

# Do Fiscal Multipliers Depend on Fiscal Positions?

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VERY PRELIMINARY AND INCOMPLETE

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*Abstract:* This paper presents estimates of fiscal multipliers that depend on fiscal position. We employ an Interactive Panel Vector Auto Regression (IPVAR) model and use a large set of advanced and developing economies. Our results suggest that the size of the fiscal multiplier indeed depends on fiscal position: fiscal multipliers are larger when fiscal position is strong (i.e. when government debt and deficits are low) than weak. For instance, the long run multiplier can be as large as unity when fiscal position is strong, while it can be negative when fiscal position is weak. This finding holds even after controlling for business cycle effects, which suggests that fiscal position is a unique conditioning state that determines the effectiveness of fiscal policy. We also provide evidence that the state-dependent effects of fiscal position on multipliers are attributable to a combination of two factors: first, an interest rate channel where higher borrowing costs, due to investors' increased perception of credit risks when stimulus is implemented from a weak initial fiscal position, crowd out private investment; second, a Ricardian channel where households reduce consumption in anticipation of future fiscal adjustments.

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## 1. Introduction

During the Great Recession of 2008-09, many countries around the world - both advanced and developing - deployed fiscal policy to support activity. As a result, government debt and deficits increased in many countries, and they remain elevated now (World Bank 2015). Against this backdrop of weak fiscal position associated with high levels of debt and deficits, there has been a revival of interest in fiscal policy as a macroeconomic stabilization tool.<sup>1</sup> Yet, there is scant evidence regarding the extent to which fiscal policy is effective in stimulating the economy during times of weak fiscal position. The objective of this paper is to fill in this gap in the literature. In particular, we ask: do fiscal multipliers depend on fiscal positions?<sup>2</sup>

The central question we ask in this paper follows the finding in recent literature that an “average” fiscal multiplier which is assumed to apply universally is irrelevant and that multipliers can depend on specific macroeconomic conditions. For instance, beginning with the work of Auerbach and Gorodnichenko (2012b), recent papers have established that multipliers tend to be larger during recessions than during expansions (Bachmann and Sims 2012; Canelon and Lieb 2013; Owyang, Ramey, and Zubairy 2013). The notion that fiscal multipliers can depend on the state of the business cycle is well grounded in theory. During recessions, the multiplier effect from government spending can rise due to slack in labor markets, larger frictions in financial markets, and an increase in constrained agents.<sup>3</sup> The literature has, thus far, offered a convincing

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<sup>1</sup> Among the advanced economies, fiscal policy has received much attention given the crisis-induced zero lower bound environment that has constrained conventional monetary policy (Blanchard et al. 2010, Delong and Summers 2012).

<sup>2</sup> A more basic reason why fiscal position matters is that it is related to the *availability* of fiscal policy as a countercyclical tool. That is, a strong fiscal position - characterized by low debt and deficits - makes available the room for implementing fiscal stimulus. This paper addresses a somewhat different question: how fiscal position determines the *effectiveness* of fiscal policy.

<sup>3</sup> These effects may be further amplified in the special case where monetary policy is also constrained by the zero lower bound (Christiano, Eichenbaum, and Rebelo 2011; Denes, Eggertsson, and Gilbukh 2013; Erceg and Linde 2014).

case that the phase of the business cycle should be regarded as a key conditioning state that may influence the efficacy of fiscal policy.

Economic theory, however, does not limit the conditioning state to the phase of the business cycle alone. In fact, theory suggests that fiscal position of the government, as a unique state in itself, can be another important determining factor for the size of fiscal multipliers. This state-dependency of multipliers on fiscal position can operate via two channels. First, a *Ricardian channel*: when a government with a weak fiscal position implements a fiscal stimulus, households expect tax increases sooner than in an economy with wide fiscal position (Sutherland 1997; Perroti 1999). The perceived negative wealth effect encourages households to cut consumption and save, thereby weakening the impact of the policy on output. Thus, the net effects of fiscal policy on output, the size of the fiscal multiplier, may be negligible or even negative.<sup>4</sup> Second, an *interest rate channel*: when the fiscal position is weak, fiscal stimulus can increase lenders' perceptions of sovereign credit risk.<sup>5</sup> This raises sovereign bond yields and hence, borrowing costs across the whole economy (Corsetti et al. 2013).<sup>6</sup> This, in turn, crowds out private investment and consumption, reducing the size of the multiplier. Therefore, both channels suggest that fiscal policy is less effective when the fiscal stimulus is implemented from a weak initial fiscal position.

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<sup>4</sup> Sutherland (1997) formalizes this idea by postulating that there exists a debt threshold at which the government makes fiscal adjustments, via increasing taxes, to remain solvent. Given a high initial level of government debt that is closer to that threshold, households expect higher taxes to be more eminent, resulting in negative wealth effects, when the government conducts an expansionary fiscal policy. In Perotti (1999), such expectations of higher taxes can also result in increased tax distortions which are an additional source of negative wealth effects.

<sup>5</sup> Bi, Shen, and Yang (2014) highlight the theoretical mechanisms how sovereign spreads can depend on the level of government debt. In particular, they establish that sovereign risk premia can increase nonlinearly as government indebtedness rises.

<sup>6</sup> An important mechanism in Corsetti et al. (2013) is that the central bank could prevent risk premia from rising through expansionary monetary policy. Thus, for this mechanism to strictly yield state-dependent fiscal multipliers there must be some constraints on monetary policy. In this regard, Corsetti et al. (2013) highlight the zero lower bound constraint. In practice, any other constraints on monetary policy like high inflation and central bank credibility issues would make the interest rate channel operational.

To estimate fiscal multipliers that depend on fiscal position, we use an Interacted Panel Vector Autoregressive (IPVAR) model.<sup>7</sup> The model is essentially an extension of an otherwise standard panel structural VAR (SVAR), with the distinction that the VAR coefficients interact with (observable) state variables. Consequently, these coefficients become time-varying, and evolve endogenously according to these states. This results in a framework where the VAR dynamics and hence, the fiscal multipliers are conditional on the state variables which we take to be the fiscal state. More importantly, since the state-dependency is captured by making use of the full sample, this nonlinear approach allows us to maintain enough degrees of freedom, thus allowing us to draw sharper inferences. This feature of the model is particularly useful when conditioning on multiple states of interest: a feature we exploit when we jointly condition on the fiscal position and the phase of the business cycle. The latter exercise allows us to evaluate whether the fiscal position is a unique state, different from the phase of the business cycle, which determines the size of the fiscal multipliers.

Applying our empirical methodology to a dataset that covers a large set of 34 countries (19 advanced and 15 developing), at the quarterly frequency over the period 1980:1 – 2014:1, we empirically establish that fiscal position is a key conditioning state that determines the size of the fiscal multipliers. In particular, estimated multipliers are systematically smaller when the fiscal position is weak (i.e. government debt is low), and vice versa when it is strong. In addition, we show that the state-dependency of multipliers on fiscal position is independent of business cycle effects. That is, while we find multipliers to be larger during recessions than expansions (consistent with Auerbach and Gorodnichenko 2012b), the weaker (stronger) multiplier effect that derives from a weak (strong) fiscal position applies even when the economy is experiencing a recession or an expansion. Furthermore, we provide empirical evidence that such state-dependent effects operate through the two channels highlighted above. When the government conducts expansionary fiscal policy during times of high debt, private sector scales back on consumption in credible anticipation of future tax pressures due to the weak state of public finances (Ricardian channel) and private investment is suppressed plausibly due to an increase in

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<sup>7</sup> The model has been used in various areas of empirical macroeconomics: exchange rates (Towbin and Weber 2013); capital flows (Sa, Towbin, and Wieladek 2014); fiscal policy (Nickel and Tudyka 2014).

economy-wide interest rate as perceptions of heightened sovereign risk become stronger (interest rate channel).

A number of recent empirical papers have begun to estimate the importance of fiscal positions for fiscal multipliers. For instance, Ilzetzki, Mendoza, and Vegh (2013) include measures of fiscal fragility in their analyses of multipliers. Unlike us, however, fiscal considerations are not the centerpiece of their analyses, and so they apply specific debt thresholds, as opposed to our more agnostic stance that allows these thresholds to emerge naturally from the data. Using a similar IPVAR approach like ours, Nickel and Tudyka (2014) provide estimates of multipliers that depend on the fiscal position for high-income European economies. However, they make no effort to clearly distinguish between the state of the business cycle and fiscal position. There is, therefore, an indeterminacy over whether the state-dependency of the multipliers is uniquely attributable to the latter. Using a different econometric methodology than ours, Auerbach and Gorodnichenko (2012a) discuss the joint conditioning exercise and find that large government debt reduces the stimulative effects of expansionary fiscal policy even during recessions. But their identification strategy requires data on government consumption forecast errors, which essentially limits the study to only OECD countries.

Our paper makes three contributions. First, by clearly distinguishing between the state of the business cycle and fiscal position, we establish that fiscal position is a unique state that determines the size of the fiscal multiplier. Second, we show the empirical relevance of the transmission mechanisms that underlay the state-dependent effects due to fiscal position: the Ricardian channel and the interest rate channel. Third, compared to previous studies, our sample includes a larger set of countries covering advanced and developing economies, thus providing a much more general result on the state-dependent effects due to fiscal position.

The rest of the paper is organized as follows. Section 2 presents the econometric methodology. Here, we discuss the IPVAR model, the identification strategy, and the database. We present estimates of state-dependent multipliers in Section 3. In Section 4, we discuss the transmission mechanisms that highlight the Ricardian and the interest rate channels. Section 5 discusses robustness exercises and Section 6 concludes.

## 2. Empirical Methodology

### 2.1. Econometric Model

A standard panel structural VAR (SVAR) estimates a single set of parameters which then yields an “average” or unconditional multiplier. The goal in this paper is to go beyond the unconditional multiplier, and investigate how multipliers can depend on specific macroeconomic conditions, in particular fiscal position of governments. For that, we deploy the Interacted Panel Vector Autoregressive (IPVAR) model where the main innovation, with respect to a standard panel SVAR, is that the model coefficients vary deterministically according to conditioning (state) variables. Thus, the IPVAR results in a framework where model dynamics and hence, estimated multipliers are conditional on the state variables. And by choosing the conditioning variable to be a measure of fiscal position in the IPVAR, we estimate multipliers that depend on fiscal position.

The IPVAR model, in its structural form, is represented by:

$$\begin{bmatrix} 1 & 0 & 0 & 0 \\ \alpha_{0,it}^{21} & 1 & 0 & 0 \\ \alpha_{0,it}^{31} & \alpha_{0,it}^{32} & 1 & 0 \\ \alpha_{0,it}^{41} & \alpha_{0,it}^{42} & \alpha_{0,it}^{43} & 1 \end{bmatrix} \begin{bmatrix} gc_{it} \\ gdp_{it} \\ ca_{it} \\ reer_{it} \end{bmatrix} = \sum_{l=1}^L \begin{bmatrix} \alpha_{l,it}^{11} & \alpha_{l,it}^{12} & \cdots & \alpha_{l,it}^{14} \\ \alpha_{l,it}^{21} & \alpha_{l,it}^{22} & \cdots & \alpha_{l,it}^{24} \\ \vdots & \vdots & \ddots & \alpha_{l,it}^{34} \\ \alpha_{l,it}^{41} & \alpha_{l,it}^{42} & \cdots & \alpha_{l,it}^{44} \end{bmatrix} \begin{bmatrix} gc_{it-l} \\ gdp_{it-l} \\ ca_{it-l} \\ reer_{it-l} \end{bmatrix} + X_{it}F + U_{it}, \quad (1)$$

where for a given country  $i$  in period  $t$ ,  $gc$  represents real government consumption,  $gdp$  real gross domestic product (GDP),  $reer$  the real effective exchange rate, and  $ca$  current account balance (as a share of GDP).

