Expansionary and contractionary fiscal multipliers in the U.S.

George Kapetanios, Panagiotis Koutroumpis and Christopher Tsoukis

Working Paper No. 939 May 2022 ISSN 1473-0278

School of Economics and Finance

Queen Mary University of London

Expansionary and contractionary fiscal multipliers in the U.S.

George Kapetanios[a], Panagiotis Koutroumpis[b], Christopher Tsoukis[c]

[a]*King's College London, UK*

[b]*Queen Mary University London, UK*

[c]*Keele University, UK*

March 24, 2022

Abstract

We estimate the fiscal (spending) multiplier using quarterly U.S. data, 1986-2017. We define government spending shocks as actual minus expected expenditure growth, the latter obtained from the Survey of Professional Forecasters. We employ the ST-VAR model with the local projections method. A key testable conjecture is that the effects of positive and negative spending shocks have numerically different effects (the latter being stronger). Although we cannot formally reject the null of equality, the conjecture does hold in general. We also find evidence of state-dependence of multipliers as previously pointed out.

JEL classification: E60, E62, H30

Keywords: Fiscal multiplier, government spending, stabilisation policy, local projections

1 Introduction

Analysis of the 'fiscal multiplier' (or suite of multipliers), the effect at the margin of government spending or taxes on economic activity, remains an active line of research. Its policy relevance is significant, not least during recessions or during times when monetary policy appears less capable of a stimulus due to the 'zero lower bound' problem.[1] It is one of the concepts by which students are first introduced into macroeconomics, yet it remains debated both conceptually and empirically; though there may be gradual convergence of views, there is no full consensus as yet (see e.g., Ramey, 2011, 2019). For policy purposes, as well as for theoretical clarity, it is important to have a sharper view of the empirical magnitude of the fiscal multipliers and its determinants.

This paper continues this investigation. We estimate the effects of unanticipated government spending shocks on output using quarterly U.S. data, 1986-2017. It has recent been found by contributions such as Auerbach and Gorodnichenko (2012, 2013, 2017), Fazzari, Morley and Panovska (2015), Jordà and Taylor (2016) and Ramey and Zubairy (2018) that the size of the multiplier depends on the state of the economy, particularly on whether output is below or above normal; the general finding is that the multiplier is stronger in recessions rather than expansions. It is easy to show (but often foregone) that this finding is consistent with standard macroeconomic reasoning; we elaborate on that below. From this departure point, our innovations and contribution to the literature are threefold.

Our first, and main, innovation is to decompose the fiscal policy shocks into positive and negative ones, and allow for effects of different magnitudes (as well as in opposite directions). The rationale is that positive and negative shocks correspond naturally to expansionary and contractionary fiscal policy (specifically spending). Basic theory leads us to expect numerically different effects, as contractionary policy may be characterised more by the demand-side, textbook ('Keynesian') multiplier, whereas expansionary policy is characterised more by the supply-side, 'neoclassical' type. We expand below; the bottomline is that the textbook Keynesian multiplier is more germane to fiscal contractions and is likely to be more sizeable than the neoclassical multplier, which is germane to fiscal expansions. Standard

[1] The ongoing Covid-19 pandemic has further highlighted the relevance of fiscal policy and the widely adopted fiscal support measures designed to alleviate the effects of the recession. However, as the paper was substantially written during 2021, while the episode was ongoing, its analysis is best left to future work.

practice pools expansions and contractions, potentially biasing the estimates. The effects of contractions, especially, are likely to be underestimated. The effects of multipliers are estimated with reference to normal fiscal experiments, which are mostly expansions, and are likely to have lower effects than contractions. Thus, when the latter actually happen, they are likely to have stronger effects than predicted. Indeed, Blanchard and Leigh (2013, 2014) and Fatás and Summers (2018) find a significant negative correlation between the forecast error of GDP growth (actual minus forecasted) and forecasted fiscal consolidations in the early post-recession years (2010-11) when various countries in Europe and elsewhere engaged in fiscal consolidations. The bias in the forecast error (which did not exist before the period) suggests that output fell more than expected (the multipliers were greater than previously estimated) during recessions and during negative fiscal shocks.[2] These arguments and findings are consistent with both state-dependency of the multipliers and potentially stronger effects of fiscal consolidations. The state-dependence of the fiscal multiplier has been verified empirically by the aforementioned studies. However, the differential between the effects of fiscal expansions and contractions should be investigated further; this is the key question we ask in this paper. A test of whether fiscal shocks of different signs have numerically different effects (as well as of a different sign) should be both an indirect test of standard theory as well as being highly policy-relevant.[3]

The textbook Keynesian spending multiplier is of the form $dY/dG = 1/(1 - MPC) > 1$, where $0 < MPC < 1$ is (the presumed fixed) marginal propensity to consume out of current income; variants include the tax and balanced-budget multipliers, or the spending multiplier with variable taxation, imports and similar extensions. As taught in elementary courses, this spending multiplier is higher than unity. The key point is that this suite of multipliers is entirely demand-side based (hence the designation 'Keynesian'); supply-side restrictions such as capacity constraints, increasing marginal disutility of labour (manifesting itself in increasing wages, e.g. overtime rates as the normal output is exceeded), rising costs of energy or materials and similar considerations, are entirely absent. This is more likely to apply during recessions

[2] The bias also suggests that the fiscal multipliers were underestimated when the fiscal consolidations were designed. Gornicka et al. (2019) confirms this and also finds that the European Commission, in particular, gradually adjusted upwards its estimates of the multiplier in the light of experience.

[3] Tenreyro and Thwaites (2016) forms an interesting background to both previous literature on fiscal policy and to the present work, as it finds (a) that monetary policy effects are state-dependent, and in fact weaker during recessions (in sharp contrast to what has been found with regard to fiscal policy); and (b) that monetary contractions have stronger effects than expansions (paralleling our results on fiscal policy).

than expansions. Another consideration, which has received less attention, is that this will be true to a larger extent during fiscal contractions than during expansions; this is because during contractions, the relevant supply constraints are less: it is more difficult to build capacity than to reduce it.

Another line of thinking on the multiplier is the neoclassical multiplier; see Hall (2009), Mulligan (2011) and Woodford (2011). Almost symmetrically, this multiplier is based entirely on supply-side considerations; consumption and labour supply are determined by (static) optimisation. Both output and labour markets clear such that there cannot be any excess supply of either output or labour; this immediately suggests that there is less scope for a fiscal expansion to affect output as demand is not lacking. As a result, this spending multiplier is less, between zero and unity. The intuition is the following: As government spending rises, with a given output, consumption is crowded out. As the marginal utility of consumption rises, so must the marginal utility of leisure, which implies less leisure and more hours of labour supply.[4] The higher employment allows extra output to be produced. But consumption will fall: this is what motivates the individual to work harder in the first place. This argument is at the heart of the result that output rises but less than government spending. As a corollary, a fiscal expansion is less likely to increase welfare or indeed, by reducing private consumption, to be politically acceptable. Thus, the neoclassical multiplier captures disutility-of-work considerations, and in broader terms all capacity constraints. Demand as an autonomous consideration is absent. Extending previous arguments, it is more likely to apply during booms than recessions, a mirror image of the state-dependency of the 'Keynesian' multiplier. Equally, it is more likely to be true during a fiscal expansion than a contraction.

Multipliers in the intertemporally optimising DSGE models (Gali, Lopez-Salido and Valles, 2007; Cogan et al., 2010) generally blend the two lines of argument; while neoclassical in their core, the Keynesian element in those models arises from frictions such as price/wage stickiness and/or the fact that some households are liquidity-constrained and hence consume a fraction of their current, rather than permanent, income ('rule-of-thumb' consumers). Some of these arguments are not inconsistent with our basic hypothesis: If the households that are able to optimise intertemporally behave in the way suggested by the neoclassical multiplier, the constrained households behave according to the Keynesian

[4] This can be seen from the equality between the marginal substitution and marginal transformation between leisure and consumption; in obvious notation: $U_l/U_c = w$.

one. If the fraction of the constrained households rises during a recession, then in such periods, we should be seeing multiplier values move towards the spectrum predicted by Keynesian arguments. But, to our knowledge, this line of argument has not been pursued in this literature. Financial frictions may also imply state dependency of fiscal multipliers (e.g., Canzoneri, Collard, Dellas and Diba, 2016). But this feature does not imply a difference between the magnitudes of fiscal contractions and expansions.

