Is U.S. Fiscal Stimulus More Powerful in Recessions?*

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Abstract

This study investigates whether an increase in government spending can mitigate output losses during recessions, and compares its effects during expansions. Using U.S. data spanning several decades, we estimate a standard neoclassical growth model, incorporating frictions or wedges that vary over time. Our counterfactual analysis suggests that, although eliminating government spending does not significantly change the path of macroeconomic aggregates during recessions such as the 2008 Great Recession and recent COVID-19 pandemic, its effect becomes more pronounced during expansions. This implies that fiscal policy effectiveness has a procyclical pattern, indicating that its effect tends to strengthen the prevailing business cycle phase. In addition, we obtain cumulative government spending multipliers that are close to unity regardless of the state of the economy. Overall, our study supports the view that fiscal policy effectiveness remains quantitatively similar across different U.S. business cycle phases, consistent with the findings of Ramey and Zubairy (2018).

Keywords: Government spending; Business cycle accounting; Counterfactual analysis; Expansion and recession

JEL Classification: E13; E32; E62

*The authors are grateful to seminar participants at Sungkyunkwan University, Yonsei University, and Yonsei Macro-Finance-International Reading Group for their helpful comments and suggestions. Any errors and omissions remain the sole responsibility of the authors. Shim gratefully acknowledges financial support from Yonsei University and Yongwoon Scholarship Foundation (Yonsei-Yongwoon Research Grant No. 2023-11-1234).

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1 Introduction

"The effectiveness of fiscal policy in stimulating economic activity has been a topic of debate among economists for decades."

– Janet Yellen

Fiscal policy's primary goal is to mitigate economic fluctuations, suggesting that its effectiveness is countercyclical in nature. The effectiveness of fiscal policy, which is mainly associated with government spending decisions, in stimulating economic activity has long been a subject of extensive debate in the field of macroeconomics. The debate centers around the degree to which changes in government spending affect aggregate demand and overall economic activity.[1] Some economists argue that fiscal policy can be a potent tool for influencing economic activity, particularly during periods of recession or sluggish growth, by boosting aggregate demand through increased government spending or tax cuts. Others contend that fiscal policy effectiveness is limited, and its impact may be offset by factors such as crowding out private investment or delayed effects.

Thus, consensus on whether such a policy can achieve its intended goal remains elusive. For instance, Auerbach and Gorodnichenko (2012) show that increased government spending boosts output, particularly during recessions, thereby aligning with the policy's intended nature. Christiano, Eichenbaum, and Rebelo (2011) similarly illustrate that fiscal policy can be more powerful during recessionary periods when conventional monetary policy is limited. Conversely, several studies, including that by Ramey and Zubairy (2018), argue that the effects of fiscal policies are acylical.[2] We seek to contribute to the existing literature by investigating the effectiveness of government spending when it is necessary. The study employs a business cycle accounting (BCA) framework proposed by Chari, Kehoe, and McGrattan (2007), distinguishing our study from previous research.

The pioneers of the BCA methodology, Chari et al. (2007), identify what drives economic fluctuations by comparing actual with simulated data generated from a quantitative neoclassical business cycle model that incorporates time-varying wedges. Subsequently, Meza (2008) adapts this approach to analyze Mexican data, investigating whether contractionary fiscal policies implemented during the 1995 economic contraction, following the 1994 financial crisis, exacerbated the downturn. The essence of the BCA approach to assessing fiscal policy effec-

[1] Debates over fiscal policy effectiveness are often related to questions regarding the magnitude of fiscal multipliers, the timing and composition of government spending, and the interaction between fiscal and monetary policy.

[2] Ramey and Zubairy (2018) use historical U.S. data spanning numerous major wars and severe economic downturns and show that the effects of scal policy are not inherently countercyclical.

tiveness appears to be straightforward; it involves constructing a counterfactual economy devoid of government policy and then estimating the differences in outcome variables, such as GDP. In our analysis, a counterfactual experiment serves as the key element for evaluating the relative importance of fiscal policy, a methodology not easily achievable in previous studies that employed conventional empirical models, such as vector autoregressive (VAR) models, to examine the effects of government spending.

Although we employ the BCA framework, our study differs from that of Chari et al. (2007) in two main ways. First, we disaggregate the government spending wedge into two distinct components—i) government consumption and ii) net exports wedges—whereas they treat these as a single wedge. Second, our analysis encompasses aggregate data spanning from the first quarter of 1959 to the second quarter of 2021, extending beyond the original dataset Chari et al. (2007) employ, which covered the first quarter of 1959 to the fourth quarter of 2004. To investigate the effect of government spending, we simulate a counterfactual economy using the following steps. First, we estimate the VAR process of wedges via maximum likelihood estimation. Second, we employ the first-order perturbation method to solve the model and extract wedges that drive fluctuations in the key macroeconomic variables observed in the data. After constructing the wedges, we generate a counterfactual path for output variables by substituting the government spending wedge with a constant series. We segment the sample period into expansionary and recessionary episodes to explore the cyclicality of fiscal policy effectiveness.

Our key findings are as follows. First, throughout most recessions dating back to the 1980s, eliminating government spending did not substantially alter the output path, although the impact was slightly more pronounced during the 2001 and 2008 recessions. For instance, without government spending during the recession, GDP decreased by an additional 0.7 percentage points at the trough. Conversely, during periods of economic expansion, the effects were significantly intensified. Notably, between 2010 and 2019, the government spending wedge was largely negative, and counterfactual simulations suggest that output would have surged by approximately 1.5 percent at its peak. Together, these observations indicate that the effectiveness of government spending in the U.S. was procyclical rather than countercyclical, signifying that the impact of fiscal policy tends to align with the current stage of the economic cycle.[3] Lastly, we obtain a cumulative government spending multiplier that is close to unity during each recession and expansion, ranging from 0.9 to 1.1 with little variation. Overall, our study supports the view that fiscal policy effectiveness remains quantitatively similar across various business cycle phases, consistent with Ramey and Zubairy (2018)'s findings.

The remainder of this paper is organized as follows. Section 2 presents a comprehensive review of existing literature, outlining the distinctions and contributions of our study com-

[3]The procyclical nature of fiscal policy effectiveness suggests that policymakers tend to respond to economic conditions in a manner that reinforces the prevailing trend in the business cycle.

pared with previous studies. Section 3 introduces the data used in our analysis and the BCA framework, as well as its procedure and implementation. Section 4 presents our main findings, which we thoroughly discuss in comparison to those of previous studies. Section 5 provides concluding remarks.

2 Related literature

Our quantitative analysis contributes significantly to two distinct strands of literature. First, the BCA procedure employed in our analysis has been widely used to identify key drivers behind specific economic downturns.[4] Cho and Doblas-Madrid (2013), for instance, comprehensively analyze 23 global financial crises, revealing the distinct influences of various time-varying wedges on crises, with Asian and other crises characterized by different combinations of these factors. Similarly, Meza (2008) points out the quantitative significance of reduced government spending during the 1995 Mexican crisis. Kersting (2008) finds that distortions in the labor-leisure decision played a notable role during two specific periods in the UK's economic history: the recession in the early 1980s and the subsequent recovery. Ohanian (2010) provides evidence that the 2008 Great Recession is remarkably different from other postwar U.S. recessions.

In addition, Brinca, Chari, Kehoe, and McGrattan (2016) apply the BCA methodology to analyze the 2008 global financial crisis across OECD countries. Their study reveals how different time-varying wedges distinctly contributed to explaining the main drivers of the crisis. Although our analysis employs the same analytical framework used in these previous studies, it is distinguished from prior research by its direct assessment of government spending effectiveness, achieved by leveraging an extensive U.S. dataset. By examining longer periods, we investigate whether Chari et al. (2007)'s assertions regarding the insignificance of government spending as a driver of business cycles still hold. Given the substantial role that fiscal policy has played in recent recessions, such as the 2008 Great Recession and 2020 COVID-19 recession, our analysis can shed new light on the study of fiscal policy effectiveness by employing the BCA framework.

Second, we contribute to the extensive body of research on government spending and its multiplier effects. Blanchard and Perotti (2002) estimate a structural VAR model to examine the dynamic effects of government spending shocks, and Ramey (2012) shows that expectations about government spending should be included in the VAR framework. In the aftermath of the 2008 Great Recession, many studies investigated state-dependent output responses to government spending shocks, although a consensus on its existence remains elusive. Prominent previous research on this important issue includes studies by Auerbach and Gorodnichenko

[4] Brinca, Costa Filho, and Loria (2020) provide a complete survey of this literature.

(2012) and Ramey and Zubairy (2018). In a related study, Fazzari, Morley, and Panovska (2015) provide empirical results, which indicate that the impact of fiscal policy varies depending on the state of the economy, with a more pronounced and enduring effect when economic conditions indicate significant slack. Owyang, Ramey, and Zubairy (2013) find that government spending multipliers in the U.S. tend to be below unity during periods of elevated unemployment, that is, when resources are idle.

