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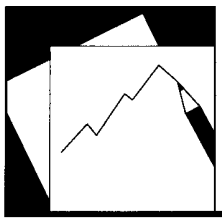

IMF Working Paper

Fiscal Multipliers and the State of the Economy

Anja Baum, Marcos Poplawski-Ribeiro, and Anke Weber

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Fiscal Multipliers and the State of the Economy[1]

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Abstract

Only a few empirical studies have analyzed the relationship between fiscal multipliers and the underlying state of the economy. This paper investigates this link on a country-by-country basis for the G7 economies (excluding Italy). Our results show that fiscal multipliers differ across countries, calling for a tailored use of fiscal policy. Moreover, the position in the business cycle affects the impact of fiscal policy on output: on average, government spending, and revenue multipliers tend to be larger in downturns than in expansions. This asymmetry has implications for the choice between an upfront fiscal adjustment versus a more gradual approach.

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I. INTRODUCTION

Since the economic crisis a rapidly expanding empirical literature tries to estimate the effect of discretionary fiscal policy on output. However, only a few empirical studies have so far analyzed the links between fiscal multipliers and the underlying state of the economy.

This paper investigates how the effects of fiscal policy on output may vary depending on whether the economy is in an expansion or a downturn. Expansions and downturns are defined by the sign of the output gap (positive and negative, respectively). The decision to use the output gap as the threshold variable is motivated by several factors, one of them is that under a negative output gap—independently of the sign of the GDP growth rate—excess capacities are available in the economy, reducing the crowding out of private investment following a government spending shock.

The contribution of the paper is twofold. First, to the best of our knowledge, this is the first study to develop a dataset of quarterly data on government expenditure and revenue for six of the G7 economies (excluding Italy) going back to the 1970s.[2] Second, country-by-country estimation allows the explanatory variables (government spending and revenue) to have differing regression slopes, depending on whether the chosen threshold variable—the output gap—is above or below a particular level, which is chosen to maximize the fit of the model.

Our analysis employs a nonlinear threshold vector autoregressive model (TVAR) which separates observations into different regimes based on a threshold variable. Within each regime, the model is assumed to be linear. However, after a fiscal shock is implemented, the regime is allowed to switch, depending on the level of the output gap. As a result, the effects of fiscal policy shocks on economic activity depend on their size, direction and timing with respect to the business cycle.

The paper shows that the position in the business cycle affects the impact of fiscal policy on output: for an average of G7 economies, government spending and revenue multipliers tend to be larger in downturns than in expansions. This asymmetry has implications for the desirability of upfront fiscal adjustment versus a more gradual approach. When the output gap is initially negative, fiscal adjustment implemented gradually has a smaller negative impact on growth (cumulative over two and one-half years) than does an up-front consolidation of the same overall size. This suggests that when feasible, a more gradual fiscal

[2] Ilzetzki, Mendoza, and Vegh (2010) also analyze expenditure multipliers with quarterly data for 44 countries. However, they only collect data on government consumption and investment (not on revenues) from the 1990s onwards. Moreover, they estimate the multipliers using panel SVAR regressions and do not include Japan in their sample.

consolidation is likely to prove preferable to an approach that aims at "getting it over quickly."

Multipliers are found to differ significantly across countries, calling for a tailored use of fiscal policies and a country-by-country assessment of their effects. In those countries where spending impact multipliers are found to be statistically significant and sizeable (Germany, Japan, and the United States), spending shocks have a significantly larger effect on output when the output gap is negative than when it is positive. In the United Kingdom, spending multipliers are small under both positive and negative output gaps. The results are generally less conclusive for revenue multipliers. The impact is more significant for Canada, France, Germany, and Japan. In Germany, revenue multipliers are slightly higher in "good times" than in "bad times", which could suggest that individuals and firms are more willing to spend additional income when market sentiment is positive, thereby becoming less Ricardian. In Canada and Japan revenue measures work as a countercyclical tool only when the output gap is negative.

The paper is structured as follows. Section II provides background information on fiscal multipliers and summarizes the findings of other studies that have estimated regime dependent multipliers. Section III presents the data sources and outlines the methodology. The main results as well as related policy implications can be found in Section IV. Section V concludes.

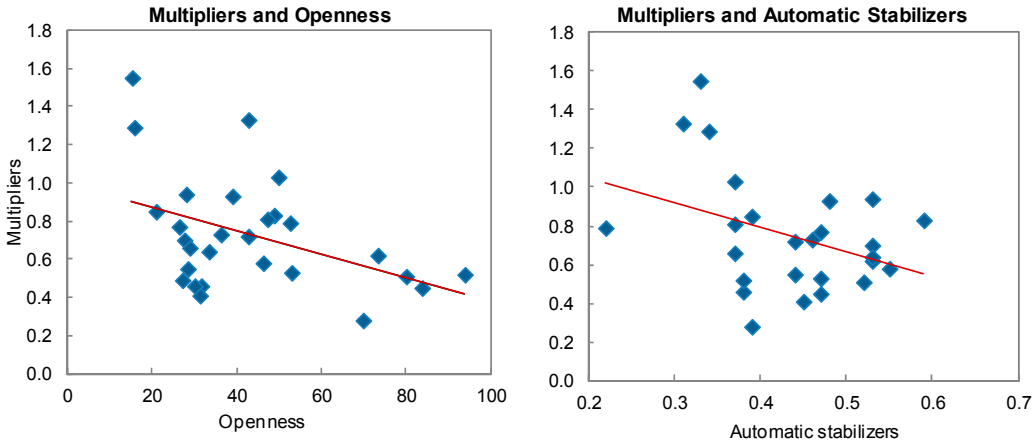
II. Background and Literature Review

A. What are Fiscal Multipliers and How Large are They?

Fiscal multipliers are typically defined as the ratio of a change in output to an exogenous and temporary change in the fiscal deficit with respect to their respective baselines (Spilimbergo, Symansky, and Schindler, 2009). In spite of an extensive literature, there is still no consensus regarding the size of fiscal multipliers. They tend to be smaller in more open economies and in countries with larger automatic stabilizers (Figure 1), but as the theoretical and empirical literature suggest, they differ widely across countries.

A comprehensive literature review on fiscal multipliers can be found in Baunsgaard and others (2012), who extend and update Spilimbergo, Symansky, and Schindler (2009). Baunsgaard and others (2012) review a total of 37 studies including both model based (DSGE) and vector autoregressive (VAR) approaches. For those studies government spending multipliers range between 0 and 2.1, with a mean of 0.8 during the first year after fiscal measures are taken. Government revenue multipliers range from about –1.5 to 1.4, with a mean of 0.3.

Figure 1. Country Characteristics and Multipliers



Sources: IMF, Fiscal Affairs Department Fiscal Rules database and Fiscal Transparency database; Organization for Economic Cooperation and Development (OECD); and IMF staff estimates.
Note: Multipliers are based on the OECD (2009). Openness is measured by import penetration, that is the 2008–11 average of Imports/(GDP – Exports + Imports)*100. Automatic stabilizers are measured as the semielasticity of the budget balance and are extracted from André and Girouard (2005). The negative correlations in the panel are robust to outliers being removed using an automated Stata procedure based on leverage (a measure of how far an independent variable deviates from its mean) and residual in the equation.

B. Do Multipliers Differ in Downturns and Expansions?

Although most studies do not distinguish between multipliers in different underlying states of the economy, the effects of fiscal policy shocks on economic activity are likely nonlinear. Multipliers could be significantly larger in downturns than in expansions. In times of a negative output gap, the traditional crowding-out argument—that higher government spending displaces private spending—is generally less applicable since excess capacities are available in the economy. In addition, the proportion of credit-constrained households and firms, which adjust spending in response to a change in disposable income, is higher.

Surprisingly few studies have tried to distinguish between multipliers in downturns and expansions. These have mostly focused on a single country (Germany: Baum and Koester, 2011; and the United States: Auerbach and Gorodnichenko, 2012a) or employed a panel data approach, thereby providing average multipliers across countries, which may mask important heterogeneities in the estimation process (Auerbach and Gorodnichenko, 2012b).[3]

A recent study that is close to our paper and that distinguishes between multipliers on a country-by-country basis is the work by Batini, Callegari, and Melina (2012). Using regime-

[3] Afonso, Baxa, and Slavik (2011) also use the TVAR technique to check the effects of fiscal multipliers on economic activity. However, those authors apply the analysis only for the United States, United Kingdom, Germany, and Italy, and use the Cholesky identification instead of a structural identification to generate their impulse responses. They also approximate fiscal policy by the public debt ratio rather than distinguishing between revenue and expenditure measures.

switching VARs with output growth as the threshold variable, the paper focuses on interactions between fiscal and monetary policies. It estimates the impact of fiscal adjustment in the United States, Europe (the Euro area as a whole, Italy and France) and Japan, allowing fiscal multipliers to vary across recessions and booms. A fiscal consolidation is found to be substantially more contractionary if made during a recession than during an expansion. First-year cumulative multipliers for consolidations that began during downturns range between 1.6 to 2.6 for expenditure shocks, and 0.2 to 0.4 for tax shocks. First-year cumulative multipliers for consolidations that began in expansions range from 0.3 to 1.6 for expenditure shocks, and -0.3 to 0.2 for tax shocks. Second-year cumulative multipliers have similar sizes to 1-year multipliers, implying that a large part of the impact of fiscal shocks on output materializes within 4 quarters. A summary of results from selected studies on fiscal multipliers that employ non-linear approaches is provided in Table 1.

