not in others. In particular, an expansion in the public budget associated with a weak fiscal position can even produce harmful effects, while, at the opposite, the same fiscal shock implemented when public finances are sound generates expansionary effects. In this paper we investigate such hypothesis empirically. Addressing this conjecture is key also at the light of the ongoing situation generated by Covid-19. Governments around the world are expanding massively their budget deficits, in an effort to mitigate the detrimental consequences of the pandemic. While these policies are certainly necessary to face the emergency, they will generate a strong deterioration in public finance sustainability in the medium-term, which might affect the effectiveness of future fiscal policy shocks. Indeed, seminal contribution from Perotti (1999) already pointed out that shocks to government expenditure in times of fiscal stress have very different effects on the economy than in normal times.[2]

This empirical work studies whether the transmission mechanism of fiscal policy is affected by the state of fiscal sustainability. In order to take into account fiscal sustainability we refer to the notion of fiscal space. Heller (2005) provides the following definition for fiscal space:[3]

[1]We are grateful to Marco Bernardini, Florin Bilbiie, Auréliene Eyquem, Valerio Ercolani, Andrea Finicelli, Andrea Gazzani, Jean-Paul Renne, Paolo Surico, Alex Tagliabracci and Andreas Tischbirek for interesting discussions and comments on preliminary ver-sions of this work. We are also grateful to seminar participants at Banca d'Italia, HEC University of Lausanne and Monash University (Applied Young Economists webinar) and to participants at the SIdE-IEA Workshop and the Workshop in Structural VAR models (3^{rd} edition), especially to Luca Fanelli and Regis Barnichon for their discussion.

[2]Previous studies (Blanchard, 1990; Sutherland, 1997) showed that fiscal consolidation in the form of tax increases lead to non-Keynesian effects in times of weak fiscal position (namely, high debt or deficits).

[3]A similar definition can be found in Ley (2009) and Escolano (2010).

Room in a government's budget that allows it to provide resources for a desired purpose without jeopardizing the sustainability of its financial position or the stability of the economy.

However, there is no agreement on how to translate such a loose notion into a proper measure. In the definition provided above, the link to the concept of fiscal sustainability is explicit. This relates to the ability of the government to fund its preferred spending programs, while being able to service its obligations and to ensure solvency. On the contrary, Bi (2012), Bi and Leeper (2013) and Ghosh et al. (2013b) regard fiscal space as the distance between the level of current debt-to-GDP ratio and a country specific debt limit, which represents the maximum amount of debt that an economy can credibly sustain. Additionally, Perotti (2007) delineates the concept of fiscal space as a different approach in setting up the intertemporal budget constraint. The key characteristic of fiscal space is to incorporate considerations on the ability of the government to service its debt, which relates, in turn, to the dynamics of macroeconomic variables like the interest rate together with perceived sovereign risk, the GDP growth rate, the amount of primary surplus and the ratio of debt-to-GDP. In front of these multiple interpretations regarding fiscal space, we propose different methods to track its evolution over time, each relating to different underlying theories, as we clarify later.

While the literature (e.g. Huidrom et al., 2019; Ilzetzki et al., 2013; Auerbach and Gorodnichenko, 2017) focused on debt-to-GDP ratio to capture the role of fiscal sustainability in the transmission of fiscal policy, we take a more comprehensive approach through the concept of fiscal space. Fiscal space is far from being a static concept and cannot be determined only by a country's public debt level. Although correlated with debt-to-GDP, fiscal space encompasses other crucial aspects. First of all, it measures the overall ability of the government to service its obligations, which depends only in part on the level of public debt to be repaid. Second, it considers public finance aggregates jointly with other key macroeconomic variables, taking also into account the fundamental debt capacity of the economy. Lastly, the forward-looking nature of fiscal space contrasts with the path-dependent nature of a stock variable like debt-to-GDP. Indeed fiscal space varies with market and economic conditions, which often change abruptly. For instance, a productive fiscal stimulus could improve the economic outlook in a country such that fiscal space improves while increasing its public debt-to-GDP ratio in the short run or, on the contrary, a harmful fiscal tightening could ameliorate a country's indebtedness while worsening growth and, thus, reducing the perceived fiscal room. Therefore, we avoid focusing on a single metric, like the debt-to-GDP ratio, and we rely on a multi-faceted approach using more indicators based on different methods within the relevant literature to measure the dynamic concept of fiscal space.

The idea of a differential effect of fiscal policy according to the fiscal position fits in the more general debate on fiscal policy, which has established a consensus on the fact that there is not such thing as a unique fiscal multiplier, but, more likely, the effects of fiscal shocks are state dependent. This literature, however, focused mainly on studying how fiscal policy's effects vary with the business cycle, differentiating in particular recession versus expansion periods, and with the monetary policy stance, with a particular reference to periods in which this is constrained by the zero lower bound. By contrast, there are no studies considering fiscal sustainability as a state variable in the transmission of fiscal policy. In this paper we investigate this form of state dependency and we aim at answering the following questions. How can we measure the evolution of fiscal space over time? Do the effects of fiscal shocks depend upon the level of fiscal space? If so, what is the rationale behind such differential effect?

The paper addresses the aforementioned questions in the following way. In the first part, we build four different indicators to measure the evolution of fiscal space over time, using data for the US. Our preferred indicator relates to the concept of primary surplus sustainability gap as in Kose et al. (2017) and we calculate, at each point in time, the primary surplus needed to stabilize the trajectory of public debt. Such simple yet effective indicator captures well periods of high debt velocity and inherent inability to contain debt roll-over needs via primary surpluses. The second indicator draws from the theoretical literature on fiscal limits as in Bi (2012) and Bi and Leeper (2013) and represents its empirical counterpart. The third one related to the idea of fiscal imbalances of Auerbach (1997), while the last one builds on Aizenman and Jinjarak (2010). We refer to Section 3 for further details on the computation of these indicators. After the construction of such fiscal space indicators, we show that they correlate well among each other, reinforcing the idea that, although derived from different underlying theories, they capture slightly different aspects of the same phenomenon we want to measure, i.e. the evolution over time of fiscal sustainability. We also provide evidence that our measures do not confound with other cyclical indicators, like the economic cycle or ZLB periods. In the second part of the paper, we estimate empirically the effects of fiscal policy in a state-dependent fashion, differentiating periods in which fiscal space is tight and when fiscal space is ample. We estimate the effects of government spending shocks in the US for the period 1929-2015, using two different identification methods, the one of Ramey (2011b,a) and the one of Blanchard and Perotti (2002).[4] We then employ the Local-Projections method developed by Jordà (2005) to estimate the state-dependent effect of fiscal policy, using our four indicators to define, for each proxy, a tight fiscal space state when the proxy is above the median and a large fiscal space state when it is below. We quantify the impact of fiscal policy in the large and tight fiscal space state calculating the cumulative fiscal multiplier, as in Ramey and Zubairy (2018). We also investigate the mechanism behind our results, analyzing the effects on other variables other than output, like private consumption, private investment, interest rates and debt-to-GDP ratio. In order to quantify what transmission channel is more relevant, we calculate multipliers also for consumption and investment.

The main results of the paper are the following. First, we find that fiscal policy is much more effective when implemented in periods associated with large fiscal space. The corresponding fiscal multiplier is above one, while by contrast, when fiscal space is tight the fiscal multiplier is smaller than one, with a difference in the two cases always statistically significant. This result is particularly relevant in light of the findings by other studies on non-linearities in fiscal policy. While Ramey and Zubairy (2018) conclude there is no difference in the effects of fiscal policy between expansion and recession and find only minor dissimilarities when monetary policy is at the ZLB, our paper identifies a major distinction in the size of fiscal multiplier across different fiscal space regimes, suggesting that such non-linearity might be the relevant one. Second, we show that our result occurs independently of the identification method adopted and is robust across different samples and different empirical specifications. More importantly, the result is strikingly similar across the four fiscal space indicators we construct, signaling that our indicators capture the same phenomenon. We also implement the estimations using debt-to-GDP ratio as the state variable. In this case we do not find difference in the two states, suggesting the importance of looking at specific indicators of fiscal space, in contrast to other variables, when studying fiscal sustainability

[4]We use such an historical perspective as we use Ramey news to instrument for government spending, which can be done only considering a long enough sample.

issues. Finally, the paper represents a first step to investigate the rationale behind the differential response of fiscal policy in the two states. We show that private consumption and investment follow a very different behaviour across states. Indeed, in case of ample fiscal space, government spending shock does not generate the standard Ricardian effect as in the case of weak fiscal space but, on the contrary, produces an increase in private consumption and does not crowd out investment.

This paper contributes to the literature in the following ways. First, we provide an historical time series for fiscal space in the US starting from 1929 up to 2015, at the quarterly frequency, according to four different indicators. The only database containing time-varying fiscal space measures, Kose et al. (2017), is at annual frequency and starts from 2001. We extend some of the measures present in Kose et al. (2017) backwards and we provide other fiscal space proxies drawing from multiple notions and documenting the variability over time of fiscal space in the US. Second, this is the first paper to investigate empirically the effects of fiscal policy according to fiscal space conditions. While Huidrom et al. (2019), Ilzetzki et al. (2013), Auerbach and Gorodnichenko (2017) estimated fiscal multipliers according to different levels of public debt, we do so using fiscal space. Finally, we also delve into an investigation of the transmission mechanism, highlighting the striking difference in the response of private consumption and investment across states of fiscal space.

The rest of the paper is organized as follows. Section 2 provides a literature review, while Section 3 describes carefully the procedure we follow to construct our fiscal space indicators and their properties. Section 4 provides details on the empirical methodology, the data and the identification method adopted. Section 5 presents the empirical results, together with a robustness section. Finally, Section 6 concludes.

2. Literature Review

Our paper is related to different strands of the literature. First of all, we relate to the literature, both empirical and theoretical, aiming at investigating and measuring the concept of fiscal space. Part of this literature provides model-free estimates of fiscal space proxies. Given that fiscal space is a multi-dimensional concept, Kose et al. (2017) propose an extensive dataset collecting model-free proxies for fiscal space for several countries. The paper collects a large cross-sectional database including 28 indicators, which cover many of the core aspects

of fiscal space: government debt sustainability, perceived sovereign risk, market access, balance sheet composition, external and private debt considerations. Among other indicators, Kose et al. (2017) reports also the so-called *de facto* fiscal space as derived in Aizenman and Jinjarak (2010) and Aizenman et al. (2013), which delineates the government's ability to raise tax revenues to contain public debt and deficits. We relate to Kose et al. (2017) and Aizenman and Jinjarak (2010) for the construction of our model-free proxies for fiscal room in the US. Moreover, in Auerbach (1997), but also in Gale and Auerbach (2009) and Auerbach and Gorodnichenko (2017), the authors approximate fiscal room in the US by measuring the size of fiscal distress via the government intertemporal budget constraint.[5] We draw also from the approach described in Auerbach (1997) for building a measure of US fiscal space.
Another part of the literature focuses on providing structural macroeconomic approaches to assessing fiscal space. This literature builds theoretical models to derive the so-called *fiscal limit*. This line of work considers the fiscal space as the distance between current public debt and a (theory-based) debt or *fiscal* limit. The latter represents the maximum expected assets attainable by the government. On one hand, Ostry et al. (2010), Ghosh et al. (2013a) and Ostry et al. (2015) compute static estimates for debt limits based on the observation that the higher the levels of debt, the weaker the reaction of primary surpluses ("fiscal fatigue").[6,7] On the other hand, in Bi (2012), Leeper (2013), Bi and Leeper (2013), Bi and Traum (2012) and Bi and Traum (2014), the theoretical fiscal limit corresponds to the discounted present value of future maximum primary surpluses.[8] Moreover, Collard et al. (2015) also exploit the idea of a maximum primary surplus to derive a static measure of debt limit. We relate to this literature by exploiting the concept of maximum primary surplus and using it to build a time-varying measure for the fiscal room in the US.

Our paper is also related to the literature studying how the fiscal position affects the transmission of fiscal policy. A few papers have analyzed this aspect. On the theoretical side, in the seminal contribution from Perotti (1999), the author builds a simple model where government expenditure shocks have a positive, "non-Keynesian" correlation in fiscal stress times.

[5]More details are provided in Section 3.3.

[6]Their approach provides static debt limit and fiscal space estimates. These studies consider two calibration periods: from 1970 to 2007 and from 1985 to 2007. Moreover, updated fiscal space static estimates are regularly reported in Moody's (2011).

[7]Note that these debt limits cannot be retrieved by a model-free estimation.

[8]Maximum surpluses arise if the government can steer tax revenues at the peak points of the Laffer curve (Trabandt and Uhlig, 2011).

Symmetrically, tax shocks have a negative, Keynesian correlation in normal times and a positive, non-Keynesian correlation in fiscal stress times. Also two other existing models (Blanchard, 1990; Sutherland, 1997) formalize the non-Keynesian effects of tax hikes at high levels of public debt, but the model presented in Perotti (1999) allows for both tax and government spending shocks to have non-Keynesian effects on private consumption via the expectations channel. This study finds a strong evidence that expenditure shocks have Keynesian effects when the level of public debt or deficits is low, and non-Keynesian effects in the opposite circumstances. In short, the more burdensome the state of fiscal stress the more a positive spending shock will lead to a steeper path of future expected tax changes and, thus, to a lower present value of consumers' wealth. Moreover, Aloui and Eyquem (2019) develop a New Keynesian model with capital, distortionary taxes and public debt in which the zero lower bound (ZLB) constraint on the nominal interest rate may be binding. In the absence of ZLB, high steady-state levels of government debt to GDP lead to reduced output multipliers. Empirically, Huidrom et al. (2019) show that the government spending multiplier is low (and even negative) under weak fiscal position. Using a sample going from 1980 until 2014, Huidrom et al. (2019) estimate an Interacted Panel VAR including 33 countries and find a multiplier that is between 0 and 0.5 when the economy is in a weak fiscal position (high government debt). The authors show that the weak fiscal position affects the size of the fiscal multiplier via two main channels: the Ricardian (households' expectations) channel and the interest rate channel. In a similar fashion, Ilzetzki et al. (2013) study fiscal multipliers according to various dimensions in a large panel of countries spanning from the '60s until before the Great Financial crisis. Finally, Auerbach and Gorodnichenko (2017) employ a local projection model for 25 OECD countries to study the multiplier in different government debt states. Using a sample spanning from 2003 until 2017, they estimate significant government spending multipliers above (below) 0 in low (high) public debt states. All of the aforementioned papers aim at studying the interaction between fiscal sustainability and fiscal policy transmission. However, they all use the simple and narrower measure of debt-to-GDP ratio as a state variable, which cannot convey enough information on the available fiscal room. To the best of our knowledge, our paper is the first to adopt a broader concept of fiscal space to study the transmission of fiscal shocks.

More in general, our paper relates to the literature studying state-dependency in fiscal policy both empirically and theoretically. Such literature, however, has focused mainly on investigating the role of the business cycle as a state.

In macroeconomic theory, very few papers (e.g., Michaillat, 2014; Albertini et al., 2019) concentrated on how recessions and expansions affect the size of the fiscal multipliers. The study of business cycle-dependent fiscal multipliers parallels Keynesian theory: a government expenditure shock has a stronger expansionary outcome during a recession. Crowding out of private spending and investment is attenuated by the slack state. This fueled an extensive use of discretionary fiscal policy to counteract business cycle contractions.

The two main empirical contributions on this topic are, on the one hand Auerbach and Gorodnichenko (2012) and Auerbach and Gorodnichenko (2013) and on the other hand Ramey and Zubairy (2018). Such papers deliver very different conclusions and do not reach a consensus in empirical research regarding the effects of expansionary fiscal shocks under slacks and boom. Indeed, using a regime-switching VAR approach, Auerbach and Gorodnichenko (2012) and Auerbach and Gorodnichenko (2013) find large differences between multipliers in recessions and expansions.[9] However, the adopted econometric model requires to assume for how many quarters the impulse response function should remain in each state of the economy. This could lead to distorted results in favor of an artificially higher multiplier in recession. By contrast, Ramey and Zubairy (2018) conclude that there is no difference in the size of multipliers across the business cycle. Using the Jordà (2005) local projection approach and high unemployment rate as proxy for recession, they show that government spending multipliers range between 0.3 and 0.8 no matter the state of the business cycle.[10] The authors also find mixed evidence on the size of the fiscal multiplier at the zero lower bound.[11,12]

[9] Indeed, the authors observe that the multiplier is much higher in recessions rather than in expansions. They report the multiplier to be as high as 2.5.

[10] However, depending on the shock series used to identify government spending innovations, the results vary. Employing Ramey (2011b,a) defense news shock series, the authors find no evidence for any difference between multipliers; while, using the Blanchard and Perotti (2002) shock series, they observe different multipliers across states. This is due to extremely low values of the multiplier in expansion rather than peaks in recessions.

[11] In Ramey and Zubairy (2018), ZLB state is defined as the quarters in which the T-bill rate is equal to or below 50 basis points. When the authors use the full sample spanning from 1889:Q1 until 2015:Q4, the multiplier is not higher at the zero lower bound; while, excluding the World War II, they found a multiplier as high as 1.5 in the ZLB state.

[12] In Macroeconomic theory, Christiano et al. (2011); Coenen et al. (2012); Cogan et al. (2010) employ New-Keynesian DSGE models to show that fiscal multipliers tend to be higher when policy rates are at the ZLB.

Our paper draws from the approach developed in Ramey and Zubairy (2018) to estimate fiscal multipliers, but we instead find a major role for state dependency, suggesting that fiscal space could be the relevant state for the transmission of fiscal shocks.

3. Fiscal Space approximations

As pointed out in Section 1, there exists no unique definition for fiscal space; its core aspect is to measure the debt service capacity of a country. The latter hinges on many dimensions: budget position, financing needs, spending and revenue prospects, resilience to contingent liabilities and access to markets. As correctly reported in Botev et al. (2016), fiscal space can be measured either in terms of achieving long-term sustainability or losing market access. In reality, risk premia arising from long-term sustainability concerns affect directly market access. Nonetheless, a single approach cannot comprehend all the aspects affecting fiscal space. Thus, the literature focuses either on long-term sustainability (Blanchard, 1990; Auerbach, 1997) or market access (Ghosh et al., 2013a). Botev et al. (2016) summarizes these two main dimensions of fiscal space altogether with the factors affecting it. According to one dimension, fiscal space is deemed as the distance between the actual debt and the debt limit for which the government would be unable to roll-over debt and, thus, lose market access. The other dimension characterizes fiscal space in terms of long-term sustainability. Thus, for instance, a country with worrying health spending forecasts could have no fiscal space according to the long-term sustainability perspective, while having plenty of fiscal room in terms of market access. The lack of credit events in advanced economies complicates the estimation of fiscal space in terms of the market access dimension; the latter can take form only under structural macroeconomic approaches that build on theoretical assumptions to gauge debt limits.[13] Therefore, our work will focus more on the long-term sustainability side of fiscal space, while still trying to embed aspects of the debt limit literature in the definition of our fiscal room measures.

In this section we describe our four historical indicators of fiscal space for the US. Two of them are based on model-free estimates of fiscal space, drawing from Kose et al. (2017), Aizenman and Jinjarak (2010) and Aizenman et al. (2013). Such measures focus on fiscal

[13] As far as we know, the only paper that manages to exploit the time-variation of sovereign credit data for advanced economies in order to estimate both debt limits and fiscal space in terms of the market access dimension is Pallara and Renne (2019).

sustainability, the revenue capacity of the government, fiscal policy stance and, indirectly, market access. One additional fiscal space proxy derives from the concept of fiscal imbalance as in Auerbach (1997). One final measure draws from the concept of fiscal (or debt) limit described in Bi (2012), Bi and Leeper (2013) and Ostry et al. (2010).

All of our indicators, as we clarify in the following sections, depend, among other key factors, i.e. on public debt, the surplus/deficit and, more in general, on government finance variables, all series that are highly correlated with expansions and recessions. Therefore, we adjust these series to purify the government's fiscal position from business cycle fluctuations.[14] This correction ensures that we capture the discretionary dimension of fiscal room in the US together with its link to medium/long run economic *phenomena*.

3.1. **Primary surplus sustainability gap.** Our first indicator draws from Kose et al. (2017), which, in turn, builds on the debt accumulation accounting equation:

$$\Delta \frac{B_t}{Y_t} \approx \frac{i_t - \gamma_t}{1+\gamma_t} \frac{B_{t-1}}{Y_{t-1}} - s_t, \tag{1}$$

where $\frac{B_t}{Y_t}$ is the debt-to-GDP, γ_t is the growth rate of nominal GDP, i_t is the nominal interest rate and s_t is the primary balance over GDP.[15] Using this simple equation, we calculate the level of the primary surplus required, in each quarter, to stabilize public debt, i.e. to make $\Delta \frac{B_t}{Y_t} = 0$. We then define our fiscal space indicator as the distance between such primary surplus and the realized one. Using equation 1 and cyclically adjusting the variables as described in the previous section, our proxy is given by the following equation:

$$FS_{1,t} = s_t^{c.a.} - \left(\frac{i_t - \tilde{\gamma}_t}{1+\tilde{\gamma}_t} \right) d_t^{c.a}, \tag{2}$$

[14]Following the method implemented by the World Bank and reported in Kose et al. (2017), we cyclically adjust the government finance statistics variables by multiplying them by $(1+\tilde{y})^{-(\epsilon_x - 1)}$ where $\tilde{y}$ is the difference between the actual GDP and the CBO potential output as % of potential output; ϵ_x stands for the output gap elasticity of x for $x =$[Revenues, Government spending, Federal debt]. We use World Bank (see also Kose et al., 2017) elasticities for revenues and government spending, respectively equal to 1 and 0.1. For what concerns federal debt, we estimate the elasticity to be not significantly different from 0 and, thus, we assume it to be equal to 0. Note that the elasticities for spending and revenues proposed here are not distant from the estimates in Girouard and André (2006).

