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Assessing the Effects of Fiscal Policy News under Imperfect Information: Evidence from Aggregate and Individual Data

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Assessing the Effects of Fiscal Policy News under Imperfect Information: Evidence from Aggregate and Individual Data*

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Abstract

We study the transmission of fiscal policy under imperfect information where government spending is composed by permanent and transitory components. Agents learn about the previous processes by only observing overall public spending and a noisy signal. Under this setting and employing maximum likelihood techniques, we construct a novel measure of fiscal policy news and show that the estimated variable agrees with the historical narrative evidence for the U.S. economy. We then use macro and micro datasets to document the effects of this proxy on real wages and consumption. The qualitative responses obtained with aggregate data are significantly the same as those using individual PSID data at the median of the empirical distributions – on impact, real consumption falls and real wages do not move, whereas both increase after one year. A potential explanation for these results relies on expectations about future policy adjustments. When we consider the tails of the distributions, real wages fall (rise) upon impact for rich (poor) households. However, the effects on consumption only differ at longer horizons where poor households increase consumption more persistently than those at the top of the distribution.

Keywords: Fiscal Policy News, Imperfect Information, Aggregate Data, PSID.
JEL Codes: C23, C32, E21, E24, E62.

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1 Introduction

There are numerous studies that look at the effects of government spending shocks, however, the results are different depending on two categories: the nature of the fiscal shock (anticipated or unexpected) and the technique employed (empirical or theoretical), see e.g. Baxter and King (1993), Blanchard and Perotti (2002), Galí et al. (2007), Mountford and Uhlig (2009), Ramey (2011) and Schmitt-Grohé and Uribe (2012). For output, these findings usually diverge in quantitative but not in qualitative terms, that is, output rises after (un)anticipated public spending shocks. On the contrary, this is not the case when one looks at private consumption – it increases in most papers that try to capture unexpected shocks (see e.g. Blanchard and Perotti, 2002, and Galí et al., 2007), whereas it falls or shows non-significant effects on impact after anticipated shocks (see e.g. Mountford and Uhlig, 2009, and Ricco, 2015)[1]. For real wages, the response is also inconclusive – they do not move significantly, increase for all periods or only rise as time goes by (see e.g. Fatás and Mihov, 2001, Mountford and Uhlig, 2009, and Ricco, 2015).

Whereas the two categories mentioned above have been extensively investigated in previous works, here we consider others that have not received the same attention and could also affect the transmission of fiscal policy – imperfect information about the composition of government spending and the use of macro or micro datasets[2]. These channels could be of key importance for policy research since i) private agents have imperfect foresight about the conduct of fiscal policy in the real world and ii) potential heterogeneity in the responses of consumption and real wages could arise when one considers micro datasets. Thus, we add upon the previous literature by empirically answering the following questions: what are the effects of government spending news on consumption and real wages when information about fiscal policy is imperfect? And does it matter whether they are analyzed using aggregate or individual data? For this purpose, we develop

[1]This is mostly true in empirical models. Yet, theoretical frameworks such as standard Real Business Cycle models produce a negative effect on private consumption with either anticipated or unexpected shocks since they imply that government spending operates through a negative wealth effect on labor supply.

[2]Imperfect information models have been previously introduced by Lorenzoni (2009), Blanchard et al. (2013) or Barsky and Sims (2012). However, they focus on aggregate productivity.

a model where government spending (measured as the ratio of government consumption and investment over output) is composed by permanent and transitory components. Agents learn about the previous processes by only observing overall public spending and a noisy signal (extracted with data from the Survey of Professional Forecasters). Under this setting and employing maximum likelihood techniques, we construct a novel measure of fiscal policy news and show that the estimated variable agrees with the historical narrative evidence for the U.S. economy. We refer to good (bad) news when the signal is strictly above (below) beliefs about the permanent component updated with overall government spending. We then use macro and micro datasets to document the effects of this proxy on real wages and consumption. First, by using SVAR methods with aggregate data, we observe that real private consumption exhibits delayed positive effects, i.e., it significantly decreases on impact and starts rising after several quarters. Real wages move insignificantly on impact but increase significantly after one year. A potential explanation for the particular behavior of consumption (and for other GDP components) is related with the notion of *spending reversals* where fiscal shocks characterized by an expected reversal of public spending growth below trend can boost economic activity and accelerate the reduction of the initial increase in public debt (see e.g. Corsetti et al., 2012, and Cimadomo et al., 2011). We empirically check that the reduction in public debt can be justified through the operation of automatic stabilizers in which tax revenues increase due to the output expansion generated by the fiscal news shock. Next, by employing panel fixed-effects techniques with individual survey data from the PSID, we have access to the whole distributions of consumption and real wages and we can analyze if there exists heterogeneity in each response which could be hidden using aggregate data. On the one hand, we observe that the responses are qualitatively the same at the median of the distributions. On the other hand, when we analyze the tails of the distributions, real wages significantly rise (fall) upon impact for low-income (high-income) households. For consumption dynamics, low-income and high-income households behave qualitatively similar to the median case. The responses only differ at longer horizons where poor households increase consumption more persistently than those at the top of the distribution.