Crafts and Mills (2013) generate defense news shocks for the United Kingdom and obtain government spending multipliers using quarterly data spanning from 1922 to 1938. Their findings reveal government spending multipliers consistently below unity, even in periods with near-zero interest rates. Caggiano, Castelnuovo, Colombo, and Nodari (2015) estimate nonlinear VARs to investigate the extent of government spending multipliers in the U.S. Based on a conventional classification of "recessions vs. expansions" in U.S. business cycle phases, their findings do not support the concept of a countercyclical government spending multiplier, suggesting that government spending tends to reinforce or amplify the business cycle's prevailing phase.

In addition, studies have emerged that employ the dynamic stochastic general equilibrium (DSGE) modeling framework. For instance, Christiano et al. (2011) show that the government spending multiplier can exceed unity when interest rates are constrained at the zero lower bound. Shen and Yang (2018) demonstrate that it becomes larger when downward nominal wage rigidity constraints bind during recessions. Canzoneri, Collard, Dellas, and Diba (2016) show that fiscal multipliers can significantly depend on the state of the economy, with fiscal expansions during recessions potentially resulting in fiscal multipliers exceeding two.

Thus, fiscal policy effectiveness in recessions and expansions remains a subject of ongoing debate among economists and policymakers alike. While some argue that fiscal policy can play a crucial role in stabilizing economies during recessions and promoting long-term growth during booms, others raise concerns about its potential drawbacks, including debt accumulation and market distortions. That is, economists' views diverge regarding the extent to which fiscal policy can effectively address economic challenges during recessions and sustain growth during periods of expansion. This discussion also addresses whether fiscal policy effectiveness demonstrates a procyclical or countercyclical pattern in recessions and expansions.

Motivated by this lack of consensus, our study investigates the effectiveness of government spending across expansionary and recessionary periods by employing the BCA framework—a novel approach within this literature. Leveraging the equivalence principle, the BCA approach is more robust against misspecifications compared with pure model-based methods. Furthermore, we can quantify the impact of government spending through counterfactual simulations, which, without making additional assumptions, are unattainable through conventional empirical analyses.

3 The model and business cycle accounting procedure

3.1 The model

In this section, we provide an overview of the BCA methodology, which is the primary tool used to conduct counterfactual analysis. The BCA procedure was initially proposed by Chari et al. (2007) to identify the primary sources of aggregate fluctuations and assist researchers in constructing parsimonious quantitative models capable of generating business cycles that closely resemble real data. Built on the equivalence principle, wherein a prototype neoclassical growth model with four varying wedges (such as efficiency, labor, investment, and government spending) equates to models featuring numerous frictions, the BCA procedure extracts the underlying evolution of the wedges responsible for the observed fluctuations in the data. By generating a counterfactual trajectory of macroeconomic aggregates that removes specific wedges, our study investigates the relative importance of various shocks or frictions in generating business cycles. Specifically, based on this framework, we explore the effectiveness of time-varying government spending throughout the history of the U.S. This involves conducting a counterfactual analysis that eliminates government spending and quantifying the impact of the time-varying government spending wedge for important episodes in the U.S.

The model employed in our analysis is a stochastic neoclassical growth model featuring five wedges, distinct from the four wedges outlined by Chari et al. (2007).[5] To precisely assess government spending's contribution to the overall economy, we decompose the initial government consumption wedge as outlined by Chari et al. (2007). This decomposition entails separating the original wedge into two distinct components: i) government consumption and ii) net exports. Within the model economy, identical households strive to maximize expected utility derived from per capita consumption (c_t) and per capita labor (l_t), subject to budget constraints and the law of motion for capital as given below:

$$\max_{c_t,l_t,x_t,k_{t+1}} \mathrm{E}_0 \sum_{t=0}^{\infty} \beta^t \left(\frac{(c_t(1-l_t)^{\psi})^{1-\sigma}-1}{1-\sigma} \right) N_t$$

$$s.t$$

$$c_t + (1+\tau_{x,t})x_t = (1-\tau_{l,t})w_t l_t + r_t k_t + \pi_t + T_t$$

$$(1+\gamma_n)k_{t+1} = (1-\delta)k_t + x_t$$

[5]Our analysis considers five wedges, including i) efficiency, ii) labor, iii) investment, iv) government consumption, and v) net exports, whereas Chari et al. (2007) focus on wedges i) to iv) in their analysis by combining iv) government consumption and v) net exports wedges into a single wedge.

where w_t and r_t represent the wage and real interest rates, respectively. k_t denotes per capita physical capital, which serves as the sole saving instrument in this economy. In addition, x_t denotes per capita investment and T_t signifies the lump-sum tax. N_t refers to the total population, which grows at a constant rate of γ_n (≥ 0). σ and ψ denote the inverse of the elasticity of substitution and time allocation parameters, respectively. δ, which falls within the range of $(0, 1)$, signifies the rate of depreciation of physical capital. Last, $\tau_{l,t}$ and $\tau_{x,t}$ represent the labor and investment wedged, respectively, which introduce distortions into the household's decision-making process concerning labor supply and consumption-saving choices.

A representative firm solves the following profit maximization problem:

$$\max \pi_t = k_t^{\theta} \left((1+\gamma_z)^t z_t l_t \right)^{1-\theta} - w_t l_t - r_t k_t$$

where $\theta \in (0, 1)$ denotes the capital income share, while $\gamma_z \geq 0$ denotes the growth rate of labor-augmenting technology. The term $z_t^{1-\theta}$ indicates an efficiency wedge that generates the gap between the production function and output.

By slightly bending the conventions of notation, where all quantity variables are expressed in efficiency labor units, we can derive the first-order conditions that characterize the competitive equilibrium as follows:

$$c_t + x_t + g_t + nx_t = y_t \tag{1}$$

$$(1+\gamma_z)(1+\gamma_n)k_{t+1} = (1-\delta)k_t + x_t \tag{2}$$

$$y_t = k_t^{\theta}(z_t l_t)^{1-\theta} \tag{3}$$

$$w_t = (1-\theta)k_t^{\theta} l_t^{-\theta} z_t^{1-\theta} \tag{4}$$

$$\psi \frac{c_t}{1-l_t} = (1-\tau_{l,t})w_t \tag{5}$$

$$\begin{aligned} &(1+\tau_{x,t})c_t^{-\sigma}(1-l_t)^{\psi(1-\sigma)} \\ &= \beta(1+\gamma_z)^{-\sigma}\mathrm{E}_t \left(c_{t+1}^{-\sigma}(1-l_t)^{\psi(1-\sigma)} (\theta k_{t+1}^{\theta-1}(z_{t+1}l_{t+1})^{1-\theta} + (1-\delta)(1+\tau_{x,t+1})) \right) \end{aligned} \tag{6}$$

$$\mathbf{s}_t = \mathbf{P}_0 + \mathbf{P}_1 \mathbf{s}_{t-1} + \boldsymbol{\varepsilon}_t, \quad \mathbf{s}_t = (z_t, \tau_{l,t}, \tau_{x,t}, g_t, nx_t) \tag{7}$$

Equations (1)–(6) describe the competitive equilibrium in this economy. Equation (1) illustrates the economy's resource constraint, with g_t and nx_t denoting the exogenous government spending and net exports wedges, respectively. Equation (2) is the law of motion for capital, factoring in exogenous growth adjustments. Equation (3) describes the production function, and Equation (4) is the labor demand equation. Equations (5) and (6) correspond to the labor supply and consumption equations of representative households, respectively.

Equation (7) is the VAR process that describes the wedge dynamics. Following Chari et al. (2007), we posit that these wedges follow a VAR (1) process, enabling each wedge to be correlated with others. Specifically, z_t represents the efficiency wedge, which generates the disparity between used inputs and aggregate output. While the efficiency wedge exactly mirrors the canonical labor-augmenting total factor productivity (TFP) shock, it can also emerge endogenously from financial frictions or market structure impediments. Thus, the efficiency wedge (z_t) should be perceived as a higher-level mechanism encompassing all frictions that contribute to the gap between inputs used and aggregate output.

The labor wedge ($\tau_{l,t}$) denotes the friction that distorts the canonical labor supply equation for households. Similar to the efficiency wedge, the labor wedge resembles the labor income tax. However, beyond labor income tax fluctuations, the labor wedge may stem from price or wage markup oscillations due to stickiness and financial frictions that restrain firms from optimally choosing labor demand. In addition, the investment wedge ($\tau_{x,t}$) captures shocks or frictions distorting the general intertemporal Euler equation. Potential structural interpretations of the investment wedge include investment adjustment costs or collateral constraints.[6] Finally, g_t and nx_t signify exogenous variations in government spending and net exports, respectively.

3.2 The business cycle accounting procedure

We employ the model to conduct a counterfactual simulation using the following steps. Initially, we fix some deep parameters and then estimate the parameters of the VAR process of wedges using maximum likelihood estimation.[7] Subsequently, we solve the model using the first-order approximation method and extract the wedges that generate fluctuations in the macroeconomic aggregates observed in the data.

To elaborate, we construct a dynamic path of capital using investment data and the law of motion for capital in Equation (2). From this, we derive the efficiency wedge using the log linearized production function in Equation (3). In addition, the government spending and net exports wedges are directly derived from their respective data counterparts. A consumption series is then constructed from the aggregate resource constraint in Equation (1). Using the data for output (y_t), hours worked (l_t), and the constructed consumption series, we recover the labor wedge through labor supply and demand equations (Equations (4) and (5)).

