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Government spending effects on the business cycle in times of crisis

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Abstract

The literature on fiscal multipliers has long established a positive impact of public spending on output. However, the size of this effect strongly depends on the employed identification strategy. Moreover, fiscal multipliers are uninformative as regards the state of the economy. Using counterfactual scenario analyses based on a conditional forecast algorithm in combination with the Beveridge-Nelson decomposition, we address both issues by assessing the effectiveness of public spending in terms of its influence on the output gap. Our approach is independent of the chosen identification strategy and allows us to make (quantitative) statements about potential downsides from public spending measures by looking at its effects on the business cycle. Using a US dataset and analyzing hypothetical government spending scenarios in times of historical crises, we find that, to avoid an overheating of the economy in combination with high inflation and public debt, the dosage of fiscal stimulus is crucial for targeted fiscal policy measures and depends on the severity of the crisis.

Keywords: Fiscal policy, output gap, conditional forecast, scenario analysis, Bayesian vector autoregression

JEL Codes: E62, E37, C53

1 Introduction

In times of the Covid-19 crisis, the energy crisis related to the Ukrainian-Russian war as well as long-term developments such as climate and demographic change in developed economies, government spending policies have many proponents. However, the excessive use of fiscal policy for stabilization and long-term purposes deteriorates public finances of many already debt-struck economies around the globe, potentially alarming financial markets, thereby worsening governments' refinancing conditions and thus their maneuverability to address policy goals (fiscal space). Other possible drawbacks include inflationary effects stemming from enhanced aggregate demand as well as potential unintended redistribution effects.

The fact that there is a noteworthy potential downside to excessive fiscal stimulus raises the question of public spending's effectiveness in terms of fulfilling policy objectives. These objectives center, aside from employment and (more controversial) redistribution goals, around the evolution of domestic output. Fiscal multipliers have been frequently used to assess the effectiveness of government spending in this way. However, their size strongly depends on the way the spending shocks are identified (see Ramey, 2019 and Ramey, 2016 for excellent expositions of the fiscal multiplier literature). Secondly, government spending multipliers give no indication with respect to fiscal policies' impact on the business cycle, thereby neglecting important implications for policymakers: For example, while according to data of the Federal Reserve Bank of St. Louis real GDP growth in 2020Q2 in the United States plummeted as a result of the Covid-19 outbreak, it jumped right back to +8% in the very next quarter.[1] The picture drawn here - that the economy was back on track (or beyond) in 2020Q3 - is highly misleading as it neglects the persistent character of the business cycle. Based on output gap data from the US Congressional Budget Office, the recovery was completed as late as 2021Q4.[2] The fact that the output gap is much better suited in terms of capturing the persistence in the business cycle therefore makes it the superior measure

[1] For details on the data, see appendix A.

[2] The respective data can be found at the Federal Reserve Bank of St. Louis (FRED) database (here).

for policymaking: Central bankers might be confronted with the decision whether to raise or reduce interest rates (expand or shrink asset purchase programs). Knowing the state of the economy, in particular whether there is a positive or negative output gap, will determine whether policy rates are raised or lowered (whether balance sheets are shrunk or expanded). To identify the unobservable output gap, a stream of recent literature has argued in favor of using multivariate approaches (see e. g. Barigozzi and Luciani, 2021, Morley and Wong, 2020 or Berger et al., 2023).

In this paper, we try to overcome the two above-mentioned problems and analyze the business cycle effects of government spending policies in the United States. In particular, we employ scenario (counterfactual) analyses for some major crises in US history to assess public spending's impact on the output gap in a unified framework, operationalized using the multivariate Beveridge-Nelson (BN) decomposition.

By tackling the two above-mentioned problems, we contribute to the literature on the efficacy of government spending policies: First, we perform scenario analyses which are "agnostic" in the sense that they are independent of the identification strategy used to identify structural shocks (see Waggoner and Zha, 1999 or Blake and Mumtaz, 2015). This avoids that results be dependent on the identification strategy (for differences in fiscal policy efficacy arising due to differing identification assumptions in the fiscal multiplier literature, see e. g. Caldara and Kamps, 2017). Second, by imposing various fiscal policy paths in the conditional forecasting exercise and then computing implied paths of the output gap identified from a BN decomposition, we can make statements about fiscal policies' effect on the business cycle.[3]

We find that, indeed, public spending positively affects output and reduces unemployment. However, the potential downside from overspending, that is, an overheating economy with rising inflation and debt levels, implies that the dosage of fiscal stimulus matters to

[3]Although this is not per se a *ceteris paribus* contemplation, we do get an idea of how different spending paths affect the output gap *given paths of tax revenues and monetary policy*, as elaborated upon below. Thus, grounding thoughts on fiscal effectiveness on differences in fiscal scenarios seems reasonable.

achieve policy goals.

The remainder of the paper is structured as follows. Section 2 elaborates on the multivariate BN decomposition and the scenario analyses (conditional forecasts). Section 3 covers the estimation strategy and the data, while in section 4, the empirical results are presented. Section 5 concludes.

2 Methodology

This section elaborates on the multivariate Beveridge-Nelson (BN) decomposition as well as the conditional forecast algorithm employed to compute the counterfactual scenarios.

2.1 The multivariate Beveridge-Nelson decomposition

In this section, we lay out the multivariate BN decomposition to compute the output gap. In particular, we follow Morley and Wong (2020) and identify the output gap as the cyclical component of the multivariate BN decomposition of the output series.

According to Beveridge and Nelson (1981), the trend of a time series $y_t, t = \{1, 2, ..., T\}$ can be defined as

$$\tau_t = \lim_{h \to \infty} \mathbb{E}_t[y_{t+h} - h\mu], \tag{1}$$

where h is the (long-run) forecast horizon and μ is a time-invariant drift. The BN cycle is then obtained as

$$c_t = y_t - \tau_t. \tag{2}$$

To compute the multivariate BN cycle as in Morley and Wong (2020), consider a standard

VAR(p) model in reduced form, written as

$$y_t = \phi_1 y_{t-1} + \phi_2 y_{t-2} + ... + \phi_p y_{t-p} + u_t, \quad u_t \sim N(0, \Sigma), \tag{3}$$

$t = \{1, 2, ..., T\}$, where y_t is a $N \times 1$ vector of demeaned stationary endogenous variables, including government spending, output, inflation, the government's tax revenues, the unemployment rate and the interest rate on three-month treasury bills. All variables are transformed to stationarity (see appendix for details). ϕ_j, $j = 1, 2, ..., p$ are $N \times N$ coefficient matrices corresponding to the respective lag matrix y_{t-j} and u_t is a $N \times 1$ vector of reduced-form shocks. Following Morley and Wong (2020), express (3) in companion form:

$$\boldsymbol{Y_t} = \boldsymbol{F}\boldsymbol{Y_{t-1}} + \boldsymbol{H}u_t, \tag{4}$$

where $\boldsymbol{Y_t} \equiv \{y'_t, y'_{t-1}, ..., y'_{t-p+1}\}'$, $\boldsymbol{F}$ is the companion matrix, and $\boldsymbol{H}$ is a matrix mapping the reduced-form errors to the companion form. The BN trend and cycle are then given by

$$\tau_t = \boldsymbol{Y_t} + \boldsymbol{F}(\boldsymbol{I} - \boldsymbol{F})^{-1}\boldsymbol{Y_t}, \tag{5}$$

$$c_t = -\boldsymbol{F}(\boldsymbol{I} - \boldsymbol{F})^{-1}\boldsymbol{Y_t}. \tag{6}$$

Assuming that the output variable is the jth element of y_t in (3), the period-t output gap is the jth element of c_t.

2.2 Assessing fiscal policy based on scenario analysis

In this section, we lay out the methodology used to compute the counterfactuals. More precisely, given the multivariate (VAR) structure of the model, we can employ conditional multivariate forecasts (scenarios) and compute the output gap forecasts (scenarios) implied by the forecasts for the endogenous variables.