As mentioned, the size of the fiscal expenditures multiplier continues to be debated. Echoing a neoclassical line of reasoning, Hall (2009) estimates it to be between 0.5 and 1. In a more Keynesian spirit, the wide-ranging review of empirical studies by Ramey (2011) leads her to suggest a plausible range for the spending multiplier of 0.8 to 1.5; her more recent survey (Ramey, 2019, Table 1), however, seems to suggest estimates mostly lower than unity. Blanchard and Perotti (2002) present evidence that a deficit-financed government spending increase that persists for four quarters raises output less than one-to-one but persistently (for up to 20 quarters ahead). In contrast, Mountford and Uhlig (2009) find a cumulative deficit-financed spending multiplier that is below unity, and when one takes into account the tax rise that will inevitably arrive later on in order to repay the debt, there is an output loss (in present-value terms). Instead, they find more encouraging results for a deficit-financed tax cut.

Using historical U.S. data covering multiple large wars and deep recessions, Ramey and Zubairy (2018) find that the multiplier is lower than unity even in conditions of slackness and recession; the only condition that might push multipliers above unity seems to be interest rates stuck at the zero lower bound. Gali, Lopez-Salido and Valles (2007) find a government spending multiplier on output of 0.78 on impact and of 1.74 after 8 quarters. Cogan et al. (2010) predicts that a permanent rise in fiscal expenditures equal to 1% of GDP leads to a 1% rise in GDP in the 1st quarter, falling to 0.6% at the 8th quarter and to a 0.4% rise after four years. Blanchard and Leigh (2014) argue that they are plausibly between 0.9 to 1.7. The follow-up study of Fatás and Summers (2018) additionally finds the mutlipliers to be very persistent: A typical fiscal consolidation in Europe during the period 2009-11 that led to a decrease of 1% in GDP on impact led to changes of greater than 1% by 2015 and was projected to lead to a decrease of 2% in GDP by the year 2021. Zubairy (2014) finds the government spending multiplier to be marginally above unity (1.07), largest on impact. We aim to contribute to this line of investigation by allowing a differentiation of the effects of positive and negative fiscal (spending) shocks.

Our second innovation is methodological: We use 'smooth transition' estimation that allows the state of the economy not to be binary (in particular, recession or expansion) but a linear combination of the two states, or regimes; furthermore, we allow this linear combination to be time-varying. Only a few of papers (Auerbach and Gorodnichenko, 2013; Ramey and Zubairy, 2018; and Tenreyro and Thwaites, 2016, for monetary policy) have hitherto used this method and we follow them. Furthermore, we use the local projections method (Jordà, 2005) in order to estimate impulse responses. We report two sets of results, the (present value of the) impulse responses of spending shocks on output and the multipliers suggested by Mountford and Uhlig (2009) and Ramey (2019).

A third innovation concerns the specification of the spending shock. Much of the literature extracts the government spending shocks form a VAR using one of the available identification procedures; a prominent example is Blanchard and Perotti (2002). However, all such identification procedures remain debatable.[5] We therefore choose to follow the alternative approach of Auerbach and Gorodnichenko (2012, 2013, 2017) in employing professional forecasts of the growth in government spending contained in the Survey of Professional Forecasters (SPF) compiled by the Federal Reserve Bank of Philadelphia; we then compute the spending (growth) shock as actual minus forecast of the government spending growth rate (see e.g. House, Proebsting and Tesar, 2020, for a recent such example). We present an additional two variants of the shock thus compiled, by filtering out any predictable component due to correlation with (detrended) output or due to autocorrelation.

The paper is organised as follows. Section 2 and 3 describe our data and estimation methods, while Section 4 describes the results. To pre-amble, we find systematic, if not always statistically significant, differences between the multipliers of the expansionary and contractionary shocks. The latter are stronger in the shorter run (an horizon of four quarters) while the former tend to dominate at the horizon of eight quarters. The last Section concludes .

[5] See e.g. Auerbach and Gorodnichenko (2017) and Ramey and Zubairy (2018) on criticisms of such procedures. Identification of tax schocks, on the other hand, raises if anything even more serious identification issues, hence tax-based fiscal policy is outside the scope of this paper. For this reason, we are also unable to differentiate between tax-financed and deficit-financed spending shocks.

2 Data Sources and Variables

We use U.S. data derived from the OECD Economic Outlook; one exception is the data on the government debt-GDP ratio (d_t), obtained from the Bank for International Settlements (BIS). Furthermore, as mentioned, forecasts of government spending growth (GSF_t) were obtained from the Federal Reserve Bank of Philadelphia's Greenbook Data Set: Survey of Professional Forecasters (SPF). These forecasts are available from 1966.[6] The data is quarterly from 1986Q1 to 2017Q4. Specifically, we use the following variables:

Y_t: Real gross domestic product (GDP). From this variable, we obtain:

$g_t^Y \equiv \Delta Y_t / Y_{t-1}$, is the real GDP growth rate where Δ is the difference operator (i.e., for any variable X_t, $\Delta X_t \equiv X_t - X_{t-1}$).

$z_t \equiv 100(logY_{t+3} - logY_{t-4})/7$ is a smoothed growth rate of output, used to identify the states of the cycle (expansion or recession) that we use in the transition function of the estimation procedure below.We characterise low (high) values of z_t as Recession (Expansion).

y_t: detrended output, deviation of $logY_t$ from potential log real GDP; the latter is constructed applying the Hodrick-Prescott (1997) filter on $logY_t$, with $\lambda = 10,000$ so as to alleviate noise added by extreme events such as the recession of 2008.

d_t: The government debt-GDP ratio (source: BIS).

GGC_t and GGI_t: real government consumption and government investment, respectively. The total real government spending (G_t) is constructed as $G_t \equiv GGC_t + GGI_t$. We then construct the growth rate of real government spending, $g_t^G \equiv \Delta G_t / G_{t-1}$.

I_t^{ST} and I_t^{LT}: the short- and long-term nominal interest rates, respectively.

GSF_t. Forecast of the growth rate of government spending during t one period in advance $(t-1)$ (source: SPF).

$FE_{t|t-1} \equiv g_t^G - GSF_t$ is the forecast error (actual minus the forecast) of the growth rate of government

[6] The OECD Economic Outlook, released twice a year, contains forecasts of various macroeconomic variables, including government spending. However, we eschew these forecasts as their semi-annual availability would require questionable interpolations in order for them to be used with quarterly data.

spending. In order to differentiate between positive and negative spending shocks, we differentiate $FE_{t|t-1}$ by sign, i.e. we define:

$$FE^{+}_{t|t-1} \equiv \begin{cases} FE_{t|t-1} \\ 0 \end{cases} \text{if } FE_{t|t-1} \begin{cases} > 0 \\ < 0 \end{cases}$$

$$FE^{-}_{t|t-1} \equiv \begin{cases} FE_{t|t-1} \\ 0 \end{cases} \text{if } FE_{t|t-1} \begin{cases} < 0 \\ > 0 \end{cases}$$

As positive (negative) numbers indicate that government spending was higher (lower) than the professional forecast of the same made one period earlier, we refer to these as expansionary ($FE^{+}_{t|t-1}$) and contractionary ($FE^{-}_{t|t-1}$) government spending shocks. We also indicate all shocks by $FE^{ALL}_{t|t-1}$; by definition, $FE^{ALL}_{t|t-1} = FE^{+}_{t|t-1} + FE^{-}_{t|t-1}$. Our government spending shock therefore is : $gss_t = FE^{ALL}_{t|t-1}$, $FE^{+}_{t|t-1}$, $FE^{-}_{t|t-1}$; it takes alternatively all, the positive, or the negative values of $FE_{t|t-1}$. Accordingly, we report separate results based on all shocks pooled together, and the positive and the negative shocks separately. Furthermore, considering that $FE_{t|t-1}$ may still contain predictable elements as argued by Ramey (2011), we improve its quality by (a) filtering out any correlation with y_t and (b) as the residuals from an AR(1) process of $FE_{t|t-1}$ itself. We use these two transformations (separately) as variants of the shock; we give more details below. We follow the same procedure in distinguishing between positive and negative shocks of both variants of the shock.

3 Econometric Methodology

We wish to allow for non-linear and state-dependent estimation, so we employ recent developments building on Chan and Tong's (1986) threshold autoregressive (TAR) and Teräsvirta's (1994) smooth transition autoregressive (STAR) models, both of which capture regime-switching behaviour. In particular, we use Auerbach and Gorodnichenko's (2012, 2013) and Ramey and Zubairy's (2018) smooth transition vector autoregressive (ST-VAR) model that allows for smooth (rather than binary) transition between states or regimes. One key advantage of the ST-VAR methodology over the standard structural vector autoregressive model (SVAR) is that the latter could potentially make the estimates unstable and less precise in the case of too few observations in a particular state (Auerbach and Gorodnichenko, 2013).