However, extracting the investment wedge series that appears in the intertemporal Euler equation remains challenging because the investment wedge cannot be directly obtained from equations. This is due to the presence of future consumption and capital expectations in the right-hand side of Equation (6). Therefore, we resort to using the policy function for invest-

[6] Refer to Brinca et al. (2020) for richer structural interpretations of wedges or frictions.
[7] See Table A1 in the Appendix for some fixed parameters.

ment to extract the investment wedge. The policy function for investment is given as follows:

$$\hat{x}_t = \gamma_k \hat{k}_t + \gamma_z \hat{z}_t + \gamma_{\tau_l} \hat{\tau}_{l,t} + \gamma_{\tau_x} \hat{\tau}_{x,t} + \gamma_g \hat{g}_t + \gamma_{nx} \hat{nx}_t \tag{8}$$

where variables with hats indicate log deviations from the steady state. We derive the series of capital and four wedges (i.e., efficiency, labor, government spending, and net exports), which enables us to deduce the investment wedge series ($\tau_{x,t}$) using Equation (8) and investment data.

Once the underlying wedges that drive the observed aggregate fluctuations are constructed, we proceed with a counterfactual analysis aimed at eliminating government spending's contribution to aggregate dynamics. For instance, by employing the policy function for output and constructed wedges, we can generate a counterfactual output trajectory. This process ensures that the evolution of the five wedges precisely recovers the observed path of output, as Equation (9) remains valid when the constructed capital and five wedge series are incorporated into the right-hand side as follows:

$$\log(y_t^{data}) = \log(y_{ss}) + \alpha_k \hat{k}_t + \alpha_z \hat{z}_t + \alpha_{\tau_l} \hat{\tau}_{l,t} + \alpha_{\tau_x} \hat{\tau}_{x,t} + \alpha_g \hat{g}_t + \alpha_{nx} \hat{nx}_t \tag{9}$$

To generate a counterfactual trajectory for output, the government spending wedge is substituted with an alternative government spending series maintaining constant values equivalent to the level observed at the beginning of particular expansions or recessions:

$$\log(y_t^{cf}) = \log(y_{ss}) + \alpha_k \hat{k}_t + \alpha_z \hat{z}_t + \alpha_{\tau_l} \hat{\tau}_{l,t} + \alpha_{\tau_x} \hat{\tau}_{x,t} + \alpha_g \hat{g}_t^{cf} + \alpha_{nx} \hat{nx}_t \tag{10}$$

where the superscript "cf" indicates that the variable represents counterfactual data.

By comparing the actual data y_t^{data} with the counterfactual data y_t^{cf}, we can assess the relative importance of government spending during specific periods of economic expansion and recession in the U.S. throughout the past decades.

3.3 Data construction

The data used for both the estimation and BCA procedure are constructed by following a methodology akin to that of Chari et al. (2007). However, there are notable distinctions between our dataset and theirs. First, we construct separate data series for government spending and net exports to align with the model specifications used in our analysis. Second, our dataset spans a significantly longer period, encompassing nearly two decades more data (from 1959Q1 to 2021Q2) compared with the sample period covered by Chari et al. (2007).[8] This extended duration permits including two additional significant recessions: the Great Recession (2007–09)

[8] Chari et al. (2007) conduct their BCA analysis using quarterly data from 1959Q1 to 2004Q3 for the U.S.

and COVID-19 recession (2020).

Specifically, we use various datasets, including output, investment, hours worked, government consumption, and net exports, to estimate the process governing the wedges. Four macroeconomic aggregates—output, investment, government spending, and net exports—are derived from the National Income and Product Accounts (NIPA). Output is obtained by summing real GDP and the real service flow from durable goods, adjusted by real sales tax. Investment comprises durable consumption, gross real private investment, and gross real government investment, minus sales tax for durable consumption. Government spending and net exports are measured by real government consumption and the difference between real exports and imports, respectively.[9] Hours worked data are derived from the raw data provided by Cociuba, Prescott, and Ueberfeldt (2018). Data on hours worked are obtained by assuming a total of 1,300 usable hours per quarter for households as follows:

$$L_t^{data} = \frac{\text{Total hours worked}}{1,300 \times \text{Non-institutional population between 16 and 64}} \tag{11}$$

where data for total hours worked and non-institutional population between 16 and 64 years are obtained from the Current Population Survey, a monthly survey of households conducted by the Bureau of Census for the Bureau of Labor Metrics.

For normalization, all variables are transformed into per capita terms and are divided by the output level at the beginning of specific expansions and recessions. To align the variables with the model, we apply a linear detrending process to all logged variables. Figure 1 displays the normalized data relative to the 1979Q3 output level. For each recessionary or expansionary episode, we generate the data for aggregate variables normalized to the beginning level and perform the BCA analysis following the outlined procedure. In Figure A1 in the Appendix, we compare the data we construct (depicted by the dotted orange line) with the data from Chari et al. (2007) (represented by the solid blue line). Apart from the government spending level, the two series exhibit considerable similarity.

4 GOVERNMENT SPENDING EFFECTIVENESS

In this section, we investigate government spending effectiveness during each phase of expansion and recession in the U.S. To specify each business cycle, we rely on data from the National Bureau of Economic Research (NBER) U.S. Business Cycle Expansions and Contractions, employing Dupraz, Nakamura, and Steinsson (2019)'s methodology to identify peak and trough

[9] Boehm (2020) shows that the government investment multiplier is approximately zero across OECD countries. In addition, Haug and Sznajderska (2024) provide evidence that there is no difference between government consumption and government investment multipliers for the U.S. Thus, our analysis focuses mainly on government consumption rather than government investment.

points using the compiled hours data.[10] The periods from this identification process are presented in Table 1, detailing the specified peaks and troughs. We define recessions as periods when the economy transitions from a peak to a trough and expansions as periods transitioning from a trough to a peak.

4.1 Government spending effectiveness during recessions

Initially, we implement a counterfactual simulation aimed at nullifying the influence of the government spending wedge across five recessionary periods identified in Table 1. Figure 2 illustrates the results from the BCA procedure during the 1980 recession. The upper left panel displays the evolution of the four wedges and the projected output derived from these wedges. Notably, the projected output (marked by the dark blue line with markers) precisely replicates the trajectory of the actual output data (depicted by the solid dark blue line). As highlighted in prior research (Chari et al., 2007), the labor wedge remarkably contributes to shaping output dynamics. However, given our primary focus on the impact of government spending, we proceed with a counterfactual simulation by maintaining government spending (indicated by the green line) at its 1979Q3 level. The subsequent three panels present the results of this counterfactual analysis. The results show that eliminating government spending does not substantially alter the course of macroeconomic aggregates, such as output, investment, and hours worked, indicating the insignificance of government spending during the 1980 recession.

To rigorously quantify the effect of eliminating government spending, we compute three metrics designed to gauge the discrepancy between the observed and counterfactual series as follows:

$$\textit{Metric 1} = 100 \times \frac{1}{T}\sum_t \frac{(Y_0 - Y_t) - (Y_0 - Y_t^{cf})}{Y_0} = 100 \times \frac{1}{T}\sum_t (Y_t^{cf} - Y_t) \tag{12}$$

$$\textit{Metric 2} = 100 \times \sqrt{\frac{1}{T}\sum_t \left(Y_t^{cf} - Y_t\right)^2} \tag{13}$$

$$\begin{aligned} \textit{Trough gap A} &= \frac{(Y_0 - Y_{trough})}{Y_0} - \frac{(Y_0 - Y_{trough}^{cf})}{Y_0} \\ &= -Y_{trough} + Y_{trough}^{cf} \end{aligned} \tag{14}$$

where Y_t^{cf} denotes counterfactual output and Y_t indicates actual output. Y_0 is set to 1 for normalization. In Equation (14), Y_{trough} is actual output at the trough, while Y_{trough}^{cf} denotes coun-

[10] As Dupraz et al. (2019) primarily focus on the plucking nature of the business cycle through the unemployment rate, they employ this data to pinpoint peaks and troughs. Similarly, we use hours data, a central aspect of our analysis, to identify these turning points. The use of the NBER business cycle dates produces outcomes consistent with theirs. These results are omitted to conserve space but are available on request from the authors.

terfactual output at the trough.

Metric 1 assesses the cyclical behavior of government spending; a positive (negative) value suggests that, on average, the counterfactual output without government spending surpasses (falls short of) the actual data process. This indicates a procyclical pattern for government spending during the given recession, wherein both output and government spending decrease. *Metric* 2 quantifies the average percentage difference between the observed data and counterfactual series. A higher value of *Metric* 2 indicates a notable impact of government spending, either mitigating or exacerbating the specific economic downturn. In addition, *Trough gap A* (in percentage points) evaluates the effectiveness of government spending by computing the difference between the observed data and counterfactual series at the trough.[11] Table 2 provides a comprehensive summary of these measures across various phases of the U.S. business cycle.