Assume that in period T, we have information about the future path of the fiscal instruments. That is, we know the $T+1, T+2, ..., T+h$ values of our government spending and tax revenue variables, where h is the number of periods we have information on the fiscal instruments for. That is, h is the scenario horizon. Now suppose we are interested in knowing the values in $T+1, T+2, ..., T+h$ for the model's other variables. Noting that, technically, such a scenario analysis is simply a conditional forecast where we employ information on the fiscal instruments to forecast the remaining variables, our approach, outlined below, draws heavily from Waggoner and Zha (1999), Blake and Mumtaz (2015), Higgins et al. (2016) and Berger et al. (2023). First, rewrite equation (3) as

$$y_t = \phi_1 y_{t-1} + \phi_2 y_{t-2} + ... + \phi_p y_{t-p} + A_0^{-1}\epsilon_t, \quad \epsilon_t \sim N(0, I), \tag{7}$$

having employed the relation $u_t = A_0^{-1}\epsilon_t$, where A_0^{-1} is a structural impact multiplier matrix, with $\Sigma = A_0^{-1}\left(A_0^{-1}\right)'$. That is, A_0^{-1} is the lower-triangular Cholesky factor of Σ. ϵ_t are structural shocks.[4]

Rewriting (7) in companion form yields

$$\boldsymbol{Y}_t = \boldsymbol{F}\boldsymbol{Y}_{t-1} + \boldsymbol{H}\boldsymbol{A_0}^{-1}\epsilon_t, \tag{8}$$

where $\boldsymbol{H}$ is a matrix mapping the reduced-form shocks $\boldsymbol{A_0}^{-1}\epsilon_t$ to the companion form, that is,

$$\boldsymbol{H} = \begin{bmatrix} \boldsymbol{I_N} \\ \boldsymbol{0}_{N(p-1)\times N} \end{bmatrix}.$$

[4]Note that the conditional forecasts are not affected by the choice of identification schemes to recover exogenous shocks (see Waggoner and Zha, 1999, Blake and Mumtaz, 2015). Thus, differences in the effectiveness of fiscal policy paths do not stem from the choice of the structural impact multiplier matrix, such that we do not need to engage in a discussion on how the chosen identification strategy affects our results. This is a major advantage compared to approaches identifying fiscal policy's effectiveness from structural VAR or DSGE models.

Iterating (8) h steps forward yields

$$\boldsymbol{Y_{t+h}} = \boldsymbol{F}^h \boldsymbol{Y}_t + \sum_{j=1}^{h} \boldsymbol{F}^{h-j} \boldsymbol{H} \boldsymbol{A_0}^{-1} \epsilon_{t+j}. \tag{9}$$

Letting $\boldsymbol{F}^k \boldsymbol{H} \boldsymbol{A_0}^{-1} \coloneqq \boldsymbol{M}_k$ be the impulse response matrix at horizon k, this can be written as

$$\boldsymbol{Y}_{t+h} = \boldsymbol{F}^h \boldsymbol{Y}_t + \sum_{j=1}^{h} \boldsymbol{M}_{h-j} \epsilon_{t+j}, \tag{10}$$

$$\sum_{j=1}^{h} \boldsymbol{M}_{h-j} \epsilon_{t+j} = \boldsymbol{Y}_{t+h} - \boldsymbol{F}^h \boldsymbol{Y}_t. \tag{11}$$

That is, given the model's parameters, restricting some variables in Y_{t+h} implies restrictions on the structural shocks ϵ_t. Conditional on this information as well as the estimated reduced-form parameters, collected in $\boldsymbol{F}$, the paths of the unconditioned variables can be obtained. To see this, follow Higgins et al. (2016) and assume we have an idea about the future path of the endogenous variables y and therefore restrict their future values to $\boldsymbol{Y}^* = \left(\boldsymbol{Y}^{*'}_{T+1}, ..., \boldsymbol{Y}^{*'}_{T+h}\right)'$, where the dimension of each $\boldsymbol{Y}^*_t$ is $Np \times 1$ (corresponding to the companion form vector $\boldsymbol{Y}_t$). Next, define the corresponding vector of *unconditional* forecasts as $\boldsymbol{Y}^u = \left(\boldsymbol{Y}^{u'}_{T+1}, ..., \boldsymbol{Y}^{u'}_{T+h}\right)'$. Given these definitions, define $r \coloneqq \boldsymbol{Y}^* - \boldsymbol{Y}^u$, $\epsilon \coloneqq (\epsilon'_{T+1}, \epsilon'_{T+2}, ..., \epsilon'_{T+h})'$ and

$$\boldsymbol{R} \coloneqq \begin{bmatrix} \boldsymbol{M_0} & \boldsymbol{0} & \cdots & \boldsymbol{0} \\ \boldsymbol{M_1} & \boldsymbol{M_0} & \cdots & \boldsymbol{0} \\ \vdots & & & \\ \boldsymbol{M_{h-1}} & \boldsymbol{M_{h-2}} & \cdots & \boldsymbol{M_0} \end{bmatrix}.$$

Note that we can conveniently summarize the restrictions imposed on the future values of the endogenous variables y, conditional on the reduced-form parameters of the VAR. To do this, collect the reduced-form parameters in $a := (vec(\phi_1)', vec(\phi_2)', ..., vec(\phi_p)', vec(A_0^{-1}))'$ and stack (11) over the whole forecast horizon $\{1, 2, ..., h\}$. That is, express (11) as

$$R(a)\epsilon = r(a). \tag{12}$$

In general, one is interested in restricting only a subset of the endogenous variables. Similar to Higgins et al. (2016) and Blake and Mumtaz (2015), define $\tilde{R}$ and $\tilde{r}$ as the respective matrices where the rows corresponding to the unrestricted variables are excluded and define q as the number of endogenous variables with restricted future paths. We can then rewrite (12) as

$$\tilde{R}(a)\epsilon = \tilde{r}(a), \tag{13}$$

where $\tilde{R}(a)$ is of dimension $qph \times Nh$, $\tilde{r}(a)$ is $qph \times 1$, and $qh \leq Nh$. As shown in Doan et al. (1984), the structural shocks ϵ can be estimated using ordinary least squares. That is,

$$\hat{\epsilon} = \tilde{R}'(\tilde{R}\tilde{R}')^{-1}\tilde{r}. \tag{14}$$

With an estimate of the structural shocks $\hat{\epsilon}$ at hand, the conditional forecasts can easily be recovered using equation (8).

Since we are interested in the effectiveness of public spending policies, we assume various paths of government spending and analyze the implied scenarios for the remaining variables. However, we constrain the path of tax revenue growth so as to exclude the possibility that the scenario results are driven by changes on the revenue side. At the same time, we condition the monetary policy variable in the model - the first differenced three-month treasury bill rate - such that differing scenario forecasts neither result from changes in monetary policy. Thus, the unconditioned variables are output growth, inflation and the unemployment rate. Details on the conditions imposed in each of the scenarios are outlined in section 4.2.

With the scenario paths of all variables at hand, we can compute our estimate of the output gap in periods $T+1, T+2, ..., T+h$ as in Berger et al. (2023):

$$c_{t+1} = -\boldsymbol{F}(\boldsymbol{I} - \boldsymbol{F})^{-1}\boldsymbol{Y_{t+1}}. \tag{15}$$

Again, assuming output growth is the jth variable in y_t means that the output gap is the jth element in c_{t+1}.

3 Empirical framework

In this section, the estimation procedure as well as the data are outlined.

3.1 BVAR estimation using a Minnesota dummy observation prior

This section lays out the estimation approach for the VAR(p) model. In particular, we use Bayesian estimation techniques, drawing from Berger et al. (2023) and Morley and Wong (2020).

