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The Impact of Policy Uncertainty on U.S. Employment: Industry Evidence

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Abstract:

The anemic pace of the recovery of the U.S. economy from the Great Recession has frequently been blamed on heightened uncertainty, much of which concerns the nation's fiscal policy. Intuition suggests that increased policy uncertainty likely has different impacts on different industries, to the extent that industries differ in their exposure to government policies. This study utilizes industry data to explore whether policy uncertainty indeed affects the dynamics of employment, and particularly its impact on industry employment, during this recovery. This analysis focuses on heterogeneity across industries in terms of the fraction of their product demand that can ultimately be attributed to federal government expenditures. The estimation results reveal that policy uncertainty indeed retards employment growth more in industries that rely more heavily on federal government demand: the growth rate of employment in these industries appears to have been four-tenths of a percentage point lower during the quarters in recent years when policy uncertainty spiked.

Keywords: uncertainty, fiscal policy, input-output tables, industry accounts, employment, hours
JEL Classifications: D57, D80, E24, E66, G18, L50.

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The tense "fiscal cliff" debate shortly before the turn of the new year, the subsequent sequestration, and continuing political wrangling once again highlighted the potential for serious drag on the U.S. economy from heightened uncertainty surrounding the nation's fiscal policy. Similar previous episodes, such as the debt ceiling debate over the summer of 2011, have been blamed for sapping the economy of its precious momentum and contributing to the slow pace of the recovery from the Great Recession. The weakness of this recovery, which follows an exceptionally deep recession, has surprised many, and the elevated perception of uncertainty has become a popular target being blamed for the slow pace of growth. In particular, much of the uncertainty seems to be concentrated at the federal level and related to the inability of the legislative and the executive branches of the U.S. government to reach consensus on a policy that will achieve long-term fiscal sustainability.

Many of the existing studies of the effect of uncertainty on economic activity, especially those that rely on a structural approach, such as the use of dynamic stochastic general equilibrium (DSGE) models, naturally focus on the impact of uncertainty on the economy in the aggregate.[1] The merit of the structural approach notwithstanding, one of its potential drawbacks is that any inferences can be sensitive to model assumptions. Therefore, conclusions may be less than robust, or even erroneous, if the simplifying assumptions miss important aspects of reality. To complement those studies, this policy brief utilizes cross-sectional variation to help identify the impact of uncertainty without imposing structural restrictions. It relies on the simple premise that cross-sectional heterogeneity in economic units' sensitivity to uncertainty likely leads to disparate effects of uncertainty across households or firms. Possible differential responses to uncertainty shocks in the cross section can stem from either different exposures to the source of the uncertainty, or from different adjustment technologies. In this study, my main interest is in the uncertainty concerning fiscal policy. Therefore, the focus will be on the dimension of heterogeneity that is due to differences in the exposure to the source of policy uncertainty.

More specifically, I utilize industry data and focus on how the fraction of industry output eventually purchased by the government sector, particularly the federal government, varies across industries. It seems natural to focus on the federal government, which has been the primary source of recent policy uncertainty. The federal budget deficit and debt have ballooned since the Great Recession,

[1] For example, Basu and Bundick (2012) use a DSGE model with time-varying markups to show that uncertainty shocks lead to declines in consumption, output, and hours. Leduc and Liu (2012) show that an uncertainty shock acts just like an aggregate demand shock—raising unemployment and lowering inflation.

because the federal government needed to provide fiscal stimulus not only to soften the fall in private-sector spending but also to partly offset the steep cuts in state and local government spending. More worrisome than this cyclical swing in the federal deficit and debt is the projected structural shortfall that will only worsen over the next decade or so, if existing policies continue, as more and more baby-boomers retire.

Federal spending is on one side of the fiscal ledger, while taxes are on the other. It is clear that the federal government will either have to cut spending or raise taxes, or both, in order to achieve long-run sustainability. However, it is far from clear whether the structural component of the federal deficit would be reduced more through spending cuts, tax increases, or a more even blend of the two. This uncertainty clearly affects both sides of the ledger. Since the cross-industry disparity in the importance of government is more clearly defined in terms of product demand, for which there is also better and more readily available data, I focus on the uncertainty concerning government spending, as opposed to taxes.

The basic logic of the identification strategy used here is that if some firms or industries rely more on government purchases, then, all else being equal, the heightened uncertainty concerning fiscal policy should cause those firms or industries to be more cautious than others about adjusting their factor inputs that are subject to adjustment costs. According to Bloom's (2009) structural study, the impact of uncertainty shocks is fairly short-lived, so we need relatively high-frequency data on factor inputs. At the industry level, this points to employment, since it is available monthly and in a timely manner. In contrast, industry-level data on investment are available only at an annual frequency and with a relatively long delay.

Specifically, we examine whether employment growth was lower in industries that rely more on government demand than in other industries during episodes of heightened fiscal policy uncertainty since the beginning of the Great Recession. It should be noted that the change in employment is a net flow, reflecting the change in hiring net of total separations (due to layoffs, quits, and other reasons). It is likely that the rates of both hiring and separations slow following an uncertainty shock, in the latter case because workers also become more cautious and therefore less likely to quit. These two gross flows would then offset each other at least partially, leaving the net change in employment less sensitive to uncertainty shocks than its gross components. In contrast, investment, as a gross flow, is not subject to this attenuation effect. Moreover, investment is subject to greater adjustment costs than employment, and so should react more strongly to uncertainty shocks. The potential advantage of using industry data, which are limited to employment, is that these data would constitute stronger evidence for the effect of

uncertainty shocks and are more reliable for making inferences about the likely aggregate effect of uncertainty.

Cross-Industry Heterogeneity of Reliance on Government Purchases

First, we describe how we measure an industry's exposure to federal government spending and present statistics summarizing the cross-industry variation in this measure. Note that here spending refers to the government's direct final purchases of goods and services produced by the private sector (that is, government consumption expenditures and gross investment in the GDP account), not its outlays that go to pay the wages of government employees who provide government services.[2] By standard definition, government spending also excludes transfer payments to individuals, such as unemployment benefits, social security payments, etc., even though (at least part of) these payments are eventually spent on goods and services.

We define an industry's policy exposure in terms of the share of its output that is accounted for, directly or indirectly, by government purchases. Our aim is to detect whether there have been systematic differences in employment growth across industries depending on an industry's degree of reliance on government purchases. Our null hypothesis is that, all else being equal, industries that sell a greater fraction of their output to the federal government are likely to slow hiring more than industries less reliant on federal government purchases during periods of heightened uncertainty regarding the future path of government spending. Since times of elevated uncertainty may coincide with times of subdued expectations regarding future growth rates of government spending, we will control for the forecast of federal government spending in order to isolate the effect of uncertainty alone. For example, the second half of 2012 and early in 2013 are perceived to be a period when the degree of uncertainty concerning future fiscal policy increased due to protracted and acrimonious disputes among politicians. Consequently, we would expect industries with a higher share of sales to the government to slow employment growth more than those industries with a lower share, all else being equal.