The papers most closely related to ours are Giavazzi and McMahon (2012), De-Giorgi and Gambetti (2012) and Anderson et al. (2016). Giavazzi and McMahon

(2012) study how households respond to a shift in military government spending using individual PSID data. They find that low-income households tend to cut consumption and households with relatively higher income increase it. The difference in our findings to Giavazzi and McMahon (2012) can be explained by the fact that their study focuses on unexpected military spending shocks. Thus, considering more productive public spending under imperfect information delivers a different picture of the responses to a fiscal shock. Furthermore, we compare our findings at different levels of aggregation of the data and perform our individual-level data analysis from 1980 to 2010, whereas they only consider observations until 1992. Both DeGiorgi and Gambetti (2012) and Anderson et al. (2016) evaluate the role of government spending shocks over the empirical distribution of consumption using CEX data in a VAR model. They find that private consumption increases at the bottom and falls at the top of the distribution. In both papers, they use different measures of fiscal shocks. While we extract government spending news under an imperfect information model, they consider forecast revisions and forecast errors, respectively.

Our paper is also related to other empirical studies focusing on the effects of anticipated government shocks. Ricco (2015) uses a similar measure of forecast revisions to DeGiorgi and Gambetti (2012) based on individuals' forecasts. He employs large BVAR methods and finds that expected fiscal changes stimulate economic activity and private investments, however, private consumption and real wages responses are either non-significant or negative. Mountford and Uhlig (2009) use sign restrictions in a VAR framework to identify an expected government spending shock and show that it does not significantly move consumption and real wages on impact, while it does after one year for the former. Cimadomo et al. (2011) and Corsetti et al. (2012) rely on expectations about future policy adjustment to show that shocks with spending reversals can alter the transmission of fiscal policy.

This work has links to several theoretical papers that examine the effects of fiscal shocks on the macroeconomy. Mertens and Ravn (2012) find that expected fiscal policy expansions (via tax cuts) decrease the main macroeconomic variables upon impact and rise them after several quarters. Galí et al. (2007) extend the standard new Keynesian model to allow for the presence of non-Ricardian consumers and show how the interaction of the latter with sticky prices and deficit financing can account for positive effects of government spending on real wages and consumption.

The remainder of the paper is structured as follows. Section 2 describes the imperfect information model, the solution method and the fiscal news series. Section 3 reports the effects of government spending news on aggregate and individual data. Section 4 concludes.

2 Imperfect Information Framework

2.1 The Model

We measure government spending as the ratio of government consumption and investment over output. Thus, the logarithm of public spending, g_t, is the sum of a permanent and a transitory component

$$g_t = g_t^{per} + g_t^{tra} \tag{1}$$

$$\Delta g_t^{per} = \rho_g^{per} \Delta g_{t-1}^{per} + \epsilon_{g,t}^{per} \tag{2}$$

$$g_t^{tra} = \rho_g^{tra} g_{t-1}^{tra} + \epsilon_{g,t}^{tra} \tag{3}$$

$$\epsilon_{g,t}^{per} \sim \mathbb{N}(0, \sigma_{g,per}^2) \qquad \epsilon_{g,t}^{tra} \sim \mathbb{N}(0, \sigma_{g,tra}^2).$$

As introduced before, individuals have incomplete information about g_t since they are assumed to observe the overall government spending but not its composition (g_t^{per} and g_t^{tra}). Moreover, agents receive each period a noisy signal about the permanent component of government spending, thus, generating the formation of incorrect expectations about the path of g_t^{per}

$$s_t = g_t^{per} + \epsilon_{s,t}, \tag{4}$$

where $\epsilon_{s,t}$ is normal and $i.i.d.$ with zero mean and standard deviation σ_s.

Moreover, we assume that

$$\rho_g \equiv \rho_g^{per} = \rho_g^{tra} \tag{5}$$

and

$$\rho_g \sigma_{g,per}^2 = (1 - \rho_g)^2 \sigma_{g,tra}^2. \tag{6}$$

The previous two restrictions ensure that g_t follows a random walk.

2.2 Solution Strategy

Following L'Huillier and Yoo (2017), our model allows for two informational subperiods. We first define agents' information set at time t, Ω_t, including actual government spending, the noisy signal and lagged information. Thus, for a given variable, ζ_t, agents' expectations updated with information at time t are defined as

$$\zeta_{t|t} = \mathrm{E}\left[\zeta_t|\Omega_t\right], \tag{7}$$

where

$$\Omega_t = \left(g_t, s_t, \Omega_{t-1}\right). \tag{8}$$

Second, agents' beliefs updated with information set including only actual government spending and past information, Λ_t, are determined as

$$\zeta_{t|g_t} = \mathrm{E}\left[\zeta_t|\Lambda_t\right], \tag{9}$$

where

$$\Lambda_t = \left(g_t, \Omega_{t-1}\right). \tag{10}$$

Given the process for g_t, we can express agents' forecasts with information set Ω_t as

$$\mathrm{E}\left[g_{t+1}|\Omega_t\right] = \lim_{j\to\infty} \mathrm{E}\left[g_{t+j}|\Omega_t\right], \tag{11}$$