Consider again the standard VAR(p) model in reduced form of equation (3), restated here for convenience:

$$y_t = \phi_1 y_{t-1} + \phi_2 y_{t-2} + ... + \phi_p y_{t-p} + u_t, \quad u_t \sim N(0, \Sigma),$$

$t = \{1, 2, ..., T\}$. With each ϕ_j, $j = 1, 2, ..., p$ being of dimension $N \times N$, the high number of parameters to be estimated for increasing N and p motivates Bayesian estimation techniques. Following Morley and Wong (2020), a natural conjugate Minnesota dummy observation prior is employed, which applies shrinkage on the model's parameters and implies that the posterior means are obtainable as closed-form solution. For illustrative purposes, consider

(3) in expanded form:

$$y_t = \begin{bmatrix} \phi_1^{1,1} & \cdots & \phi_1^{1,N} & \phi_2^{1,1} & \cdots & \phi_2^{1,N} & \cdots & \cdots & \phi_p^{1,N} \\ \vdots & \ddots & \vdots & \vdots & \ddots & \vdots & \ddots & \ddots & \vdots \\ \phi_1^{N,1} & \cdots & \phi_1^{N,N} & \phi_2^{N,1} & \cdots & \phi_2^{N,N} & \cdots & \cdots & \phi_p^{N,N} \end{bmatrix} \begin{bmatrix} y_{t-1} \\ y_{t-2} \\ \vdots \\ y_{t-p} \end{bmatrix} + \begin{bmatrix} u_{1,t} \\ \vdots \\ u_{N,t} \end{bmatrix} \tag{16}$$

As outlined in Morley and Wong (2020), the first two prior moments of $\phi_i^{j,k}$, the slope coefficient corresponding to the i^{th} lag of the k^{th} variable in the j^{th} equation, are set as

$$\mathbb{E}\left[\phi_i^{j,k}\right] = 0, \tag{17}$$

$$Var\left[\phi_i^{j,k}\right] = \begin{cases} \dfrac{\lambda^2}{i^2}, & j = k \\ \dfrac{\lambda^2}{i^2}\dfrac{\sigma_j^2}{\sigma_k^2}, & \text{else.} \end{cases} \tag{18}$$

Thus, we follow Bańbura et al. (2010) in setting the first prior moment to 0 for all slope parameters due to their "substantial mean reversion", following from the imposition of stationarity on all series. The coefficient λ, which according to Bańbura et al. (2010) governs the prior's "overall shrinkage", is obtained from minimizing the corresponding pseudo-out-of-sample one-period-ahead forecast errors of the real GDP growth series, as in Morley and Wong (2020). Clearly, our loss function centers around real GDP as we want to optimize the model's forecasting capacity with respect to the output gap.

The choice of an out-of-sample loss function is to avoid overfitting that might be more likely to occur when minimizing an in-sample forecast error (once again, see Morley and Wong, 2020). The one-step-ahead root mean squared forecast error is computed recursively, with an initial sample covering the first 80 observations (that is, the first 20 years of the sample), then adding one observation in turn up to period $T-1$.

Intuitively, λ approaching zero is equivalent to the assumption that the variables tend to be independent white noise processes. Further note that a common feature of the Minnesota prior is the $\frac{1}{i^2}$ term in the prior variances of $\phi_i^{j,k}$, which implies that longer lags are shrunk more towards the mean, that is, towards zero. The σ_j^2 and σ_k^2 terms stem from AR(4) processes of the respective variables, estimated with ordinary least squares, as is common in the literature (see, among others, Berger et al., 2023 and Bańbura et al., 2010). Lastly, note that working with demeaned variables is equivalent to employing constants with a flat prior in each equation.

Following Morley and Wong (2020) and Del Negro and Schorfheide (2011), the model can be estimated by first embedding the above-specified prior by adding dummy observations to the data set and then simply running least squares on the extended data set, which is feasible due to the natural conjugacy of the prior.

3.2 Data

As mentioned above, our BVAR model includes six variables, namely real GDP, CPI inflation, the unemployment rate, the three-month treasury bill rate, real government current receipts and real government spending, motivated by standard choices in the fiscal multiplier literature (see for example Caldara and Kamps, 2017 or Ramey, 2019). Our quarterly dataset covers observations from 1952Q1 to 2022Q2. Non-stationary series are transformed to stationarity. Sources and transformations of all series are provided in appendix A.

4 Empirical results

In this section, our empirical results are presented. In section 4.1, we show our *ex-post* output gap, based on the full sample information. Section 4.2 describes the considered scenarios and lays out the results of the counterfactual analysis.

4.1 Ex-post output gap results

This section outlines the results of the estimated output gap based on the full information dataset. That is, we use all observations, from 1952Q1 to 2022Q2, and apply equation (6) to get the full information estimate of the Beveridge-Nelson output gap.

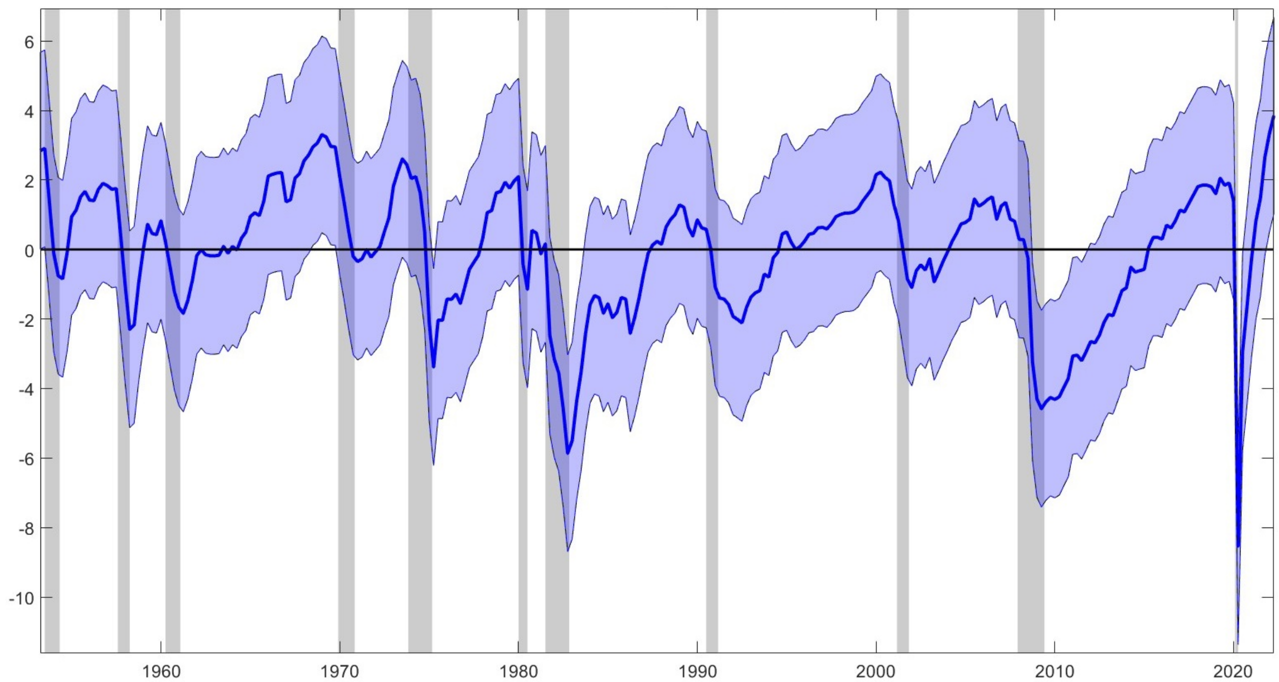
Figure 1 shows this result. The thick blue line represents the posterior mean of the output gap estimate, with the blue shaded area being the 90% credible set, and the gray shaded vertical areas representing NBER recession dates. As can be see from this figure, our estimated output gap captures the NBER recessions quite well, with the First Oil Crisis, the recession of 1981 to 1982, the Great Recession and the Covid-19 Recession being the most severe ones according to the respective business cycle troughs. Moreover, note that our output gap estimate is quite similar to both those in Berger et al. (2023) and Morley and Wong (2020), who use a higher number of variables and, in the case of Berger et al. (2023), a higher data frequency for most variables.

4.2 The fiscal scenarios

In this section, we analyze hypothetical macroeconomic consequences of various fiscal scenarios for different economic crises in US history. That is, unlike in section 4.1, we now look into counterfactuals that - according to our model - would have occurred for different paths of government spending. As explained above, in each of the scenarios, we control for the path of tax revenue and our model's nominal interest rate measure, both of which are set to follow their actual (ex-post observed) paths in each of the analyzed crisis scenarios.

Section 4.2.1 presents some details on the analyzed fiscal scenarios - from restrictive to "super-expansive". Section 4.2.2 briefly elaborates on the chosen crises. Finally, the scenario results are presented in section 4.2.3.

Figure 1: Output gap based on full sample information



Notes: The thick blue line represents the posterior mean of the estimated output gap based on the full information set, with the surrounding shaded area being the 90% credible interval of that estimate. The gray shaded areas indicate NBER recession dates.