We take government consumption as the fiscal instrument and we track the effects of fiscal policy in terms of GDP. Separately, we check the robustness of our results by tracking fiscal outcomes in terms of private consumption and private investment (Section 4). Real effective exchange rate and the current account are included in the model to account for open economy features that characterize most of the countries in our sample. The matrix  $X$  captures additional

controls, which include the time-invariant country fixed effects, and  $U$  is a vector of uncorrelated, *i.i.d.* (structural) shocks. The shock corresponding to government consumption is the fiscal shock. Following Ilzetki, Mendoza, and Vegh (2013), we set the lag length as  $L = 4$ .<sup>8</sup>

The impact matrix  $A_0$  (matrix of coefficients on the left hand side of Equation 1) is lower triangular. This along with the ordering of the variables in the VAR is related to our identification scheme (discussed in detail in the next section). Both the impact matrix  $A_0$  and the coefficient matrices  $A_l$ ,  $l = 1, \dots, L$  (on the right-hand side of Equation 1) comprises time-varying model coefficients that, for any given entry in row  $j$  and column  $k$ , evolve deterministically according to:

$$\alpha_{l,it}^{jk} = \beta_{1,l}^{jk} + \beta_{2,l}^{jk} f_{s_{it}}, \quad (2)$$

where  $f_s$  refers to the fiscal position. Our baseline measure of the fiscal position is the government debt-to-GDP ratio. While the literature has used a variety of measures in this regard, our choice is in line with theoretical macro models, where government debt is the modal state variable.<sup>9</sup> Since measures of fiscal position are endogenous and move in tandem with the business cycle, we take lagged moving averages of all our fiscal measures to control for business cycle effects.<sup>10</sup> Equations (1) and (2) jointly denote the IPVAR system. When the law of motion in Equation (2) is suppressed, the IPVAR reduces to a standard panel SVAR which we use to estimate the unconditional multipliers. The latter serve as a baseline against which we compare the conditional multipliers from the IPVAR.

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<sup>8</sup> We use the same lag length of 4 when we report results for specific country groups as well. Ilzetki, Mendoza, and Vegh (2013) note that the optimal lag length in the VAR varies across country groups. Choosing the same lag length (that equals 4) ensures that differences in the multipliers are not attributable to the lag structure of the VAR.

<sup>9</sup> For instance, while Riera-Crichton, Vegh, and Vuletin (2014) condition multipliers on fiscal balances, Auerbach and Gorodnichenko (2012a), Ilzetki, Mendoza, and Vegh (2013), and Nickel and Tudyka (2014) condition on government debt. For robustness, we present results when fiscal balances are the conditioning variable.

<sup>10</sup> In particular, we take the 5-quarter moving average of the fiscal position, and then lag it by 2 quarters. Given the average length of the business cycle, this effectively allows us to abstract from changes in the fiscal state that may potentially be contaminated by cyclical movements. We allay any residual endogeneity concerns by jointly conditioning on the fiscal position and the phase of the business cycle.

The matrices  $A_l$ ,  $l = 0, \dots, L$  determine the effects of structural shocks on the dynamics of endogenous variables in the VAR system. And by conditioning the law of motion of the coefficients in these matrices on the fiscal position, as in Equation 2, we are allowing those effects to depend on the fiscal position. This scheme allows us to calculate impulse responses and hence estimates of fiscal multipliers conditional on a given level of fiscal position.<sup>11</sup> When estimating the VAR system, we make use of the full sample. This enables us to circumvent the degrees-of-freedom challenge that frustrates the ability of existing empirical models to account for joint conditioning on multiple states.

As standard in the literature, we compute the cumulative fiscal multiplier at horizon  $T$  as the discounted cumulative change in output until horizon  $T$ , as the discounted cumulative government consumption increases by one unit. That is,

$$\text{Multiplier}(T) = \frac{\sum_{t=0}^T (1+r)^{-t} \Delta g d p_t}{\sum_{t=0}^T (1+r)^{-t} \Delta g c_t}, \quad (3)$$

where  $r$  denotes the interest rate. We utilize the median short-term rate in the sample for this purpose which is about 7.4 percent.

From the multiplier equation (3), the impact multiplier is obtained by setting  $T = 0$  and the long-run multiplier by setting  $T$  at an arbitrarily large number, which is taken to be  $T = 20$  (5 years) in our exercise. At  $T = 20$ , impulse responses in our model by and large revert to their unconditional means, and so we take this to be representative of the long run. In addition, we specifically report multipliers corresponding to one-year ( $T = 4$ ) and 2-year ( $T = 8$ ) horizons, when the fiscal multipliers typically peak. To calculate the fiscal multiplier using the coefficient

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<sup>11</sup> More precisely, the impulse response calculation assumes that the initial level of fiscal position on which the impulses are conditioned prevails throughout the impulse horizon. In practice, fiscal position can also respond to the fiscal shock and its dynamics can have implications for fiscal multipliers (see Ramey and Zubairy (2014) for a similar point). Since fiscal position is not an endogenous variable in our IPVAR model, calculating impulse responses while taking into account the endogenous evolution of fiscal position is not possible.



estimates from the IPVAR, we first cumulate the discounted impulses of output and government consumption at different horizons and compute the ratio of the two impulses. That ratio is then multiplied by the average government consumption to GDP ratio in the sample to yield multipliers.<sup>12</sup>

## 2.2. Identification and Estimation

To identify fiscal shocks, we rely on the standard recursive identification scheme of Blanchard and Perotti (2002). The key timing assumption in this scheme is that discretionary fiscal policy does not respond to macroeconomic conditions within the quarter.<sup>13</sup> Such a timing assumption can be motivated by implementation lags typically associated with discretionary fiscal policy. In the VAR model, this timing assumption is achieved by ordering government consumption first in Equation 1, before GDP. The timing assumption for the remaining variables in the VAR follows Ilzetki, Mendoza, and Vegh (2013): the current account is ordered before the real effective exchange rates. This ordering implies that GDP does not respond to the current account within one quarter, and that the current account does not respond within one quarter when the real effective exchange rate moves. The precise ordering of the latter two variables is, however, immaterial for our main results.<sup>14</sup>

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<sup>12</sup> This step to calculate multipliers from impulse responses follows Ilzetki, Mendoza, and Vegh (2013). Since the conditional multipliers are estimated from the panel of countries, they reflect an average estimate across those countries included in the panel. Thus, we use the average government consumption to GDP ratio in the sample to calculate the multipliers rather than country-specific government consumption to GDP ratios.

<sup>13</sup> One caveat of the recursive identification scheme is that the fiscal shocks identified using this scheme may be predicted by private forecasts (Ramey, 2011). Ilzetki, Mendoza, and Vegh (2013), who use a similar identification scheme and sample of countries like ours, provide evidence that this is unlikely the case.

<sup>14</sup> Of course, there are alternative identification schemes used in the literature. For instance, Romer and Romer (2010) use a narrative approach to identify exogenous fiscal shocks for the US. Auerbach and Gorodnichenko (2012a) proxy exogenous fiscal shocks by forecast errors of government consumption for OECD countries. Due to data limitations, these approaches are not feasible for our sample that includes developing countries, and hence we rely on the recursive identification scheme.

The IPVAR system, comprising Equations 1 and 2, is estimated with ordinary least squares (OLS) applied separately to each equation.<sup>15</sup> The estimated system yields model coefficients that depend on the fiscal position such that a given level of the fiscal position maps out to a set of model coefficients. For presenting the results, we evaluate model coefficients at specific values of the fiscal position which are taken to be the percentiles within the sample. Confidence bands are calculated by bootstrapping over 300 iterations. We report median estimates, along with the 16 - 84 percent confidence bands.

### **2.3. Database**

Our main database comprises an unbalanced panel that covers 34 countries (19 advanced and 15 developing), at the quarterly frequency over the period 1980:1 – 2014:1.<sup>16</sup> Real government consumption and real GDP are based on the quarterly database in Ilzetki, Mendoza, and Vegh (2013), which ends in 2008. These two series are extended until 2014:1 by splicing from the OECD and Haver Analytics. Real effective exchange rates are from the narrow (wherever available) and broad indices of the BIS, and current account from the IMF’s WEO database. The short-term rate used for discounting the multiplier is drawn mainly from the IMF’s IFS database. For the robustness results, we augment this database to include quarterly real private consumption and private investment series. These are drawn from the OECD, Haver Analytics, and Eurostat. Additional details on the sources and definitions of all of these variables are provided in Table A2 in the Appendix.

The government consumption and GDP series (as well as private consumption and private investment) are converted into logarithmic form, and detrended using a linear quadratic trend as

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<sup>15</sup> Because the error terms are uncorrelated across equations by construction, estimating the IPVAR equation by equation does not result in loss of efficiency. See Towbin and Weber (2013) for a discussion.

<sup>16</sup> The full list of economies is listed in Table A1 in the Appendix. Our developing-country coverage comprises primarily emerging and frontier market economies that have some ability to tap into international financial markets, which renders the fiscal solvency risks that underpin our nonlinear crowding-out mechanisms relevant. We exclude low-income countries not only because of data reliability issues, but also because they primarily rely on concessional finance for government expenditure, which would not reflect the crowding-out mechanisms.

in Ilzetzki, Mendoza, and Vegh (2013). The exchange rate is transformed into quarter-to-quarter growth rates, and the current account series is seasonally-adjusted using the *X11* routine. All these series are detrended and demeaned on a country-by-country basis, which effectively controls for country fixed effects in the regressions.

Another database is an unbalanced panel with the same cross sectional and time series coverage as before but at the annual frequency. This includes the conditioning variables that are not explicitly required for the identification scheme to be valid in the VAR model but are necessary to estimate the interaction terms. These are government debt and fiscal balances as percentage of GDP which are drawn from the IMF's WEO database; and government consumption-to-GDP ratios which we obtain from the World Bank's WDI database.

### **3. Results**

#### **3.1. Unconditional Multipliers**

To establish a benchmark, we first report estimates of the unconditional multiplier from a standard panel SVAR. For that, we suppress the law of motion for the coefficients in Equation 2. This renders the coefficient matrices  $A_t$  in Equation 1 invariant across countries and time. Figure 1 presents the unconditional multipliers for the select horizons: on impact, 1 year, 2 years, and long run (5 years). While the size of the unconditional multiplier is either slightly negative or positive depending on the time horizon in question, the estimates are both small and imprecise.<sup>17</sup> Indeed, across all horizons considered, the uncertainty surrounding these estimates is sufficiently large such that the multiplier is essentially statistically indistinguishable from zero. This echoes the often small and the wide range in the estimates of the fiscal multipliers as reported in previous studies (see Batini and Weber (2014) for a survey). The unconditional impulse responses presented in Figure 2 corroborate the small and imprecise estimates of the effects that fiscal policy has on activity on an average. Barring only a few periods in the impulse horizon, the

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<sup>17</sup> When we split our sample into advanced and developing economies, our estimates of the unconditional multiplier are very similar to the ones reported in Ilzetzki, Mendoza, and Vegh (2013). See Figure A2 in the Appendix.

unconditional impulse responses of output due to a positive fiscal shock are either negative or insignificant.