To obtain a measure of the amount of an industry's output that is eventually driven by government demand, as opposed to only its direct sales to the government, we make use of the input-output (IO) tables compiled by the Bureau of Economic Analysis (BEA), which summarize the production

[2] Note also that purchases of services by the government on behalf of households, such as medical care purchased under government programs such as Medicare, are counted under personal consumption expenditures (PCE) in the National Income and Product Accounts, not as government expenditures.

structure across industries and the eventual supply to final uses. More specifically, we compute the share of each industry's output that is either sold directly to the federal government or incorporated into products eventually sold directly to the federal government. We do so by combining the information on how many dollars of each industry's output is needed to supply one dollar of final demand for any good or service (which is provided in the total requirements table) with the federal government's final demand for each commodity (provided in the use table), and each industry's total output (provided in the make table).[3] The distinction between an industry's ultimate versus direct sales to government stems from the multistage production chain common in modern economies.[4] Thus, every dollar of final demand for any good or service calls for intermediate output by multiple industries in different stages along the production chain. It is intuitive to recognize that the difference between these two measures of industry sales to the government is larger for industries situated earlier in the production chain.[5]

To measure an industry's reliance on federal government demand, and hence its sensitivity to policy uncertainty, we use the industry's total ultimate supply to the federal government to satisfy both defense and nondefense needs. It is possible that future defense spending may be subject to less uncertainty than nondefense spending, but no separate measures of uncertainty are available. On the other hand, as a measure of exogenous fluctuations in the demand for an industry's product, we use only federal government purchases for defense purposes, weighted by the share of each industry's output driven ultimately by defense spending. By the same logic, we will also include exports as an exogenous demand control, since exports in the short run are mostly influenced by foreign demand. Inclusion of these demand controls should yield more consistent coefficient estimates for policy uncertainty, to the extent that greater uncertainty tends be associated with lower spending, and the latter also dampens employment growth by reducing demand for an industry's output. The coefficient on policy uncertainty alone would in this case overstate its impact unless we also control for federal government demand to correct this bias.

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[3] The use table is essentially a commodity-by-industry matrix where the element (i, j) in row i and column j reports the amount of commodity i used by industry j in producing its output, or consumed as part of a final expenditure item (that is, expenditures in the national income accounts such as government consumption and gross investment). The make table, on the other hand, is an industry-by-commodity matrix where the element (i, j) shows the amount of a given commodity j that is produced in industry i.

[4] A firm or industry that sells directly to the government has to purchase its inputs from other industries, which in turn use as inputs products from industries further upstream in the production chain, and so forth.

[5] The less processed an industry's output (for example, steel sheets versus assembled cars), the greater the number of subsequent steps of production it will traverse before eventually reaching the final user—the federal government in this case.

In contrast, it is not valid to control for product demand using general cyclical variables, which, unlike defense spending, are themselves influenced by policy uncertainty. Nevertheless, as a robustness check, we will also examine specifications that include controls for aggregate activity, such as GDP or total private employment, which should already incorporate the influence of policy uncertainty and thus most likely bias its coefficient downward. Thus, estimates from these specifications can be regarded as close to a lower bound on the effect of policy uncertainty.

First, we present summary statistics of the cross-industry distribution of the share of ultimate sales to the federal government, which uses the purchased goods and services for defense versus nondefense purposes. Table 1a lists the top 10 industries in descending order of the share of output sold directly and indirectly to the government in 2002 to satisfy *defense* demand, as well as their ranking for a few other select years spanning the sample period over which we have input-output tables compiled by the BEA.[6] There are a total of 59 industries, dictated by the availability of annual input-output tables compiled by the BEA. As can be seen, the ranking is rather stable over all these years, especially between 2002 and 2007; most of these industries ranked among the top 10 in most of the years. Table 1b reports the actual shares of output, which span a fairly wide range from a little over 30 percent to just 3 percent.

It is worth remarking that many of the industries on the list are what we would call high-tech (that is, computer-related, information processing) or durable goods industries (for example, transportation equipment, fabricated metal). This is noteworthy because durable goods output tends to be more cyclical than that of other industries on average. So if uncertainty shocks were associated with slower aggregate growth, then these industries' growth would be more correlated with heightened uncertainty because of their greater cyclicality, not simply because of their heavier reliance on government purchases. Some may therefore argue that one needs to control for the greater cyclicality of these industries in order to uncover the heterogeneous effect of uncertainty accurately. On the other hand, it can also be argued that if increased uncertainty is consistently associated with slower aggregate growth, then it is, in and of itself, supportive evidence for the deleterious effect of uncertainty shocks.

To obtain consistent estimates of the effect of fiscal policy uncertainty on an industry's employment, we control, in some of the panel regressions, for the greater cyclicality of those industries with larger shares of output sold to the government. We then explore the resulting difference in the estimated coefficients of interest. One way to control for the different cyclicality is to interact a durable-

[6] We choose 2002 as the base year because it is the last year for which there are detailed benchmark IO tables available.

goods industry dummy variable with total private industry employment when the latter is included as a control for macroeconomic conditions. Alternatively, the two industry-specific exogenous aggregate demand variables (that is, defense spending and exports) explained above can be viewed as a partial control for the different sensitivity to demand shifts across industries.

Tables 2a and 2b report the corresponding figures for industry direct and indirect sales for federal government *nondefense* spending: Table 2a lists the top 10 industries in 2002, while Table 2b details the shares. It is worth noting that this list overlaps heavily with the list for federal nondefense spending, especially among the high-tech industries and durable goods industries. Quantitatively, it is obvious that nondefense spending accounts for a smaller share of industry sales than defense spending, significantly so for the top two or three industries. A natural effect of the smaller magnitude of industry supply to nondefense needs is that the ranking for sales for nondefense spending is slightly less stable across the years than that for defense spending. Detailed differences notwithstanding, the high correlation between these two lists implies that an industry's total sales to the federal government for all purposes should be a robust measure of its dependence on federal demand and, in turn, its exposure to fiscal uncertainty.

To provide a summary view of the cross-industry distribution of the share of sales that eventually go to the federal government, Figure 1 depicts the histogram of the share of each industry's total sales to the government. We sum defense and nondefense sales because they are shown to be highly correlated in each industry. We report the averages for three subperiods chosen to reflect the general pattern of the evolution of the shares. Two features emerge. First, the distribution of the sales share is rather skewed: federal demand accounts for less than 10 percent of sales in 50 to 60 percent of the industries, but for over 20 percent of sales in just a handful of industries. This suggests that the importance of federal demand and, in turn, the sensitivity to policy uncertainty may not differ meaningfully for a large fraction of the industries. Instead, we are likely to detect significant differences in the impact of policy uncertainty only between the handful of industries with nontrivial reliance on federal demand and the remaining industries. Second, the share of ultimate industry sales to the federal government increased between 1998 and 2011.

This second pattern can be seen more clearly through the time series range plot in Figure 2a. It traces the *change* since 1998 in the share of industry sales eventually to the federal government, which grew steadily between 2002 and 2010, but started to fall since 2010. This increase is somewhat skewed toward industries that are already highly ranked in terms of shares of sales to the federal government.

The overall upward trend is consistent with the aggregate time series of the share of federal government spending in GDP, and this is mostly driven by defense spending (Figure 2b).

We next report some simple comparisons of employment growth across industries sorted by their share of direct plus indirect sales to the federal government. Again, we sum defense and nondefense sales because of their high correlation, and we rank industries by this total share.[7] The employment data we use come from the Current Employment Statistics (CES, also known as the payroll survey) compiled by the Bureau of Labor Statistics (BLS). The CES data by industry are organized by the North America Industry Classification System (NAICS) codes, which we match to the industry codes used in the BEA's annual IO tables. The 59 IO industries correspond to 80 NAICS codes.

Figure 3a shows the weighted average employment growth rates from January 2008 to March 2013 for the industries in the top (the solid green line) and the bottom (the dashed red line) quartiles based on the average share of total sales to the federal government over the 2002-to-2007 period. The falloff in employment was much steeper during the recession in those industries that sell more of their products to the government. They then recovered at a faster clip in 2010 and 2011. For comparison, Figure 3b depicts the comparison between the same two sets of industries over the longer sample period starting in 1990. It shows that the industries with high shares of total sales driven by government demand are more cyclical in general, with the differential being especially wide during the 2001 recession and the Great Recession. This is consistent with the identity of the top 10 industries reported above in terms of their shares of direct and indirect sales going to the federal government; we would expect them to have been hit harder when the tech boom turned into a bust, and intrinsically more cyclical as well.

To get a sense of the importance of these two sets of industries in terms of employment, Figure 4 plots on the left axis the share of total employment of all private industries accounted for by the industries in the top and the bottom quartiles, respectively, in terms of the share of sales to the federal government. It plots on the right axis the ratio of employment between these two sets of industries. It is clear, and not too surprising, that industries with high shares of sales to the government account for a much smaller (and shrinking since the latest downturn) share of total nonfarm private employment. Furthermore, this share exhibits significant cyclicality: falling during downturns and rising moderately or robustly (in the late 1990s) during booms.