Our paper conducts a nonlinear time-series analysis for six G7 countries, applying a threshold methodology that closely follows Baum and Koester (2011). The threshold value is determined endogenously, allowing the data to find the value of the output gap that maximizes the fit of the model in both regimes. It contrasts with Auerbach and Gorodnichenko (2012a), who use a regime-switching structural VAR (SVAR) in which the threshold value has to be determined exogenously. Furthermore, Auerbach and Gorodnichenko (2012a) use a moving average presentation of the GDP growth rate as the threshold variable. The main difference between our paper and Batini, Callegari, and Melina (2012) is the country sample as well as the threshold variable.

The reasons to employ the output gap instead of the GDP growth rate are manifold. The output gap is the measure most commonly used to identify economic cycles, as it is seen not only as reliable ex-post but also as a reliable real-time indicator for policy-makers. It is thus an appropriate choice given our focus on downturns and expansions. More importantly, one argument for fiscal policy being more effective in downturns than in expansions is that under a negative output gap, excess capacities are available in the economy, making the crowding out of private investment lower. This argument is expected to hold as long as the output gap is negative, which can hardly be captured by low or negative growth rates. The GDP growth rate has also the disadvantage that it can be positive after output has reached its trough, while a negative output gap can prevail for various further quarters (see Woo, Kinda, and Poplawski-Ribeiro, 2013). Furthermore, the usual presence of positive serial correlation in GDP growth rates plays a role in explaining business cycles length. Business cycles are often found to be shorter when one uses the GDP growth rates (Harding and Pagan, 2002).[4]

[4] As a robustness check, we also perform the estimations using output growth as a threshold variable.

Table 1. Cumulative Fiscal Multiplier Estimates from Selected Non-Linear Approaches

					4 quarters	8 quarters
Auerbach-Gorodnichenko (2012a)	Quarterly data 1947:1-2008:4	U.S.	Spending	Expansion	0.0	-0.1
				Recession	1.4	1.8
Auerbach-Gorodnichenko (2012b)*	Semiannual data Old members: 1985-2010. Newer members: mid-1990s-2010	OECD	Spending	Expansion	-0.3	-0.3
				Recession	0.5	0.4
Batini, Callegari and Melina (2012)	Quarterly Data: 1975:1-2010:2	U.S.	Spending	Expansion	0.3	-0.5
				Recession	2.2	2.2
			Revenue	Expansion	0.2	0.7
				Recession	0.2	0.7
	Quarterly Data: 1981:1-2009:4	Japan	Spending	Expansion	1.4	1.1
				Recession	2	2
			Revenue	Expansion	-0.3	-0.1
				Recession	-0.2	0.2
	Quarterly Data: 1981:1-2007:4	Italy	Spending	Expansion	0.4	0.5
				Recession	1.6	1.8
			Revenue	Expansion	0.1	0.1
				Recession	0.2	0.2
	Quarterly Data: 1970:1-2010:4	France	Spending	Expansion	1.6	1.9
				Recession	2.1	1.8
			Revenue	Expansion	-0.1	-0.2
				Recession	0	-0.3
	Quarterly Data: 1985:1-2009:4	Euro Area	Spending	Expansion	0.4	0.1
				Recession	2.6	2.5
			Revenue	Expansion	-0.2	-0.1
				Recession	0.4	0.4

* Multipliers reported here reflect the real GDP response (in percent) to a 1 percent spending shock.

III. Data and Methodology

A. Data Sources and Description

The countries included in our sample are Canada, France, Germany, Japan, the United Kingdom and the United States.[5] For most countries we construct quarterly datasets since at

[5] Quarterly fiscal data (on an accrual basis) were not available for Italy for a comparable period. Therefore, Italy is excluded from the analysis.

least the 1970s. Data sources include the Organization for Economic Cooperation and Development (OECD) Economic Outlook, the IMF's *International Financial Statistics* and Eurostat as well as national account data. Fiscal data cover the general government. There are some caveats regarding the data sources, especially in the cases of Japan and France, for which data were interpolated for some years (see also Perotti, 2005).

The vector autoregression consists of three variables, namely real GDP, real net revenue and real net expenditure, as in the seminal paper by Blanchard and Perotti (2002). The net revenue series is equal to general government revenues minus net transfers; and government spending comprises general government investment and general government consumption (but excludes transfers and subsidies). All series are deflated with the GDP deflator. For most of the countries—except for Germany, for which the HP filter is used (see Baum and Koester, 2011)—output gap data are obtained directly from the OECD. A detailed description of the data can be found in Appendix A.

B. Threshold VAR Methodology

A threshold VAR is a simple method to model changing dynamics of a set of variables over two or more distinct regimes. The regimes are determined by a transition variable, which is either endogenous or exogenous (Hansen 1996, 1997, Tsay 1998). In general, it is possible to obtain more than one critical threshold value, but for simplicity we will focus on a model with only two regimes.

The threshold VAR can be represented as

$$y_t = \delta_1 X_t + \delta_2 X_t I\left[z_{t-d} \geq z^*\right] + u_t \qquad (1)$$

z_{t-d} is the threshold variable determining the prevailing regime of the system, with a possible lag d . $I[\bullet]$ is an indicator function that equals *1* if the threshold variable z_{t-d} is above the threshold value z^*, and *0* otherwise. The coefficient matrices δ_1 and δ_2, as well as the contemporaneous error matrix u_t, are allowed to vary across regimes. The delay lag d and critical threshold value z^* are unknown parameters and are estimated alongside the parameters.

Whether or not system (1) offers threshold behavior is determined by means of the Tsay (1998) multi-variate threshold approach. The method applies a white noise test to predictive

residuals of an arranged regression.[6] A detailed description of the testing procedure can be found in Tsay (1998), as well as in Baum and Koester (2011).

Impulse response (IR) functions need to be based on well identified shocks. This study employs the Blanchard and Perotti (2002, BP) structural identification procedure, which accounts for the effect of automatic stabilization on revenues. Revenue elasticities with respect to GDP are obtained following OECD calculations (Girouard and André, 2005). Subsequently, the share of direct and indirect taxes, social security contributions, and social spending (transfers) in total net revenue are multiplied by their respective elasticities to construct quarterly weighted elasticities.

The BP approach has been subject to various criticisms (IMF, 2010). These include that it may fail to capture exogenous policy changes correctly, since changes in revenues are not only due to cyclical developments and discretionary policy, but also to asset and commodity price movements. For example, a boom in the stock market improves cyclically-adjusted tax revenues and is also likely to reflect developments that raise private consumption and investment. Such measurement error is likely to bias the analysis towards downplaying contractionary effects of deliberate fiscal consolidation. A rise (fall) in cyclically adjusted revenue (spending) may also reflect a government's decision to raise taxes or cut spending to restrain domestic demand and reduce the risk of overheating. In this case, using the cyclically adjusted data to measure the effect of fiscal consolidation on economic activity would suffer from reverse causality and bias the analysis towards supporting the expansionary fiscal contractions hypothesis.

Alternative methods proposed include the "narrative" and "action"-based approaches by Romer and Romer (2010) and the IMF (2010), which use information from budget documents to directly identify exogenous policy changes. So far, the narrative approach has only been applied using quarterly data for the United Kingdom (Cloyne, 2011) and the United States (Romer and Romer, 2010). The IMF (2010) created a multiple country data set based on this approach (see also Devries and others, 2011), but it only includes annual data. Therefore, given the lack of quarterly data of comparable quality for the countries in our sample, the BP approach is employed in this study.[7]

In order to take previous criticism into account, the net revenue and expenditure series are corrected to eliminate, to the extent possible, those changes in government revenues and expenditure that are not necessarily linked to fiscal policy decisions and that cyclical

[6] The data are arranged in increasing order on the basis of the threshold variable. Sequential estimation of linear VARs gives a sequence of OLS regressions, each using the first *x* ranked observations. For each of these regressions, the one-step ahead predictive residuals are kept.

[7] Caldara and Kamps (2012) show that differences in estimates of fiscal multipliers documented in the literature by Blanchard and Perotti (2002), Mountford and Uhlig (2009) and Romer and Romer (2010) are due mostly to different restrictions on the output elasticities of tax revenue and government spending.

adjustment methods may fail to capture (for example, large movements in asset or commodity prices).[8] This removes the largest—but not all—measurement errors, as identified episodes in IMF (2010) refer to cases of fiscal consolidations and not expansions. Furthermore, the IMF (2010) only provides data on an annual basis and therefore covers only part of our dataset.[9] Hence, especially the responses of output to revenue shocks have to be interpreted cautiously.

C. Impulse Response Functions

The impulse response functions (IRFs) need to reflect the nonlinearity of our model. The challenge in computing IRFs in a nonlinear model is that they should allow not only the shock impact to depend on the regime itself, but also the regime to switch after a shock has been implemented. The latter is important, as output—and the output gap—evolve over time following a fiscal policy shock. Thus, not considering regime switches in the impulse response functions could result in over- or understated fiscal multipliers.

The generalized impulse response function (GIRF), developed by Koop (1996) and Koop, Pesaran, and Potter (1996), addresses nonlinearity by being history-dependent. This implies that the IRF depends on the specific time period in which the shock occurs. Formally, we implement shocks for each period within one regime and then take regime averages to obtain the GIRFs.[10] Defining ε_t as a shock of a specific size, m as the forecasting horizon and Ω_{t-1} as the history or information set at time $t-1$, the GIRF for each period is described as the difference between two conditional expectations:

$$\text{GIRF} = E[\mathrm{X}_{t+m} \mid \varepsilon_t, \varepsilon_{t+1} = 0, ..., \varepsilon_{t+m} = 0, \Omega_{t-1}] - E[\mathrm{X}_{t+m} \mid \varepsilon_t = 0, \varepsilon_{t+1} = 0, ..., \varepsilon_{t+m} = 0, \Omega_{t-1}] \quad (2)$$

Since the GIRF methodology allows the regimes to switch after a fiscal shock is implemented, the IRFs depend on the size and also the direction (sign) of the shocks. For example, a positive spending shock in a downturn could increase output for several quarters,

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[8] When large discrepancies are observed between the IMF (2010) "action-based" measure of policy changes and the cyclically adjusted primary balance, the component of revenue and expenditure changes unrelated to output developments and discretionary measures is removed from the quarterly net revenue and expenditure series. This yields a "clean" series, where changes in revenue mainly reflect changes related to output and policy measures.

