Fiscal Policy, Wages, and Jobs in the U.S.

Kim, Hyeongwoo

Auburn University

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Hyeongwoo Kim†
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Abstract

This paper empirically investigates the fiscal policy effects on labor market conditions, employing an array of structural vector autoregressive models for the post-war U.S. data from 1960:I to 2017:II. Fiscal spending shocks increase jobs in the government sector at the cost of private sector jobs, resulting in net losses to the total employment. Private wages increase insignificantly in the short-run, while government wages rise significantly and persistently in response to the fiscal shock. Consequently, the wage gap across the two sectors widens in response to the fiscal shock. The wage shock yields significantly positive responses of corporate profits in the long-run as it enhances productivity, which supports wage-led growth models. On the other hand, I report negligible in-sample and out-of-sample predictive contents for private jobs and wages from corporate profits, meaning that there's virtually no evidence of the trickle-down effect, which is essential for profit-led growth models.

Keywords: Government Spending; Labor Market Condition; Trickle-Down Effect; Profit-Led Growth; Wage-Led Growth; Out-of-Sample Forecast

JEL Classification: E24; E52; E62

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†Patrick E. Molony Professor of Economics, Auburn University, 138 Miller Hall, Auburn, AL 36849. Tel: (334) 844-2928. Fax: (334) 844-4615. Email: gmmkim@gmail.com.

1 Introduction

The sluggish recovery from the recent Great Recession has revived the debate on the effectiveness of the fiscal policy in stimulating economic activity among the economics profession. Can increases in government spending help promote economic activity in the private sector? And if so, will key variables of interest such as consumption, investment, employment, and real wages respond persistently positively to expansionary fiscal policy? These questions has led to a large literature on this issue.

Some researchers are fairly optimistic about the role of government stimulus. They report overall positive responses of consumption, real wages, and output to expansionary government spending shocks, which are roughly in line with the New Keynesian macroeconomic model, even though replications of empirical findings can be difficult unless their models are heavily restricted. See, among others, Rotemberg and Woodford (1992), Devereux, Head, and Laphan (1996), Fatás and Mihov (2001), Blanchard and Perotti (2002), Perotti (2004), Galí, López-Salido, and Vallés (2007).

On the other hand, another group of scholars provides strong evidence of negative responses of consumption and real wages to fiscal spending shocks. See, for example, Aiyagari, Christiano, and Eichenbaum (1992), Hall (1986), Ramey and Shapiro (1998), Edelberg, Eichenbaum, and Fisher (1999), Burnside, Eichenbaum, and Fisher (2004), Mountford and Uhlig (2009), Ramey (2012), and Owyang, Ramey, and Zubairy (2013). Ramey (2011b) points out that these responses reflect a negative wealth effect that often appears in the neoclassical macroeconomic model such as Aiyagari, Christiano, and Eichenbaum (1992) and Baxter and King (1993). Increases in government spending may result in a negative wealth effect because the government has to raise tax in the future to finance the deficits. Rational consumers respond to it by reducing consumption and increase labor supply. Overall, empirical evidence on the effectiveness of fiscal stimulus is mixed.[1]

It should be noted that much of the attention in the literature has focused on the effects of the fiscal policy on the gross domestic product (GDP) and consumption,

[1] One closely related issue is on the possibility of the asymmetric effects of the government spending shock. That is, fiscal policy may become more effective in the presence of slacks during recessions. Again, empirical evidence is again mixed. Auerbach and Gorodnichenko (2012), Bachman and Sims (2012), Mittnik and Semmler (2012), and Fazzari, Morley, and Panovska (2015) report higher fiscal multipliers in a regime of a low economic activity than those in a high regime activity, whereas Owyang, Ramey, and Zubairy (2013), Ramey and Zubairy (2014), and Kim and Jia (2017) find no such evidence. Christiano, Eichenbaum, and Rebelo (2011) reports a larger spending multiplier when the zero lower bound on the nominal interest rate binds.

whereas much less attention was paid to its effects on labor market conditions, although policy-makers seems to have focused more on the latter in their efforts to combat the Great Recession.[2]

Some research works report a positive fiscal policy effect on employment as a *by-product* of its output effects. See, among others, Fatás and Mihov (2001) and Burnside, Eichenbaum, and Fisher (2004). In contrast, some focused on its direct effects on labor market variables. Finn (1998) demonstrates an increase in government jobs could result in a decrease in private sector employment. Cavallo (2005) proposes a similar model but with a dampened negative effect on consumption as the government spending for public employment serves as a transfer for households. Monacelli, Perotti, and Trigari (2010) report more beneficial effects of the fiscal policy on an array of labor market variables. Overall, the labor market effects of fiscal policy have been somewhat overlooked in the current literature, and we attempt to fill the gap.

In this paper, we investigate the fiscal policy effects on labor market variables in the U.S. using an array of recursively identified vector autoregressive (VAR) models, similar to the one by Blanchard and Perotti (2002), for the post-war macroeconomic data. Unlike Monacelli, Perotti, and Trigari (2010), we distinguish the key labor market variables in the private sector from those in the government sector. Unlike Finn (1998) and Cavallo (2005), we focus on *empirical* evidence of the fiscal policy effects on labor market conditions. Our major findings are as follows.

First, government spending shocks are not effective in stimulating private activity. The *private* gross domestic product that excludes government spending responds negatively to the fiscal spending shock. Furthermore, its negative responses eventually dominate increases in the government spending. Second, fiscal spending shocks increase government jobs at the expense of private employment. Private and government wages both rise in response to expansionary fiscal policy, although increases in private wages are overall insignificant. Government wages rise significantly and persistently. Third, corporate profits have virtually no role in improving the labor market conditions, meaning that there's not much evidence of the so-called trickle-down effect

[2]The U.S. Congress enacted the American Recovery and Reinvestment Act of 2009 (ARRA) in February 2009. The Recovery Act was signed into law by then-President Barack Obama one week later on February 17, 2009. In addition to extensive economic stimulus programs, the law's primary objective was to create new employment opportunities as well as saving existing jobs. For instance, \$275 billion out of the total \$787 billion funding was allocated in federal contracts, grants, and loans that hired new staffs in the public agencies such as the Environmental Protection Agency and the Food and Drug Administration. In addition, \$224 billion was allocated for extended unemployment benefits, education and health care.

that is crucial for profit-led economic growth models. Also, increases in productivity have limited effects in enhancing labor market conditions.

Lastly, we corroborate these in-sample evidence with an array of out-of-sample forecasting exercises that statistically evaluate predictive contents of key macroeconomic variables for wages and employment in the future. Government spending seems to have substantial and significant out-of-sample predictive contents for employment. Private GDP contains some useful information for dynamics of wages and jobs in the future. On the contrary, corporate profits have virtually no predictive contents for jobs and wages, which is again at odds with implications of the trickle-down effect. Again, productivity provides limited information for out-of-sample prediction of private jobs and wages.

The remainder of this paper is organized as follows. Section 2 introduces our VAR models and out-of-sample forecast schemes. In Section 3, we present data descriptions and our major empirical findings. We also report an array of robustness check analyses and simulation exercises. Section 4 reports our out-of-sample forecasting exercise results. Section 5 concludes.

2 The Econometric Model

We employ the following vector autoregressive (VAR) model.

$$\mathbf{x}_t = \gamma' \mathbf{d}_t + \sum_{j=1}^{p} \mathbf{A}_j \mathbf{x}_{t-j} + \mathbf{C}\mathbf{u}_t, \tag{1}$$

where

$$\mathbf{x}_t = [g_t \quad y_t \quad lab_t \quad i_t \quad m_t]',$$

$\mathbf{d}_t$ is a vector of deterministic terms that includes an intercept and time trend, $\mathbf{C}$ is a lower-triangular matrix, and $\mathbf{u}_t$ is a vector of mutually orthonormal structural shocks, that is, $E\mathbf{u}_t\mathbf{u}_t^{'} = \mathbf{I}$. g_t denotes the real federal government consumption and gross investment spending per capita, y_t is the real GDP per capita, lab_t is the labor market variable, i_t is the effective federal funds rate, and m_t denotes the monetary base.