The main message we take away from above is that the unconditional multipliers can mask important state-dependencies as suggested by theory. The estimates of unconditional multipliers suggest that fiscal policy, on average, has no stimulative effects on the economy. However, as recent empirical work shows, fiscal policy can be stimulative during specific times, for instance during recessions (Auerbach and Gorodnichenko, 2012b). Accordingly, we turn, in the following section, to our conditional multiplier estimates.

### **3.2. Fiscal Position-Dependent Multipliers**

Figure 3 presents the set of estimated fiscal multipliers (on the vertical axis) that depend on government debt (on the horizontal axis) - our baseline measure of fiscal position.<sup>18</sup> The four panels correspond to the four horizons previously selected.<sup>19</sup> The figure shows that there is a systematic link between the size of the multiplier and the fiscal position: the median value of the multiplier decreases monotonically in debt, for all horizons reported. That is, the estimated multipliers for all the horizons are positive and significant for low levels of debt, but turn negative or insignificant when debt levels are high. For instance, the long run multiplier is close to unity when debt is low (strong fiscal position), but is negative and as low as -3 for high levels of debt (weak fiscal position). The difference in the estimated multipliers for low and high levels of debt is particularly significant at longer horizons. Our empirical results therefore lend support to the theoretical insights of earlier studies which show that a weak fiscal position can result in stronger crowding-out effects, blunting the stimulative effects of fiscal policy (Sutherland 1997; Perroti 1999; Corsetti et al. 2013; Bi, Shen, and Yang 2014).<sup>20</sup>

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<sup>18</sup> Figure A1 in the Appendix provides the distribution of government debt-to-GDP ratio in our sample. Table A3 provides the specific percentile values from the sample.

<sup>19</sup> The median multipliers for all horizons are presented in Figure A8 in the Appendix.

<sup>20</sup> Our headline result is generally robust when we split the sample into advanced and developing economies. See Figure A3 in the Appendix.

Compared with the unconditional multipliers (Figure 1), the conditional multipliers paint a more nuanced picture of the effects of fiscal policy. For instance, at the 1-year horizon, the unconditional multiplier is small and insignificant. The estimated conditional multipliers at the same horizon (Figure 3) highlight that much of those small and insignificant average effects actually reflect episodes when fiscal positions are weak. On the other hand, when the fiscal position is strong, the conditional fiscal multipliers are not only larger than the unconditional estimates but they are also statistically different from zero.

To better grasp the economics underlying these results, it is useful to examine the conditional impulse responses associated with expansionary fiscal policy. For the purpose of illustration, consider impulse responses conditional on two levels of debt: one corresponding to the 10<sup>th</sup> percentile in the sample (strong fiscal position) and the other corresponds to the 90<sup>th</sup> percentile (weak fiscal position). For comparability, the shock size in each case is normalized such that government consumption rises by 1 percentage point on impact. The conditional impulses are shown in Figure 4.

The most striking pair of the impulse responses is that for output. While output increases on impact and remains significantly positive for around 2 years when the fiscal position is strong, such stimulative effects dissipate after about a year with output falling significantly below zero through till the end of the projection horizon.<sup>21</sup> Coming to government consumption, the conditional impulses for both strong and weak fiscal positions exhibit some persistence in response to the positive fiscal shock. However, fiscal expansion is more quickly unwound when fiscal position is strong than weak. In other words, relative to the strong fiscal position, the government in fact spends more, especially during the initial periods, when fiscal position is weak.<sup>22</sup> Despite this, it is then quite remarkable that output falls more during times of weak fiscal

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<sup>21</sup> To allay any concerns that the choice of the 10<sup>th</sup> and 90<sup>th</sup> percentiles merely reflects outliers, we report results for the 25<sup>th</sup> and the 75<sup>th</sup> percentiles as well (Figure A4 in the Appendix). Even though the differences in the conditional impulse responses are admittedly not as sharp as before, they are statistically significant in the relevant horizons so that our conclusion remains robust.

<sup>22</sup> Nickel and Tudyka (2014) also report similar findings, although government consumption in their study is unwound at longer horizons during times of high debt.

position. This is a result that reinforces our earlier point that weak fiscal position can blunt the stimulative effects of expansionary fiscal policy.

### **3.3. Distinguishing between Business Cycle and Fiscal Position**

Recent studies (e.g. Auerbach and Gorodnichenko 2012a) have established that fiscal multipliers depend on the phase of the business cycle: they tend to be larger during recessions than expansions. To the extent that fiscal position is endogenous and varies according to the business cycle, it is possible that our empirical exercise so far of conditioning only on debt is simply capturing business cycle effects. Controlling for business cycle effects is therefore important to establish that fiscal position is a unique state that matters for the size of the fiscal multipliers. In this section, we undertake a multi-pronged sequence of empirical exercises designed to demonstrate this.

First, we tabulate a number of descriptive statistics to verify that there is little relationship between incidences of the two states. The top panel of Table 1 computes the relative frequency in which countries in our sample experience both a strong or weak fiscal position state and a recession.<sup>23</sup> The fact is that the two states rarely coincide: for the pooled sample, the concurrence of both states occurs less than 3 percent of the time. Even for the category with the highest relative frequency - developing economies with a weak fiscal state undergoing a recession - the coincidence of these states is very infrequent (less than 5 percent of the time).

Second, we perform a number of formal tests that compares the distribution of fiscal position (debt-to-GDP ratio) during recessions and expansions. These are reported in the bottom panel of Table 1. It is clear that any differences - to the extent that they exist - are minimal: for instance, the average debt-to-GDP ratio in the expansionary state is 52 percent, compared to 54 percent during recessions. More formally, the  $t$  tests all fail to reject the null hypothesis of no difference

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<sup>23</sup> Like before, the strong fiscal position corresponds to the 10th percentile of debt-to-GDP ratio in the sample while the weak fiscal position corresponds to the 90th percentile. The recessionary state is defined as the period from peak to trough as determined by the Harding and Pagan (2002) business cycle dating algorithm. We discuss alternative approaches to date the business cycle in the robustness exercise in Section 5.

in means at the standard confidence levels. In effect, there is little evidence that the distributions of fiscal position in our sample differ between recessionary and expansionary states.

Our third approach is to estimate fiscal multipliers conditional on the fiscal position while explicitly controlling for business cycle effects. For that, we replace Equation (2) by the following expression that jointly conditions the model coefficients on both the fiscal position and the business cycle state as follows:

$$\alpha_{l,it}^{jk} = \beta_{1,l}^{jk} + \beta_{2,l}^{jk}f_{s_{it}} + \beta_{3,l}^{jk}bc_{it}, \quad (4)$$

where  $bc$  is an indicator variable that equals 1 for a recession and 0 for an expansion as determined by the Harding-Pagan (2002) dating algorithm. The IPVAR system now comprises of Equations 1 and 4.

Figure 5 presents estimates of the multipliers for different levels of fiscal position during recessions. Compared with the earlier result (Figure 3), which effectively spans both phases of the business cycle, the magnitude of the multipliers during recessions (Figure 5) is larger for any given level of fiscal position. For instance, the point estimate of the long-run multiplier for the strongest fiscal position during recessions almost reaches 1.5, while it is less than 1 when conditioned only on the fiscal position. This echoes the empirical literature that has argued that multipliers tend to be larger during recessions (Auerbach and Gorodnichenko 2012b; Bachmann and Sims 2012; Candelon and Lieb 2013). Our results show that multipliers remain dependent on fiscal position even during recessions: estimated multipliers decline monotonically in debt for all horizons.<sup>24</sup>

One important corollary of this result is that the multiplier can be small even during recessions, if the fiscal position is weak. This is especially the case in the longer-run, as the implications of a heavier debt burden on private demand ultimately play out. Where the fiscal position is especially weak, the multiplier even turns significantly negative. Our central result therefore

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<sup>24</sup> During expansions multipliers are negligible over most horizons.

nuances other authors' findings that multipliers are larger during recessions than expansions. Conditioning our IPVAR only on the phase of the business cycle, we indeed obtain similar results (Figure 6) to other authors (e.g. Auerbach and Gorodnichenko 2012b).<sup>25</sup> Yet, our joint conditioning results (Figure 5) caution that fiscal policy may not be stimulative even during recessions. Even during recessions, multipliers can be small and even negative if fiscal position is weak.

#### **4. Transmission Channels**

The key mechanism that could reduce multipliers when fiscal positions are weak, especially in the long run, rests on private agents' concerns about fiscal sustainability when the government implements expansionary fiscal policy. As mentioned earlier, this can operate via reductions in private consumption as households anticipate a larger tax burden in the future (the Ricardian channel), or via reductions in consumption and investment by investors facing an ever-greater borrowing costs (the interest rate channel). In this section, we attempt to assess the relative strength of these two channels.

We first consider the Ricardian channel by augmenting the IPVAR system with private consumption, with the model coefficients conditioned on fiscal position. For this specification, we order private consumption right after GDP, thus keeping intact the recursive identification scheme of Blanchard and Perotti (2002). Ordering the current account and exchange rates last preserves a domestic macroeconomic bloc in the IPVAR. The conditional impulse responses of private consumption and output to the fiscal shock, for both the strong and the weak fiscal position, are presented in the left panel of Figure 7. As before, the strong and the weak fiscal positions respectively correspond to the 10<sup>th</sup> and 90<sup>th</sup> percentile of debt-to-GDP ratio from our sample. We check the robustness of our results by choosing the 25th and 95th percentiles (Figure A4 in the Appendix).

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<sup>25</sup> Despite the differences in econometric approaches and sample, the precise magnitude of our multipliers during recessions and expansions is comparable with Auerbach and Gorodnichenko (2012b). For instance, their point estimate of the long multiplier (when government consumption is the fiscal instrument) is around 1.47. The corresponding number from the IPVAR model is around 1.67.



The results are unambiguous: when the fiscal position is strong, private consumption rises following the impact of the fiscal shock, peaking around a year after the shock before returning to its initial level. On the other hand, when the fiscal position is weak, private consumption falls precipitously and remains depressed for around three years after the fiscal shock. During these horizons, the difference in the response of private consumption is also statistically significant, judging from the non-overlapping confidence bands. The divergence in private consumption responses across strong and weak fiscal positions is consistent with the Ricardian channel outlined earlier where households reduce consumption in anticipation of more imminent fiscal adjustments during times of high government debt (Sutherland 1997 and Perroti 1999).<sup>26</sup>

Our result on the divergence of private consumption paths provides a new dimension on the debate concerning how private consumption responds to fiscal stimulus. Perroti (2005) finds that private consumption rises in response to a positive fiscal shock, while Ramey (2011) shows that private consumption actually declines – a difference which is attributed to the specific identification scheme used in these studies. Ilzetzki, Mendoza, and Vegh (2013) reconcile these two contrasting views in terms of monetary policy behavior and argue that once monetary policy is controlled for, fiscal policy has expansionary effects on private consumption. Our results, by explicitly showing how a weak fiscal position undermines and reverses the response of private consumption, suggest an additional aspect that can help reconcile the conflicting results found in the literature.