For the 1980 recession, in Panel (a) of Table 2, the computed *Metric* 1 and *Trough gap A* are as follows: –0.056 and –0.280 for output and –0.087 and –0.442 for hours worked. The slightly negative values of *Metric* 1 and *Trough gap A* suggest that, on average, government spending displays an acyclical pattern and does not significantly affect the exacerbation or alleviation of the decline in overall economic activity, corroborating the pattern depicted in Figure 2. In sum, government spending had neither a mitigating nor deepening effect on the 1980 recession.

Next, we examine the 1990 recession. Figure 3 illustrates the consequences of eliminating government spending during this recession. Once more, the labor wedge remains a primary driver of the recession, with government spending showing little mitigation of the economic downturn. Specifically, the counterfactual series closely aligns with the actual data across all three variables (second to fourth panels), indicating that the government spending wedge had a negligible effect. The metrics for the 1990 recession are presented in Panel (b) of Table 2. Across all macroeconomic aggregates, *Metric* 1 exhibits positive values with exceedingly small magnitudes, suggesting that government spending was largely acyclical during this period. *Metric* 2 indicates that the government spending wedge contributed only a marginal increase of approximately 0.087%–0.134% to the aggregate activities fluctuation.

Figure 4 illustrates the results of the counterfactual analysis conducted for the 2001 recession. The upper left panel clearly depicts the increase in government spending during this specific recession period (green dotted line). The countercyclical nature of government spending is further summarized by *Metric* 1 in Panel (c) of Table 2. Across all variables, *Metric* 1 exhibits negative values that are significantly larger than those observed during the 1990 recession. On average, output (hours worked) would have experienced an additional decline of 0.239 (0.362) percentage points without the increase in government spending. *Metric* 2 indicates that government spending contributed an additional 0.3 to 0.9 percentage point gap to aggregate ac-

[11] Note that we refer to *Trough gap A* in Equation (14) to distinguish from *Trough gap B* in Equation (15), which is based on the methodology outlined by Meza (2008).

tivities.

Figure 5 presents the results of the counterfactual analysis conducted for the 2008 Great Recession, widely regarded as the most severe recession since the 1980s. Similar to the 2001 recession, government spending significantly increased during the 2008 Great Recession, as depicted in the upper-left panel. Notably, there is a remarkable gap between the data and counterfactual trajectories in the other panels. In Panel (d) of Table 2, *Metric* 1 indicates that government spending, on average, mitigated an additional fall of 0.252, 0.602, and 0.379 percentage points in output, investment, and hours worked, respectively. At the trough (2009Q4), output experienced a decline of 6.7 percentage points compared with the peak level. Government spending contributed to mitigating the decline in output and hours worked by 0.708 and 1.042 percentage points, respectively. Comparing the trough gap from previous recessions (Panels (a)–(c) of Table 2), it is evident that government spending played a more significant role during the 2008 recession.

Finally, Figure 6 illustrates the impact of eliminating the government spending wedge during the recent COVID-19 recession. Given the acute nature of the recession triggered by COVID-19 (which, according to the NBER recession dates, lasted three quarters), government spending is estimated to have a small influence. Similar to previous recessions, the labor wedge predominantly accounts for the decline in overall economic activity. While government spending exhibits a mild countercyclical pattern, its absolute effect appears to be minor and nearly negligible. At the trough (2020Q2), output and hours worked experienced declines compared with peak levels of 8.9% and 18%, respectively. In Panel (e) of Table 2, government spending merely contributes to mitigating a drop of 0.351 and 0.485 percentage points in output and hours worked, respectively. This finding may be attributed to transfers rather than government consumption being the primary stimulus for boosting aggregate demand during the COVID-19 recession.

As a final measure of the significance of the government spending wedge, we also calculate the percentage differential between the actual decline in aggregate variables and the counterfactual series, following the methodology outlined by Meza (2008):

$$\begin{aligned} \textit{Trough gap B (\%)} &= \frac{\frac{(Y_0 - Y_{trough})}{Y_0} - \frac{(Y_0 - Y^{cf}_{trough})}{Y_0}}{\frac{(Y_0 - Y_{trough})}{Y_0}} \\ &= \frac{-Y_{trough} + Y^{cf}_{trough}}{1 - Y_{trough}} \end{aligned} \tag{15}$$

where Y_0 is set to 1 as a normalization.

This metric quantifies the percentage contribution of the government spending wedge at the trough. The numerator signifies the additional fall or rise in macroeconomic aggregates attributable to the government spending wedge. A considerable negative percentage gap indicates that government spending substantially contributed to stabilizing that particular recession. In other words, the counterfactual decline in output is considerably greater than the actual decline.

Table 3 presents the trough gap measure for each recession. While the magnitude of the percentage gap varies across recessions, it remains below 10% in nearly all cases. This contrasts with Meza (2008)'s findings, wherein the percentage trough gap for output in Mexico reached approximately 20% in 1995, indicating a significant governmental role. This implies that government spending was not an effective stimulus for mitigating the decline in aggregate activity during U.S. recessions. Put differently, the recession's severity would have seen small changes even in the absence of time-varying government spending in our analysis.

4.2 Government spending effectiveness during expansions

In Section 4.1, we demonstrated that government spending proved less effective when needed. However, what about its impact during expansionary phases when government spending is deemed less imperative? Figures 7–10 present the results of eliminating the government spending wedge during four expansion periods. Intriguingly, the absolute magnitude of the government spending wedge (depicted by the dotted green line in each first panel) surpasses what was observed during recessionary episodes. Except for the 2003 expansion, the counterfactual trajectories notably diverge from their data counterparts, albeit the cyclical nature of government spending varies. Although government spending exhibited a procyclical pattern in the 1983 expansion, it predominantly showed a countercyclical pattern in recent expansions. An interesting observation is found in the 2010 recession, wherein output failed to rebound to its pre-crisis levels, largely due to a substantial decline in government consumption that did not revert to its trend level.

We construct two measures that correspond to Equations (14) and (15), respectively:

$$
\begin{aligned}
Peak\ gap\ A &= \frac{(Y_{peak} - Y_0)}{Y_0} - \frac{(Y^{cf}_{peak} - Y_0)}{Y_0} \\
&= Y_{peak} - Y^{cf}_{peak}
\end{aligned} \tag{16}
$$

where Y_0 is set to 1 as a normalization. In Equation (16) above, Y_{peak} is actual output at the peak, while Y^{cf}_{peak} denotes counterfactual output at the peak.

$$Peak\ gap\ B\ (\%) = \frac{\frac{(Y_{peak}-Y_0)}{Y_0} - \frac{(Y^{cf}_{peak}-Y_0)}{Y_0}}{\frac{(Y_{peak}-Y_0)}{Y_0}}, \quad Y_0 = 1 \tag{17}$$
$$= \frac{(Y_{peak}-1)-(Y^{cf}_{peak}-1)}{Y_{peak}-1}$$

We then compute the metrics, defined in Equations (12), (13), (16), and (17), for each expansion to measure the cyclical nature and relative importance of government spending[12] The results are presented in Table 4. We adjust the sign for the metrics such that a positive (negative) *Metric* 1 denotes the procyclical (countercyclical) government spending wedge. Compared with the results observed during recessions outlined in Section 4.1, most metrics exhibit larger values during expansionary periods. This finding emphasizes that fluctuations in government consumption have a more pronounced influence as drivers of business cycles during economic expansions than during recessions, contrary to several empirical observations indicating larger government spending multipliers during recessions (Auerbach & Gorodnichenko, 2012). Given that the government spending wedge is predominantly countercyclical, variations in government spending substantially contribute to a slower recovery of aggregate activity during expansions.

4.3 Effectiveness measure for cumulative government spending multipliers

The previous findings suggest that government spending exerts a more pronounced influence during economic expansions than during recessions. However, this observation may be influenced by the difference in the absolute magnitude of government spending between these two business cycle phases. To measure the effectiveness of government spending on a per-unit basis, we introduce an effectiveness measure that corresponds to the cumulative government spending multiplier employed in empirical studies such as those by Ramey (2016) and Ramey and Zubairy (2018):

$$\text{Effectiveness measure} = \frac{\sum_{j=trough(peak)}^{peak(trough)} \left(Y^{data}_j - Y^{cf}_j\right)}{\sum_{j=trough(peak)}^{peak(trough)} \left(G_j - G_0\right)} \tag{18}$$

[12]While *Peak gap A* measures the absolute magnitude of the government spending wedge's contribution at its highest point, *Peak gap B* assesses the government spending wedge's contribution relative to the observed output change from the trough to the peak. Given the value of *Peak gap A*, a lower (higher) value of *Peak gap B* indicates a strong (sluggish) recovery during expansionary periods.

where G_0 is the level of government spending at the beginning of each expansion and recession.

Suppose that government spending increases during a recession or expansion. In this scenario, both the denominator and numerator of the effectiveness measure would yield positive values. Conversely, if government spending decreases, both the denominator and numerator would yield negative values. Consequently, the effectiveness measure typically yields a positive value under the general condition where output and government spending either monotonically increase or decrease.

Panels (a) and (b) of Table 5 provide an overview of the effectiveness measures for each recession and expansion, respectively. Across all cases, the effectiveness measure falls within the range of 0.9 to 1.1, which implies that one unit of government spending is equally effective in both recessionary and expansionary periods. Therefore, the significant disparity between the actual data and counterfactual series during expansions primarily stems from the difference in the absolute size of government spending during those periods, rather than any state dependency on government spending.