where the RHS can be written as

$$\begin{aligned}
\lim_{j\to\infty} \mathrm{E}\left[\left(g^{per}_{t+j} + g^{tra}_{t+j}\right)\Big|\Omega_t\right] &= \lim_{j\to\infty} \mathrm{E}\left[\left(\Delta g^{per}_{t+j} + \Delta g^{per}_{t+j-1} + \ldots + \Delta g^{per}_{t+1} + g^{per}_{t} + g^{tra}_{t+j}\right)\Big|\Omega_t\right] \\
&= \lim_{j\to\infty} \mathrm{E}\left[\left(\rho^j \Delta g^{per}_{t+1} + \rho^j \Delta g^{per}_{t} + \ldots + \Delta g^{per}_{t+1}\right)\Big|\Omega_t\right] + g^{per}_{t|t} \\
&= \rho \lim_{j\to\infty} \mathrm{E}\left[\left(1+\rho+\ldots+\rho^j\right)\Delta g^{per}_{t}\Big|\Omega_t\right] + g^{per}_{t|t} \\
&= \frac{\rho}{1-\rho}\mathrm{E}\left[\Delta g^{per}_{t}|\Omega_t\right] + g^{per}_{t|t} \\
&= \frac{\rho}{1-\rho}\left[g^{per}_{t|t} - g^{per}_{t-1|t}\right] + g^{per}_{t|t} \\
&= \frac{1}{1-\rho}\left[g^{per}_{t|t} - \rho g^{per}_{t-1|t}\right].
\end{aligned}$$

The previous expression implies that agents' forecasts depend on their beliefs about current and lagged permanent government spending[3].

[3]From the first to the second equality we have used the definition of $\mathrm{E}[g^{per}_t|\Omega_t]$ and the fact that $\lim_{j\to\infty}\mathrm{E}[\rho^{j+1} g^{tra}_t|\Omega_t] = 0$. Finally, the third equality comes from the assumption that $\rho < 1$.

Now, we can derive the individuals' beliefs about the components of government spending using the Kalman filter. Let's consider the following dynamic system in state space form

$$\begin{aligned} \textit{Observation equations: } g_t &= D_1 x_t + F_1 U_t \\ s_t &= D_2 x_t + F_2 U_t \end{aligned} \tag{12}$$

$$\textit{Transition equation: } x_t = C x_{t-1} + H V_t \tag{13}$$

where

- $x_t = \begin{pmatrix} g_t^{per} & g_{t-1}^{per} & g_t^{tra} \end{pmatrix}'$.
- $V_t = \begin{pmatrix} \epsilon_{g,t}^{per} & 0 & \epsilon_{g,t}^{tra} \end{pmatrix}'$, $U_t = \epsilon_{s,t}$.
- $D_1 = \begin{bmatrix} 1 & 0 & 1 \end{bmatrix}$, $F_1 = 0$.
- $D_2 = \begin{bmatrix} 1 & 0 & 0 \end{bmatrix}$, $F_2 = 1$.
- $C = \begin{bmatrix} 1+\rho_g & -\rho_g & 0 \\ 1 & 0 & 0 \\ 0 & 0 & \rho_g \end{bmatrix}$, $H = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 1 & 0 \end{bmatrix}$.

After having processed the observations, the filter delivers the estimates of $x_{t|g_t}$, $x_{t|t}$ and the covariance matrices ($P_{t|g_t}$ and $P_{t|t}$)

$$x_{t|g_t} = [I - KD_1] C x_{t-1|t-1} + K g_t \tag{14}$$

$$x_{t|t} = [I - JD_2] C x_{t|g_t} + J s_t \tag{15}$$

$$P_{t|g_t} = P_{t|t-1} - P_{t|t-1} C_1' [C_1 P_{t|t-1} C_1']^{-1} P_{t|t-1} C_1' \tag{16}$$

$$P_{t|t} = P_{t|g_t} - P_{t|g_t} C_2' [C_2 P_{t|g_t} C_2' + \sigma_s^2]^{-1} P_{t|g_t} C_2' \tag{17}$$

where $K = P_{t|t-1} C_1' [C_1 P_{t|t-1} C_1']^{-1}$ and $J = P_{t|g_t} C_2' [C_2 P_{t|g_t} C_2' + \sigma_s^2]^{-1}$ are the Kalman gains for observing actual government spending and the additional noisy signal, respectively.

Finally, replacing $x_{t|g_t}$ from (14) in (15), we get the complete vector of agents' expectations

$$x_{t|t} = [I - JD_2][I - KD_1] C x_{t-1|t-1} + [I - JD_2] H g_t + J s_t. \tag{18}$$

2.3 Fiscal News

We define the fiscal news variable under imperfect information as follows

Definition 1. *When the signal is strictly above (below) beliefs about the permanent component updated with actual government spending, $s_t > g^{per}_{t|g_t}$, it is said to deliver good (bad) fiscal news.*

2.4 Estimation Results

We proceed to estimate the model by maximum likelihood given the individuals' Kalman filter. The econometrician does not observe the noisy signal, but instead use agents' forecasts. Thus, our observables are the demeaned first differences of the logarithms of actual government spending and one-step-ahead forecasts. We construct the series for current spending over output from the Bureau of Economic Analysis (BEA) Table 3.9.5, line 9, "Federal Government Consumption Expenditures and Gross Investment", and Table 1.1.5, line 1, "Gross Domestic Product". For agents' forecasts deflated by output, we use the median responses of "Real Federal Government Consumption Expenditures & Gross Investment (RFEDGOV)" and "Real Gross National Product/Gross Domestic Product (RGDP)" from the Survey of Professional Forecasters. The time unit is one quarter from 1981Q4 to 2017Q1.