[7] We have ascertained that the patterns are indeed extremely similar if we instead sort by sales to defense or nondefense spending separately.

Over the first three quarters of last year, average employment growth in these industries slowed more than in industries that sell less to the government. The deceleration, however, seems to have reversed since last October. This suggests that concerns about a possible hard landing in China plus continued woes in Europe may have played as prominent a role as heightened uncertainty concerning domestic fiscal policy. For that matter, these industries also experienced a more pronounced slowing in employment growth during the first half of 2011, when the uncertainty surrounding fiscal policy was probably also elevated, culminating in the debt-ceiling showdown in early August. On the other hand, the first half of 2011 also saw major disruptions from natural disasters, such as the earthquake and tsunami in Japan. Thus, it is necessary to control for other variables that also influence an industry's employment dynamics in order to isolate the effect of fiscal policy uncertainty more cleanly.

Panel Regression Specifications

This section discusses how to specify panel regressions to control for the factors relevant for an industry's employment growth and uncover the marginal effect of policy uncertainty. For example, those industries that sell more to the government may have grown faster in the early days of the recovery because they were helped by a faster increase in demand owing to orders from the government financed under the stimulus package, and their employment growth has slowed more since the second half of last year because federal spending has waned following the expiration of the stimulus. Specifically, we run the following fixed-effects panel regression, using quarterly industry- level data.

$$\begin{aligned} n_{it} = {} & \alpha_i + \beta_0 PUI_t + \beta_1 \left(s_{it}^{G1} PUI_t \right) + \sum_{j=1}^{\tau} \rho_j n_{i,t-j} + \sum_{k=D}^{ND} \delta_{sk} \left(s_{it}^{k} g_{t+4|t}^{k} \right) + \sum_{k=D}^{ND} \delta_k g_{t+4|t}^{k} + \delta_s s_{it}^{G} \\ & + \sum_{j=0}^{q} \left[\gamma_{sEg,j} \left(s_{it}^{Exp} g_{Exp,t-j} \right) + \gamma_{Eg,j} g_{Exp,t-j} + \gamma_{sE,j} s_{it}^{Exp} \right] \\ & + \sum_{j=0}^{p} \left[\gamma_{sDg,j} \left(s_{it}^{D} g_{D,t-j} \right) + \gamma_{Dg,j} g_{D,t-j} \right] + \theta X_{it} + \varepsilon_{it}. \end{aligned} \tag{0}$$

The dependent variable, n_{it}, represents employment growth for industry i in quarter t, calculated as the log difference for the last month of each quarter relative to three months ago (which is equivalent to the average monthly growth rate within the quarter). Its own lags (up to τ lags) on the right-hand side are meant to capture the partial adjustment dynamics of employment.[8] α_i is the industry fixed effect.

[8] We also experimented with a specification without lags of employment. It does not alter the results qualitatively, other than yielding somewhat more negative coefficients on PUI.

PUI is the composite index of policy uncertainty constructed by Baker, Bloom, and Davis (2013).[9] According to Baker et al. (2013), because of the design of their keyword search, this policy uncertainty index covers not only fiscal policy (which includes spending, subsidies, and taxes), but also monetary policy. We include only the contemporaneous level. This is adapted from the specification in Bloom, Bond, and van Reenan (2007), which includes both the level and the change in uncertainty in the current period. We leave out the contemporaneous change in *PUI* because it is insignificant in all our specifications.[10]

s_{it}^{G1} is a binary dummy variable defined based on s_{it}^{G}, the share of an industry's total sales to the government in its output, where s_{it}^{G} equals the sum of defense and nondefense spending shares ($s_{it}^{G} = s_{it}^{D} + s_{it}^{ND}$). s_{it}^{G1} equals one for industries with shares of sales to the government above a certain threshold, and zero otherwise. This formulation captures the idea that policy uncertainty shocks are likely to have meaningfully different impacts only on industries with a nontrivial share of sales to the government. We explore where the threshold lies. β_0 measures the general, uniform across industries, marginal effect of a higher level of policy uncertainty, while β_1 captures any differential impact of policy uncertainty on the industries that depend most heavily on government purchases.

Ideally, one would want to control for an industry's demand conditions in explaining its labor input. However, output data at the industry level are available only annually. As a noisy proxy, we consider two alternative sets of aggregate variables to control for economic conditions. The first set is based on current and lagged growth rates of federal defense spending ($g_{D,t-j}$) and exports ($g_{Exp,t-j}$), with up to p and q lags, respectively. They are weighted by s_{it}^{D} and s_{it}^{Exp}, each industry's share of output accounted for by federal defense spending and exports, respectively, to approximate the exogenous demand condition faced by each industry.[11] For completeness, the two growth rate series and the exports' share in output also enter separately. The share of defense spending is not included because it is highly correlated with the share of total federal government spending at the industry level, and the latter will

[9] The original data are monthly, downloaded from http://www.policyuncertainty.com/us_monthly.html. For a detailed description of the index and its components, see Baker, Bloom, and Davis (2013), http://www.policyuncertainty.com/methodology.html.

[10] Bloom et al. (2007) include both the current level and the change in policy uncertainty to tease apart how much of the effect of uncertainty is due to a high level and how much is due to an increase, respectively.

[11] The share of an industry's output sold directly and indirectly to satisfy exports is also calculated using the input-output tables, analogous to the share of sales to the government.

enter as a regressor.[12] The lag terms are meant to capture the dynamic response of employment to changes in demand. In particular, compared with just the contemporaneous value, a number of lags may better capture the degree of persistence in spending for a defense program, which is in principle more relevant for firms' production and hiring decisions.

As discussed above, industry-specific weighted defense spending serves as a control for exogenous demand for an industry's products, which is less likely than aggregate output to be influenced by uncertainty. The weights also partially account for the greater cyclicality of those industries selling more to the government. Including weighted exports as another control for demand follows the same logic. Exports, especially in the short run, are much more influenced by foreign demand than by the exchange rate, which is also affected by domestic (monetary) policy and economic conditions. Exports are, of course, affected by the global component of demand fluctuations. These arguments of exogeneity in principle, however, do not rule out the possibility that, for a specific sample, defense spending and exports may be highly correlated with aggregate output empirically. This is, in fact, the case for our sample period since 1998. Defense spending has become moderately countercyclical, compared with its acyclical behavior in earlier periods, while exports are mostly procyclical (Figure 5).[13] This means that statistically the coefficient on policy uncertainty will likely diminish in magnitude and significance when exports and defense spending are included.

In addition to federal defense spending that has already occurred, we also control for expected future growth of federal government defense and nondefense spending, denoted $g^{D}_{t+4|t}$ and $g^{ND}_{t+4|t}$, respectively, using the same-period forecasts from Global Insight (GI). Specifically, we use the forecasts made in quarter t of the cumulative growth of federal government defense and nondefense spending over the next four quarters (that is, until quarter t+4)[14]. This four-quarter growth rate should summarize the forward-looking demand expectations relevant for firms' production and hiring decisions. To account for the cross-industry variation in the importance of federal government purchases, we also interact the GI forecasts with s^{D}_{it} and s^{ND}_{it}, each industry's share of output eventually sold to the federal government to satisfy defense and nondefense demand, respectively. We therefore also include the sum of the two

[12] When both shares are included, their coefficients have opposite signs and essentially the same magnitude.

[13] Stock and Watson (1999) find that defense spending is basically acyclical, using post-WWII data until 1997.