[9] We apply the Cholesky decomposition as a robustness check to account for the sensitivity of our results to the exact identification method; even though this identification methodology does not identify the revenue shocks correctly (it does not account for the effects of automatic stabilizers). The results with respect to spending multipliers, available upon request, remain robust.

[10] GIRFs have been employed in several empirical applications. For example, in monetary economics they are applied by Balke (2000) and Atanasova (2003).

closing the output gap and inducing a shift into the expansionary regime. A negative shock might not cause the same shift of regimes.

Nevertheless, due to various features of our GIRF generation, the differences between positive and negative shocks tend to be small:

- First, the output gap in our sample is rather persistent. It does not close immediately after a shock of a reasonable size is implemented (2 percent shocks are used).
- Second, the output gap has to be updated after each forecast period, which makes the forecast of the GDP trend necessary. The one-sided Hodrick-Prescott (HP)-filter could potentially be applied to update the trend, as done in Baum and Koester (2011), but this yields very little precision along the boundaries. Instead, within the forecast horizon we take the trend as given, so that it follows the evolution of the original trend series. The trend GDP is thus unaltered by fiscal shocks for several quarters, allowing for less variation between positive and negative shocks than in Baum and Koester (2011).[11]
- Third, the output gap itself enters the VAR with one or more lags. For instance, in cases in which the highest threshold significance was obtained for an output gap in three lags, there will be no difference between positive and negative shocks for the first three quarters of the IRF.

Confidence bands are constructed using the standard parametrical bootstrap procedure following Luetkepohl (2000). This method randomly draws from the estimated residuals, recursively computes bootstrap time series, and re-estimates the coefficient matrices accordingly for a large number of repetitions (500). Thus, the non-linear impulse responses reported are averages of stochastic simulations, while the confidence bands are percentiles of 500 stochastic simulations of the nonlinear impulse responses. The 1 standard deviation confidence bands are taken from the distribution of the resulting IRFs.

[11] In principle, fiscal policy measures could have an impact on potential GDP, for example through tax policy or changes in government investment. Those trend changes, however, are expected to occur in the long-run, while we are forecasting up to about 15 quarters only. We thus expect the resulting bias to be small. It should also be noted that large and short-term trend shifts in response to policy actions are unlikely to have occurred over the available data span, thus our model is unlikely to diverge from a pattern of a very slowly and gradually changing trend GDP even if we allowed the trend to vary after a fiscal policy shock.

IV. RESULTS

A. Country-by-Country Results

Table 2 summarizes selected descriptive statistics. For all countries but Japan the majority of statistical tests suggest a specification with one lag in the VAR.

Table 2. G7 Selected Countries: Descriptive Statistics

(Percent of GDP, unless otherwise specified)

	Period Sample	VAR Lag Length[a]	Mean Output Gap	Max. Output Gap	Min. Output Gap
Canada	1966Q1–2011Q2	1	-0.71	4.09	-8.31
France	1970Q4–2010Q4	1	-0.17	4.00	-4.42
Germany	1975Q3–2009Q4	1	-0.01	3.65	-2.92
Japan	1970Q1–2011Q2	2	-0.39	5.67	-7.81
UK	1970Q1–2011Q2	1	-0.04	10.42	-10.25
US	1965Q2–2011Q2	1	-0.23	4.66	-7.05

Source: Authors' calculations.

Note: [a] Unit value. The VAR lag length is chosen based on the majority of suggestions by the sequential modified LR test statistic (LR), the Final prediction error (FPE), the Akaike information criterion (AIC), the Schwarz information criterion (SC) and the Hannan-Quinn information criterion (HQ).

The results for the Tsay threshold approach are presented in Table 3. The estimated threshold values and the corresponding lag length are chosen based on the highest significance.[12] Since the threshold output gap value for most countries is relatively small, the discussion that follows refers to the two regimes as the positive and negative output gap regimes or, simply, as expansions and downturns. Apart from the United Kingdom, the threshold value is below the average output gap (see Table 2) and negative for all countries. Consequently, for most of the countries, the majority of the observations lie in the upper output gap regime. The suggested threshold values are significant at the 10 percent level for France, at 5 percent for the United Kingdom, and at 1 percent for Canada, Germany, Japan and the United States. Therefore, we estimate a two regime threshold SVAR for all countries in our sample.

Table 3. G7 Selected Countries: Threshold Estimation

	Estimated Threshold	*Chi2 Value*	*Threshold Lag*	*Number of Observations in Each Regime*	
				High	*Low*
Canada	-1.29***	31.457	4	120	60
France	-0.31*	20.124	4	85	75
Germany	-0.15***	39.916	1	94	43
Japan	-1.28***	53.694	2	102	61
UK	0.91**	25.168	1	59	105
US	-1.33***	45.688	1	130	53

Source: Authors' calculations.

Note: *,**,*** indicate significance levels at the 10, 5, 1 percent level respectively.

[12] The Tsay threshold test is conducted for threshold lag levels of 1 to 8 lags. Results (not shown here) are available upon request.

Figures 2 and 3 present four and eight quarter cumulative multipliers for each country. In addition, Appendix B presents the cumulative GIRFs for each country under the two output gap regimes for a fiscal expansion (Figures B.1 and B.2) and a fiscal contraction (Figures B.3 and B.4).

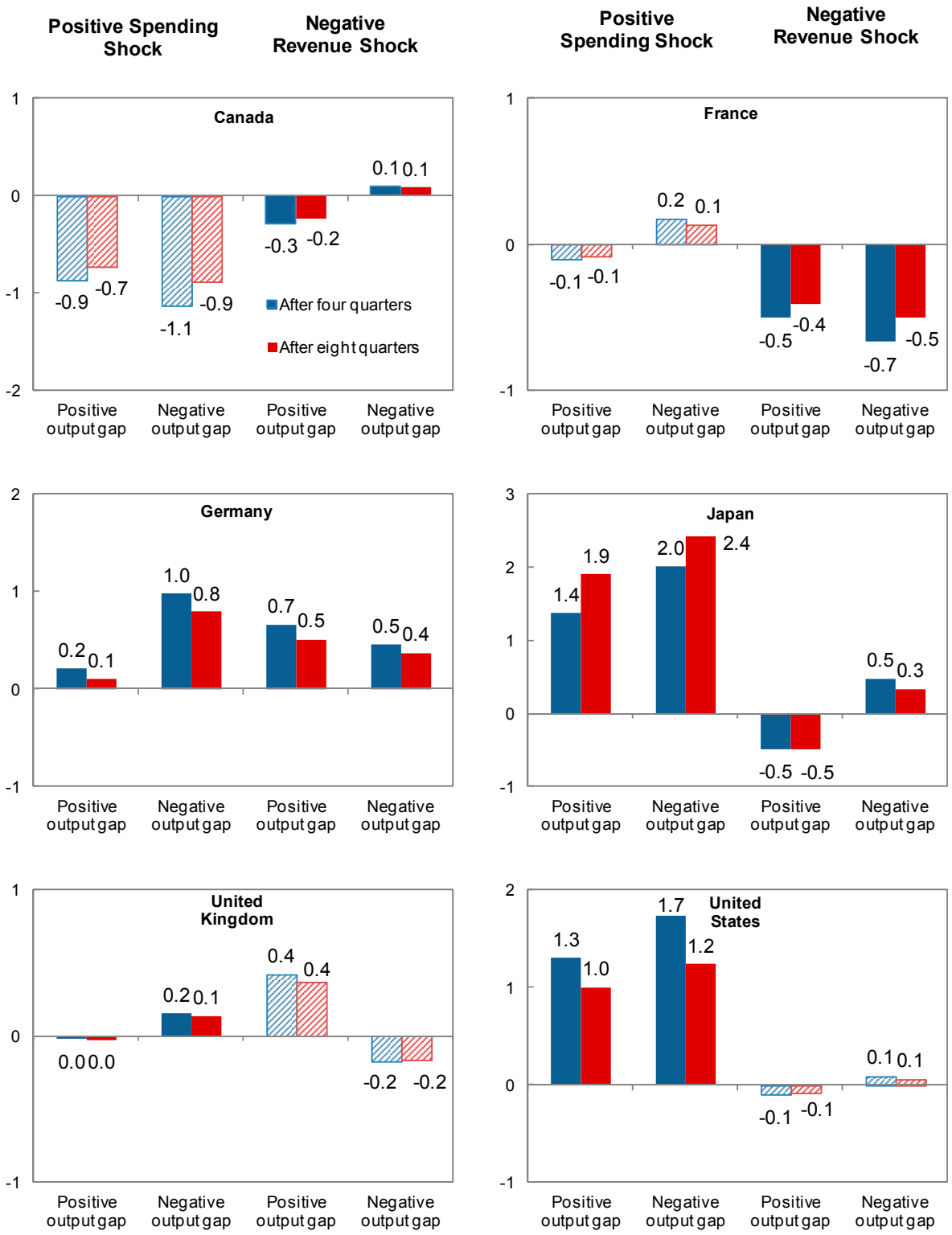
We find broad supportive evidence for a nonlinear impact of fiscal policy on output. Government spending shocks have a larger effect on output when the output gap is negative (Canada being the only exception). This is particularly true for those countries where spending multipliers are statistically significant on impact (see Appendix B), and sizeable (Germany, Japan, and the United States).[13]

The results are generally less conclusive for revenue multipliers. However, quite a consistent result across countries is that first year revenue multipliers are small (on average well below 0.5). Their impact is statistically significant for Canada, France, Germany, and Japan. In Germany, revenue multipliers are slightly higher in "good times" than in "bad times", which could suggest that individuals and firms are more willing to spend additional income when market sentiment is positive, thereby becoming less Ricardian. In Canada and Japan revenue measures work as a countercyclical tool only when the output gap is negative.

