

# The Household Effects of Government Spending\*

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## Abstract

This paper provides new evidence on the effects of fiscal policy by studying, using household-level data, how households respond to shifts in government spending. We find that there is no such thing as a single “fiscal multiplier”; the effects on households of a shift in government spending vary over time depending, among other factors, on the state of business cycle and, at a lower frequency, on the composition of employment (such as the share of workers in part-time jobs). Shifts in spending also have important distributional effects that are lost when estimating an aggregate multiplier. Heads of households working relatively few (weekly) hours, for instance, suffer from a spending shock of the type we analyzed: their consumption falls, their hours increase and their real wages fall.

**Keywords:** Fiscal Policy; PSID; Household Consumption; Labor Supply

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# 1 Introduction

This paper provides new evidence on the effects of fiscal policy by studying, using household-level data, how households respond to a shift in government spending. Evidence based on micro data is interesting for three reasons. First, aggregation bias might impair aggregate data such as the aggregate consumption time series used to study households' response to fiscal shocks. The problems raised by the aggregation bias in consumer behavior are well known, at least since Gorman's (1953) seminal contribution.<sup>1</sup> Second, individual households' data allow us to identify how different groups (defined, as an example, by their age, income, occupation, the state of the labor market where they live) respond to the same shift in fiscal policy. For instance Ercolani and Pavoni (2011), using Italian micro data, find that the response to shifts in government spending differs depending on the age of the head and on where the family lives (Northern or Southern Italy). Thus the finding that aggregate consumption does not respond to a shift in public spending could simply be the result of averaging across households who all respond significantly but with off-setting signs. Moreover, knowing how different groups respond to a shift in fiscal policy allows such shifts to be better designed and targeted to groups or areas where they might be more effective. Finally, if households' responses to fiscal shocks differ depending on their characteristics, "multipliers" would change over time depending on the composition—for instance by age, occupation, or geographical distribution—of the population, or by the state of the labor market as pointed out in Auerbach and Gorodnichenko (2011).

We use data from the Panel Study of Income Dynamics (PSID) of U.S. households. Theory suggests that households could respond to a shift in fiscal policy in two ways: by changing their consumption and/or by changing their labor supply. We use the information on hours worked contained in the PSID to estimate the response labor supply to fiscal shocks. To build household consumption, which is not collected in the PSID, we use the methodology proposed by Blundell, Pistaferri and Preston (2008) which combines Consumer Expenditure Survey (CEX) and PSID data.

There are lively disagreements over the effects of fiscal policy on consumption, on labor supply and, through changes in labor supply, on real wages, the third variable we analyze. They center on theory—the very different predictions of alternative models—and on the way the empirical evidence is analyzed. Starting from theory, the sharpest difference arises between the predictions of the textbook Keynesian model and of models based upon representative agents who base their choices on optimal intertemporal decisions. The first,

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<sup>1</sup>Among many others, Constantinides (1982), Atkeson and Ogaki (1996) and Maliar and Maliar (2003) make the point that household heterogeneity collapses into parameters of the representative agent model, modifying its stochastic properties—a result extended by Lopez (2010) to the case of incomplete markets.

as is well known, predicts that a positive spending shock raises consumption and the real wage, while the model has no predictions for hours worked. Intertemporal models give the opposite result: the negative wealth effect associated with an increase in government spending lowers consumption and (if consumption and leisure are complements) raises hours worked; this in turn lowers the real wage. The sharp difference between these results is attenuated in optimizations models that allow for nominal rigidities, or introduce consumers subject to credit constraints: the latter is one case in which the response of consumption to a spending shock can be positive.

On the empirical front the main issue is how the shifts in fiscal policy are identified, whether through VAR techniques or the “narrative” approach. This paper does not take a stand on this issue but follows a third path: like Nakamura and Steinsson (2011), the shifts in government spending we analyze are variations in military contracts across states. This allows us to control for time-specific aggregate effects (such as, importantly, the stance of monetary policy — common across U.S. states — that accompanies a shift in fiscal policy) and instead measure the fiscal shock as the state-specific variation in military contracts driven by aggregate changes in U.S. military spending.

When the effects of government spending shocks are studied identifying such shocks within a VAR, one typically finds that a positive spending shock raises consumption, hours worked and real wages (see e.g. Blanchard and Perotti (2002); Mountford and Uhlig (2009); Perotti (2008); Galí, López-Salido, and Vallés (2007)). In contrast, analyses that use narrative spending shocks (typically shifts in defence spending) find that while government spending raises hours, it lowers consumption and the real wage (e.g. Ramey and Shapiro (1998); Edelberg, Eichenbaum, and Fisher (1999); and Burnside, Eichenbaum, and Fisher (2004)). The difference between these two sets of results could be due to the fact that narrative shocks, as mentioned above, are mostly shocks to military spending, while shocks identified within a VAR refer to overall government spending. A comparison of the effects of military and non-military spending shocks, both identified with a VAR, is reported in Blanchard and Perotti (2002): they find similar multipliers in both cases, suggesting that the difference seems to be related to the way shocks are identified. Event studies such as Giavazzi and Pagano’s (1990) analysis of fiscal consolidations in two European countries, and Cullen and Fishback’s (2006) analysis of WWII spending on local retail sales in the U.S., generally show a negative effect of government spending on private consumption. Hall’s (1986) analysis using annual data back to 1920 and also identifying government spending shocks through shifts in military spending, finds a slightly negative effect of government purchases on consumption.

Our results suggest that there is no such thing as a single “fiscal multiplier”. The effects on the economy of a shift in military spending — the case we analyze — vary

over time depending, among other factors, on the state of business cycle and, at a lower frequency, on the composition of employment, for instance the share of workers on part-time jobs. Shifts in spending also have important distributional effects that are lost when estimating an aggregate multiplier. For instance the effect of a positive spending shock on aggregate consumption appears to be positive, but the effect is concentrated on households with relatively higher income and on households where the head has a full-time job; on the contrary, lower-income households and households where the head works relatively few hours per week, following a positive spending shock tend to cut consumption. Heads who on average work relatively few hours, differently from those working full-time, also respond by increasing their hours and their real wages fall, also differently from full-time workers. Aggregate fiscal multipliers conceal this wealth of information on the effects of shifts in fiscal policy; they also hamper the design fiscal policies that are appropriate given the state of the business cycle. Finally, the more diverse are the effects of a fiscal impulse across different groups in the population, the more likely is the possibility that an economy-wide multiplier suffers from an aggregation bias (see e.g. Stoker (2008)).

The risks of relying on a single multiplier have recently been emphasized in the literature. Auerbach and Gorodnichenko (2011), using regime-switching models, find large differences in the size of spending multipliers in recessions and expansions with fiscal policy being considerably more effective in recessions than in expansions. Favero, Giavazzi, and Perego (2011) compare fiscal multipliers across countries and find that they differ depending on the country's degree of openness to international trade, its debt dynamics and its local fiscal reaction function. Interestingly, such differences concern not only the size of the multiplier, but sometimes also its sign.

We start in Section 2 describing our data. Section 3 discusses how the fiscal shocks we analyze are identified. Our results are presented in Section 4 and Section 5. Section 6 concludes.

## 2 Combining household and state data

We first detail the data that we use. We discuss the household level data and in particular the approach to construct consumption data. We then explore the state-level data especially the military procurement that provides the basis for our fiscal shocks instrument.

## 2.1 Constructing the data for individual consumption, hours and real wages

In order to construct the panel of individual household data on consumption, we follow the approach of Blundell, Pistaferri, and Preston (2008a). The primary source of data is the PSID, a long-running (surveys since 1968) panel series which includes a large number of socio-economic characteristics of U. S. households. These include data on income, hours worked <sup>2</sup>, wealth, taxes as well as other household characteristics such as family size and levels of education. However, it does not include data on total household consumption; instead there are measures of household expenditure on food.<sup>3</sup>

The CEX, collected by the Bureau of Labour Statistics, provides high quality information on the purchasing habits of U.S. consumers. While these data include numerous household characteristics, they are not collected in the form of a panel; specifically, different households respond in each year of the survey. Nonetheless, Blundell, Pistaferri, and Preston (2008a) impute estimates of both aggregate consumption as well as consumption of non-durables in the PSID using information from the CEX.

Their approach is detailed in their paper and in an unpublished appendix (Blundell, Pistaferri, and Preston 2008b): here we outline their imputation procedure. They estimate a demand function for food consumption (a variable which is available both in the PSID and CEX surveys but was not collected in the 1988 and 1989 surveys) using a total consumption variable (such as non-durable consumption expenditure),<sup>4</sup> a variety of household characteristics, and the relative prices of food and other types of consumption as regressors. They allow this function to have time- and characteristic-varying budget elasticities,<sup>5</sup> and they allow for measurement error in the total consumption variable by instrumenting it with cohort, year and education-level demeaned hourly wages for the husband and wife. They then invert this consistently estimated demand function to derive the imputed PSID consumption measures.

Before we can make use of these data, they need to be carefully combined and merged

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<sup>2</sup>The 1983 questionnaire asks “*How many weeks did you work in your main job in 1982? And, on the average, how many hours a week did you work on your main job in 1982?*”

<sup>3</sup>Again, using 1983 as a typical year, the question asked is “*In addition to what you buy with food stamps, how much do you (or anyone else in your family) spend on food that you use at home? How much do you spend on that food in an average week? Do you have any food delivered to the door which isn’t included in that? How much do you spend on that food? About how much do you (and everyone else in your family) spend eating out not counting meals at work or at school?*”

<sup>4</sup>Nondurable consumption is defined as food, alcohol, tobacco, and expenditure on other nondurable goods, such as services, heating fuel, public and private transport (including gasoline), personal care, and semi durables, defined as clothing and footwear. It excludes housing (furniture, appliances, etc.), health, and education.

<sup>5</sup>The budget elasticity is the elasticity of the food expenditure measure to the aggregate spending measure.

to ensure that the timing of the PSID data matches the fiscal data that we discuss below. In particular, the questions used to construct the hours and income variables are retrospective: in the 1983 survey, the household is asked to report their working hours and income for 1982. With this in mind, and as shown in Figure 1, the responses to the questions reported by the household during their interview in 1983 are recorded as head of household  $i$ 's income earned and hours worked in 1982; these are denoted  $y_{i,82}$  and  $h_{i,82}$ .

The questions referring to food expenditure, described footnote 3 above, are much less clear in terms of their timing. The questions asks about food expenditure in an average week and we follow Blundell, Pistaferri, and Preston (2008a) in assuming that this too refers to the previous calendar year. The imputed consumption variable,  $c_{i,82}$ , is therefore also the value from the 1983 survey.