Table 1: Parameter Estimates

Parameter	Definition	Median	S.D.
ρ_g	Persistence Government Spending	0.8022	0.0545
σ_g	Standard Deviation Government Spending	0.0191	0.0009
$\sigma_{g,tra}$	Standard Deviation Perceived Transitory Shock	0.0171	–
$\sigma_{g,per}$	Standard Deviation Perceived Permanent Shock	0.0037	–
σ_s	Standard Deviation Noise Shock	0.0062	0.0029

Table 1 reports the parameter estimates. The standard deviation for the permanent component is 0.37%, while for the transitory component is 1.71%. Their joint persistence is estimated at 0.80. The standard deviation for the noise shock is 0.62%. Table 2 presents the variance decomposition of actual government spending and agents' forecasts over various horizons at the estimated median parameter values. For government spending, the perceived permanent shock has only a small quantitative impact compared with the transitory innovation which is able to explain an important fraction of the forecast error variance at short horizons. However, at longer horizons, the permanent shock is the major source of volatility. For agents' forecasts, the noise shock explains more than 63% of the fluctuations on impact. As time goes by, this shock reduces its importance in the variance, explaining around 10% of agents' forecasts volatility after 5 quarters.

Table 2: Variance Decomposition

Quarter	Permanent Shock	Transitory Shock	Noise Shock
Government Spending			
0	0.0465	0.9535	0.0000
1	0.1119	0.8881	0.0000
2	0.1951	0.8049	0.0000
3	0.2851	0.7149	0.0000
4	0.3727	0.6273	0.0000
8	0.6310	0.3690	0.0000
12	0.7612	0.2388	0.0000
Agents' Forecasts			
0	0.2956	0.0682	0.6362
1	0.6462	0.0364	0.3174
2	0.7997	0.0200	0.1803
3	0.8648	0.0132	0.1220
4	0.8990	0.0098	0.0912
8	0.9496	0.0049	0.0455
12	0.9662	0.0033	0.0305

Now, in order to construct the fiscal news variable, we need to obtain the estimated states and shocks of the model. To do so, we employ the Kalman smoother by exploiting the fact that the econometrician has access to the whole sample. Figure 1 exhibits the estimated news variable. We can observe that the proxy matches the most important fiscal events for the U.S. economy. For instance, considering the main war episodes – Gulf I and II, Kosovo and Afghanistan – we can observe large positive spikes in those events. During crises periods (dashed areas), fiscal news movements have been countercyclical with the exception of the 1981Q3–1982Q4 crisis where agents mostly received bad news. In the 1990Q3–1991Q1 and 2001 crises, they got good news about the permanent component of government spending due to Gulf wars I and II. For the 2007Q4–2009Q2 crisis, agents received good news as a consequence of the Obama fiscal plans (with the exception of the first quarters of this crisis). In the current 2010s, individuals have experienced more bad than good news. One explanation for this could be the fear of extraordinarily high deficits after the Great Recession.

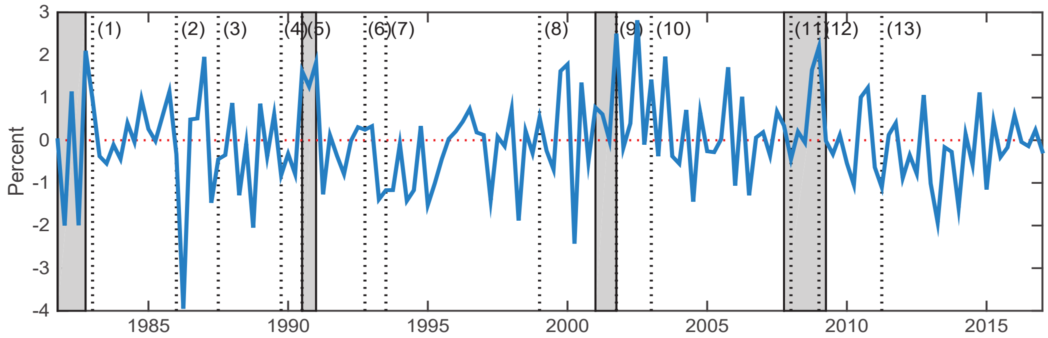

Figure 1: Estimated Fiscal Policy News

Note: The vertical dotted lines represent the following fiscal events: (1) 1983Q1 - Strategic defense initiative; (2) 1986Q1 - Emergency deficit control act; (3) 1987Q3 - Emergency deficit control reaffirmation act (4) 1989Q4 - Berlin wall fall; (5) 1990Q3 - Gulf war; (6) 1992Q4 - Clinton's election; (7) 1993Q3 - Omnibus budget reconciliation act; (8) 1999Q1 - Kosovo war; (9) 2001Q4 - Afghanistan war; (10) 2003Q1 - II Gulf war; (11) 2008Q1 - Fiscal Stimulus; (12) 2009Q1 - Obama fiscal stimulus; (13) 2011Q1 - Debt-ceiling crisis. Grey-shaded areas indicate NBER recession dates.