[15]Eq. 1 should include also the stock-flow adjustments not to hold as an approximation. Stock-flow adjustments comprise of factors that affect debt but are not included in the budget balance (such as acquisitions or sales of financial assets). For sake of simplicity, we focus on the "snowball-effect" side of the debt accumulation equation and on the government budget balance for the construction of FS_1.

where $s_t^{c.a.}$ is the cyclically adjusted primary surplus over potential GDP, $d_t^{c.a}$ is the cyclically adjusted debt over potential GDP, $\tilde{\gamma}_t$ is the nominal potential GDP growth and i_t is the historical interest rate on 10-year maturity US government bonds.[16,17] This gap incorporates information on the fiscal stance, public debt acceleration and the difference between the interest rate and GDP growth. This last measure represents the first nod to the study of fiscal sustainability in macroeconomics and contributes in a relevant way to the dynamics of our fiscal space indicator.[18] We regard this measure as the benchmark indicator of fiscal space since it summarizes the many features a proxy for fiscal space should contain: considerations of fiscal sustainability, debt dynamics, interest rate, output growth and fiscal policy stance. In particular, this fiscal space measure highlights times of rapid debt accumulation due to inherent inability to roll-over debt via primary surpluses, crucial characteristics of the fiscal position of the government. We estimate FS_1 from 1889Q1 to explore the history of fiscal room in the United States. Figure 1 reports the results. The figure shows that fiscal space was especially tight over the depression of the early 20s, the Second World War and started to worsen from 2001 onward and, in particular, during the Great Financial Crisis.

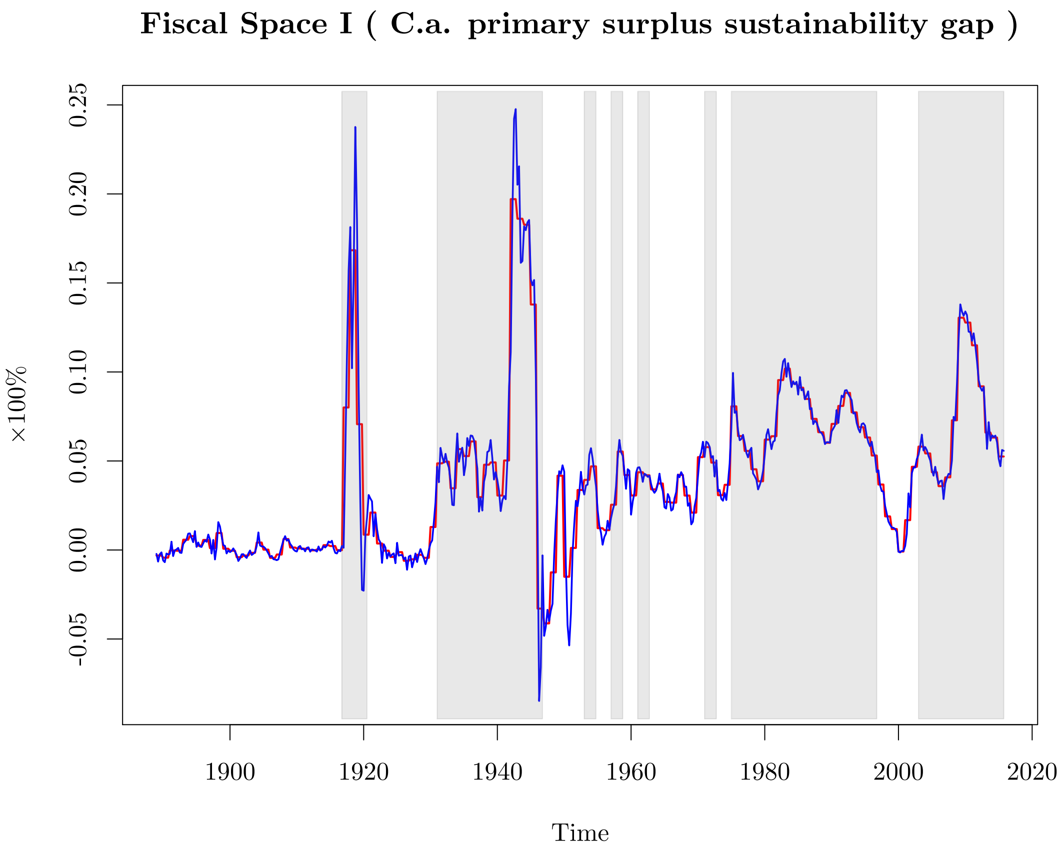
3.2. **Laffer curve peak-implied surplus gap.** According to the literature on fiscal limits, fiscal space is defined by the distance between the actual debt and the maximum amount of debt the government can sustain, i.e. the debt limit. In Bi (2012) and Bi and Leeper (2013), this limit is defined by the discounted projected path of maximum primary surpluses implicit in the

[16] As potential GDP we take the CBO potential GDP estimates. Additionally, we also implemented sensitivity analysis using different potential GDP measures (e.g., sixth-degree polynomial for the logarithm of GDP) that leaves unaffected both the dynamics of the fiscal space measure and the econometric results of the paper.

[17] We acknowledge that the average debt maturity for the US is around 6 years and using the 5-year maturity yield would be more precise. However, we have only historical data points for the 10-year maturity yield, which correlates more than 95% with the 5-year maturity yield.

[18] According to Blanchard (2019), as long as the yields are lower than the GDP growth rate, even in the current low-growth environment, countries have fiscal space (see also Mauro and Zhou, 2019). However, there is a growing consensus that such argument is incomplete. For instance, the simple measure of $i - \mathbf{g}$ does not consider the evolution of the primary balance itself and the stock-flow adjustments. Moreover Jiang et al. (2019) find that the discount factor on government debt is decoupled from the yields on bonds, which would nuance the claims in Blanchard (2019).

FIGURE 1. FS_1 (1889:1-2015:4): Primary surplus sustainability gap



The Figure shows the estimates for FS_1 or cyclically adjusted primary surplus sustainability gap in blue and its 1-year moving average in red. The series are expressed in annual percentage of potential output. The series are adjusted so that the shaded regions indicate the areas where fiscal space is tight (1-year $FS >$ median).

peak of the Laffer curve.[19,20] We exploit the concept of debt limit as described in Bi (2012) and Collard et al. (2015), but we apply this intuition on a quarter-by-quarter perspective. Indeed, we define and calculate below, for each quarter, the maximum primary surplus attainable in the US. We then define fiscal space as the difference between such maximum surplus and the

[19]In Bi (2012) and Bi and Leeper (2013), fiscal limit is defined as follows,

$$\ell_t = \mathbb{E}_t \left(\sum_{j=1}^{+\infty} \exp(\gamma_t - i_t + \cdots + \gamma_{t+j-1} - i_{t+j-1}) s^*_{t+j} \right), \tag{3}$$

where ℓ_t is the fiscal limit-to-GDP, $\mathbf{g}_t$ stands for nominal growth, i_t is the risk-free rate and s^*_t is the maximum surplus over GDP. The maximum primary surplus s^*_t is the surplus implicit at the peak of the Laffer curve.

[20]The Laffer curve represents the reverse bell-shaped relationship between the average tax rate and government revenues.

realized primary deficit.[21] This measure captures how far is the government from revenue maximization.

We calculate maximum government revenues using Laffer curve-peak tax rates estimates as in Trabandt and Uhlig (2011) for labour, capital and consumption:

$$\hat{T}_t = \tau_K^\star TB_t^K + \tau_L^\star TB_t^L + \tau_c^\star TB_t^c, \tag{4}$$

where $\tau_K^\star$, $\tau_L^\star$ and $\tau_c^\star$ stand for the peak tax rates.[22] $\hat{T}_t$ represents the maximum revenues and TB_t^i ($i = K, L, c$) are the tax bases. Then, we compute the (cyclically adjusted) maximum surplus as follows:[23]

$$\hat{s}_t = (\hat{t}_t^{c.a.} - g_t^{c.a.}), \tag{5}$$

where $\hat{t}^{c.a.}$ and $g_t^{c.a.}$ are the cyclically adjusted maximum revenues and government spending, respectively. Finally, our fiscal space indicator is defined as:

$$FS_{2,t} = \hat{s}_t - deficit_t^{c.a.}, \tag{6}$$

thus, the higher the distance, the greater the actual deficit compared to peak surplus $\hat{s}_t$.[24] Figure 2 reports the estimates for FS_2 expressed in percentage of potential output.

3.3. **Fiscal imbalance.** Auerbach (1997) first proposed a measure to quantify US fiscal imbalances by taking into account the impact of future government expenditure (such as contingent liabilities/implicit spending) and revenues on the intertemporal government budget constraint. The same approach has been employed in Gale and Auerbach (2009) and Auerbach and Gorodnichenko (2017). We adopt the idea of fiscal imbalance as described in Auerbach (1997) and we calculate, in each period, by what constant fraction of GDP taxes (revenues) would have to be increased for the government budget constraint to be satisfied when

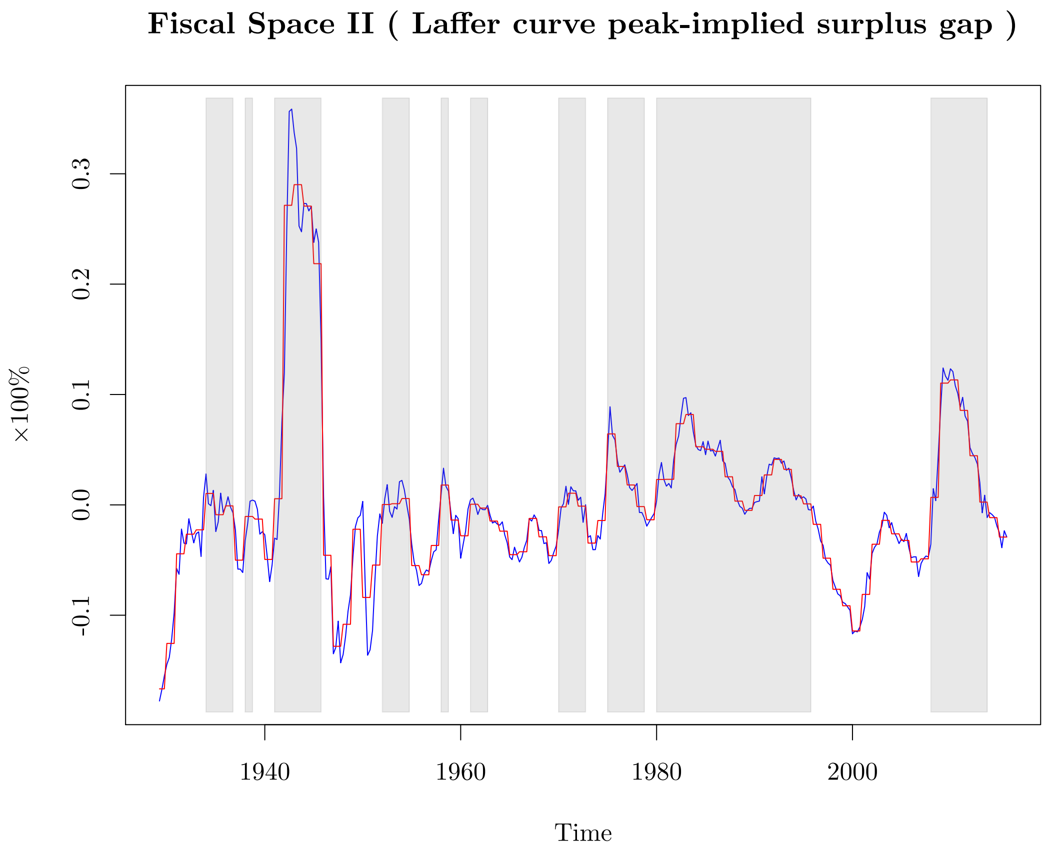
[21] Indeed, we can think of the debt-to-GDP ratio, $\frac{B_t}{Y_t}$, as the cumulative discounted stream of past deficits. Therefore, the distance between L_t and $\frac{B_t}{Y_t}$ gives the size of the available fiscal space of the country.

[22] $\tau_K^\star$, $\tau_L^\star$ and $\tau_c^\star$ are respectively equal to 0.6, 0.52 and 0.05. These represent the tax rates estimated in the benchmark model in Trabandt and Uhlig (2011) for the US. $\tau_L^\star$ and $\tau_k^\star$ correspond to the benchmark Laffer curve model with Frisch elasticity equal to 3 and intertemporal elasticity of substitution equal to 2. For more details on the tax rates we refer to appendix A.2. Moreover, We decided to use ones of the lowest estimates because there is no explicit mention of compliance neither in the present work nor in Trabandt and Uhlig (2011), namely the higher the tax rate the more tax evasion and avoidance become relevant phenomena. Compliance is actually a meaningful issue concerning tax rates and revenues (Pappada and Zylberberg, 2017).

[23] See section 3 for details on the cyclical adjustment.

[24] For instance, during WWII and the Great Recession, the Laffer curve peak-implied surplus was smaller than the actual deficit.

FIGURE 2. FS_2 (1929:2-2015:4): Laffer curve peak-implied surplus gap



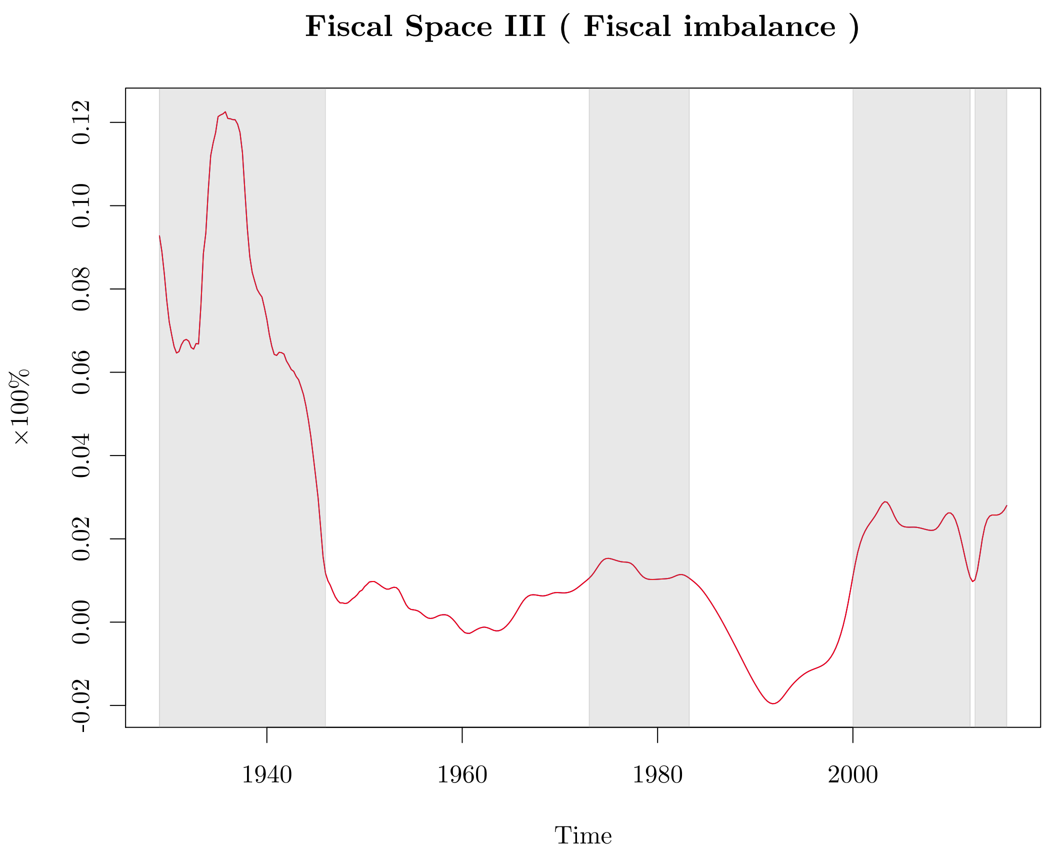
The Figure shows the plot for FS_2 in blue and its 1-year moving average in red. The series are demeaned and expressed in quarterly percentage of potential output. The series are adjusted so that the shaded regions indicate the areas where fiscal space is tight (1-year $FS >$ median).

the dynamics of future spending is considered. In our approach, we estimate the fiscal imbalance measuring the fiscal adjustment needed to satisfy the government budget constraint over a 10 years horizon:

$$B_t = (1+i_t)^{-[(t+H)-t]} \left(\frac{B_t}{GDP_t} \right) GDP_{t+H} - \sum_{k=0}^{t+H} (1+i_t)^{-(k+1-t)} (S_k + \Delta_t GDP_k), \tag{7}$$

where B_t is the total nominal government debt, S_t is surplus, i_t is the interest rate on the ten years maturity government bond and H is the last horizon (10 years, namely 40 quarters). Δ_t represents the quarterly fiscal imbalance as a percentage of GDP. The government budget constraint implies a projected path for purchases, revenues and income. These projections account for the foreseen dynamics in implicit spending for healthcare and the social security system. For the out-of-sample forecasts we use CBO projections that consider spending for

FIGURE 3. FS_3 (1929:1-2015:4): Fiscal Imbalance *á la* Auerbach



The Figure shows the estimates for the fiscal imbalance measure *á la* Auerbach. The series is expressed in quarterly percentage of potential output. The shaded regions indicate the areas where fiscal space is tight (FS $>$ median).

health and pensions under current and anticipated regulations.[25] The advantage of this fiscal space measure lies in its forward-looking nature, as it considers the projected path of the government budget. Figure 3 reports the estimates for FS_3 expressed in percentage of potential output. The chart highlights the periods of major fiscal distress for the US government.

3.4. ***De facto* fiscal space.** Aizenman and Jinjarak (2010) and Aizenman et al. (2013) build a measure to capture fiscal room defined as *de facto* fiscal space. The measure proposed is inversely related to the tax-years necessary to repay public debt or deficits. *De facto* fiscal space in Aizenman and Jinjarak (2010), Aizenman et al. (2013), Kose et al. (2017) is defined as the ratio of either public debt or the deficit over GDP (averaged over several years) to

[25]Since CBO projections are only available from 2006, for the in-sample projections, we take the realized values of the considered variables assuming perfect foresight.

the average *de facto* tax base, namely the realized tax collection averaged over several years in order to smooth for business cycle fluctuations. We build on the concept of *de facto* fiscal space to construct an indicator that uses current cyclically adjusted revenues and deficits run by the government. In our approach, we define *de facto* fiscal space in the following way:

$$FS_{4,t} = \frac{(deficit_t^{c.a.})}{(receipts_t^{c.a.})}, \tag{8}$$

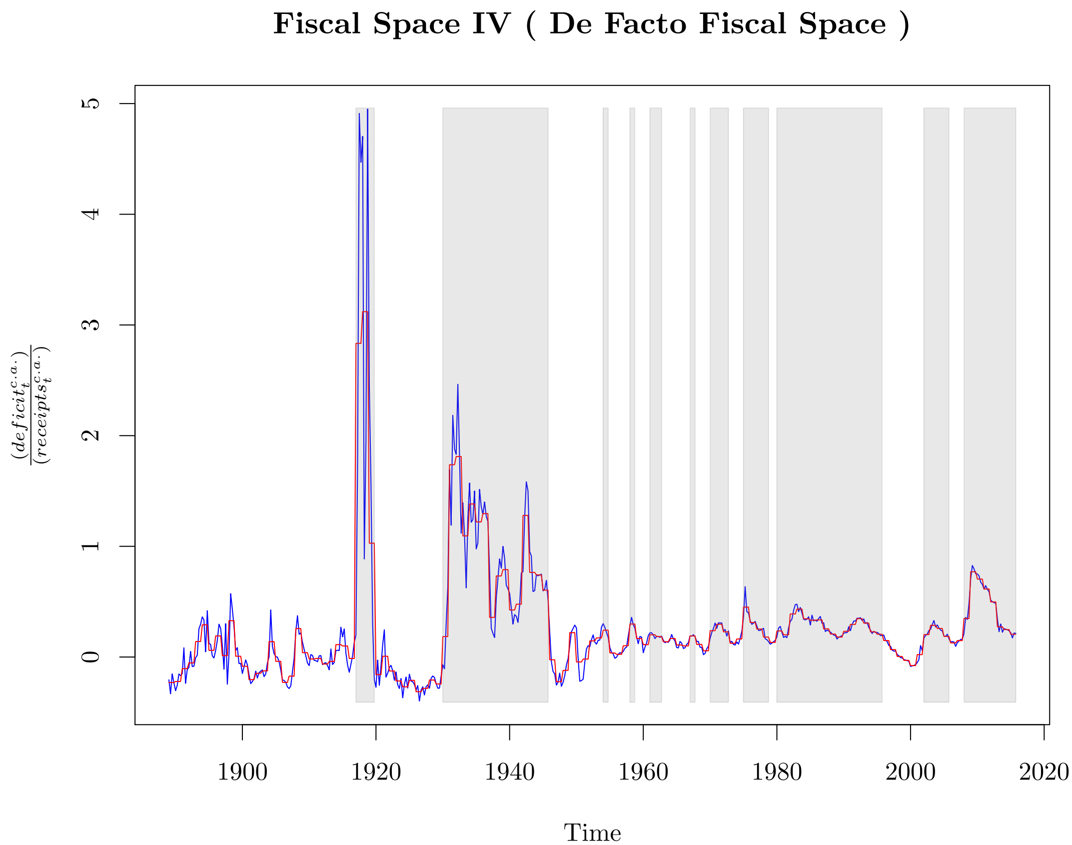
where $deficit_t^{c.a.}$ stands for the cyclically adjusted deficit-to-potential GDP and $receipts_t^{c.a.}$ represents the total realized government tax receipts over potential GDP.[26] The advantage of this measure is to provide insights on the actual tax capacity of a country to balance current deficits. FS_4 highlights periods of high deficit overhangs with respect to the government inability to raise revenues via tax collection. Figure 4 reports the estimates for FS_4.