Using output growth as a threshold variable rather than the output gap yields results that are qualitatively similar, with the exception of France. With GDP growth as the threshold variable, fiscal expansions result in an increase in output for France and vice versa for fiscal contractions. For the other countries, the results remain comparable, although in the case of Canada, using output growth as the threshold gives much larger multipliers in the downturn regime. A detailed comparison of multipliers between models employing the different thresholds variables is shown in Appendix C.

[13] In contrast to Appendix 1 of the April 2012 IMF Fiscal Monitor, we are now able to investigate the significance of the multipliers using confidence bands for the nonlinear model rather than only for the linear model. The results remain robust and identical to those presented in the Fiscal Monitor.

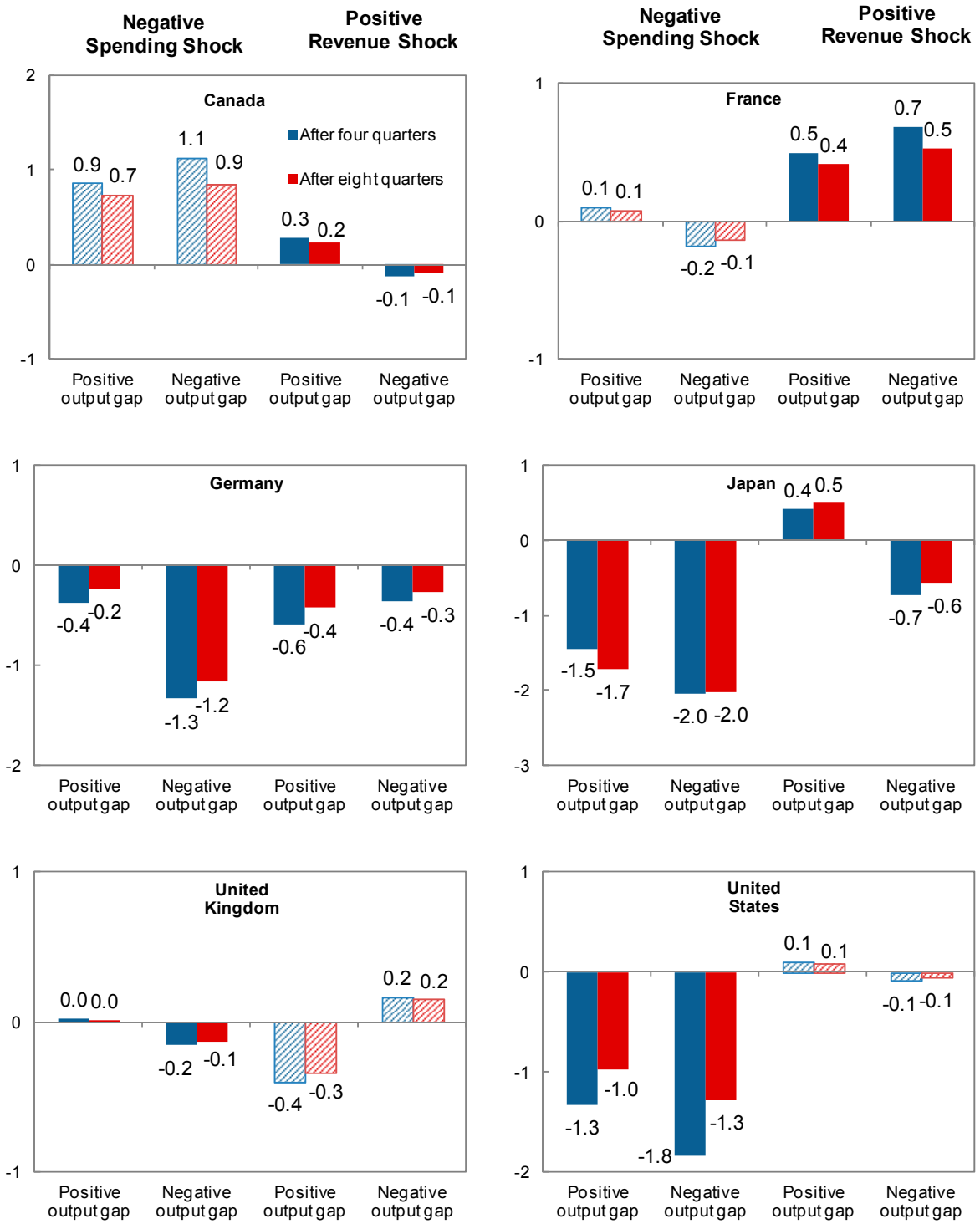
Figure 2. Cumulative Fiscal Multipliers: Fiscal Expansion



Source: IMF staff estimates.

Note: The striped bars correspond to those measures for which no significant multiplier is found at the time the fiscal shock is implemented.

Figure 3. Cumulative Fiscal Multipliers: Fiscal Contraction



Source: IMF staff estimates.

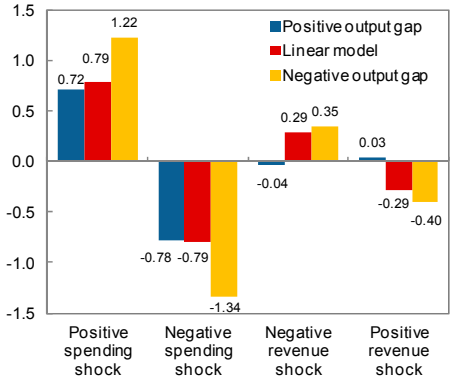
Note: The striped bars correspond to those measures for which no significant multiplier is found at the time the fiscal shock is implemented.

B. Average of G7 Economies

Figure 4 shows multipliers for the average of the G7 economies (excluding Italy). It broadly supports the above findings, with both spending and revenue multipliers significantly larger in times of a negative output gap than when the output gap is positive.

Figure 4 also includes average multipliers estimated with a standard linear structural VAR for the same countries and period. We find that these multipliers lie between the positive and negative regime multipliers, and that they are very much in line with averages identified in the previous literature (Baunsgaard and others, 2012). This suggests that the linear model underestimates the effects of spending and revenue shocks during downturns and overestimates their effects in expansions.

Figure 4. Fiscal Multipliers in G-7 Economies



Source: IMF staff calculations.
Note: Cumulative multipliers are standardized multipliers over four quarters. Only statistically significant multipliers are included in the average. Average revenue multipliers exclude France, for which the outliers are large and data limitations are particularly severe. Italy is not included in the G7 average.

Assuming, in line with recent fiscal adjustment packages in advanced economies, that two thirds of the adjustment comes from spending measures, a weighted average of spending and revenue multipliers in downturns yields an overall fiscal multiplier of about 1.

C. Discussion and Caveats

The results indicate that multipliers vary significantly between and within countries, which calls for a tailored use of fiscal policies and a country-by-country assessment of their effects. The empirical results are mostly in accordance with other studies on fiscal multipliers (see Favero, Giavazzi, and Perego, 2011, Perotti, 2005). We confirm the sizable spending multipliers that have been found in the previous literature for the United States. For Canada and the United Kingdom, our low expenditure multipliers are in line with Perotti (2005), who, using a structural VAR, finds that spending multipliers have decreased significantly since the 1980s.

We find that revenue multipliers in the United States and the United Kingdom are very small and not statistically significant. This could be due to a change in the impact of revenue measures on output over time, while our results reflect the historical average impact of fiscal policy. Perotti (2005) shows that prior to the 1980s, tax cuts had a significant positive impact on GDP, but in the period after 1980 this effect became negative. These results contradict the findings of Romer and Romer (2010) and Cloyne (2011), who, using a narrative approach to

construct a dataset on exogenous revenue shocks, find significant and large revenue multipliers for the United States and the United Kingdom, respectively. [14] However, recent work by Favero and Giavazzi (2012), as well as Perotti (2011), demonstrate that the revenue multipliers in Romer and Romer (2010) are subject to a strong upward bias as their specification cannot be interpreted as a moving average (MA) representation of the output process. When using a "corrected" truncated MA representation, Favero and Giavazzi (2012) estimate revenue multipliers of around -0.5.

Our results are also mostly in line with the analyses that control for the state of the cycle (Auerbach and Gorodnichenko (2012a) and Batini, Callegari, and Melina (2012)). Our study confirms the state dependency of fiscal multipliers and shows that multipliers, and especially spending multipliers, are significantly larger in downturns than in expansions. Spending multipliers in the United States are found to be significantly above one during downturns.