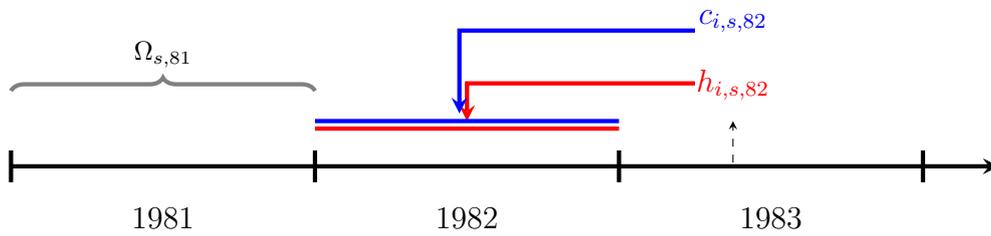


Figure 1: A Sample Timeline of our Data

Figure 2 shows a number of measures of the distribution of the (log growth) of the imputed non-durable consumption variable. We report the mean, median, 25th percentile and 75th percentile for the cross-section in each year. As discussed above, the absence of the food expenditure variable for the years 1987 and 1988 (1988 and 1989 surveys) means that we lose the observations from those years. Additionally, the need to calculate a growth rate means we lose two further years worth of observations: we lose the first year of data, as well as 1989 (the first year after the two-year break).

Figure 3 reports analogous statistics for the annual hours worked by the head of household. Three points are worth noting: (i) these data are continuous between 1967 and 1992 as the question was asked in each year of the PSID survey;<sup>6</sup> (ii) the mean is below the median; (iii) the median head of household works full time with about 2000 hours per year (or nearly 42 hours per week based on 48 weeks of work) but there is a downside skew to the distribution caused by part-time and low-hours workers, as well those who do not work.

In order to explore the response of real wages, we take the real labor income of the head of household and divide it by annual hours. This gives us a measure of real labor

<sup>6</sup>The survey started in 1968 but our retrospective treatment of the responses gives us data from 1967.

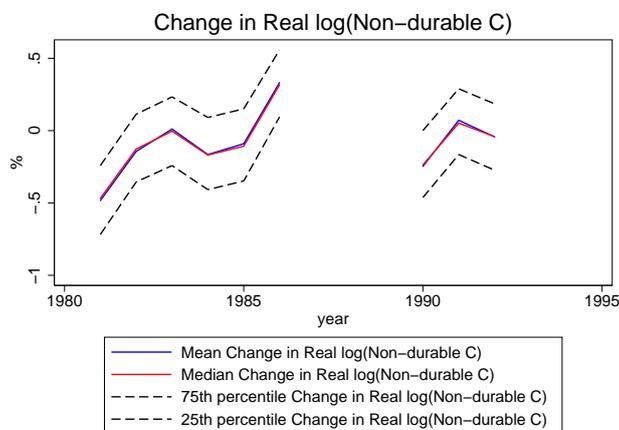


Figure 2: The Distribution of Imputed Household Non-Durable Consumption Growth

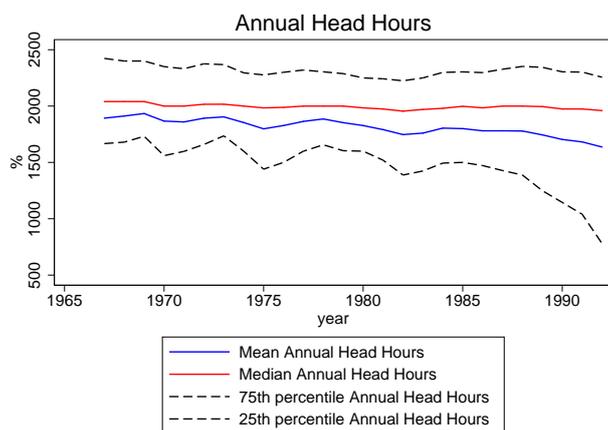


Figure 3: The Distribution of Hours Worked by Head of Household

income per hour worked which we use as our measure of the real hourly wage. As with the hours data, this variable is available between 1967 and 1992. Overall, the sample contains between 1500 households, for the early years in which we have only hours and real wage data, and nearly 3000 households in the main part of the sample, when data for consumption can also be constructed, through the 1980s. The time series of the number of observations per year, split between the hours and consumption variables, are displayed in Figure 4. The main consumption regressions use 24,348 observations while the hours and real wages regressions make use of 58,428 observations.

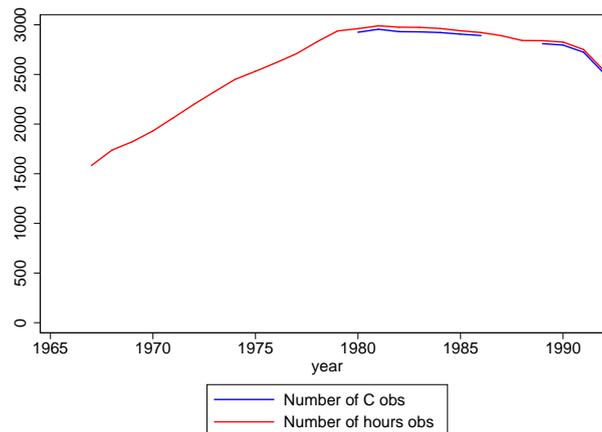


Figure 4: The Number of Households With Hours and Consumption Data

## 2.2 State-level data

In order to measure state-level fiscal shocks, we follow Nakamura and Steinsson (2011) and use state-level military spending data which comes from the U.S. Department of Defense’s electronic database of military procurement (as reported in the DD-350 forms). They compiled these data for each state and year between 1966 and 2006. The spending covers all military purchases with value greater than \$10,000 (from 1966 to 1983) and greater than \$25,000 (1983 to 2006) and the form specifies the prime contractor as well as the location where the majority of the work was completed.<sup>7</sup> The DD-350 measure of government spending in each state is denoted  $G_{s,t}$  and it forms the basis of our fiscal policy instrument.

<sup>7</sup>Nakamura and Steinsson (2011) deal with the potential concern that these data are mismeasured due to inter-state subcontracting using a newly-digitized dataset from the U.S. Census Bureau’s Annual Survey of Shipments by Defense-Oriented Industries. This is an alternative measure of state-level shipments from defense industries to the government. Though the alternative series only runs up to 1983, the two series are very closely correlated over the coincident time periods, suggesting that cross-border sub-contracting plays little role in the  $G_{s,t}$  variable.

The macroeconomic literature generally agrees that aggregate military spending is exogenous to the economic decisions of U.S. households and to the U.S. business cycle (e.g. Ramey and Shapiro (1998)). As such a natural measure of the fiscal shock occurring in state  $s$  at time  $t$ , and resulting from changes in military spending in that state, is the percentage change in state military spending normalized by state GDP:

$$\Omega_{s,t} \equiv \frac{\Delta G_{s,t}}{Y_{s,t}} \quad (1)$$

In the next section we discuss issues related to the potential endogeneity of this variable.

We use Gross State Product (GSP) compiled by the U.S. Bureau of Economic Analysis (BEA) as the measure of state output ( $Y_{s,t}$ ) used to normalize the level of fiscal spending. To convert this, and other, variables to per capita values we use U.S. Census Bureau state population data. Nominal variables are converted into real series using the state-level CPI data computed by Del Negro (2002) and constructed aggregating a number of sources of state-level prices and costs of living. As these state level data do not include CPI for the District of Columbia (D.C.), we assume that the price level there follows that of the overall U.S. in order to deflate nominal data from D.C..

In terms of states, we use data from all 50 states as well as the District of Columbia. Of course, PSID sampling means that some states have much fewer households in each year. Figure 5 shows the median number of households per year in each state; to calculate this, we first calculate the total number of households in each state in each year and then calculate the median for each state. In Figure 5 we show only the contiguous United States; this is simply to ensure that the map is easier to read. The median number of households per year is 4.5 in Alaska and 2.5 in Hawaii.

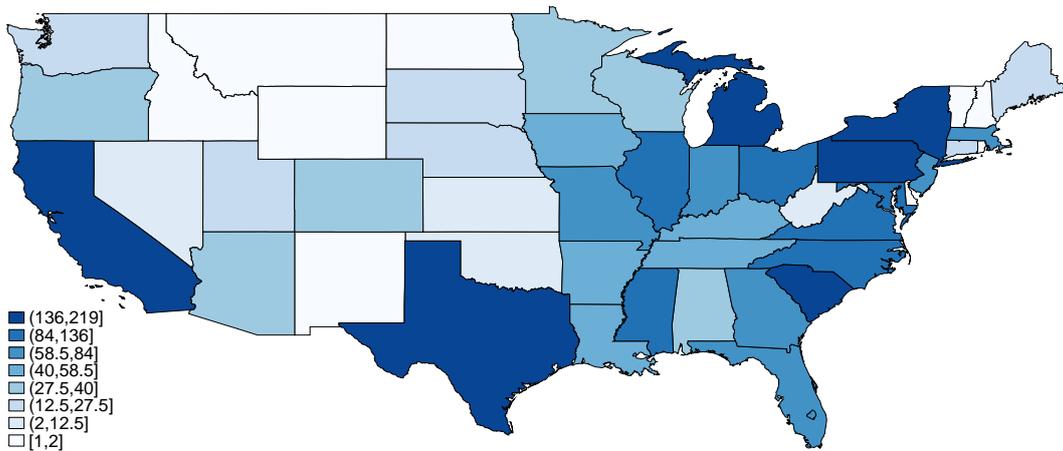


Figure 5: The Average Number of Households Surveyed in Each State Per Year

### 3 Econometric identification of the effects of fiscal shocks

The main advantage over aggregate studies of our use of state-level fiscal shocks is that we are able to control for those time effects that are common across states. Unfortunately this does not guarantee that we do not have endogeneity concerns: the variation in fiscal spending may not be completely random across states even if aggregate military spending is. Consider the possible factors which can drive the behavior of, for example, the change in hours of a head of household  $i$  who lives in state  $s$  at time  $t$  ( $\Delta h_{i,s,t}$ ). As shown in equation (2), the movement of ( $\Delta h_{i,s,t}$ ) will partly reflect factors which are common to all households at time  $t$  (for example, changes in monetary policy which affect the entire U.S.), factors common to all residents of state  $s$  (*e.g.* cross-state differences in working regulations) and then the idiosyncratic part related to household  $i$ . The latter two effects can be split into those effects which are time-invariant (such as the fact that certain people always work more hours than others) and those which are time-varying.

$$\Delta h_{i,s,t} = \underbrace{\delta_t}_{\text{Time } t \text{ Effects}} + \underbrace{\bar{\gamma}_s + \tilde{\gamma}_{s,t}}_{\text{State } s \text{ Effects}} + \underbrace{\bar{\alpha}_i + \tilde{\alpha}_{i,t}}_{\text{Household } i \text{ Effects}} \quad (2)$$

In our analysis, we are interested in the effect of changes in state-level military spending,  $\Omega_{s,t}$  on the behavior of households in those states. Our baseline equation, which we estimate for the three main dependent variables of interest (consumption, hours and real wages), is:

$$\Delta z_{i,s,t} = \alpha_i + \gamma_s + \delta_t + \sum_{k=0}^K \beta_k \Omega_{s,t-k} + \phi X_{i,s,t} + \epsilon_{i,s,t}$$

where  $z_{it}$  is (log) of household's  $i$  consumption/hours/real wages at time  $t$ ,  $\Omega_{s,t-k}$  is the  $k$  period lag of government military procurements from supplier companies located in state  $s$  in period  $t$  expressed as a percentage of state output, and  $X_{it}$  is a vector of control characteristics such as whether the head of household is employed or retired.  $\alpha_i$ ,  $\gamma_s$  and  $\delta_t$  are, respectively, household, state and time fixed-effects.<sup>8</sup>

In order to analyze the effects of shifts in fiscal policy, the fiscal shocks should be exogenous and so uncorrelated with the error term. Relating this regression equation to (2), and assuming that no controls and only the contemporaneous shock ( $k = 0$ ) are included, the estimated equation is:

$$\Delta z_{i,s,t} = \delta_t + \bar{\gamma}_s + \bar{\alpha}_i + \beta_0 \Omega_{s,t} + \underbrace{\tilde{\gamma}_{s,t} + \tilde{\alpha}_{i,t}}_{\epsilon_{i,s,t}}$$

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<sup>8</sup>Standard errors are clustered by household in all the household level regressions.