4.2.1 The scenarios

We start by outlining the scenarios analyzed for each of the economic crises. For each crisis, we present four scenarios, which all differ according to the "expansiveness" of the government spending path. For all scenarios, using the ex-post information on the reduced-form parameters (that is, using all information up to the final observation in 2022Q2), we consider the hypothetical case of forecasting output growth, the unemployment rate, consumer price inflation and, by implication, the output gap, *at the time of the respective crisis*, conditional on the assumption that our government spending variable takes a certain path. At the same time, we control for the paths of tax revenues and the nominal interest rate, which we restrict to have the same values in each scenario. Thus, differences in the paths of the unrestricted variables - and particularly the output gap - will not result from different tax or monetary policies. The four scenarios can be described in the following way:

- **Actual spending path:** In this scenario, government spending follows its actual ex-post path. Assume we are interested in knowing what our model would predict for the business cycle at the height of the Global Financial Crisis, say at the end of 2008. The *actual spending path* scenario answers the question: According to our model, what values would the output gap take in 2009-2013 *if we knew the path government spending would take in 2009-2013* (and given the ex-post reduced-form parameter estimates and the paths of tax revenues and the nominal interest rate)?

- **Restrictive spending path:** In this scenario, we assume that government spending growth is 1 percentage point lower than it actually was during the whole scenario (forecast) horizon. Our Global Financial Crisis question becomes: How would the output gap be affected if in 2009-2013, government spending growth would be 1 percentage point lower than it actually was (given the same ex-post reduced-form parameter estimates and the paths of tax revenues and the nominal interest rate as in the actual spending path scenario)?

- **Expansive spending path:** This time, we assume government spending growth is 1 percentage point higher than it actually was for the whole scenario (forecast) horizon.

- **Super-expansive spending path:** Finally, we consider a "super-expansive" public spending scenario, where government spending growth is 5 percentage points higher than it actually was during the whole scenario (forecast) horizon.

For all scenarios, tax revenue growth and the first difference of the three-month treasury bill rate - the transformations we use in the model - will be conditioned to follow their actual ex-post paths.

4.2.2 The crises

The previously outlined scenarios are analyzed for a variety of crises in US history. In particular, we look into the four most severe crises as defined by our estimates of their business cycle troughs, displayed in figure 1. For each of the crises, we will briefly elaborate on the policy measures in place at the time as well as on the dating of the crises as defined by the NBER.[5] Finally, note that we assume some sluggishness in the implementation of fiscal measures, thus starting our scenario analyses two quarters after the respective recession start date. The scenario start dates are included in the following recession summaries.

- **The First Oil Crisis:** At the time of the First Oil Crisis, economic policy was dominated by the Federal Reserve, which was particularly concerned with countering the pronounced inflation dynamics: The monetary tightening certainly did not support the recovery. On the fiscal side, policymakers finally used tax cuts to stabilize the economy (see Blinder, 2022). According to the NBER, the First Oil Crisis lasted from November 1973 to March 1975. Following the logic described above, we start our scenario analysis in the second quarter of 1974.

- **The 1981-1982 recession:** When the 1981-1982 recession hit, the Federal Reserve was once again dominating economic policy, and once again mainly concerned with bringing down high inflation levels. However, President Reagan brought fiscal policy back to the center of attention: To counter the deep recession, the Reagan government implemented enormous tax cuts in 1981, 1982 and 1983, amounting, according to Blinder (2022), to a 23% personal income tax rate reduction in total, thus strongly weighing on the government's budget balance. Government spending still played no prominent role in terms of stabilization policies and was even reduced to partly finance the arising budget deficit. However, due to increased military spending expenses that incurred at the same time, this deficit reduction was negligible, implying soaring debt-to-GDP levels (see Blinder, 2022). According to the NBER, the 1981-1982 recession lasted from July 1981 to November 1982, implying a start date for our counterfactuals in 1982Q1.

[5] See here for the business cycle dating. For the description of the economic policies in place during the recessions, we borrow from Blinder (2022), who provides an excellent overview on historical monetary and fiscal policies in the US.

- **The Great Recession:** Roughly 25 years later, monetary policy still held supremacy with respect to the conduct of stabilization policy: The primary response to the Great Recession was a massive reduction in the policy rate of more than 5 percentage points, combined with other measures such as *quantitative easing* and *forward guidance*. On the fiscal side, things changed once President Obama took office, who quickly implemented the *American Reinvestment and Recovery Act* (ARRA) - a massive fiscal stimulus package of approximately 5% of GDP, which was a combination of expansionary spending and tax measures. As laid out in Blinder (2022), the ARRA was far from uncontroversial: While some prominent voices, among them Paul Krugman and Christina Romer, argued that the stimulus program was not sufficient given the size of the recession, the Obama administration faced a lot of headwind particularly from the Republican side, whose criticism focused on the spending components of the stimulus package. After the midterms, with the Republicans having reclaimed the House of Representatives, fiscal policy even became contractionary towards the beginning of the 2010s, much to the disliking of the incumbent chairman of the Federal Reserve, Ben Bernanke, who was suggesting the Fed and government to move in lock step to further soften the recessionary blow (see Blinder, 2022). With NBER recession start and end dates in December 2007 and June 2009, we start our Great Recession scenarios in 2008Q2.

- **The Covid-19 Recession:** The policy response to the Covid-19 Recession was different again, as with the major monetary expansion in response to the Great Recession, the Fed's policy rate was close to the zero lower bound. The Fed used what maneuverability it still had and reduced rates further, simultaneously once again resorting to quantitative easing and forward guidance. The monetary dominance of former crises was over, though: Most prominently, the incumbent governments passed a variety of fiscal stimulus packages, among them the *Coronavirus Aid, Relief, and Economic Security Act* and later on the *American Relief Plan*, with a total of approximately 6 trillion USD, together more than 27% of 2021 GDP. Unlike in the Great Recession, the biggest components of these stimulus packages were tax cuts and transfer payments (for more details, see Blinder, 2022). According to the NBER, the Covid-19 Recession lasted from February to April 2020, implying a scenario start date in 2020Q3.

In conclusion, government spending was not the main contributor to the stabilization policies for the crises at hand, even though things have shifted more towards fiscal policy measures (both on the revenue and expenditure front) since the Great Recession. With the following scenario analyses, we address the question whether different government spending policies would have led to different economic outcomes, especially in terms of the speed of recovery.

4.2.3 Scenario results

This section presents the scenario results for all of the above-mentioned crises. For all but the Covid-19 crisis, the scenario (conditional forecast) horizon is 5 years (20 quarters). Since the conditions for the fiscal and monetary variables are based on their actual ex-post values, the Covid-19 scenario horizon is restricted to 8 quarters, that is, the scenario ends in 2022Q2, which is the last observation in the sample.

Figure 2 displays the scenario results for the First Oil Crisis. The thick blue line represents the mean path of the ex-post output gap (as presented in figure 1). The scenarios start in 1974Q2, that is, early in the First Oil Crisis, as defined by the NBER. The dashed blue line indicates the scenario where government spending follows its true (ex-post) path ("actual spending path" scenario, see section 4.2.1). The red, green and cyan dashed lines represent the restrictive, expansive and super-expansive scenarios, respectively. As can be seen, had the US government done more to counter the crisis (by means of increased government spending) early on, the recession would have been less pronounced. For example, in the case of the super-expansive scenario, the business cycle trough would have been at approximately -1.9% instead of -3.4% in the case of the full information estimate (displayed in figure 1), while the expansion phase would have been reached as early as 1975Q3 instead of 1978Q1.