We find that revenue multipliers are significantly smaller than spending multipliers. This can be explained with basic Keynesian theory, which argues that tax cuts are less potent than spending increases in stimulating the economy since households may save a significant portion of the additional after-tax income. However, a number of earlier studies have shown that expenditure-based fiscal consolidations have a more favorable effect on output than revenue-based consolidations (see, for example, Alesina and Ardagna, 2010). IMF (2010) reaches the same conclusion and notes that this result is partly due to the fact that, on average, central banks lower interest rates more in case of expenditure-based consolidations (perhaps because they regard them as longer-lasting).[15] When interest rates are already low, the interest rate response becomes less relevant. This may imply that, in the current environment, the Keynesian positive fiscal multiplier prediction prevails.[16]

When thinking about the exact design of a fiscal consolidation package one needs to take into account other factors in addition to the size of multipliers. Notably, the long-term effects of

[14] Romer and Romer (2010) use quarterly data for the United States from 1945 to 2007 and look at official budget reports to classify changes in tax rates as endogenous or exogenous. The exogenous changes are then used as a measure of discretionary policies and their effects on output are investigated. Cloyne (2011) applies the same narrative approach to the United Kingdom using data from 1945 to 2009.

[15] IMF (2010) shows that in the case of tax-based programs, the effect on GDP of a fiscal consolidation of 1 percent of GDP is -1.3 percent after two years, whereas for spending-based programs, the effect is -0.3 after two years and not statistically significant.

[16] Batini, Callegari, and Melina (2012) explicitly embed the response of monetary policy to a fiscal shock and show that historically, for example in the case of the United States, real interest rates rise instead of falling following a fiscal consolidation. They interpret this result as a sign that in the United States, nominal rates have not been cut sufficiently or sufficiently fast to alleviate the negative effects of consolidation. Thus, the existing empirical literature has not yet substantiated the proposition that spending multipliers following a consolidation may be smaller than what is implied by our estimates.

specific adjustments and the efficiency of tax and expenditure changes depend on their preexisting levels and structure. For example, the current high tax pressures in some countries (particularly in Europe) suggest that the bulk of the fiscal adjustment should focus on the expenditure side (although revenue increases may be inevitable when the targeted adjustment is large).

Moreover, several important caveats apply to our analysis. First, the model only includes three variables and does not take into account possible interactions with monetary policy and public debt. For instance, Auerbach and Gorodnichenko (2012b) find that the size of government debt reduces the response of output to government expenditure shocks (see also Ilzetzki, Mendoza, and Vegh, 2010).[17] Thus, the analysis may have overestimated fiscal multipliers, especially in high debt countries.[18] Second, some of the country heterogeneities may be the result of different data sources. Data limitations are particularly important for France, where true quarterly data are available only since the 1990s.

D. Policy Implications: Up-front versus Gradual Implementation

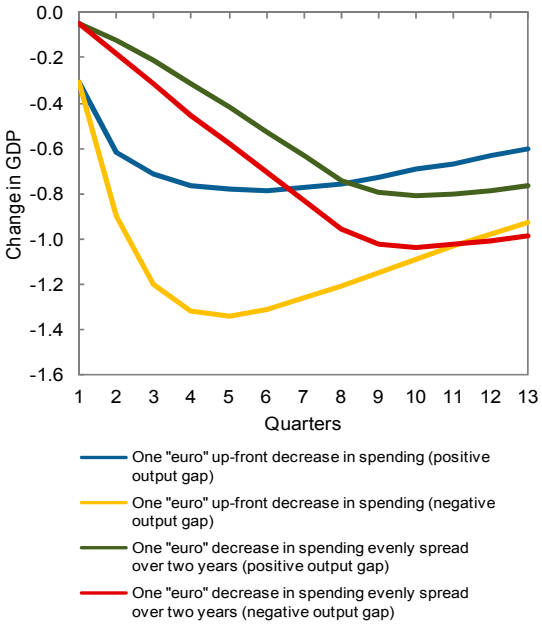
An important policy implication of the found asymmetries is that if financing allows, gradual fiscal adjustment may in some cases be preferable to a more frontloaded approach. For example, when the output gap is negative, at the time the fiscal shock is implemented, a gradual spending adjustment will have a smaller negative impact on output in the short term than an up-front reduction.

[17] Ilzetzki, Mendoza, and Vegh (2010) show that the impact of government expenditure shocks depends crucially on key country characteristics, which includes public indebtedness, level of development, exchange rate flexibility, and openness to trade.

[18] The effect of interactions between fiscal and monetary policy on multipliers is ambiguous. In periods in which fiscal and monetary policies were not coordinated, the effect of fiscal policy may have been even greater than our model suggests. Conversely, in periods in which there was policy coordination, multipliers may have been overestimated, since monetary policy could have contributed in the same direction to changes in output. However, more recently the zero lower bound on interest rates has been binding, and some studies have argued that fiscal multipliers became much larger than unity once this happened (Woodford, 2010; and Christiano, Eichenbaum, and Rebelo, 2011).

Figure 5 illustrates this for an average of the G7 economies in the sample (excluding Italy). It shows the impact of a one euro (or the relevant national currency) front-loaded improvement in the fiscal deficit versus a gradual improvement that is spread evenly over two years. When the output gap is negative initially, a more gradual fiscal adjustment hurts growth less in the first two and one-half years of the simulation period. Conversely, when the output gap is initially positive, a more front-loaded shock has a smaller cumulative impact on growth. [19]

Figure 5. G-7 Economies: Cumulative Impact on Output from a Negative Discretionary Fiscal Spending Shock



Sources: National sources; and IMF staff estimates.
Note: The figure shows average multipliers for G7-countries with significant impact multipliers.

An explanation for this finding lies in the nonlinear nature of the impulse response functions. They allow the regime to switch after the impact of the shock. Thus, if the shock initially occurs in a negative output gap regime, over the course of the tightening there is some probability of moving into a positive output gap regime in which multipliers are lower. With a longer fiscal consolidation period, the probability of this occurring is higher. Conversely, if the impact of the shock initially occurs in a positive output gap regime, then policymakers should use the favorable conditions and tighten upfront.

The discussion of up-front versus gradual adjustment is subject to some caveats. First, our results do not include anticipation effects. Especially in case of a gradual adjustment, such effects could alter the growth impact significantly. Second, a sharp up-front fiscal adjustment might be accompanied by further negative growth effects (such as a further downward pressure on employment, human capital, and financial markets), which our model does not capture in the current specification. If such additional negative impacts were to occur, the upward sloped parts of the IRFs for the up-front fiscal adjustment might not materialize, or only much later. Third, a sharp up-front adjustment may increase market confidence. Fiscal consolidation can in general calm markets, in which case the results of the up-front adjustment might be biased downwards. However, in the current sovereign debt crisis the bond spreads seem largely driven by GDP growth prospects (Cottarelli and Jaramillo, 2012).

[19] Annex 3 of IMF (2012) also finds that provided that hysteresis effects are significant and multipliers are asymmetric across the business cycle, delaying consolidation can generate permanent output gains.

V. CONCLUSIONS

This paper investigates the relationship between fiscal multipliers and the underlying state of the economy on a country-by-country basis for the G7 economies (except Italy). It extends the rapidly evolving literature on fiscal multipliers using non linear estimation techniques and a new dataset for six of the G7 economies.

We find evidence that the impact of fiscal policy on economic activity varies with the business cycle and that the effect of fiscal policy on output is nonlinear. Fiscal multipliers for the six economies analyzed are on average larger in times of negative output gaps than when the output gap is positive.

However, the value of multipliers differs noticeably across countries. Spending shocks tend to have a larger effect on output when the output gap is negative, particularly in those countries where spending impact multipliers are statistically significant and sizeable (Germany, Japan, and the United States). The results are generally less conclusive for revenue multipliers. For Canada, France, Germany, and Japan the impact is statistically significant. However, in Germany revenue multipliers are slightly higher in "good times" than in "bad times". In Canada and Japan, on the other hand, revenue measures work as a countercyclical tool only when the output gap is negative. This heterogeneity of the multipliers calls for a tailored use of fiscal policies and a country-by-country assessment of their effects.

The finding that the impact of fiscal policy on output depends on the underlying state of the economy has important implications for the choice between an upfront fiscal adjustment versus a more gradual approach. When the output gap is negative at the time the fiscal shock is initially implemented, an up-front negative fiscal spending shock will have a larger short-term impact on output than a more gradual fiscal adjustment.

Our analysis can be extended in various directions. It would be relevant to investigate the interaction between fiscal multipliers and monetary policy, particularly during periods in which interest rates are close to the zero lower bound. Moreover, the multiplier effects of different revenue and expenditure components, and how these are related to the underlying state of the economy, could be analyzed. The country sample could also be extended to other advanced and emerging economies, to investigate the state dependency of multipliers in a broader group of countries.