The key for unbiased estimates of the  $\beta_0$  coefficient is that  $\Omega_{s,t}$  is uncorrelated with  $\epsilon_{i,s,t}$  which incorporates state-time fixed effects which are not controlled for elsewhere. This may not be the case if the amount of state-level military spending is related to the state economic cycle. Even though aggregate military spending has been shown to be exogenous, we may still worry that the allocation of this spending across states is correlated with the state cycle; in other words, spending associated with an exogenous military build-up is directed toward those states with weaker local conditions following lobbying and the resulting political decision.<sup>9</sup> Therefore, like Nakamura and Steinsson (2011) we build state-level fiscal spending shocks instrumenting  $\Omega_{s,t}$ . Specifically, we shall use the same logic that Nekarda and Ramey (2011) applied to industry shares. The share that state  $s$  receives of overall military spending in year  $t$  is  $\eta_{s,t} = \frac{G_{s,t}}{G_t}$  so that:

$$G_{s,t} = \eta_{s,t} G_t \quad (3)$$

$$\Rightarrow \dot{G}_{s,t} = \eta_{s,t} \dot{G}_t + \dot{\eta}_{s,t} G_t \quad (4)$$

$$\frac{\dot{G}_{s,t}}{Y_{s,t}} = \frac{\eta_{s,t} \dot{G}_t}{Y_{s,t}} + \frac{\dot{\eta}_{s,t} G_t}{Y_{s,t}} \quad (5)$$

$$\Rightarrow \Omega_{s,t} \approx \frac{\eta_{s,t} \Delta G_t}{Y_{s,t}} + \underbrace{\frac{\Delta \eta_{s,t} G_t}{Y_{s,t}}}_{\text{Endogenous?}} \quad (6)$$

Equation (6) shows that the overall change in military spending in state  $s$  in year  $t$  can be split between the fact that aggregate spending has changed and a share of this goes to state  $s$ , and the fact that the share of aggregate spending going to state  $s$  has changed. If our worry is that states in which there are weaker economic conditions increase their share more ( $\Delta \eta_{s,t} > 0$ ), then the second term on the right-hand-side equation (6) is potentially endogenous. Of course, some of  $\Delta \eta_{s,t}$  may be exogenous variation and so excluding it we potentially reduce the variability in our shocks which would lead to less tight standard errors. However, given that using an endogenous regressor will bias our estimates, we choose to purge the shocks of this potential correlation with the residual at the expense of potentially less precise estimates of effects of fiscal shocks. Doing this, we concentrate on the first term on the right-hand side of (6) which can be re-written as:

$$\frac{\eta_{s,t} \Delta G_t}{Y_{s,t}} = \frac{\Delta G_t}{G_t} \frac{G_{s,t}}{Y_{s,t}}$$

As a result of the GSP term in the denominator of  $\frac{G_{s,t}}{Y_{s,t}}$ ,  $\frac{\eta_{s,t} \Delta G_t}{Y_{s,t}}$  is likely to be correlated

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<sup>9</sup>For example, Mayer (1992) finds strong evidence of political business cycles in the distribution of military contracts, but suggests there is little evidence of the use of military contract awards for economic stimulus after 1965.

with the state business cycle even if  $G_{s,t}$  and  $\frac{\Delta G_t}{G_t}$  are exogenous. We thus need instrument fiscal shocks using, rather than  $\Omega_{s,t}$ ,

$$\widehat{\Omega}_{s,t}^R = \Delta \ln(G_t) \bar{\theta}_s \quad (7)$$

where  $\bar{\theta}_s$  is the time-average of the share of military spending in total output ( $\frac{G_{s,t}}{Y_{s,t}}$ ) falling on state  $s$ .

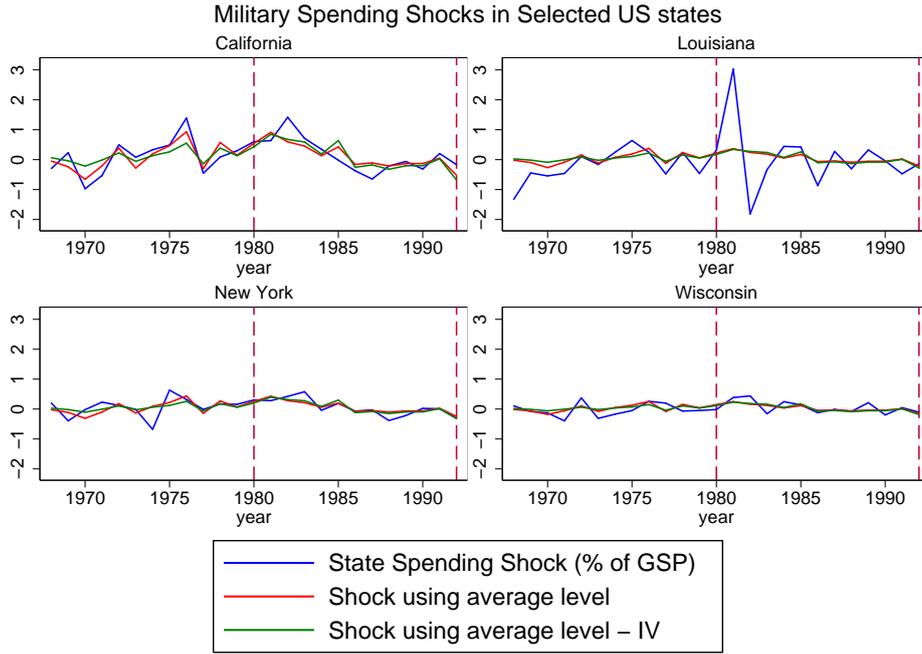


Figure 6: State Fiscal Shocks in a Selection of U.S. States

Figure 6 shows, for four states, the raw shocks ( $\Omega_{s,t}$ ) calculated according to equation (1) as well as the instrumented shocks ( $\widehat{\Omega}_{s,t}^R$ ) as defined in (7) above. These data show, particularly in the case of Louisiana (top right frame), how the approach removes measurement error. The large spike up and then down in Louisiana in 1981 and 1982 is smoothed through when we use the instrumented approach. This noise seems to be less of an issue in some of the other states displayed. Comparing California (top left) to Wisconsin (bottom right) and New York (bottom left), it is clear that some states see much greater swings in the shock variable. In California the instrumented shocks are on average 0.14% of GSP and are as large (small) as 0.93% (-0.66%); in Wisconsin the mean is only .04% and the largest (smallest) shock was 0.25% (-0.18%) of GSP.

Of course, Figure 6 shows only a small sample of the states we use. To show the difference in variability across states in the main shock that we use, Figure 7 shows the

heat map (as in Figure 5) of the inter-quartile range of  $\widehat{\Omega}_{s,t}^R$ ; <sup>10</sup> California (0.7) is indeed one of the states with larger swings in military contracts. The most volatile are Missouri (1.0) and Connecticut (1.3). As before, we only show the contiguous United States; the inter-quartile range is 0.4 in Alaska and 0.5 in Hawaii.

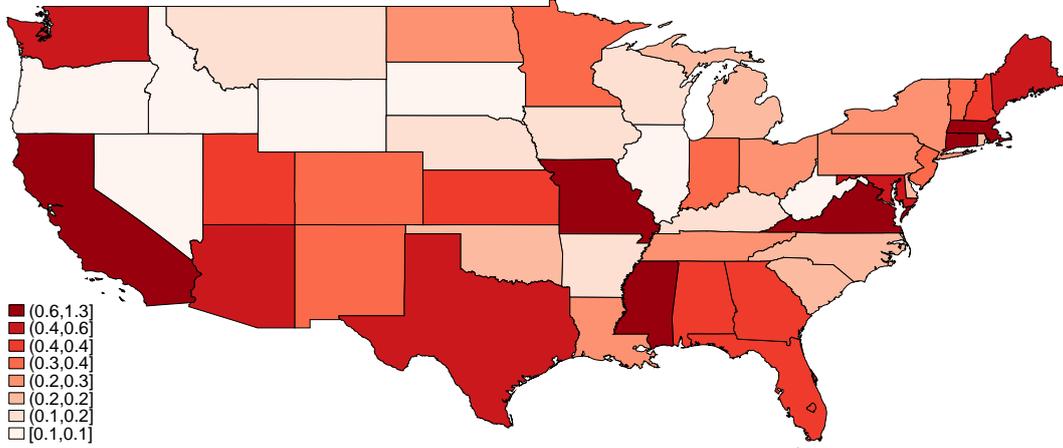


Figure 7: The Inter-quartile Range of  $\widehat{\Omega}_{s,t}^R$  by State

As an alternative instrument, we also consider using Ramey’s (2011) measure of defense news to instrument for aggregate U.S. military spending. Specifically, we regress  $\Delta \ln(G_t)$  on an annual sum of the news measure and generate  $\widehat{\Delta \ln(G_t)}$  as the fitted value. We then create an alternative measure of our state level shocks by applying the formula:

$$\widehat{\Omega}_{s,t}^{IV} = \widehat{\Delta \ln(G_t)} \bar{\theta}_s \quad (8)$$

This gives a very similar pattern as shown in Figure 6 above; the correlation between the two shock series is over 0.9 across all time periods and states. In appendix A, we show that the main results are robust to using this alternative measure of fiscal shock.

### 3.1 Household heterogeneity

As mentioned above, an advantage of household data is that we can explore heterogeneity amongst households. Consider a simple dummy variable  $D(A)_{i,s,t}$  which is 1 when the characteristic A applies to the head of household  $i$  in state  $s$  at time  $t$ . With this separation of households, we interact particular set of household characteristics with the shock variables. For example, consider the 0 – 1 dummy variable  $D(Z)_{i,s,t}$  which equals 1 if a particular household characteristic of interest applies to household  $i$  at time  $t$ ; the

<sup>10</sup>As variability in  $\widehat{\Omega}_{s,t}^R$  is driven by the aggregate growth in military spending, this map captures differences in average military intensity across states ( $\theta_s$ ).

estimated regression is:<sup>11</sup>

$$\Delta z_{i,s,t} = \alpha_i + \gamma_s + \delta_t + \sum_{k=0}^K \beta_k \Omega_{s,t-k} + \sum_{k=0}^K \psi_k (D(Z)_{i,s,t} \times \Omega_{s,t-k}) + \sigma D(Z)_{i,s,t} + \phi X_{i,s,t} + \epsilon_{i,s,t}$$

In the remainder of the paper we follow Romer and Romer (2010), who examine the effects of tax changes on the U.S. economy, and choose a lag length which corresponds to three years ( $K = 3$ ).