We are particularly interested in the j-period ahead orthogonalized impulse-response functions (OIRF) defined as follows.

$$IRF(j) = E\left(\mathbf{x}_{t+j} | u_{k,t} = 1, \Omega_{t-1}\right) - E\left(\mathbf{x}_{t+j} | \Omega_{t-1}\right), \tag{2}$$

where $u_{k,t}$ is the structural shock to the k^{th} variable in (1) and Ω_{t-1} is the adaptive information set at time $t-1$.[3]

We also consider the private real GDP per capita ($pgdp_t$) for y_t in (1), which does not include the total government consumption and gross investment. For lab_t, we employ one of the following four labor market condition variables: private sector wages (pw_t), government sector wages (gw_t), private sector employment (pj_t), and government sector employment (gj_t).

Note that g_t is ordered first in (1), meaning that g_t is not contemporaneously influenced by innovations in other variables within one quarter. This assumption is often employed in the current literature (e.g., Blanchard and Perotti [2002] and Ramey [2011a]), because implementations of discretionary fiscal policy actions normally require Congressional approvals, which take longer than one quarter. On the other hand, the money market variables, i_t and m_t, are ordered last. This is because the Federal Open Market Committee (FOMC) can revise the stance of monetary policy via regular and emergency meetings whenever it is necessary. i_t is ordered before m_t because the Fed targets the interest rate and the monetary base responds endogenously.

It is well documented that econometric inferences from recursively identified VAR models may not be robust to alternative VAR ordering. However, Christiano, Eichenbaum, and Evans (1999) show that impulse-response functions can be invariant when the location of the shocking variable is fixed. It turns out that all response functions to the fiscal spending shocks are numerically *identical* even when one randomly rearranges the variables next to g_t.[4] Therefore, our key findings presented in this paper are robust to alternative ordering.

In addition to the VAR model (1) for in-sample analysis, we employ the following autoregressive (AR) type *out-of-sample* forecasting model to study the predictive contents for labor market variables in other macroeconomic variables z_t. For this purpose, we use the following j-period ahead AR(1)-type prediction model. Abstracting from deterministic terms, the benchmark forecasting model is,

$$lab_{t+j} = \alpha_j lab_t + u_{t+j},\ \ j = 1, 2, .., k, \tag{3}$$

where α_j is less than one in absolute value for stationarity. Note that we employ a

[3] That is, the information set has the following property, $\Omega_{t-1} \supseteq \Omega_{t-2} \supseteq \Omega_{t-3} \supseteq \cdots$.

[4] Similarly, all response functions to monetary policy shocks stay identical even if the variables before the monetary variables are randomly reshuffled.

direct forecasting approach by regressing lab_{t+j} on the current value lab_t. It should be also noted that α_j coincides with the AR(1) persistence parameter ($\alpha_1 = \alpha$) when $j = 1$.[5] The ordinary least squares (OLS) estimator for (3) yields the following j-period ahead forecast from this benchmark AR-type model.

$$lab^{BM}_{t+j|t} = \hat{\alpha}_j lab_t \tag{4}$$

We propose the following competing model that extends (3) with a predictor variable z_t.

$$lab_{t+j} = \alpha_j lab_t + \beta_j z_t + u_{t+j},\ \ j = 1, 2, .., k \tag{5}$$

Applying the OLS estimator for (5), we obtain the following j-period ahead forecast for the target variable from this competing model,

$$lab^{C}_{t+j|t} = \hat{\alpha}_j lab_t + \hat{\beta}_j z_t \tag{6}$$

Note that the competing model (5) nests the stationary benchmark model (3) when z_t does not contain any useful predictive contents for lab_{t+j}, that is, $\beta_j = 0$.

We implement out-of-sample forecast exercises, employing a fixed-size rolling window method that performs better than recursive methods in the presence of a structural break.

We first estimate the coefficients in our forecasting models (3) and (5) using the initial $T_0 < T$ observations, $\{lab_t, z_t\}_{t=1}^{T_0}$, then obtain the $j-$period ahead out-of-sample forecast for the target variable, lab_{T_0+j} by (4) or (6). Next, we move the sample period of the data forward by adding one more observation to the sample but dropping one earliest observation, $\{lab_t, z_t\}_{t=2}^{T_0+1}$, then re-estimate the coefficients for the next round forecast for lab_{T_0+j+1}. Note that we maintain the same number of observations (T_0) throughout the whole exercises. We repeat until we forecast the last observation, lab_T. We implement this scheme for up to 12 quarter (3 years) forecast horizons, $j = 1, 2, ..., 12$.

For evaluations of the out-of-sample prediction accuracy, we use the ratio of the

[5]For $j > 1$, $\alpha_j = \alpha^j$ and $u_{t+j} = \varepsilon_{t+j} + \alpha\varepsilon_{t+j-1} + ... + \alpha^{j-1}\varepsilon_{t+1}$, where ε_t is a white noise process.

root mean square prediction error ($RRMSPE$) defined as follows,

$$RRMSPE(j) = \frac{\sqrt{\frac{1}{T-T_0-j}\sum_{t=T_0+j}^{T}\left(u_{t+j|t}^{BM}\right)^2}}{\sqrt{\frac{1}{T-T_0-j}\sum_{t=T_0+j}^{T}\left(u_{t+j|t}^{C}\right)^2}}, \tag{7}$$

where

$$u_{t+j|t}^{BM} = lab_{t+j} - lab_{t+j|t}^{BM},\ u_{t+j|t}^{C} = lab_{t+j} - lab_{t+j|t}^{C} \tag{8}$$

Note that our competing model outperforms the benchmark model when $RRMSPE$ is greater than 1.

We supplement our analyses by employing the Diebold-Mariano-West (DMW) test. See Diebold and Mariano (1995) and West (1996). For this, we define the following loss function,

$$d_t = (u_{t+j|t}^{BM})^2 - (u_{t+j|t}^{C})^2, \tag{9}$$

where the squared loss function can be replaced by the absolute value loss function. The DMW statistic is defined as follows to test the null of equal predictive accuracy, that is, $H_0 : Ed_t = 0$,

$$DMW(j) = \frac{\bar{d}}{\sqrt{\widehat{Avar}(\bar{d})}}, \tag{10}$$

where $\bar{d}$ is the sample average, $\bar{d} = \frac{1}{T-T_0-j}\sum_{t=T_0+j}^{T} d_t$, and $\widehat{Avar}(\bar{d})$ denotes the asymptotic variance of $\bar{d}$,

$$\widehat{Avar}(\bar{d}) = \frac{1}{T-T_0}\sum_{i=-q}^{q} k(i,q)\hat{\mathbf{\Gamma}}_i,$$

where $k(\cdot)$ is a kernel function with the bandwidth parameter q, and $\hat{\Gamma}_i$ is the i^{th} autocovariance function estimate.

It is known that the asymptotic distribution of the DMW statistics does not follow the standard normal distribution when the competing model nests the benchmark one as in our case. Therefore, we use the critical values from McCracken (2007) that re-centers the distribution of the test statistics to acquire asymptotically correct critical values.

3 Empirical Findings

3.1 Data Descriptions

We obtained all data from the Federal Reserve Economic Data (FRED). Observations are quarterly frequency and span from 1960:I to 2017:II.

The private GDP (py_t) is the total GDP (y_t) minus the total government consumption and gross investment spending (tg_t). That is, tg_t include the federal government spending (g_t) as well as those of the state and local governments. All income/spending variables are log-transformed and are expressed in real per capita terms using the GDP deflator and total population. The money market variables are the effective federal funds rate (EFFR, i_t) and the monetary base (MB, m_t), which are used to control the effect of monetary policy.

The private wage (pw_t) is the total compensation in the private sector (A132RC1Q027SBEA) divided by the GDP deflator and the number of employees in the total private industries (USPRIV; pj_t). The government sector wage (gw_t) denotes the total compensation in the government sector (B202RC1Q027SBEA) divided by the GDP deflator and the number of employees in the government (USGOVT; gj_t). In addition to the private sector jobs (pj_t) and the government sector jobs (gj_t), we also use the total nonfarm employment (PAYEMS; tj_t) in our baseline VAR models.

The corporate profits (prf_t) is the nominal corporate profits after tax (CP) divided by the GDP deflator, which is log-transformed. We consider the following two measures of productivity (prd_t): real output per person in nonfarm business sector (OPHNFB) and real output per hour of all persons in nonfarm business sector (PRS85006163). Both are log-transformed and yielded similar results, so we report findings with the second measure of productivity.