This finding appears to challenge the notion that the government spending multiplier is contingent on the state of the economy, as suggested by Auerbach and Gorodnichenko (2012), Christiano et al. (2011), and Shen and Yang (2018). These studies argue that government spending is more effective during periods of economic slack, in contrast to phases of economic expansion. By contrast, our findings align well with those of Ramey and Zubairy (2018), which indicates a lack of state dependency in the government spending multiplier.

5 Conclusion

Government spending effectiveness in stabilizing the economy has long been a contentious issue in macroeconomics. To address this issue, our study investigates whether an increase in government spending can alleviate declines in output during economic downturns, while also examining its effects during periods of economic expansion. Using U.S. data spanning several decades, we employ the BCA methodology developed by Chari et al. (2007), which combines aspects of model-based analysis with empirical investigation. Our counterfactual analysis indicates that eliminating government spending does not notably alter the trajectory of key macroeconomic indicators during periods of recession. However, its influence becomes more pronounced during phases of economic expansion. That is, government spending has substantially influenced business cycles, particularly during periods of expansion compared with recessions.

This suggests that fiscal policy effectiveness follows a procyclical pattern, implying that it tends to reinforce or amplify the business cycle's current stage. In addition, we obtain cumulative government spending multipliers that remain close to unity regardless of the economic state. This finding raises questions about previous theories that propose an amplification mechanism triggered by government spending, suggesting that these theories may not fully capture the dynamics at play or may have overlooked factors that constrain government spending effectiveness during recessions. Overall, our study supports the view that fiscal policy effectiveness remains quantitatively similar across various business cycle phases, consistent with Ramey and Zubairy (2018)'s findings.

Our analysis centers solely on government consumption; therefore investigating the effectiveness of other fiscal policies may present an intriguing avenue for further exploration. In particular, with government transfers emerging as the principal instrument for boosting aggregate demand during recent economic downturns, such as those witnessed in the 2008 and 2020 recessions, analyzing the role and dynamics of government transfers could deepen our understanding of fiscal policy effectiveness. We leave this possible extension for future research.

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TABLE 1: DATES OF PEAKS AND TROUGHS IN U.S. BUSINESS CYCLES

	(1) Hours		(2) NBER	
	Peak	Trough	Peak	Trough
(a)	1979Q3		1980Q1	1980Q3
		1982Q4	1981Q3	1982Q4
(b)	1989Q4	1992Q2	1990Q3	1991Q1
(c)	2000Q2	2003Q3	2001Q1	2001Q4
(d)	2006Q4	2009Q4	2007Q4	2009Q2
(e)	2019Q3	2020Q2	2019Q4	2020Q2

Notes. This table reports peaks and troughs identified based on (1) the methodology outlined by Dupraz et al. (2019) using the compiled hours data and (2) the NBER business cycle dates. We define recessions as periods when the economy transitions from a peak to a trough and expansions as periods transitioning from a trough to a peak. Our analysis employs hours data in Panel (1) to identify these turning points.

TABLE 2: EFFECTIVENESS OF GOVERNMENT SPENDING IN RECESSIONS

	Output	Investment	Hours worked
	(a) 1980 recession		
Metric 1	–0.056	–0.166	–0.087
Metric 2	0.137	0.413	0.214
Trough gap A (% point)	–0.280	–0.794	–0.442
	(b) 1990 recession		
Metric 1	0.026	0.037	0.040
Metric 2	0.087	0.119	0.134
Trough gap A (% point)	0.138	0.190	0.210
	(c) 2001 recession		
Metric 1	–0.239	–0.644	–0.362
Metric 2	0.334	0.906	0.507
Trough gap A (% point)	–0.339	–0.934	–0.507
	(d) 2008 recession		
Metric 1	–0.252	–0.602	–0.379
Metric 2	0.389	0.919	0.582
Trough gap A (% point)	–0.708	–1.684	–1.042
	(e) 2020 recession		
Metric 1	–0.133	–0.312	–0.191
Metric 2	0.188	0.244	0.264
Trough gap A (% point)	–0.351	–0.817	–0.485

Notes. This table reports Metrics 1, 2, and trough gap (% point) as defined in Equations (12), (13), and (14), respectively. *Trough gap A* measures the effectiveness of government spending by computing the difference between the observed data and the counterfactual series at the trough.

TABLE 3: ALTERNATIVE TROUGH GAP (%) IN RECESSIONS

Trough gap B	Output	Investment	Hours worked
(a) 1980 recession	–2.851	–3.426	–6.034
(b) 1990 recession	4.197	2.210	4.733
(c) 2001 recession	–8.689	–13.144	–7.905
(d) 2008 recession	–10.549	–7.071	–9.861
(e) 2020 recession	–3.927	–6.680	–2.687

Notes. This table reports *Trough gap B* (%) as defined in Equation (15). *Trough gap B* (%) measures the effectiveness of government spending by computing the difference between the observed data and the counterfactual series at the trough based on the methodology of Meza (2008).

TABLE 4: EFFECTIVENESS OF GOVERNMENT SPENDING IN EXPANSIONS

	Output	Investment	Hours worked
	(a) 1983 expansion		
Metric 1	1.019	2.713	1.575
Metric 2	1.246	3.305	1.927
Peak gap A (% point)	2.125	5.415	3.314
Peak gap B (%)	16.690	20.931	22.293
	(b) 1992 expansion		
Metric 1	–0.577	–1.779	–0.893
Metric 2	0.659	2.042	1.019
Peak gap A (% point)	–0.748	–2.511	–1.132
Peak gap B (%)	–9.208	–7.990	–18.216
	(c) 2003 expansion		
Metric 1	–0.080	–0.244	–0.124
Metric 2	0.145	0.439	0.225
Peak gap A (% point)	–0.214	–0.638	–0.335
Peak gap B (%)	–24.299	–26.240	–14.217
	(d) 2010 expansion		
Metric 1	–1.641	–5.636	–2.706
Metric 2	1.773	6.130	2.933
Peak gap A (% point)	–1.544	–5.497	–2.630
Peak gap B (%)	–142.238	–25.187	–22.926

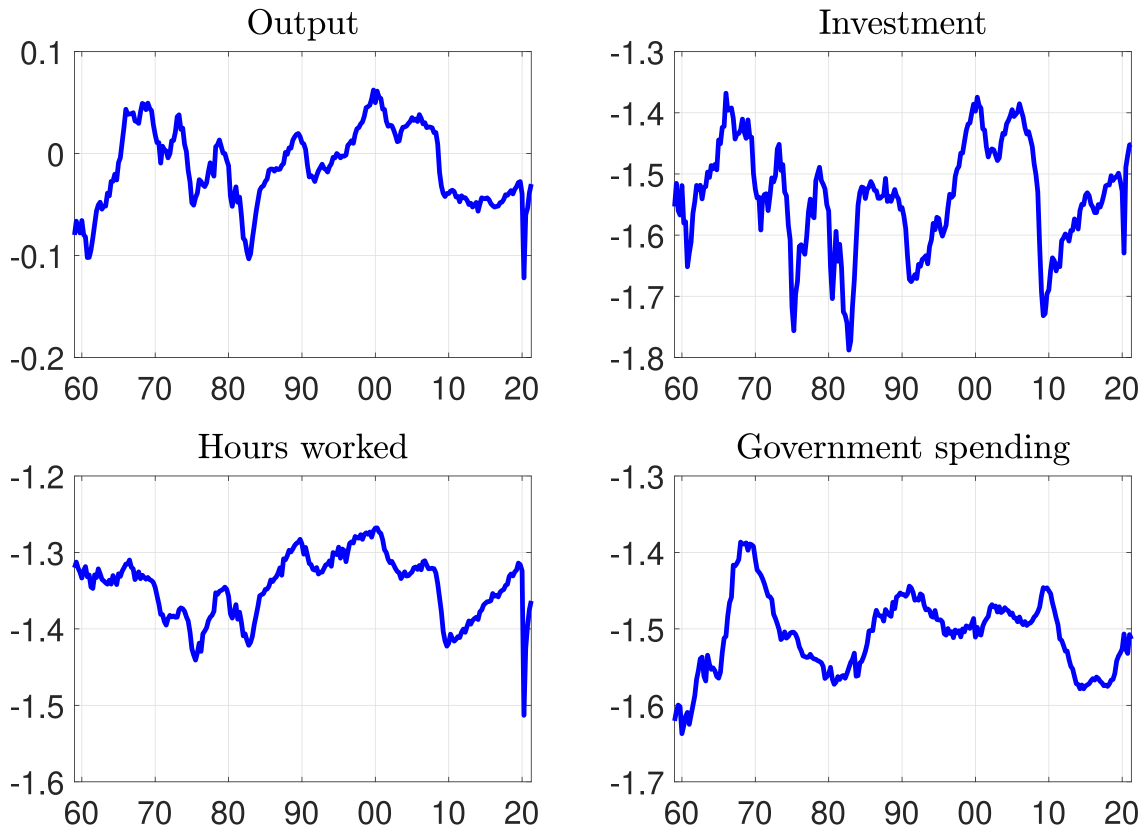
Notes. This table reports Metrics 1 and 2, Peak gap A (% point), and Peak gap B (%) as defined in Equations (12), (13), (16), and (17). Peak gap B (%) measures the effectiveness of government spending by computing the difference between the counterfactual series and the observed data at the peak based on the methodology of Meza (2008).