3 The Effects of Government Spending News under Imperfect Information

3.1 Evidence from Aggregate Data

We first analyze how government spending news affects real wages and private consumption using aggregate data.

3.1.1 VAR Model

We consider the following benchmark VAR specification

$$y_t = c_0 + c_1 t + c_2 t^2 + \sum_{k=1}^{4} \beta_k y_{t-k} + \epsilon_t, \qquad \epsilon_t \sim \mathbb{N}(0, Q), \tag{19}$$

where c_0 is a constant, t represents a linear trend and t^2 is a quadratic trend, y_t stands for the vector of endogenous variables and ϵ_t is a Gaussian white noise with covariance matrix Q. We identify the shocks recursively where the observables are government spending, fiscal news, GDP, consumption, investment, real wages, public debt and tax revenues. We opt for this augmented VAR model to account for richer dynamics, although we are mainly interested in consumption and real wages responses. We use U.S. quarterly data in real per capita terms for all the variables except those expressed in rates. The initial sample is from 1981Q4 to 2017Q1. We obtain real GDP, real personal consumption expenditures and real private domestic investment from BEA Table 1.1.6, "Real Gross Domestic Product", lines 1, 2 and 7, respectively; real wages from BLS (retrieved from FRED), "Business Sector: Real Compensation Per Hour (RCPHBS)"; public debt from U.S. Department of the Treasury (retrieved from FRED), "Federal Debt: Total Public Debt (GFDEBTN)"; tax revenues from BEA Table 3.2, line 2, "Federal Government Current Receipts and Expenditures – Current Tax Receipts"; and to scale by population, we use "Civilian Non-Institutional Population (CNP16OV)" from U.S. Bureau of Labor Statistics (retrieved from FRED).

Figure 2 and Figure 3 report the IRFs to a fiscal news shock. The plots time-unit is one quarter and the responses are in percent. We observe that output, consumption and investment exhibit delayed positive effects, i.e., they significantly decreases on impact and start rising persistently after several quarters. Real wages move insignificantly on impact but increase significantly after one year[4]. A potential explanation for the particular behavior of consumption (and for other GDP components) is related with the notion of *spending reversals* where fiscal shocks characterized by an expected reversal of public spending growth below trend can boost economic activity and accelerate the reduction of the initial in-

[4]Since our PSID dataset contains observations until 2010, we re-estimate the VAR from 1981Q4 to 2010Q4. Figure 7 and Figure 8 in Appendix A show the estimated responses. The results are almost identical.

crease in public debt (see e.g. Corsetti et al., 2012, and Cimadomo et al., 2011). In Figure 3 we show that the expectation of reduction in public debt can be justified through the operation of automatic stabilizers in which tax revenues increase due to the output expansion generated by the fiscal news shock.

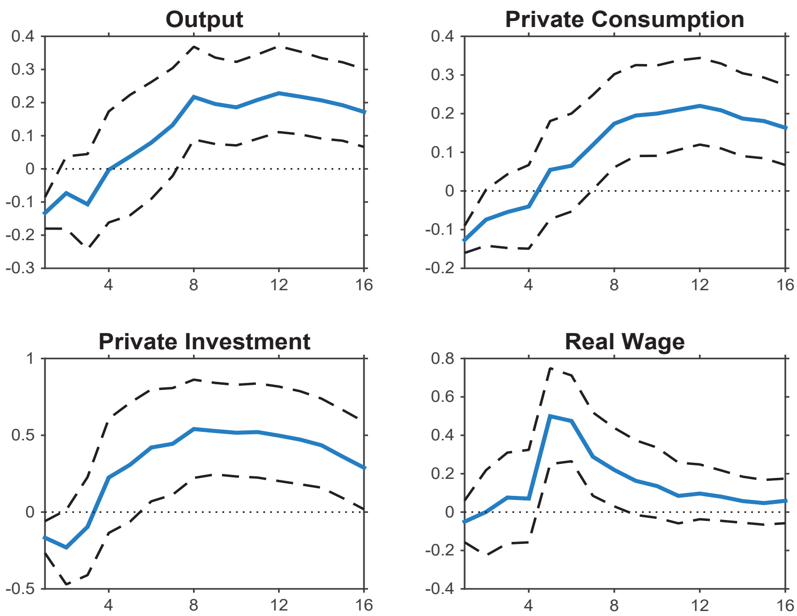

Figure 2: Impulse Responses to a Fiscal News Shock in the VAR model with Aggregate Data

Note: Each entry shows the median and the bootstrapped symmetric 68% confidence bands.