3.5. **Properties of the fiscal space indicators.** For each fiscal space indicator, we generate a dummy variable equal to 1 (0) when our FS measures is above (below) its median value, meaning that fiscal space is tight (loose). In Table 1 we calculate the correlations among such dummies, in order to show how our indicators relate to each other. Dummy indicators FS_1 and FS_4 show the highest correlation (equal to 0.73 in median). FS_2 and FS_4 also display significant correlation (equal to 0.64 in median) since government revenues are key in their respective fiscal space definitions. Dummies FS_2 and FS_3 show very low median correlation (equal to 0.01) and we cannot reject that they are uncorrelated. The remaining cross-correlations among fiscal space dummies are above 30% in median. These results suggest that our indicators are mutually consistent while capturing different aspects of the evolution of fiscal space. Table 2 reports the correlations between fiscal space dummies and a broad set of relevant macroeconomic indicators, in particular NBER recession dates, zero lower bound (ZLB) dates and high/low federal debt-to-GDP ratio periods. The correlation between all four fiscal space measures and the NBER recession dates is approximately null, consistent with the fact that our proxies are purified from the transitory effects of the business cycle.[27] Our fiscal space measures are rather linked to the discretionary dimension of government

[26] We use latest CBO potential output estimates and we also estimated the fiscal space using a sixth-degree polynomial for the logarithm of GDP as real trend GDP as a robustness, which did not lead to changes in the dynamics of the estimates neither the interpretation of the fiscal space size over the sample.

[27] This is evident also from Figure 13 in Appendix E, which reports tight fiscal space periods across our FS dummies and recession events over time.

FIGURE 4. FS_4 (1889:1-2015:4): De Facto fiscal space



The Figure shows the estimates for our definition of the *de facto* fiscal space *á la* Aizenman and Jinjarak (2010). The plot for FS_4 is in blue and its 1-year moving average in red. The series expresses the relative size of deficit with respect to government revenues. Shaded areas stand for tight fiscal space periods (1-year $FS >$ median).

finance variables and to medium/long run economic phenomena.[28] Tight fiscal space states also partially relate to ZLB periods.[29] This is mainly due to the Second World War and the Great Recession, in which both fiscal distress and low interest rates coexisted. However, although such correlations are positive, they are not particularly high. Table 2 also shows that our measures are related to high/low government debt-to-GDP periods.[30] Such correlations range between 0.24 and 0.7, highlighting the role of public debt in the evolution of fiscal

[28]In Table 36 in the Appendix, we also report the correlations of fiscal space series with unemployment and potential output.

[29]ZLB dummy indicates the state when the interest rate is at the zero lower bound or the FED is being very accommodative of fiscal policy (1932Q1-1951Q1, 2008Q4-2015Q4).

[30]High (low) federal debt-to-GDP ratio means that the federal debt-to-GDP ratio is above (below) its historical median, which is equal to 32.85%.

space.[31] However, debt-to-GDP is not sufficiently informative to capture the whole dynamics of fiscal space: other key factors such as output trends, the interest rate and the fiscal policy stance are also of crucial importance for identifying the level of fiscal room in the economy. Finally, in Table 2 we also calculate the correlations of our indicators with a dummy variable equal to one when the US was involved in a major war and with another dummy variable capturing the party of the US president. None of these correlations are relevant, suggesting that our fiscal space indicators are not driven neither by military spending nor by the political cycle.

In Figure 5, we plot the periods in which fiscal space is identified as tight, according to each FS dummy. The panel at the center of the figure reports a similar information, however using debt-to-GDP, which is the standard indicator used by the literature to identify periods of fiscal distress. Two main results emerge from Figure 5. First, our measures are well related with each other, as most of the periods identified are common across the four indicators. This is especially the case for FS_1 and FS_4. Second, tight fiscal space periods identified by debt-to-GDP do not coincide with those identified by our method. Indeed, the concept of fiscal space refers to a broader notion of fiscal sustainability as opposed to the debt-to-GDP ratio. In fact, fiscal space takes into account the dynamics of other key macroeconomic variables and the fundamental debt capacity of the economy.

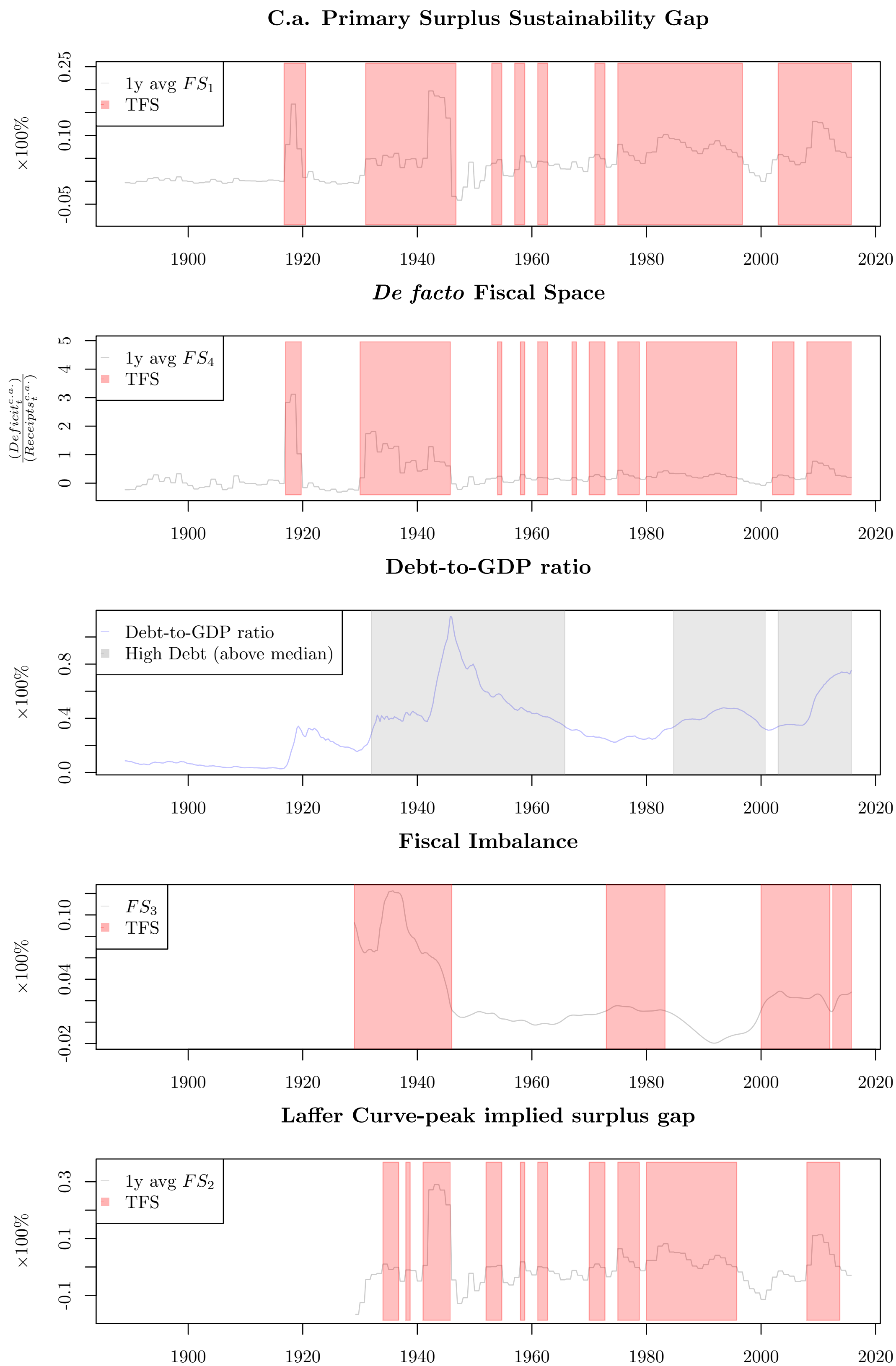
TABLE 1. Bootstrapped correlations (95 % confidence interval) among Fiscal space dummies.

	Median	Lower bound	Upper bound
$\mathbb{C}orr(FS1_t^d, FS2_t^d)$	0.597	0.520	0.673
$\mathbb{C}orr(FS1_t^d, FS3_t^d)$	0.344	0.248	0.439
$\mathbb{C}orr(FS1_t^d, FS4_t^d)$	0.732	0.670	0.798
$\mathbb{C}orr(FS2_t^d, FS3_t^d)$	0.014	-0.090	0.121
$\mathbb{C}orr(FS2_t^d, FS4_t^d)$	0.636	0.564	0.707
$\mathbb{C}orr(FS3_t^d, FS4_t^d)$	0.326	0.234	0.424

The Table shows the estimates for median non-parametric bootstrapped correlation coefficients and their intervals at the 95% confidence level. Intervals are calculated using the normal approximation. FSj_t^d $(j = 1,2,3,4)$ stand for the fiscal space dummies.

[31] Additionally, in Table 36 in the Appendix, we can see that the fiscal space series are consistently correlated with debt-to-GDP series and the change in public debt.

FIGURE 5. *FS* dummies and High Debt-to-GDP ratio.



This figure shows the periods of Tight Fiscal Space via our *FS* state dummies and of high Debt-to-GDP ratio (identifying high debt periods whenever Debt-to-GDP ratio is above its median). See also Table 2 for more details.

TABLE 2. Bootstrapped correlations (95 % confidence interval) between Fiscal space dummies and NBER recession dates, High/Low Debt-to-GDP states, ZLB periods, War dates and US political cycle.

	Median	Lower bound	Upper bound
$\mathbb{C}orr(FS1_t^d, Rec_t^d)$	-0.165	-0.247	-0.083
$\mathbb{C}orr(FS2_t^d, Rec_t^d)$	-0.074	-0.112	0.096
$\mathbb{C}orr(FS3_t^d, Rec_t^d)$	0.170	0.071	0.273
$\mathbb{C}orr(FS4_t^d, Rec_t^d)$	-0.070	-0.158	0.024
$\mathbb{C}orr(FS1_t^d, \frac{B}{GDP}_t^d)$	0.487	0.407	0.565
$\mathbb{C}orr(FS2_t^d, \frac{B}{GDP}_t^d)$	0.545	0.425	0.665
$\mathbb{C}orr(FS3_t^d, \frac{B}{GDP}_t^d)$	0.243	0.108	0.371
$\mathbb{C}orr(FS4_t^d, \frac{B}{GDP}_t^d)$	0.701	0.603	0.810
$\mathbb{C}orr(FS1_t^d, ZLB_t^d)$	0.349	0.277	0.420
$\mathbb{C}orr(FS2_t^d, ZLB_t^d)$	0.047	-0.053	0.150
$\mathbb{C}orr(FS3_t^d, ZLB_t^d)$	0.394	0.302	0.484
$\mathbb{C}orr(FS4_t^d, ZLB_t^d)$	0.341	0.268	0.417
$\mathbb{C}orr(FS1_t^d, War_t^d)$	0.089	0.004	0.172
$\mathbb{C}orr(FS2_t^d, War_t^d)$	-0.047	-0.158	0.060
$\mathbb{C}orr(FS3_t^d, War_t^d)$	0.130	0.026	0.227
$\mathbb{C}orr(FS4_t^d, War_t^d)$	0.110	0.026	0.197
$\mathbb{C}orr(FS1_t^d, Dem_t^d)$	0.169	0.083	0.255
$\mathbb{C}orr(FS2_t^d, Dem_t^d)$	-0.027	-0.133	0.076
$\mathbb{C}orr(FS3_t^d, Dem_t^d)$	0.081	-0.025	0.185
$\mathbb{C}orr(FS4_t^d, Dem_t^d)$	0.146	0.061	0.227

The Table shows the estimates for median non-parametric bootstrapped correlation coefficients and their intervals at the 95% confidence level. Intervals are calculated using the normal approximation. FSj_t^d $(j = 1, 2, 3, 4)$ are the fiscal space dummies, Rec_t^d is the dummy for NBER recession dates $\frac{B}{GDP}_t^d$ is the dummy for high-low federal debt-to-GDP states[a], ZLB_t^d is the dummy for the zero lower bound state, War_t^d is the dummy indicating US involvement in major wars.[b] Lastly, Dem_t^d stands for the dummy indicating the party of the US president in the office each quarter.

[a]High (low) federal debt status is considered as above (below) the historical median.

[b]We consider as major wars involving the US the following conflicts: Spanish-American War (1898), Philippine-American War (1899-1902), World War I (1914-1918), World War II (1939-1945), Korean War (1950-1953), Vietnam War (1965-1973), Gulf War (1990-1991), Afghanistan War (started in 2001), Iraq War (2003-2011), American-led intervention in Syria and Iraq (2014-present).

Finally, to further validate our fiscal space indicators, we also provide a narrative behind their evolution over time. Both dummies FS_1 and FS_4 indicate that the fiscal space was tight between 1917 and the end of 1920 (see Figures 1 and 4). This is due to the large wartime increase in the debt-to-GDP ratio, which rose from a 3% level up to 30% on average. Moreover, this tight fiscal space state partially overlaps with the depression of 1920-21 characterized by extreme deflation and whose key factor was the erroneous tightening stance by the FED.[32] Not surprisingly, all indicators identify the Great Depression and the Second World War as periods of tight fiscal space. Indeed, these periods are characterized by sluggish growth, high real interest rates, increasing debt-to-GDP ratios and deficits, all ingredients generating a reduction in fiscal space. FS_1, FS_2 and FS_4 dummies correctly signal the military build-ups due to the Korean war in 1953-54 (see Figures 1, 2 and 4). Additionally, virtually all fiscal space dummies (Figures 1, 2, 3 and 4) identify a long-lasting tight fiscal space state starting with the 1973 Oil crisis and continuing through the 1979 energy crisis, the fiscal expansionary policies during the Reagan administration and the Gulf war. Lastly, as already mentioned, the FS dummies characterize the Great Financial Crisis and its aftermath as tight fiscal space periods, given the hefty rise in public spending, the low-growth and low-inflation environment.[33]

Notably, in Figure 5, we observe that indicators FS_1 and FS_4 report periods of tight fiscal space between the end of 1916 and the beginning of 1920, while debt-to-GDP was low (and below its historical median). Indeed, in this time-span, deficit over GDP rose from being close to inexistent to oscillating around 15% until 1919. Our indicators righteously pick up the unsustainable fiscal path of government finances of those years compared to the erroneous signal of the debt stock. Similarly, from the end of the 70*s* until the beginning of the 80*s*, our indicators signal a period of tight fiscal space while debt-to-GDP was at low levels (around 30%). During this period, the distance between the cost of financing debt (namely, the yield on government bonds) and the growth rate of output (see discussion in Sec. 3.1) oscillated around 5% (capping in 1982 at 10%).[34] This points out both that the economy was slowing down, due to the energy crisis, and that United States experienced its most volatile money growth rates in the post-war era, which translated into higher yields. Additionally, in the late 90*s* and early 2000*s*, while debt-to-GDP was higher than 60% (and than its historical median), our indicators denote periods of loose fiscal space. This is due to the evolution of deficit over

[32] For details, see Friedman and Schwartz (2008)

[33] Public spending rose following the fiscal stimulus packages enacted from 2008 onwards. First, the Economic Stimulus Act of 2008 (enacted February 13, 2008) was an Act of Congress providing for several kinds of economic stimuli intended to boost the United States economy in 2008 and to avert a recession, or ameliorate economic conditions. Second, the American Recovery and Reinvestment Act of 2009 was a stimulus package signed into law by President Barack Obama in February 2009. The approximate cost of this stimulus package was estimated to be $ 831 billion.

[34] As in Section 3.1 we use the 10-year maturity yield.

GDP, which decreased from an average 5% in the early 90*s* to being mildly negative (surplus) at the end of the decade before rising again from 2002 onwards to early 90*s* levels.

4. METHODOLOGY

In this section we present the methodology employed to estimate the fiscal multipliers depending on the state of fiscal space. We then describe the identification method adopted and we outline the specification of the empirical model.

4.1. **State-dependent Local Projection.** Local Projections - introduced in Jordà (2005) - are becoming an increasingly popular estimation strategy for Impulse Response Functions (IRF) as opposed to more standard methods like structural VARs. A wide range of estimation procedures can in principle be applied to estimate LPs, and our approach hinges on a standard IV strategy to identify the relevant IRFs. Nevertheless, the discussion to follow is general enough to be applied to other estimation procedures. In a general form, the kind of linear Local Projections we are interested in estimating can be written as

$$y_{t+h} = \alpha_h + \beta_h g_t + \psi_h(L)\mathbf{X}_{t-1} + \varepsilon_{t+h} \quad h = 0, 1, 2, \ldots, H, \tag{9}$$

where y_t is the variable whose dynamic response we want to track, g_t is the endogenous variable we want to shock (government spending in our application), and $\mathbf{X}_t$ is a vector of control variables. Estimation is performed *separately* for each horizon and for each dependent variable with two-stage least squares. Generally speaking, IRFs are defined by the sequence $\{\beta_h\}_{h=0}^{H}$, and inference is performed with Newey-West standard errors.

The focus of this paper is on state-dependent responses of macroeconomic variables to fiscal policy. The non-linearity we add is a very simple one, i.e. we investigate the extent to which fiscal policy is transmitted differently under two different regimes, and we separate those two states with a simple indicator variable. Specifically,

$$\begin{aligned} y_{t+h} = & \mathcal{S}_{t-1}\left[\alpha_{A,h} + \beta_{A,h} g_t + \psi_{A,h}(L)\mathbf{X}_{t-1}\right] + \\ & + (1 - \mathcal{S}_{t-1})\left[\alpha_{B,h} + \beta_{B,s} g_t + \psi_{B,h}(L)\mathbf{X}_{t-1}\right] + \varepsilon_{t+h} \\ & h = 0, 1, 2, \ldots, H. \end{aligned} \tag{10}$$

This kind of non-linearity is conceptually the same as the one used in (e.g.) Ramey and Zubairy (2018).[35] Other authors - e.g. Tenreyro and Thwaites (2016) - have opted for smooth transition local projections, which allow parameters to smoothly switch between the two regimes, instead of letting them change abruptly around a threshold. While a smooth transition is desirable, for this model - first developed in Granger et al. (1993) - to be employed one needs to calibrate two key curvature and location parameters, whose choice turns out to be quite important in terms of the final set of IRFs that are obtained. In principle, those parameters could be estimated, but in order to do so reliably the researcher would need a lot of data around the transition of the state variable, something that is virtually never the case in macroeconomic applications.[36] We therefore decided to stick with the easier to interpret (and more robust) discrete indicator variable, which nonetheless yields a cleaner interpretation of the coefficients as exact average causal effects within a given state.

4.2. **Model specification and Identification.** In our approach, we estimate the LP model as in equation 10. The state dependency is given by the lagged dummy variable $\mathcal{S}_{t-1}$ that indicates the fiscal space status. Taking as baseline proxy FS_1 (Eq. 2 in section 3.1), we define the fiscal space state as tight (large) whenever the 1 year moving average proxy is above (below) its historical median.[37,38] We implement an IV approach using two different shock series to instrument government spending g_t in equation 10. The first shock series that we use as IV is Ramey news. Ramey (2011b,a) builds a series of estimated changes in expected present value of government purchases caused by military events: the so-called Ramey news shock series.[39] The second series that we consider as instrument for government spending is the Blanchard and Perotti shock. Blanchard and Perotti (2002) provide identification for both government

[35]The underlying assumption in this framework is that, once we calculate impulse response function in each state, the IRFs remain in that same state through the whole horizon of the estimation. Such assumption seems plausible in our analysis given the persistent behaviour of our fiscal space indicators. Indeed, the average duration of periods characterized by tight fiscal space is, respectively for FS_1, FS_2, FS_3, FS_4, of 31.5, 17.6, 43.5, 23.3 quarters, suggesting the slow moving behaviour of fiscal room. In section 5 we also calculate the impulse response of the state itself, showing how the dynamics of the states over time are not particularly affected by the shock in the short term.