Appendix

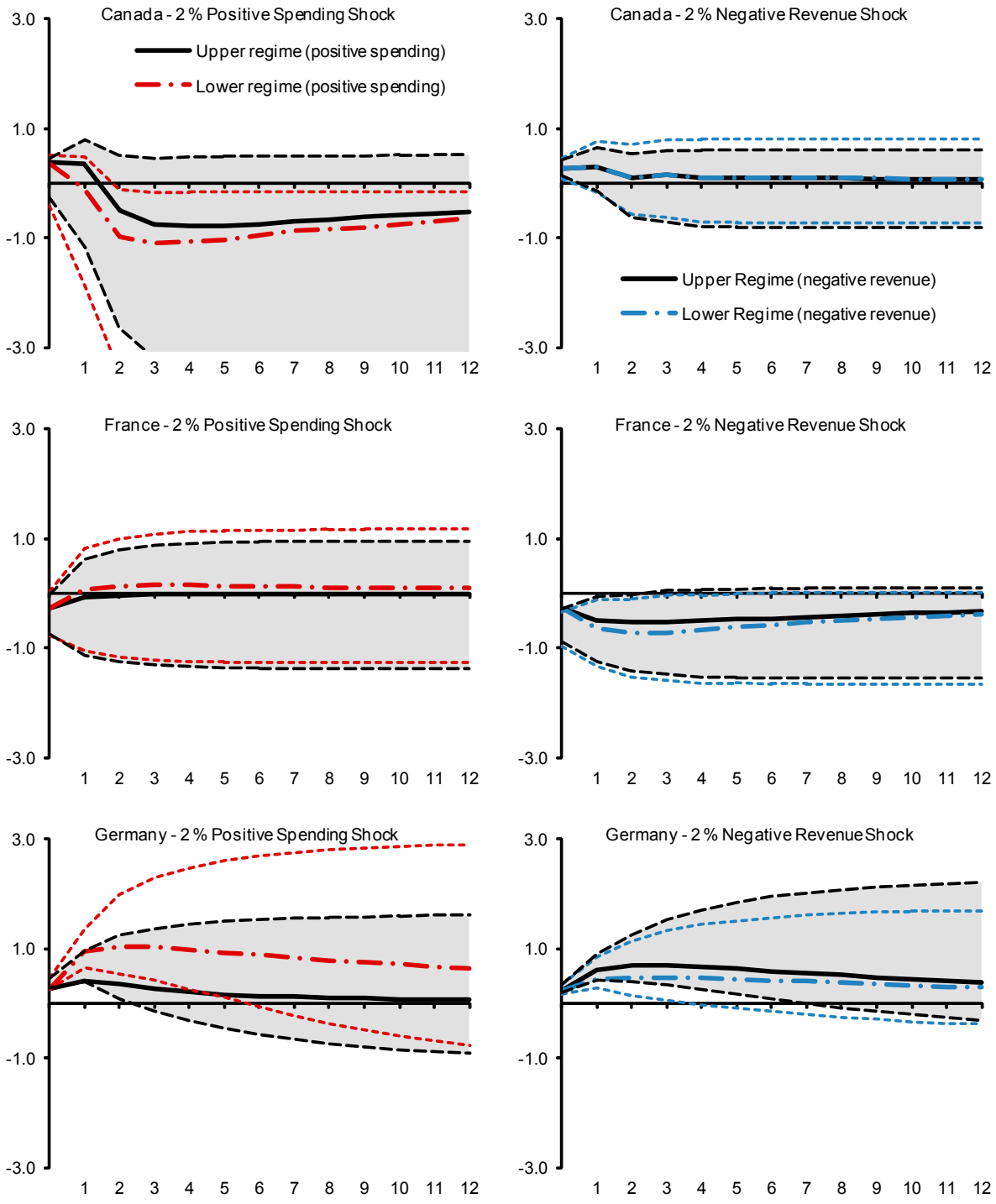
A. Data Sources and Description

Country	Sample	Definition of net revenue	Definition of expenditure	Sources	Notes	Other variables (Sources)
Canada	1966Q1–2011Q2	Taxes on income+contributions to social insurance plan+taxes on production and income+(other current transfers from persons-current transfers paid).	Outlay-Interest paid on public debt-current transfers.	CANSIM National Income and Expenditure Accounts.	Fiscal Data on general government and accrual basis in national currency. Data were seasonally adjusted with Tramo Seats in EViews.	Gross domestic product, value, market prices \ Canadian dollars, Gross domestic product, deflator, market prices \ INDEX, base 2002, Output gap of the total economy \ PERCENT. All seasonally adjusted (OECD).
France	1970Q4–2010Q4	Tax revenue+social security contributions+other current transfers-social transfers-subsidies.	Total expenditure-interest payments-transfers-subsidies.	IFS (until 1990) and Eurostat (since 1991).	Fiscal data from Eurostat on accrual basis. Prior to 1990 likely interpolated. We used percentage changes prior to 1991 to combine the two different data sources. The data were seasonally adjusted using Tramo Seats in EViews.	Gross domestic product, value, market prices \ Canadian dollars, Gross domestic product, deflator, market prices \ INDEX, base 2002, Output gap of the total economy \ PERCENT. All seasonally adjusted (OECD).
Germany	1975Q3–2009Q4	Government and social security revenues -receipts on dividends - unemployment insurance spending (as a proxy for transfer spending).	Government consumption + investment-interest payment -unemployment insurance spending.	Baum and Koester (2011).	Deutsche Bundesbank's national accounts database and defined according to the European System of National Accounts (ESA) 1979 and 1995. Data are for general government and on an accrual basis.	Real GDP and deflator (2000=100) are seasonally adjusted by applying the BV 4.1 procedure of the German Federal Statistical Office. Output gap is calculated with HP filter (λ=1600). (Deutsche Bundesbank's national accounts database).

Japan	1970Q1–2011Q2	Total receipts-interest receipts-social security benefits paid by general government-other transfers-subsidies.	Total disbursements-interest payments-social security benefits paid by general government-subsidies-other transfers.	OECD	Not clear whether interpolated for some years. Data are on a general government and accrual basis and already seasonally adjusted.	Gross domestic product, value, market prices \ yen, Gross domestic product, deflator, market prices \ INDEX, base 2000, Output gap of the total economy \ PERCENT. All seasonally adjusted (OECD).
UK	1970Q1–2011Q2	Total receipts-interest receipts-social security benefits paid by general government-other transfers-subsidies	Total disbursements-interest payments-social security benefits paid by general government-subsidies-other transfers	OECD	Data are on a general government and accrual basis and already seasonally adjusted.	Gross domestic product, value, market prices \ pound sterling. Gross domestic product, deflator, market prices \ INDEX, base 2000, Output gap of the total economy \ PERCENT. All seasonally adjusted (OECD).
US	1965Q2–2011Q2	Current tax receipts+ Contributions for government social insurance+ Current transfer receipts-current transfers-subsidies.	Consumption expenditures+ government investment.	Bureau of Economic Analysis, OECD.	Data are on a general government and accrual basis and already seasonally adjusted.	Real gross domestic product (chained 2005 dollars), Implicit GDP deflator (2005=100), Bureau of Economic Analysis. Output gap of total economy\PERCENT (OECD).

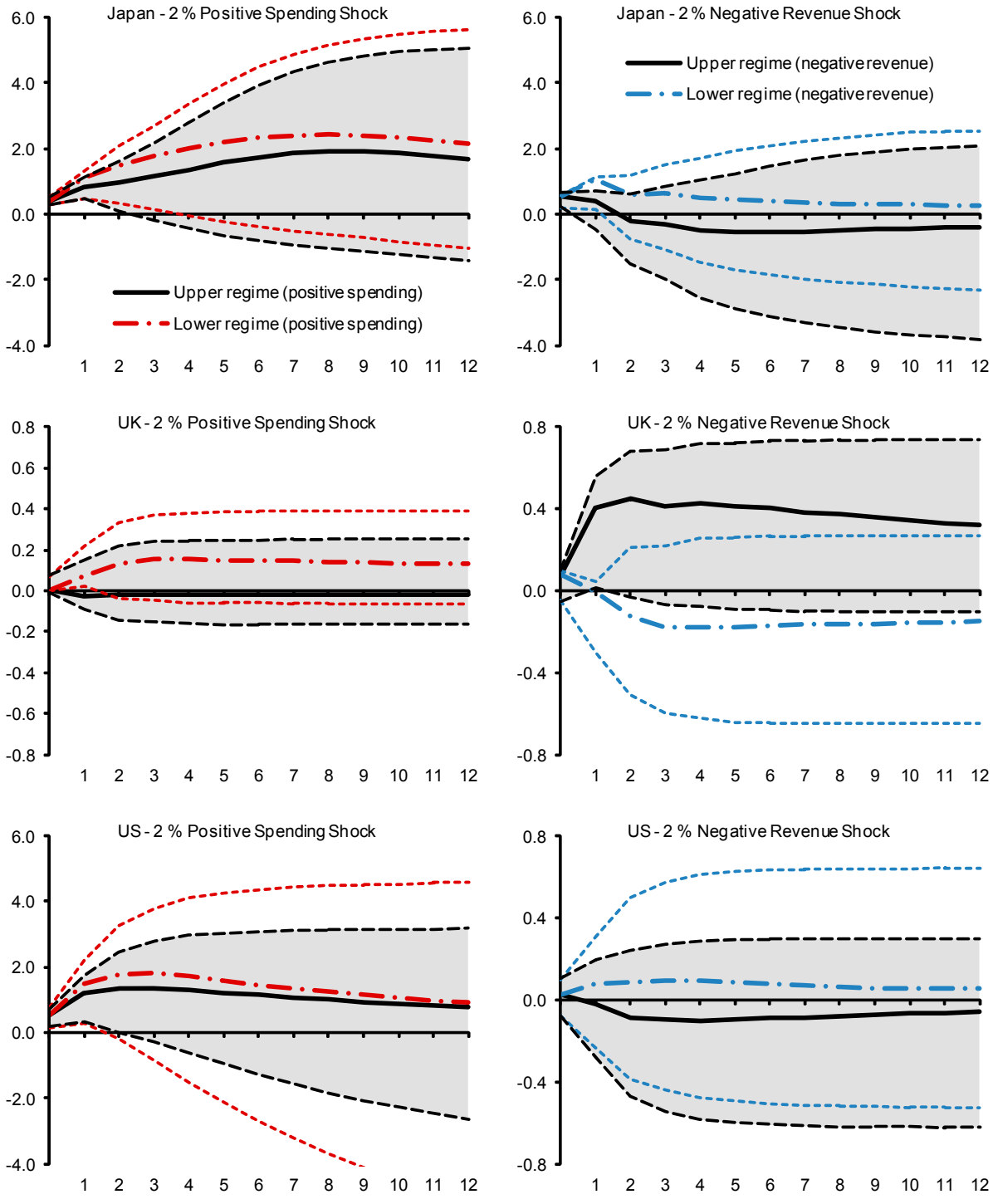
B. Cumulative Generalized Impulse Response Functions and Confidential Intervals