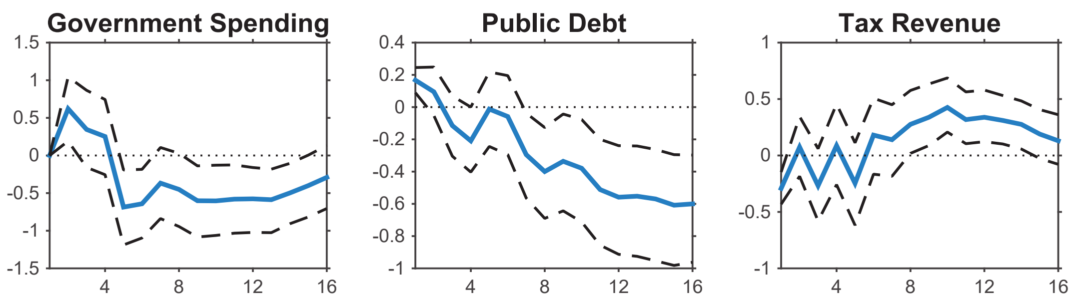

Figure 3: Impulse Responses to a Fiscal News Shock in the VAR model with Aggregate Data: Public Finances

Note: Each entry shows the median and the bootstrapped symmetric 68% confidence bands.

Now, we compare our results with the fiscal news literature using aggregate data. For instance, employing VAR techniques and the same consumption variable than us, Mountford and Uhlig (2009) show that an anticipated government expenditure shock does not significantly moves consumption on impact, whereas it does after one year. They obtain this result by imposing sign restrictions on the government spending shock. That is, they assume that the fiscal variable does not move for the first four quarters and it increases for the next four. Ricco (2015) uses a different method to extract fiscal news. He constructs forecasts revisions by using individuals' projections in the SPF and employs large BVAR methods to find that durables, non-durables and services consumption react negatively to fiscal news, although these results are not statistically significant. Cimadomo et al. (2011) rely on expectations about future policy adjustment to show that military build-up shocks with spending reversals boost private consumption. Yet, their results differ to ours in which their consumption variable starts increasing upon impact. Finally, real wages behave similar to Cimadomo et al. (2011) or Ricco (2015) where they significantly increase as time goes by, while in Mountford and Uhlig (2009) real wages move insignificantly.

3.2 Evidence from Individual Data

Do fiscal policy news effects that we have documented in the previous section change when we move from aggregate to individual data? We answer this question by using survey data from the 1981–2011 PSID. It is the most representative longitudinal household survey in the U.S. The data coverage is annual until 1996 and biennial from 1997. However, the original PSID dataset only provides consumption components from 1999[5]. As in Attanasio and Pistaferri (2014), total household consumption before 1999 is imputed using consumption data available from 1999 onward[6]. Our final sample consists of 71,503 observations[7]. Table 3 in Appendix B summarizes the main PSID variables in our dataset. Total consumption has a higher volatility than income or family wages with a standard deviation of 0.48, 0.80 and 0.78, respectively. The average family size is around 3 members. House owner is a dummy variable that takes value one if the fa-

[5] In the surveys of 1988, 1989 and 1990 there is not consumption data to impute.

[6] For a detailed explanation, we refer the reader to Attanasio and Pistaferri (2014).

[7] Following Attanasio and Pistaferri (2014), we drop the SEO, Latino and Immigrant subsamples and we only keep households where the head is older than 25 or younger than 65.

mily owns the house where they live and zero otherwise. The remaining socio-demographic variables refer to the family head who is on average male and older than 41 years. The proportion of self-employed heads is low at 12%[8]. Since the PSID variables are on annual base and retrospective – in the 1982 survey households are asked to report their characteristics for 1981 – we have annualized our quarterly proxy of fiscal news therefore harmonizing it with the time span of the PSID.

3.2.1 Panel Fixed-Effects Model

We use the following baseline equation, which we estimate for the two main dependent variables

$$\Delta x_{i,t} = \alpha_i + \sum_{k=0}^{2} \theta_k \times news_{t-k} + \beta \times Z_{i,t} + \epsilon_{i,t}, \tag{20}$$

where Δ is the first differences operator, $x_{i,t}$ is the logarithm of household's consumption/real wages at time t, α_i is household fixed-effects, $news_{t-k}$ is the k period lag of fiscal policy news in period t, $Z_{i,t}$ is a vector of control characteristics such as state of residence, age or employment status and $\epsilon_{i,t}$ is the error term[9].

Figure 4 shows the dynamic effects to a fiscal news shock. The plots time-unit is one year and the responses are in percent. When we move from aggregate-level to individual-level data, we observe that the responses are qualitatively the same at the median of the empirical distributions - on impact, real consumption falls and real wages do not move, whereas both increase after one year. This is one of the key features of the paper, that is, without regarding which data structure we choose, we get the same qualitative effects in response to a government spending news shock.

3.2.2 Disentangling the Effects from Poor and Rich Households

What happens if we distinguish between relatively rich and poor households? Can we obtain positive effects on impact after a fiscal news shock? The particular

[8]For further details about the questionnaires: `https://psidonline.isr.umich.edu`.

[9]Standard errors are clustered at the household level.