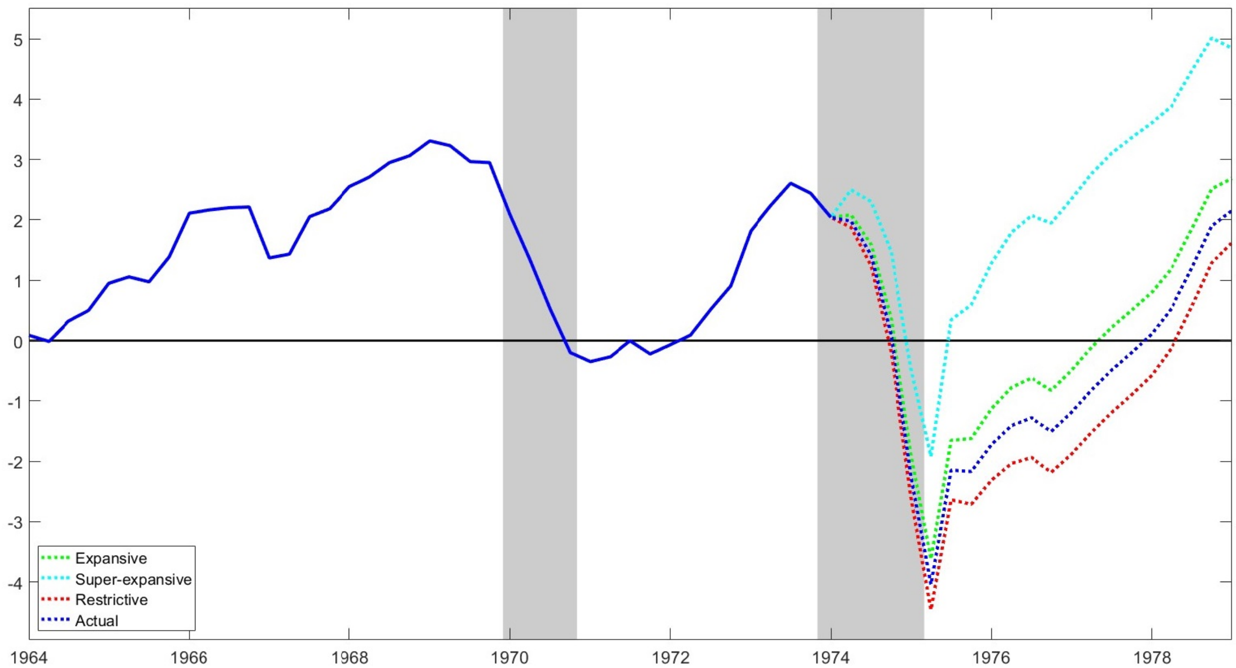
However, this highly expansionary spending path is not costless: Had the US government in fact raised public spending growth by an amount of 5 percentage points above its actual path, the public debt-to-GDP ratio (debt ratio) would have roughly risen by 21 percentage points over the analyzed five year period.[6] Moreover, with the output gap closed so quickly in the super-expansive scenario, there clearly is a danger of overheating in this case, with the output gap rising above 5% towards the end of the scenario horizon. This development is also confirmed by the implied rising inflation levels, see figure B.1 in the appendix.

A less severe increase in the output gap and therefore inflationary pressure would have occurred for a less pronounced fiscal expansion: In the expansive scenario, where each period's public spending growth is just 1 percentage point higher than its ex-post value (instead of 5 percentage points in the super-expansive scenario) the output gap towards the scenario end approaches 3% instead of 5% in the super-expansive case. This is again confirmed by lower inflation tendencies as indicated in figure B.1, with quarter-on-quarter inflation roughly at 1.5% towards scenario end, instead of almost 2% in the super-expansive case. On the other hand, the lower amount of public spending means that the recession is much more severe, as indicated by the trough of the green dashed line. In fact, the recession is hardly cushioned at all, and the output gap is closed only in 1977Q3 (only two quarters before the same occurs in the actual spending scenario and according to the full information estimate of figure 1). At the same time, the debt ratio lies 4 percentage points above its ex-post value at scenario end.

Clearly, resorting to stabilization policies leads to the well-known trade-off between the speed of recovery and the possibility of overheating with inflationary tendencies, combined with a potential strain on fiscal solvency as a consequence of increasing debt levels. Scenario analyses of the kind presented here provide policymakers with a tool to quantitatively

[6] Instead of 32% at the end of the scenario horizon (in 1978Q4), the debt ratio would have risen to 53%. However, this is just a very rough guess, assuming the spending-induced increase in aggregate demand has no feedback effects on the debt ratio. It serves - in a simplistic way - the purpose of illustrating the looming danger of overspending in terms of fiscal sustainability.

Figure 2: Output gap paths for First Oil Crisis scenario



Notes: Displayed are the implied paths of the output gap resulting from four different fiscal scenarios: Actual (blue), restrictive (red), expansive (green) and super-expansive (cyan). The thick blue line indicates sample observations, dashed lines indicate scenarios paths. NBER recession dates are depicted as gray shaded areas. The scenario (forecast) horizon is 20 quarters.

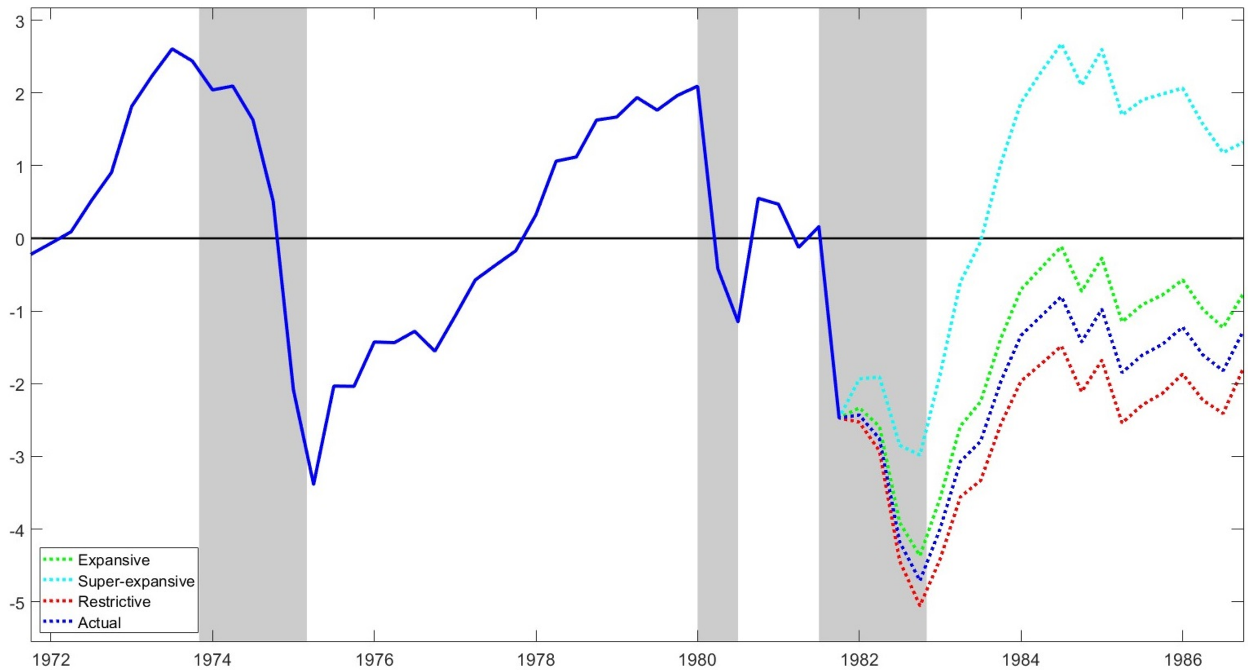
investigate this trade-off.

The importance of the "dosage" of fiscal stimulus, injected into the system, is apparent for the 1981-1982 recession as well. Figure 3 presents the output gap scenarios for this crisis. Again, the super-expansive scenario shows a much less severe downturn, with a trough around -3% (as opposed to -4% to -6% for the alternative cases). This time, though, in all but the super-expansive scenario, the output gap is never closed for the duration of the scenario. This makes a stronger case for excessive fiscal spending and might be more of a justification of the (hypothetically) resulting pronounced increase in public debt.[7]

Similar findings are given for the Great Recession case in figure 4: A massive and persistent increase in fiscal stimulus as in the super-expansive scenario would have led to a

[7]However, it should be noted that the increase in the debt-to-GDP ratio in the Reagan years was quite pronounced even without the high public spending growth rates of the super-expansive scenario. One could argue, nevertheless, that a faster recovery might at least partially offset the increase in the debt ratio due to automatic stabilizers and a higher denominator.