[36]Teräsvirta (1994) discusses those estimation issues in detail.

[37]We take the 1 year averaged series so to have a smooth enough series and make sure that the fiscal space state is persistent and lasts at least one year. The average quarters spent in tight fiscal space are approximately equal to 20.

[38]The same definition for fiscal space state goes for FS_2 and FS_4 indicators proposed in Section 3; while, given the intrinsic smoothness of the series, for FS_3 (see section 3) there is no need to take the 1-year average. Then, the derived fiscal space state series are used to support the results obtained in section 5.

[39]In these papers, the author embeds the derived series in a VAR ordered first (Choleski recursive causal ordering).

spending and tax shocks in a structural VAR, where government spending is ordered first. The identification is based on short-run restrictions and on the automatic stabilizers of fiscal policy to economic activity. A similar approach has been employed also by Fatás et al. (2001) and Galí et al. (2007) among others.

We follow the Ramey and Zubairy (2018) approach to compute fiscal multipliers.[40] The authors propose to scale output, government spending and the shock series by trend GDP in order to estimate directly the multipliers.[41,42] Additionally, as proposed in Mountford and Uhlig (2009), we estimate integral multipliers.[43] In order to estimate the cumulative output, consumption and investment multipliers, we adopt a one-step IV estimation of

$$\begin{aligned}\sum_{j=0}^{h} y_{t+j} =& \mathcal{S}_{t-1}[\alpha_{A,h} + m_{A,h} \sum_{j=0}^{h} g_{t+j} + \psi_{A,h}(L)\mathbf{X}_{t-1}] + \\ &+ (1-\mathcal{S}_{t-1})[\alpha_{B,h} + m_{B,h} \sum_{j=0}^{h} g_{t+j} + \psi_{B,h}(L)\mathbf{X}_{t-1}] + u_{t+h},\end{aligned} \tag{11}$$

instrumenting government spending with the Ramey news and Blanchard and Perotti shock series. Under this approach, we can estimate the integral state-dependent multiplier $m_{i,h}$ ($i = A, B$) in one step. This allows us to calculate directly the standard errors of the multipliers and, therefore, to implement statistical inference. We select a lag-order of 4 as in most of the empirical fiscal policy literature (e.g., Fatás et al., 2001; Blanchard and Perotti, 2002; Galí et al., 2007; Ramey and Zubairy, 2018, among others) that accounts for the implementation lags of fiscal policy. An advantage of adopting LP methods compared to VARs is the possibility to include a wider set of controls without worrying about the quadratic increase of parameters in the estimation. Hence, we include an extensive set of controls (in $\mathbf{X}_{t-1}$ in equations 10 and 11) that include the average marginal tax rate as in Barro and Redlick (2011) and Bernardini and Peersman (2018), the nominal interest rate on 10 years maturity government bonds, the logarithm of the implicit GDP deflator, real consumption and real investment scaled by trend GDP, the ratio of federal debt to lagged GDP, the ratio of current government deficits on GDP

[40] One of the pitfalls of calculating multipliers: the use of log transformed variables (as in most fiscal VAR analyses) requires an *ex-post* adjustment that leads to biased multipliers. The multipliers must be multiplied by the average output-to-spending ratio that greatly varies for the US across different estimation samples. As observed in Ramey and Zubairy (2018), In post-WWII, the average output-to-spending ratio is equal to 5; while, from 1890 the average output-to-spending ratio is equal to 8.

[41] And, by analogy, any real variables whose multiplier is of interest for the researcher.

[42] The real GDP time trend is estimated as a sixth-degree polynomial for the logarithm of GDP.

[43] Rather than peak multipliers as in Blanchard and Perotti (2002) or average multipliers given the initial shock as in Auerbach and Gorodnichenko (2012).

and, lastly, the corporate bond spread (AAA Moody's - Y10). In the bag of controls, lags of output, government spending and the shock series are included. Details on the data used can be found in Appendix A.[44]

5. Results

This section presents the results, reporting the state-dependent effects of government spend-ing shocks. First we provide the main result of the paper, obtained using FS_1 as the baseline state variable for measuring fiscal space. However, later we provide additional evidence us-ing the remaining fiscal space proxies to prove the stability of our results, together with a further robustness section regarding the sample size.

5.1. **IRF and fiscal multipliers.** Figure 6 reports the impulse response function for government spending and economic activity when fiscal shock is estimated using the Ramey news, both in the linear case (top panel) and in the two states of large and tight fiscal space (bottom panel). First of all, we note that the evolution of the two variables of interest in the linear case is fairly standard and in line with that reported in Ramey and Zubairy (2018). Consistent with the dynamics of a news shock, actual government consumption slowly increases and peaks around 10 quarters after the initial impulse. Economic activity follows a comparable pattern. Turning to the non-linear case, we observe a similar dynamic in the two states, even if the same reaction in GDP in the large fiscal space case is determined by a less pronounced increase in spending. However, in order to evaluate quantitatively the effects of fiscal policy, both in general and in particular in non-linear cases, graphical impulse response functions are not particularly useful, as we need to compare shocks of similar size and take into account the evolution of the instrumented variable (government consumption in this case). In line with the literature (Ramey and Zubairy, 2018; Mountford and Uhlig, 2009) we calculate the cumulative fiscal multipliers and we henceforth concentrate on this measure to quantify the impact of spending shocks. Tables 3 and 4 report the fiscal multipliers at each horizon, respectively for the Ramey shock and the Blanchard-Perotti shock. The first column of the tables presents the value of the fiscal multiplier in the linear case, while the second and the third column in large and tight fiscal space. Finally, the last column tests the statistical significance of the difference between the multipliers in the two states, reporting the p-value of the test. Table 3 shows that, while the linear case presents multipliers smaller than one,

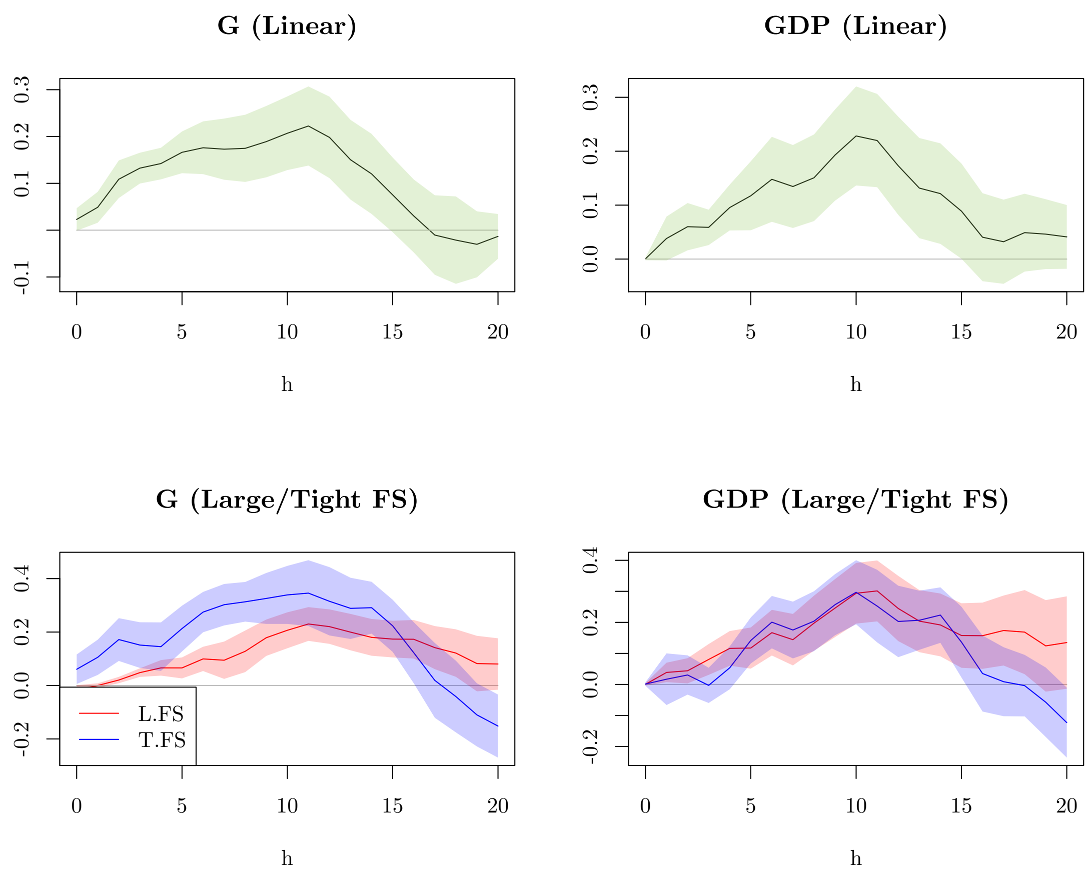
[44] All scaled by trend GDP.

this average effect is very different once disentangled between our two states. Indeed, in tight fiscal space the multiplier averages around 0.6, while in large fiscal space is around 1.5. Such difference is present at each horizon and it is always statistically significant.[45] A similar picture emerges from Table 4, which finds slightly larger fiscal multipliers in the two states. However, the main takeaway remains valid and represents the principal result of the paper, being the fiscal multiplier smaller than one in the tight fiscal space state and larger than one in the opposite case. Such result is particularly important as, adopting a methodology which follows closely that of Ramey and Zubairy (2018) we draw very different conclusions regarding the state dependent nature of fiscal policy. We also note that such results are not driven by an unbalanced distribution of shocks in the two states. Indeed, as we show in Appendix C, shocks are equally distributed between periods of tight fiscal space and periods of large fiscal space.[46] Tables 5 and 6 calculate fiscal multipliers when we change the way we define our two states. Section 3.5 clarified that, for each of our measures, we define fiscal space as tight (large) when the indicator is above (below) the median. Tables 5 and 6 report the results when instead we concentrate on extreme episodes, meaning that we define fiscal space as tight when the underlying indicator (FS_1 in this case) is above the 80th percentile and as large when it is below the 20th. We do so to investigate whether our results depend upon the threshold adopted to distinguish between the two states. Both tables show results consistent with the main takeaway of the paper. Indeed, the effects are even more pronounced, in line with what one would expect looking at the extreme tails of the distribution. In particular, while the fiscal multiplier becomes larger as there is more fiscal room available, the multiplier shrinks when we consider periods of very tight fiscal space.

[45] However, as the relevance of Ramey instrument is lower for the first horizons of the impulse response, we concentrate our attention on the period two-years after the shock

[46] We cannot instead exclude the possibility of composition effects occurring if shocks to government consumption and investment are distributed unevenly in periods of tight and large fiscal space. Unfortunately, there is not a proper way to check for this possibility. Ramey news have been constructed through a careful work consisting of analyzing weekly newspapers and magazines in the search of military spending news, without distinguishing whether the future increase/decrease in military spending regards consumption or investments. Moreover, the standard practice when adopting this identification method is to instrument general government spending, which comprises both government consumption and investment. While we acknowledge that this strategy could confound two possibly different types of shocks, such problem is common to every paper adopting this identification scheme. Moreover, as government investment shocks are much less frequent than consumption shocks, we believe that the possible confounding effect should not alter the estimates by a too large factor.

FIGURE 6. G and GDP IRFs - FS_1 - Ramey News (1929-2015)



The Figure shows the estimates for the impulse response function of real government spending scaled by trend output (G) and real GDP scaled by trend output (GDP) following a Ramey news shock.

5.2. **Transmission mechanism.** In this subsection we investigate the transmission mechanism. Figure 15 reports the impulse response of private consumption and investment. While in the linear case they both fall in response to a positive government spending shock, when state-dependencies are considered we observe an opposite behavior in the two states. When fiscal space is tight, private consumption and investment decreases; by contrast, when fiscal space is large they both increase, giving rise to non-Ricardian effects. This result is made clear in Table 7, which reports the consumption and investment multipliers, together with the associated error bands. The consumption multiplier in the large fiscal space state (red line) is around 0.5 one-year after the shock and slowly decays over time; in the tight fiscal space it is negative, around -0.1, and slowly reverts towards zero. A similar pattern, although less pronounced, holds for private investment. When fiscal space is large the multiplier is basically zero, given the wide uncertainty surrounding the estimates; when fiscal space is tight,

TABLE 3. Fiscal Space-dependent Fiscal Multiplier: Baseline - FS_1 - Ramey News Shock (1929-2015)

Horizon	Linear	Large FS	Tight FS	p -value Diff.
1-year	0.63154	2.59324	0.20505	0.0013***
	(0.14822)	(0.82358)	(0.24826)	
2-years	0.73058	1.84459	0.48422	0.0009***
	(0.15028)	(0.33708)	(0.17141)	
3-years	0.84010	1.50515	0.60074	$5.88 \cdot 10^{-8***}$
	(0.11044)	(0.11772)	(0.13488)	
4-years	0.86660	1.32009	0.61816	$9.18 \cdot 10^{-6***}$
	(0.10107)	(0.12729)	(0.14161)	
5-years	0.96984	1.33614	0.60957	0.0002***
	(0.17138)	(0.13926)	(0.18746)	
Signif. codes	0.01***	0.05**	0.1*	

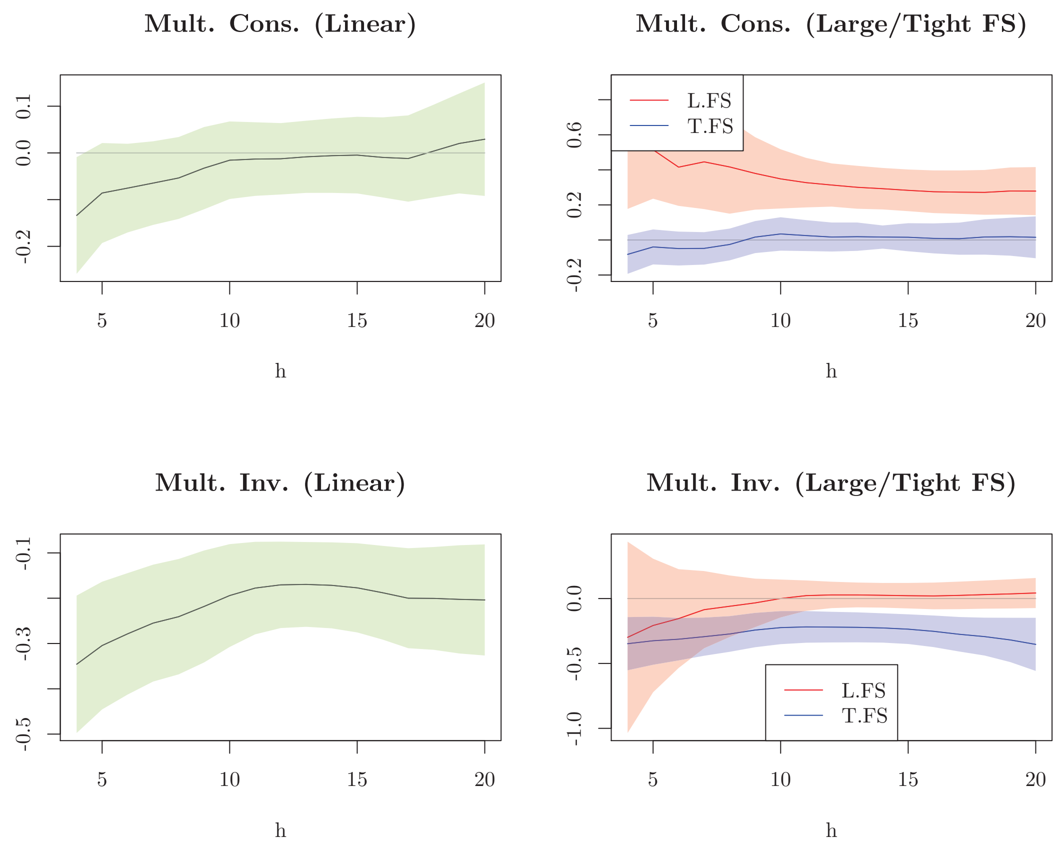
TABLE 4. Fiscal Space-dependent Fiscal Multiplier: Baseline - FS_1 - Blanchard and Perotti Shock (1929-2015)

Horizon	Linear	Large FS	Tight FS	p -value Diff.
1-year	0.58461	1.17810	0.59973	0.14563
	(0.07333)	(0.34638)	(0.07025)	
2-years	0.72999	1.19385	0.81420	0.27954
	(0.10334)	(0.31641)	(0.12329)	
3-years	0.77180	1.49097	0.85638	0.00059***
	(0.11598)	(0.13626)	(0.14276)	
4-years	0.82710	1.51589	0.91605	0.00017***
	(0.14259)	(0.14345)	(0.17982)	
5-years	0.79798	1.71866	0.90564	0.00868***
	(0.18411)	(0.34744)	(0.19070)	
Signif. codes	0.01***	0.05**	0.1*	

instead, private investment multiplier is negative and significant. The differential effects highlighted in Figure 15 and Table 7 are at the root of the difference in the output multipliers reported in the previous section. The mechanism we have in mind to rationalize this empirical evidence relates to Perotti (1999), which shows how the degree of public finance sustainability alters the transmission of fiscal policy.[47] Indeed, a deficit-financed increase in government spending generates an increase in future taxation, needed to repay the cost of

[47] In his seminal contribution Perotti (1999) refers to public debt as the variable defining the state of public finance, as opposed to fiscal space. Moreover, Perotti (1999) studies an economy populated both by unconstrained and constrained individuals. However, the main intuition of the paper applies irrespective of such choices.

FIGURE 7. Cons. and Inv. multipliers - FS_1 - Ramey News (1929-2015)



The Figure shows the estimates for the integral multiplier of real consumption and real total private investment.

the fiscal expansion. However, in an environment with distortionary taxation, such tightening will be more pronounced when fiscal space is already tight, because of the convexity in tax distortions. This steeper path of future taxes, internalized by agents, produces a larger negative wealth effect and therefore a subdued reaction of private consumption. Although we believe the aforementioned channel is at the heart of the differential evolution of private consumption in the two states, it is not straightforward to obtain supporting empirical evidence, given the forward-looking nature of the variables involved, in particular expectations regarding future taxation.[48]

For the sake of completeness, we also analyze the response of all control variables employed in regression 10. Figures 18 and 19 report the results. The average marginal tax rate (AMTR),

[48]Another potential way to interpret our results is that, in an economy with finite-lived agests, in the tight fiscal space state we obtain standard Ricardian effects on consumption. At the opposite, in the large fiscal space state the negative wealth effect following the fiscal shock is small as consumers perceive they will not have to repay all of the government spending during their finite lifetime, therefore pushing consumption up.

at least for a large part of the horizon of the IRF, does not display significant different behaviour in the two states. Although such result would suggest that tax do not play a major role in explaining the dichotomy in fiscal multipliers, we stress that the horizon of our IRF is at most five years, too short to observe changes in future tax rates, also given the length of the political cycle[49]. The figure also shows the evolution of debt and deficit ratios, which both increase much more in the tight fiscal space. Such behavior suggests that economic growth and the evolution of budget variables, in the case of large fiscal space, contribute positively to repay for the initial fiscal stimulus and avoid to generating a large increase in the long-run overall level of debt-to-GDP. On the contrary, in the tight fiscal space state, debt and deficit are magnified by the less favourable environment following the shock. This is clear also from Figure 17, where we report the estimates for the debt multiplier; the latter proves to be significantly higher in the tight state with respect to large fiscal space over the impulse response horizon.[50] Turning to other variables of interest for the transmission of fiscal shock, the most important one is the interest rate. Consistently with the puzzling behavior of the linear case, already shown in the empirical literature by Mountford and Uhlig (2009), Fisher and Peters (2010) and Ramey (2011b), the nominal interest rate slightly decreases in both states.[51,52] Finally, the response of the price deflator falls slightly in the tight fiscal space state, while it remains constant in the other state.[53]

5.3. **Additional results and robustness.** This section proposes a series of additional results and robustness checks. First of all, we show that all of our results are robust to different definitions of fiscal space. In order to do so, we perform the same estimations as those provided in the previous section, however adopting the remaining measures, FS_2, FS_3 and FS_4, to identify periods of tight and large fiscal space. In all these cases, fiscal multipliers are calculated

[49]Results from Perotti (1999) link explicitly the effect of government spending to the political cycle: a lower probability of survival of the policy maker implies a steeper path of future expected taxation, which is distortionary, and, thus, a larger negative wealth effect following a public expenditure shock.

[50]In Appendix B, we show the adjustment needed for the correct computation of the debt multiplier.

[51]Mountford and Uhlig (2009) observe that a government spending shock reduces investment, although interestingly not via higher interest rates (that are moderately falling).

[52]Referring to Fisher and Peters (2010) and Ramey (2011b), Murphy and Walsh (2016) report that one possible explanation for the fall in interest rates is an endogenous response of monetary policy to government spending shocks.