For the interest rate channel, we would ideally introduce a proxy for sovereign risk, such as the yield spread, directly into our IPVAR system. However, this is precluded by the paucity of credible long-term rates, especially in developing countries, at the quarterly frequency. We thus proceed with our second-best option, which is to augment private investment into the IPVAR system. As in the case of private consumption, private investment is ordered after GDP but

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<sup>26</sup> The estimates of the multipliers with this specification are broadly in line with the baseline estimates. More importantly, our headline result that multipliers depend on fiscal position holds when private consumption is included in the IPVAR. See Figure A6 in the Appendix.

before the current account. Since private investment is particularly sensitive to borrowing costs, a reduction in private investment during times of weak fiscal position is indicative of the interest rate channel. Figure 7 presents the conditional impulse responses of private investment for both weak and strong fiscal positions.<sup>27</sup>

The contrast between strong and weak fiscal positions for the path of private investment is, again, striking. Investment rises significantly when the fiscal position is strong, peaking after around 6 quarters, but remaining sustained through at least 10 quarters. When the fiscal position is weak, investment drops sharply after about a year, and never fully recovers, failing to revert even after 5 years. The difference in the impulse responses across strong and weak fiscal positions is also statistically significant (barring the initial few quarters). These responses are qualitatively similar to those of private consumption but much larger in magnitude. This suggests that investor concerns about borrowing cost could be an additional channel for dampening the effectiveness of fiscal policy.

## 5. Robustness

This section reports robustness checks for our multiplier estimates. We consider three sets of variations from the baseline: (a) an alternative measure of fiscal position where we use fiscal balances instead of government debt; (b) an alternative dating scheme of the business cycle similar to Auerbach and Gorodnichenko (2012b) to define recessions as periods with a significant probability of negative output growth<sup>28</sup>.

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<sup>27</sup> The multipliers are presented in Figure A7 in the Appendix. Our main result that multipliers depend on fiscal position generally holds.

<sup>28</sup> Following Auerbach and Gorodnichenko (2012b), we define the indicator function,  $I(z_{it}) = \frac{\exp(-\gamma z_{it})}{1 + \exp(-\gamma z_{it})}$ , where  $z_{it}$  is taken to be 7 quarter moving averages of quarter-to-quarter growth rates normalized to have a zero mean and a unit variance. Calibrating  $\gamma$  as  $1.5 > 0$ , the indicator function pins down the probability of negative output growth. Recessions are then defined as periods where that probability exceeds a threshold, which in our implementation is taken to be 80 percent.

Table 2 presents the results. The top panel shows the range of estimates of the fiscal multipliers for the strongest and weakest fiscal positions which, like before, are taken to be fiscal balances corresponding to the 10<sup>th</sup> (weak) and 90<sup>th</sup> (strong) percentiles from the sample. By and large, our baseline results are qualitatively similar when fiscal balances, instead of debt-to-GDP ratios, are used to measure fiscal positions. That is, the multipliers are systematically larger for high fiscal balances (strong fiscal position) than low fiscal balances (i.e. weak fiscal position). This is true regardless of the horizons considered and when jointly conditioned on the state of the business cycle.<sup>29</sup> The middle panel of Table 2 presents the multipliers using the alternative definition of recessions. Our headline result – multipliers depend on the fiscal position even during recessions - generally holds, especially at longer horizons.

## 6. Conclusion

In this paper, we argue that a sound fiscal position is a critical precondition for effective fiscal policy. In particular, fiscal multipliers tend to be larger when the fiscal position is stronger. For instance, our estimates suggest that the long run multiplier can be as big as unity when the fiscal position is strong but it can turn negative when the fiscal position is weak. A weak fiscal position can undermine fiscal multipliers even during recessions, when the literature thus far has argued that fiscal policy is at its most effective. We illustrate how weak fiscal starting positions can weaken fiscal policy through both a Ricardian channel and an interest rate channel. These results are not only deeply intuitive, but also align well with existing theoretical models.

Our headline result that multipliers are smaller and even negative when the fiscal position is weak has important policy implications at a time when debt and deficits remain elevated in many countries around the world. It serves as a caution that fiscal stimulus, when implemented during times of weak fiscal position, can have little stimulative effects on the economy, even during recessions. Thus, the main finding underscores the need for countries to build fiscal buffers

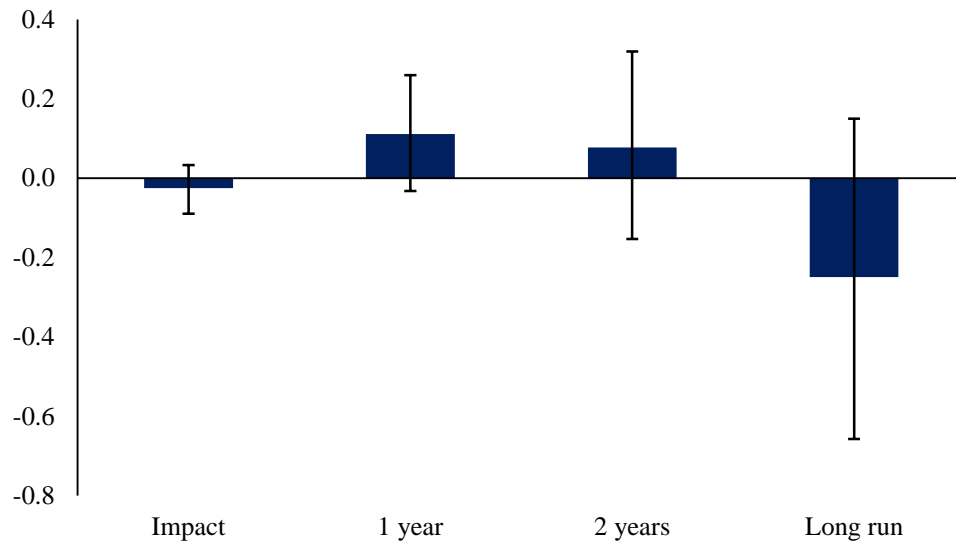
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<sup>29</sup> We also considered the de facto fiscal space measure of Aizenman and Jinjark (2012). De facto fiscal space takes the ratio of debt to revenue, under the premise that it is necessary to adjust government debt for repayment capacity, via revenue. We obtained very similar results with this measure of fiscal position as well.

during good times so that fiscal policy remains an effective macro stabilization tool when most needed.

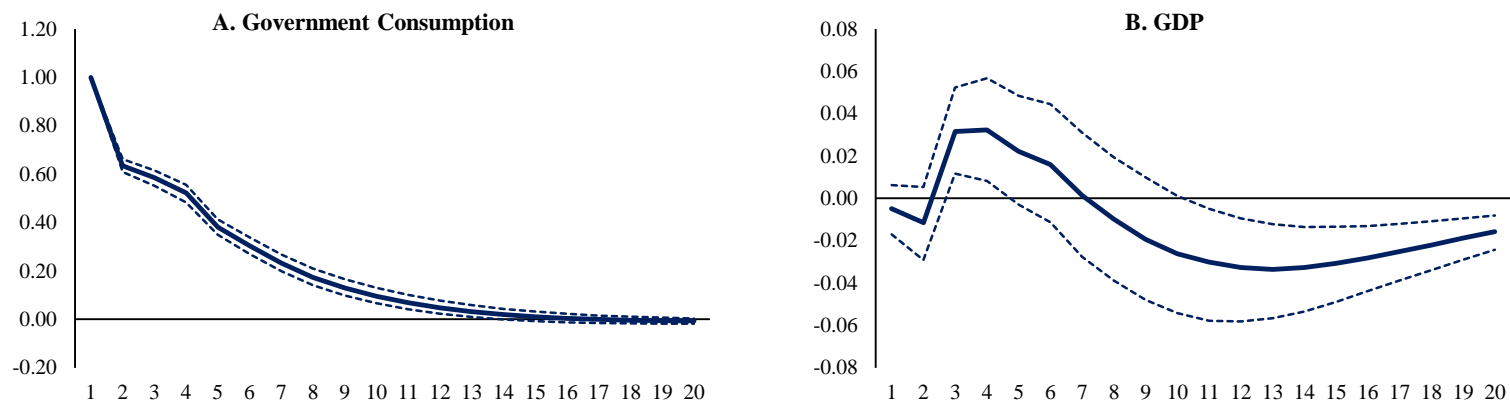
There are several avenues for future work. First, while data limitations have precluded a deeper and more direct exploration of the interest rate channel, future research, perhaps with more comprehensive and representative data on yield spreads, can seek to improve our understanding of the interest rate channel. Second, fiscal-monetary interactions can be studied using a similar model like ours. In particular, one can evaluate if and the extent to which monetary policy offers a more effective stabilization tool during times of weak fiscal position.

**Figure 1: Unconditional Multipliers**



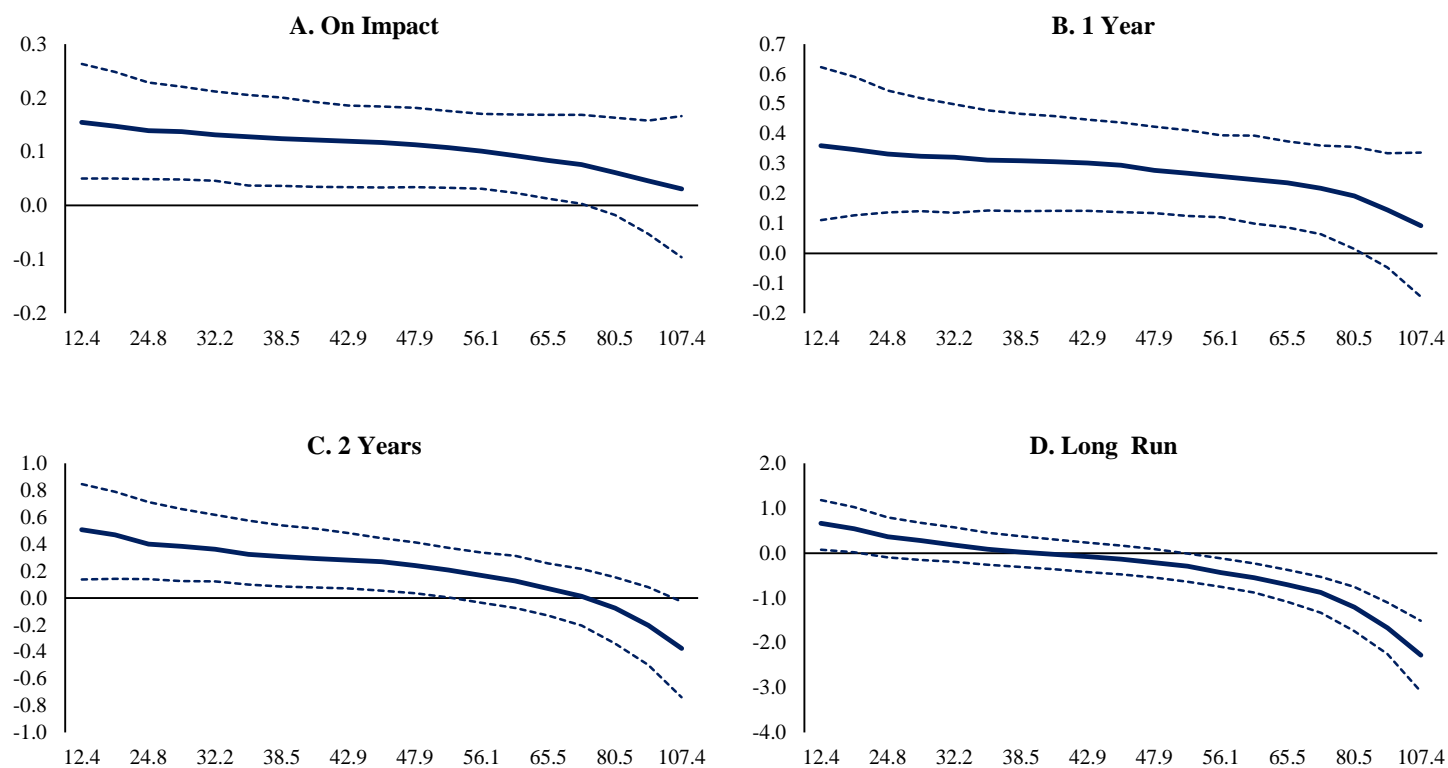
*Note:* The graph shows the unconditional fiscal multipliers for select horizons. These are based on estimates from the SVAR model of Ilzetki, Mendoza, and Vegh (2013) that features with no interaction terms. Bars represent the median, and error bands are the 16-84 percent confidence bands.