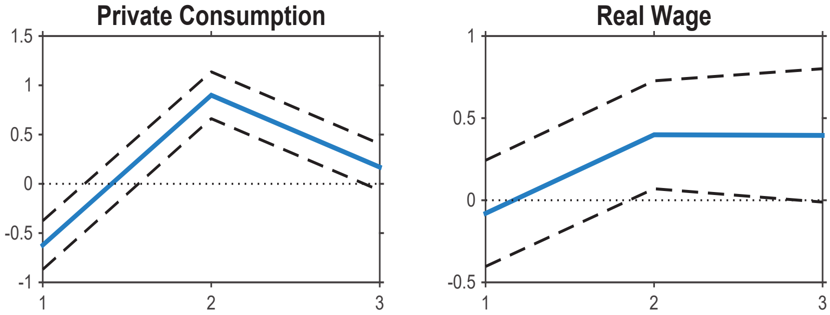

Figure 4: Impulse Responses to a Fiscal News Shock in the PSID Survey: Median Effects

Note: Each entry shows the median and the symmetric 68% confidence bands.

structure of the PSID survey allows us to uncover these questions. We modify the benchmark econometric model in 3.2.1 to introduce these relative measures

$$\Delta x_{i,t} = \alpha_i + \sum_{k=0}^{2} \theta_k \times news_{t-k} + \sum_{k=0}^{2} \kappa\big(D(j)_{i,t} \times news_t\big) + \beta \times Z_{i,t} + \epsilon_{i,t}, \tag{21}$$

where $D(j)$ is a dummy variable which takes value 1 when the characteristic j applies to household i at time t. Thus, we can distinguish between relatively rich and poor households as follows

$$D(low\ income)_{i,t} = \begin{cases} 1\ \textit{if family income} < 25^{th}\ \textit{percentile} \\ 0\ otherwise \end{cases}$$

$$D(high\ income)_{i,t} = \begin{cases} 1\ \textit{if family income} > 75^{th}\ \textit{percentile} \\ 0\ otherwise \end{cases}$$

Then, household i will be treated as poor (rich) if its real disposable income is below (above) the 25^{th} (75^{th}) percentile of the whole income distribution in year t.

First, Figure 5 shows the responses to a fiscal news shock when we consider the tails of real wages distribution. For low-income households, we find that real wages increase significantly upon impact by 1%, reaching their largest value after one year. For high-income households, real wages fall on impact and rise with a two-year delay. On the one hand, the dynamics of the latter deliver results that

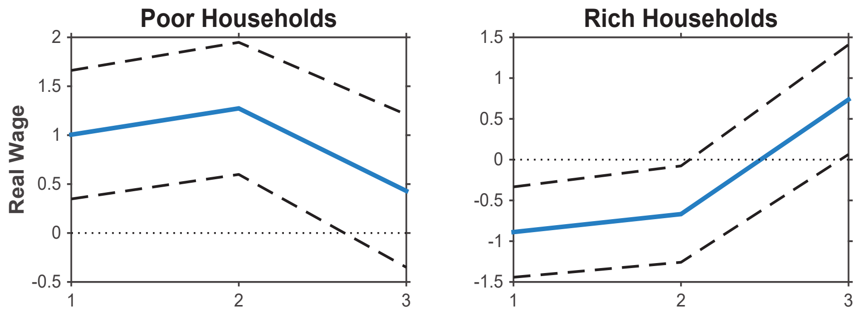

Figure 5: Real Wages Response to a Fiscal News Shock in the PSID survey: Poor and Rich Households

Note: Each entry shows the median and the symmetric 68% confidence bands.

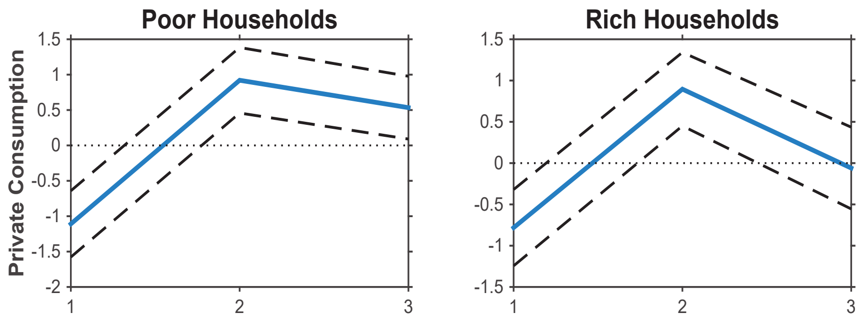

Figure 6: Private Consumption Response to a Fiscal News Shock in the PSID survey: Poor and Rich Households

Note: Each entry shows the median and the symmetric 68% confidence bands.

are mainly consistent with standard RBC models. On the other hand, the former group mimics the implications of New Keynesian models with sticky prices where the increase in labor demand is stronger than the shift in labor supply and boosts real wages. Next, Figure 6 shows the responses at the tails of consumption distribution. Low-income and high-income households behave qualitatively similar to the median case. The only difference comes from the medium-run response for low-income households where consumption significantly rises after both the first and the second year.

These results (in terms of private consumption) differ to DeGiorgi and Gambetti (2012) and Anderson et al. (2016) since we obtain that both poor and rich households react similarly on impact. However, these papers use CEX data which it is not a proper panel structure since it does not follow individuals through time. Giavazzi and McMahon (2012) obtain different results using also data from PSID. They find that, upon impact, low-income households tend to cut consumption and households with relatively higher income increase it. This could be due to the different nature of the fiscal shock. While we use a measure of government consumption and investment news under imperfect information, they use unexpected military spending shocks.