Figure 1 reports time series graphs of key macroeconomic data in panel (a) and of labor market variables in panel (b). All variables exhibit an upward trend over time. In order to check the business cycle properties of the data, we apply the Hodrick-Prescott (HP) filter to the data with a smoothing parameter of 1,600 for quarterly data. Figure 2 reports the cyclical components along with the NBER recession dates marked in shaded areas.

By construction, the real GDP per capita (y_t) tends to decrease (increase) when the economy enters a downturn (boom) phase. The federal government spending (g_t) often exhibits counter-cyclical movements, reflecting stabilization policies that are implemented by the federal government. The corporate profits and the real hourly output (productivity) tend to show procyclical dynamics. Private wages and jobs overall exhibit comovements and are procyclical, while government wages and jobs often increase during economic downturns. It should be noted that the wage gap ($gw_t - pw_t$) and the job ratio ($gj_t - pj_t$) show strong counter-cyclical movements. That is, the wage gap and the job ratio tends to rise rapidly during economic downturns. In what follows, we show that these changes can be explained by expansionary government spending shocks.

Figures 1 and 2 around here

3.2 VAR Analysis

This subsection reports an array of the impulse-response function estimates based on (1) and (2) along with the one standard deviation confidence bands that are generated from 500 nonparametric bootstrap simulations. We first report responses of the real GDP variables (y_t and py_t) to the fiscal spending shock (g_t) in Figure 3 based on $\mathbf{x}_t = [g_t \;\; py_t \;\; tj_t \;\; i_t \;\; m_t]'$ and $\mathbf{x}_t = [g_t \;\; y_t \;\; tj_t \;\; i_t \;\; m_t]'$, where tj_t is the total nonfarm employment.

One notable finding is that the government spending (g_t) shock is ineffective in stimulating private activity (py_t). The initial increase in the real GDP (y_t) is driven mainly by the increase in the government spending because the private spending barely responds to the shock in the short-run. Eventually, the real GDP responses become negligible as the private GDP declines, cancelling out the increase in the government spending.[6]

Figure 3 around here

In Figure 4, we report fiscal policy effects on key labor market variables. As can be seen in the upper panel (a), the government spending shock has a statistically

[6]The monetary policy shock, identified by a negative (−) 1% shock to the EFFR (i_t), generates a significant stimulus effect on the private GDP. The response of the total GDP is weaker (in percent) than that of the private GDP, which implies that the monetary policy shock stimulates private spending not the government spending. All results are available upon requests.

significant positive effect only on the government sector wages (gw_t). Its effect on the private sector wages (pw_t) is statistically insignificant, although its point estimates stay positive for about 2 years. The wage gap ($gw_t - pw_t$) responds positively, meaning that public sector workers are more likely to benefit from fiscal policy shocks.

It turns out that these responses are closely related with those of employment in the private and the government sectors that are reported in the lower panel (b). In response to the government spending shock, private jobs (pj_t) declines significantly for about 4 years, while government sector jobs (gj_t) increase significantly for over a year.

It should be noted that these responses are likely to occur when the government implements *value-added* type policy instead of *government purchases*. That is, when the government hires more workers, private sector labor may move to the government sector, which results in a decrease in the labor supply in the private sector. Strong demand in the government labor market raises the government wages, while a decrease in the labor supply in the private sector also increases the private wages.[7]

Figures 4 around here

We noticed that the fiscal policy has not been quite successful in improving the labor market condition. We next investigate how other economic variables influence the labor market condition. The first variable we consider is the after-tax corporate profit (prf_t), motivated by the so-called trickle-down effect that often appear in profit-led growth models. These models claim that labor market condition would improve when businesses prosper because the strong demand for labor generates more jobs and higher wages.

In response to the 1% corporate profit shock, private wages respond significantly positively for about a year. See Figure 5. However, its responses are quantitatively weak and short-lived, which implies a very limited support for the trickle-down effect in the U.S.[8]

It should be noted, however, that the corporate profit (prf_t) rises significantly in the long-run in response to a 1% private wage shock, although it initially decreases

[7]Monetary policy tends to strengthen labor market conditions in both sectors. Expansionary monetary policy stimulates private spending that creates the stronger labor demand in the private sector. As the economy grows, the demand for public services also grows, then labor market conditions in the public sector improve endogenously.

[8]This might happen if corporate profits are likely to be distributed to share holders as dividends or to be kept as retained earnings.

reflecting higher manufacturing costs. One explanation may be found from statistically significant positive responses of the productivity (prd_t) to a private wage shock. See Figure 6. That is, higher wages in the private sector may improve working environment, thus increase labor productivity, then contributes to higher corporate profits in the long-run. Note that these responses are consistent with the efficiency wage hypothesis.[9]

Private wages respond significantly positively for less than 2 years when the productivity shock occurs, implying that workers garner a limited amount of benefits of higher productivity.

Figures 5 and 6 around here

3.3 Robustness Check

This sub-section reports an array of robustness check analysis. We first investigate the stability of our key VAR findings over time. Among others, we are particularly interested in fiscal policy effects on labor market variables in Figure 4.

For this, I employ a 30-year rolling window scheme to repeatedly estimate the impulse-response functions over different sample periods. I start with estimations of the impulse-response functions using the first 30-year long data. Then, I moved the sample period forward by adding one new observation but dropping one oldest observation, which is used to obtain the second set of the impulse-response functions. I repeat until I estimate the response functions using the last 30-year long data.

Graphs in Figure 7 show fairly consistent sets of the impulse-response function estimates. In response to the fiscal spending shock, private jobs (pj_t) decrease then recover in two or more years. Total employment (tj_t) exhibits similar responses, meaning that increases in government jobs (gj_t) are dominated by decreases in private jobs. Private wages (pw_t) rise a little, whereas government wages (gw_t) rise more substantially.

Figure 7 around here

[9] They are also consistent with the so-called wage-led economic growth model.

Next, we implement the forecast error variance decomposition (FEVDEC) analysis for private sector wages and jobs. The purpose of this exercise is to measure the further in-sample evidence of the trickle-down effect. When the business condition improves and corporate profits rise, workers may be able to share the gains eventually. In panel (a) of Figure 8, I report the share of corporate profit shock in explaining the total variation of private wages or jobs in up to 5 years. In addition to the corporate profit shock, I also added the real GDP shock as another explanatory variable, and the remaining explanatory power is assumed to be due to the private wage shock as residuals.

Surprisingly, corporate profits have virtually no explanatory power for future private wages in all forecast horizons we consider. On the other hand, the share of the real GDP continuously rise up to almost 50% in 5 years. Similarly, corporate profits have negligible explanatory power for private jobs in all forecast horizons.

In panel (b), we implement a similar FEVDEC analysis to measure the role of productivity in explaining private labor market conditions. It turns out that productivity has virtually no explanatory power for future private wages in all forecast horizons. However, it has some (15 to 20%) explanatory power for private jobs.

These findings again imply very limited evidence of the trickle-down effect. Private wages fail to benefit from increases in corporate profits. Higher productivity seems to generate jobs in the private sector but fails to generate higher wages. In addition to these in-sample evidence, we further investigate the validity of the trickle-down effect employing the out-of-sample forecasting framework in Section 4.

Figure 8 around here

3.4 Simulation Exercises

In this subsection, I report simple simulation exercise results based on my VAR impulse-response function estimates presented earlier. Figures 9 and 10 show the new equilibrium path of the labor variables in response to a 1% federal government spending shock. Light solid lines are the point estimates that are accompanied by 95% confidence bands (dashed lines). Dark solid lines are the dynamic path with deterministic time trends with no structural shocks.

Private jobs fall significantly below the deterministic time trend line when the fiscal spending shock occurs. The job losses reach over 12 millions of jobs in about 3 years in annual rate as can be seen in Table 1. Government jobs significantly increase above the trend line only for a short period of time, and eventually are dominated by decreases in private jobs.

Private wages rise for about 2 and a half year, then declines below the trend. Overall, the responses of private wages are statistically insignificant. On the other hand, government wages increase highly significantly for over 5 years. Increases in government wages are substantial and overall dominate the decreases in private wages in longer term, widening the wage gap between the two sectors.