**Figure 2: Unconditional Impulse Responses**



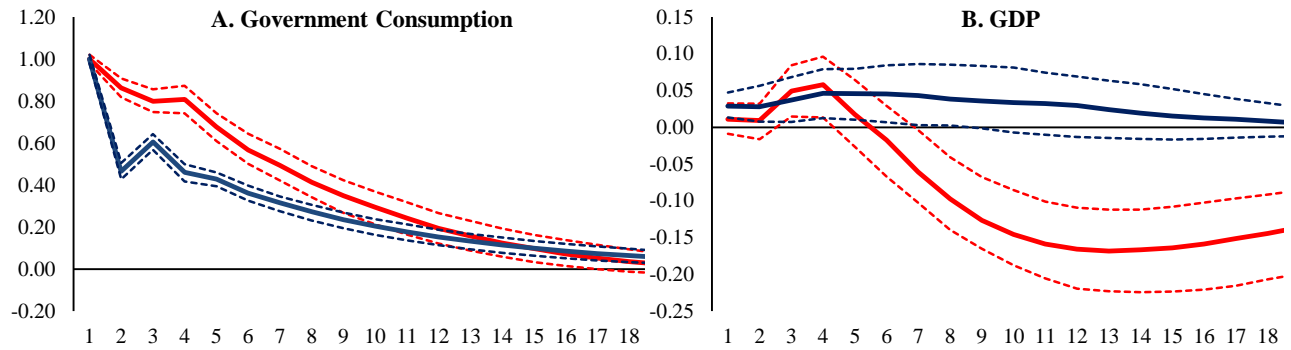
*Note:* The graphs show the unconditional impulse responses (percentage points) to a positive shock to government consumption. These are based on estimates from the SVAR model of Ilzetzi, Mendoza, and Vegh (2013) that features with no interaction terms. Solid lines represent the median, and dotted lines are the 16-84 percent confidence bands.

**Figure 3: Fiscal Position-Dependent Multipliers**



*Note:* The graphs show the conditional fiscal multipliers for different levels of fiscal position at select horizons. These are based on estimates from the IPVAR model, where model coefficients are conditioned only on fiscal position. Government debt as a percentage of GDP is the measure of fiscal position and the values shown on the x-axis correspond to the 5<sup>th</sup> to 95<sup>th</sup> percentiles from the sample. Fiscal position is strong (weak) when government debt is low (high). Solid lines represent the median, and dotted bands are the 16-84 percent confidence bands.

**Figure 4: Conditional Impulse Responses**



*Note:* The graphs show the conditional impulse responses (percentage points) for the strong (blue) and the weak (red) fiscal positions. These are based on estimates from the IPVAR model, where model coefficients are conditioned only on fiscal position. Government debt as a percentage of GDP is the measure of fiscal position. The strong fiscal position corresponds to the 10<sup>th</sup> percentile of debt-to-GDP ratio from the sample, while the weak fiscal position corresponds to the 90<sup>th</sup> percentile. Solid lines represent the median, and dotted bands are the 16-84 percent confidence bands.



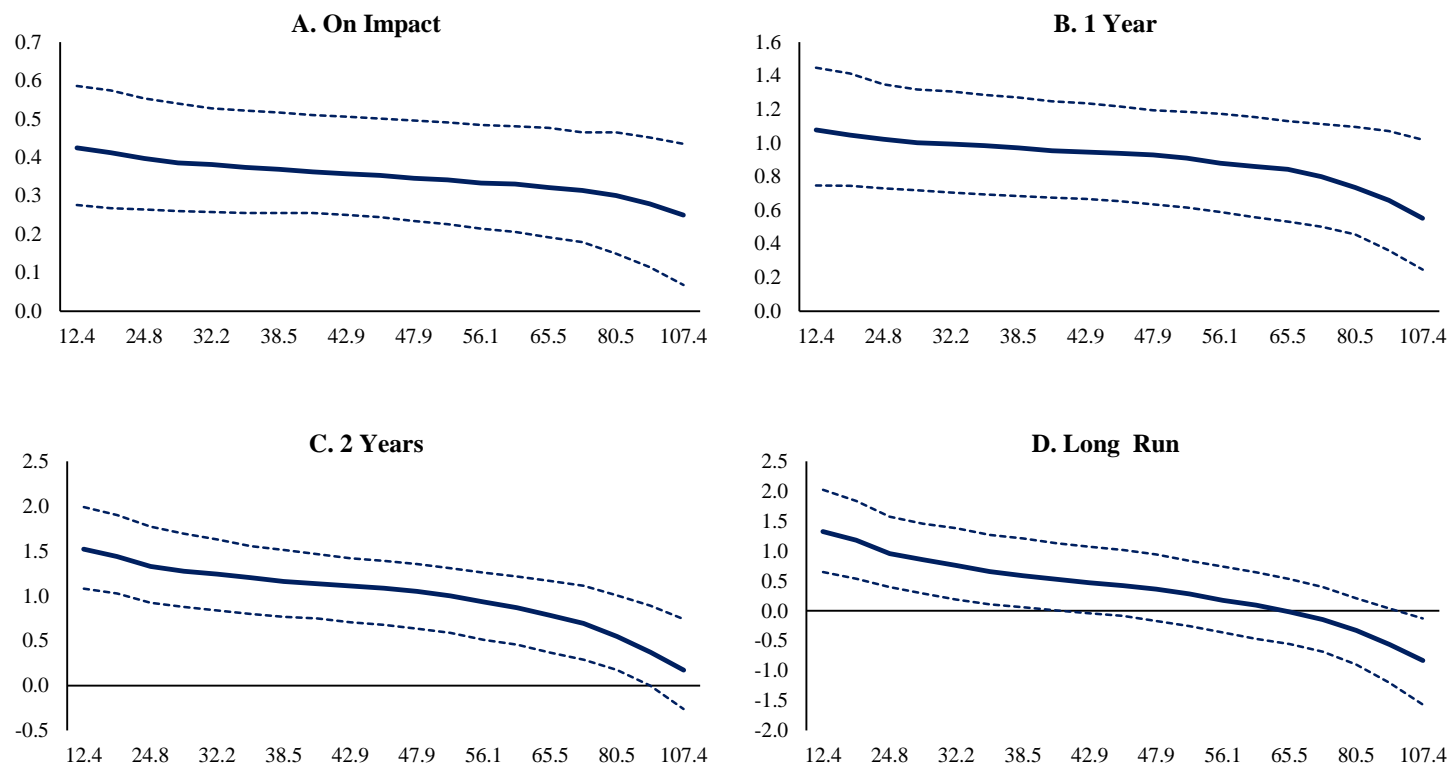
**Table 1: Comparison of Fiscal and Business Cycle States**

	<b>Full Sample</b>	<b>Advanced</b>	<b>Developing</b>
<b>Relative frequency<sup>a</sup></b>			
Strong fiscal and recessionary state	1.9	2.1	1.4
Weak fiscal and recessionary state	2.8	1.7	4.7
<b>Test of differences</b>			
In means <sup>b</sup>	[52.3, 54.0]	[57.3, 57.9]	[43.4, 44.6]
	0.25	0.76	0.55

*Note:* The table shows the association (or lack thereof) between different fiscal positions and the recessionary state. The top panel shows the relative frequency of the strong fiscal position and the recessionary state, and that of weak fiscal position and the recessionary state. The frequencies are reported for the full sample and also for specific country groups: advanced and developing economies. The strong (weak) fiscal position corresponds to the 10<sup>th</sup> (90<sup>th</sup>) percentile of debt-to-GDP ratio in each sample. The bottom panel reports results that show the statistical significance of the difference of those relative frequencies. The recessionary state is determined by the Harding-Pagan (2002) business cycle dating algorithm.

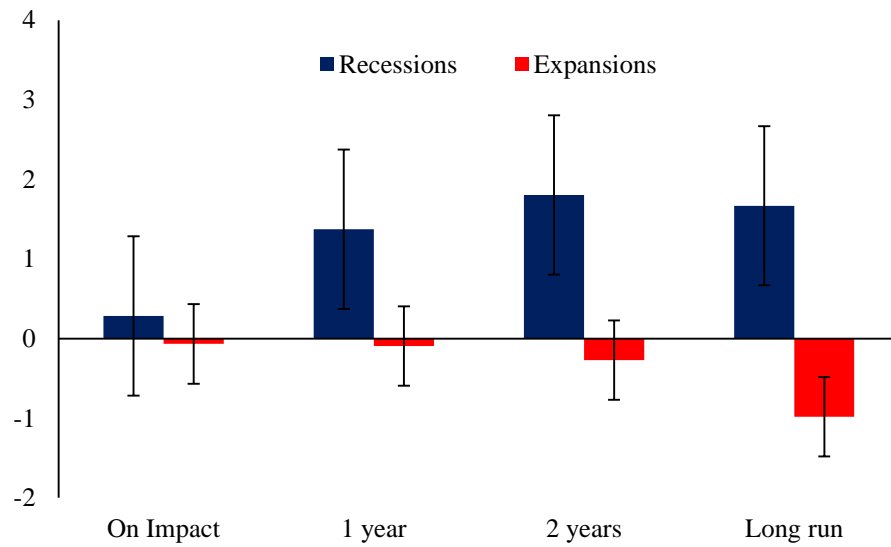
<sup>b</sup> The top entry shows the average debt-to-GDP ratio during expansions (left) and recessions (right). The bottom entry shows the p-values of two-group *t-test* of difference in means with unequal variances.