## 4 Results

Before describing our results it is useful to briefly summarize the predictions of a few models. In the (static) IS-LM model an increase in government spending has no wealth effect and acts like a pure demand shock: consumption increases; because output is demand determined and prices do not respond; labour demand also increases (although the model does not distinguish between an intensive and an extensive margin and thus has no predictions about the intensive margin) and so does the real wage.

Models based on a representative agent who makes optimal intertemporal decisions give the opposite result: the negative wealth effect associated with an increase in government spending lowers consumption and raises hours worked; this in turn lowers the real wage. The sharp difference between the results of the IS-LM and the intertemporal optimization models are attenuated in intertemporal models that allow for nominal rigidities, or introduce consumers subject to credit constraints: in the latter the response of consumption to a spending shock can be positive. (See Leeper, Traum, and Walker (2011) for a detailed analysis of the multiplier implied by different models. The accompanying monetary policy obviously makes a difference but remember that here we control for monetary policy that is the same across U.S. states). Table 1 summarizes these theoretical results:

Table 1: Effects of a positive spending shock in alternative models

	<i>Consumption</i>	<i>Labour Supply</i>	<i>Real Wages</i>
<i>Keynesian IS-LM model</i>	+		+
<i>Dynamic representative agent models</i>	−	+	−
- <i>with nominal rigidities</i>	−	+	+
- <i>with credit constrained consumers</i>	+	+	+

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<sup>11</sup>Where the characteristic is split into more than two groupings, for example splitting the household into young, middle-aged and older, we can use a similar but extended regression approach.

We now illustrate our empirical findings. When we aggregate all households (Figure 8) we find that following the increase in military spending consumption increases right after the shock and remains higher for about two years (this is true for both durables and non durables. Given that the two categories of consumptions seem to respond very similarly, in the rest of the paper we only look at total consumption). Hours worked and real wages initially do not move, although both increase significantly three years after the increase in spending. While this pattern seems to be consistent with the increase in military spending inducing a (positive) shift in aggregate demand which over time results in longer hours and higher real wages, the long lag is perhaps made up of off-setting positions by heterogeneous groups in the economy. Our estimates of the labor supply response focus on the intensive margin: longer hours by employed workers (we control for employment status in the regressions). In Section 5 we return to the issue of the extensive margin. The magnitude of these lagged effects is small. Since our shocks are equivalent to 1% of GDP, a point estimate of 0.16 for the percent change in aggregate consumption after the first year suggests that consumption increases by less than one-fifth which is similar to the year-3 response of hours, but four times as large as the percent change in real wages (0.04). In appendix A, we show that these results are unchanged if we use the alternative measure of the fiscal shock given by  $\widehat{\Omega}_{s,t}^{IV}$  in equation (8) above. All the regressions control for some time-varying, household characteristics; all regressions control for whether the head of household is employed or retired, and the consumption regressions control for real disposable income.

As we mentioned, there are reasons to be concerned about the effects of aggregation. Our data allow us to split the sample along a very large number of dimensions, although along some of them the resulting sub-sample included too few individuals. For instance looking at splits based on the marital status of the head is problematic; over 70% of our more than 67,000 observations are married household (including permanently cohabiting) while only 11% are single and 19% are Widowed, Divorced or Separated. We thus have decided to look at six dimensions: the state of the local labor market, household income, workers in low-hours jobs, age, sector of employment and gender.

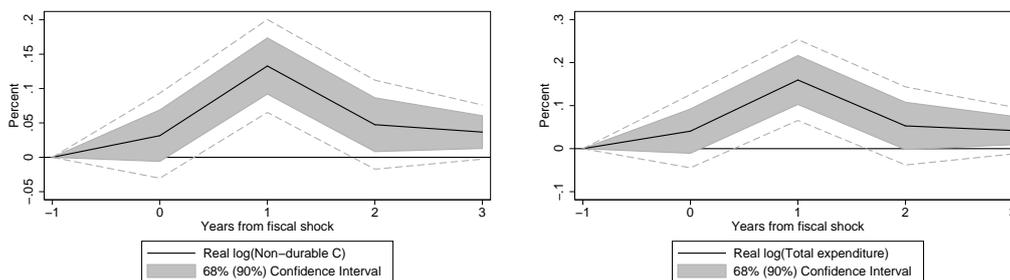
## 4.1 The effect of the state cycle on responses to shocks

Using Bureau of Labor Statistics (BLS) data on state level unemployment (available from 1976), we can derive measures of the state business cycle.<sup>12</sup> Auerbach and Gorodnichenko

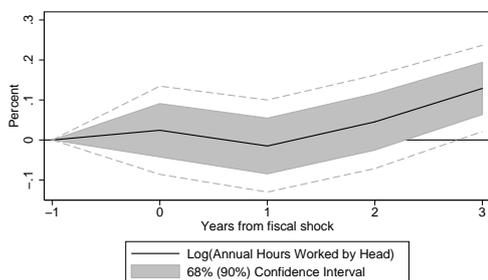
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<sup>12</sup>Using county-level unemployment data is problematic for two reasons. First, because many heads of household live outside the county in which they work and commute across county lines. Second, to protect the anonymity of respondents the PSID public-use files suppress the county identifier. As we wish to evaluate whether the local labour market is above or below its normal conditions, we cannot use the

(a) Response of Real Non-dur. Consumption    (b) Response of Real Total Consumption



(c) Response of Hours



(d) Response of Real Wages

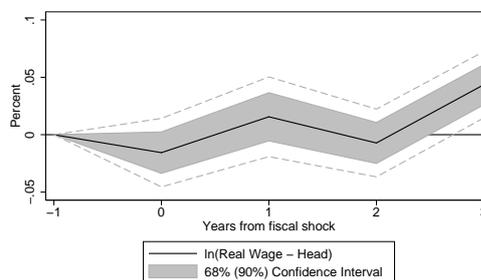


Figure 8: IRFs to a 1% GDP state spending shock: the average response

(2011) find that the effects of government purchases are larger in a recession: we can evaluate this with our data.

To measure economic conditions at the state level we proceed as we now describe. Figure 9 shows the key components of the calculation for the same four states used above to illustrate the military spending shocks. First, we take the time-series of state-level unemployment and calculate a trend unemployment rate by fitting a third-order polynomial trend. Second, we calculate the state unemployment gap as the difference between state unemployment and this fitted trend - the lower line in Figure 9. Finally, we look across time comparing, within each state, periods of high and low unemployment where we define “tight” (“loose”) labor market conditions as periods when the state unemployment gap is in the lower (upper) quartile.<sup>13</sup> A tight labor market is therefore one in which the state unemployment is far below its trend. We then include these dummy

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reported household measure of county unemployment because households may move county meaning that the reported local unemployment rate can change with no meaningful change in labor market conditions relative to normal conditions.

<sup>13</sup>The quartiles are marked in the Figure by the parallel lines which cut through the unemployment gap.

variables, as well as the appropriate interactions, in our regression equation as described above.

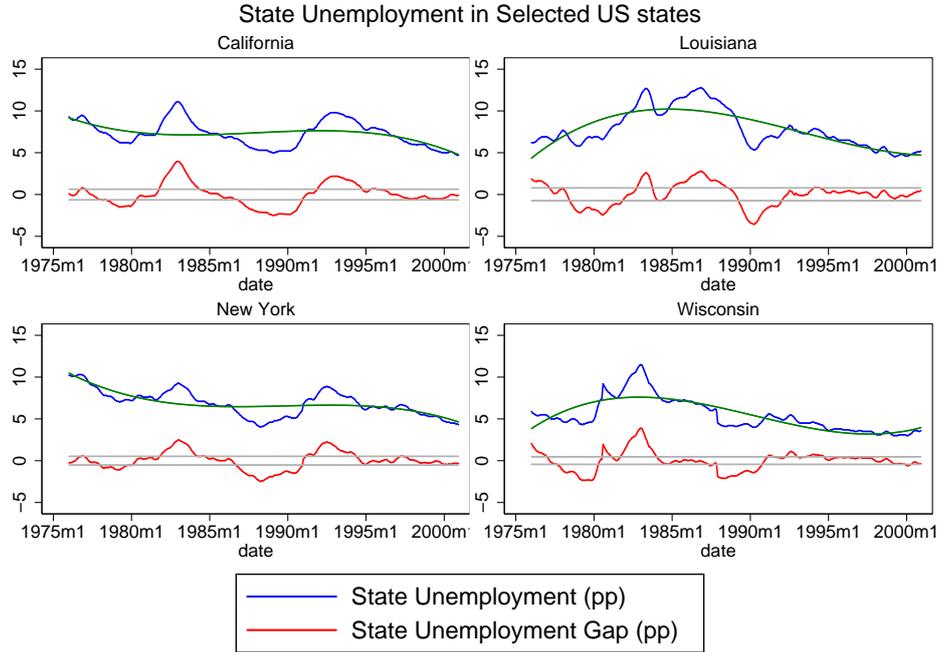


Figure 9: State Unemployment in a Selection of U.S. States

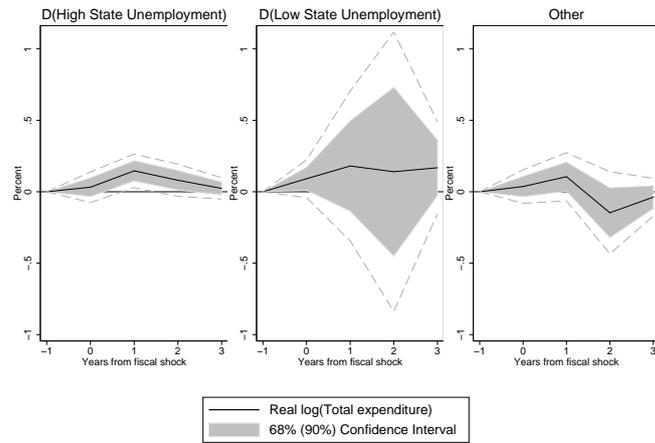
The results (see Figure 10) are consistent with Auerbach and Gorodnichenko (2011): fiscal policy is more effective during recessions than during expansions. Following a spending shock consumption increases in periods of relatively high unemployment and so do hours (although not statistically significantly) and real wages (with the same lag observed in the aggregate response). Thus, during a local recession, an increase in government spending acts like a positive shift in aggregate demand. On the contrary, when the local labor market is tight, neither consumption nor hours respond. However, the very wide standard errors in the low-unemployment periods suggest that positive spending shocks during booms could potentially have a positive or a negative effect on consumption and hours with no clear average effect.