Figures 9 and 10 around here
Table 1 around here

4 Out-of-Sample Forecast Exercises

This section investigates what variables contain predictive contents for our key labor market variables under the out-of-sample forecasting framework described earlier in Section 2. For this purpose, we employ the model (5) that augments an AR(1) type benchmark prediction model (3) of the labor market variable (lab_t) with an extra predictor of interest (z_t) to see whether z_t provides additional predictive power to the benchmark model.

We consider the following four labor market variables for lab_t: private jobs (pj_t), government jobs (gj_t), private wages (pw_t), and government wages (gw_t). For the predictor variable (z_t), we use the government spending (g_t), corporate profits (prf_t), productivity (prd_t), and the private GDP (py_t). We report the *RRMSPE* and the *DMW* statistics for each exercise in Tables 2 and 3.

As can be seen in Table 2, g_t contains strong out-of-sample predictive contents for pj_t in all forecast horizons. *RRMSPE* statistics are greater than one for all cases, meaning that the competing model (5) outperforms the benchmark model (3). *DMW* statistics are also consistent with the *RRMSPE.* It rejects the null of equal predictability for 11 out of 12 forecast horizons at the 5% significance level, and for 12 out of 12 at the 10% level. g_t also has significant predictive contents for gj_t in the short-run for up to

1 year. These out-of-sample findings corroborate our earlier in-sample evidence that fiscal policy tends to strengthen the public job market at the expense of private jobs.

Other variables add a lot weaker performance in our out-of-sample forecast exercises. prf_t and py_t have additional predictive contents only in a few cases. That is, I fail to find out-of-sample evidence in favor of the trickle-down effect, which corroborates my previous in-sample evidence. prd_t seems to have stronger performance in the medium-run than prf_t and py_t for pj_t. Interestingly, py_t seems to have substantial predictive contents for gj_t, which implies that the demand for government services increases as the economy flourishes.

Table 2 around here

Table 3 reports the *RRMSPE* and *DMW* statistics for wage variables, pw_t and gw_t. g_t and prf_t add virtually no additional predictive contents for private wages (pw_t), which again implies virtually no evidence of the trickle-down effect. prd_t and py_t have some predictive contents for it in the long-run and in the short-run, respectively. For government sector wages (gw_t), I find very limited or virtually no predictive contents from all variables we consider. g_t does not have much out-of-sample predictive contents for gw_t, although it does an important role in explaining gw_t in previous in-sample analysis. In a nutshell, these predictor variables play very weak roles in forecasting wage dynamics in the near future.

Table 3 around here

5 Conclusion

This paper investigates empirical evidence of the fiscal policy effects on labor market conditions, employing an array of VAR models for the post-war U.S. macroeconomic data. In response to the fiscal spending shock, government jobs increase significantly at the expense of private jobs, which implies a possibility of government value-added shocks instead of government purchase shocks. Government wages rise more persistently and significantly, whereas increases in private wages die out quickly.

Corporate profits have negligible effects on private wages, which provides strong empirical evidence against the trickle-down effect. Increases in productivity have significantly positive effect on private wages only in the short-run. On the other hand, positive wage shocks in the private sector increase corporate profits in the long-run, reflecting significant productivity improvement in response to the wage shock. Our robustness check analysis via the FEVDEC and sub-sample analysis overall confirms these findings. We also implement simulation exercises to numerically assess how wages and jobs evolve over time in response to the fiscal spending shock in comparison with the dynamic path with no structural shocks. Results imply that the fiscal shock shrinks private sector employment substantially, while government wages rise significantly and substantially, widening the wage gap between the two sectors.

In addition to the in-sample analysis, I implement an array of out-of-sample forecasting exercises that evaluate the importance of predictive contents in key macroeconomic variables for labor market variables in the future. Government spending contains useful information for predicting private employment dynamics in all forecast horizons as well as government jobs in the short-run. Corporate profits have virtually no predictive contents for any labor market condition variables, confirming there's no evidence for the trickle-down effect. Productivity and real GDP contain some limited information for predicting wages and jobs.

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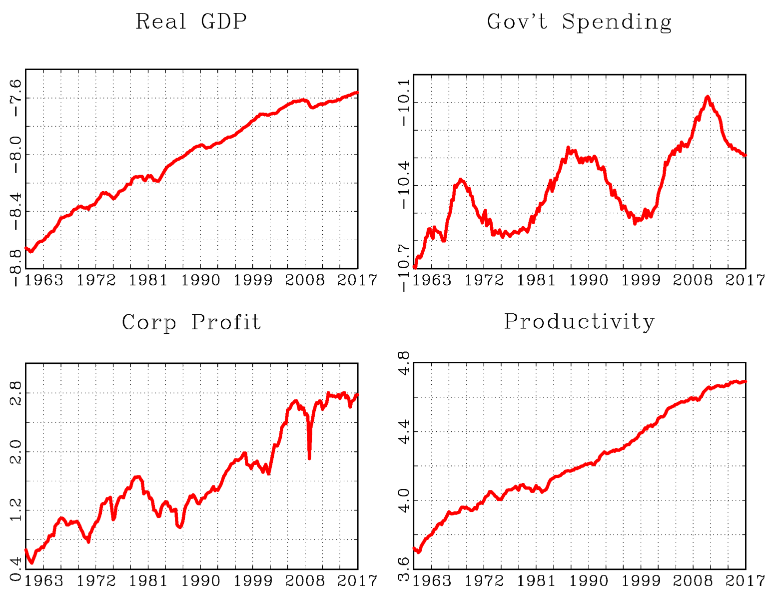
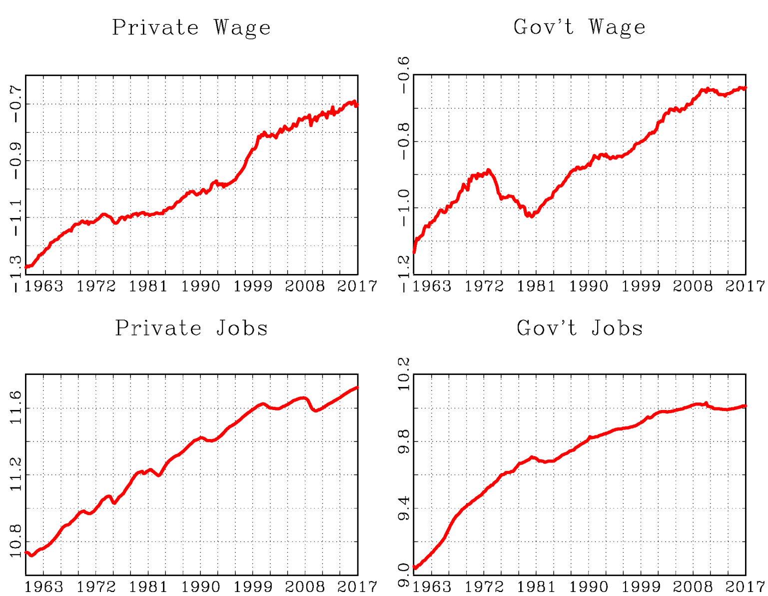
Figure 1. The Data