4 Conclusion

In this paper, we have analyzed the effects of government spending news on consumption and real wages when information about the conduct of fiscal policy is imperfect by using aggregate and individual datasets. First, we develop a model where government spending is composed by permanent and transitory components. Agents learn about the previous processes by only observing overall public spending and a noisy signal. Under this setting and employing maximum likelihood techniques, we construct a novel measure of fiscal policy news and show that the estimated variable agrees with the historical narrative evidence for the U.S. economy. We refer to good (bad) news when the signal is strictly above (below) beliefs about the permanent component updated with overall government spending. Next, by employing SVAR methods with aggregate data, we observe that real private consumption exhibits delayed positive effects, i.e., it significantly decreases on impact and starts rising after several quarters. Real wages move insignificantly on impact but increase significantly after one year. A potential explanation for the particular behavior of consumption (and for other GDP components) is related with the notion of *spending reversals*. Later, under panel fixed-effects techniques with individual survey data from PSID, we have access to the whole distributions of consumption and real wages and we can analyze if there exists heterogeneity in each response which could be hidden using aggregate data. On the one hand, we observe that the responses are qualitatively the same at the median of the distributions. On the other hand, when we analyze the tails of the distributions, real wages significantly rise (fall) upon impact for low-income (high-income) households. For consumption dynamics, low-income and high-income households behave qualitatively similar to the median case. The responses only differ at longer horizons where poor households increase consumption more persistently than those at the top of the distribution.

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Appendix

A Further VAR Results

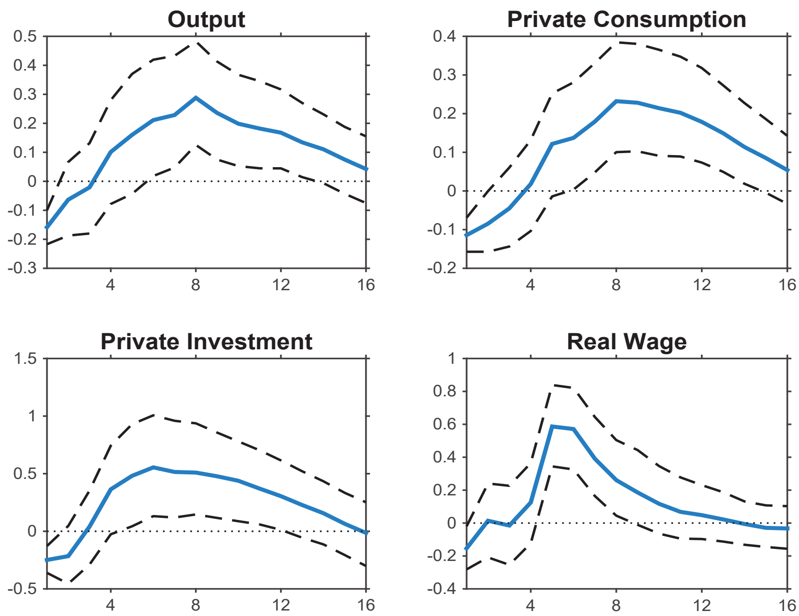

Figure 7: Impulse Responses to a Fiscal News Shock in the VAR model with Aggregate Data: Sample through 2010Q4

Note: Each entry shows the median and the bootstrapped symmetric 68% confidence bands.

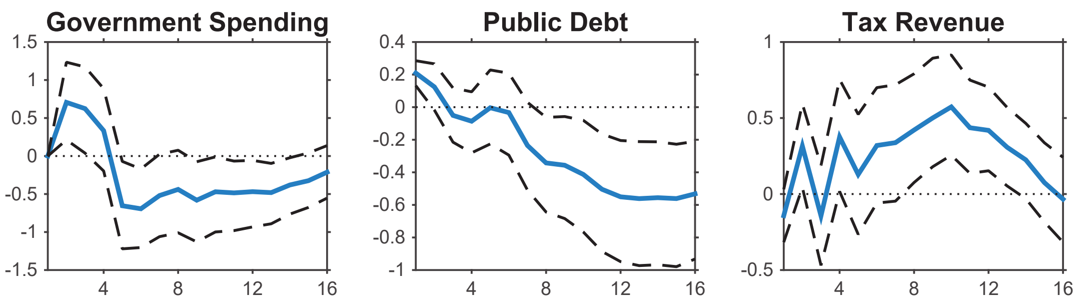

Figure 8: Impulse Responses to a Fiscal News Shock in the VAR model with Aggregate Data: Public Finances, Sample through 2010Q4

Note: Each entry shows the median and the bootstrapped symmetric 68% confidence bands.

B PSID Statistics

Table 3: Descriptive Statistics

Variable	Mean	S.D.	Min	Max
Ln Total Consumption	8.41	0.48	3.92	10.90
Ln Family Income	9.28	0.80	0.52	14.56
Ln Family Wages	2.96	0.78	0.45	10.04
Family Size	2.85	1.40	1	14
House ower	0.68	0.47	0	1
Education	2.75	1.03	1	4
Age	41.64	11.13	25	65
Sex	1.19	0.39	1	2
Unemployed	0.04	0.19	0	1
Self-employed	0.12	0.33	0	1
Number of Observations				71,503

Note: Education refers to 0-11 grades (1), high-school or 12 grades + non-academic training (2), college dropout (3) and professional or bachelor degree (4). Sex refers to male (1) and female (2).

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