**Figure 5: Fiscal Position-Dependent Multipliers during Recessions**



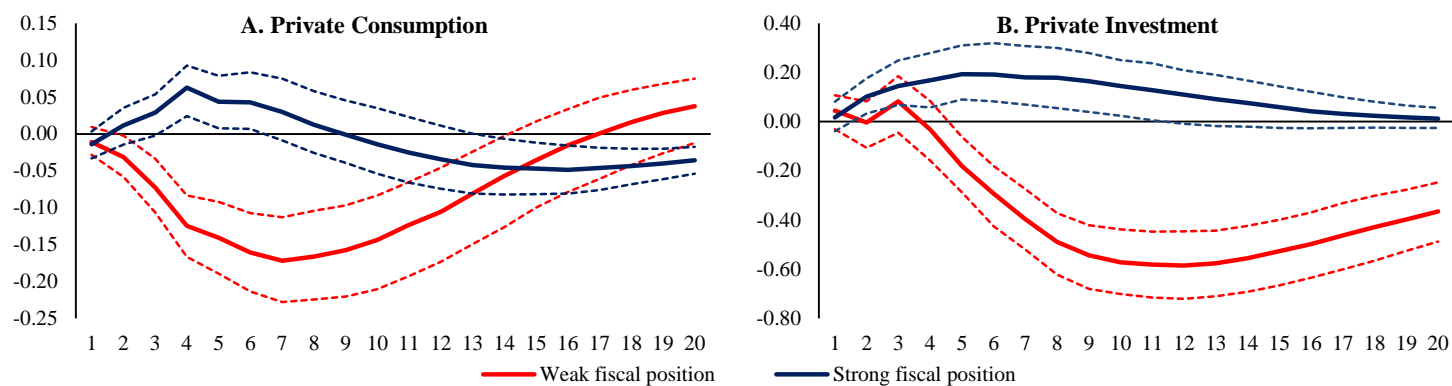
*Note:* The graphs show the conditional fiscal multipliers during recessions for different levels of fiscal position at select horizons. These are based on estimates from the IPVAR model, where model coefficients are jointly conditioned on fiscal position and the phase of the business cycle. Government debt as a percentage of GDP is the measure of fiscal position and the values shown on the x-axis correspond to the 5<sup>th</sup> to 95<sup>th</sup> percentiles from the sample. Recessions are determined by the Harding-Pagan (2002) business cycle dating algorithm. Fiscal position is strong (weak) when government debt is low (high). Solid lines represent the median, and dotted bands are the 16-84 percent confidence bands.

**Figure 6: Multipliers by Business Cycles only**



*Note:* The graphs show the conditional fiscal multipliers during recessions at select horizons. These are based on estimates from the IPVAR model, where model coefficients are conditioned only on the phase of the business cycle. Recessions are determined by the Harding-Pagan (2002) business cycle dating algorithm. Bars represent the median, and error bands are the 16-84 percent confidence bands.

**Figure 7: Transmission Channels**



*Note:* The graphs show the conditional impulse responses (percentage points) of private consumption and private investment due to a positive shock to government consumption for the strong (blue) and the weak (red) fiscal positions. These are based on estimates from the IPVAR model, where model coefficients are conditioned only on fiscal position. Government debt as a percentage of GDP is the measure of fiscal position. The strong fiscal position corresponds to the 10<sup>th</sup> percentile of debt-to-GDP ratio from the sample, while the weak fiscal position corresponds to the 90<sup>th</sup> percentile. Solid lines represent the median, and dotted bands are the 16-84 percent confidence bands.

**Table 2: Robustness Checks: Fiscal Multipliers**

		<i>Fiscal position only</i>				<i>Recessions and fiscal position</i>			
		<b>Impact</b>	<b>1 year</b>	<b>2 years</b>	<b>Long run</b>	<b>Impact</b>	<b>1 year</b>	<b>2 years</b>	<b>Long run</b>
<b>Alternative fiscal position</b>									
Fiscal balances	<i>Strong</i>	[0.16, 0.31]	[0.29, 0.63]	[0.43, 1.10]	[0.39, 1.38]	[0.37, 0.57]	[1.34, 2.00]	[1.76, 2.66]	[1.09, 2.35]
	<i>Weak</i>	[-0.08, 0.08]	[0.16, 0.54]	[0.19, 0.76]	[-0.05, 0.97]	[-0.02, 0.24]	[1.04, 1.78]	[1.25, 2.16]	[0.65, 1.74]
<b>Alternative business cycle dates</b>									
Auberch and Gorodnichenko (2012b)	<i>Strong</i>	...	...	...	...	[0.54, 0.85]	[1.23, 1.75]	[1.13, 1.78]	[0.61, 1.48]
	<i>Weak</i>	...	...	...	...	[0.48, 0.80]	[1.36, 1.96]	[0.85, 1.52]	[-0.56, 0.54]

*Note:* The table presents estimates of fiscal multipliers from alternative specifications of the IPVAR model for the strong and the weak fiscal positions. The top panel presents the multipliers using an alternative measure of fiscal position and the bottom panel considers an alternative business cycle dating scheme. Fiscal position is strong (weak) when government debt is high (low) or when fiscal balances are low (high). When fiscal position is measured in terms of government debt, the strong position corresponds to the 10<sup>th</sup> percentile and the weak position corresponds to the 90<sup>th</sup> percentile. When fiscal balances are taken as the measure of fiscal position, the strong position corresponds to the 90<sup>th</sup> percentile and the weak position corresponds to the 10<sup>th</sup> percentile. Numbers reported in square bracket are the 16-84 percent confidence range.

## Appendix: Additional Figures and Tables

**Table A1: Country Coverage**

<i>Advanced</i>		<i>Developing</i>	
<b>Country</b>	<b>Period</b>	<b>Country</b>	<b>Period</b>
Australia	1980:Q1--2013Q4	Argentina	1993:Q1--2013Q4
Belgium	1991:Q1--2013Q4	Bulgaria	1999:Q1--2013Q4
Canada	1980:Q1--2013Q4	Brazil	1995:Q1--2013Q4
Germany	1991:Q1--2013Q4	Chile	1989:Q1--2013Q4
Denmark	1999:Q1--2013Q4	Colombia	2000:Q1--2013Q4
Spain	1995:Q1--2013Q4	Czech Republic	1999:Q1--2013Q4
Finland	1998:Q1--2013Q4	Croatia	2000:Q1--2013Q4
France	1980:Q1--2013Q4	Hungary	1995:Q1--2013Q4
United Kingdom	1980:Q1--2013Q4	Israel	1999:Q1--2013Q4
Iceland	1997:Q1--2013Q4	Mexico	1991:Q1--2013Q4
Italy	1999:Q1--2013Q4	Poland	1999:Q1--2013Q4
Lithuania	1995:Q1--2013Q4	Romania	1998:Q1--2013Q4
Netherlands	1988:Q1--2013Q4	Slovak Republic	1999:Q1--2013Q4
Norway	1996:Q1--2013Q4	South Africa	1993:Q1--2013Q4
Puerto Rico	1980:Q1--2013Q4	Turkey	1998:Q1--2013Q4
Slovenia	1995:Q1--2013Q4		
Sweden	1993:Q1--2013Q4		
United States	1980:Q1--2013Q4		

*Note:* The table shows the list of countries in the sample. Coverage corresponds to maximum temporal coverage for each country in the baseline specification of the IPVAR model. Coverage may differ for specifications used in the robustness exercises.

**Table A2: Data Sources**

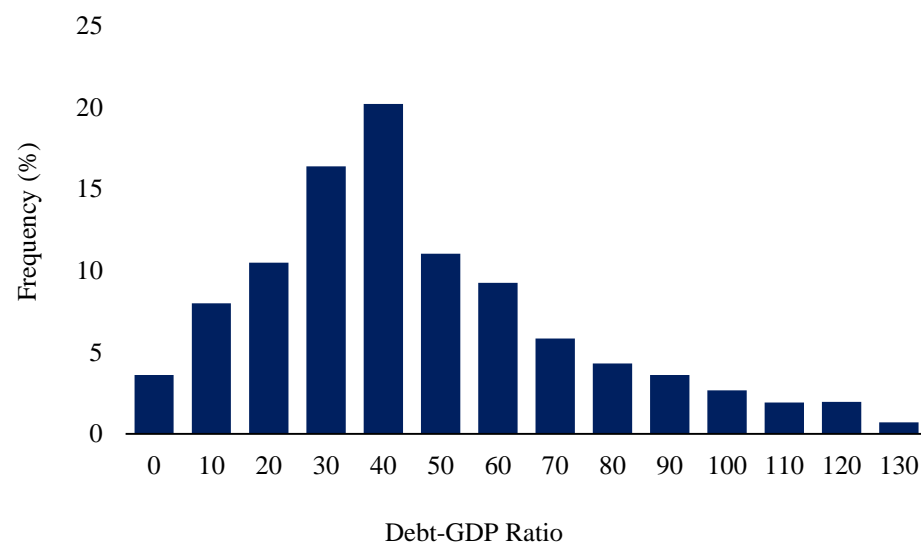
<b>Variable</b>	<b>Definition</b>	<b>Frequency</b>		<b>Source</b>
Output	Real gross domestic product (GDP)	Quarterly		Ilzetzki, Mendoza, and Vegh (2013), OECD, Haver Analytics
Private consumption	Real personal consumption expenditure	Quarterly		Ilzetzki, Mendoza, and Vegh (2013), OECD, Haver Analytics
Private investment	Real private gross fixed capital formation	Quarterly		
Government consumption	Real government consumption expenditure <sup>a</sup>	Quarterly		Ilzetzki, Mendoza, and Vegh (2013), OECD, Haver Analytics
Government investment	Real government gross fixed capital formation <sup>a</sup>	Quarterly		OECD, Haver Analytics, Eurostat
Real effective exchange rate	Real effective exchange rate <sup>b</sup>	Quarterly		Ilzetzki, Mendoza, and Vegh (2013), BIS
Current account	Current account as percent of GDP	Quarterly		Ilzetzki, Mendoza, and Vegh (2013), WEO
Government debt	General government debt as percent of GDP	Annual		WEO
Fiscal balance	Overall fiscal balance as percent of GDP	Annual		WEO
Government consumption-to-GDP ratio	Government consumption as percent of GDP	Annual		WDI
Government investment-to-GDP ratio	Government investment as percent of GDP	Annual		WDI
Interest rate	Short term nominal interest rate	Quarterly		Ilzetzki, Mendoza, and Vegh (2013)

*Note:* The main source for the quarterly series is Ilzetzki, Mendoza, and Vegh (2013). This database which ends around 2008 is extended by splicing from different sources as mentioned in the table.

<sup>a</sup> This refers to general government for most countries while for a few countries central government is taken. See Ilzetzki, Mendoza, and Vegh (2013).

<sup>b</sup> The narrow index wherever available is taken while the remainder uses the broad index. Details are available upon request.

**Figure A1: Distribution of Fiscal Position**



*Note:* The graph shows the distribution of fiscal position, taken to be the annual government debt-to-GDP ratio, from the sample of advanced and developing economies during the period 1980-2014.