(a) Macroeconmic Data



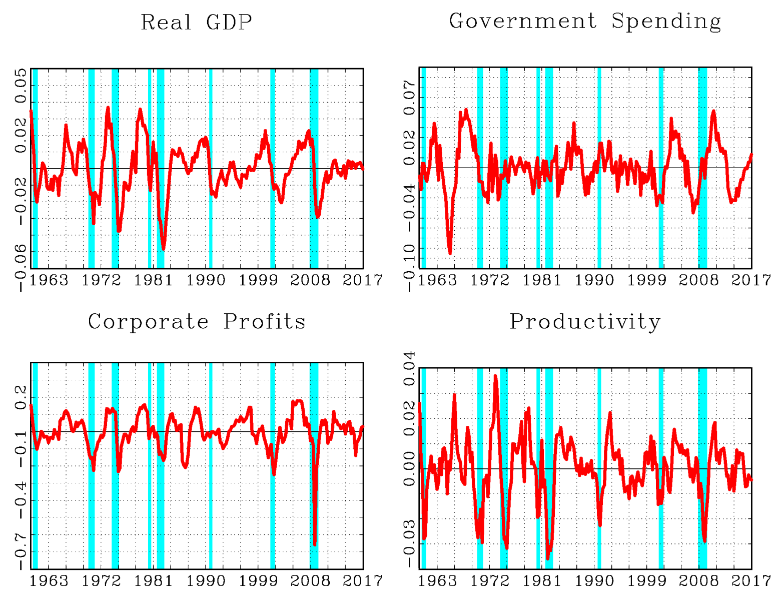
(b) Labor Market Data



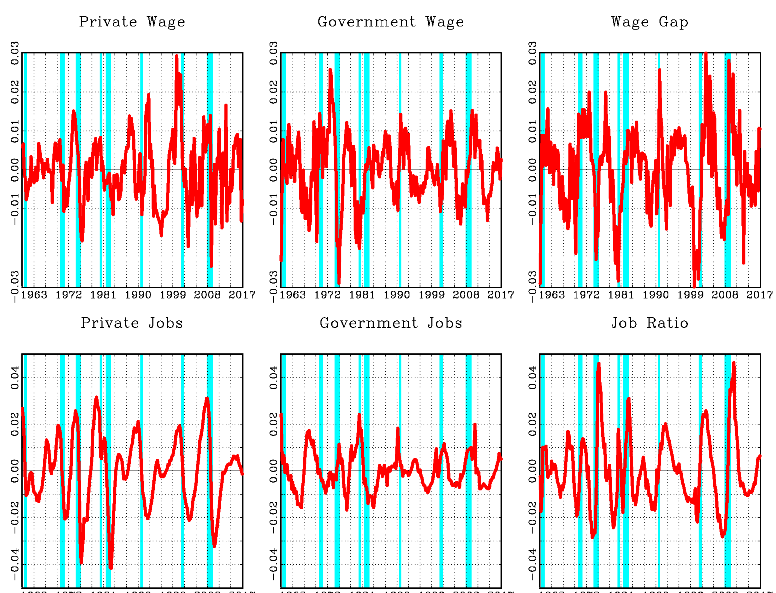
Note: All data are log-transformed. Real GDP, government spending, private wage, and government wage are expressed in real per capita terms. Corporate profits are also in real terms.

Figure 2. Business Cycle Components of the Data

(a) Macroeconomic Data

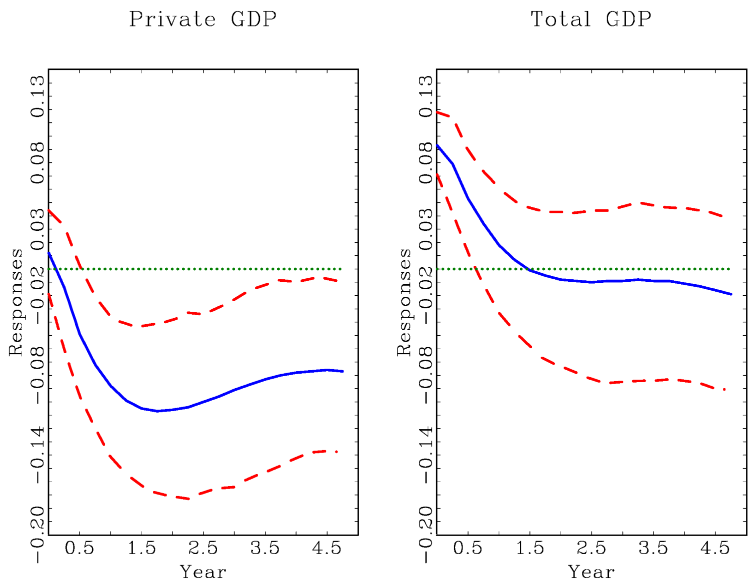


(b) Labor Market Data



Note: We employed the Hodrick-Prescott filter to extract the business cycle component from the data. We use a conventional smoothing parameter of 1,600 for quarterly data. The wage gap is defined as the log government sector wage minus the log private sector wage. The job ratio is the log government sector employment minus the log private sector employment.

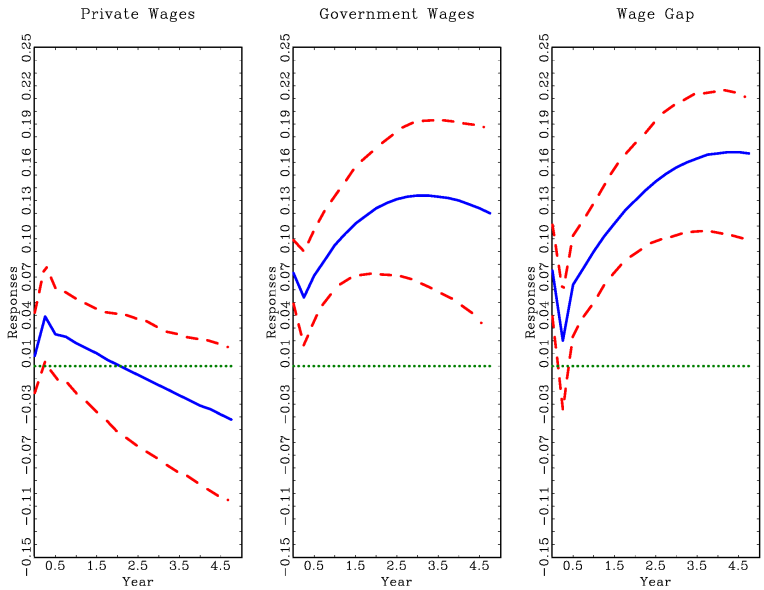
Figure 3. Fiscal Policy Effects on the Real Gross Domestic Product



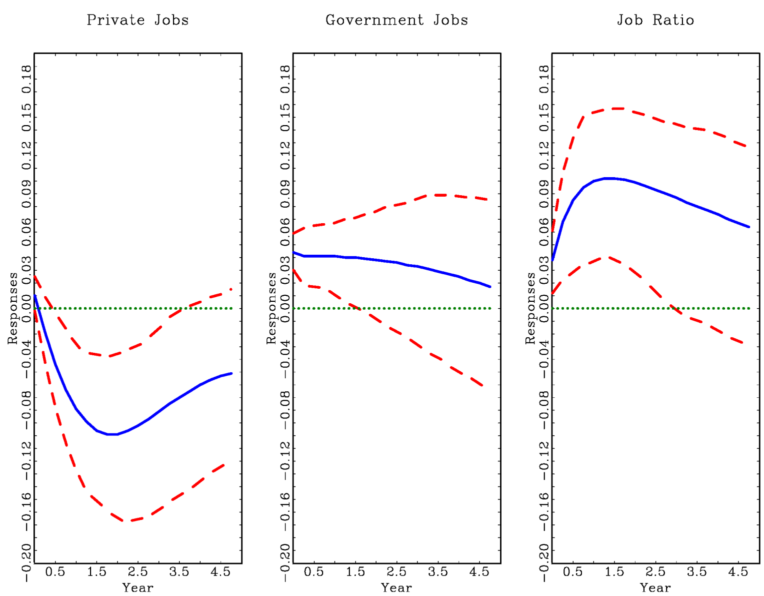
Note: Prior to estimations, all variables were demeaned and detrended with up to a quadratic time trend. The first panel reports response function estimates to a 1% positive shock to the government consumption and gross investment (g_t). Dashed lines are 1 standard deviation confidence intervals obtained from 500 nonparametric bootstrap simulations.