## 4.2 Responses by Income Group

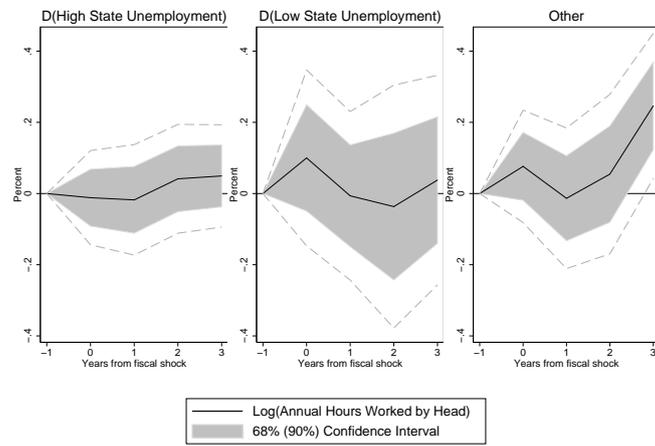
In order to examine whether relatively richer and relatively poorer households react differently to a spending shock, we define two dummy variables:

$$D(\text{Low Income})_{ist} = \begin{cases} 1 & \text{if in lower quartile of year } t \text{ disposable income distribution} \\ 0 & \text{otherwise} \end{cases}$$

(a) Response of Real Total Consumption



(b) Response of Hours



(c) Response of Real Wages

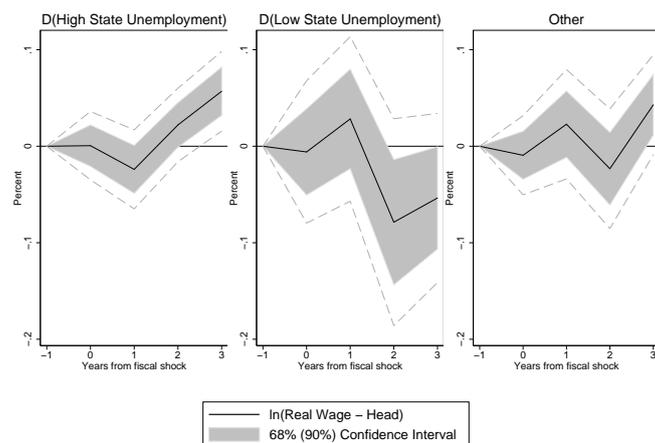


Figure 10: IRFs to a 1% GDP state spending shock: the response by State labour conditions

$$D(\text{High Income})_{ist} = \begin{cases} 1 & \text{if in upper quartile of year } t \text{ disposable income distribution} \\ 0 & \text{otherwise} \end{cases}$$

Our definition means that a household  $i$  will be marked as a low (high) income household with  $D(\text{Low Income})_{ist} = 1$  ( $D(\text{High Income})_{ist} = 1$ ), if the household has real disposable income in year  $t$  that is at or below (at or above) the 25th (75th) percentile of the U.S. income distribution in year  $t$ .

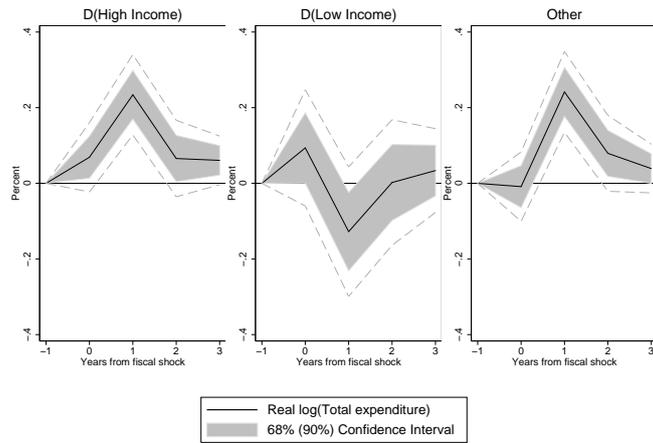
Figure 11 shows that there is an important difference between the response of higher and lower-income households according to our definition of relative income. High- and middle-income households behave as if they were hit by a positive demand shock. The future taxes the government will have to raise to pay for the additional spending seem to be totally overlooked, or at least their effect is swamped by the positive demand effect. Higher income households also see their real wages go up (albeit with a 3-year lag), while their working hours don't change very much. One interpretation is that these households are disproportionately benefiting from the increase in military spending because they work in, or receive the dividends from, the sectors that are the suppliers of these contracts. To the extent that they are also hit by a negative wealth effect, they tend to overlook it-or to assume lower income households will mostly bear the burden.

This is in fact consistent with the behavior of lower income households whose consumption and labour supply responses match the predictions of standard intertemporal representative agents models. They cut consumption and work longer hours (also with some lag), precisely as we would expect from households that receive no benefit from higher public spending but realize they will eventually have to pay for it. However, the real wages of these low income workers don't change significantly, as the intertemporal model with a competitive labor market would suggest. This could be because there are regulatory reasons that make their wages relatively sticky (such as minimum wages laws).

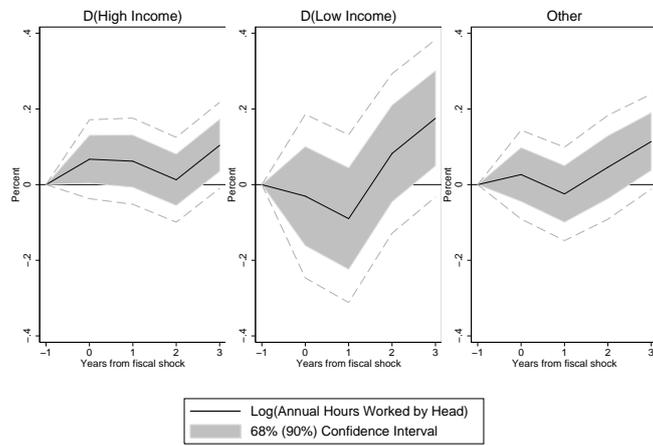
One concern with this analysis is that our dummy variable could simply capture differences in levels of income across states: remember that we have identified those households with extreme (high or low) incomes within the entire distribution of income in the PSID in each year. Therefore, we repeat our analysis but use the following two alternative dummy variables:

$$D(\text{Low Income}^A)_{ist} = \begin{cases} 1 & \text{if in lower quartile of state } s, \text{ year } t \text{ disposable income distribution} \\ 0 & \text{otherwise} \end{cases}$$

(a) Response of Real Total Consumption



(b) Response of Hours



(c) Response of Real Wages

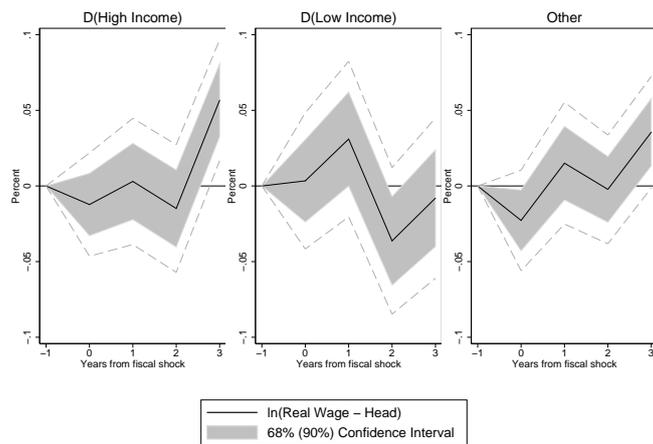


Figure 11: IRFs to a 1% GDP state spending shock: the response by income relative to the U.S.-wide distribution of income in period  $t$

$$D(\text{High Income}^A)_{ist} = \begin{cases} 1 & \text{if in upper quartile of state } s, \text{ year } t \text{ disposable income distribution} \\ 0 & \text{otherwise} \end{cases}$$

Now a household is a low (high) income household if the household has real disposable income in year  $t$  that is at or below (at or above) the 25th (75th) percentile of the *state*  $s$  income distribution in year  $t$ . The potential worry about this approach is that some of the states, as discussed above, have relatively few households and therefore such a distribution is based on very few observations. Nonetheless, the results of the earlier analysis are little changed as we show in Figure 12.

### 4.3 Workers who work low hours

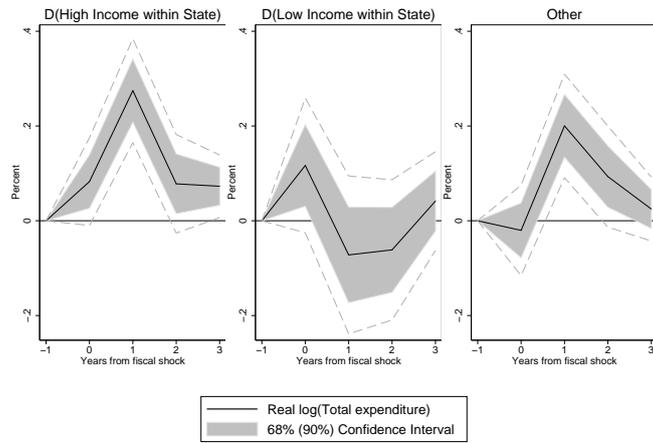
Heads of household working relatively few hours (most likely on part-time jobs) are likely to have more labor supply flexibility. In fact in Giavazzi and McMahon (2010) we found that part-time German workers responded to an exogenous increase in uncertainty by working longer hours - a response we did not observe for workers in full-time employment. In order to check whether the response differs between full-time and part-time workers, we define a dummy variable:

$$D(\text{Low Hours})_{ist} = \begin{cases} 1 & \text{if the head regularly works less than 20 hours per week} \\ 0 & \text{otherwise} \end{cases}$$

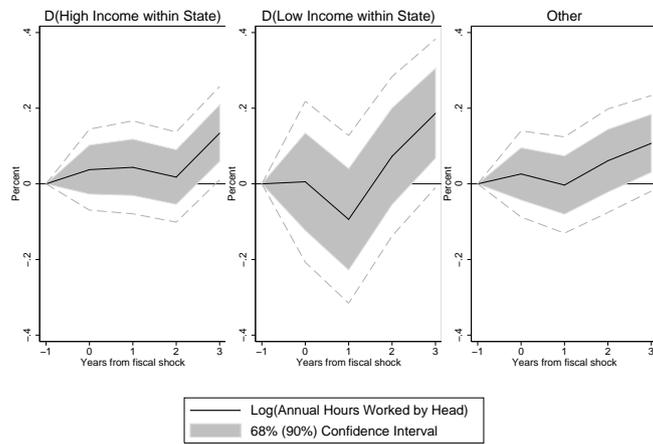
The choice of 20 hours per week is somewhat arbitrary. As mentioned above, we find that the median worker works about 40 hours per week and so this number represents someone working about half the full-time workers hours. We restrict the sample to heads of household who did not change their employment status during the year: since our data measure annual hours worked, if someone worked for 6 months and then lost their job and did not get a new one for the remainder of the year, their hours for the year would look like someone working about 20 hours a week but their position is not as a regular low hours worker.