[14] For comparison, we also examined the median forecast from the Survey Professional Forecasters (SPF), which unfortunately covers only total federal spending, but not defense and nondefense spending separately. The SPF forecasts have fairly similar time-series patterns to the GI forecasts, but are generally less volatile, being the median of individual forecasts.

shares, s_{it}^{G}, as a regressor; the two shares are too highly correlated at the industry level to enter separately. These controls should guard against the possibility of finding a significant coefficient on policy uncertainty due to periods of elevated uncertainty coinciding with periods of low expectations about the future growth of federal government spending. Simple unconditional correlation suggests that this may indeed be the case within our sample period—1998:Q1 to 2013:Q1—as evidenced by the negative correlation coefficients between the PUI and $g_{t+4|t}^{D}$ as well as between the PUI and $g_{t+4|t}^{ND}$, reported in Table 3.

An alternative set of "demand" controls is composed of contemporaneous and lagged growth rates of total employment in all private industries. That is, the regression equation becomes:

$$n_{it} = \alpha_i + \beta_0 PUI_t + \beta_1 \left(s_{it}^{G1} PUI_t \right) + \sum_{j=1}^{\tau} \rho_j n_{i,t-j} + \sum_{k=D}^{ND} \delta_{sk} \left(s_{it}^{k} g_{t+4|t}^{k} \right) + \sum_{k=D}^{ND} \delta_k g_{t+4|t}^{k} + \delta_s s_{it}^{G} + \sum_{j=0}^{q} \left[\gamma_{DY,j} \left(g_{Y,t-j} Dur \right) + \gamma_{Y,j} g_{Y,t-j} + \gamma_{D,j} Dur \right] + \theta X_t + \varepsilon_{it}. \quad (1')$$

$g_{Y,t-j}$ denotes the growth rate of either total private employment or GDP. *Dur* is a dummy variable that equals 1 for durable goods industries and 0 otherwise. Including the contemporaneous value of these controls is again meant to be conservative with regard to the coefficient on policy uncertainty because these should already embed the entire general influence of policy uncertainty on current activity. In addition, we also want to control for the greater cyclical variations in output, and hence employment, in those industries with high shares of sales to the government, which tend to produce durable (including high-tech) goods (as shown above). This is to minimize potential bias in the coefficient on uncertainty, since it also exhibits a cyclical component. To this end, we interact these aggregate variables with *Dur*, the durable industry dummy, to account for the greater cyclicality of those industries selling more to the government or foreigners.

Unlike the first set of controls included in equation (1), total payroll growth here is itself adversely affected by policy uncertainty, and so its inclusion may well bias downward the estimate of the coefficients on policy uncertainty. Alternatively, we use quarterly GDP growth as an aggregate control in another specification, plus its interaction with the durable industry dummy. When GDP is included as the aggregate control, we also include the GI same-period forecast of four-quarter cumulative GDP growth on the right-hand side, plus its interaction with *Dur* to account for the durable industries' greater cyclicality. These terms are summarized in X_t. Note that the forecast of the cumulative growth in federal

government spending over the next four quarters, along with its interaction with the share of spending in industry output, is still controlled for in both of these two alternative specifications.

Panel Regression Results

Table 4 reports the coefficient estimates from the panel regressions. The sample period spans 1998:Q1 to 2013:Q1. The first year of the sample is chosen to coincide with the start of the annual input-output tables provided by the BEA. The regressions use industry employment data reported at the NAICS level.[15] All growth rates are annualized rates of growth over three months ago (which are equivalent to quarterly averages of monthly growth). The quarterly frequency is used because monthly fluctuations in employment contain much pure noise that is averaged out over a quarter. Moreover, the GI forecast variables are available only quarterly. We measure the share of an industry's sales accounted for by exports and government purchases using the one-year lagged value to balance the need for an up-to-date share and the minimal impact of contemporaneous growth on the share.[16] All the regressions contain industry fixed effects. For brevity of presentation, we omit the coefficients on all industry dummy variables, and also report only the sum of lagged coefficients on each industry's own employment growth.

The first column reports estimates from a regression that includes only three lags of each industry's own employment growth as controls, the federal government purchase share, plus two recession and the post-2009 recovery dummy variables (so the omitted base period is the normal period between the 2001 and 2008–2009 recessions). The sum of the lagged coefficients on own growth does not change significantly if the lag length is expanded up to eight, with six lags maximizing the adjusted R^2. Here we report the results with only three lags to be consistent with the later regressions with additional controls. The recession and the recovery dummies all have the expected signs and are significant, whereas the coefficient on the federal spending share is insignificant.

The coefficient on the current-period policy uncertainty index (PUI) is negative and statistically

[15] These regressions leave out three industries, NAICS 3364 to 3366, which constitute the "Other transportation equipment" industry in the IO tables. Collectively, they far exceed all other industries in terms of the share of sales to the government, so we exclude them to avoid the possibility of distorting the parameter estimates. Nevertheless, including them does not alter the significance of the coefficient on policy uncertainty, although its magnitude is slightly diminished.

[16] The shares calculated directly from the input-output tables remain fixed within each year. We also experimented with interpolating the shares, based on the assumption that they evolve linearly from quarter to quarter. This makes little difference for the results because the shares evolve slowly from year to year.

significant, meaning that a high level of policy uncertainty has a uniformly negative impact on industry employment growth. A one-standard-deviation increase in policy uncertainty, which is 0.37 since the beginning of our estimation sample in 1998, would reduce employment growth across all industries by 0.80 (that is, 0.37 times 2.16) percentage point per year.[17] To put this in perspective, the annualized rate of quarterly employment growth has averaged 0.53 percent with a standard deviation of 2.40 percent over the same period. More importantly, the coefficient on the interaction term between PUI and the dummy variable identifying industries in the top quartile in terms of overall sales share to the government is also negative and significant. Specifically, industries relying the most on government purchases curtail their employment growth by an extra 0.35 percentage point on average compared with the other industries when policy uncertainty is one standard deviation higher.

Columns (2) through (4) report the estimates when additional controls for either demand or general economic conditions are included. Column (2) adds two sets of industry demand variables: current and two lags of exports growth, along with their interaction with the share of each industry's output driven by exports, plus current and four lags of defense spending growth, along with their interaction with the share of an industry's sales to the government.[18] Adding a few more lags for either or both tends to raise the adjusted R^2 slightly, although it makes little difference for the coefficient on PUI. The sums of coefficients on the share-interacted lagged exports and defense spending growth are both positive and significant, whereas the growth rate of either demand series itself is insignificant.[19] This suggests that the interaction terms are much better proxies for the demand condition at the industry level. The coefficient on the share of exports in output is positive, indicating that an industry's growth rate tends to rise when it exports more. Moreover, these controls take away some of the explanatory power of each industry's own lagged employment growth, so that the sum of the latter's coefficients is now somewhat lower. These demand controls also generally reduce the magnitude of the recession dummies. This is consistent with the observation that both defense spending and exports are correlated with the business cycle over our sample period.

Interestingly, the coefficients on the GI forecasts of federal government defense and nondefense spending over the next four quarters (weighted by each industry's share of output eventually driven by

[17] Note that we scale down the PUI by a factor of 100 to optimize the magnitude of the related coefficients.

[18] Coefficients on zero to three lags of defense spending growth are all small and insignificant. This seems consistent with the intuition that hiring responds more to persistent changes in government spending than to single-period changes.

[19] Coefficients on the fourth to the fifth lags of defense spending growth are, in fact, significantly negative, likely because defense spending is empirically countercyclical for our sample period.

federal government defense and nondefense demand, respectively) are negative, but only the coefficient on the interacted defense spending term is significant. This may seem puzzling at first glance, but there is an intuitive explanation. The forecast of total federal government spending, like the actual spending (illustrated in Figure 5), is countercyclical over our sample period. This is evidenced by its negative coefficient of unconditional correlation with past GDP growth as well as with employment growth, at both the aggregate and the industry levels, as shown in Table 3. Moreover, for our sample period, the growth of defense spending happened to be high during periods when employment was weaker than can be accounted for (linearly) by output growth, as evidenced by its significant negative coefficient in a regression of total private payroll growth on lagged and forecast four-quarter GDP growth, along with forecasts of four-quarter growth in defense and nondefense spending, shown in Table 5. This is largely because the timing of the Iraq war coincided with the anemic early recovery after the 2001 recession. At the same time, those industries selling a high share of their output to the federal government were hit hard by the 2001 recession and the high-tech slump. Hence, part of the "excess" cyclical movements in these industries' employment growth loads up negatively on the interacted defense spending forecast variable.