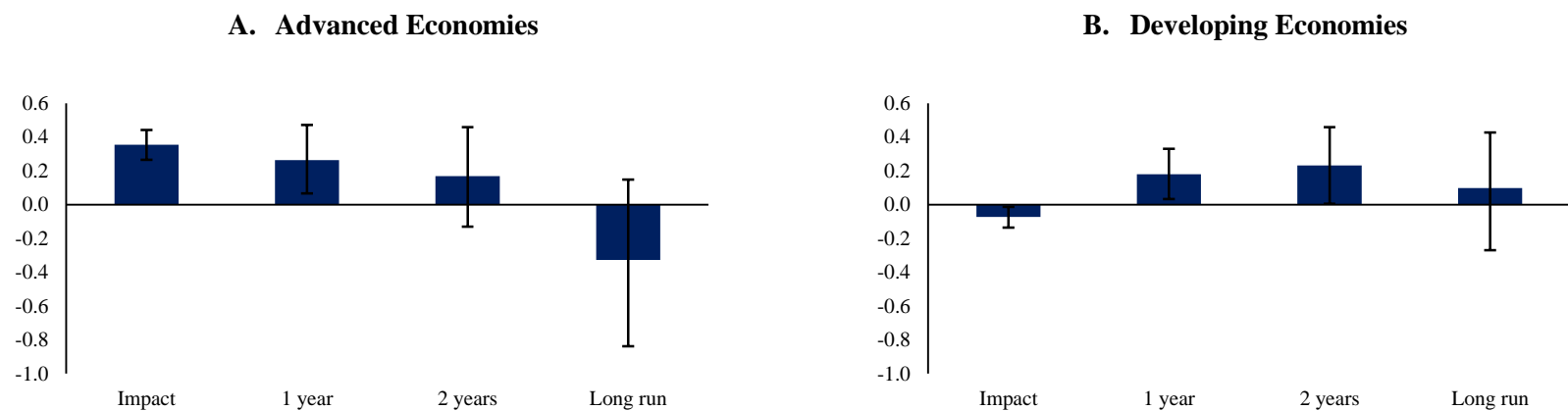
**Table A3: Distribution of Fiscal Position**

Percentile	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95
<b>Debt-GDP Ratio</b>	12.4	17.3	24.8	28.7	32.2	35.9	38.5	40.7	42.9	45.1	47.9	51.4	56.1	60.1	65.5	71.3	80.5	92.4	107.4

*Note:* The table shows the percentile values of fiscal position, taken to be annual government debt-to-GDP ratio, from the sample of advanced and developing economies during the period 1980-2014.



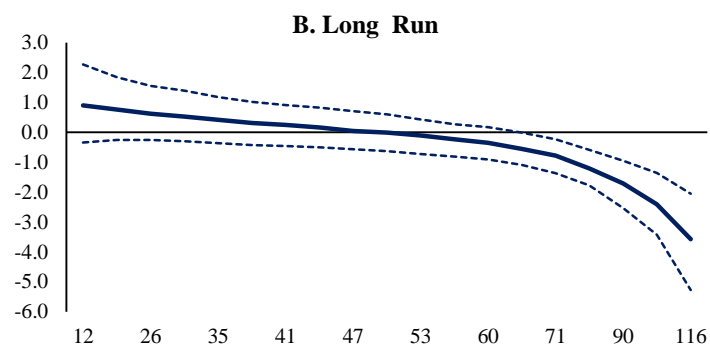
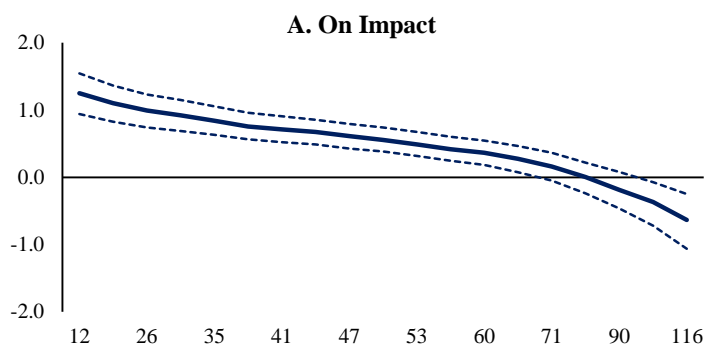
**Figure A2: Unconditional Multipliers**



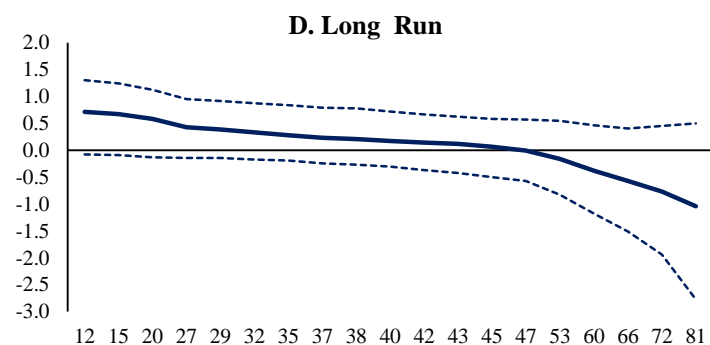
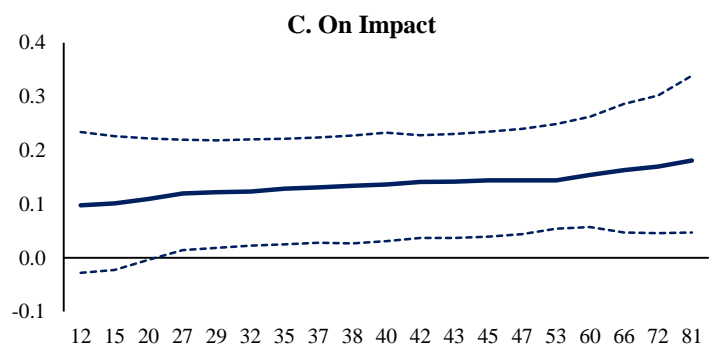
*Note:* The graph shows the unconditional fiscal multipliers for select horizons. Panel A uses a sample of advanced economies only while Panel B uses only developing economies. These are based on estimates from the SVAR model of Ilzetki, Mendoza, and Vegh (2013) that features with no interaction terms. Bars represent the median, and error bands are the 16-84 percent confidence bands.

**Figure A3: Fiscal Position-Dependent Multipliers by Country Groups**

**Advanced Economies**

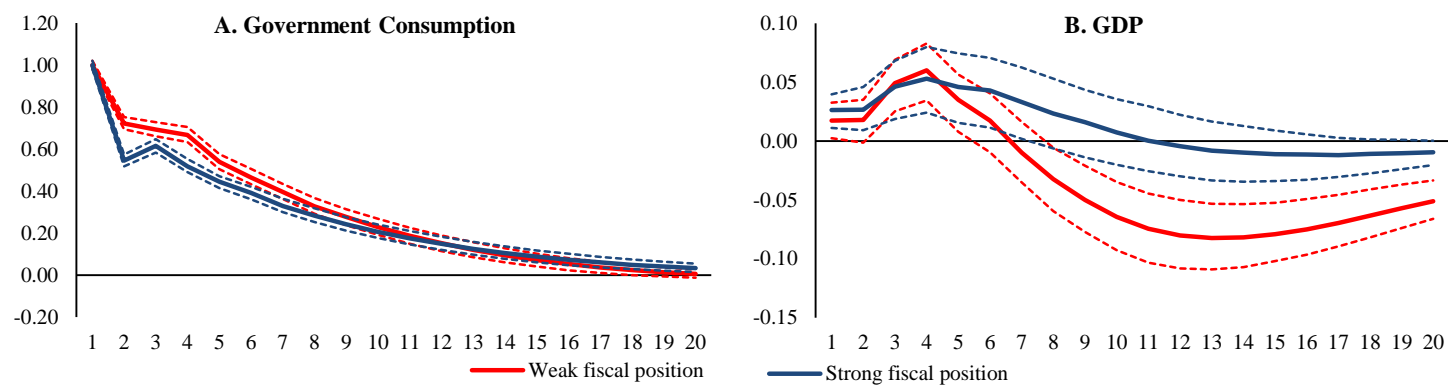


**Developing Economies**



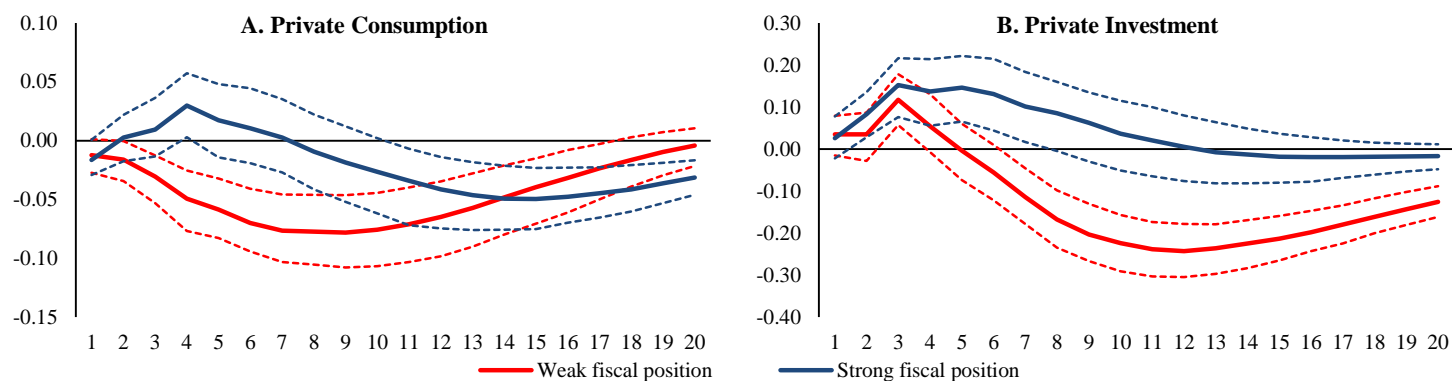
*Note:* The graphs show the conditional fiscal multipliers for different levels of fiscal position at select horizons. These are based on estimates from the IPVAR model, where model coefficients are conditioned only on fiscal position. The top (bottom) panel is based a sample of only advanced (developing) economies. Government debt as a percentage of GDP is the measure of fiscal position and the values shown on the x-axis correspond to the 5<sup>th</sup> to 95<sup>th</sup> percentiles from each sample. Fiscal position is strong (weak) when government debt is low (high). Solid lines represent the median, and dotted bands are the 16-84 percent confidence bands.