[53]Figure 20 in Appendix E reports the IRFs of the state variables itself, i.e. when $FS_{1,t}$ is considered as dependent variable. The figure shows that the responses are not very significant in large fiscal space, while fiscal space narrows even more in the tight state. This suggests that our states do not change regime over the impulse response horizon, validating the econometric framework adopted to investigate the state-dependency (as described in Section 4.1).

using both Ramey shocks and Blanchard-Perotti ones. Tables 7 and 8 summarize, respectively for the two identification methods, the fiscal multiplier when fiscal space is given by measure FS_2. The multipliers in the two states are statistically significant, with those in the large fiscal space state being consistently above one and those in the alternative state below one. A similar narrative emerges from Tables 9 and 10, which adopt FS_3 as fiscal space indicator. According to these estimates, the fiscal multiplier in the tight fiscal space is basically zero at each horizon given the large error bands associated, with a point-estimate which in some cases turns even negative. The multiplier in large fiscal space is instead statistically significant and greater than one. Tables 11 and 12 repeat the same exercise using FS_4 and once again confirm the main result of the paper. All in all, these results confirm the importance of considering fiscal space for the transmission of fiscal policy. Moreover, they re-assure that the methods employed to measure the evolution of fiscal space over time are consistent, as different indicators in the end produce very similar results. Finally, in this robustness section we study how a different sample size affects our results. We first show the results when the estimation is performed only in the post-WWII period and after we reconsider the full sample (1929-2015) once we exclude the global financial crisis of the late 2000s. Tables 13, 14, 15 and 16 reports the fiscal multiplier, respectively for FS_1, FS_2, FS_3 and FS_4, when the estimation is performed over the period 1947-2015. The government spending shock is estimated only using Blanchard-Perotti shocks, as it is not possible to use the Ramey shock on such a short sample. As Ramey and Zubairy (2018) show, such shocks do not have enough variation to be relevant when instrumenting government spending in the more recent period. The aforementioned tables provide the same univocal picture. Indeed, when considering only the post-war period the difference among multipliers in the two states is magnified, with multipliers in the tight fiscal space shrinking towards zero and instead becoming larger than 1.5 when public finances are sound. Finally, Tables from 17 to 24 calculate fiscal multipliers over the full sample for each fiscal space indicator and each identification method, omitting the great financial crisis. In order to do so, we exclude from the sample the period 2007:Q4 - 2010:Q4 Results clearly show that the financial crisis does not play a role in the determining the size of fiscal multipliers, as results remain basically unchanged with respect to the baseline. In Appendix D, we report additional estimates of fiscal multipliers to further validate our findings.[54]

[54]In Appendix D, we report estimates of the fiscal multiplier across states of recession and expansion (Tables 34 and 35) finding no evidence for a difference in multipliers as in Ramey and Zubairy (2018). Moreover,

6. Conclusions

The paper investigated the state-dependent effects of fiscal policy, once the dynamics of fiscal sustainability and fiscal room are jointly considered. Drawing from different strands of the literature we developed several indicators of fiscal space and we measured its evolution over time. The main result highlighted by this paper is that fiscal space matters for the transmission of fiscal policy, as fiscal multipliers are much larger (smaller) when fiscal shocks are implemented in periods of loose (tight) fiscal space. Such a result appears important mainly in two respects. First of all, it stresses the importance of state-dependency in the study of fiscal policy. While the recent literature has found only minor differences in fiscal multipliers across business cycle and monetary policy regimes, our paper finds that, by contrast, fiscal space matters a lot. Second, the paper shows, especially from a policy prospective, that fiscal policy can be a very powerful tool in stimulating the economy, but this is not always the case. Particular attention needs to be paid to the economic conditions in which fiscal policy is implemented, as weak public finances could hamper the transmission of fiscal shocks and, in extreme cases, even produce detrimental effects.

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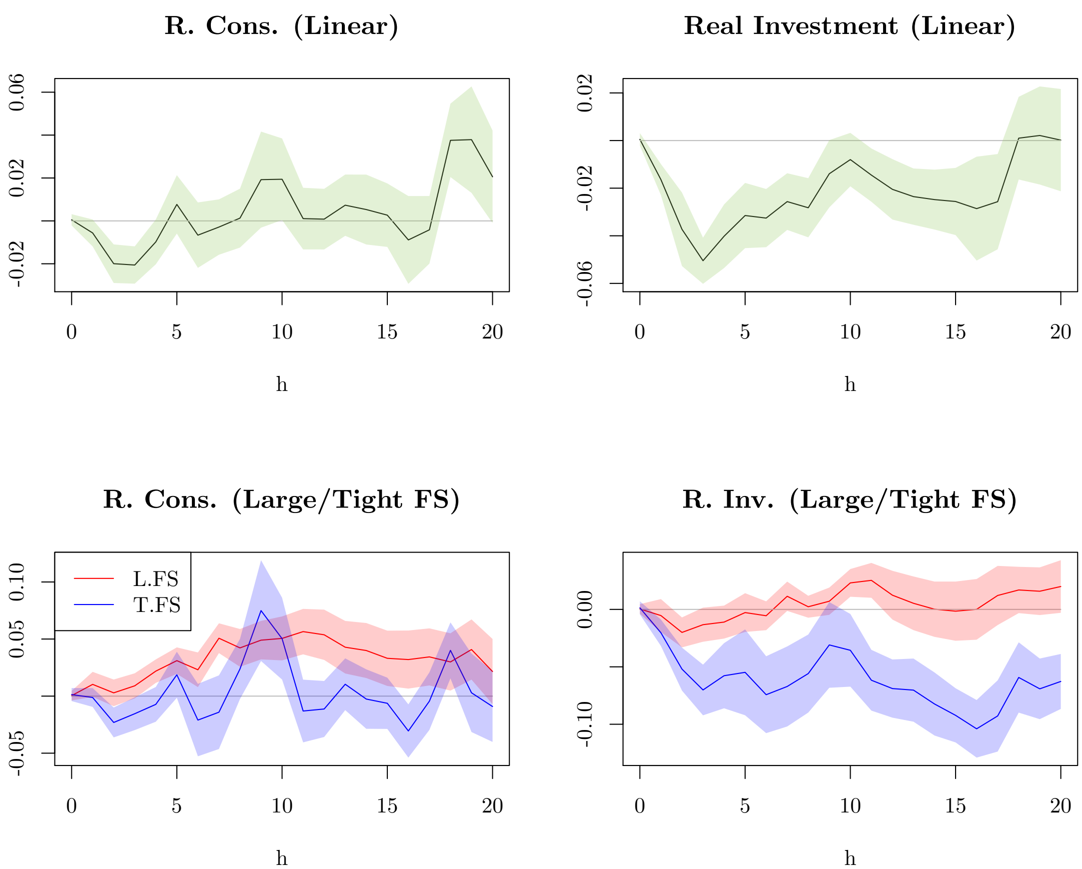
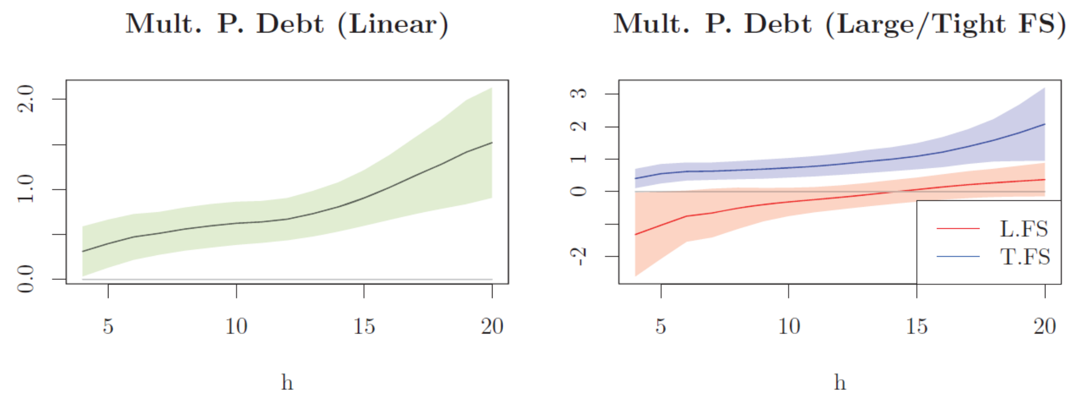
we also compute the multiplier across states of High/Low Federal Debt-to-GDP (Tables 28 and 29) and velocity (Tables 30 and 31) that validate our results even though the estimates are mostly not significant. Lastly, we also show the results on the fiscal multiplier interacting our baseline tight fiscal space state with the zero lower bound without getting any relevant result (see Tables 32 and 33).

FIGURE 8. C and I IRFs - FS_1 - Ramey News (1929-2015)



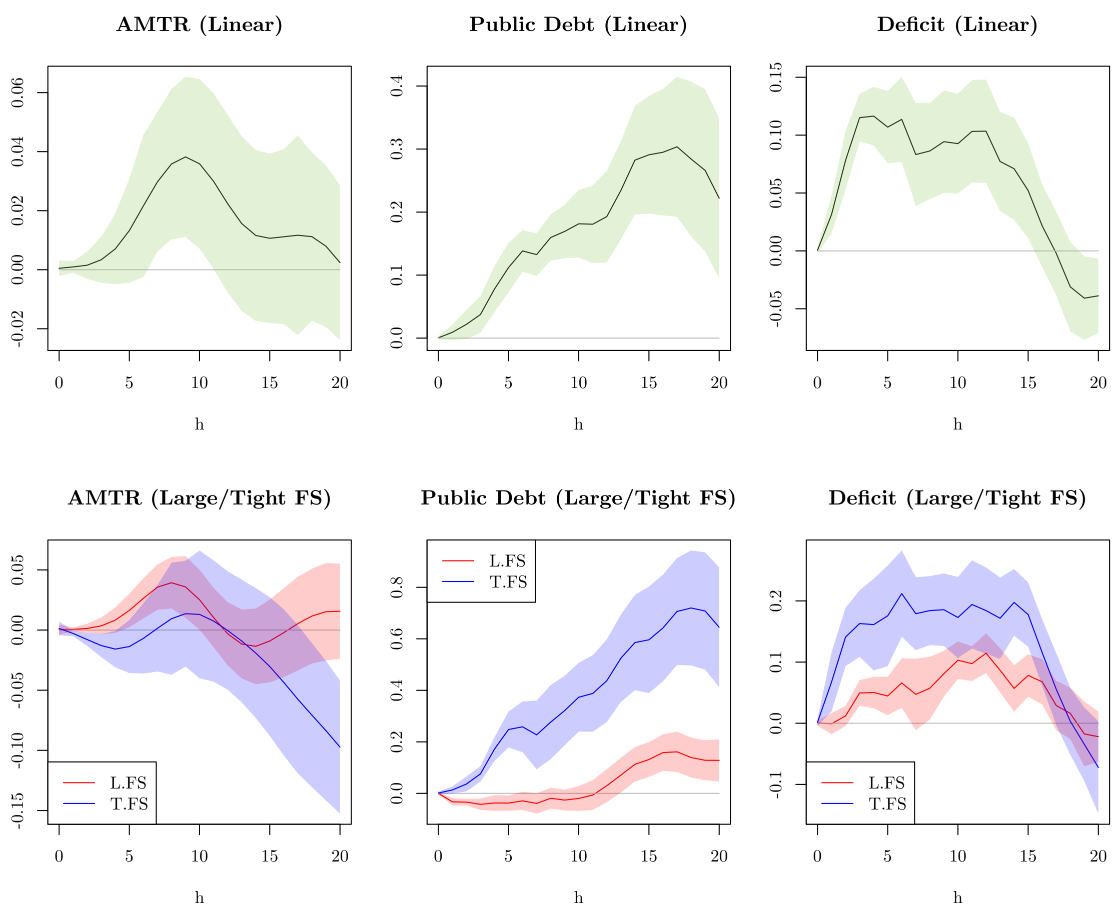
The Figure shows the estimates for the impulse response function of real consumption scaled by trend output (C) and real total private investment scaled by trend output (I) following a Ramey news shock.

FIGURE 9. Public debt multiplier - $FS1$ - Ramey News (1929-2015)



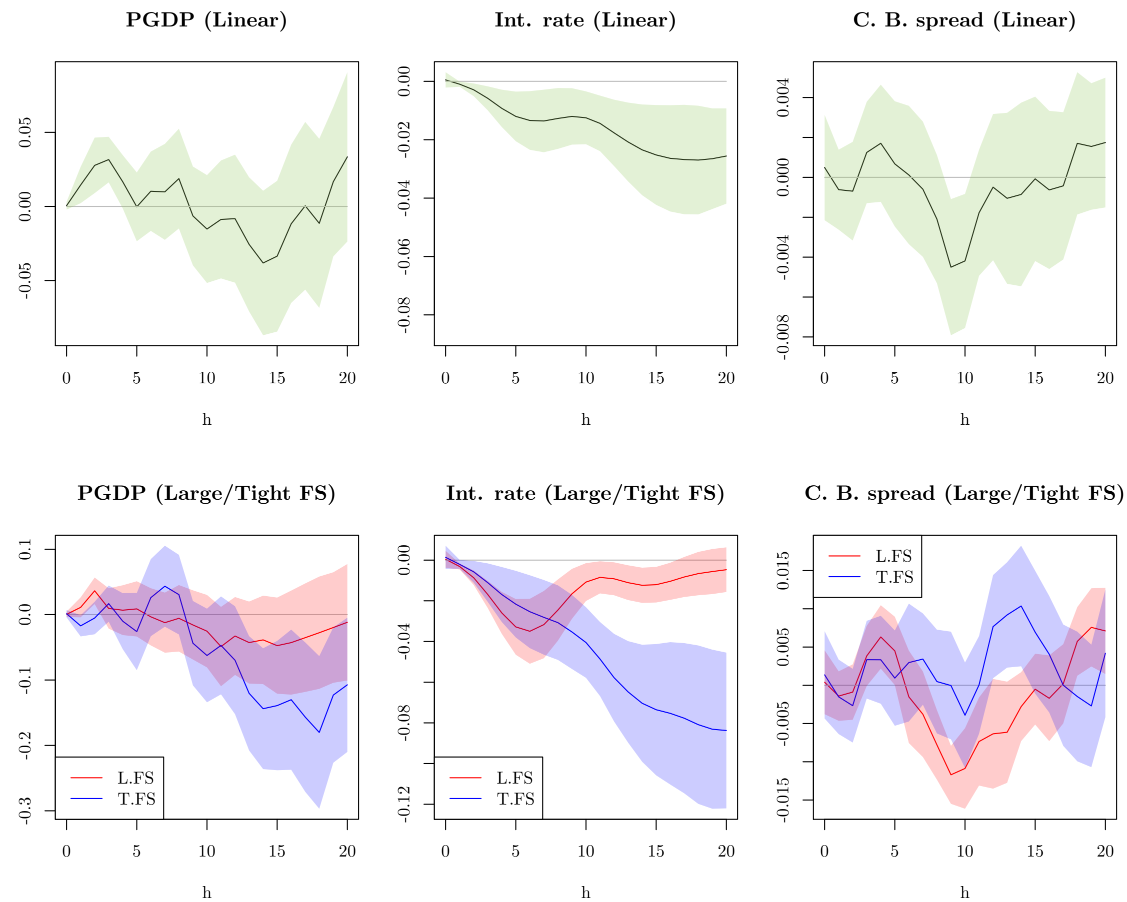
The Figure shows the estimates for the integral multiplier of federal debt. The correct multiplier is derived by adjusting the resulting 2SLS, see Appendix B for details.

FIGURE 10. $AMTR$, P. Debt, deficit IRFs - FS_1 - Ramey News (1929-2015)



The Figure shows the estimates for the impulse response function of the average marginal tax rate as in Barro and Redlick (2011) and Bernardini and Peersman (2018) ($AMTR$), federal debt-to-lagged GDP, deficit-to-GDP following a Ramey news shock.

FIGURE 11. $log(IPGDP)$, $Y10$, C.B. spread IRFs - FS_1 - Ramey News (1929-2015)



The Figure shows the estimates for the impulse response function of the logarithm of the implicit price deflator ($log(IPGDP)$), 10-years government bond yield ($Y10$), corporate bond spread (C.B. spread) following a Ramey news shock.

TABLE 5. Fiscal Space-dependent Fiscal Multiplier: Extremes - FS_1 - Ramey News Shock (1929-2015)

Horizon	Linear	Large FS	Tight FS	p -value Diff.
1-year	0.63154	2.81727	-0.21469	$3.50 \cdot 10^{-7***}$
	(0.14822)	(0.56600)	(0.13276)	
2-years	0.73058	1.70203	0.35317	0.00120^{***}
	(0.15028)	(0.40783)	(0.07934)	
3-years	0.84010	1.88123	0.58868	$6.01 \cdot 10^{-7***}$
	(0.11044)	(0.25094)	(0.06006)	
4-years	0.86660	1.77096	0.54652	$1.56 \cdot 10^{-9***}$
	(0.10107)	(0.19341)	(0.07147)	
5-years	0.96984	1.80390	0.42486	$3.53 \cdot 10^{-16***}$
	(0.17138)	(0.14593)	(0.08855)	
Signif. codes	0.01^{***}	0.05^{**}	0.1^{*}	

TABLE 6. Fiscal Space-dependent Fiscal Multiplier: Extremes - FS_1 - Blanchard and Perotti Shock (1929-2015)

Horizon	Linear	Large FS	Tight FS	p -value Diff.
1-year	0.58461	2.14032	0.35654	$4.71 \cdot 10^{-6***}$
	(0.07333)	(0.37591)	(0.09213)	
2-years	0.72999	2.23721	0.55709	$3.40 \cdot 10^{-12***}$
	(0.10334)	(0.22677)	(0.08843)	
3-years	0.77180	2.37341	0.60591	0^{***}
	(0.11598)	(0.10159)	(0.07333)	
4-years	0.82710	2.29881	0.53609	0^{***}
	(0.14259)	(0.07158)	(0.08137)	
5-years	0.79798	3.49345	0.31733	0.00225^{***}
	(0.18411)	(1.03655)	(0.07357)	
Signif. codes	0.01^{***}	0.05^{**}	0.1^{*}	

TABLE 7. Fiscal Space-dependent Fiscal Multiplier: FS_2 - Ramey News Shock (1929-2015)

Horizon	Linear	Large FS	Tight FS	p -value Diff.
1-year	0.64555	1.88273	0.44398	0.06724*
	(0.15678)	(0.77452)	(0.10089)	
2-years	0.74378	1.74077	0.76256	0.03579**
	(0.15380)	(0.45041)	(0.06955)	
3-years	0.84977	1.76922	0.85130	0.03082**
	(0.11385)	(0.44278)	(0.04943)	
	(0.10841)	(0.38137)	(0.04137)	
4-years	0.87766	1.59097	0.85816	0.02053**
	(0.11009)	(0.31850)	(0.03960)	
5-years	0.98316	1.47619	0.92338	0.01052**
	(0.14459)	(0.20549)	(0.04105)	
Signif. codes	0.01***	0.05**	0.1*	

TABLE 8. Fiscal Space-dependent Fiscal Multiplier: FS_2 - Blanchard and Perotti Shock (1929-2015)

Horizon	Linear	Large FS	Tight FS	p -value Diff.
1-year	0.57740	0.78042	0.59651	0.58361
	(0.07776)	(0.32745)	(0.05936)	
2-years	0.72720	1.41969	0.83229	0.04505*
	(0.10753)	(0.29852)	(0.06061)	
3-years	0.77148	2.01395	0.88710	0.04079*
	(0.12386)	(0.48205)	(0.05796)	
4-years	0.82850	2.23201	0.90586	0.11401
	(0.15460)	(0.68862)	(0.05945)	
5-years	0.80963	2.43213	0.84064	0.14908
	(0.19480)	(1.06717)	(0.05386)	
Signif. codes	0.01***	0.05**	0.1*	

TABLE 9. Fiscal Space-dependent Fiscal Multiplier: FS_3 - Ramey News Shock (1929-2015)

Horizon	Linear	Large FS	Tight FS	p -value Diff.
1-year	0.63154	0.06175	-1.29681	0.40762
	(0.14822)	(0.59070)	(1.45076)	
2-years	0.73058	1.05849	-0.24363	0.00357***
	(0.15028)	(0.22630)	(0.35900)	
3-years	0.84010	1.55694	0.23091	0.00010***
	(0.11044)	(0.19291)	(0.28947)	
4-years	0.86660	1.59637	0.11623	0.06148*
	(0.10107)	(0.28190)	(0.73807)	
5-years	0.96984	1.41966	5.82865	0.94841
	(0.17138)	(0.39664)	(68.12317)	
Signif. codes	0.01***	0.05**	0.1*	

TABLE 10. Fiscal Space-dependent Fiscal Multiplier: FS_3 - Blanchard and Perotti Shock (1929-2015)

Horizon	Linear	Large FS	Tight FS	p -value Diff.
1-years	0.58461	0.76187	0.45005	0.19568
	(0.07333)	(0.25133)	(0.08753)	
2-years	0.72999	1.05299	0.55512	0.13296
	(0.10334)	(0.25256)	(0.24944)	
3-years	0.77180	1.43210	0.62393	0.15728
	(0.11598)	(0.24250)	(0.54125)	
4-years	0.82710	1.48427	1.22196	0.81256
	(0.14259)	(0.27920)	(1.06721)	
5-years	0.79798	1.59052	0.92785	0.17297
	(0.18411)	(0.34296)	(0.35007)	
Signif. codes	0.01***	0.05**	0.1*	