Our baseline ST-VAR model is given by the following specification:

$$X_t = F(z_{t-1})\Pi_R(L)X_{t-1} + (1 - F(z_{t-1}))\Pi_E(L)X_{t-1} + u_t, \quad (1)$$

$$u_t \sim N(0, \Omega_t), \quad (2)$$

$$\Omega_t = \Omega_R F(G_t^Y) + \Omega_E(1 - F(G_t^Y)), \quad (3)$$

$$F(z_t) \equiv \frac{\exp(-\gamma z_t)}{1 + \exp(-\gamma z_t)}, \gamma > 0 \quad (4)$$

where $X_t = [g_t^Y \; g_t^G \; d_t \; I_t^{ST}]'$ is the vector of the explanatory variables. All have been defined above.[7] The model estimates lag (L) polynomials of X_{t-1}. In common with state-dependent estimation, we obtain two sets of estimated coefficients and variance-covariance matrices, $\Pi_i(L)$ and $\Omega_i(L)$, respectively, depending on the state (or regime) i, $i = R, E$, where R is recession and E is expansion. In line with smooth transition (ST-VAR) modelling, we estimate a time-varying linear combination of the two, based on the weight $0 < F(z_t) < 1$, which can be interpreted as the probability of the economy being in a particular state (R or E). Following again Auerbach and Gorodnichenko's (2012, 2013) and Ramey and Zubairy's (2018), we use the smoothed output growth rate (z_t) as an indicator of the state of the economy: recession (R, with low z_t and high $F(z_t)$) and expansion (E, the opposite).[8] Given the difficulty in estimating the γ parameter as well as the $\{\Pi_i(L), \; \Omega_i\}$ matrix concurrently, Granger and Teräsvirta (1993) suggest imposing fixed values of γ. We set $\gamma = 1.5$ so that the economy does not spend more than 20 percent of the time in a recession. This is consistent with the National Bureau of Economic Research (NBER) business cycles dates regarding the duration of the business cycles in the U.S., showing that 21 percent of the time since 1946 has been characterised by recession.

[7] As a check, we also used the long interest rate (I_t^{LT}) but the results were essentially identical; they are available on request.

[8] We also tested a variant of the state of the economy based on detrended output (y_t). The findings were very similar and hence not reported.

Furthermore, we employ the Jordà (2005) local-projections method to simplify estimation of the effects of various shocks, as do Auerbach and Gorodnichenko (2013) and Ramey and Zubairy (2018). This method estimates the Impulse Response Functions arising from equation (1) in a tractable way, while allowing for state dependence. To this end, we estimate a set of regressions for 8 quarters ($h = 0, 1, 2, 3, \ldots, 7$) as follows:

$$g^Y_{t+h} = F(z_{t-1})(\alpha^Y_{R,h} + \psi^Y_{R,h}(L)X_{t-1} + \beta^Y_{R,h} gss_t) + (1 - F(z_{t-1}))(\alpha^Y_{E,h} + \psi^Y_{E,h}(L)X_{t-1} + \beta^Y_{E,h} gss_t) + \varepsilon_{t+h}, \tag{5}$$

where $\alpha_{R,h}$ and $\alpha_{E,h}$ are time effects, $\psi_{R,h}(L)$ and $\psi_{E,h}(L)$ are lag polynomials of order 4 (as usual with quarterly data in order to filter out any residual seasonality), and the $\beta_{R,h}$, $\beta_{E,h}$ coefficients estimate the response of X_{t+h} to a shock at time t. ε_{t+h} is an error term; we apply the Newey-West (1987) correction to address the issue of serial correlation in this error term, induced by the successive leading of the dependent variable. Using: $gss_t = FE^{ALL}_{t|t-1}$, $FE^{+}_{t|t-1}$, $FE^{-}_{t|t-1}$, we estimate the following equation:

$$\begin{aligned} g^Y_{t+h} \quad = \quad & F(z_{t-1})(\alpha^Y_{R,h} + \psi^Y_{R,h}(L)X_{t-1} + \beta^{Y+}_{R,h} FE^{+}_{t|t-1} + \beta^{Y-}_{R,h} FE^{-}_{t|t-1}) + \\ & + (1 - F(z_{t-1}))(\alpha^Y_{E,h} + \psi^Y_{E,h}(L)X_{t-1} + \beta^{Y+}_{E,h} FE^{+}_{t|t-1} + \beta^{Y-}_{E,h} FE^{-}_{t|t-1}) + \varepsilon_{t+h} \ , \end{aligned} \tag{6}$$

3.1 *Multipliers*

Before proceeding, it is useful to digress briefly on what channels of propagation the spending shocks may follow. Consider a spending shock, δG_t, where δ is a deviation from the reference path of government spending (G_t) caused by the shock at time t. Whether a Keynesian or neoclassical multiplier applies, this will induce the following three effects: Firstly, a direct effect of δG_t begins by affecting output contemporaneously, $\delta G_t \to \delta Y_t$, and this will affect future output through the persistence and lag mechanisms in output (current income affecting future consumption or investment, current investment affecting future investment through 'time-to-build' effects, etc); schematically; $\delta Y_t \rightarrow \delta Y_{t+h}$. Secondly, there is an indirect effect, as some government spending is proportional to output and thus endogenous and not discretionary, therefore there may be a feedback effect from this spending to output. Schematically, if T_t is taxation, we have: $\delta Y_{t+h} \rightarrow \delta T_{t+h} \rightarrow \delta G_{t+h} \rightarrow \delta Y_{t+h}$. The last link appears because the balanced-budget multiplier tells us that the net effect of taxation and spending is non-zero (expansionary). Thirdly, another indirect effect may be present as current government spending may be autocorrelated, such that $\delta G_t \rightarrow \delta G_{t+h}$. This may be because current government spending affects the future one, again because of 'time-to-build' effects, this time in relation to public infrastructure; if so, the autocorrelation of δG_{t+h} will be positive.

However, this autocorrelation may be negative if there is a 'mean reversion' in spending growth, i.e. shocks of a certain sign are likely to be followed by shocks of the opposite sign, and government spending returns to normal after a shock. To pre-amble, this effect shows up quite strongly in our data. Whatever the autocorrelation in government spending, future changes in the latter will affect output (even though they are anticipated at the time they happen); schematically; $\delta G_{t+h} \rightarrow \delta Y_{t+h}$. In a nutshell, the original unit unexpected shock δG_t induces changes in current and future output via a number of channels. All these effects are included in the estimated impulse responses of the original shock. We first estimate the present value of the impulse responses, $m_t \equiv \sum \frac{\delta Y_{t+h}}{\delta G_t}(1+r)^{-h}$, over two horizons of 4 and 8 quarters, as the horizon of 8 quarters seems to be the one over which most of the effects of fiscal policy have manifested themselves, in much of the literature. We call this the 'Present-Value Impulse Response - Fiscal Multiplier' (PVIR-FM).

Much of the literature is focused on the question whether a fiscal shock elicit a greater response on output than on government spending itself. In this regard, Mountford and Uhlig (2009) and Ramey (2019) propose the ratio $\frac{\sum \delta Y_{t+h}(1+r)^{-h}}{\sum \delta G_{t+h}(1+r)^{-h}}$, i.e. the ratio of the present values of output responses (output deviations from baseline) to that of spending deviations from baseline. This information is useful as a measure of effectiveness of the fiscal shock, i.e. as comparison of the output gain to the total fiscal cost involved in generating it. In this spirit, we present the difference:

$$M_t \equiv \sum(\frac{\delta Y_{t+h}}{\delta G_t})(1+r)^{-h} - \sum(\frac{\delta G_{t+h}}{\delta G_t})(1+r)^{-h}$$

again over 4 and 8 quarters, and call it the 'Effectiveness Coefficient - Fiscal Multiplier' (EC-FM). [9] This coefficient gives the rise of output over fiscal spending, therefore it also has the interpretation as the rise of private spending (or crowding-in) following the shock (in present-value terms).

3.1.1 ***Present-Value Impulse Response - Fiscal Multiplier (PVIR-FM)***

The spending multiplier measures the discounted cumulative impact in $ of an unexpected shock in public spending equal to $1 at time t on output over an horizon H, i.e.:

$$m_t \equiv \sum_{h=0}^{H-1} (\frac{\delta Y_{t+h}}{\delta G_t})(1+r)^{-h}$$

where, it should be recalled, Y_t is real GDP, δY_{t+h} is the deviation in output from baseline due to the fiscal shock, with $\bar{Y}_{t+h}$being baseline output (in the absence of shocks), δG_t is a unit, unexpected government spending shock at t and $r > 0$ is the real interest rate, assumed constant. The horizon is H=4,8 (quarterly data).

Both real GDP and government spending enter our empirical specification as growth rates, i.e. g_t^Y and g_t^G, and it should be recalled that the fiscal shock is actual minus expected growth of fiscal spending, $gss_t \equiv g_t^G - GSF_t \equiv \delta g_t^G$. From this, the shock in levels is obtained by noting that $\delta G_t / G_{t-1} \equiv \delta g_t^G \equiv gss_t$. Furthermore, since from basics we have: $Y_{t+h} = \left\{ Y_{t-1} \prod_{s=0}^{h} \left(1 + g_{t+s}^Y\right) \right\}$, we calculate the effect of a given shock on future output by cumulating the effect on future output growth rates:

$$\delta Y_{t+h} = \delta \left\{ Y_{t-1} \prod_{s=0}^{h} \left(1 + g_{t+s}^Y\right) \right\} = Y_{t-1}(1+g^Y)^h \sum_{s=0}^{h} \delta g_{t+s}^Y$$

The above assumes that the baseline growth rate, i.e. without the effect of the shock, is constant: $g_{t+i}^Y = g^Y$, for all i. Also, using definitions, we have: $\delta G_t = gss_t G_{t-1}$.