**Figure A4: Conditional Impulse Responses**



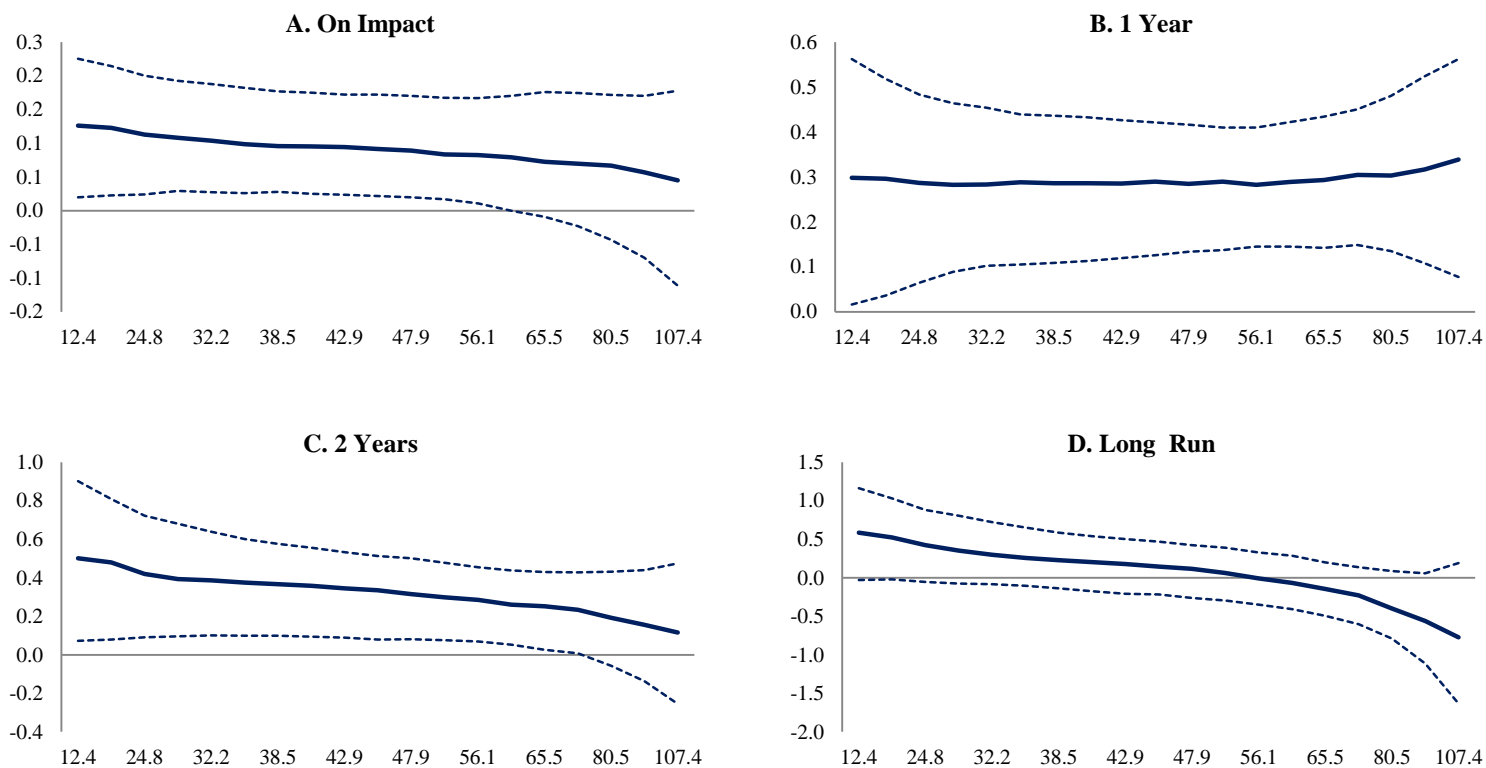
*Note:* The graphs show the conditional impulse responses (percentage points) for the strong (blue) and the weak (red) fiscal positions. These are based on estimates from the IPVAR model, where model coefficients are conditioned only on fiscal position. Government debt as a percentage of GDP is the measure of fiscal position. The strong fiscal position corresponds to the 25<sup>th</sup> percentile of debt-to-GDP ratio from the sample, while the weak fiscal position corresponds to the 75<sup>th</sup> percentile. Solid lines represent the median, and dotted bands are the 16-84 percent confidence bands.

**Figure A5: Transmission Channels**



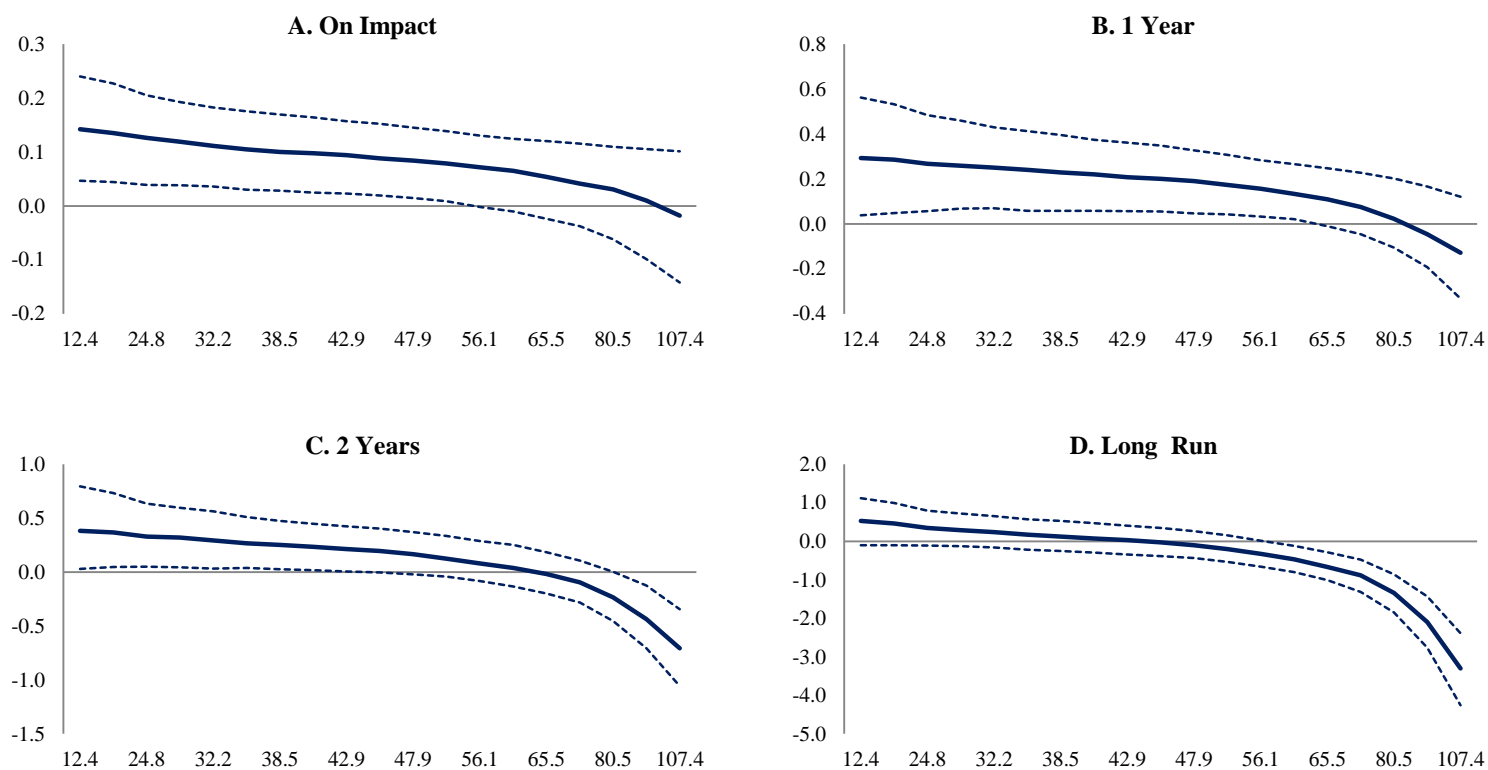
*Note:* The graphs show the conditional impulse responses (percentage points) of private consumption and private investment due to a positive shock to government consumption for the strong (blue) and the weak (red) fiscal positions. These are based on estimates from the IPVAR model, where model coefficients are conditioned only on fiscal position. Government debt as a percentage of GDP is the measure of fiscal position. The strong fiscal position corresponds to the 25<sup>th</sup> percentile of debt-to-GDP ratio from the sample, while the weak fiscal position corresponds to the 75<sup>th</sup> percentile. Solid lines represent the median, and dotted bands are the 16-84 percent confidence bands.

**Figure A6: Fiscal Position-Dependent Multipliers with Private Consumption**



*Note:* The graphs show the conditional fiscal multipliers for different levels of fiscal position at select horizons. These are based on estimates from the IPVAR model that includes private consumption. The model coefficients are conditioned only on fiscal position. Government debt as a percentage of GDP is the measure of fiscal position and the values shown on the x-axis correspond to the 5<sup>th</sup> to 95<sup>th</sup> percentiles from the sample. Fiscal position is strong (weak) when government debt is low (high). Solid lines represent the median, and dotted bands are the 16-84 percent confidence bands.

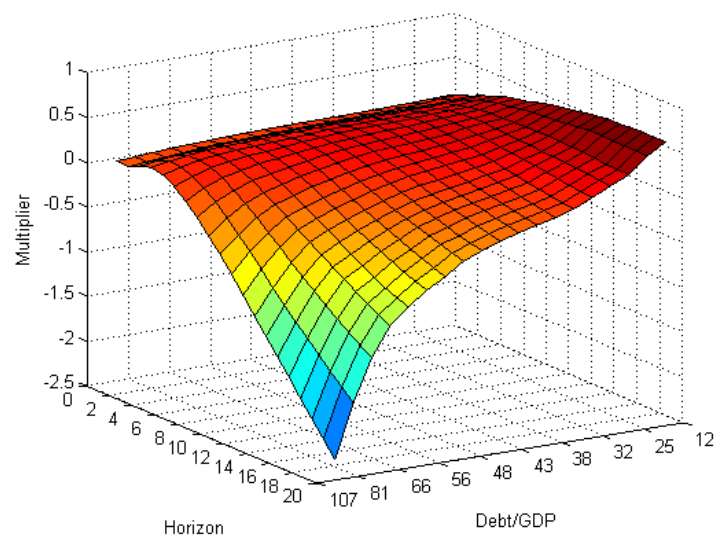
**Figure A7: Fiscal Position-Dependent Multipliers with Private Investment**



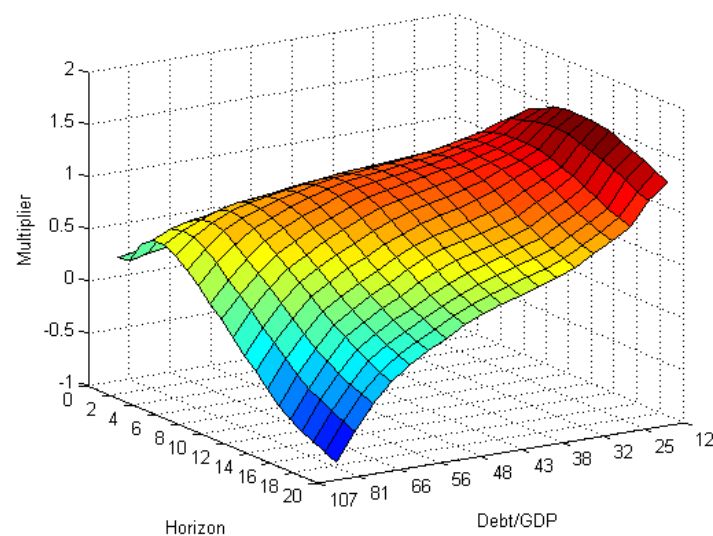
*Note:* The graphs show the conditional fiscal multipliers for different levels of fiscal position at select horizons. These are based on estimates from the IPVAR model that includes private investment. The model coefficients are conditioned only on fiscal position. Government debt as a percentage of GDP is the measure of fiscal position and the values shown on the x-axis correspond to the 5<sup>th</sup> to 95<sup>th</sup> percentiles from the sample. Fiscal position is strong (weak) when government debt is low (high). Solid lines represent the median, and dotted bands are the 16-84 percent confidence bands.

**Figure A8: Fiscal Position-Dependent Multipliers**

**A. Fiscal Position Only**



**B. Fiscal Position and Recessions**



*Note:* The surf plots show the conditional fiscal multipliers for different levels of fiscal position and across all horizons. These are based on estimates from the IPVAR model. The left panel is when model coefficients are only conditioned on the fiscal position, and in the right panel they are jointly conditioned on the fiscal position and the phase of the business cycle. Government debt as a percentage of GDP is the measure of fiscal position and the values shown on the x-axis correspond to the 5<sup>th</sup> to 95<sup>th</sup> percentiles from the sample. Recessions are determined by the Harding-Pagan (2002) business cycle dating algorithm. Fiscal position is strong (weak) when government debt is low (high). Numbers shown are the median estimates of the multipliers.

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