TABLE 11. Fiscal Space-dependent Fiscal Multiplier: FS_4 - Ramey News Shock (1929-2015)

Horizon	Linear	Large FS	Tight FS	p -value Diff.
1-year	0.63154	3.75108	0.28423	0.01406**
	(0.14822)	(1.38169)	(0.22158)	
2-years	0.73058	2.05270	0.60125	0.04503**
	(0.15028)	(0.69020)	(0.13488)	
3-years	0.84010	1.88193	0.73149	0.05170*
	(0.11044)	(0.56384)	(0.11566)	
4-years	0.86660	1.85698	0.75159	0.04717**
	(0.10107)	(0.49944)	(0.11650)	
5-years	0.96984	1.95285	0.79650	0.02287**
	(0.17138)	(0.41647)	(0.12164)	
Signif. codes	0.01***	0.05**	0.1*	

TABLE 12. Fiscal Space-dependent Fiscal Multiplier: FS_4 - Blanchard and Perotti Shock (1929-2015)

Horizon	Linear	Large FS	Tight FS	p -value Diff.
1-year	0.58461	1.10744	0.62750	0.22530
	(0.07333)	(0.41681)	(0.07530)	
2-years	0.72999	1.81899	0.79186	0.01629**
	(0.10334)	(0.45954)	(0.10872)	
3-years	0.77180	2.49842	0.80025	0.00201***
	(0.11598)	(0.56230)	(0.13046)	
4-years	0.82710	2.68677	0.85427	0.00054***
	(0.14259)	(0.52123)	(0.17516)	
5-years	0.79798	2.64423	0.79593	0.00022***
	(0.18411)	(0.43731)	(0.20899)	
Signif. codes	0.01***	0.05**	0.1*	

TABLE 13. Fiscal Space-dependent Fiscal Multiplier: Baseline - FS_1 - Blanchard and Perotti Shock (1947-2015)

Horizon	Linear	Large FS	Tight FS	p -value Diff.
1-year	0.78241	1.58795	0.00138	0.00035***
	(0.25513)	(0.28862)	(0.42515)	
2-years	0.84343	1.57688	-0.25010	0.00297***
	(0.25494)	(0.23773)	(0.63100)	
3-years	0.98088	1.67524	-0.75365	0.00878***
	(0.24902)	(0.19679)	(0.90610)	
4-years	1.02607	1.93252	-0.70540	0.03675**
	(0.26606)	(0.20905)	(1.23985)	
5-years	1.08399	2.17235	-0.27979	0.04273**
	(0.25559)	(0.18201)	(1.18732)	
Signif. codes	0.01***	0.05**	0.1*	

TABLE 14. Fiscal Space-dependent Fiscal Multiplier: FS_2 - Blanchard and Perotti Shock (1947-2015)

Horizon	Linear	Large FS	Tight FS	p -value Diff.
1-year	0.78985	1.10333	0.79735	0.47290
	(0.25330)	(0.29539)	(0.32461)	
2-years	0.84899	1.83026	0.89623	0.02108**
	(0.25321)	(0.33419)	(0.27809)	
3-years	0.98172	1.84778	0.93012	0.01249**
	(0.24859)	(0.31810)	(0.28208)	
4-years	1.02114	1.76111	0.89232	0.00982***
	(0.26731)	(0.20896)	(0.28746)	
5-years	1.07650	1.82689	0.57381	0.00254***
	(0.25816)	(0.15332)	(0.38968)	
Signif. codes	0.01***	0.05**	0.1*	

TABLE 15. Fiscal Space-dependent Fiscal Multiplier: FS_3 - Blanchard and Perotti Shock (1947-2015)

Horizon	Linear	Large FS	Tight FS	p -value Diff.
1-year	0.78241	1.28176	-1.13708	0.02744**
	(0.25513)	(0.28592)	(1.04374)	
2-years	0.84343	1.41547	-2.04633	0.00022***
	(0.25494)	(0.35766)	(0.86894)	
3-years	0.98088	1.60183	-3.90825	$3.12{\cdot}10^{-9}$***
	(0.24902)	(0.33893)	(0.89952)	
4-years	1.02607	1.62012	-6.53132	$1.19{\cdot}10^{-7}$***
	(0.26606)	(0.48563)	(1.53528)	
5-years	1.08399	1.57074	16.14953	0.07216*
	(0.25559)	(0.52679)	(8.18320)	
Signif. codes	0.01***	0.05**	0.1*	

TABLE 16. Fiscal Space-dependent Fiscal Multiplier: FS_4 - Blanchard and Perotti Shock (1947-2015)

Horizon	Linear	Large FS	Tight FS	p -value Diff.
1-year	0.78241	1.56535	-0.00647	0.00265***
	(0.25513)	(0.34450)	(0.40649)	
2-years	0.84343	1.76408	-0.26973	0.00292**
	(0.25494)	(0.33348)	(0.57273)	
3-years	0.98088	1.95465	-0.78494	0.00074***
	(0.24902)	(0.29949)	(0.73521)	
4-years	1.02607	1.95133	-0.90096	0.00536***
	(0.26606)	(0.29333)	(0.88961)	
5-years	1.08399	1.98488	-0.68068	0.02237**
	(0.25559)	(0.31918)	(0.96942)	
Signif. codes	0.01***	0.05**	0.1*	

TABLE 17. Fiscal Space-dependent Fiscal Multiplier: Baseline FS_1 Ramey News shock - Omit Crisis

Horizon	Linear	Large FS	Tight FS	p -value Diff.
1-year	0.63896	2.55736	0.06951	0.00074***
	(0.14066)	(0.71521)	(0.27292)	
2-years	0.74396	1.73903	0.35627	0.00055***
	(0.15074)	(0.34519)	(0.16722)	
3-years	0.85485	1.41452	0.47287	$1.54{\cdot}10^{-8***}$
	(0.09304)	(0.12955)	(0.14483)	
4-years	0.87870	1.27713	0.40662	0.00002***
	(0.11012)	(0.12861)	(0.22632)	
5-years	0.97504	1.30148	0.30150	0.01104**
	(0.12487)	(0.14879)	(0.42682)	
Signif. codes	0.01***	0.05**	0.1*	

TABLE 18. Fiscal Space-dependent Fiscal Multiplier: Baseline FS_1 Blanchard and Perotti shock - Omit Crisis

Horizon	Linear	Large FS	Tight FS	p -value Diff.
1-year	0.54651	1.14114	0.53379	0.16038
	(0.07806)	(0.40017)	(0.08380)	
2-years	0.67261	1.21673	0.69745	0.22398
	(0.11321)	(0.34065)	(0.13816)	
3-years	0.70251	1.62939	0.71931	0.00001***
	(0.13626)	(0.17793)	(0.13992)	
4-years	0.75703	1.58922	0.79008	$1.16{\cdot}10^{-6***}$
	(0.16345)	(0.17858)	(0.18488)	
5-years	0.71765	1.80372	0.77752	0.00621***
	(0.24502)	(0.45168)	(0.22075)	
Signif. codes	0.01***	0.05**	0.1*	

TABLE 19. Fiscal Space-dependent Fiscal Multiplier: FS_2 Ramey News shock - Omit Crisis

Horizon	Linear	Large FS	Tight FS	p -value Diff.
1-year	0.63896	1.94393	0.44715	0.01460**
	(0.14066)	(0.58502)	(0.13637)	
2-years	0.74396	1.86138	0.71612	0.00533***
	(0.15074)	(0.40031)	(0.06716)	
3-years	0.85485	1.80166	0.80316	0.05382*
	(0.09304)	(0.49519)	(0.05158)	
4-years	0.87870	1.66456	0.85050	0.01837**
	(0.11012)	(0.32840)	(0.04357)	
5-years	0.97504	1.54585	0.92032	0.02200**
	(0.12487)	(0.26892)	(0.05141)	
Signif. codes	0.01***	0.05**	0.1*	

TABLE 20. Fiscal Space-dependent Fiscal Multiplier: FS_2 Blanchard and Perotti shock - Omit Crisis

Horizon	Linear	Large FS	Tight FS	p -value Diff.
1-year	0.54651	0.76758	0.49637	0.42038
	(0.07806)	(0.32950)	(0.05274)	
2-years	0.67261	1.26224	0.71170	0.07070*
	(0.11321)	(0.31148)	(0.05126)	
3-years	0.70251	1.64182	0.78839	0.00305***
	(0.13626)	(0.28023)	(0.04261)	
4-years	0.75703	1.99602	0.80259	0.00787*
	(0.16345)	(0.44734)	(0.04848)	
5-years	0.71765	3.54341	0.74643	0.53239
	(0.24502)	(4.48613)	(0.06969)	
Signif. codes	0.01***	0.05**	0.1*	

TABLE 21. Fiscal Space-dependent Fiscal Multiplier: FS_3 Ramey News shock - Omit Crisis

Horizon	Linear	Large FS	Tight FS	p -value Diff.
1-year	0.63896	0.27217	-1.89126	0.42092
	(0.14066)	(0.59703)	(2.53122)	
2-years	0.74396	1.16356	-0.32423	0.00670***
	(0.15074)	(0.23563)	(0.46379)	
3-years	0.85485	1.60680	0.37605	0.00003***
	(0.09304)	(0.20433)	(0.22082)	
4-years	0.87870	1.65308	0.33197	0.00806***
	(0.11012)	(0.30131)	(0.39214)	
5-years	0.97504	1.48477	-1.14925	0.63974
	(0.12487)	(0.41332)	(5.60615)	
Signif. codes	0.01***	0.05**	0.1*	

TABLE 22. Fiscal Space-dependent Fiscal Multiplier: FS_3 Blanchard and Perotti shock - Omit Crisis

Horizon	Linear	Large FS	Tight FS	p -value Diff.
5	0.54651	0.79592	0.39108	0.09210*
	(0.07806)	(0.24045)	(0.11518)	
9	0.67261	1.10331	0.43783	0.03523**
	(0.11321)	(0.24385)	(0.22482)	
13	0.70251	1.46096	0.43690	0.00878***
	(0.13626)	(0.23693)	(0.29317)	
17	0.75703	1.50260	1.07389	0.17138
	(0.16345)	(0.27861)	(0.17707)	
21	0.71765	1.59887	1.13084	0.27203
	(0.24502)	(0.33966)	(0.28495)	
Signif. codes	0.01***	0.05**	0.1*	

TABLE 23. Fiscal Space-dependent Fiscal Multiplier: FS_4 Ramey News shock - Omit Crisis

Horizon	Linear	Large FS	Tight FS	p -value Diff.
1-year	0.63896	4.85276	0.13557	0.06720*
	(0.14066)	(2.58132)	(0.22769)	
2-years	0.74396	2.38234	0.46661	0.00518***
	(0.15074)	(0.72015)	(0.12042)	
3-years	0.85485	2.06588	0.62613	0.01986**
	(0.09304)	(0.61290)	(0.14324)	
4-years	0.87870	1.96149	0.60623	0.01136**
	(0.11012)	(0.51298)	(0.15202)	
5-years	0.97504	2.07480	0.58778	0.00236***
	(0.12487)	(0.45158)	(0.22400)	
Signif. codes	0.01***	0.05**	0.1*	

TABLE 24. Fiscal Space-dependent Fiscal Multiplier: FS_4 Blanchard and Perotti shock - Omit Crisis

Horizon	Linear	Large FS	Tight FS	p -value Diff.
1-year	0.54651	1.14853	0.55512	0.15520
	(0.07806)	(0.40505)	(0.08777)	
2-years	0.67261	1.79567	0.69595	0.02435**
	(0.11321)	(0.48749)	(0.12827)	
3-years	0.70251	2.37696	0.69215	0.00233***
	(0.13626)	(0.54977)	(0.16690)	
4-years	0.75703	2.86686	0.75256	0.00029***
	(0.16345)	(0.58986)	(0.19760)	
5-years	0.71765	2.81454	0.71643	0.00011***
	(0.24502)	(0.53381)	(0.22694)	
Signif. codes	0.01***	0.05**	0.1*	

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Appendix A. Data

A.1. **Data table.** In Table 25, we show the time series used both for the estimation of our fiscal space proxies in Section 3 and the empirical analysis described in Section 4 . We provide also the sources where the data are retrieved with relative samples, the sections where the series are used and the transformation applied to them for both Sections 3 and 4.

Table 25. Data table

Variable	Sample	Source	Transformation & Usage
Government Spending (Real and Nominal)	1889:Q1-2015:Q4	Ramey and Zubairy (2018)	Sec. 3; Sec. 4: scaled by real trend GDP
Government Revenues (Real and Nominal)	1889:Q1-2015:Q4	Ramey and Zubairy (2018)	Sec. 3; Sec. 4: nominal over nom. GDP
Nominal GDP	1889:Q1-2015:Q4	Ramey and Zubairy (2018)	Sec. 3; Sec. 4
Real GDP	1889:Q1-2015:Q4	Ramey and Zubairy (2018)	Sec. 3; Sec. 4
Real Consumption	1919:Q1-1946:Q4	Gordon and Krenn (2010)	Sec. 4: growth rate
Real Consumption	1947:Q1-2015:Q4	FRED[a]	Sec. 4
Real Investment	1919:Q1-1946:Q4	Gordon and Krenn (2010)	Sec. 3; Sec. 4: growth rate
Real Investment	1947:Q1-2015:Q4	FRED	Sec. 3; Sec. 4
T-bill rate	1889:Q1-2015:Q4	Ramey and Zubairy (2018)	Sec. 3; Sec. 4
10-y Gov. bond yield	1889:Q1-1952:Q4	Shiller (1992)	Sec. 3; Sec. 4
10-y Gov. bond yield	1953:Q1-2015:Q4	Bloomberg	Sec. 3; Sec. 4
Federal debt	1889:Q1-2015:Q4	Ramey and Zubairy (2018)	Sec. 3; Sec. 4: nominal over lag nom. GDP
Deficit	1889:Q1-2015:Q4	Ramey and Zubairy (2018)	Sec. 3; Sec. 4: nominal over nom. GDP
Implicit GDP deflator	1889:Q1-2015:Q4	Ramey and Zubairy (2018)	Sec. 3; Sec. 4: in logarithm
Real Potential Output	1889:Q1-2015:Q4	CBO[b]	Sec. 3
Nominal Potential Output	1889:Q1-2015:Q4	CBO	Sec. 3
Government spending forecasts	2006:Q1-2015:Q4	CBO	Sec. 3
Government revenues forecasts	2006:Q1-2015:Q4	CBO	Sec. 3
Federal debt forecasts	2006:Q1-2015:Q4	CBO	Sec. 3
Real trend GDP[c]	1889:Q1-2015:Q4	Ramey and Zubairy (2018)	Sec. 4
Average marginal tax rate	1919:Q1-1949:Q4	Barro and Redlick (2011)	Sec. 4: *Federal individual income tax*, stacking
Average marginal tax rate	1950:Q1-2013:Q4	Mertens and Ravn (2013)	Sec. 4: *All tax units (series 1)*
NBER recession dates	1919:Q1-2015:Q4	FRED	Sec. 3
Unemployment rate	1889:Q1-2015:Q4	Ramey and Zubairy (2018)	Sec. 4; Sec. 3
Dividends	1929:Q1-1946:Q4	HSUS[d]	Sec. 3: cubic spline interpolation
Dividends	1947:Q1-2015:Q4	FRED	Sec. 3
Corporate profits before taxes	1929:Q1-1946:Q4	HSUS	Sec. 3: cubic spline interpolation
Corporate profits before taxes	1947:Q1-2015:Q4	FRED	Sec. 3
Gross wages and salaries	1929:Q1-1946:Q4	HSUS	Sec. 3: cubic spline interpolation
Gross wages and salaries	1947:Q1-2015:Q4	FRED	Sec. 3
Moody's Seasoned Aaa Corporate Bond Yield	1929:Q1-2015:Q4	FRED	Sec. 4
Moody's Seasoned Baa Corporate Bond Yield	1929:Q1-2015:Q4	FRED	Sec. 4

[a]Federal Reserve Economic Data (St. Louis FED)

[b]Congressional Budget Office

[c]The real GDP time trend is estimated as a sixth-degree polynomial for the logarithm of GDP, from 1889Q1 through 2015Q4.

[d]Historical Statistics of the United States. Series from HSUS are at annual frequencies and they are interpolated to quarterly frequencies by cubic spline.

A.2. FS_2**: Maximum tax rates and tax base series.** In order to compute approximated government maximum revenues, we use the peak tax rates as derived in Trabandt and Uhlig (2011) to compute an approximation of the government maximum revenues. In their paper, the authors characterize the Laffer curves for capital and labour quantitatively for the US and several EU countries by comparing the balanced growth paths of a neoclassical growth model with constant Frisch elasticity preferences. Moreover, the authors implement a dynamic scoring analysis to explore how tax revenues and production adjust when labour and/or capital income taxes change and which portion of labour and/or capital tax cuts is self-financing. The Laffer curve for consumption taxes does not have a peak and is always increasing (approaching a tax rate of infinity). Hence, we replicate their results using an intertemporal elasticity of substitution (η in Table 26) equal to 2 and a Frisch elasticity (φ in Table 26) equal to 3. For what concerns the consumption tax rate, we take the nearest half-point maximum rate among the tax rates reported in Table 27 as it appears in Trabandt and Uhlig (2011). The maximum tax rates for labour (τ_n), capital (τ_k) are reported in Table 26. Lastly, we take dividends and corporate profits before taxes, wages and salaries before taxes and the portion of disposable income not destined to savings as proxies for the tax base series for capital, labour and consumption respectively. The data sources used for the tax base series are the Historical Database for the United States (HSUS) and FRED (see Table 25 in Appendix A for details).

TABLE 26. Characterization of US Laffer Curves for capital and labour (Dynamic Scoring at steady state, $\eta = 2$ and $\varphi = 3$).

% self-fin.		max. τ_k		max. add. tax rev.	
same	varied	same	varied	same	varied
60	56	60	65	4	5
% self-fin.		max. τ_n		max. add. tax rev.	
same	varied	same	varied	same	varied
49	47	52	53	14	16

TABLE 27. Consumption tax rates in % across years (Trabandt and Uhlig, 2011).