TABLE 5: EFFECTIVE MEASURE

	(a) Recession				
	1980	1990	2001	2008	2019
Measure	0.979	1.107	1.052	1.017	0.912
	(b) Expansion				
	1983	1992	2003	2010	
Measure	0.911	1.023	1.102	1.069	

Notes. This table reports the effectiveness measure that corresponds to the cumulative government spending multiplier for each (a) recession and (b) expansion using Equation (18).

FIGURE 1: MACROECONOMIC AGGREGATES



Notes. This figure displays the normalized data relative to the output level of 1979Q3. All variables are transformed into per capita terms and are divided by the output level at the beginning of specific expansions and recessions for normalization. To align the variables with the model, we apply a linear detrending process to all the logged variables. For each recessionary or expansionary episode, we generate the data for aggregate variables normalized to the level at the beginning and perform the BCA analysis.

FIGURE 2: 1980 RECESSION

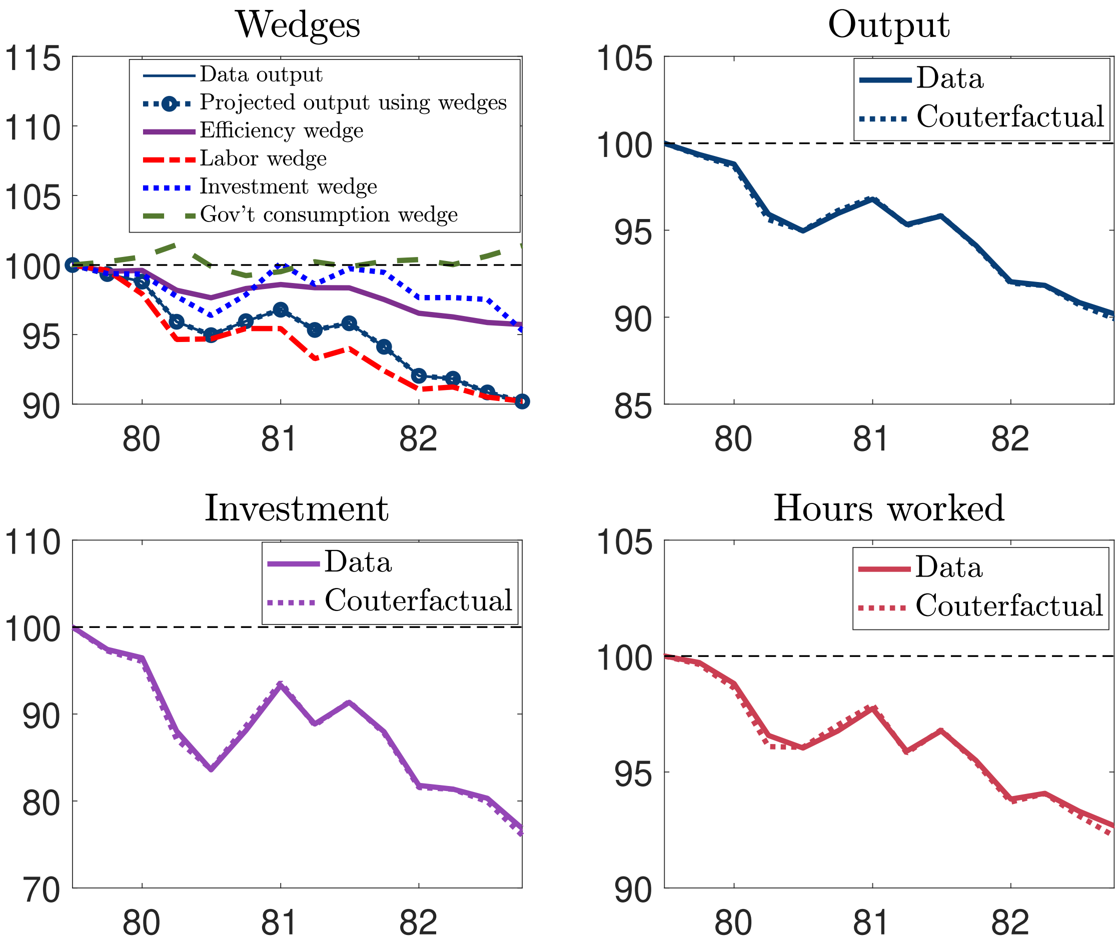


FIGURE 3: 1990 RECESSION

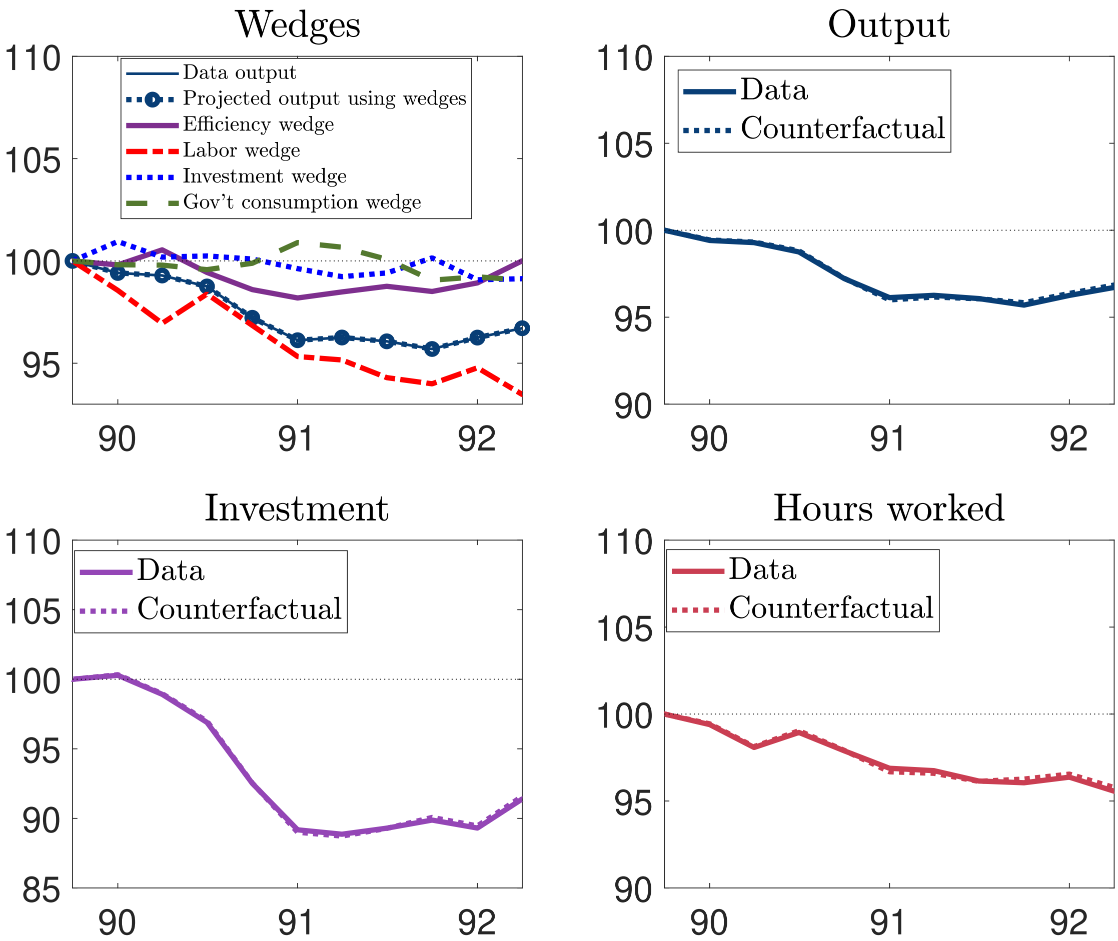


FIGURE 4: 2001 RECESSION

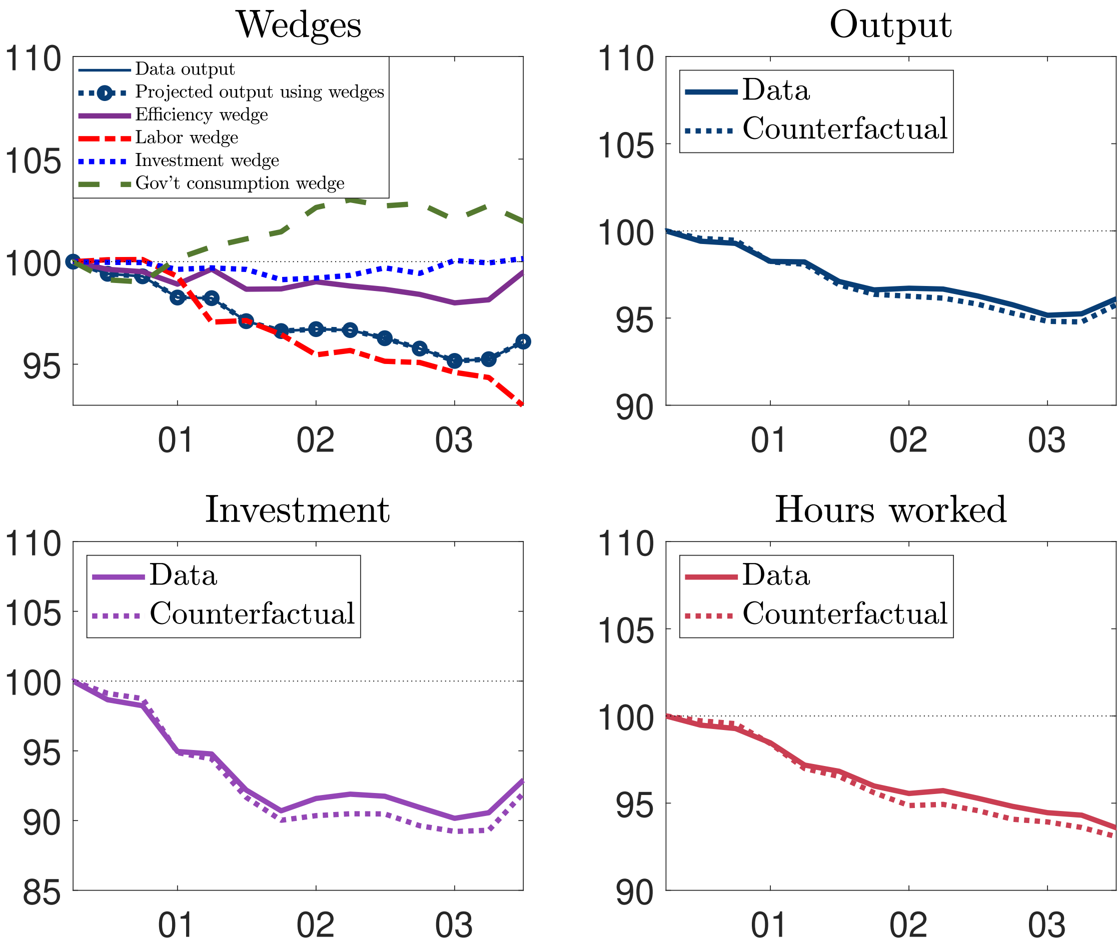


FIGURE 5: 2008 RECESSION

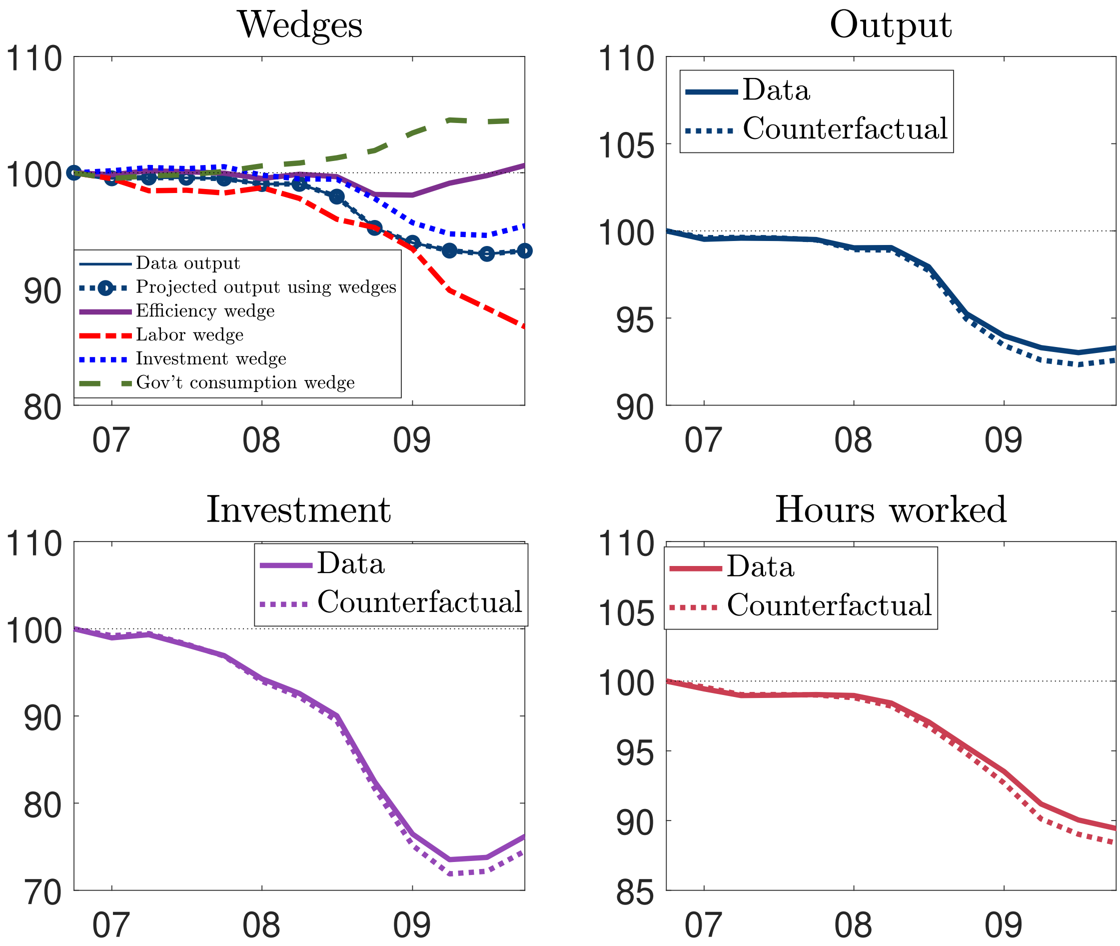


FIGURE 6: 2020 RECESSION

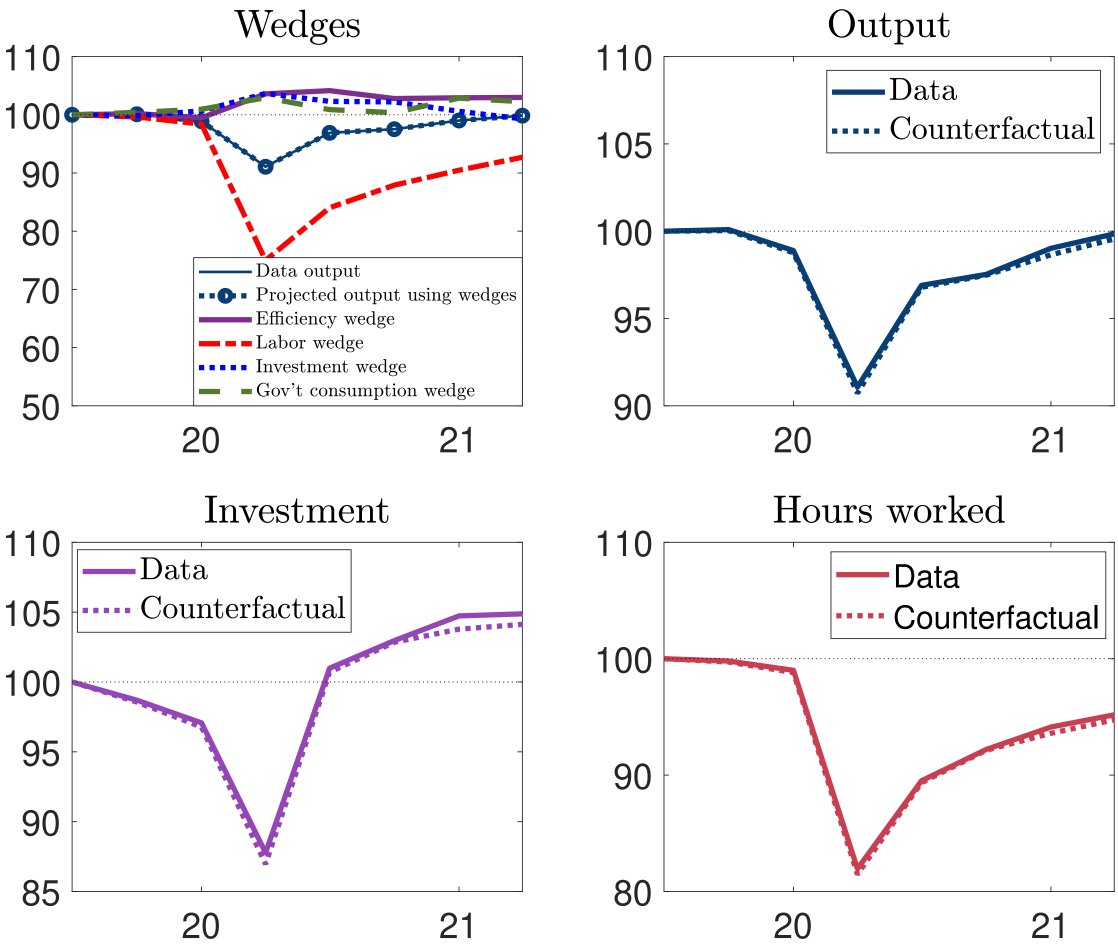


FIGURE 7: 1983 EXPANSION

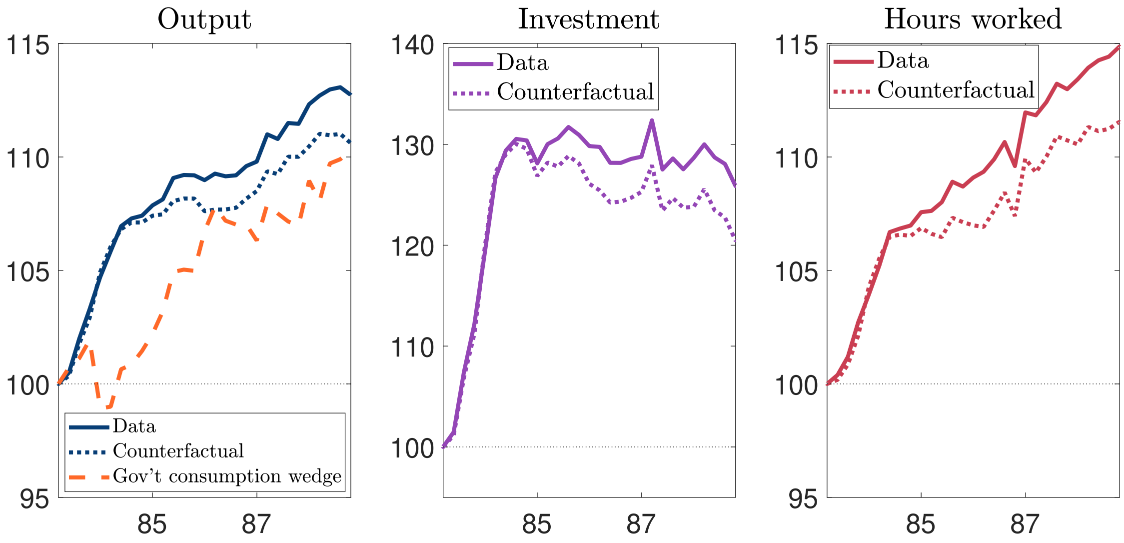


FIGURE 8: 1992 EXPANSION

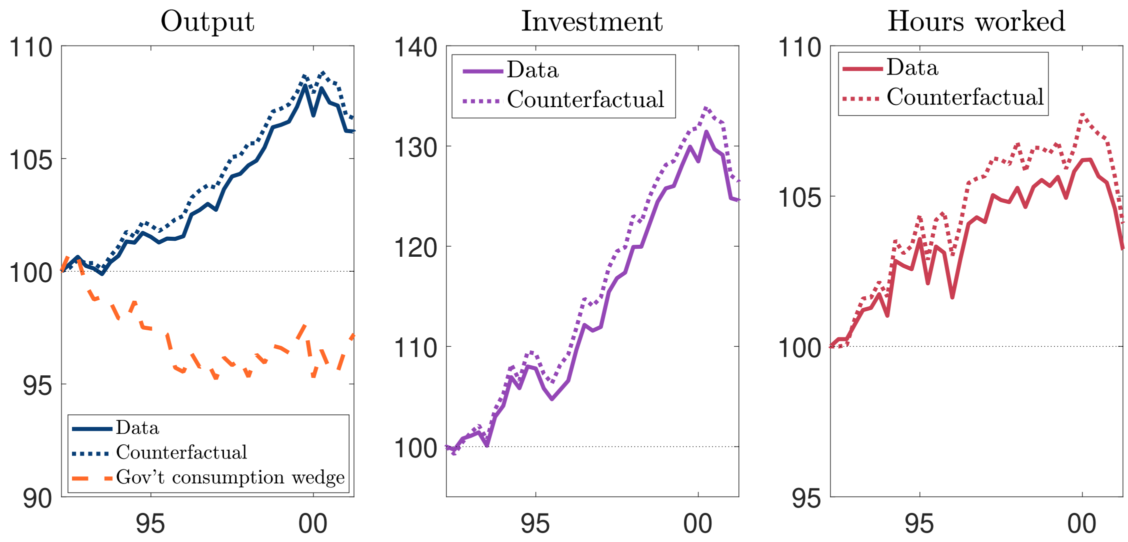


FIGURE 9: 2003 EXPANSION

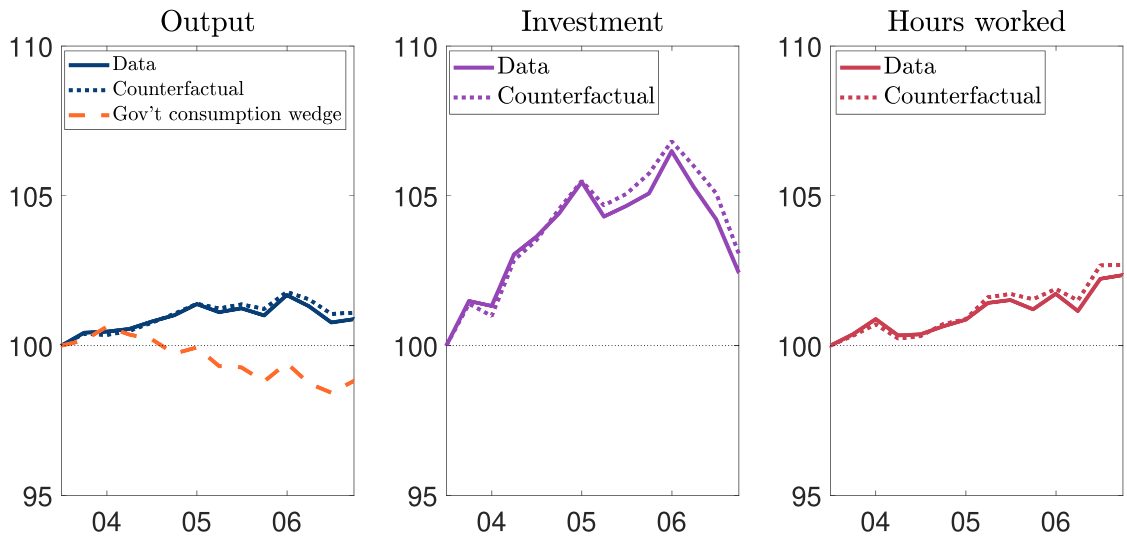
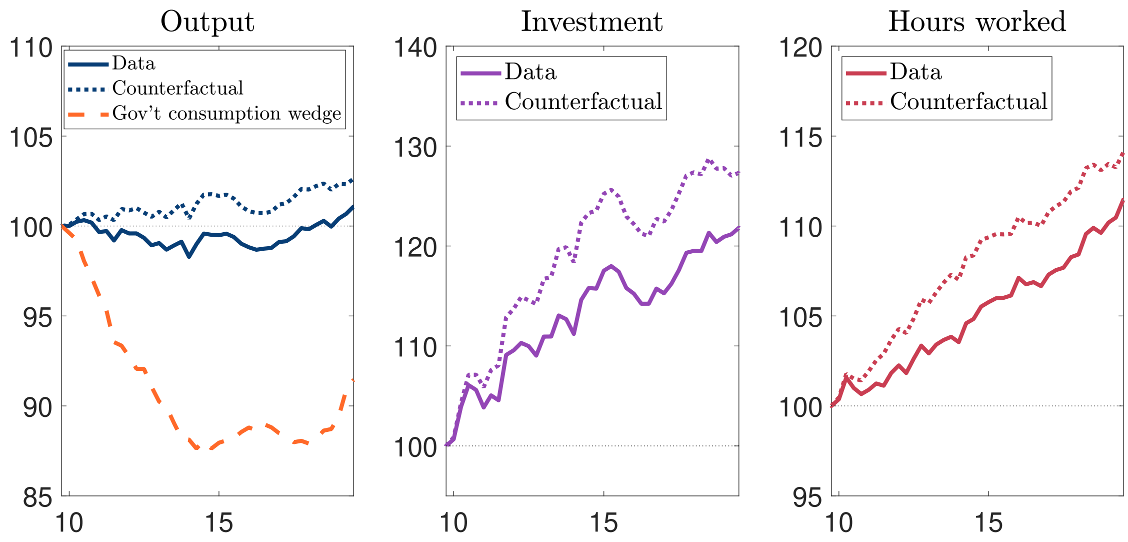


FIGURE 10: 2010 EXPANSION



A Appendix

A.1 Fixed parameters

We fix some parameters within the model, which remain invariant throughout each estimation process. All values are taken from Chari et al. (2007).

TABLE A1: FIXED PARAMETERS

Parameter	Description	Value
β	Discount factor	0.9930
δ	Capital depreciation rate	0.0118
θ	Capital share	0.35
ψ	Labor disutility parameter	2.24
σ	Inverse of elasticity of substitution	1
γ_n	Quarterly population growth rate	0.0037
γ_z	Quarterly productivity growth rate	0.0040

A.2 Data comparison

Instead of individually applying linear detrending to each series, we detrend the data series uniformly using a consistent annual growth rate of 1.6%. The original data used in our analysis is sourced from a data file constructed by Johaness Pfeifer, who rectifies a minor error in the initial data compilation by Chari et al. (2007).

FIGURE A1: DATA COMPARISON