Figure 4. Fiscal Policy Effects on Labor Market Conditions

(a) Wage Effects

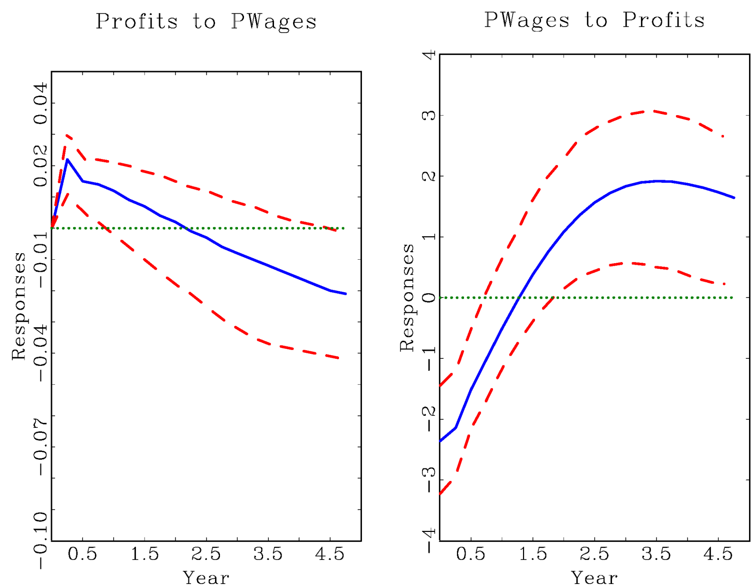


(b) Employment Effects



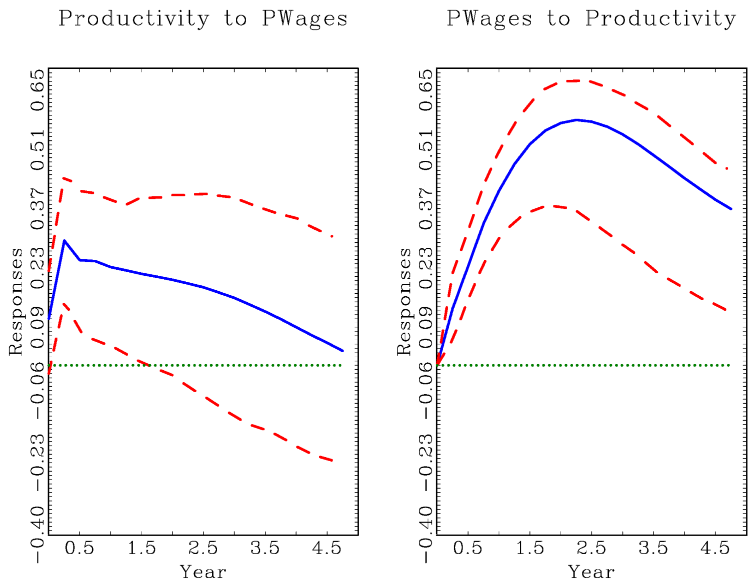
Note: We estimate the impulse-response function with the total GDP. The wage gap is defined as the log government sector wage minus the log private sector wage. The job ratio is the log government sector employment minus the private sector employment. Prior to estimations, all variables were demeaned and detrended with up to a quadratic time trend. We report response function estimates to a 1% positive shock to the government consumption and gross investment (g_t). Dashed lines are 1 standard deviation confidence intervals obtained from 500 nonparametric bootstrap simulations.

Figure 5. Corporate Profits and Wages



Note: We estimate the impulse-response function based on $x_t^{'}= [g_t,\ y_t,\ pw_t,\ prf_t,\ i_t,\ m_t]^{'}$. Prior to estimations, all variables were demeaned and detrended with up to a quadratic time trend. The first figure is the response function estimates of the private wages (pw_t) to a 1% positive shock to the corporate profits after tax (prf_t). The second figure is the response of the corporate profits after tax (prf_t)to a 1% positive shock to the real wage in the private sector (pw_t). Dashed lines are 1 standard deviation confidence intervals obtained from 500 nonparametric bootstrap simulations.

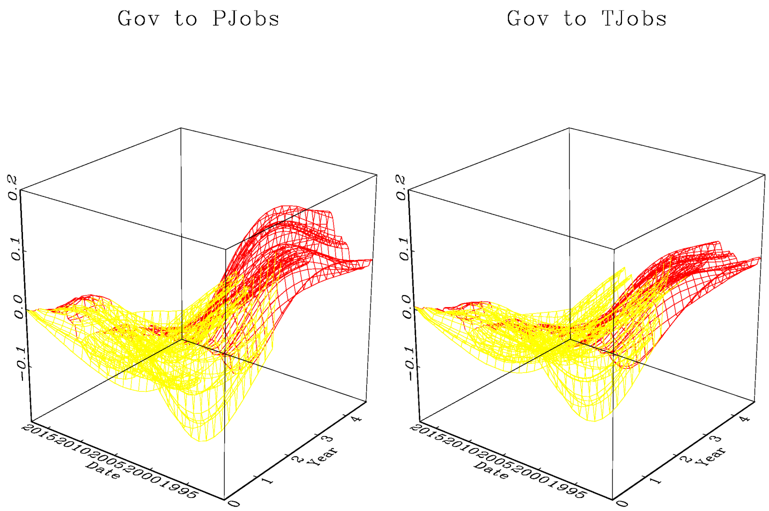
Figure 6. Productivity and Real Wages



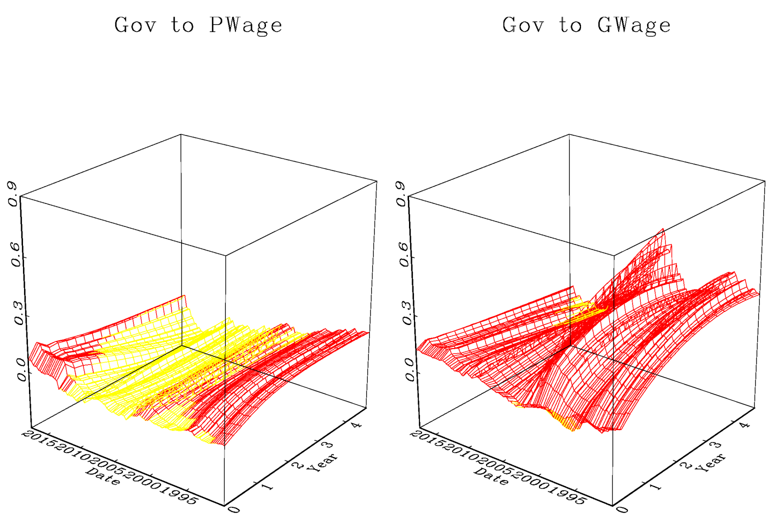
Note: We estimate the impulse-response function based on $x_t^{'}= [g_t,\ y_t,\ prd_t,\ pw_t,\ i_t,\ m_t]^{'}$. Prior to estimations, all variables were demeaned and detrended with up to a quadratic time trend. The first figure is the response function estimates of the private wages (pw_t) to a 1% positive shock to the productivitiy (prd_t). The second figure is the response of the productivity (prd_t)to a 1% positive shock to the real wage in the private sector (pw_t).Dashed lines are 1 standard deviation confidence intervals obtained from 500 nonparametric bootstrap simulations..

Figure 7. 30-Year Fixed Rolling Window Analysis

(a) Government Spending Shock Effects on Jobs



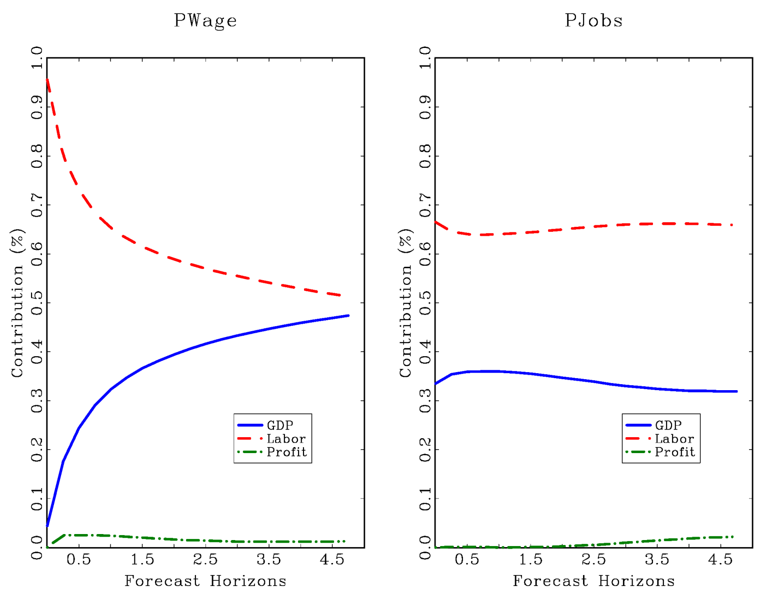
(b) Government Spending Shock Effects on Wages