Introducing into the previous and summing up over H-1 (so that the horizon is H quarters) we obtain:

[9] We present the difference percentage changes in output and fiscal spending as taking the ratio of deviations involves very small magnitudes of the denominator that destabilises the ratio.

$$\sum_{h=0}^{H-1}(\frac{\delta Y_{t+h}}{\delta G_t})(1+r)^{-h} = \frac{Y_{t-1}}{G_{t-1}}\sum_{h=0}^{H-1}\frac{(1+g^Y)^h}{(1+r)^h}\sum_{s=0}^{h}\frac{\delta g^Y_{t+s}}{gss_t} \approx \frac{Y_{t-1}}{G_{t-1}}\sum_{h=0}^{H-1}\sum_{s=0}^{h}\frac{\delta g^Y_{t+s}}{gss_t} = \frac{Y_{t-1}}{G_{t-1}}\sum_{h=0}^{H}(H-h)\frac{\delta g^Y_{t+h}}{gss_t} \tag{7}$$

The approximation follows from assuming $g^Y_t \approx r$; with quarterly data and H=4 or 8, the error will be negligible. Note also that, in order to move away of percentage effects (implicit in growth rates) and obtain 'dollar effects', we multiply $\frac{Y_{t-1}}{G_{t-1}}$ and not by sample means; thus, we avoid a pitfall highlighted by Ramey (2019) that could bias our results.

Finally, using equation (7) and replacing $\frac{\delta g^Y_{t+i}}{gss_t}$ by the regression coefficients in equation (6), we have:

$$m_t = \sum_{h=0}^{H-1}(\frac{\delta Y_{t+h}}{\delta G_t})(1+r)^{-h} = \frac{Y_{t-1}}{G_{t-1}}\sum_{h=0}^{H-1}(H-h)\left[F(z_{t-1})(\beta^{Y+}_{R,h} + \beta^{Y-}_{R,h}) + (1 - F(z_{t-1})(\beta^{Y+}_{E,h} + \beta^{Y-}_{E,h})\right] \tag{8}$$

Following from the differentiation of shocks, these PVIR-type of multipliers are also differentiated as $m_t = m^{ALL}_t$, m^+_t, m^-_t, corresponding to the three cases of $\beta^{Y+}_{i,h} = \beta^{Y-}_{i,h}$, $\beta^{Y-}_{i,h} = 0$ and $\beta^{Y+}_{i,h} = 0$, respectively, for $i = R, E$. The results are presented accordingly. It is worth noting that all versions of m_t are complete series, even though the positive/negative shocks series are not complete, as these PVIR-FMs are built on the estimated coefficients from the instances when the shocks do exist.

3.1.2 *Effectiveness Coefficient - Fiscal Multiplier (EC-FM)*

As mentioned, in the spirit of Mountford and Uhlig (2009) and Ramey (2019), we present the coefficient that shows the output effect of a given spending shock compared to all the government spending that it elicits.

$$M_t \equiv \sum_{h=0}^{H-1}(\frac{\delta Y_{t+h}}{\delta G_t})(1+r)^{-h} - \sum_{h=0}^{H-1}(\frac{\delta G_{t+h}}{\delta G_t})(1+r)^{-h}$$

Again, this is the difference (in $) between the sum of output effects (the present value of deviations from the baseline), minus the sum of such effects on future spending, arising out of a $1 unexpected increases in spending at time t. The first part of the ratio is simply m_t; to get the latter, we expand in a familiar way:

$$\sum_{h=0}^{H-1}(\frac{\delta G_{t+h}}{\delta G_t})(1+r)^{-h} = \frac{G_{t-1}}{G_{t-1}}\sum_{h=0}^{H-1}\frac{(1+g^G)^h}{(1+r)^h}\sum_{s=0}^{h}\frac{\delta g^G_{t+s}}{gss_t} \approx \sum_{h=0}^{H-1}\sum_{s=0}^{h}\frac{\delta g^G_{t+s}}{gss_t} = \sum_{h=0}^{H-1}(H-h)\frac{\delta g^G_{t+h}}{gss_t}$$

To get that, we estimate the above with the growth rate of government spending g^G_{t+h} as the dependent variable:

$$\begin{aligned} g^G_{t+h} &= F(z_{t-1})(\alpha^G_{R,h} + \psi^G_{R,h}(L)X_{t-1} + \beta^{G+}_{R,h}FE^+_{t|t-1} + \beta^{G-}_{R,h}FE^-_{t|t-1}) + \\ &\quad +(1-F(z_{t-1}))(\alpha^G_{E,h} + \psi^G_{E,h}(L)X_{t-1} + \beta^{G+}_{E,h}FE^+_{t|t-1} + \beta^{G-}_{E,h}FE^-_{t|t-1}) + \varepsilon_{t+h}\ , \qquad (9) \end{aligned}$$

This is in complete analogy to equation (8) above. Therefore, assuming that the trend growth of output and government spending are both equal to the real interest rate, $g^Y = g^G \equiv r$, the EC-FM becomes:

$$M_t = m_t - \sum_{h=0}^{H-1}(H-h)\frac{\delta g^G_{t+h}}{gss_t} = m_t - \sum_{h=0}^{H-1}(H-h)\left[F(z_{t-1})(\beta^{G+}_{R,h} + \beta^{G-}_{R,h}) + (1-F(z_{t-1})(\beta^{G+}_{E,h} + \beta^{G-}_{E,h})\right]$$

Again, we show $M_t = M^{ALL}_t$, M^+_t, M^-_t, corresponding to the three cases of $\beta^{G+}_{i,h} = \beta^{G-}_{i,h}$, $\beta^{G-}_{i,h} = 0$ and $\beta^{G+}_{i,h} = 0$, respectively, for $i = R, E$.

4 Empirical Results

We first report key statistics related to the PVIR-FMs, over two horizons (H=4,8 quarters), using the original shocks; see Table 1a. A reminder that these give the present value of output effects arising (in $)

from an unanticipated government spending shock equal to $1. The present-value effect of an individual shock is below unity for four quarters (H=4), but it exceeds that by a big margin in the case of eight quarters. This is so for all types of shock, whether pooled (all), negative or positive. Thus, one first result is that it takes a few quarters for the full effect of government spending to be felt on output. Regarding the differential between positive and negative shocks, the key question we ask in this paper, we find that in the four-quarter horizon, the negative shocks have a larger impact; but this is reversed in the eight-quarter horizon, when positive shocks have a greater impact. Thus, the effect of the negative shocks is sharper in shorter horizons. The persistence of the effects of fiscal consolidations has been pointed out by Fatás and Summers (2018); here, we show that the effects of both fiscal expansions and consolidations are persistent.

A further result concerns the strong counter-cyclicality of these impulse response multipliers, as can be seen in Figures (1a,b); their correlation coefficient with Hodrick-Prescott-filtered output (y_t) is around -0.25. This result will be seen to be robust below. In other words, the multipliers are high during recessions and low during expansions. This finding, noted in previous literature, is confirmation of the basic macroeconomics discussed above; namely that fiscal shocks have a greater effect when there is slackness in the economy. Furthermore, in the H=4 case, the PVIR-FM of the contractionary shocks has a greater variance than that of the positive shocks. This enhances the stronger effect of the negative shocks during recessions. In general, while the estimates are low much of the time, they rise sharply during recessions; in the four-quarter horizon, to about 2 around 1991 and 2001 and to as much as 6 during 2007-9; the corresponding figures in the eight-quarter horizon case are 10 and 25. The result is that the effectiveness of government spending as a stabilisation tool rises sharply when it is most needed, i.e. during recessions.

Fourthly, and continuing, shocks of all signs occasionally have an impact with a negative sign; such effects occur about 20% of the time, always during expansions. Primarily, this is the case with negative shocks, which during such episodes have an expansionary effect; we find here evidence of 'expansionary fiscal contractions' suggested by a strand in earlier literature. This effect arises, the argument goes, as a current consolidation generates expectations of a better shape concerning public finances, thus less future taxation and more future growth, which has a feedback on current growth. The issue remains hotly debated and some of these findings have been critical revisited (see Hernandez de Cos and Moral-Benito, 2013, and Perotti, 2013, for critical discussion and references to the earlier literature). One contribution of this paper is to offer a reconciliation between the conflicting results: While a fiscal consolidation (austerity) normally has contractionary effects, during booms, it may on occasion produce expansionary effects. In Figues 1a (i, ii), we show graphically the PVIR-FMs presented in Table 1a in summary form.