Figure 3: Output gap paths for 1981-1982 recession scenario

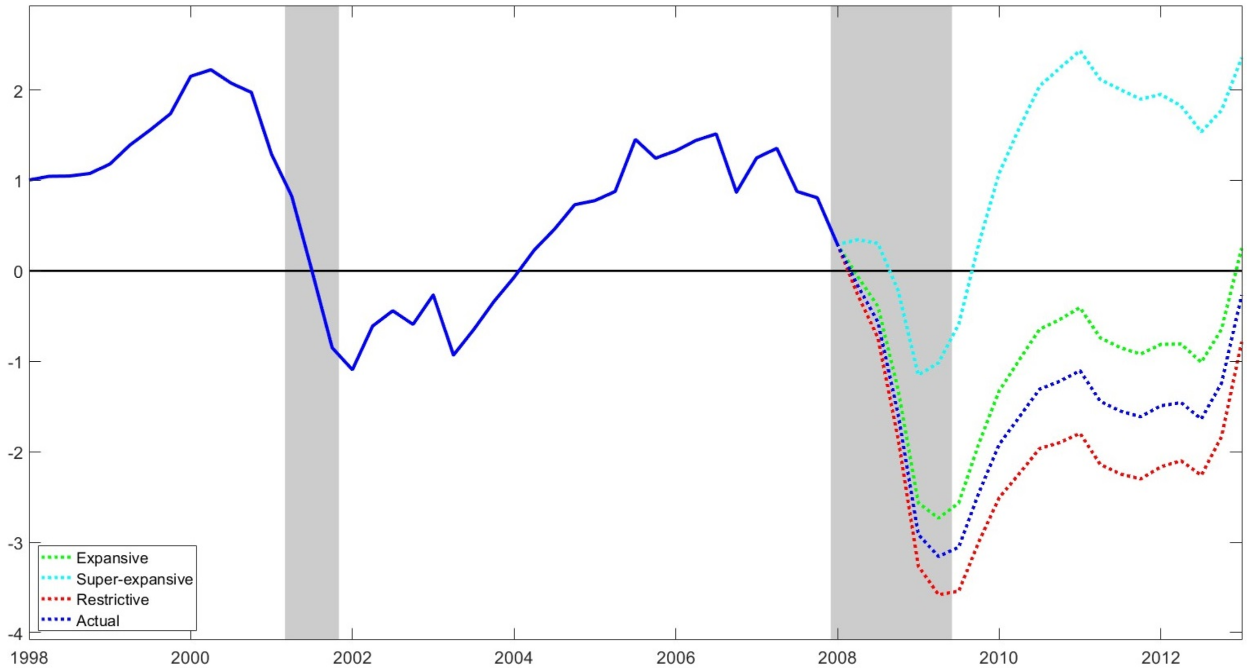


Notes: Displayed are the implied paths of the output gap resulting from four different fiscal scenarios: Actual (blue), restrictive (red), expansive (green) and super-expansive (cyan). The thick blue line indicates sample observations, dashed lines indicate scenarios paths. NBER recession dates are depicted as gray shaded areas. The scenario (forecast) horizon is 20 quarters.

distinctly faster recovery, both compared to the alternative scenarios as well as the full information output gap: In the super-expansive case, the recovery phase would have set in at the end of 2009 already, while - according to our model - in the actual spending scenario and for the full information case a recovery was not even in place towards the end of the scenario horizon. Again, despite a hypothetical increase in the debt ratio from 99% to 117% at the end of the scenario horizon (ignoring potential mitigating effects from higher GDP growth), there is a case for pronounced fiscal stimulus, and even more so than already occurred in response to the Great Recession. Thus, our findings are somewhat in line with the position of proponents of more fiscal stimulus, mentioned above. The case for more public spending is also confirmed by an only moderate increase in inflation (see figure B.3).

In the Covid-19 case, presented in figure 5, our model predicts that additional positive effects on the output gap are expensively bought: Although massive public spending does

Figure 4: Output gap paths for Great Recession scenario



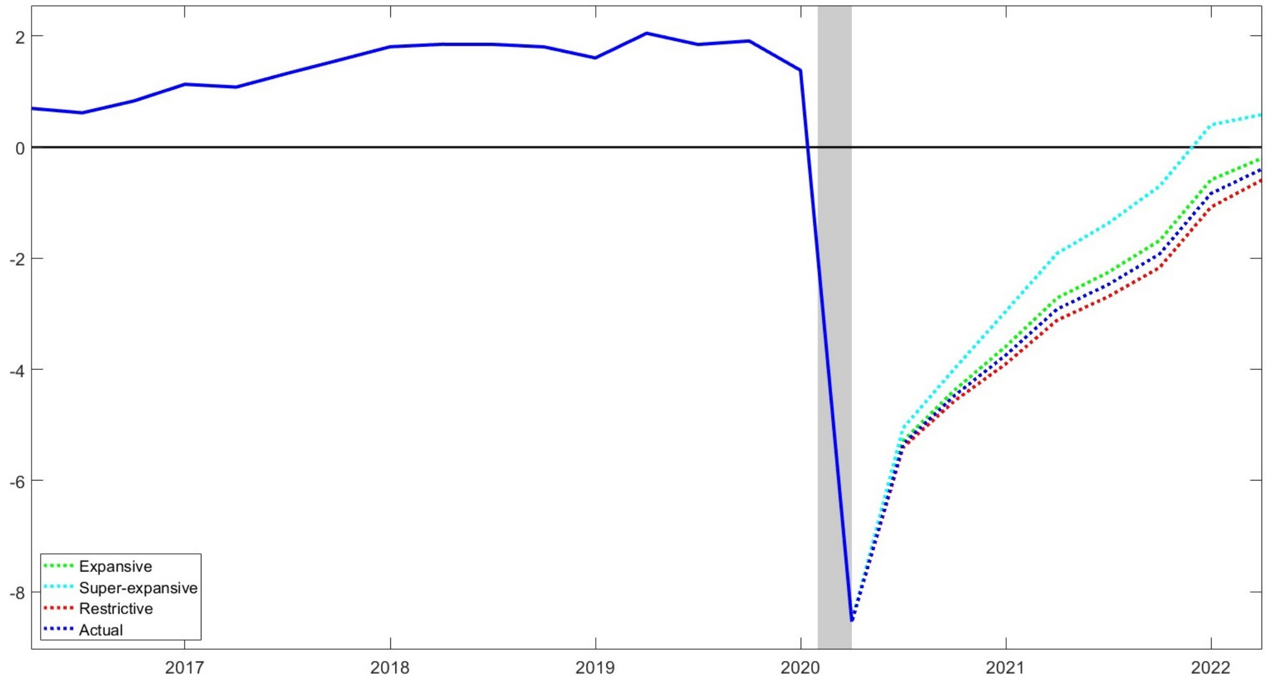
Notes: Displayed are the implied paths of the output gap resulting from four different fiscal scenarios: Actual (blue), restrictive (red), expansive (green) and super-expansive (cyan). The thick blue line indicates sample observations, dashed lines indicate scenarios paths. NBER recession dates are depicted as gray shaded areas. The scenario (forecast) horizon is 20 quarters.

help to close the output gap more quickly, the difference appears almost negligible, with a difference in means against the actual spending scenario over the scenario horizon of 0.54 percentage points. Given the implied increase in the debt ratio of roughly 8 percentage points, this seems costly. However, note that the Covid-19 scenario is restricted to 8 quarters only, as mentioned above. Thus, judging the full effect of a fiscal stimulus as shown for the other crises needs to be assessed in the future. It should still be noted that this finding appears somewhat counterintuitive, given the literature on more effective fiscal multipliers at the zero lower bound (see e. g. Ramey, 2019).[8]

Finally, note that according to our model, massive fiscal stimulus has a pronounced effect on the unemployment rate, too: For example, in the case of the 1981-1982 recession, the

[8]However, note that while for the first three crises considered, the conditional forecasts (scenarios) are quite close to the estimated ex-post gaps, this is not the case for the Covid-19 case. Here, the recovery according to the full information gap estimate set in much faster than predicted by our model. Still, the finding that a massive increase in fiscal stimulus on the spending side does not seem to have much effect here is insightful.

Figure 5: Output gap paths for Covid-19 scenario



Notes: Displayed are the implied paths of the output gap resulting from four different fiscal scenarios: Actual (blue), restrictive (red), expansive (green) and super-expansive (cyan). The thick blue line indicates sample observations, dashed lines indicate scenarios paths. NBER recession dates are depicted as gray shaded areas. The scenario (forecast) horizon is restricted to 8 quarters since the conditions on fiscal and monetary variables are proportional to the variables' ex-post paths, which in this case are available only for 8 "future" (pseudo-out-of-sample) observations.

super-expansive scenario predicts an unemployment rate of roughly 3.9% as opposed to 6.7% for the actual spending scenario and a true (ex-post) value of 6.8%. The reduction in the unemployment rate is similar for the First Oil Crisis and the Great Recession cases, again making more of a case for (even more) pronounced fiscal stimulus. As for the output gap, the unemployment effect in the Covid-19 case appears to be smaller, at least upon observation of the shorter scenario of only 2 years.