More importantly, once exogenous demand fluctuations plus expected future government spending are accounted for, the coefficient on PUI becomes much less negative—its magnitude shrinks to only one-fourth and is no longer significant. On the other hand, the coefficient on the interaction between PUI and the top-quartile-government sales dummy variable is as negative and significant as before. This indicates that heavy reliance on government demand still renders an industry more cautious in its employment adjustment when policy uncertainty is high, over and above what can be accounted for by variations in both past and expected future demand for those industries' output.

Column (3) instead uses contemporaneous growth plus three lags of total employment in all private industries as controls for macroeconomic conditions, while column (4) substitutes GDP for total private payroll. Either set of aggregate controls is also interacted with the durable-goods industry dummy to account for those industries' greater cyclical variations in output, and hence employment. In column (4), the GI forecast of cumulative GDP growth over the next four quarters is also included. For brevity of presentation, we report only the sum of coefficients on these additional controls based on aggregate economic activity. Note that controls based on the forecast of federal government spending for defense and nondefense purposes over the next four quarters are still included.

Between these two sets of macroeconomic controls, total private payroll growth enhances the adjusted R^2 by a fair margin. By comparison, GDP growth rates contribute no more explanatory power than the two exogenous demand variables alone. Nonetheless, the sum of coefficients on either set of aggregate controls is positive and highly significant, as would be expected. Most of the individual coefficients, not reported, are in fact significant as well. The sum of coefficients on the interaction terms with the durable-goods industry dummy, on the other hand, is noticeably smaller, especially for total private payrolls. This is because the individual coefficients, not reported, switch from positive in the current and last quarters to negative in earlier quarters. This pattern suggests that swings in employment in durable-goods industries are magnified at first relative to the economy as a whole, but are partially reversed later on. In sum, they have a larger loading on aggregate fluctuations.

We still include three lags of each industry's own payroll growth in these regressions. The sum of these lagged coefficients is but slightly smaller than in column (1). We omit the recession and recovery dummies from the regression in column (3) because they are all insignificant, which is not surprising, since total private payroll on the right-hand side fully accounts for the aggregate dynamics of employment. In contrast, the 2001-recession dummy remains as significant in column (4) as in column (1), whereas the Great Recession dummy is no longer significant. This suggests that employment was in fact weaker early in the previous recovery than in this recovery, conditional on output.

The coefficients on the industry-sales-share-weighted forecasts of future four-quarter growth in federal defense and nondefense spending are still negative, but no longer significant in either specification, indicating that these aggregate activity indicators plus the additional control for durable-goods industries' excess cyclicality account adequately for industry-level cyclical dynamics of employment growth. The coefficient on the federal defense spending forecast itself remains significantly negative in column (4), which can again be explained by the empirical behavior of defense spending during our sample period, as revealed by the regression results reported in Table 5. That is, the unusually weak employment growth after the 2001 recession coincided with the military build-up for the Iraq war. By comparison, the forecast of cumulative four-quarter growth in GDP is positive but insignificant, while its interaction with the durable-goods industry dummy is more significant. This seems to suggest that GDP growth in the current and past quarters already contains adequate information as far as the cyclical movement of employment is concerned, except for those durable-goods industries.

Regarding the main variables of interest, we note that the coefficient on PUI is minuscule in column (3), indicating that controlling for aggregate employment sufficiently accounts for the general

effect of policy uncertainty. In contrast, this coefficient remains significantly negative in column (4) and larger in magnitude than that in column (2); that is, employment is weaker than can be accounted for by output when policy uncertainty is high. The coefficient on the interacted PUI term is in fact slightly more negative than in the regression without any demand or macro controls (in column (1)), and equally significant. These estimates imply that, when policy uncertainty is high, industries in the top quartile in terms of reliance on government purchases curtail their employment more than other industries and beyond what can be explained by their exposure to the macroeconomy.

We use these estimates to gauge the range of impact on employment of the heightened uncertainty regarding fiscal policy in recent years. The most conservative estimate is to consider only the cross-industry heterogeneous effect as identified and select the regression that generates the smallest estimate (in absolute value). This in fact corresponds to the coefficient on the interacted PUI term in column (1), a regression without any demand or aggregate controls. This estimate would imply that the PUI decline of 0.4 point in September from August 2011, the height of the debt ceiling crisis, added about four-tenths of a percentage point to the employment growth of those industries selling the most to the government. To put this in perspective, the one-year employment growth in September 2011 was only about 2 percent. Counting only the one-month, post-crisis change in PUI again errs on the conservative side, minimizing any influence on the PUI from the European turmoil around that time. The PUI experienced a comparable decline in January of this year from a month ago, after the "fiscal cliff " debate was resolved. In sum, it appears that policy uncertainty has a non-negligible deleterious effect on employment growth even when we adopt the most conservative estimate.

Concluding Remarks

To summarize, using quarterly industry employment data, we find evidence that high levels of policy uncertainty retard employment growth. More specifically, industries selling a relatively high fraction of their output directly and indirectly to the federal government tend to slow their payrolls more than other industries when policy uncertainty is elevated, even after accounting for industry demand conditions. Moreover, this effect is nontrivial economically, although it is insufficient to fully account for the unusually slow employment growth during the Great Recession and the subsequent recovery. There is also some indication, albeit not particularly robust, that policy uncertainty exerts a negative across-the-board influence on growth.

One implication of these findings is that the upcoming re-match between Congress and the administration regarding the debt ceiling and possibly even a government shutdown will likely again create drag on the economy to the extent it raises policy uncertainty again. Moreover, fiscal uncertainty may well drive up Treasury yields, especially at the long end, and this will result in a high cost of capital for businesses and consumers. All this restraint on the macroeconomy will mean that full employment will be reached later than currently anticipated, unless it is countered by monetary policy remaining accommodative for longer.

In fact, the detrimental effect of greater policy uncertainty on the aggregate economy may well exceed the magnitude estimated in this study. This is because employment is a net outcome between the gross flows of hiring and separation. To the extent that workers also become more cautious, and thus less likely to look for new jobs and then quit when policy uncertainty is perceived to be high, the lower rate of separation at least partially offsets the lower rate of hiring due to caution on the part of employers. This then results in a smaller change in the net flow—employment. In contrast, investment is a gross flow, and so the impact of policy uncertainty on business investment is likely to be more pronounced.

There are certainly other ways in which firms' exposures to fiscal policy uncertainty differ. For example, industries that receive more government subsidies are likely to become more cautious when the policy outlook is more uncertain. Also, taxes on capital affect the cost of capital, and they likely matter more for industries that are more capital intensive. These issues will be worth exploring in future analysis.

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Table 1a. Top 10 industries in terms of share of direct and indirect sales to the federal government for *defense* spending

Industry Name	1998	2002	2007	2011
Other transportation equipment	1	**1**	1	1
Computer and electronic products	3	**2**	2	2
Computer systems design and related services	9	**3**	3	4
Miscellaneous professional, scientific, and technical services	2	**4**	4	5
Information and data processing services	7	**5**	5	6
Primary metals	8	**6**	6	8
Printing and related support activities	5	**7**	8	9
Oil and gas extraction	16	**8**	7	7
Fabricated metal products	6	**9**	10	11
Administrative and support services	14	**10**	9	12

Source: Author's calculations.

Table 1b. Share of industry output sold directly and indirectly into federal *defense* spending (%)

Industry Name	1998	2002	2007	2011
Other transportation equipment	19.5	**27.0**	27.5	34.0
Computer systems design and related services	5.4	**10.3**	16.4	22.5
Computer and electronic products	4.1	**7.8**	9.2	13.1
Miscellaneous professional, scientific, and technical services	5.5	**7.6**	8.6	10.0
Information and data processing services	4.2	**6.3**	7.2	8.8
Printing and related support activities	4.2	**5.1**	6.3	6.7
Oil and gas extraction	4.6	**5.1**	6.0	6.2
Fabricated metal products	3.0	**5.0**	6.1	7.9
Publishing industries (includes software)	4.5	**4.8**	5.3	6.0
Administrative and support services	3.2	**4.6**	5.3	5.4

Source: Author's calculations.