Table 1a: Summary statistics of the PVIR-FMs; original shocks (gss_t)

		All shocks (m_t^{ALL})	Positive shocks (m_t^{+})	Negative shocks (m_t^{-})
H=4	Average	0.93	0.77	0.84
H=4	St.dev.	1.67	1.38	1.83
H=4	Corr(m_t,y_t)	-0.27	-0.27	-0.27
H=4	Max	7.11	5.82	7.61
H=4	Min	-1.34	-1.11	-1.66
H=8	Average	4.97	4.98	4.72
H=8	St.dev.	6.08	6.34	5.07
H=8	Corr(m_t,y_t)	-0.27	-0.27	-0.26
H=8	Max	27.34	28.30	23.33
H=8	Min	-3.23	-3.58	-2.08

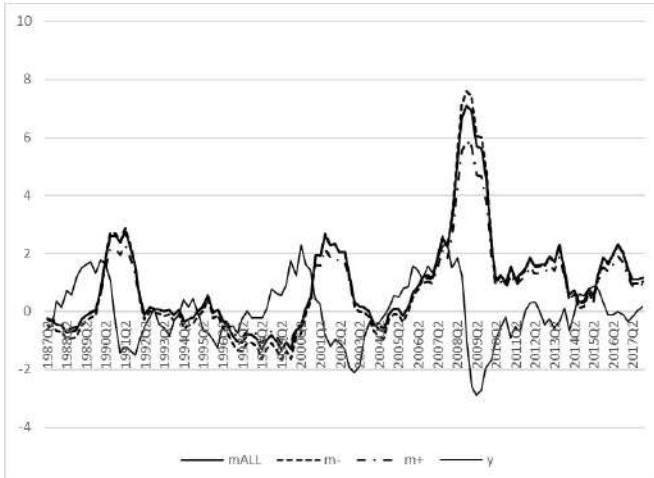

Figure 1a(i): Plots of the PVIR-FMs, original shocks (H=4)

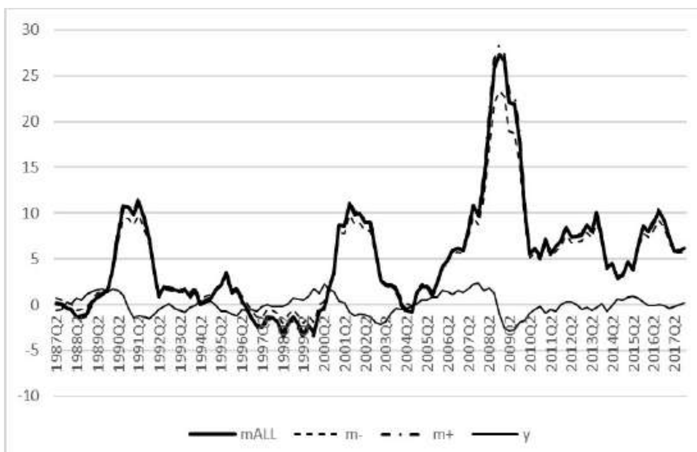

Figure 1a(ii): Plots of the PVIR-FMs, original shocks

(H=8)

Table 1b: Summary statistics of the EC-FMs, original shocks (gss_t)

		All shocks (M_t^{ALL})	Positive shocks (M_t^{+})	Negative shocks (M_t^{-})
H=4	Average	0.03	−0.01	0.07
H=4	St.dev.	0.05	0.05	0.08
H=4	Corr(m_t,y_t)	0.29	0.29	−0.30
H=4	Max	0.10	0.06	0.37
H=4	Min	−0.16	−0.21	−0.03
H=8	Average	0.05	0.01	0.11
H=8	St.dev.	0.13	0.13	0.01
H=8	Corr(m_t,y_t)	0.29	0.29	0.16
H=8	Max	0.21	0.18	0.11
H=8	Min	−0.41	−0.44	0.08

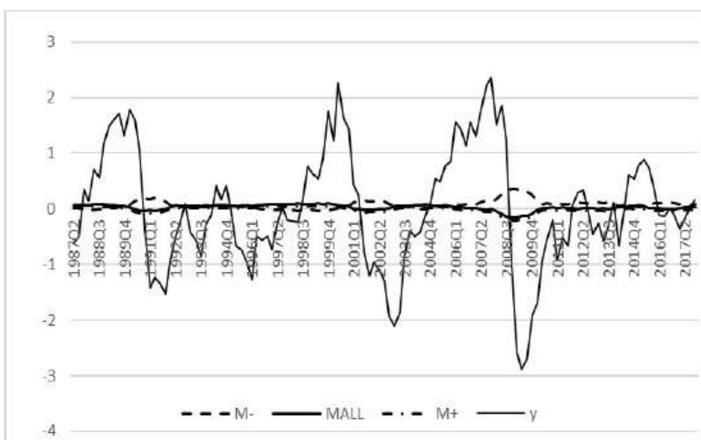

Figure 1b(i): Plot of the PVIR-FMs, original shocks (H=4)

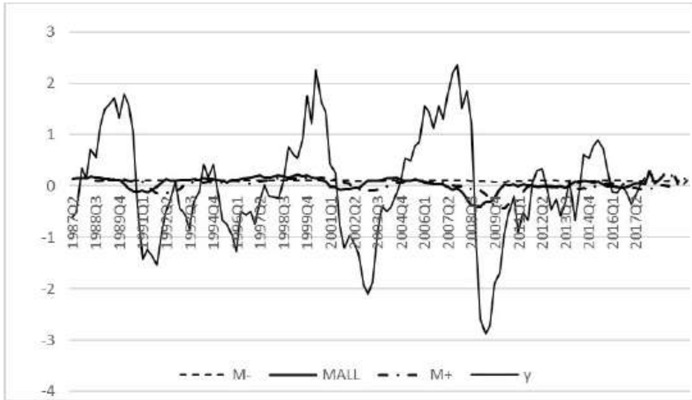

Figure 1b(ii): Plots of the PVIR-FMs, original shocks

(H=8)

Table 1b summarise the EC-FM arising out of the original shock. Several results become apparent. Firstly, again there is a difference between the estimates for four- and eight-quarter horizons. When H=4, the difference between negative and positive shocks is quite sharp. On average, $M_t^+ = -0.01$, while $M_t^- = 0.07$. Furthermore, the procyclicality of M_t^+ implies that, during recessions, the output effect of the fiscal shock rises but less so than the effect on spending; hence M_t^+ falls. But M_t^-rises during recessions - to about 0.75 around 1991 and 2001 and more than 1.5 around 2008. The conclusion from these estimates is that not only are the effects of the positive and negative shocks different; their state-dependence also differs sharply. As a corollary, negative shocks during recessions are quite damaging to output. In the case of a longer horizon (H=8), the same difference in magnitude is evident between the EC-FMs of positive and negative shocks (0.1 and 0.11, respectively). Here our results echo Fatás and Summers (2018) in finding the persistent effects of fiscal consolidations. However, both M_t^+ and M_t^- are procyclical, in contrast to the H=4 case. With respect to negative shocks, in particular, these multipliers suggest that a \$1 fall in fiscal spending crowds out \$0.11 of private spending (over 8 quarters, as a present value); while the corresponding figure is \$0.07 in the H=4 case. We return below to the question of whether the difference between positive and negative shocks is statistically significant; see Table 4 and surrounding discussion. Figues 1b (i, ii) show graphically these EC-FMs.

We now return to the specification of the fiscal (spending) shocks. As pointed out by Ramey (2019), it is possible that the forecast error as presented in statistics may not be white noise; by potentially being correlated with other variables, it may not represent a genuinely independent innovation in fiscal policy. To investigate this, we show estimates based on the same model and estimation method, but different shocks. Our first variant is based on shock produced by filtering out any correlation of $FE^{ALL}_{t|t-1}$ with detrended output (y_t); in other words, the shock is the error term (e_t) from the regression:

$$FE^{ALL}_{t|t-1} = \alpha + \gamma y_t + e^{ALL}_{t|t-1}$$

We then let the shock be: $gss'_t = e^{ALL}_{t|t-1}$, $e^{-}_{t|t-1}$, $e^{+}_{t|t-1}$, i.e. by filtering out positive or negative values, in complete analogy as before. The interpretation of the resulting PVIR-FMs (shown in Table 2a) and EC-FMs (Table 2b) is the same. The corresponding Figures are 2a (i, ii) and 2b (i, ii). Regarding PVIR-FMs, the results are similar to those in Table 1a, in that the effect of negative shocks is higher than that of the positive shocks in the H=4 case (but slightly lower than the all-shocks case); in fact, all values are somewhat higher than in Table 1a. In the H=8 case, again the effect of positive shocks is somewhat higher (as in Table 1a). In addition, all PVIR-FMs are countercyclical, with the same correlation coefficient (of the order of -0.27). The EC-FM of Table 2b also shows a greater multiplier for the negative shocks in the short horizon (H=4) but only marginally so in the longer horizon (H=8). In other words, all shocks have persistent effects, not only (or not even predominantly) the consolidations. A notable difference with the results of Table 1b is that now these multipliers are countercyclical in all cases - both horizons and all types of shock.