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
USA	5.1	5.1	5.0	5.0	4.9	4.8	4.6	4.5	4.5	4.4	4.5	4.4	4.2

Appendix B. Debt multiplier adjustment

Since we compute the multipliers for output, consumption, investment and public debt using the technique described in Section 4, the latter multiplier needs an *ex-post* adjustment given that public debt is not scaled by trend GDP (real). First, we assume that

$$\sum_{h=1}^{H} \frac{Debt^N_{t+h}}{GDP^N_{t-1+h}} \approx \sum_{h=1}^{H} \frac{Debt^R_{t+h}}{GDP^R_{t-1+h}}, \tag{Ass. I}$$

where the superscripts N and R indicate nominal and real variables, respectively. Second, we assume that the ratio of real GDP (but also its lag) and trend GDP is approximately constant,

$$\frac{GDP^R_{t-1+j}}{Trend^{GDP^R}_{t+j}} \approx \kappa_h, \;\; j = 0, \ldots, h \tag{Ass. II}$$

Indeed, κ_h oscillates around 1 over the impulse response horizon with very little variation. Thus, following the strategy described in Section 4, we regress cumulative debt over lagged GDP (nominal) on cumulative government spending scaled by trend output (real) as follows:

$$\sum_{j=0}^{h} \frac{Debt^N_{t+j}}{GDP^N_{t-1+j}} = \alpha_h + m_h \sum_{j=0}^{h} g_{t+j} + \psi_h(L)\mathbf{X}_{t-1} + u_{t+h}, \tag{B.I}$$

where m_h represents the one-step cumulative multiplier for debt for each h. However, we are interested in finding the multiplier $\hat{m}_h$ such that, for each h,

$$\sum_{j=0}^{h} \frac{Debt^R_{t+j}}{Trend^{GDP^R}_{t-1+j}} = \hat{\alpha}_h + \hat{m}_h \sum_{j=0}^{h} g_{t+j} + \hat{\psi}_h(L)\mathbf{X}_{t-1} + \hat{u}_{t+h}. \tag{B.II}$$

We know that

$$\hat{m}_h = \frac{\partial \sum_{j=0}^{h} \frac{Debt^R_{t+j}}{Trend^{GDP^R}_{t+j}}}{\partial \sum_{j=0}^{h} g_{t+j}} \tag{B.III}$$

and that

$$m_h = \frac{\partial \sum_{j=0}^{h} \frac{Debt^N_{t+j}}{GDP^N_{t-1+j}}}{\partial \sum_{j=0}^{h} g_{t+j}} \tag{B.IV}$$

thus, we can rewrite Eq. B.III as follows,

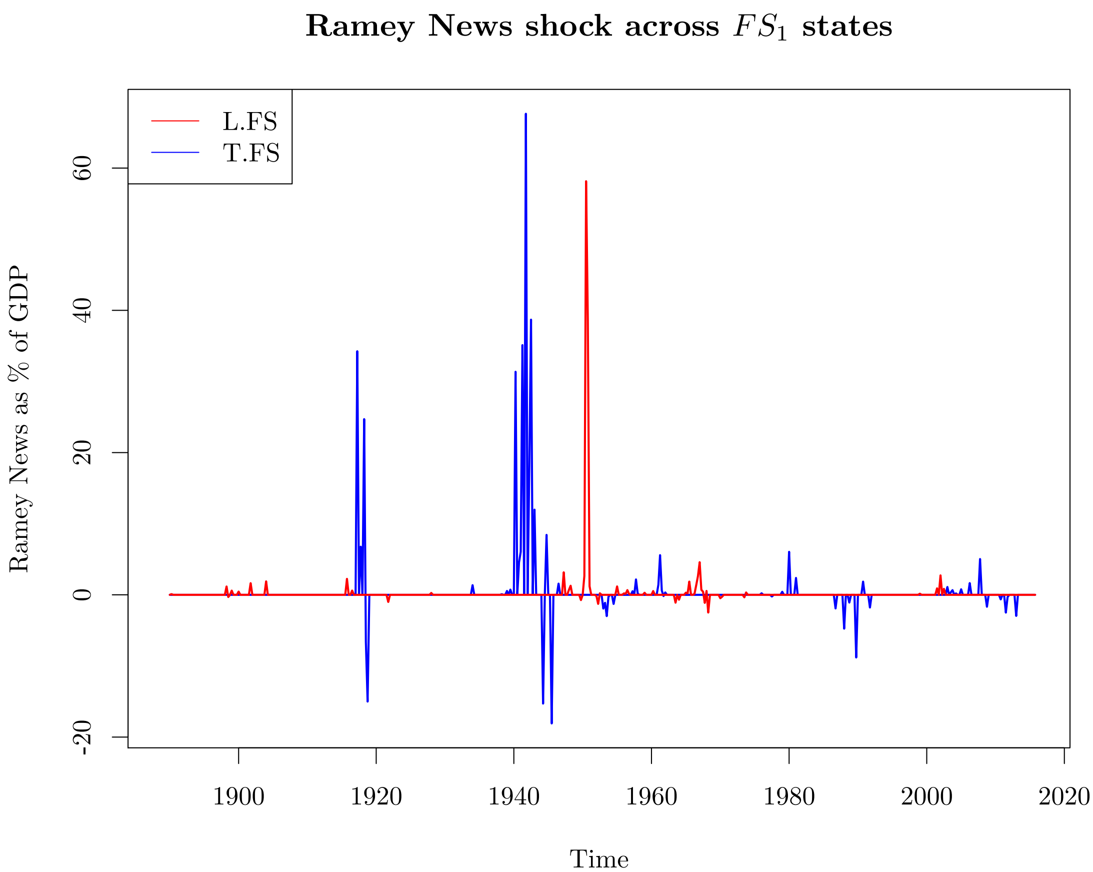
$$\hat{m}_h = \frac{\partial \sum_{j=0}^{h} \frac{Debt_{t+j}^{R}}{Trend_{t+j}^{GDP^R}}}{\partial \sum_{j=0}^{h} g_{t+j}} = \frac{\partial \sum_{j=0}^{h} \frac{Debt_{t+j}^{R}}{GDP_{t-1+j}^{R}} \frac{GDP_{t-1+j}^{R}}{Trend_{t+j}^{GDP^R}}}{\partial \sum_{j=0}^{h} g_{t+j}} \approx m_h \cdot \kappa_h \tag{B.V}$$

given Ass. I and Ass. II. Therefore, we adjust the debt multiplier following Eq. B.V. Note that the adjustment holds true also for the state-dependent case. Moreover, we adjust the standard error of the debt multiplier using standard delta methods.

APPENDIX C. DISTRIBUTION OF FISCAL SHOCKS ACROSS STATES

Figure 12 below reports the ratio between the Ramey instrument, used to identify exogenous fiscal expansions/contractions, and GDP, distinguishing between shocks in tight fiscal space (blue) and large fiscal space (blue). The picture shows that shocks are roughly balanced across regimes, in the sense that there is similar mass of fiscal policy shocks in periods of tight fiscal space and in periods of large fiscal sp ace. Looking at the two biggest shocks recorded by Ramey, one is in a period of fiscal s pace, while the other coincides with the large fiscal space period. The graph also shows that shocks are balanced between negative and positive signs. Shocks are instead less balanced in terms of magnitude. However, this is a well-known characteristic regarding shocks identified Ã la Ramey. Even in the linear analysis, WWII and the Korean war represent major fiscal policy shocks while the rest are much smaller in size. While we acknowledge this limitation, such problem is common to every paper employing the Ramey instrument, which is nonetheless one of the most common identification methods in fiscal policy.

FIGURE 12.



APPENDIX D. ADDITIONAL RESULTS ON THE FISCAL MULTIPLIER

D.1. **Federal Debt-to-GDP.** Tables 28 and 29 show the estimates for the fiscal multiplier according to the level of federal debt-to-GDP ratios. We define the state as *High Debt* (*Low Debt*) when the federal debt-to-GDP ratio is above (below) its historical median.[55] Consistently with Auerbach and Gorodnichenko (2017) and Huidrom et al. (2019), we find a multiplier that is higher in a low debt state. We do not find evidence to support a multiplier close to zero – or even negative – as in Ilzetzki et al. (2013). The multiplier is significantly different across the two states for most horizons when the shock series is instrumented with Ramey news; while we find no statistical significant difference using the Blanchard and Perotti shock (besides for the 5-years horizon multiplier).

[55]The historical median for federal debt-to-GDP ratio is equal to 32.85%.

TABLE 28. Fiscal Space-dependent Fiscal Multiplier: Federal Debt-to-GDP - Ramey News Shock (1929-2015)

Horizon	Linear	Low Debt	High Debt	p -value Diff.
1-year	0.64555	1.96134	0.70015	0.32558
	(0.15678)	(1.24905)	(0.19650)	
2-years	0.74378	1.58695	0.84027	0.35393
	(0.15380)	(0.46191)	(0.19793)	
3-years	0.84977	1.93751	0.91943	0.00057***
	(0.11385)	(0.19939)	(0.16250)	
4-years	0.87766	2.20669	0.90973	$6.03 \cdot 10^{-7***}$
	(0.11009)	(0.20368)	(0.15726)	
5-years	0.98316	1.68699	1.04301	0.01065**
	(0.14459)	(0.15720)	(0.17652)	
Signif. codes	0.01***	0.05**	0.1*	

TABLE 29. Fiscal Space-dependent Fiscal Multiplier: Federal Debt-to-GDP - Blanchard and Perotti Shock (1929-2015)

Horizon	Linear	Low Debt	High Debt	p -value Diff.
1-year	0.57740	0.03135	0.58395	0.47683
	(0.07776)	(0.75732)	(0.08169)	
2-years	0.72720	0.62630	0.86743	0.57475
	(0.10753)	(0.35351)	(0.12950)	
3-years	0.77148	1.22643	0.95096	0.26663
	(0.12386)	(0.16173)	(0.15893)	
4-years	0.82850	1.57550	1.01879	0.10046
	(0.15460)	(0.21285)	(0.22657)	
5-years	0.80963	1.50644	0.84209	0.01333**
	(0.19480)	(0.17706)	(0.18071)	
Signif. codes	0.01***	0.05**	0.1*	

D.2. Δ **Debt.** Tables 30 and 31 show the estimates for the fiscal multiplier according to the change in federal debt-to-GDP ratio. We define the state as *High* Δ *Debt* (*Low* Δ *Debt*) when the change in federal debt-to-GDP ratio is above (below) zero.[56] We find a multiplier that is higher in a decelerating debt state using Ramey news for the 4 and 5-years horizon. We find no statistical significant difference across states employing the Blanchard and Perotti shock.

[56]This value represents also the historical median other than the turning point between accelerating and decelerating debt.

TABLE 30. Fiscal Space-dependent Fiscal Multiplier: Change in Federal Debt-to-GDP - Ramey News Shock (1929-2015)

Horizon	Linear	Low Δ Debt	High Δ Debt	p -value Diff.
1-year	0.64555	0.75493	0.60510	0.62602
	(0.15678)	(0.23394)	(0.17767)	
2-years	0.74378	0.93194	0.78165	0.47637
	(0.15380)	(0.14717)	(0.14758)	
3-years	0.84977	1.08050	0.80710	0.10353
	(0.11385)	(0.11204)	(0.12705)	
4-years	0.87766	1.15485	0.82131	0.06296*
	(0.11009)	(0.12138)	(0.13819)	
5-years	0.98316	1.31979	0.83600	0.04028**
	(0.14459)	(0.16888)	(0.16059)	
Signif. codes	0.01***	0.05**	0.1*	

TABLE 31. Fiscal Space-dependent Fiscal Multiplier: Change in Federal Debt-to-GDP - Blanchard and Perotti Shock (1929-2015)

Horizon	Linear	Low Δ Debt	High Δ Debt	p -value Diff.
1-year	0.57740	0.95312	0.61212	0.02633**
	(0.07776)	(0.12153)	(0.05837)	
2-years	0.72720	1.08142	0.78136	0.12113
	(0.10753)	(0.15878)	(0.09679)	
3-years	0.77148	1.13838	0.81918	0.11319
	(0.12386)	(0.16953)	(0.11446)	
4-years	0.82850	1.17187	0.86669	0.34797
	(0.15460)	(0.30239)	(0.13098)	
5-years	0.80963	2.90419	0.84928	0.93328
	(0.19480)	(26.79590)	(0.13662)	
Signif. codes	0.01***	0.05**	0.1*	

D.3. **Interaction of ZLB and Fiscal Space state.** The two most remarkable periods of tight fiscal space are the Second World War and the Great financial Crisis jointly with its aftermath. These periods coincide with the most long-lasting periods under the zero lower bound. Thus, we estimate the multiplier depending on the interaction of the zero lower bound and tight fiscal space periods. We do so to see whether the presence of the zero lower bound biased our estimates. Tables 32 and 33 show no difference across states in the multiplier validating our baseline results.

TABLE 32. Fiscal Space-dependent Fiscal Multiplier: Interaction ZLB and FS_1 - Ramey News Shock (1929-2015)

Horizon	Linear	LFS & No ZLB	TFS & ZLB	p -value Diff.
1-year	0.64555	2.07650	1.01782	0.21670
	(0.15678)	(0.86684)	(0.41416)	
2-years	0.74378	1.43534	0.55875	0.16245
	(0.15380)	(0.46597)	(0.30145)	
3-years	0.84977	1.28415	0.74756	0.08978*
	(0.11385)	(0.24309)	(0.11227)	
4-years	0.87766	1.18503	0.11092	0.78251
	(0.11009)	(0.21641)	(3.44917)	
5-years	0.98316	1.21257	0.96030	0.22542
	(0.14459)	(0.20555)	(0.00684)	
Signif. codes	0.01***	0.05**	0.1*	

TABLE 33. Fiscal Space-dependent Fiscal Multiplier: Interaction ZLB and FS_1 - Blanchard and Perotti Shock (1929-2015)

Horizon	Linear	LFS & No ZLB	TFS & ZLB	p -value Diff.
1-year	0.57740	0.60104	0.37292	0.54738
	(0.07776)	(0.25408)	(0.25914)	
2-years	0.72720	0.78203	4.78244	0.66873
	(0.10753)	(0.19778)	(8.39845)	
3-years	0.77148	0.82977	1.64638	0.30290
	(0.12386)	(0.19360)	(0.78621)	
4-years	0.82850	0.81061	0.98918	0.53830
	(0.15460)	(0.20094)	(0.21637)	
5-years	0.80963	0.78085	2.73383	0.87672
	(0.19480)	(0.26161)	(12.56156)	
Signif. codes	0.01***	0.05**	0.1*	

D.4. **Slack.** We replicate the results in Ramey and Zubairy (2018) estimating the multiplier under recessions and expansions. Tables 34 and 35 show no statistical difference across states of slack and boom for the fiscal multiplier. This validates our empirical strategy and provides robustness for the results in Ramey and Zubairy (2018) given the different sample and the wider set of controls used in the present work.

TABLE 34. Fiscal Space-dependent Fiscal Multiplier: Recession and Expansion[a] - Ramey News Shock (1929-2015)

Horizon	Linear	Expansion	Recession	p -value Diff.
1-year	0.64555	0.92530	-0.61172	0.00541***
	(0.15678)	(0.25120)	(0.51275)	
2-years	0.74378	1.12149	-3.90960	0.03860**
	(0.15380)	(0.27101)	(2.03599)	
3-years	0.84977	1.23876	-1.92392	0.44267
	(0.11385)	(0.21261)	(3.79865)	
4-years	0.87766	1.43659	1.92033	0.75045
	(0.11009)	(0.26078)	(1.54041)	
5-years	0.98316	1.65454	0.02609	0.59480
	(0.14459)	(0.25525)	(3.05506)	
Signif. codes	0.01***	0.05**	0.1*	

[a]Unemployment > 8%

TABLE 35. Fiscal Space-dependent Fiscal Multiplier: Recession and Expansion - Blanchard and Perotti Shock (1929-2015)

Horizon	Linear	Expansion	Recession	p -value Diff.
1-year	0.57740	0.66432	0.69821	0.96562
	(0.07776)	(0.08819)	(0.65954)	
2-years	0.72720	0.77796	-1.87081	0.31921
	(0.10753)	(0.14893)	(2.56745)	
3-years	0.77148	0.90941	0.89519	0.96985
	(0.12386)	(0.21230)	(0.31763)	
4-years	0.82850	1.03321	0.90694	0.72403
	(0.15460)	(0.29877)	(0.21281)	
5-years	0.80963	0.93673	0.86724	0.85744
	(0.19480)	(0.37941)	(0.07089)	
Signif. codes	0.01***	0.05**	0.1*	

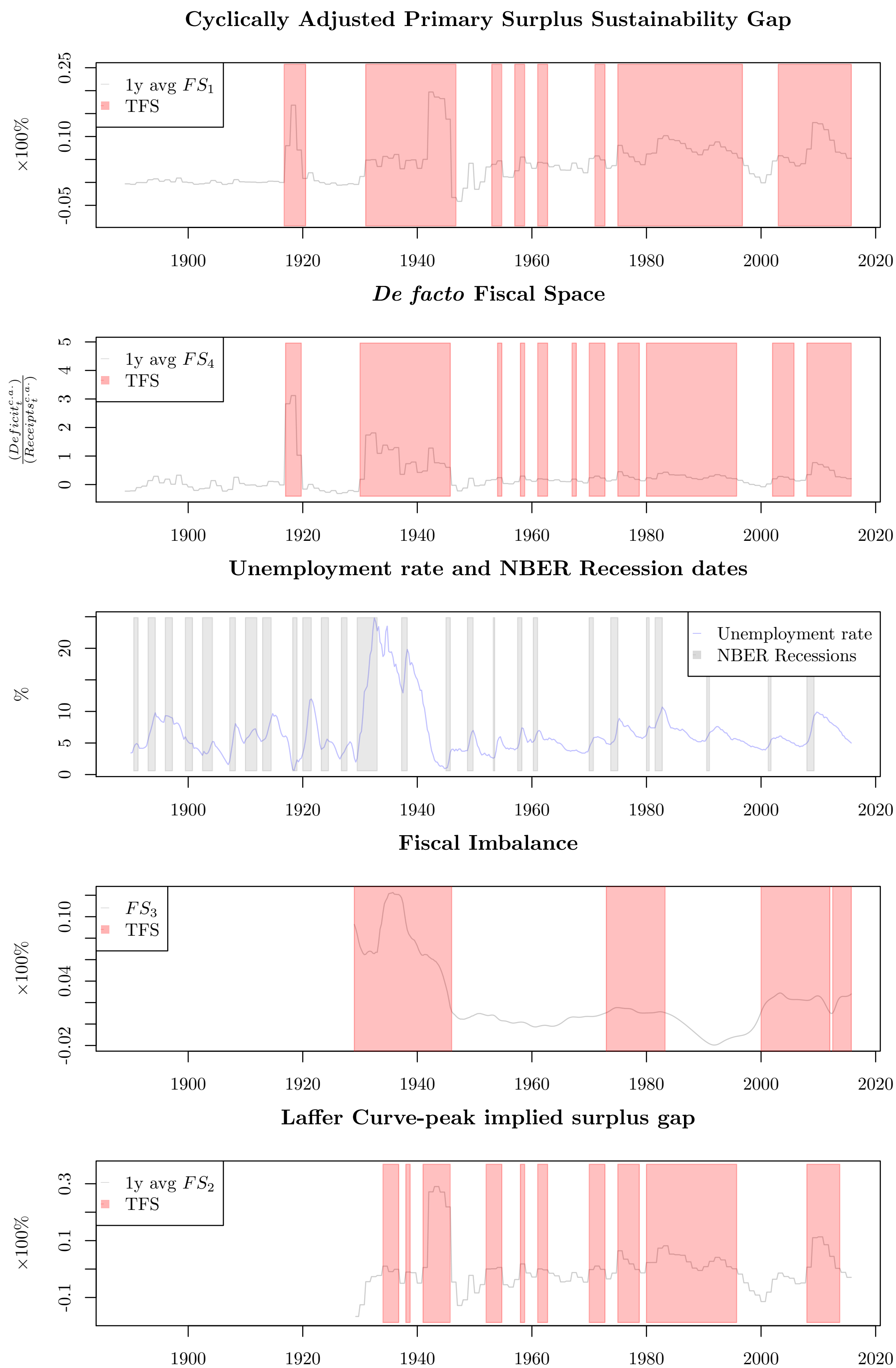
Appendix E. Additional Figures and Tables

Table 36. Bootstrapped correlations (95 % confidence interval) among Fiscal space, potential CBO output, unemployment rate, federal debt-to-GDP, change in debt, growth rate of debt series.

	Median	Lower bound	Upper bound
$\mathbb{C}orr(FS1_t, \tilde{y}_t)$	0.396	0.304	0.482
$\mathbb{C}orr(FS2_t, \tilde{y}_t)$	0.002	-0.112	0.112
$\mathbb{C}orr(FS3_t, \tilde{y}_t)$	-0.347	-0.416	-0.279
$\mathbb{C}orr(FS4_t, \tilde{y}_t)$	-0.002	-0.078	0.072
$\mathbb{C}orr(FS1_t, U_t)$	0.079	-0.0003	0.158
$\mathbb{C}orr(FS2_t, U_t)$	-0.042	-0.141	0.055
$\mathbb{C}orr(FS3_t, U_t)$	0.685	0.605	0.770
$\mathbb{C}orr(FS4_t, U_t)$	0.427	0.269	0.579
$\mathbb{C}orr(FS1_t, \frac{B}{GDP}_t)$	0.413	0.296	0.577
$\mathbb{C}orr(FS2_t, \frac{B}{GDP}_t)$	0.244	0.090	0.395
$\mathbb{C}orr(FS3_t, \frac{B}{GDP}_t)$	-0.084	-0.145	-0.026
$\mathbb{C}orr(FS4_t, \frac{B}{GDP}_t)$	0.131	0.039	0.222
$\mathbb{C}orr(FS1_t, \Delta B_t)$	0.394	0.312	0.470
$\mathbb{C}orr(FS2_t, \Delta B_t)$	0.242	0.140	0.337
$\mathbb{C}orr(FS3_t, \Delta B_t)$	-0.055	-0.102	-0.009
$\mathbb{C}orr(FS4_t, \Delta B_t)$	0.117	0.053	0.176

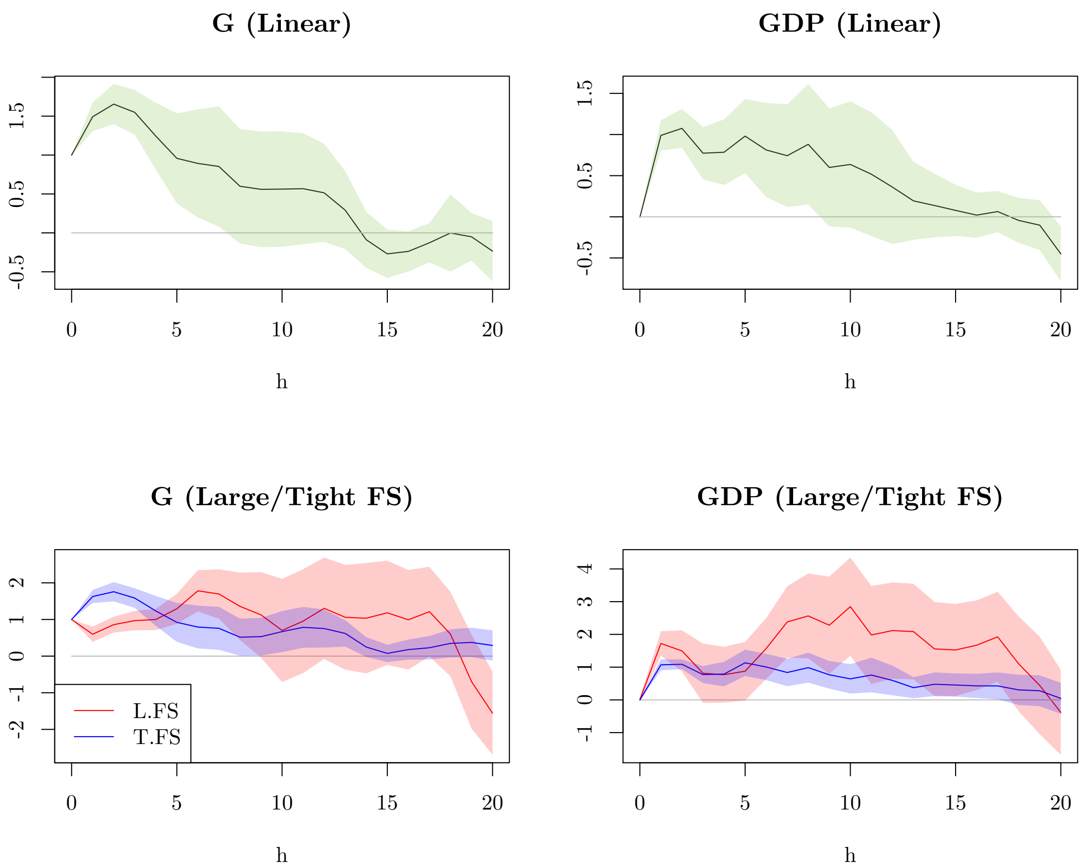
The Table shows the estimates for median non-parametric bootstrapped correlation coefficients and their intervals at the 95% confidence level. Intervals are calculated using the normal approximation. FSj_t $(j = 1, 2, 3, 4)$ are the fiscal space proxies, $\tilde{y}_t$ is the potential output (latest estimates from CBO), U_t is the unemployment rate, $\frac{B}{GDP}_t$ is the federal debt-to-GDP ratio and ΔB_t represents its change.