Figure B1. Fiscal Stimulus: Cumulative Global Impulse Response Functions and Confidence Bands (68 percent)



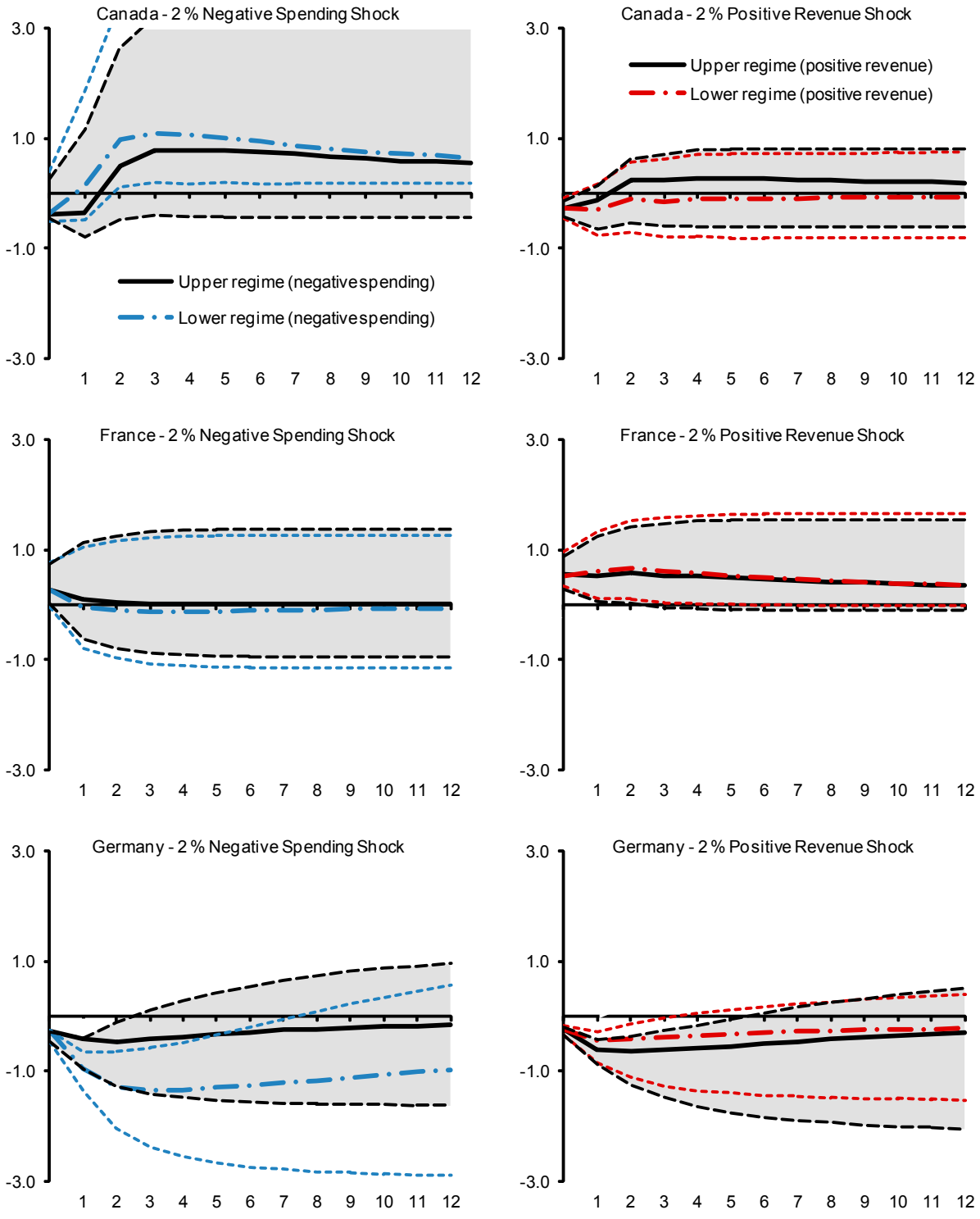
Source: Authors' calculations.

Figure B2. Fiscal Stimulus: Cumulative Global Impulse Response Functions and Confindence Bands (68 percent)



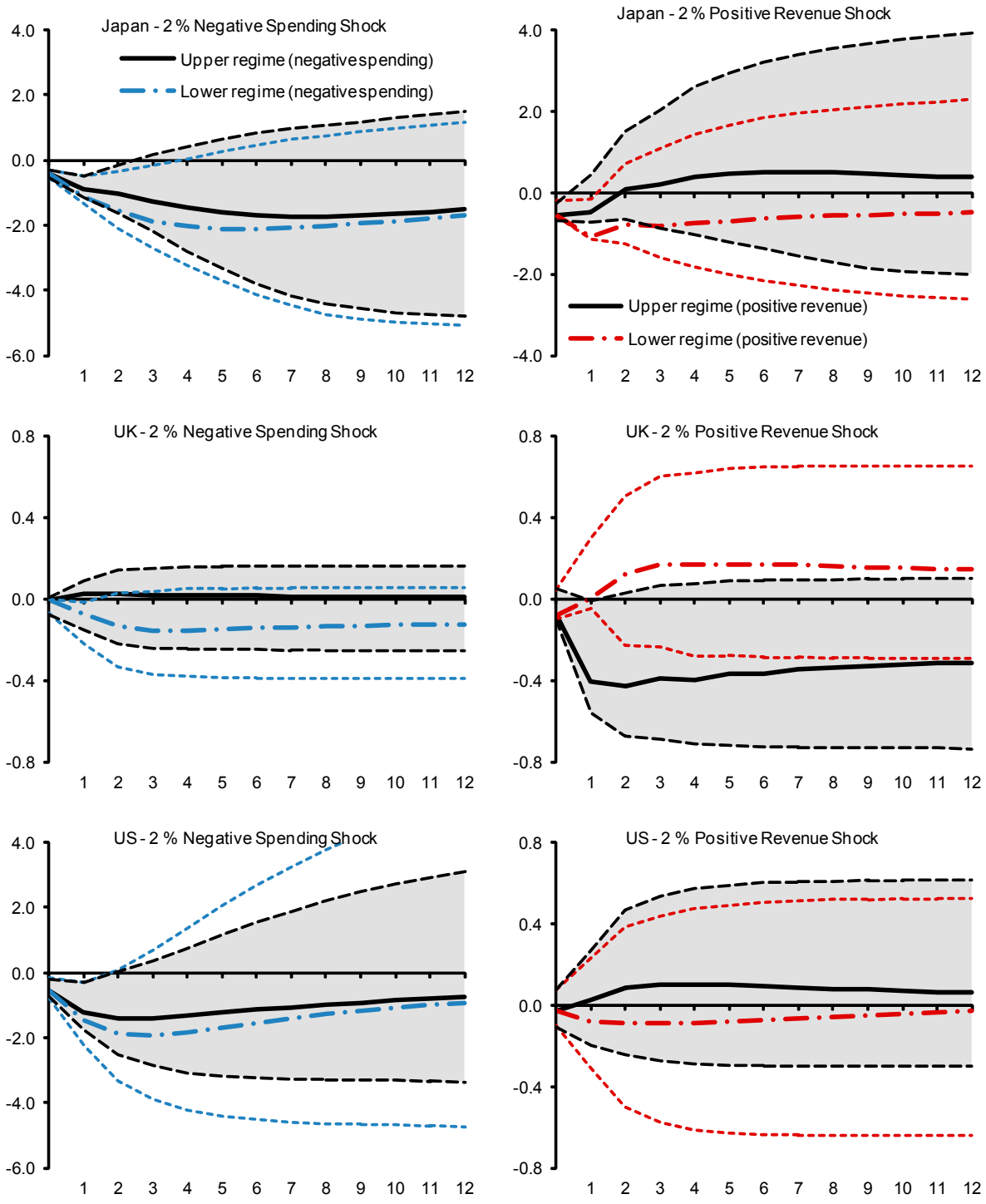
Source: Authors' calculations.

Figure B3. Fiscal Contraction: Cumulative Global Impulse Response Functions and Confidence Bands (68 percent)



Source: Authors' calculations.

Figure B4. Fiscal Contraction: Cumulative Global Impulse Response Functions and Confidence Bands (68 percent)



Source: Authors' calculations.