5 Conclusion

Challenges justifying a role for fiscal policy and public spending are omnipresent: Be it distortions resulting from recent crises such as the Covid-19 pandemic or the Ukrainian-Russian war, or long-term challenges such as increased financing needs in aging societies or investment requirements to tackle and adapt to climate change.

At the same time, these very challenges strongly weigh on fiscal sustainability, especially given the already pronounced debt levels in advanced economies. Lately, rising interest rates and the consequently increasing refinancing costs amplify the severity of these dynamics. Therefore, placing the trade-off between stimulating effects from public spending on the one hand and overheating as well as potentially rising debt levels on the other at the center of attention is essential for adequate policymaking.

In accordance with the literature on fiscal multipliers, we show that an increase in public spending positively affects output and reduces unemployment in times of crisis. In addition, we provide empirical evidence for a positive impact of public spending on the output gap, thereby extending the debate on fiscal efficacy from the mere discussion of output levels and growth rates to the more policy-relevant question of business cycle effects. Thus, next to the upside of fiscal expansions, our model gauges potential downsides from "overspending" in terms of an overheating economy and resulting inflationary effects, which should be evaluated on a case-by-case basis. In this light, our model hands the prudent fiscal policymaker a tool to assess the dosage of public spending measures.

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A Data appendix

Table A.1 displays the data series employed in the BVAR. All series are taken from the Federal Reserve Bank of St. Louis database (FRED) and are transformed to stationarity. The respective transformation of the series is displayed in the table.[9]

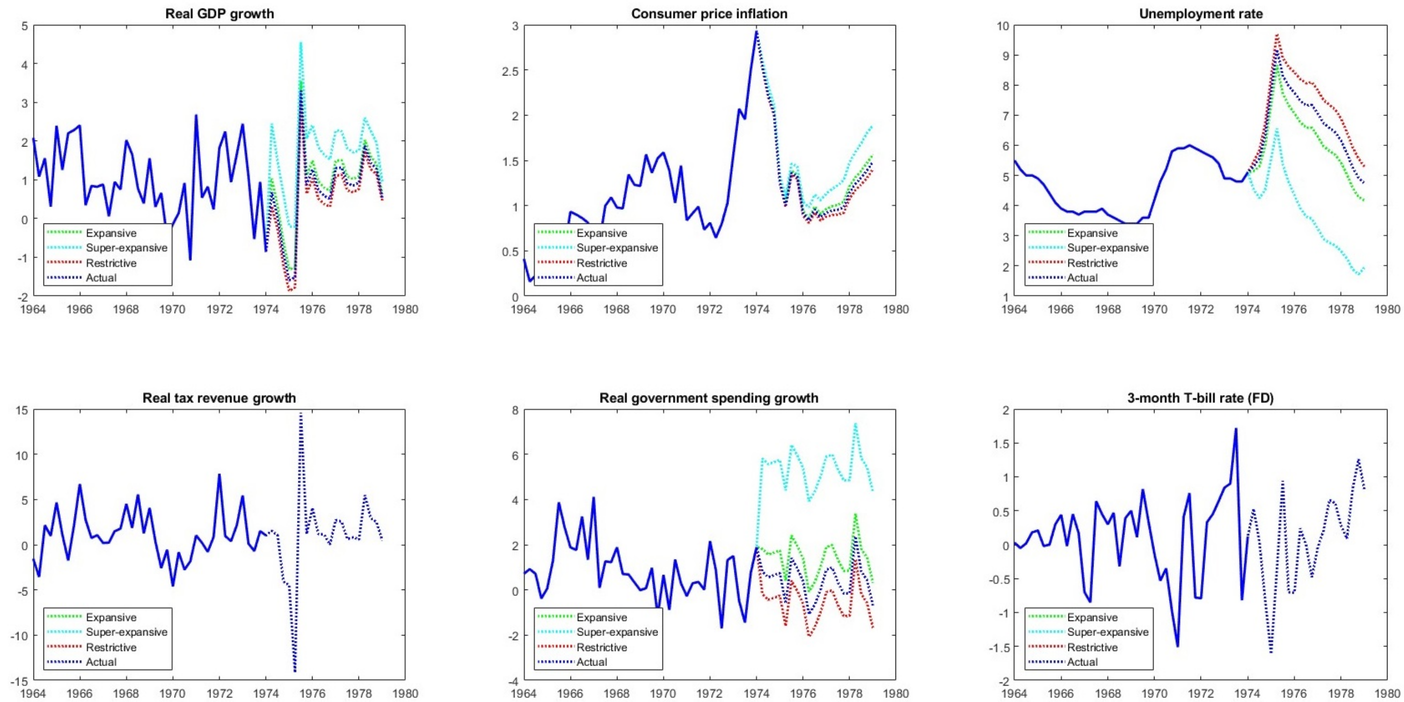
Table A.1: Data description for the vector autoregression

Series name	Sources	Transformation
Real government spending	"Government Consumption Expenditures and Gross Investment" (FRED code: GCE), deflated by "Gross Domestic Product: Implicit Price Deflator" (FRED code: GDPDEF)	Δln
Real gross domestic product	"Gross domestic product" (FRED code: GDP), deflated by "Gross Domestic Product: Implicit Price Deflator" (FRED code: GDPDEF)	Δln
Consumer price index	"Consumer Price Index for All Urban Consumers: All Items in U.S. City Average" (FRED code: CPIAUCSL)	Δln
Real government current receipts	"Federal Government Current Receipts" (FRED code: FGRECPT), deflated by "Gross Domestic Product: Implicit Price Deflator" (FRED code: GDPDEF)	Δln
Unemployment rate	"Unemployment Rate" (FRED code: UNRATE)	–
Nominal interest rate	"3-Month Treasury Bill Secondary Market Rate, Discount Basis" (FRED code: TB3MS)	Δ

[9]Note that growth rates are expressed as quarter-on-quarter percentage changes.

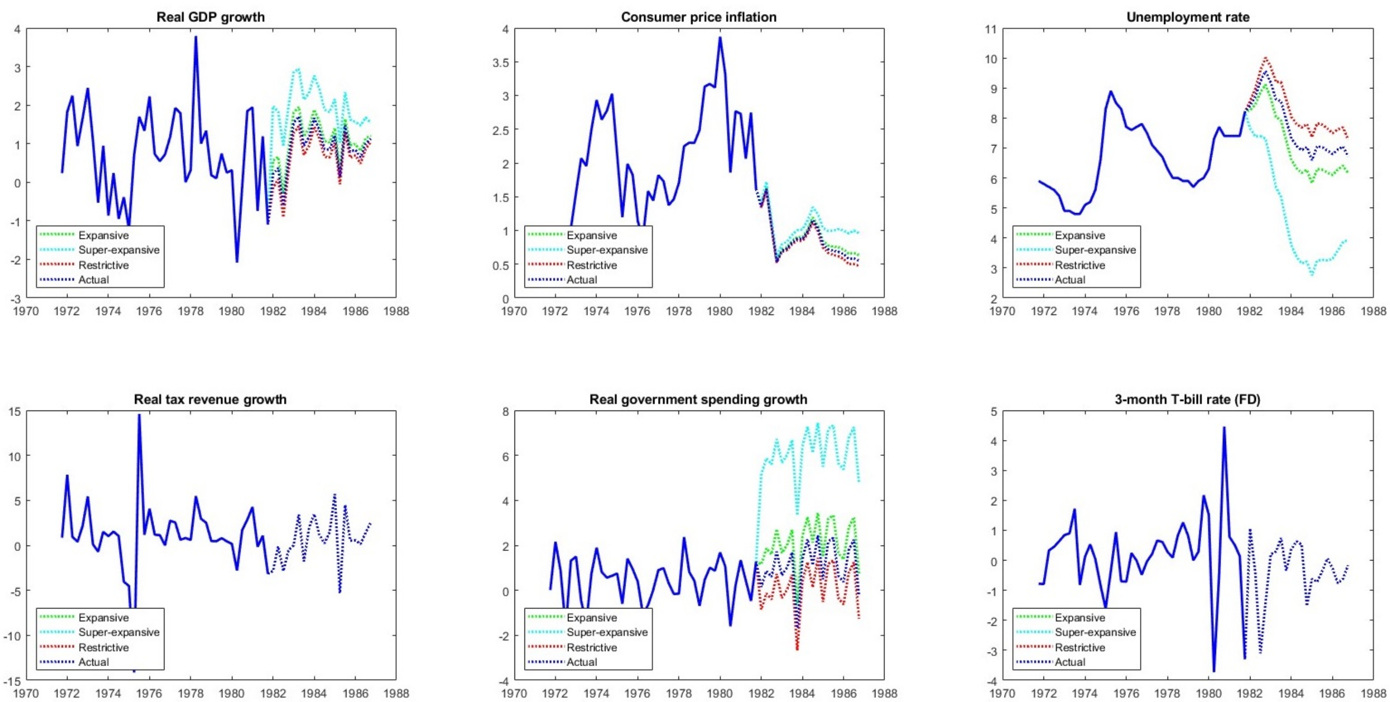
B Scenario plots of endogenous variables