Table 2a. Top 10 industries in terms of share of direct and indirect sales to the federal government for *nondefense* spending

Industry Name	1998	2002	2007	2011
Other transportation equipment	1	**1**	1	3
Computer systems design and related services	4	**2**	2	1
Computer and electronic products	6	**3**	3	4
Miscellaneous professional, scientific, and technical services	3	**4**	4	5
Information and data processing services	10	**5**	5	6
Printing and related support activities	7	**6**	7	11
Oil and gas extraction	15	**7**	6	7
Fabricated metal products	8	**8**	9	12
Publishing industries (includes software)	22	**9**	12	16
Administrative and support services	16	**10**	10	13

Source: Author's calculations.

Table 2b. Share of industry output sold directly and indirectly into federal *nondefense* spending (%)

Industry Name	1998	2002	2007	2011
Other transportation equipment	8.4	**8.3**	7.9	7.8
Computer systems design and related services	2.9	**7.5**	7.1	8.5
Computer and electronic products	2.6	**4.3**	5.7	7.4
Miscellaneous professional, scientific, and technical services	2.9	**4.2**	4.1	4.9
Information and data processing services	2.2	**3.5**	3.4	4.3
Printing and related support activities	2.4	**2.9**	2.9	3.1
Oil and gas extraction	1.8	**2.8**	3.0	4.1
Fabricated metal products	2.4	**2.7**	2.6	2.9
Publishing industries (includes software)	1.4	**2.6**	2.2	2.2
Administrative and support services	1.7	**2.6**	2.5	2.7

Source: Author's calculations.

Table 3. Unconditional Correlations among Variables over the Sample Period (1998:Q1–2013:Q1)

	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)
(I) Forecast, GDP Next 4 Quarters	1						
(II) Forecast, Fed. Gov. Defense Spending Next 4 Quarters	0.47	1					
(III) Forecast, Fed. Gov. Nondefense Spending Next 4 Quarters	0.129	0.595	1				
(IV) Policy Uncertainty Index	-0.329	-0.431	-0.228	1			
(V) GDP 4-Quarter Average	0.45	-0.052	-0.354	-0.449	1		
(VI) Industry Employment	0.111	-0.18	-0.252	-0.1	0.327	1	
(VII) Total Private Employment	0.396	-0.355	-0.526	-0.29	0.824	0.403	1

Notes: All variables other than the Policy Uncertainty Index are annualized rates of quarterly growth, unless the horizon is specified otherwise. All forecasts are produced by Global Insight.
Source: Author's calculations.

Table 4. Panel regression estimates

VARIABLES	(1) Own Lags Only	(2) Own Lags + AD Control	(3) Own Lags + Total Empl.	(4) Own Lags + GDP
PUI	**-2.160*** **	**-0.505**	**-0.0569**	**-1.317*** **
	[0.385]	**[0.441]**	**[0.225]**	**[0.464]**
High government purchase share * PUI	**-1.108*** **	**-1.546*** **	**-1.622*** **	**-1.588*** **
	[0.359]	**[0.410]**	**[0.484]**	**[0.537]**
Sum of 3 lags of own employment growth	0.503***	0.419***	0.432***	0.440***
	[0.058]	[0.079]	[0.082]	[0.074]
Sum of Total private employment or GDP growth (t-3 to t)			0.465***	0.279***
			[0.076]	[0.057]
Sum of Durable dummy * Total empl. or GDP growth (t-3 to t)			0.215*	0.403***
			[0.115]	[0.114]
GI forecast of GDP growth over next 4 quarters				0.211
				[0.164]
Durable*GI forecast of GDP growth over next 4 quarters				0.461**
				[0.182]
Sum of lags of defense growth * defense share		0.860**		
		[0.394]		
Sum of lags of defense growth		-0.002		
		[0.027]		
Sum of lags of exports growth * export share		0.651***		
		[0.166]		
Sum of lags of exports growth		-0.002		
		[0.036]		
Export share		10.31***		
		[3.056]		
GI forecast of fed. gov. defense spending growth over next 4 quarters * Government defense purchase share in output		-2.601**	-1.431	-1.100
		[1.239]	[1.139]	[1.186]
GI forecast of fed. gov. nondefense spending growth over next 4 quarters * Gov. nondefense purchase share in output		-3.639	-3.135	-3.735
		[2.541]	[2.263]	[2.359]
GI forecast of fed. gov. defense spending growth over next 4 quarters		-0.0974	-0.0523	-0.132**
		[0.0638]	[0.0541]	[0.0580]
GI forecast of fed. gov. nondefense spending growth over next 4 quarters		0.0388	0.0337	0.0917
		[0.0693]	[0.0659]	[0.0676]
Government purchase share in output	-2.799	-3.382	-2.159	0.950
	[5.712]	[4.076]	[6.233]	[8.349]
2001 recession dummy	-2.973***	-1.694***		-2.302***
	[0.548]	[0.572]		[0.533]
2008-9 recession dummy	-2.858***	-3.144***		-0.941
	[0.498]	[0.566]		[0.735]
Post-2009 recovery dummy	2.516***	0.0429		1.811**
	[0.425]	[0.795]		[0.722]
Constant	2.754***	0.209	0.576	0.314
	[0.473]	[0.657]	[0.471]	[0.667]

Observations	4,697	4,466	4,697	4,697
R-squared	0.281	0.306	0.316	0.303
Adjusted R-squared	0.279	0.300	0.313	0.299
Number of NAICS code	77	77	77	77
Quarters per NAICS code	61	58	61	61

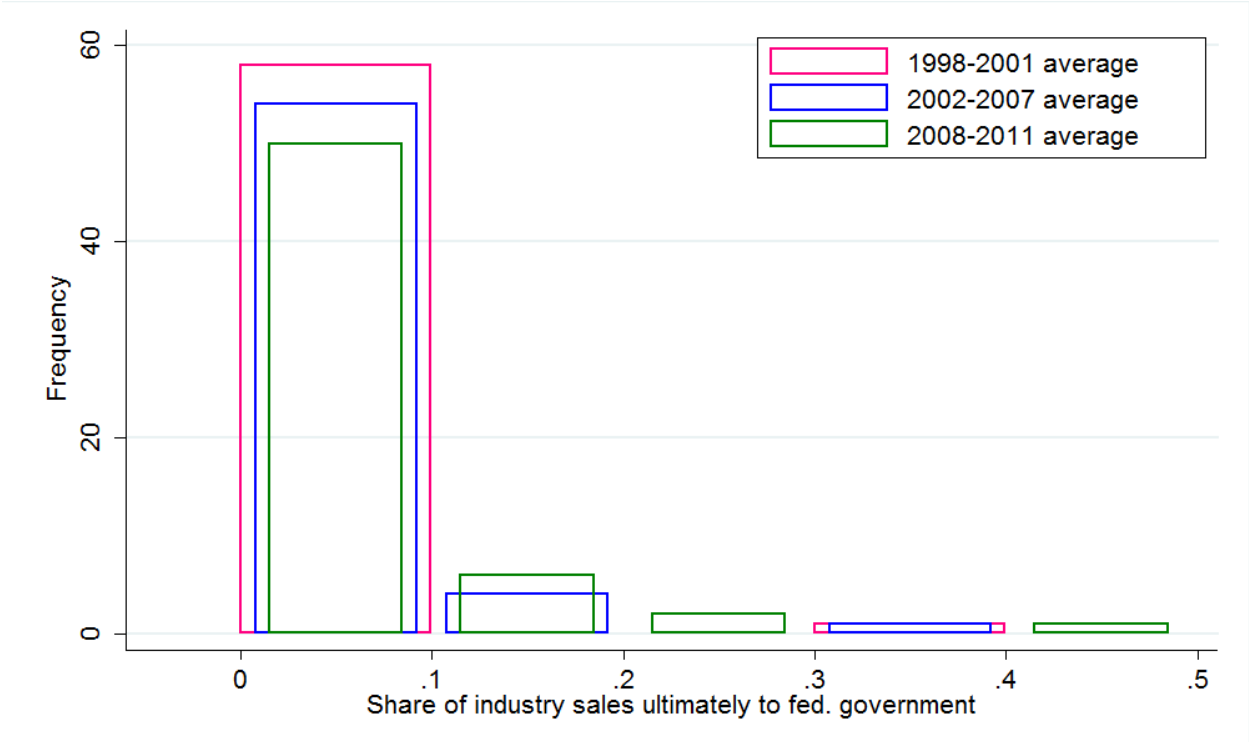
Notes: Robust standard errors in brackets. *** p < 0.01, ** p < 0.05, * p < 0.1.
Source: Author's calculations.