C. Using Output Growth as the Threshold Variable

Table C1. Comparison of Multipliers Estimated Using Output Gap or GDP Growth as Threshold Variable

Country	Regime	4 quarters				8 quarters			
		Spending Shock		Revenue Shock		Spending Shock		Revenue Shock	
		Positive	Negative	Positive	Negative	Positive	Negative	Positive	Negative
Canada	Positive output gap	-0.9	0.9	0.3	-0.3	-0.7	0.7	0.2	-0.2
	Positive GDP growth	*-0.8*	*0.9*	*0.2*	*-0.5*	*-1.1*	*1.2*	*0.2*	*-0.6*
	Negative output gap	-1.1	1.1	-0.1	0.1	-0.9	0.9	-0.1	0.1
	Negative GDP growth	*-2.7*	*3.0*	*-0.2*	*0.2*	*-3.3*	*3.9*	*-0.2*	*0.3*
France	Positive output gap	-0.1	0.1	0.5	-0.5	-0.1	0.1	0.4	-0.4
	Positive GDP growth	*1.7*	*-1.8*	*-0.7*	*0.6*	*2.1*	*-2.3*	*-0.9*	*0.7*
	Negative output gap	0.2	-0.2	0.7	-0.7	0.1	-0.1	0.5	-0.5
	Negative GDP growth	*-0.7*	*1.0*	*-1.6*	*1.6*	*-1.1*	*1.6*	*-2.2*	*2.2*
Germany	Positive output gap	0.2	-0.4	-0.6	0.7	0.1	-0.2	-0.4	0.5
	Positive GDP growth	*0.4*	*-0.5*	*-0.6*	*0.5*	*0.4*	*-0.6*	*-0.8*	*0.6*
	Negative output gap	1.0	-1.3	-0.4	0.5	0.8	-1.2	-0.3	0.4
	Negative GDP growth	*1.0*	*-1.0*	*-0.5*	*0.6*	*1.3*	*-1.3*	*-0.6*	*0.7*
Japan	Positive output gap	1.4	-1.5	0.4	-0.5	1.9	-1.7	0.5	-0.5
	Positive GDP growth	*0.9*	*-1.0*	*0.6*	*-0.9*	*1.3*	*-1.2*	*0.4*	*-0.6*
	Negative output gap	2.0	-2.0	-0.7	0.5	2.4	-2.0	-0.6	0.3
	Negative GDP growth	*1.6*	*-1.4*	*0.2*	*-0.4*	*1.8*	*-1.5*	*-0.2*	*-0.2*
United Kingdom	Positive output gap	0.0	0.0	-0.4	0.4	0.0	0.0	-0.3	0.4
	Positive GDP growth	*0.1*	*-0.1*	*0.0*	*0.1*	*0.1*	*-0.1*	*-0.1*	*0.1*
	Negative output gap	0.2	-0.2	0.2	-0.2	0.1	-0.1	0.2	-0.2
	Negative GDP growth	*-0.1*	*0.1*	*0.1*	*-0.1*	*-0.1*	*0.1*	*0.1*	*-0.1*
United States	Positive output gap	1.3	-1.3	0.1	-0.1	1.0	-1.0	0.1	-0.1
	Positive GDP growth	*1.8*	*-1.6*	*-0.4*	*0.4*	*2.4*	*-2.0*	*-0.5*	*0.5*
	Negative output gap	1.7	-1.8	-0.1	0.1	1.2	-1.3	-0.1	0.1
	Negative GDP growth	*1.9*	*-2.1*	*-0.2*	*0.2*	*2.4*	*-2.9*	*-0.3*	*0.3*

Source: Authors' calculations.

REFERENCES

Afonso, A., J. Baxa, and M. Slavik 2011, "Fiscal Developments and Financial Stress: A Threshold VAR Analysis," ECB Working Paper No. 1319 (Frankfurt: European Central Bank).

Alesina, A., and S. Ardagna, 2010, "Large Changes in Fiscal Policy: Taxes versus Spending," NBER Chapters, in: Tax Policy and the Economy, Vol. 24, pp. 35-68.

Atanasova, C., 2003, "Credit Market Imperfections and Business Cycle Dynamics: A Nonlinear Approach", *Studies in Nonlinear Dynamics and Econometrics,* Vol. 7(4), No. 5.

Auerbach, A.J., and Y. Gorodnichenko, 2012a, "Measuring the Output Responses to Fiscal Policy," *American Economic Journal: Economic Policy*, Vol. 4, pp. 1–27.

Auerbach, A.J., and Y. Gorodnichenko, 2012b, "Fiscal Multipliers in Recession and Expansion," in "Fiscal Policy after the Financial Crisis," A. Alesina and F. Giavazzi, (eds.), University of Chicago Press.

Balke, N. S., 2000, "Credit and Economic Activity: Credit Regimes and Nonlinear Propagation of Shocks", *Review of Economics and Statistics,* Vol. 82(2), pp. 344-349.

Batini, N., G. Callegari, and G. Melina, 2012, "Successful Austerity in the United States, Europe and Japan," IMF Working Paper 12/190 (Washington: International Monetary Fund).

Baum, A., and G.B. Koester, 2011, "The Impact of Fiscal Policy on Economic Activity over the Business Cycle –Evidence from a Threshold VAR Analysis," Bundesbank Discussion Paper, 03/2011 (Frankfurt: Deutsche Bundesbank).

Baunsgaard, T., A. Mineshima, M. Poplawski-Ribeiro, and A. Weber, 2012, "Fiscal Multipliers", in *Post-crisis Fiscal Policy*, ed. by C. Cottarelli, P. Gerson, and A. Senhadji (forthcoming; Washington: International Monetary Fund).

Blanchard, O., and R. Perotti, 2002, "An Empirical Characterization of the Dynamic Effects of Changes in Government Spending and Taxes on Output," *Quarterly Journal of Economics,* Vol. 117, pp. 1329–1368.

Caldara, D. and C. Kamps, 2012, "The Analytics of SVARs: a Unified Framework to Measure Fiscal Multipliers," Finance and Economics Discussion Series 2012-20 (Washington: Board of Governors of the Federal Reserve System)

Christiano, L., M. Eichenbaum, and S. Rebelo, 2011, "When Is the Government Spending Multiplier Large?" *Journal of Political Economy*, Vol. 119(1), pp. 78 - 121.

Cloyne, J., 2011, "What are the Effects of Tax Changes in the United Kingdom? New Evidence from a Narrative Evaluation," CESifo Working Paper Series 3433 (Munich: CESifo Group).

Cottarelli, C., and L. Jaramillo, 2012, "Walking Hand in Hand: Fiscal Policy and Growth in Advanced Economies," IMF Working Paper No. 12/137, May (Washington: International Monetary Fund).

Devries, P., J. Guajardo, D. Leigh, and A. Pescatori, 2011, "A New Action-based Dataset of Fiscal Consolidation," IMF Working Paper No. 11/128, June (Washington: International Monetary Fund).

Favero, C., and F. Giavazzi, 2012, "Reconciling VAR based and Narrative Measures of the Tax Multiplier,"*American Economic Journal: Economic Policy*, forthcoming.

Favero, C., F. Giavazzi, and J. Perego, 2011, "Country Heterogeneity and the International Evidence on the Effects of Fiscal Policy," CEPR Discussion Paper No. 8517, August (London: Centre for Economic Policy Research).

Girouard, N., and C. André, 2005, "Measuring Cyclically-Adjusted Budget Balances for OECD Countries," *OECD Economics Department Working Papers*, No. 434 (Paris: Organization for Economic Cooperation and Development).

Hansen, B. E., 1996, "Inference When a Nuisance Parameter Is Not Identified under the Null Hypothesis," *Econometrica*, Vol. 64(2), pp. 413-430.

Hansen, B.E., 1997, "Inference in TAR Models," *Studies in Nonlinear Dynamics and Econometrics*, Vol. 2(1), pp. 1-14.

Harding, D., and A. Pagan, 2002, "Dissecting the cycle: a methodological investigation," *Journal of Monetary Economics* 49, pp. 365–381.

Ilzetzki, E., E. Mendoza, and C. Vegh, 2010, "How big (small?) are fiscal multipliers?" NBER Working Paper No. 16479, October (Cambridge: National Bureau of Economic Research).

International Monetary Fund (IMF), 2010, *World Economic Outlook,* October (Washington: International Monetary Fund).

International Monetary Fund (IMF), 2012, "United Kingdom—Staff Report for the 2012 Article IV Consultation, IMF Country Report SM/12/168, July (Washington: International Monetary Fund).

Koop, G., 1996, "Parameter Uncertainty and Impulse Response Analysis," *Journal of Econometrics,* Vol. 72(1), pp. 135-49.

Koop, G., Pesaran, M. H., and S. M. Potter, 1996, "Impulse Response Analysis in Nonlinear Multivariate Models," *Journal of Econometrics*, Vol. 74(1), pp. 119-147.

Luetkepohl, H., 2000, "Bootstrapping Impulse Responses in VAR Analyses," SFB 373 Discussion Paper Series, 2000-22 (Berlin: Humboldt University).

Mountford, A., and H. Uhlig, 2009, "What Are the Effects of Fiscal Policy Shocks?" *Journal of Applied Econometrics*, Vol. 24(6), pp. 960–992.

Organization for Economic Cooperation and Development (OECD), 2009, Interim Report (Economic Outlook).

Perotti, R., 2005, "Estimating The Effects of Fiscal Policy in OECD Countries," CEPR Discussion Paper No. 4842, January (London: Centre for Economic Policy Research).

Perotti, R., 2011, "The Effects of Tax Shocks on Output: Not So Large, But Not Small Either," NBER Working Paper No. 16786 (Cambridge: National Bureau of Economic Research).

Romer, C.D., and D.H. Romer, 2010, "The Macroeconomic Effects of Tax Changes: Estimates Based on a New Measure of Fiscal Shocks," *American Economic Review*, Vol. 100, pp. 763–801.

Spilimbergo, A., Symansky, S., and M. Schindler, 2009, "Fiscal Multipliers," IMF Staff Position Note, SPN/09/11, May 2009. (Washington: International Monetary Fund).

Tsay, R. S., 1998, "Testing and Modeling Multivariate Threshold Models," *Journal of the American Statistical Association*, Vol. 93, pp. 1188-1202.

Woo, J., T. Kinda, and M. Poplawski-Ribeiro, 2013, "Economic Recovery from Recessions: The Role of Fiscal Policy, and Structural Reforms," forthcoming IMF Working Paper (Washington: International Monetary Fund).

Woodford, M., 2010, "Simple Analytics of the Government Expenditure Multiplier," Working Paper No. 15714, (Cambridge: National Bureau of Economic Research).