Table 2a: Summary statistics of the PVIR-FMs, shocks uncorrelated with output (gss'_t)

		All shocks (m_t^{ALL})	Positive shocks (m_t^{+})	Negative shocks (m_t^{-})
H=4	Average	1.04	0.84	1.00
H=4	St.dev.	1.73	1.43	1.83
H=4	Corr(m_t,y_t)	−0.27	−0.27	−0.27
H=4	Max	7.43	6.13	7.76
H=4	Min	−1.30	−1.11	−1.50
H=8	Average	4.98	5.03	4.47
H=8	St.dev.	6.19	5.97	4.86
H=8	Corr(m_t,y_t)	−0.27	−0.27	−0.26
H=8	Max	27.75	27.00	22.31
H=8	Min	−3.37	−3.01	−2.05

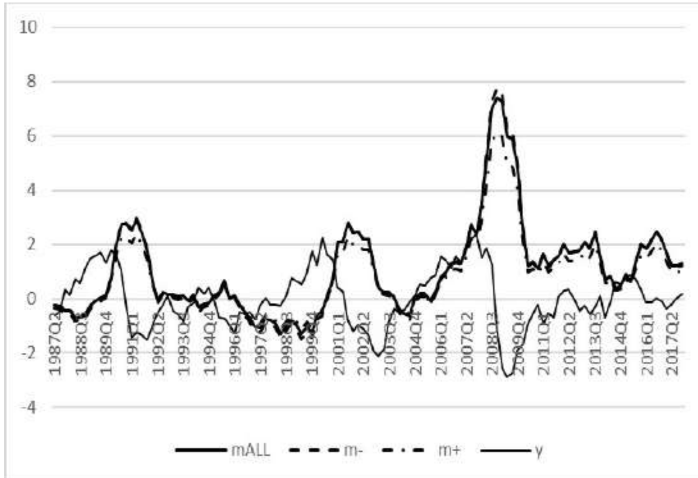

Figure 2a(i): Plots of PVIR-FMs, shocks uncorrelated with output (gss'_t) (H=4)

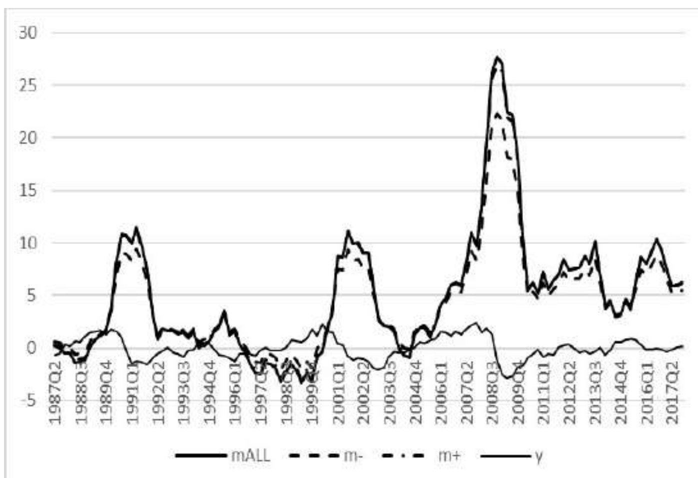

Figure 2a(ii): Plots of PVIR-FMs, shocks uncorrelated with output (gss'_t) (H=8)

Table 2b: Summary statistics of the EC-FMs, shocks uncorrelated with output (gss'_t)

		All shocks (Γ_t^{ALL})	Positive shocks (Γ_t^{+})	Negative shocks (Γ_t^{-})
H=4	Average	0.28	0.19	0.31
H=4	St.dev.	0.38	0.31	0.53
H=4	Corr(m_t,y_t)	−0.27	−0.27	−0.27
H=4	Max	1.68	1.34	2.27
H=4	Min	−0.24	−0.23	−0.41
H=8	Average	0.64	0.62	0.64
H=8	St.dev.	0.63	0.61	0.59
H=8	Corr(m_t,y_t)	−0.26	−0.26	−0.26
H=8	Max	2.98	2.86	2.83
H=8	Min	−0.21	−0.20	−0.16

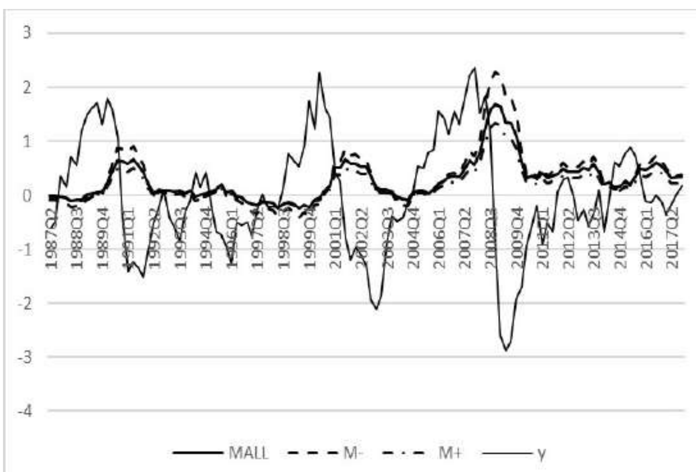

Figure 2b(i): Plots of EC-FMs, shocks uncorelated with the output (gss'_t) (H=4)

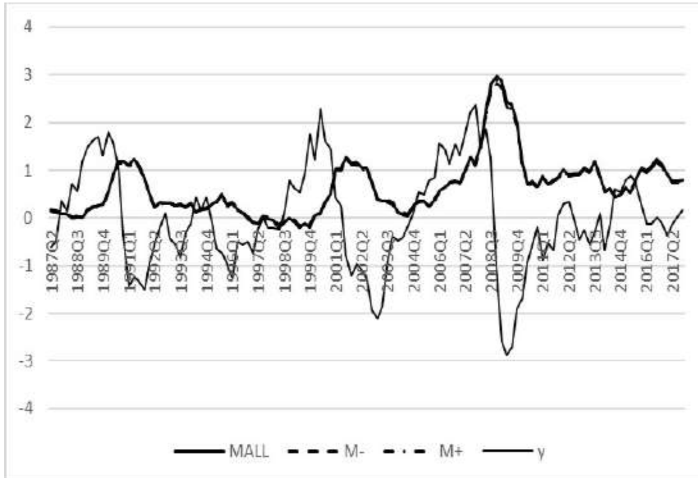

Figure 2b(ii): Plots of EC-FMs, shocks uncorrelated with

output (gss_t') (H=8)

A second variant of the shock specification postulates an AR(1) structure for the forecast error $FE_{t|t-1}^{ALL}$ and filters out any predictable component accordingly; in other words, the shock is the error term (v_t) from the regression:

$$FE_{t|t-1}^{ALL} = \alpha + \beta FE_{t-1|t-2}^{ALL} + v_{t|t-1}^{ALL}$$

We then let the shock be: $gss_t^{''} = v_{t|t-1}^{ALL}$, $v_{t|t-1}^{-}$, $v_{t|t-1}^{+}$, again filtering out positive or negative values as before. The PVIR-FM and EC-FM (Tables 3a and 3b, respectively) are interpreted in the same way. The key results of Table 3a are the same, except that all effects are now higher. In particular, the effect of PVIR-FM in H=4 is now clearly higher than unity for all shocks; and the effects of H=8 are correspondingly higher. Otherwise, we make similar observations: Negative shocks produce higher PVIR-FMs under H=4; and all effects are counter-cyclical. The EC-FM in Table 3b also shows a greater multiplier for the short horizon (H=4) but a smaller one for the longer horizon (H=8). Similar points about persistence can be made as in the context of previous Tables. In common with Table 2b and in contrast to the results of Table 1b, these multipliers are countercyclical in all cases - both horizons and all types of shock. The corresponding graphs are given in Figures 3a (i, ii) and 3b (i, ii).