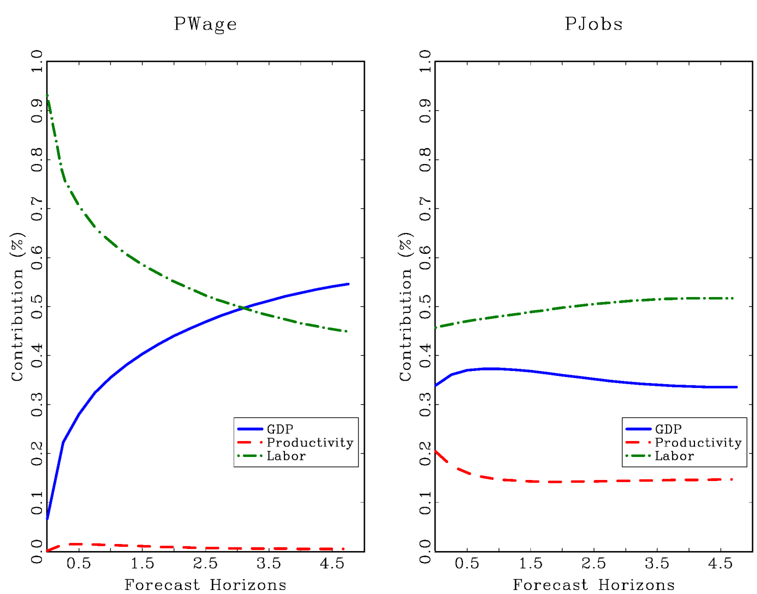
Note: We estimate the impulse-response function to the government spending shock with the total GDP. Prior to estimations, all variables were demeaned and detrended with up to a quadratic time trend. We repeat the same estimation using the 30-year (120 quarters) fixed-size rolling window scheme. That is, we begin the estimation utilizing observations from 1960Q1 to 1989Q4, and repeat estimations by adding one new observation and dropping one oldest observation, maintaining 120 observations. We repeat until the last estimation is done with the data from 1988Q3 to 2017Q2.

Figure 8. Forecast Error Variance Decomposition Analysis

(a) Share of Corporate Profits



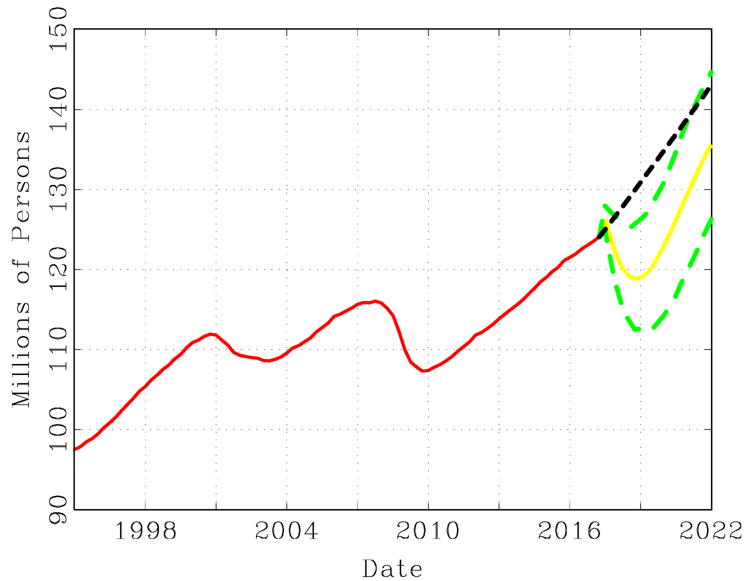
(b) Share of Productivity



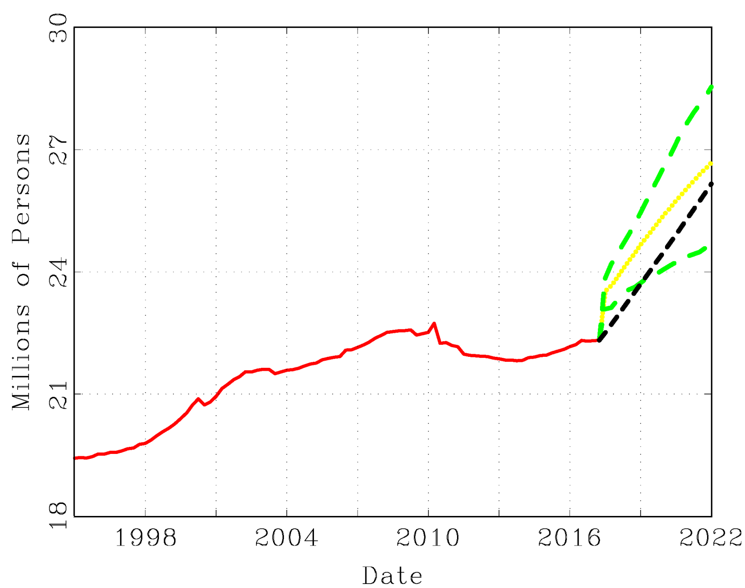
Note: We estimate the forecast error variance decomposition for the labor variable in the private sector, that is, $x_t^{'}= [y_t,\ pw_t,\ prf_t]^{'}$, $[y_t,\ pj_t,\ prf_t]^{'}$, $[y_t,\ prd_t,\ pw_t]^{'}$, and $[\ y_t,\ prd_t,\ pj_t]^{'}$. Prior to estimations, all variables were demeaned and detrended with up to a quadratic time trend. The first panel reports shares of the forecast error variance of the corporate profits for labor variables up to 5-year forecast horizons. The second panel provides shares of the forecast error variance of the productivity variable for labor variables up to 5-year forecast horizons.

Figure 9. Simulation Exercises: Employment Effects

(a) Private Jobs



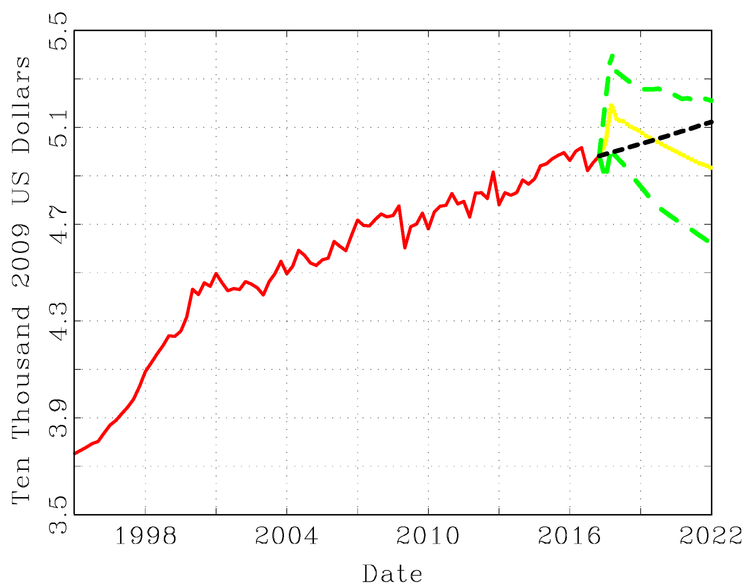
(b) Government Jobs



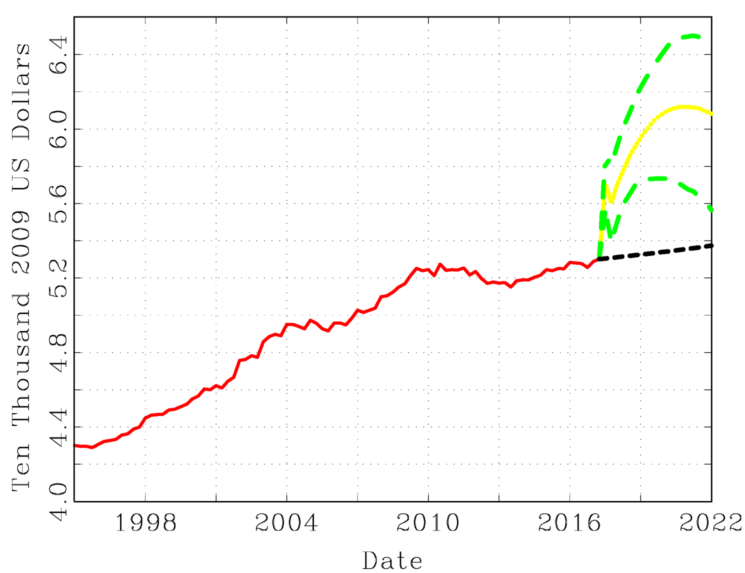
Note: We simulate the gains or losses of employment in each sector in response to the 1% fiscal spending shock by the new dynamic path point estimate minus deterministic path with no structural shocks.

