How Big (Small?) are Fiscal Multipliers?*

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Abstract

The effect of fiscal stimulus on GDP has been intensely debated in recent years. We contribute to this discussion by showing that the impact of a shock to government expenditures depends crucially on country characteristics. We present a novel quarterly dataset of government expenditure in 44 countries. We find that government consumption has a smaller short-run effect on output and a less persistent one in developing than in high-income countries. The short-run multiplier of government consumption shocks is small on impact, but the long run fiscal multiplier varies considerably. In economies with high trade-output ratios or flexible exchange rates, a fiscal expansion leads to no significant output gains. In contrast, in economies with low trade-output ratios or fixed exchange rates, the long-run effect of government consumption on GDP is large. Further, we find some tentative evidence that fiscal stimulus is counterproductive in highly-indebted countries; in developing countries with debt ratios of 50% of GDP or higher, government consumption shocks have strong negative effects on output.

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As fiscal stimulus packages were hastily put together around the world last spring, one could not have been blamed for thinking that there must be some broad agreement in the profession regarding the size of the fiscal multipliers. Far from it. In a January 2009 Wall Street Journal op-ed piece, Robert Barro argued that peacetime fiscal multipliers are essentially zero. At the other extreme, Christina Romer, Chair of President Obama's Council of Economic Advisers, used multipliers as high as 1.6 in estimating the job gains that will be generated by the $787 billion stimulus package approved by Congress last February. The difference between Romer's and Barro's views of the world amounts to a staggering 3.7 million jobs by the end of 2010.

If anything, the uncertainty regarding the size of fiscal multipliers in developing and emerging markets is even greater. Data is more scarce and often of dubious quality. A history of fiscal profligacy and spotty debt repayments calls into question the sustainability of any fiscal expansion. How does this financial fragility affect the size of fiscal multipliers? Does the exchange regime matter? What about the degree of openness? There is currently little empirical evidence to inform these critical policy questions.

A big hurdle in obtaining precise estimates of fiscal multipliers has been data availability. Most studies have relied on annual data, which makes it difficult to obtain precise estimates. To address this shortcoming, we have put together a novel quarterly dataset for 44 countries (20 high-income and 24 developing). The coverage, which varies across countries, spans from as early as 1960:1 to as late as 2007:4. We have gone to great lengths to ensure that only data originally collected on a quarterly basis is included (as opposed to interpolated based on annual data). Using this unique database, we have estimated fiscal multipliers for different groups of countries in our sample.

The paper's main results may be summarized in the following five points:

1. In *developing countries*, the response of output to increases in government consumption is negative on impact. It is smaller by a statistically significant margin from both zero and the response estimated for high-income countries. The response is also considerably less persistent than in high-income countries. In contrast to high-income countries, where output responds positively to government expenditure shocks, output's response to a government spending shock in developing countries becomes negative in the medium run (after approximately three years).

2. The degree of *exchange rate flexibility* is a critical determinant of the size of fiscal multipliers. Economies operating under predetermined exchange rate regimes have long-run multipliers that are larger than one in some specifications, but economies with flexible exchange rate regimes have essentially zero multipliers. The fiscal multiplier in countries with predetermined exchange rates is statistically different from zero and from the multiplier in countries with flexible exchange arrangements at almost any forecast horizon. We find that the main difference between the response to government consumption in countries with different exchange rate regimes is in the degree of monetary accommodation to fiscal shocks. Our evidence supports the notion that the response of central banks to fiscal shocks is crucial in assessing the size of fiscal multipliers.

3. The *openness to trade* (measured as exports plus imports as a proportion of GDP) is another critical determinant. Relatively closed economies have long-run multipliers of around 1.6, but relatively open economies have very small or zero multipliers. In closed economies the multiplier is statistically different from zero and from the multiplier in open economies at any forecast horizon. The multiplier in open economies is negative and significantly lower than zero on impact. It is not distinguishable from zero in longer horizons.

4. In developing countries with relatively high levels of debt (comprising more than 50 percent of gross domestic product), the fiscal multiplier is negative on impact and may be very negative in the long run.

5. We do not find that the multiplier on government investment is significantly higher than that of government consumption in most country groupings. An exception is in developing countries, where the multiplier on government investment is positive, close to 1 in the medium term, and statistically different from the multiplier on government consumption at forecast horizons of up to two years. This indicates that the composition of expenditure may play an important role in assessing the effect of fiscal stimulus in developing countries. Our point estimate of the fiscal multiplier on government investment is larger than that of government consumption in high-income countries as well, but this difference is small and not statistically significant.

Given increasing trade integration and the adoption of flexible exchange rate arange-

ments, particularly the adoption of inflation targetting regimes, our results cast doubt on the effectiveness of fiscal stimuli. Moreover, fiscal stimuli are likely to become even weaker, and potentially yield even negative multipliers, in the near future, because several countries are now carrying very high public debt ratios. At the same time, our findings provide new evidence on the importance of fiscal-monetary interactions as a crucial determinant of the effects of fiscal policy on GDP.

The paper proceeds as follows: Section 2 describes the methodology. Section 3 conducts the econometric analysis. Section 4 examines extensions and robustness checks, and Section 5 concludes.

1 Methodology

1.1 Identification of Fiscal Shocks

In addition to the existing debate on the size of the fiscal multipliers, there is substantial disagreement in the profession regarding how one should go about identifying fiscal shocks. This identification problem arises because there are two possible directions of causation: (i) government spending could affect output or (ii) output could affect government spending (through, say, automatic stabilizers and implicit or explicit policy rules). How can we make sure that we are isolating the first channel and not the second?