Table 5. Relationship between payroll growth of all private industries and forecasts

LHS: Total private payroll growth	Coefficient	Std. Error	t
GDP 4-Quarter Average	0.667***	0.073	9.18
Forecast, GDP Next 4 Quarters	0.868***	0.191	4.54
Forecast, Fed. Gov. Defense Spending Next 4 Quarters	-0.339***	0.063	-5.41
Forecast, Fed. Gov. Nondefense Spending Next 4 Quarters	-0.083	0.059	-1.42
Constant	-2.691***	0.439	-6.14

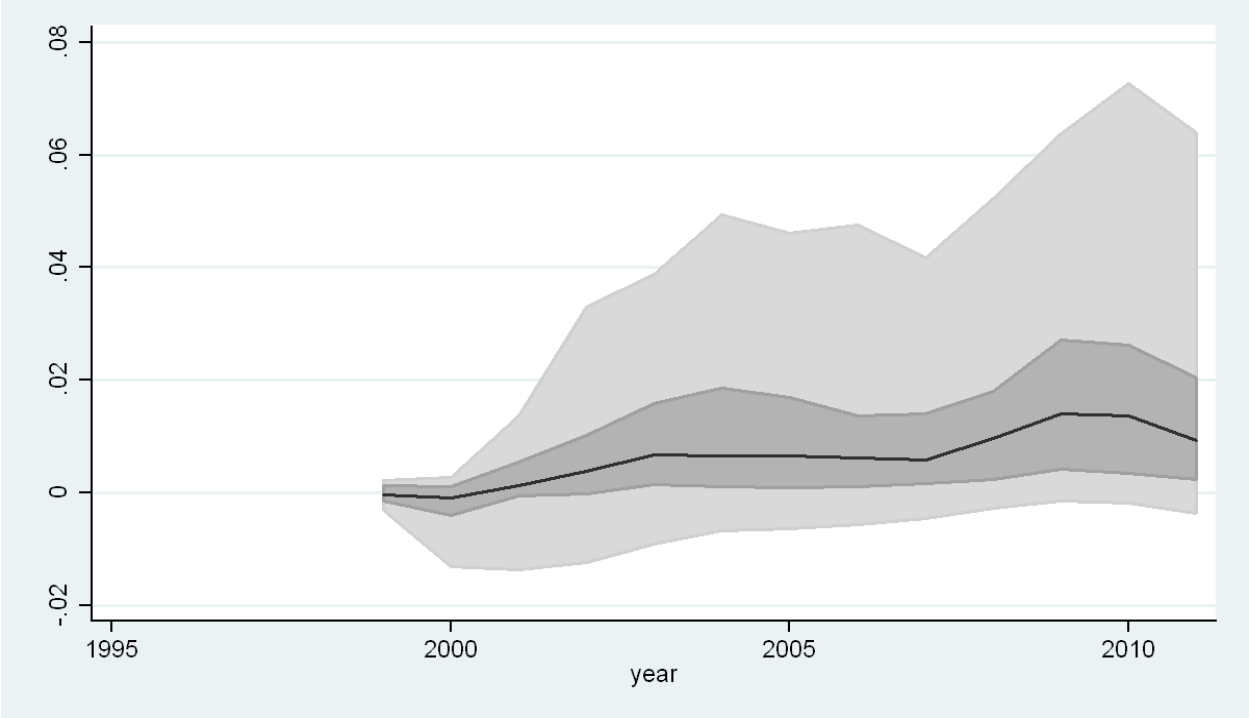
Notes: *** p < 0.01, ** p < 0.05, * p < 0.1.
Source: Author's calculations.

Figure 1. Histogram: Shares of industry total sales directly plus indirectly to the federal government, 1998 to 2011



Source: Author's calculations.

Figure 2a. Evolution of industry shares of direct plus indirect sales to the federal government: *change* since 1998



Notes: the solid line depicts the median industry in terms of the *change* in government sales share since 1998, the dark shaded area depicts the inter-quartile range, while the light shaded area depicts the 10th to the 90th percentile.
Source: Author's calculations.