Figure 13 shows that there is an important difference between the response of full-time and part-time workers. Heads working less than 20 hours per week initially respond to a spending shock increasing consumption, but they then soon reduce it. They also work longer hours, precisely as we observed for lower income households. But differently from lower income heads, those working less than 20 hours also see their real wages fall which is consistent with the increase in their labor supply. This evidence matches the

(a) Response of Real Total Consumption



(b) Response of Hours



(c) Response of Real Wages

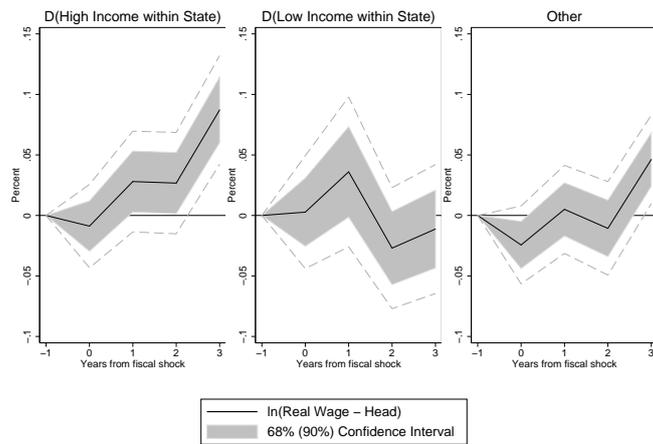


Figure 12: IRFs to a 1% GDP state spending shock: the response by state income

response predicted by a model in which liquidity-constrained households make optimal intertemporal decisions and government spending is pure waste, at least from their viewpoint. As a result of liquidity constraints, the spending shock initially result in higher consumption, although over time the negative wealth effects tends to dominate. Hours, on the contrary, increase from the year of the shock and real wages fall. Hours, which average about 10 per week for this group, actually increase by between 50 and 75 per cent meaning the average worker would now work 15 to 18 hours per week.

The response of heads working more than 20 hours per week is instead closer to the response obtained using aggregate data: consumption increases (by about 0.2pp), hours and real wages increase only marginally and with a lag.

#### 4.4 Age

We have also looked at different age groups. In order to split the sample into different age groups, we do as we did for income above and use the by-year distribution of ages as the point of reference. This is shown in Figure 14 and we will define anyone above (below) the 75th (25th) percentile in a given year as the high (low) age group:

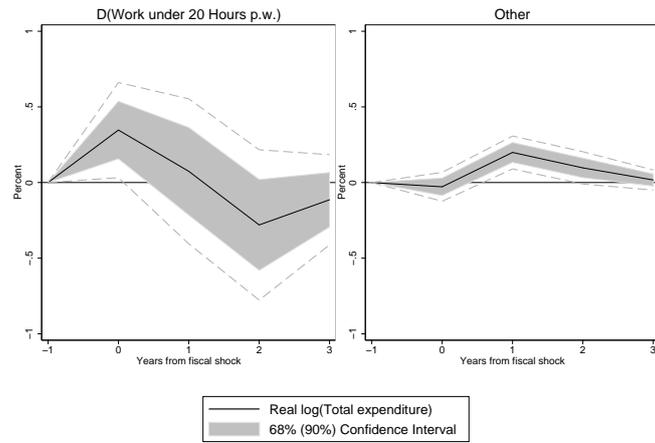
$$D(\text{Low Age})_{ist} = \begin{cases} 1 & \text{if in lower quartile of age distribution in } t \\ 0 & \text{otherwise} \end{cases}$$

$$D(\text{High Age})_{ist} = \begin{cases} 1 & \text{if in upper quartile of age distribution in } t \\ 0 & \text{otherwise} \end{cases}$$

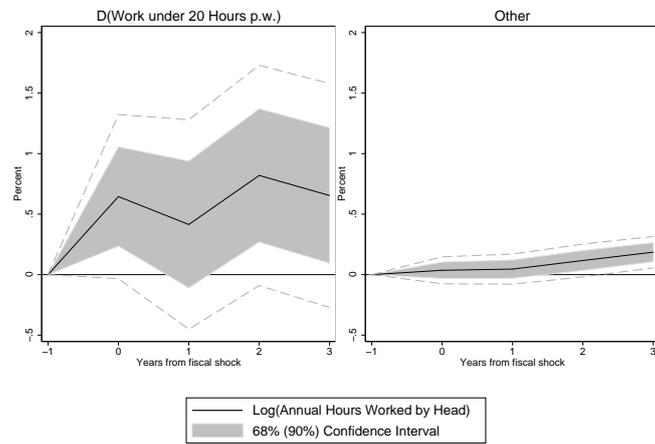
The response of older workers, relative to younger ones, should depend, in principle, on their life horizon and on the extent to which they internalize the well-being of their children. If they do not, and expect that someone else will pay the taxes that will be raised to pay for the additional spending, they will increase consumption even if they were intertemporal maximizers. Instead, if they expect that some of these taxes will fall upon themselves, they will cut consumption and increase hours, the more so the fewer the active years they have left.

The results are shown in Figure 15. Age seems to make no difference in terms of the response of consumption: consumption increases throughout age groups, as in the aggregate response. The response of hours is intriguing: relatively young heads increase hours, thus behaving as if responding to an shift in aggregate demand: older heads, on the contrary, reduce their labour supply cutting hours worked. This is the only case in which we observe a significant reduction in hours. Lower hours (and thus more leisure) and higher consumption are consistent with the response to a positive wealth shock. Older

(a) Response of Real Total Consumption



(b) Response of Hours



(c) Response of Real Wages

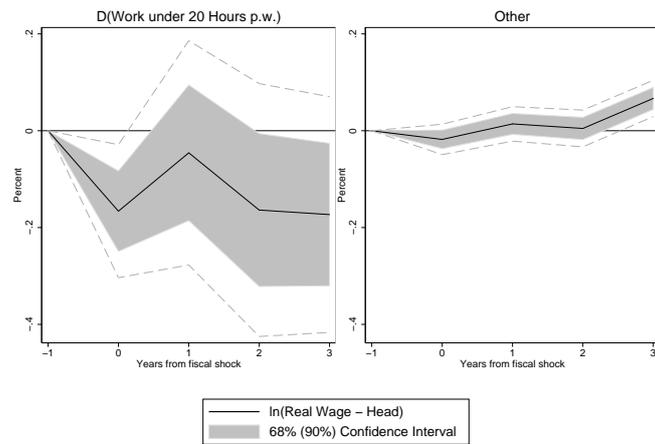


Figure 13: IRFs to a 1% GDP state spending shock: the response by part-time workers

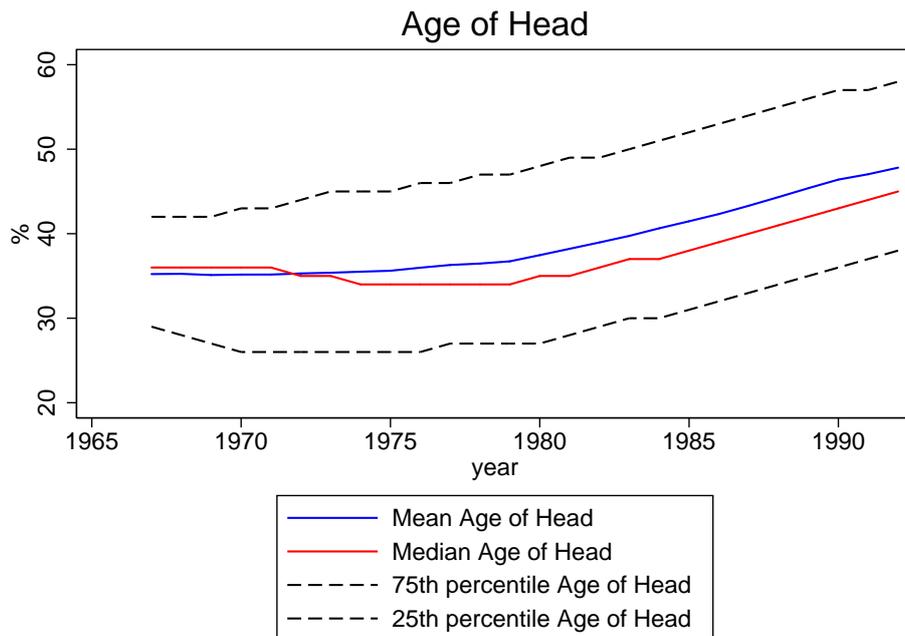


Figure 14: Time-series of the Age Distribution

workers seem to perceive the increase in military contracts as a positive wealth shock, maybe because it is a transfer to the sectors they work in (or receive dividends from) and they assume that someone else will pay.

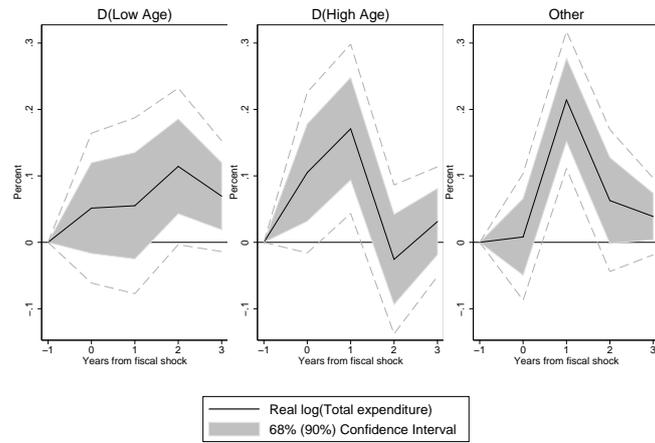
#### 4.5 Responses by Workers from Different Industries

We are also able to follow which industry a head of household works for between 1976 to 1992. This is the response to a question in which the head is asked to report the “kind of business” that the head of household considers themselves to work in. The categorization uses the 3-digit industry codes from the 1970 Census of Population Classified Index of Industries and Occupations. We use these data and classify workers according to two dummy variables which we define only for those who are employed:<sup>14</sup>

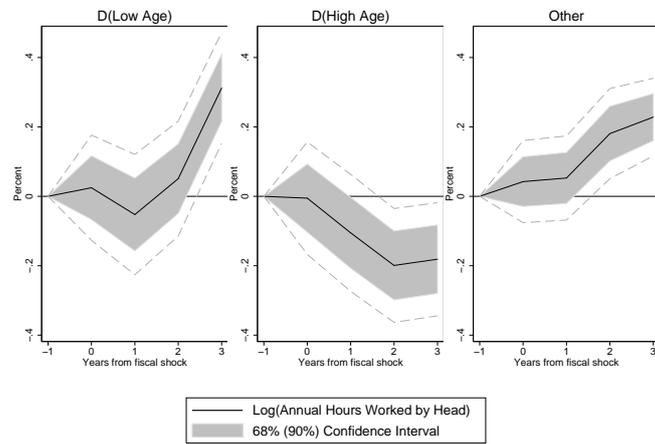
$$D(\text{Manufacturing})_{ist} = \begin{cases} 1 & \text{if head is employed in manufacturing industry} \\ 0 & \text{otherwise} \end{cases}$$

<sup>14</sup>Manufacturing industries include both durable and non-durable industries given by codes 139-169, 177-209, 219-238, 107-138, 239-259, 268-299, and 307-398. The “Services” sector is identified by codes 707-718, 757-759, 727-749, 769-798, 807-809, 338-389, 828-848, 857-868, 869-897 and 849.