FIGURE 13. *FS* dummies and NBER recession dates.



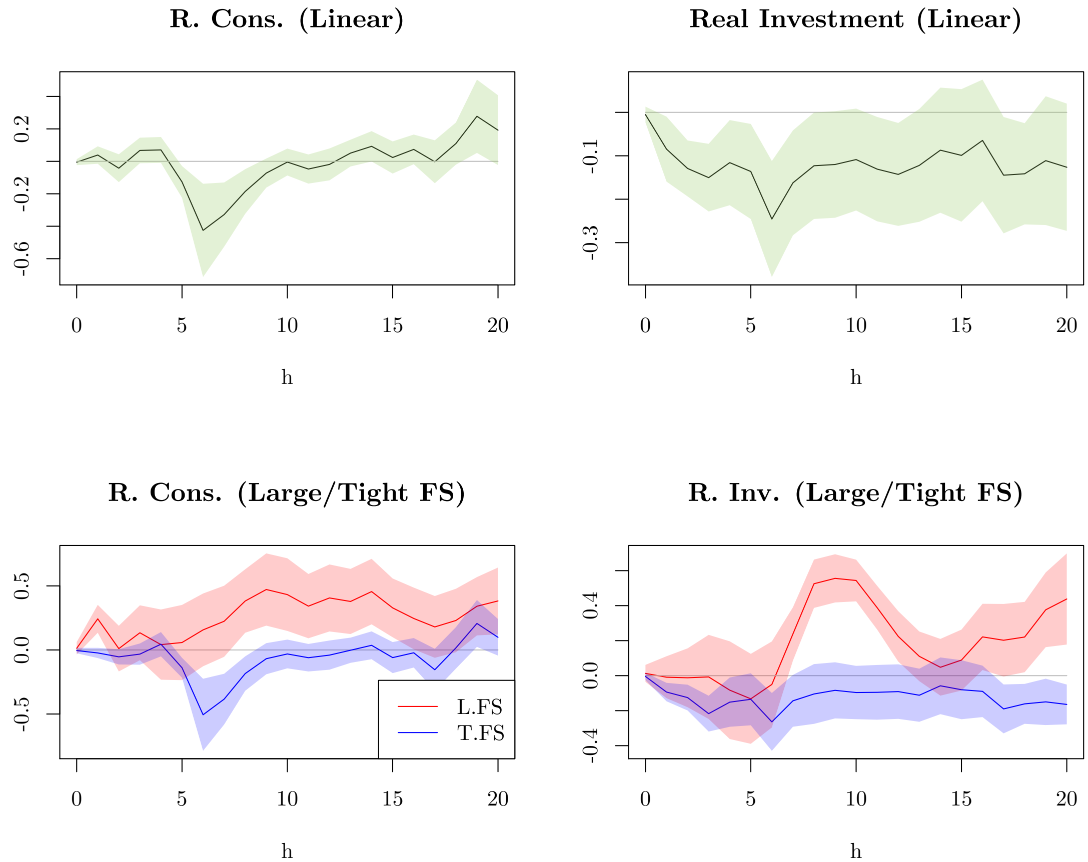
This figure shows the periods of Tight Fiscal Space via our *FS* state dummies and of Recessions (identifying recessions with NBER recession dates). See also Table 2 for more details.

FIGURE 14. G and GDP IRFs - FS_1 - Blanchard and Perotti (1929-2015)



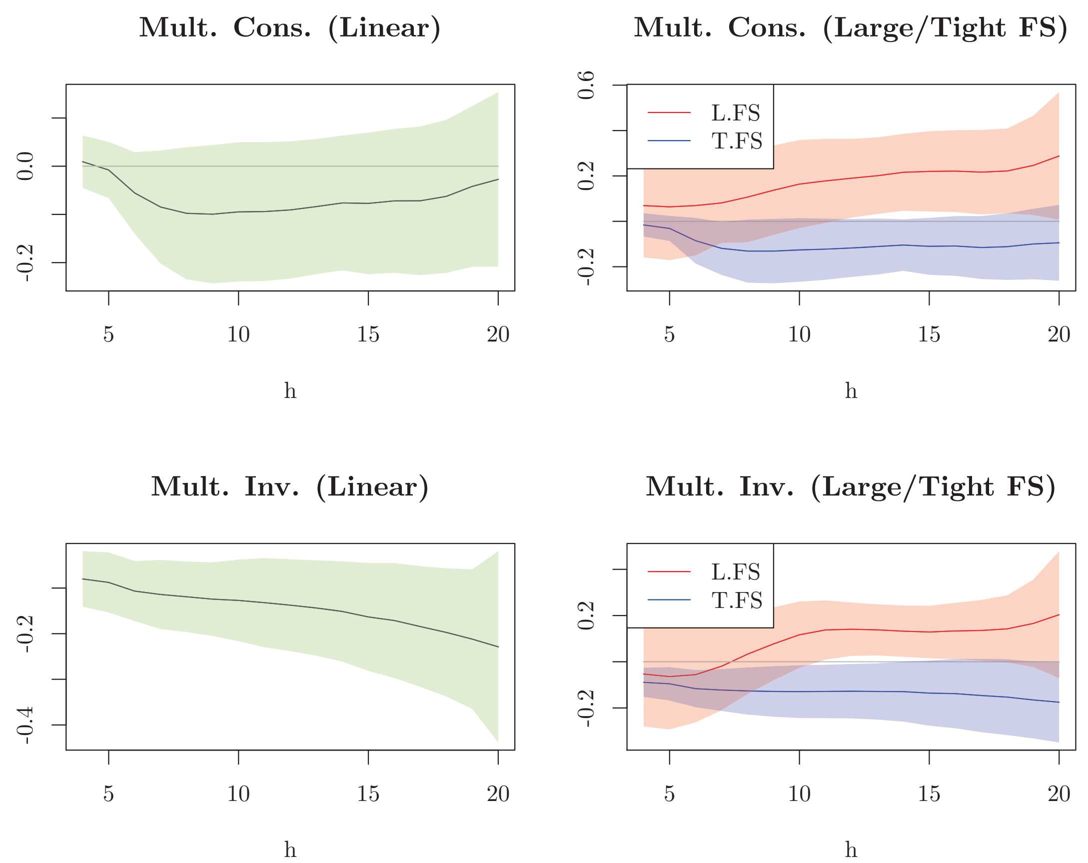
The Figure shows the estimates for the impulse response function of real government spending scaled by trend output (G) and real GDP scaled by trend output (GDP) following a Blanchard and Perotti shock.

FIGURE 15. C and I IRFs - FS_1 - Blanchard and Perotti (1929-2015)



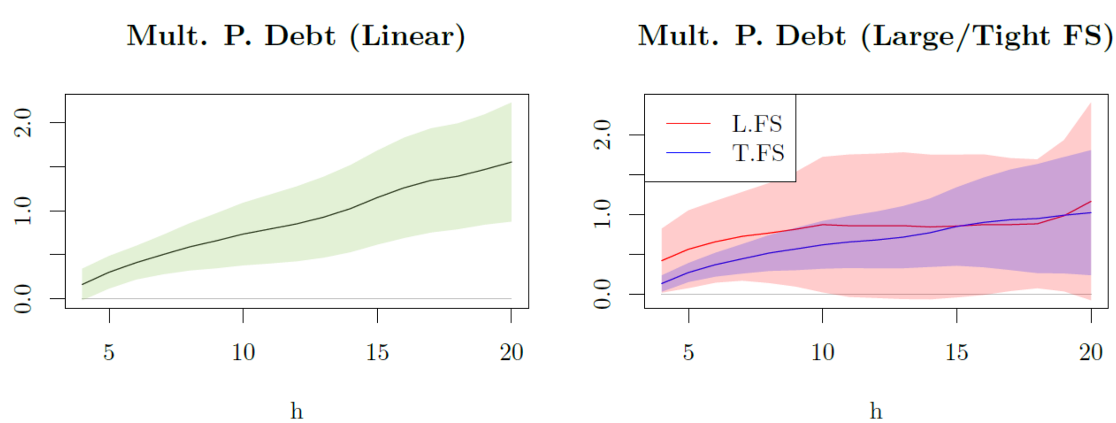
The Figure shows the estimates for the impulse response function of real consumption scaled by trend output (C) and real total private investment scaled by trend output (I) following a Blanchard and Perotti shock.

FIGURE 16. Cons. and Inv. multipliers - FS_1 - Blanchard and Perotti (1929-2015)



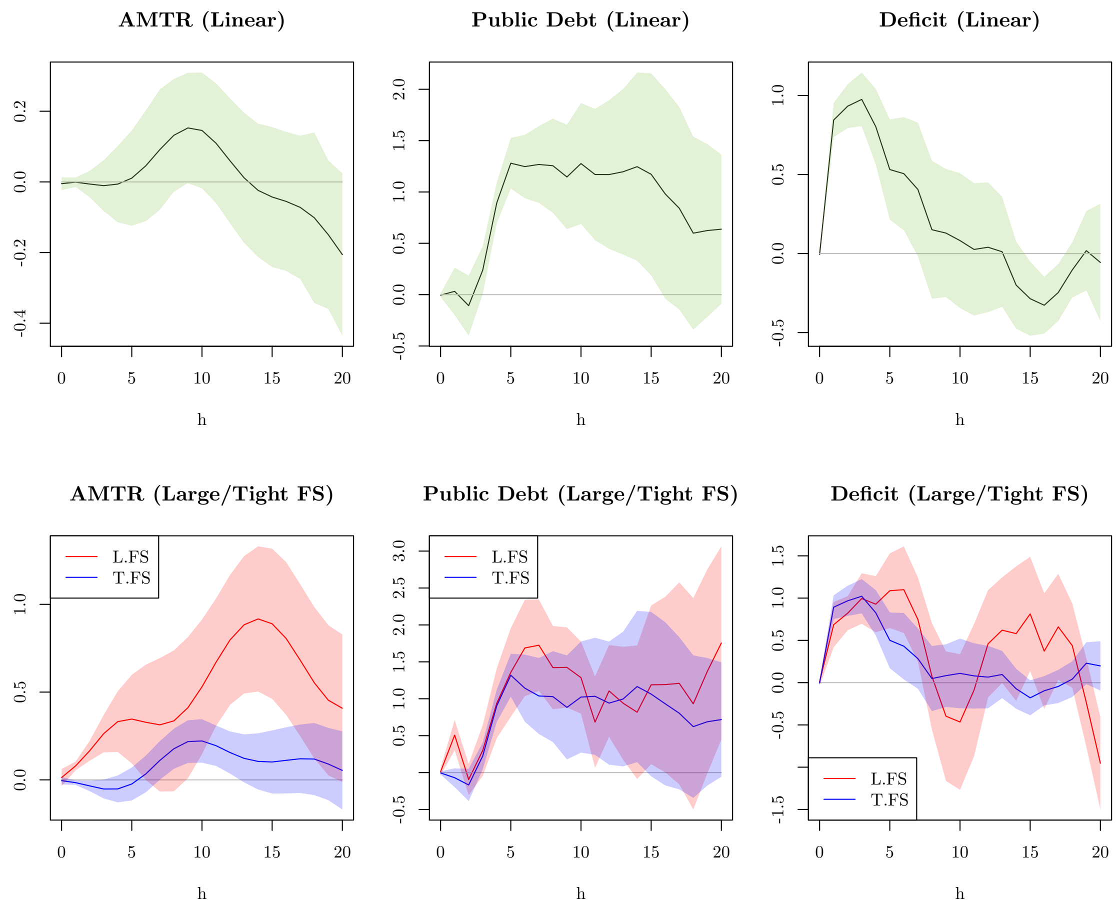
The Figure shows the estimates for the integral multiplier of real consumption and real total private investment.

FIGURE 17. Public debt multiplier - FS_1 - Blanchard and Perotti (1929-2015)



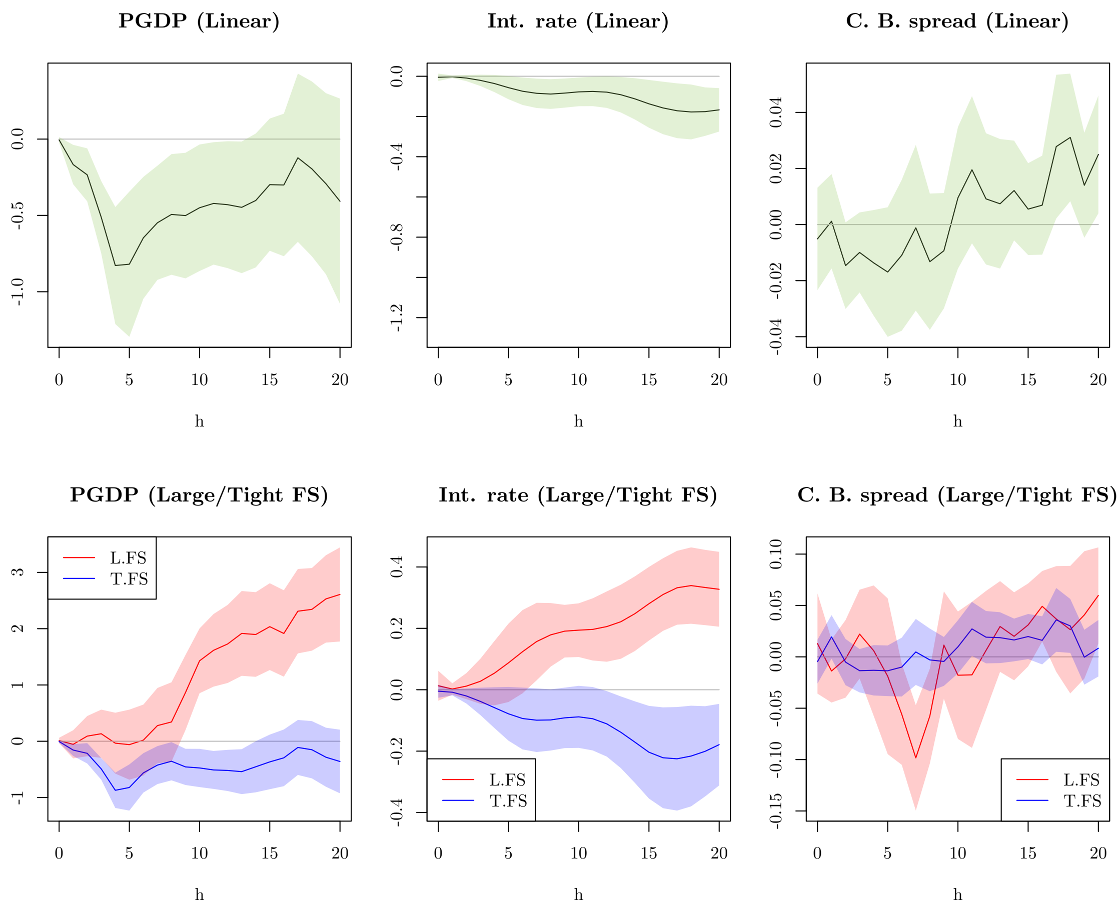
The Figure shows the estimates for the integral multiplier of federal debt. The correct multiplier is derived by adjusting the resulting 2SLS, see Appendix B for details.

FIGURE 18. $AMTR$, P. Debt, deficit IRFs - FS_1 - Blanchard and Perotti (1929-2015)



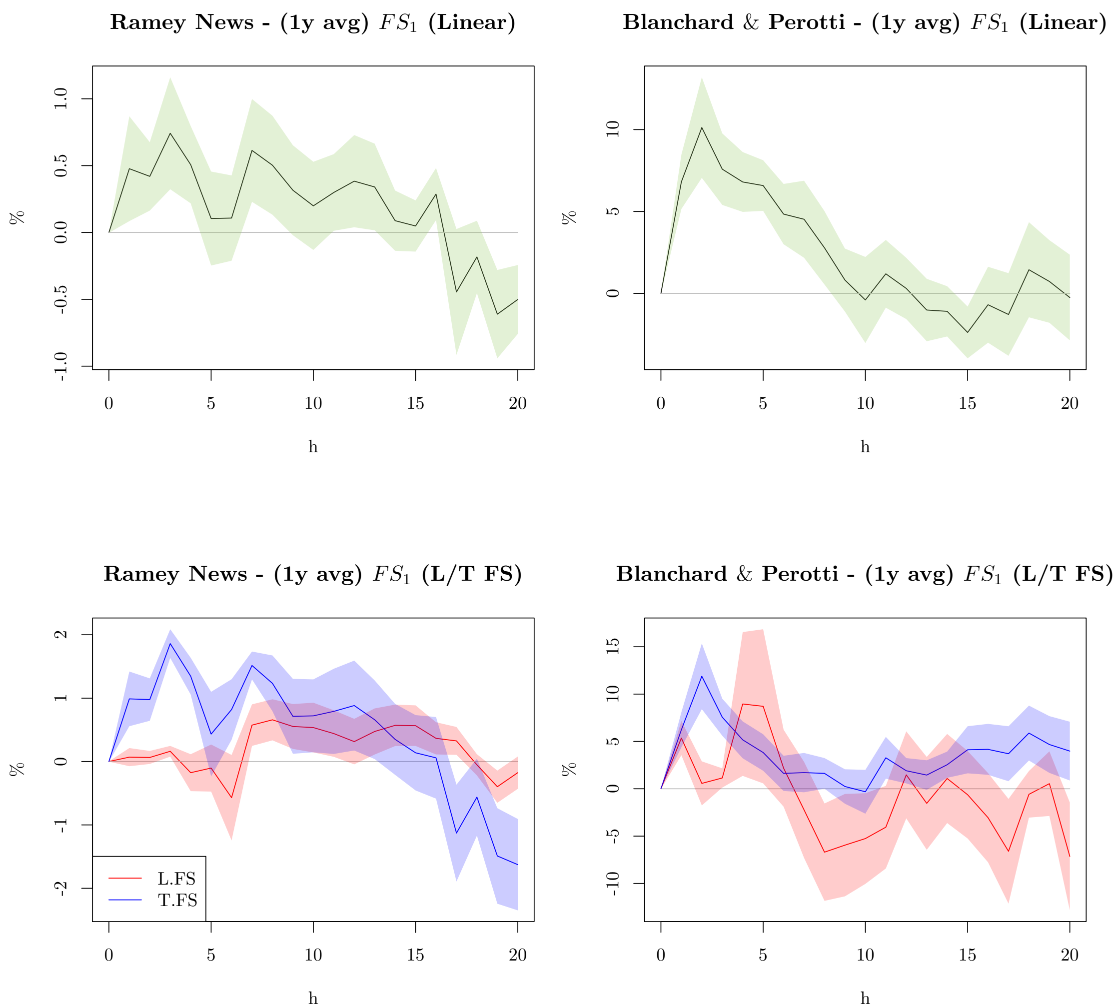
The Figure shows the estimates for the impulse response function of the average marginal tax rate as in Barro and Redlick (2011) and Bernardini and Peersman (2018) ($AMTR$), federal debt-to-lagged GDP, deficit-to-GDP following a Blanchard and Perotti shock.

FIGURE 19. $log(IPGDP)$, $Y10$, C.B. spread IRFs - FS_1 - Blanchard and Perotti (1929-2015)



The Figure shows the estimates for the impulse response function of the logarithm of the implicit price deflator ($log(IPGDP)$), 10-years government bond yield ($Y10$), corporate bond spread (C.B. spread) following a Blanchard and Perotti shock.

FIGURE 20. (1 year average) FS_1 (in real terms) IRFs - Ramey news and Blanchard & Perotti shock (1929-2015).



The Figure shows the estimates for the impulse response function of the Fiscal Space (1 year average) series (in real terms) following both a Ramey news and Blanchard & Perotti shock.

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