Figure 10. Simulation Exercises: Wage Effects

(a) Private Wages



(b) Government Wages



Note: We simulate the gains or losses of employment in each sector in response to the 1% fiscal spending shock by the new dynamic path point estimate minus deterministic path with no structural shocks.

Table 1. Gains or Losses to the 1% Fiscal Spending Shock

j (year)	$pjob_t$	$gjob_t$	$pwag_t$	$gwag_t$
0.25	$1,257$	$1,013$	401	$4,020$
0.50	$-2,371$	951	$1,987$	$2,950$
0.75	$-5,466$	959	$1,267$	$3,910$
1.00	$-7,933$	967	$1,166$	$4,600$
1.50	$-11,064$	959	708	$5,830$
2.00	$-12,433$	951	253	$6,670$
3.00	$-11,325$	855	-554	$7,600$
4.00	$-8,810$	699	$-1,358$	$7,560$
5.00	$-7,166$	452	$-2,110$	$6,860$

Note: Units are thousands of persons for employment and 2009 U.S. dollars for wages. We simulate the gains or losses of employment in each sector in response to the 1% fiscal spending shock by the new dynamic path point estimate minus deterministic path with no structural shocks.

Table 2. h-Period ahead Out-of-Sample Forecast for Employment

(a) Private Jobs

	Gov't Spending		Profits		Productivity		Private GDP	
h	*RRMSPE*	*DMW*	*RRMSPE*	*DMW*	*RRMSPE*	*DMW*	*RRMSPE*	*DMW*
1	1.021	**3.463**	1.017	**1.358**	0.977	−2.435	1.006	0.283
2	1.016	**2.235**	1.005	0.542	0.978	−2.750	1.000	0.019
3	1.012	**1.421**	0.996	−0.743	0.982	−2.623	0.997	−0.220
4	1.009	**0.998**	0.989	−2.505	0.987	−2.421	0.996	−0.404
5	1.006	**0.648**	0.986	−4.002	0.992	−1.910	0.996	−0.470
6	1.005	0.561	0.983	−3.751	0.997	−0.794	0.997	−0.462
7	1.006	**0.694**	0.984	−3.193	1.003	**1.397**	0.998	−0.439
8	1.008	**0.932**	0.986	−2.335	1.008	**4.051**	0.999	−0.181
9	1.008	**0.896**	0.991	−1.290	1.013	**5.059**	1.001	0.475
10	1.011	**1.215**	0.999	−0.165	1.018	**5.222**	1.004	**2.261**
11	1.017	**1.913**	1.009	**0.930**	1.025	**4.960**	1.010	**3.417**
12	1.024	**2.388**	1.021	**1.980**	1.034	**4.887**	1.020	**3.685**

(b) Government Jobs

	Gov't Spending		Profits		Productivity		Private GDP	
h	*RRMSPE*	*DMW*	*RRMSPE*	*DMW*	*RRMSPE*	*DMW*	*RRMSPE*	*DMW*
1	1.014	**1.098**	0.994	−0.614	0.962	−1.322	1.039	**0.708**
2	1.022	**1.500**	0.986	−1.128	0.923	−2.297	1.087	**1.283**
3	1.021	**1.514**	0.979	−1.749	0.889	−3.838	1.127	**1.580**
4	1.009	**0.723**	0.976	−2.604	0.866	−4.401	1.186	**2.633**
5	0.991	−0.635	0.974	−3.260	0.864	−4.042	1.230	**3.249**
6	0.963	−2.183	0.971	−3.826	0.877	−3.748	1.301	**4.514**
7	0.931	−3.481	0.968	−3.609	0.892	−3.431	1.368	**6.859**
8	0.896	−4.783	0.958	−3.553	0.913	−2.689	1.413	**8.779**
9	0.866	−6.929	0.939	−3.805	0.943	−1.742	1.413	**9.463**
10	0.837	−6.272	0.913	−4.420	0.979	−0.594	1.401	**9.875**
11	0.816	−8.834	0.890	−5.195	1.008	0.245	1.359	**10.008**
12	0.799	−7.530	0.864	−6.707	1.027	**0.766**	1.309	**9.637**

Note: *RRMSPE* denotes the ratio of the root mean squared prediction errors, which is the mean squared prediction error (*RMSPE*) from the benchmark AR(1) type model divided by the *RMSPE* from the competing augmented forecasting model. DMW is the Diebold-Mariano-West statistics. DMW statistics in bold is cases the competing model significantly outpeforms the benchmakr model at the 5% level. Critical values are from McCracken (2007) for rolling window schemes with a 50% split point. We repeat estimations and forecasting starting from the first 50% observations by adding and dropping one observation, maintaing the same number of observations in each iteration, until we (out-of-sample) forecast the last observation of the target variable. We demeaned and detrended all data prior to estimations.

Table 3. h-Period ahead Out-of-Sample Forecast for Wages

(a) Private Wages

	Gov't Spending		Profits		Productivity		Private GDP	
h	*RRMSPE*	*DMW*	*RRMSPE*	*DMW*	*RRMSPE*	*DMW*	*RRMSPE*	*DMW*
1	0.995	−0.420	1.002	0.313	0.996	−0.888	1.017	0.649
2	0.988	−0.624	0.994	−0.890	0.975	−3.669	1.022	**0.802**
3	0.981	−0.958	0.986	−1.904	0.963	−4.744	1.018	**0.677**
4	0.979	−1.052	0.972	−3.627	0.955	−4.208	1.016	**0.794**
5	0.977	−1.195	0.963	−4.515	0.957	−5.146	1.008	0.330
6	0.974	−1.271	0.958	−6.254	0.963	−3.631	1.001	0.056
7	0.972	−1.693	0.953	−7.000	0.975	−2.054	0.991	−0.514
8	0.973	−1.280	0.953	−6.971	0.983	−1.336	0.999	−0.060
9	0.970	−1.704	0.946	−8.676	0.999	−0.176	0.995	−0.269
10	0.966	−1.914	0.942	−8.250	1.007	**1.393**	0.998	−0.125
11	0.972	−1.731	0.937	−9.623	1.011	**2.256**	1.005	0.284
12	0.978	−1.398	0.932	−8.265	1.012	**2.324**	1.010	0.535

(b) Government Wages

	Gov't Spending		Profits		Productivity		Private GDP	
h	*RRMSPE*	*DMW*	*RRMSPE*	*DMW*	*RRMSPE*	*DMW*	*RRMSPE*	*DMW*
1	0.918	−2.740	0.980	−0.511	0.973	−1.557	0.976	−1.719
2	0.831	−5.697	0.959	−0.917	0.948	−2.539	0.949	−3.323
3	0.784	−6.163	0.940	−1.302	0.922	−2.798	0.927	−3.484
4	0.739	−9.372	0.920	−2.202	0.901	−4.434	0.907	−5.848
5	0.732	−11.041	0.922	−2.238	0.890	−5.094	0.913	−5.237
6	0.713	−11.737	0.915	−2.618	0.878	−5.762	0.929	−4.721
7	0.702	−13.716	0.908	−3.241	0.860	−6.660	0.953	−2.764
8	0.688	−17.030	0.893	−4.417	0.850	−8.659	0.990	−0.633
9	0.679	−17.354	0.889	−5.107	0.843	−8.300	1.048	**3.048**
10	0.662	−17.919	0.881	−5.456	0.839	−8.998	1.116	**6.753**
11	0.642	−19.761	0.866	−6.853	0.829	−9.504	1.183	**9.348**
12	0.620	−21.858	0.854	−7.411	0.829	−10.960	1.267	**13.411**

Note: *RRMSPE* denotes the ratio of the root mean squared prediction errors, which is the mean squared prediction error (*RMSPE*) from the benchmark AR(1) type model divided by the *RMSPE* from the competing augmented forecasting model. DMW is the Diebold-Mariano-West statistics. DMW statistics in bold is cases the competing model significantly outpeforms the benchmakr model at the 5% level. Critical values are from McCracken (2007) for rolling window schemes with a 50% split point. We repeat estimations and forecasting starting from the first 50% observations by adding and dropping one observation, maintaing the same number of observations in each iteration, until we (out-of-sample) forecast the last observation of the target variable. We demeaned and detrended all data prior to estimations.