Table 3a: Summary statistics of the PVIR-FMs, shocks as residuals from an AR1 process of the original shocks ($gss_t^{''}$)

		All shocks (m_t^{ALL})	Positive shocks (m_t^{+})	Negative shocks (m_t^{-})
H=4	Average	1.06	1.18	1.32
H=4	St.dev.	1.69	1.89	2.71
H=4	Corr(m_t,y_t)	−0.27	−0.27	−0.2
H=4	Max	7.30	8.17	11.31
H=4	Min	−1.24	−1.39	−2.38
H=8	Average	5.41	8.50	6.14
H=8	St.dev.	6.30	10.65	5.92
H=8	Corr(m_t,y_t)	−0.26	−0.27	−0.26
H=8	Max	28.57	47.71	27.85
H=8	Min	−3.06	−5.87	−1.77

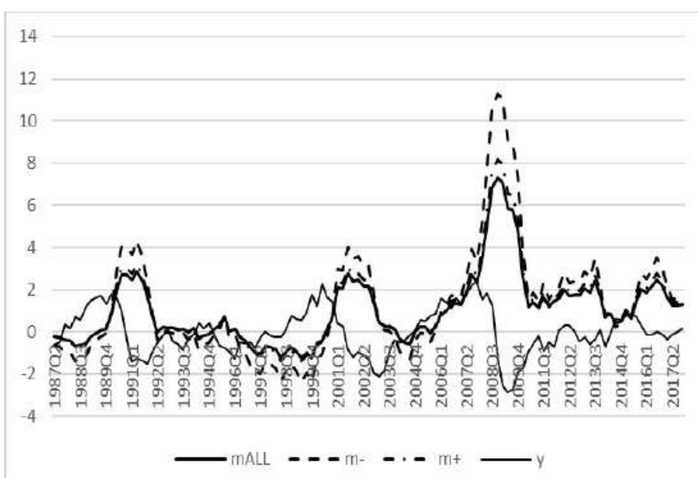

Figure 3a(i): Plots of PVIR-FMs, shocks as residuals from an AR1 process of the original shocks ($gss_t^{''}$) (H=4)

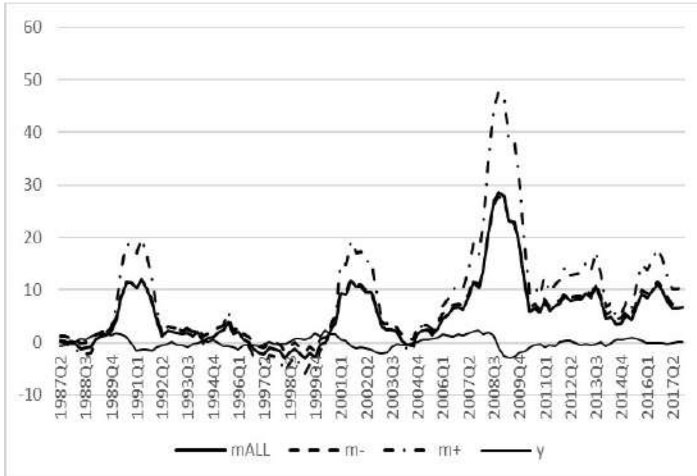

Figure 3a(ii): Plots of PVIR-FMs, shocks as residuals from an AR1 process of the original shocks ($gss_t^{''}$) (H=8)

Table 3b: Summary statistics of the EC-FM, shocks as residuals from an AR1 process of the original shocks ($gss_t^{''}$)

		All shocks (M_t^{ALL})	Positive shocks (M_t^{+})	Negative shocks (M_t^{-})
H=4	Average	0.24	0.23	0.33
H=4	St.dev.	0.37	0.37	0.63
H=4	Corr(m_t,y_t)	−0.27	−0.27	−0.27
H=4	Max	1.62	1.60	2.67
H=4	Min	−0.26	−0.27	−0.53
H=8	Average	0.66	0.95	0.77
H=8	St.dev.	0.62	1.06	0.49
H=8	Corr(m_t,y_t)	−0.26	−0.26	−0.24
H=8	Max	2.97	4.86	2.59
H=8	Min	−0.19	−0.48	0.12

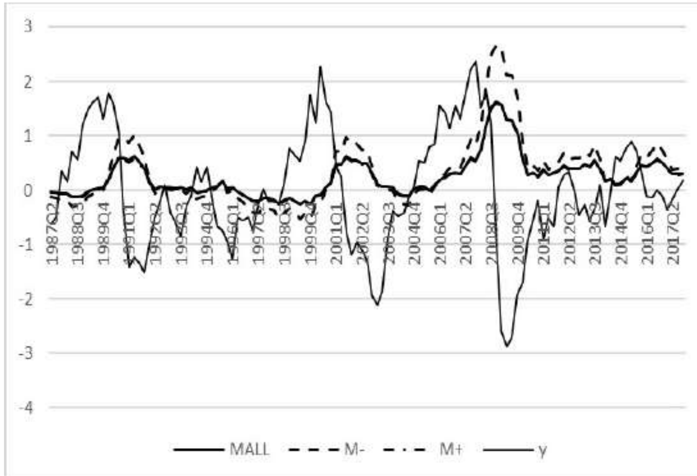

Figure 3b(i): Plots of EC-FMs, shocks as residuals from an

AR1 process of the original shocks ($gss_t^{''}$) (H=4)

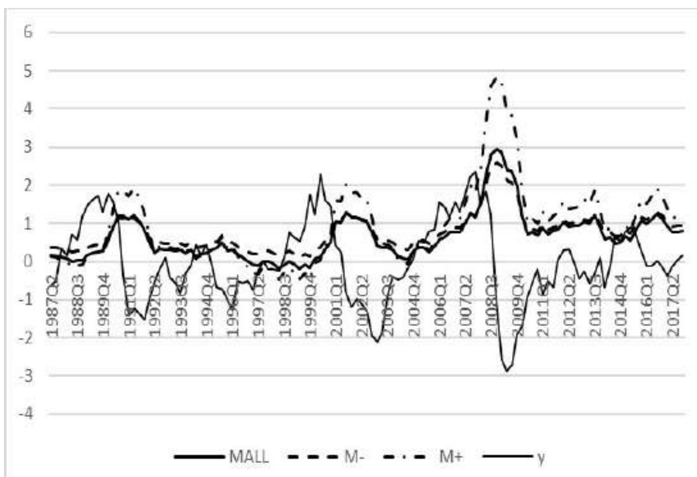

Figure 3b(ii): Plots of EC-FMs, shocks as residuals from an

AR1 process of the original shocks ($gss_t^{''}$) (H=8)

We now investigate further our key point that the effect of the contractionary shocks is higher on average than that of the expansionary shocks. Assuming that the timing of positive versus positive shocks is random,[10] then a test of equality of two sample means is based on the statistic $T = \frac{\sqrt{\frac{n_1 n_2}{n_1+n_2}}(\bar{X}_1 - \bar{X}_2)}{\sqrt{\frac{(n_1-1)S_1^2+(n_2-1)S_2^2}{n_1+n_2-2}}}$,

[10]Hernandez de Cos and Moral-Benito (2013) points out that the timing of fiscal consolidations is not exogenous (as

where n_1, n_2 are the sample sizes, $\bar{X}$, $\bar{X}_2$ the sample means and S_1^2, S_2^2 the sample variances (Mood, Graybill and Boes, 1974, p. 435). This statistic follows the t-distribution with $n_1 + n_2 - 2$ degrees of freedom. As we allow for either possibility, the test is two-sided; for a sample size of about 120, the critical value at 2.5% significance is 1.98. Table 4 reports the results.

Table 4: Test of sample mean equality; see the text for details.

		statistic (sample means)	
Model/Horizon		$m_t^- - m_t^+$	$M_t^- - M_t^+$
Original shocks (T. 1a, b)	H=4	0.22	7.45
	H=8	−0.25	5.73
Uncorrelated shocks (T. 2a, b)	H=4	0.54	1.57
	H=8	−0.58	0.19
Residuals from AR1 (T. 3a, b)	H=4	0.32	1.07
	H=8	−1.55	−1.19

Compared to the critical value of 1.98, the null of equality is rejected only once, in the EC-FM mutliplier with the original shocks. In that case, the effect of negative shocks is significantly higher (with quite a margin) than that of the positive ones. In the rest of the grid, the numbers show no significant difference between the samples. Yet, these numbers do indicate two patterns: Firstly, the negative shocks have a higher effect uniformly in the shorter horizon case and even in the longer run in some cases. Secondly, the sample difference in the case of the EC-FM multipliers tends to be higher than the counterpart in the PVIR-FM case. In all, despite the absence of formal significance, we see enough of a difference between the effects of fiscal expansions and contractions to suggest that their effects are not identical, as commonly assumed. As argued in Footnote 10, the endogenous timing of consolidations if anything understates the true differences.

often assumed); consolidations are more likely to go ahead when times are good, are they are likely to stop (even temporarily) when there is a recession. Accounting for this endogeneity and reverse causality is at the heart of their ciritque of 'expansionary fiscal consolidations'. But a key inference for our purposes is that, if anything, the difference between positive and negative shocks is understated; as fiscal expansions occur in recessions, when they have their highest effects, while contractions occur in good times, when their effects are probably more muted.