Figure B.1: Endogenous variable paths for First Oil Crisis scenario



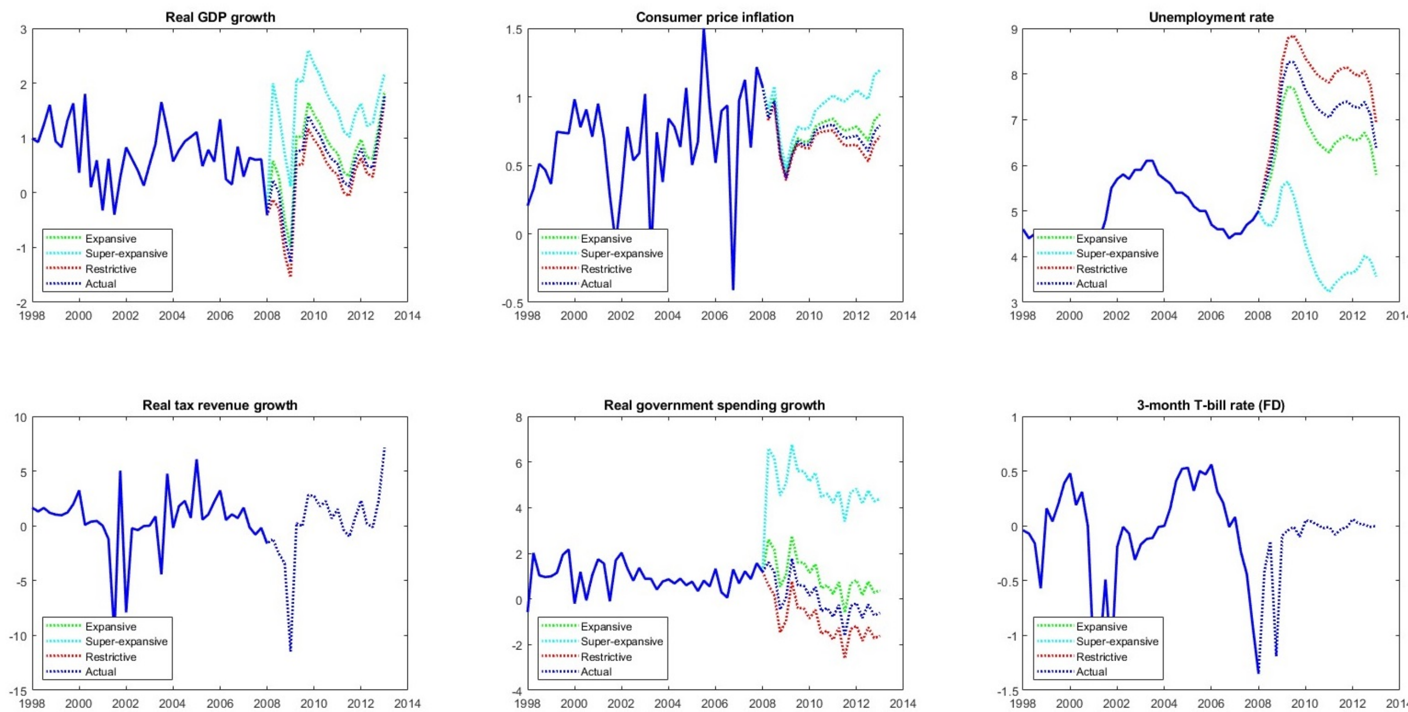
Notes: Displayed are the implied paths resulting from four different fiscal scenarios: Actual (blue), restrictive (red), expansive (green) and super-expansive (cyan). The thick blue line indicates sample observations, dashed lines indicate scenario paths.

Figure B.2: Endogenous variable paths for 1981-1982 recession scenario



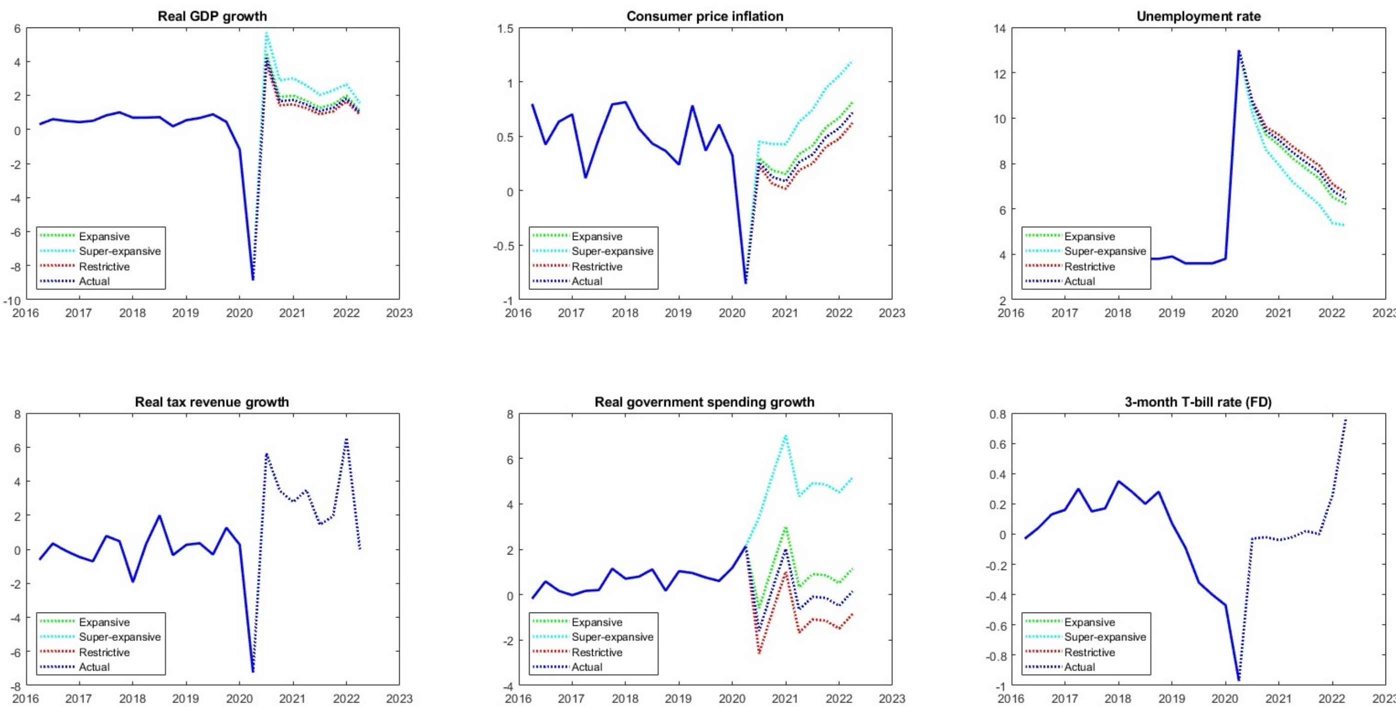
Notes: Displayed are the implied paths resulting from four different fiscal scenarios: Actual (blue), restrictive (red), expansive (green) and super-expansive (cyan). The thick blue line indicates sample observations, dashed lines indicate scenario paths.

Figure B.3: Endogenous variable paths for Great Recession scenario



Notes: Displayed are the implied paths resulting from four different fiscal scenarios: Actual (blue), restrictive (red), expansive (green) and super-expansive (cyan). The thick blue line indicates sample observations, dashed lines indicate scenario paths.

Figure B.4: Endogenous variable paths for Covid-19 scenario



Notes: Displayed are the implied paths resulting from four different fiscal scenarios: Actual (blue), restrictive (red), expansive (green) and super-expansive (cyan). The thick blue line indicates sample observations, dashed lines indicate scenario paths.