(a) Response of Real Total Consumption



(b) Response of Hours



(c) Response of Real Wages

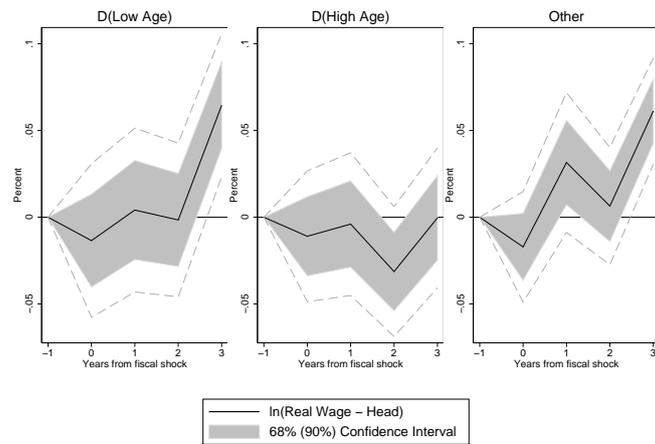


Figure 15: IRFs to a 1% GDP state spending shock: the response by age

$$D(\text{Services})_{ist} = \begin{cases} 1 & \text{if head is employed in services sector} \\ 0 & \text{otherwise} \end{cases}$$

We use these two industries as Nekarda and Ramey (2011) discuss the effects of military spending on U.S. manufacturing while services account for about 70% of the U.S. economy; the residual includes “Agriculture, Forestry, and Fishing”, “Mining and Extraction”, “Construction”, “Retail or Wholesale”, “Transport, Communication & Utilities” and “Government” industries.

The results of our sectoral split are reported in Figure 16. The sectoral response of consumption matches the aggregate response: there is no difference across sectors. But the (positive) response of hours is concentrated in the service sector confirming what we had found looking at heads working less than 20 hours: flexibility is higher where part-time jobs are more frequent (3.2% of heads who work in the services sector work low hours compared with only 1.4% of those in other sectors).

We also compared government employees (including those working for states and cities) with heads of households working in the private sector. Interestingly, spending shocks have no effect on government employees: neither their consumption, nor their hours move.

## 4.6 Gender Split

Finally, we look at whether there are differences in the reaction of households in which the head is a female. Such households make up 26% of all observations. While 12% of male heads are in the lower income quartile (as defined above), 40% of female heads are. Female heads are disproportionately not employed; half of not employed heads are female. Of those female heads in employment, they are under-represented (in the sense of less than 25% share) in all sectors of employment except for services; they make up 37% of the services sector.

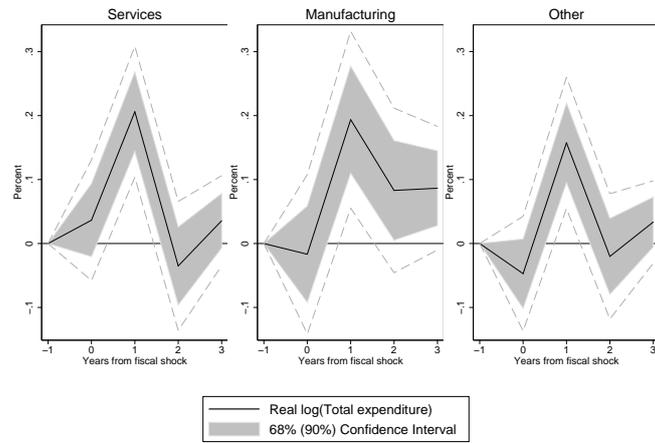
Given this, it is not surprising that their response to a spending shock matches that of heads working in the service industry. While the effect of the spending shock on consumption is independent of gender, the response of hours is concentrated on women. Also their real wages increase more than those of non-female heads.

## 4.7 Summing up

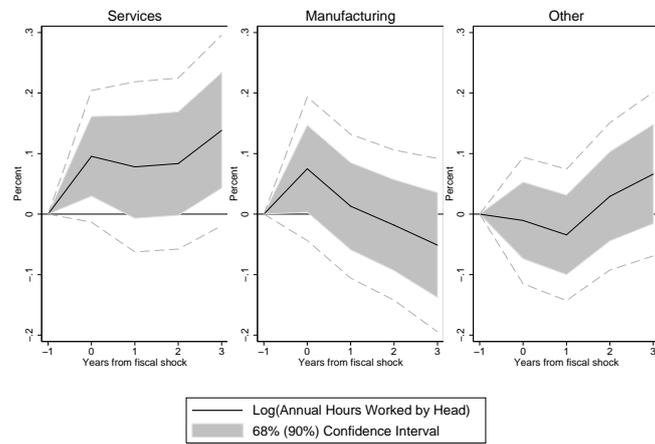
Our main findings from the various splits can be summarized as follows:

1. at the aggregate level an increase in military spending raises consumption; hours

(a) Response of Real Total Consumption



(b) Response of Hours



(c) Response of Real Wages

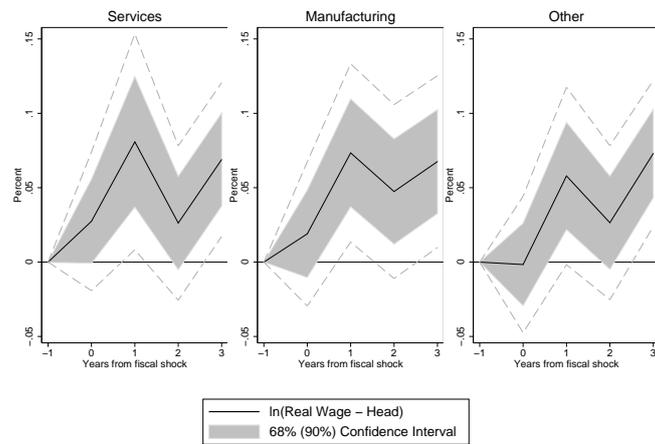
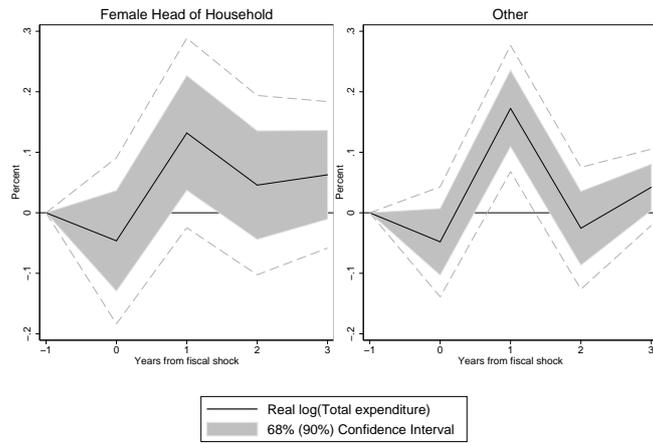
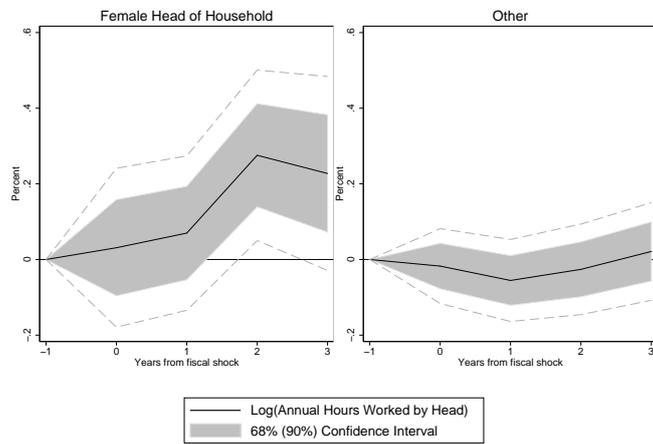


Figure 16: IRFs to a 1% GDP state spending shock: the response by industry

(a) Response of Real Total Consumption



(b) Response of Hours



(c) Response of Real Wages

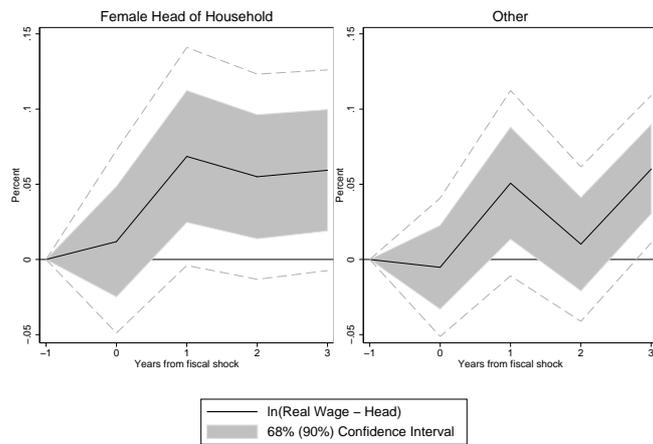


Figure 17: IRFs to a 1% GDP state spending shock: the response by gender

worked and real wages also respond positively, but with a long lag (about three years after the shift in spending). This response is consistent with the increase in military spending inducing a (positive) shift in aggregate demand which over time results in longer hours and higher real wages;

2. the positive response of consumption, hours and real wages is concentrated in states experiencing a local recession. Where the local labor market is tight, neither consumption nor hours respond;
3. the positive response of hours worked to a spending shock is concentrated among households headed by a woman, among heads employed in the service sector and among relatively younger workers. In all of these cases however, the positive response on hours is accompanied by a positive response of consumption, consistently with the effects of a positive shift in aggregate demand. Women also see their probability of being employed increase: their labor supply increases along both its intensive and extensive margins;
4. there is an important difference between the response of higher and lower-income households. Higher income households behave as if they were hit by a positive demand shock: the future taxes the government will have to raise to pay for the additional spending seem to be totally overlooked, or at least their effect is swamped by the positive demand effect. On the contrary, the response of lower income households, matches the predictions of standard intertemporal representative agents models: they cut consumption and work longer hours, precisely as we would expect from households that receive no benefit from higher public spending but realize they will eventually have to pay for it;
5. there is also an important difference between the response of full time and part time workers. Part time workers respond to a spending shock by initially increasing consumption, but they soon reduce it. They also work longer hours, precisely as we observed for lower income households. But differently from lower income heads, those working less than 20 hours also see their real wages fall which is consistent with the increase in their labor supply. Thus the response of part-time workers matches that predicted by a model in which liquidity-constrained households make optimal intertemporal decisions and government spending is pure waste, at least from their viewpoint. As a result of liquidity constraints, the spending shock initially result in higher consumption, although over time the negative wealth effects tends to dominate.

## 5 The Extensive Margin of Employment

So far we have analyze the intensive labor supply margin: hours worked by employed workers. A separate question is the effect of the spending shocks on the extensive margins: employment. Specifically, we estimate a linear probability model and regress a dummy variable for whether the worker is employed on state, time and household fixed effects, as well as controls. The regression is analogous to those estimated above. For the aggregate results, reported in Figures 18, the estimated equation is:

$$D(\text{Employed})_{i,s,t} = \alpha_i + \gamma_s + \delta_t + \sum_{k=0}^K \beta_k \Omega_{s,t-k} + \phi X_{i,s,t} + \epsilon_{i,s,t}$$

While the point estimate is for an increase in the likelihood of employment for a household in a state receiving a positive fiscal spending shock, the result is only marginally significant after 2 years.