5 Concluding Remarks

Fiscal policy activism is enjoying a comeback; there is now greater responsibility placed on fiscal policy to provide a stimulus during recessions. The recession due to the Covid-19 pandemic (ongoing at the time of writing, spring 2022) only serves to heighten the urgency for fiscal policy-based stabilisation. Yet, at the same time that fiscal policy is being called upon to play a stronger activist role, its effects remain debatable.

This paper is in the line of papers that attempt to identify the effects of fiscal shocks (as well as the shocks themselves). Our point of departure is the expenditure shocks that can be identified by subtracting expected from actual expenditure growth. We utilise quarterly U.S. data, 1986-2017. Most data is standard; the notable addition is expected government expenditure (growth), which has been obtained from the Survey of Professional Forecasters compiled by the Federal Reserve Bank of Philadelphia. Methodologically, we employ the smooth transition vector autoregressive model, coupled with the local projections method so as to identify impulse responses.

We present two sets of fiscal (expenditure) multipliers: the present-value impulse responses on output of an \$1 unexpected shock for two horizons (H=4,8); and the present-value output responses minus the effects (present-value impulse responses) of the shock on government spending itself for the same horizons. The latter type of multiplier is in the spirit of Mountford and Uhlig (2009) and Romer (2019) and can be informative about the cost effectiveness of the fiscal shock.

All results are in line with theory and intuition. They suggest, that (a) the fiscal consolidations on average have a numerically stronger effect than the expansionary shocks (as well as in the opposite direction); and (b) the effects of shocks are in most models countercyclical (in terms of absolute values). All this is in line with the basic premise that different theoretical multipliers (Keynesian vs. neoclassical) apply in different force to fiscal expansions versus contractions (the point of this paper), and during booms versus recessions (as shown by recent literature). Our results furthermore show (c) persistence of the effects of all shocks, positive and negative, and often higher persistence of the former (that of negative shocks has already been pointed out). Despite the lack of formal statistical significance between the sample averages of the negative and the positive shocks, we uncover enough evidence that warrants further investigation of point (a) above.

The policy implications of these findings are significant: Negative shocks have stronger effects in the short run, and particularly so during recessions, but weaker in the long run than positive shocks. Therefore, from the point of view of a fiscal authority that has the dual objective of providing a stimulus to the economy while at the same time not exacerbating a possible government debt situation (and hopefully improving it), the following strategy appears sensible: Fiscal consolidations are more painful and should best be avoided during the output troughs; instead, limited positive shocks should be applied (most powerful during recessions, as the Figures above attest). When the worst of recessions are over, then moderate consolidations should take place, in order to reverse the effects of expansions on debt and even reduce the latter, as required. In other words, the differential effects of fiscal expansions and consolidations, highlighted here, gives policy-makers a valuable extra degree of freedom. To recall the vintage Tinbergen tools-objectives theorem, where one policy tool (an undifferentiated fiscal shock) would be unable to cope with two conflicting objectives (stimulus and low debt), two essentially different tools (expansions and consolidations) will be better able to solve the dilemma. We leave it to future work to examine whether policy-makers use optimally this strategy; analysing further Hernandez de Cos and Moral-Benito's (2013) finding of the endogenous timing of consolidations. More broadly, further work will examine the effects of rising debt on the degree of fiscal activism and the question of 'fiscal space' (Romer and Romer, 2019).

References

[1] Auerbach, A.J. and Gorodnichenko, Y., 2012. Measuring the output responses to fiscal policy. American Economic Journal: Economic Policy, 4(2), pp.1-27.

[2] Auerbach, A.J. and Gorodnichenko, Y., 2013. Output spillovers from fiscal policy. American Economic Review, 103(3), pp.141-46.

[3] Auerbach, A.J. and Gorodnichenko, Y., 2017. Fiscal stimulus and fiscal sustainability (No. w23789). National Bureau of Economic Research.

[4] Blanchard, O. and Perotti, R., 2002. An empirical characterization of the dynamic effects of changes in government spending and taxes on output. The Quarterly Journal of Economics, 117(4), pp.1329-1368.

[5] Blanchard, O.J. and Leigh, D., 2013. Growth forecast errors and fiscal multipliers. American Economic Review, 103(3), pp.117-20.

[6] Blanchard, O.J. and Leigh, D., 2014. Learning about fiscal multipliers from growth forecast errors. IMF Economic Review, 62(2), pp.179-212.

[7] Canzoneri, M., Collard, F., Dellas, H. and Diba, B., 2016. Fiscal multipliers in recessions. Econ J, 126(590), pp.75-108.

[8] Chan, K.S., Tong, H., 1986. On estimating thresholds in autoregressive models. Journal of Time Series Analysis 7, pp.179-190.

[9] Cogan, J.F., Cwik, T., Taylor, J.B. and Wieland, V., 2010. New Keynesian versus old Keynesian government spending multipliers. Journal of Economic Dynamics and Control, 34, pp.281–295.

[10] Fatás, A. and Summers, L.H., 2018. The Permanent effects of fiscal consolidations. Journal of International Economics, 112, pp.238-250.

[11] Fazzari, S.M., Morley, J. and Panovska, I., 2015. State-dependent effects of fiscal policy. Studies in Nonlinear Dynamics and Econometrics, 19(3), pp.285–315.

[12] Galí, J., López-Salido, D. and Vallés, J., 2007. Understanding the effects of government spending on consumption. Journal of the European Economic Association 5, pp.227–270.

[13] Gornicka, L., Kamps, C., Koester, G. and Leiner-Killinger, N., 2019. Learning about fiscal multipliers during the European sovereign debt crisis: evidence from a quasi-natural experiment. Economic Policy, 35(101), pp.5–40.

[14] Granger, C.W. and Teräsvirta, T., 1993. Modelling non-linear economic relationships. Oxford University Press.

[15] Hall R.E., 2009. By how much does GDP rise if the government buys more output?. Brookings Papers on Economic Activity, 40(2), pp.183-249.

[16] House, C.L., Proebsting, C. and Tesar, L.L., 2020. Austerity in the aftermath of the great recession, Journal of Monetary Economics, 115, pp.37-63.

[17] Jordà, Ò., 2005. Estimation and inference of impulse responses by local projections. American Economic Review, 95(1), pp.161-182.

[18] Jordà, .Ò and Taylor, A.M., 2016. The time for austerity: estimating the average treatment effect of fiscal policy. The Economic Journal, 126(590), pp.219-255.

[19] Mood, A.M., Graybill, F.A. and Boes, D.C., 1974. Introduction to the theory of statistics. McGraw-Hill, 3rd Edition, New York.

[20] Mountford, A. and Uhlig, H., 2009. What are the effects of fiscal policy shocks?. Journal of Applied Econometrics, 24, pp.960–992.

[21] Mulligan, C.B., 2011. Simple analytics and empirics of the government spending multiplier and other 'Keynesian' paradoxes. The B.E. Journal of Macroeconomics. Berkeley Electronic Press, 11(1), Article 19.

[22] Newey, W.K. and West, K.D., 1987. Hypothesis testing with efficient method of moments estimation. International Economic Review, pp.777-787.

[23] Perotti, R., 2013. The 'austerity myth': Gain without pain?. In A. Alesina and F. Giavazzi (eds.): Fiscal policy after the financial crisis, NBER and Chicago University Press, pp.307–354.

[24] Ramey, V.A., 2011. Can government purchases stimulate the economy?. Journal of Economic Literature, 49(3), pp.673–685.

[25] Ramey, V.A., 2019. Ten years after the financial crisis: What have we learned from the renaissance in fiscal research?. Journal of Economic Perspectives, 33(2), pp.89-114.

[26] Ramey, V.A. and Zubairy, S., 2018. Government spending multipliers in good times and in bad: Evidence from US historical data. Journal of Political Economy, 126(2), pp.850-901.

[27] Romer, C.D. and Romer, D.H., 2019: Fiscal space and the aftermath of financial crises: How it matters and why. Brookings Papers on Economic Activity, 2019(1), pp. 239-331.

[28] Tenreyro, S. and Thwaites, G., 2016. Pushing on a string: US monetary policy is less powerful in recessions. American Economic Journal: Macroeconomics, 8(4), pp.43-74.

[29] Teräsvirta, T., 1994. Specification, estimation and evaluation of smooth transition autoregressive models. Journal of the American Statistical Association 89(425), pp.208-218.

[30] Woodford, M.D., 2011. Simple analytics of the government expenditure multiplier. American Economic Journal: Macroeconomics, 3(1), pp.1-35.

[31] Zubairy, S., 2014. On fiscal multipliers: Estimates from a medium scale DSGE model. International Economic Review, 55(1), pp.169-195.

School of Economics and Finance

School of Economics and Finance Queen Mary University of London
Mile End Road
London E1 4NS
Tel: +44 (0)20 7882 7356
Fax: +44 (0)20 8983 3580
Web: www.econ.qmul.ac.uk/research/workingpapers/