Figure 2b. Share of federal government expenditures in GDP

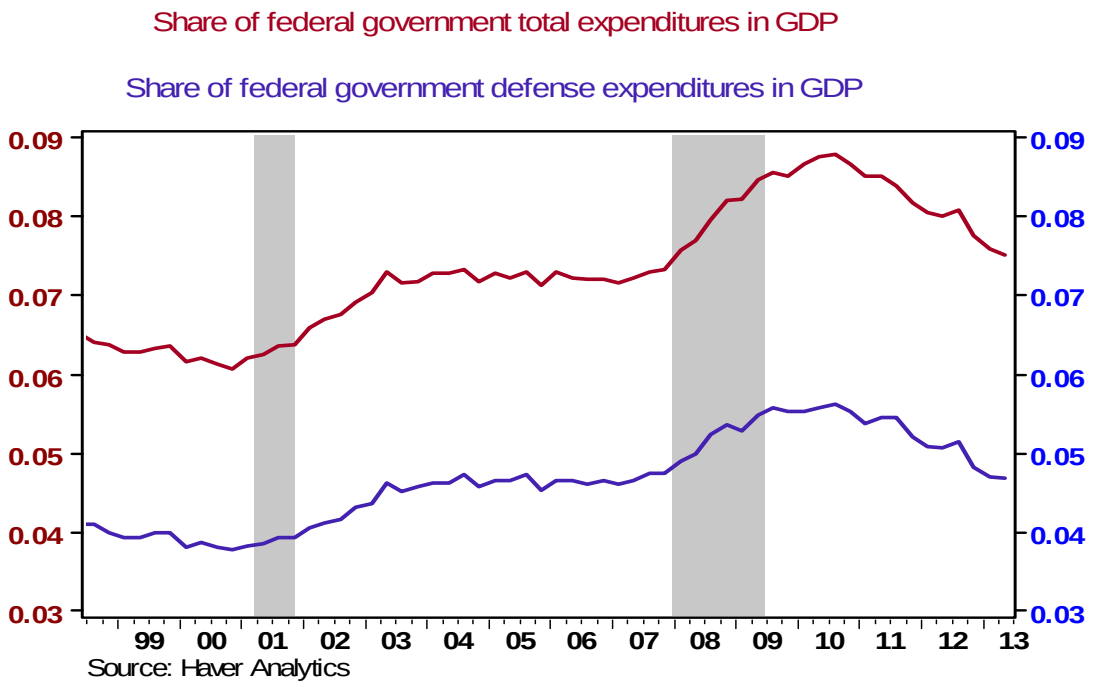
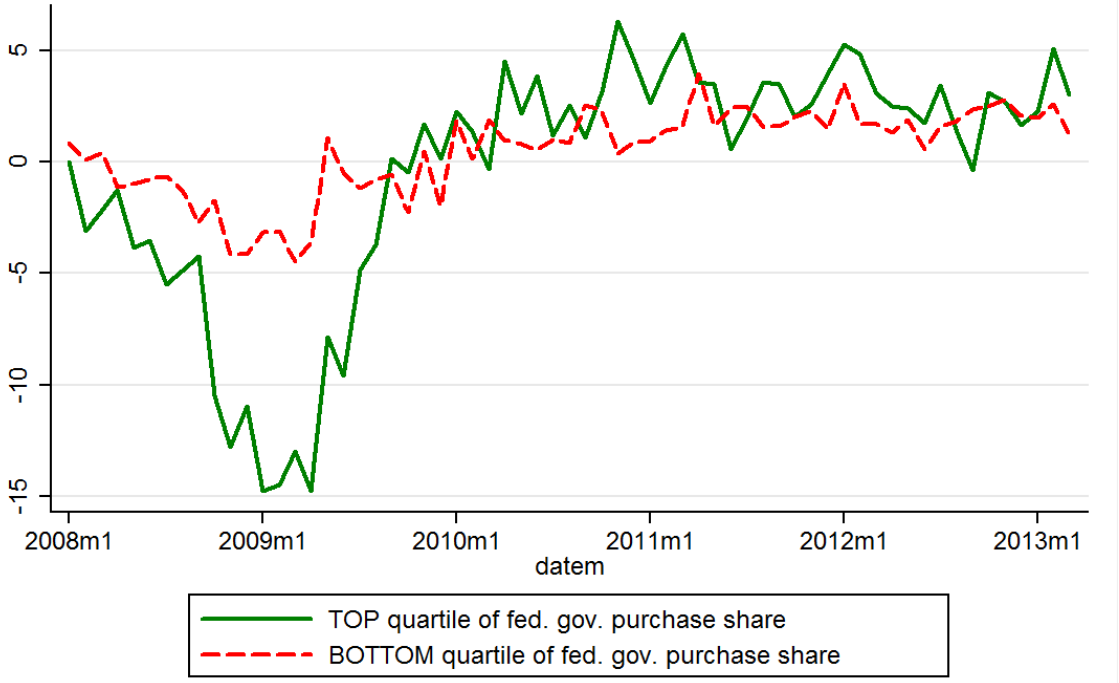
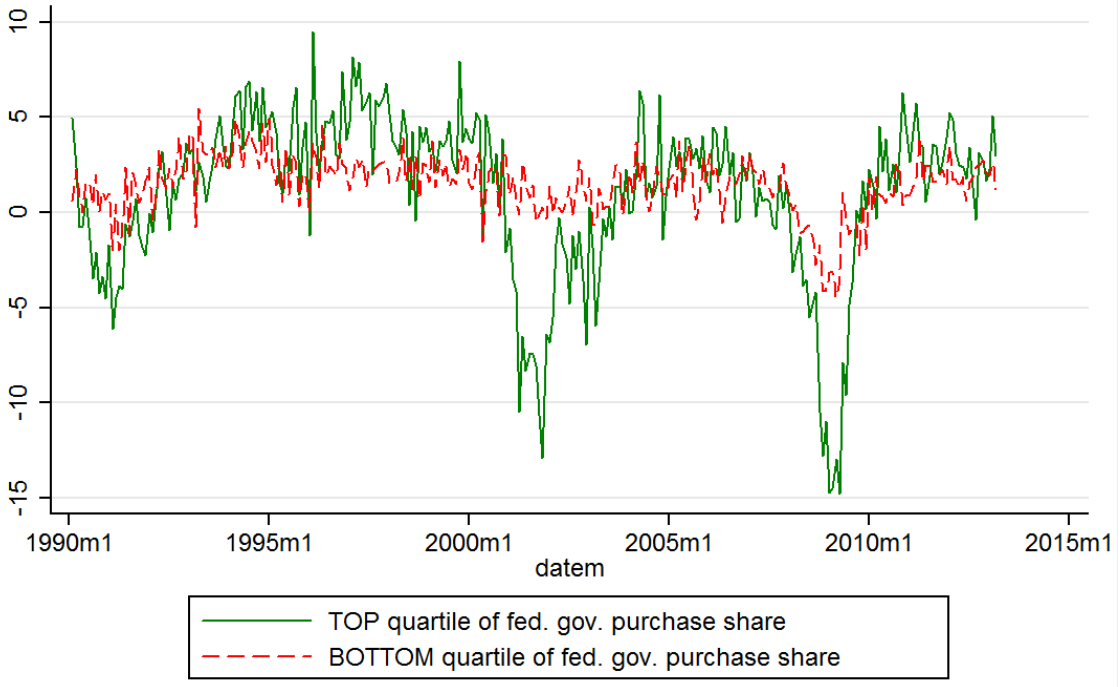


Figure 3a. Industry employment growth rate (annualized %) in Jan. 2008 to Mar. 2013



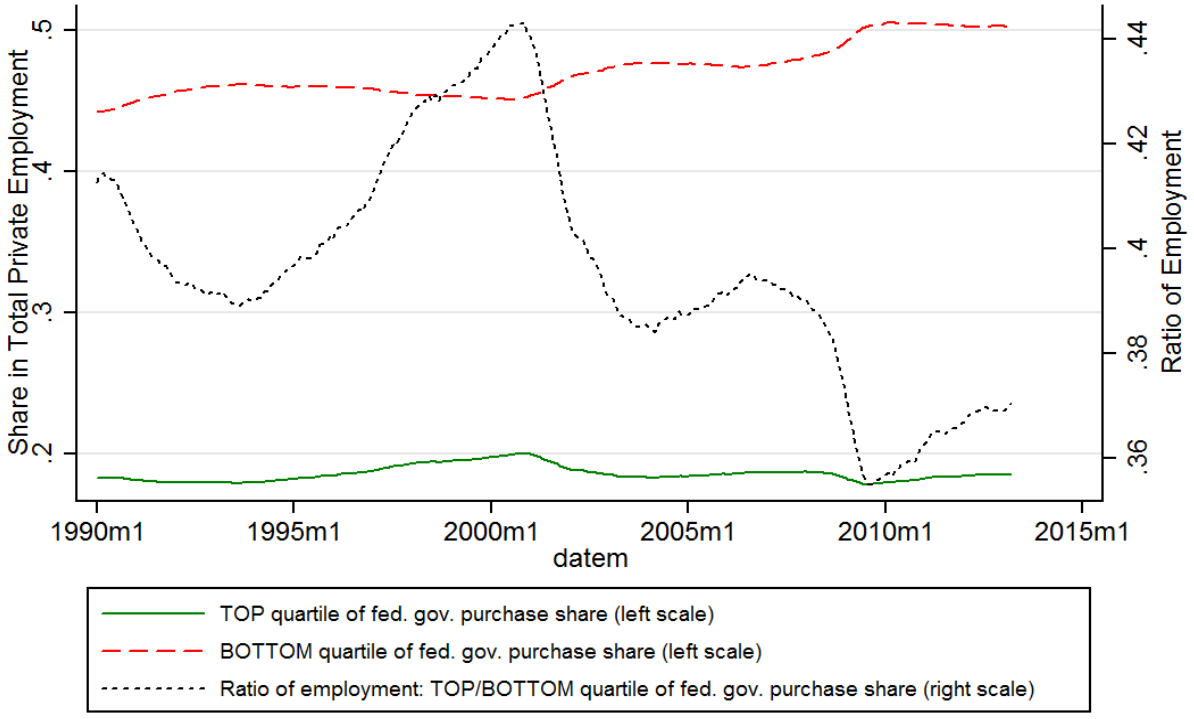
Source: Author's calculations.

Figure 3b. Industry employment growth rate (annualized %) in Feb. 1990 to Mar. 2013



Note: These two charts compare the monthly employment growth between the top and the bottom quartiles of industries using the 2002–2007 average shares of direct and indirect sales to the federal government.
Source: Author's calculations.

Figure 4. Share in private employment by industries' share of sales to the federal government



Source: Author's calculations.

Figure 5. Cyclicality of exports and federal defense spending