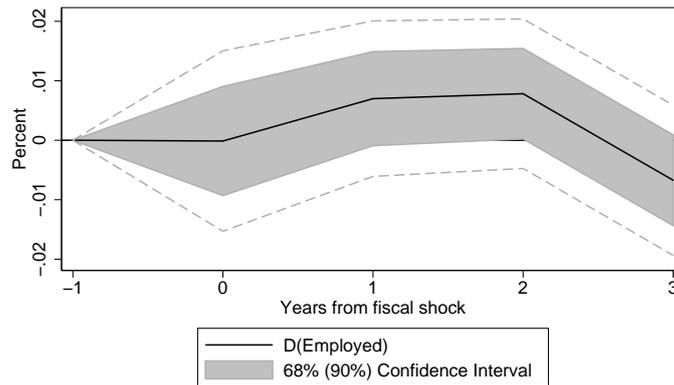


Figure 18: Change in the Probability of Employment following a 1% fiscal shock

Figure 19 reports the results for a variety of the classifications used above; we cannot, obviously, do the industry breakdown as it is only classified for those that are employed.

A positive spending shock raises the likelihood of employment for female heads and for households headed by relatively older workers (less significantly for the middle aged). Women are the group for which our spending shocks exert the larger effects on work, raising both hours and the likelihood of being employed. The employment effect on relatively older workers probably reflects an increase in the retirement age, or the return to work of already retired workers.

Finally, in periods of relatively high unemployment spending shocks increase con-

sumption, as we have seen above, but neither hours worked nor the likelihood of being employed. This is consistent with what you would expect in the presence of liquidity constrained consumers and excess supply in the goods market.

## 6 Conclusion

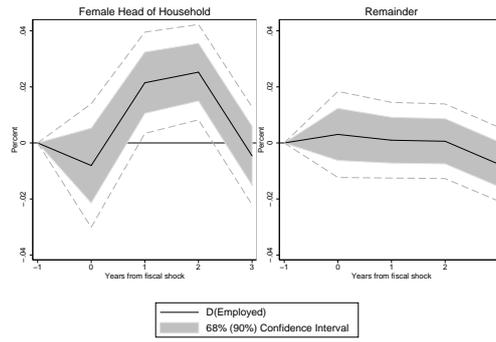
Observing significant differences across the responses of various groups does not necessarily imply that aggregate estimates are biased: they could simply reflect the average of group-level responses. Aggregation theory suggests however that the large differences we have documented are likely to result in biased aggregate estimates. In our results however there are no instances of a consistent response among all groups that disappears at the aggregate level, which would be clear evidence of an aggregation bias. If aggregation bias exists, it is likely to be attenuated.

Our results could be used to design the allocation of military contracts across states, so as to increase their macroeconomic effect: the answer here is simple: you want to spend in states with relatively high unemployment.

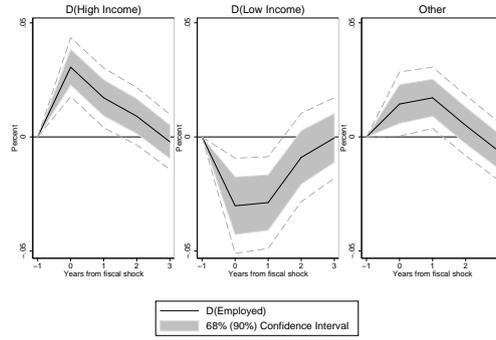
They also suggest that military spending has significant distributional effects: the group more negatively hit appears to be part-time workers: they cut consumption, work longer hours and see their real wages fall. Women are the group for which spending shocks exert the larger effects on work, raising both hours and the likelihood of being employed.

Finally, what do we learn from the group-level results that could help us discriminate among alternative models? Simply, and not surprisingly, that there is not “a” model to analyze the effects of fiscal policy, much as there is not a “single multiplier”. Different models appear to describe the behavior of different groups, although at the aggregate level, and overlooking the possibility of aggregation bias, the spending shocks we have analyzed have effects that are consistent with those of a positive shift in aggregate demand.

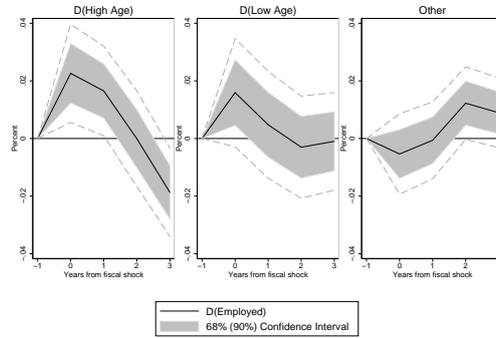
(a) Gender Response



(b) Income Response



(c) Age Response



(d) Unemployment Response

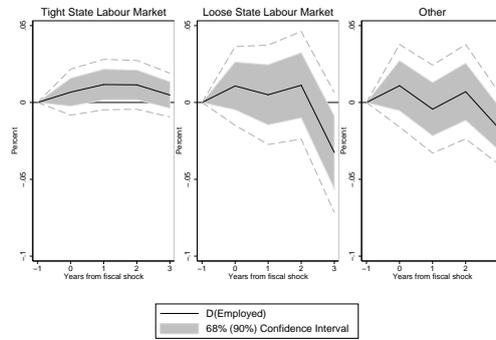


Figure 19:  $\Delta$  in Probability of Employment following a 1% fiscal shock

## References

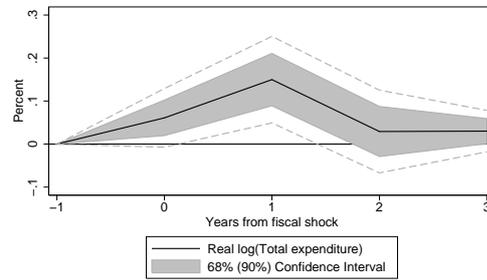
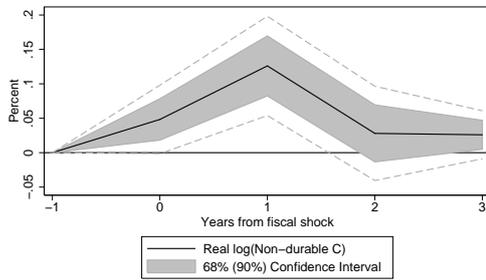
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# A Robustness to the Instrumented Instrument

(a) Response of Real Non-dur. Consumption    (b) Response of Real Total Consumption



(c) Response of Hours

(d) Response of Real Wages

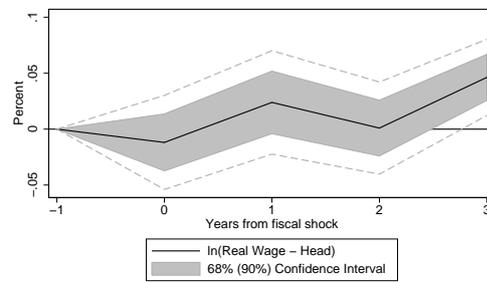
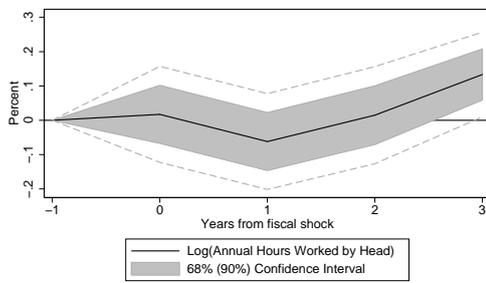


Figure 20: IRFs to a 1% GDP state spending shock: the average response using the alternative measure of fiscal shock

## B Robustness to Excluding Individual Years

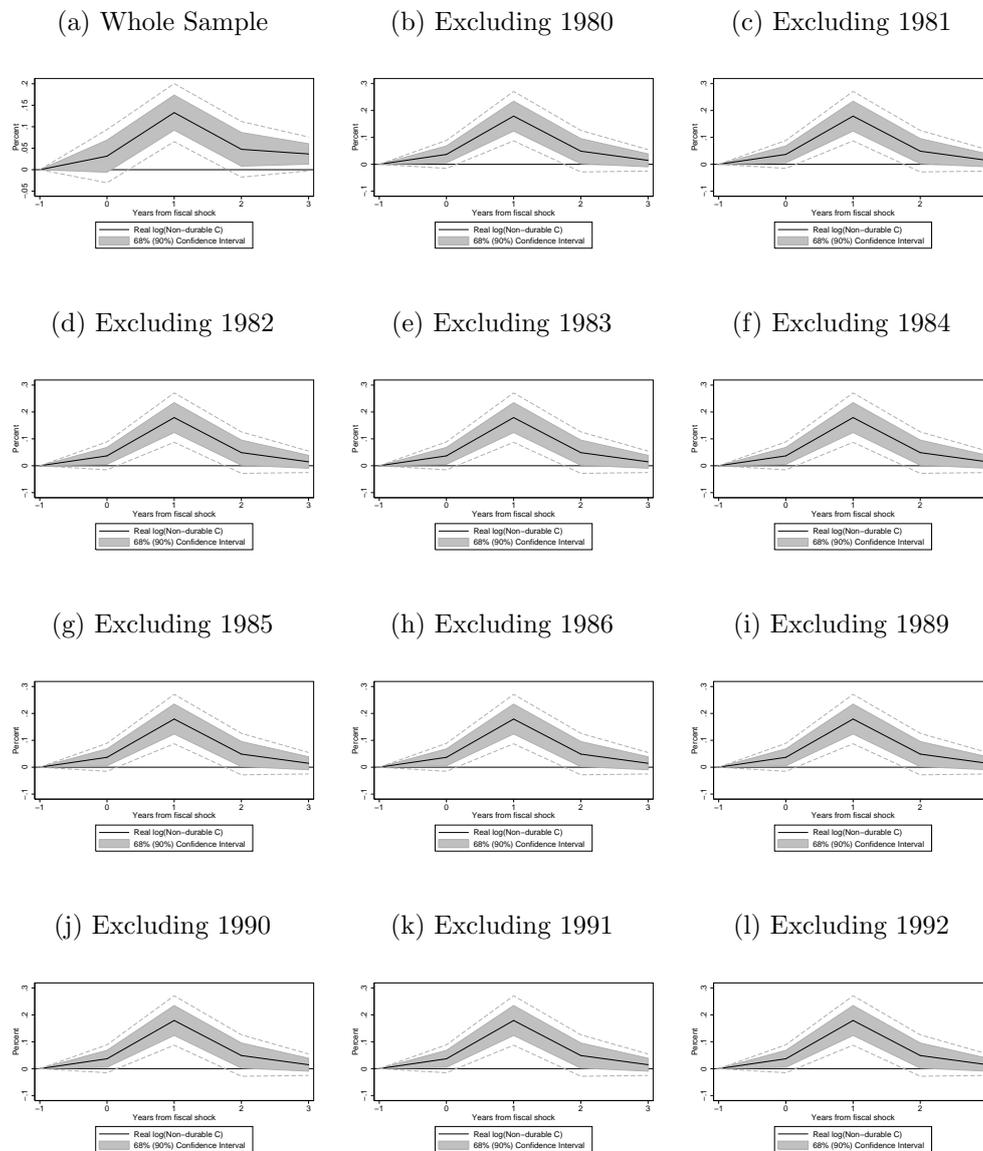


Figure 21: IRFs to a 1% GDP state spending shock: Response of Real Non-dur. Consumption