There have been two main approaches to addressing this identification problem: (i) the Structural Vector Autoregression approach (SVAR), first used for the study of fiscal policy by Blanchard and Perotti (2002) and (ii) the "natural experiment" of large military buildups first suggested by Barro (1981) and further developed by Ramey and Shapiro (1998). Rather than using military buildups per se to identify fiscal shocks, Ramey and Shapiro (1998) use news of impending military buildups (through reporting in Business Week) as the shock variable.

The basic assumption behind the SVAR approach is that fiscal policy requires some time (which is assumed to be at least one-quarter) to respond to news about the state of the economy. After using a VAR to eliminate predictable responses of the two variables to one another, it is assumed that any remaining correlation between the unpredicted components of government spending and output is due to the impact of government spending on output.

The possible objection is that these identified shocks, while unpredicted by the econometrician, may have been known to private agents.

The natural experiment approach relies on the fact that it is very unlikely that military buildups may be caused by the state of the business cycle, and thus are truly exogenous fiscal shocks. The objections to this approach are (i) military buildups occur during or in advance of wars, which might have a macroeconomic impact of their own and (ii) in the United States, two military buildups (WWII and the Korean war) dwarf all other military spending, so that in practice, this instrument may be viewed as consisting of only two observations (see Hall (2009)).

The existing range of estimates in the SVAR literature varies considerably, in the few OECD countries that have been studied so far. Specifically, Blanchard and Perotti (2002) find a multiplier of close to 1 in the United States for government purchases. Perotti (2004a, 2007), however, shows that estimates vary greatly across (five OECD) countries and across time, with a range of -2.3 to 3.7. Other estimates for the United States–using slight variations of the standard SVAR identifying assumption–yield values of 0.65 on impact but -1 in the long run (Mountford and Uhlig (2008)) and larger than one (Fatas and Mihov (2001)).

In the "natural experiment" literature, Ramey (2009) recently extended and refined the Ramey and Shapiro (1998) study using richer narrative data on news of military buildups and finds a multiplier of close to 1. She also shows that SVAR shocks are predicted by professional forecasts and Granger-caused by military buildups, a critique of the SVAR approach. Using a similar approach, Barro and Redlick (2009) find multipliers on military spending of around 0.5. Fisher and Peters (2009), on the other hand, address possible anticipation effects using stock prices of military suppliers as an instrument for military spending, and find a multiplier of 1.5.

In this paper, we employ the SVAR approach as in Blanchard and Perotti (2002) and elsewhere. In our case the choice is forced because the military buildup approach is not practical for our purposes. While U.S. wars have been fought primarily on foreign soil and have not involved significant direct losses of productive capital, this is certainly not the case in developing or smaller developed countries. The main cause for military buildups are wars or the anticipation of wars; but in most countries wars have had devastating direct macroeconomic effects. Identifying government consumption through military purchases risks conflating the effects of government consumption on output with those of war, risking

significant misestimation of fiscal multipliers in developing countries.

1.2 Estimation Methodology

Following Blanchard and Perotti (2002), our objective is to estimate the following system of equations:

$$AY_{n,t} = \sum_{k=1}^{K} C_k Y_{n,t-k} + Bu_{n,t}, \tag{1}$$

where $Y_{n,t}$ is a vector of variables–government expenditure variables (e.g. government consumption and/or investment), GDP, and other endogenous variables (the current account, the real exchange rate, and the policy interest rate set by the central bank) for a given quarter t and country n. C_k is a matrix of the own- and cross-effects of the k^{th} lag of the the variables on their current observations. The matrix B is diagonal, so that the vector u_t is a vector of orthogonal, i.i.d. shocks to government consumption and output such that $Eu_{n,t} = 0$ and $E\left[u_{n,t}u'_{n,t}\right]$ is an identity matrix. Finally, the matrix A allows for the possibility of simultaneous effects between the endogenous variables $Y_{n,t}$. We assume that the matrices A, B, and C_k are invariant across time and countries. In section 3.4 we allow for variability in the autoregressive process across both time and countries to assess the effects of government debt on fiscal multipliers. In additional regressions (not reported), we have allowed for variability across countries to ensure that our results are robust to assuming heterogeneity across countries in autoregressive process.[1]

In our standard specification (1) can be estimated by panel OLS regression.[2] OLS provides us with estimates of the matrices $A^{-1}C_k$. As is usual in SVAR estimation of this system, additional identification assumptions are required to estimate the coefficients in A and B. In our benchmark regressions, which are bivariate regressions where $Y_{n,t} = \begin{pmatrix} g_{n,t} \\ y_{n,t} \end{pmatrix}$, where g_t and y_t are government consumption and output, respectively, we follow Blanchard and Perotti (2002) in assuming that changes in government consumption require at least one quarter to respond to innovations in output. This is equivalent to a Cholesky decomposition

[1] Formally, we used the Mean Group estimator of Pesaran and Smith (1995) and obtained similar results to the ones reported here, although the power of the regressions for inference purposes was significantly diminished.

[2] Formally, we use an OLS regression with fixed effects. All results are robust to using a GLS estimator allowing for different cross-sectional weights.

with g_t ordered before y_t or the assumption that A takes the form $A = \begin{pmatrix} 1 & 0 \\ a_{21} & 1 \end{pmatrix}$

We choose to pool the data across countries rather than provide estimates on a country-by-country basis. As we discuss in Section 2, with the exception of a handful of countries, the sample for a typical country is of approximately ten years, giving approximately forty observations. We therefore exploit the larger sample size–almost always exceeding one thousand observations–delivered from pooling the data. We divide the sample into a number of country–observation groupings: high-income vs. developing, predetermined vs. flexible exchange arrangements, open vs. closed, high vs. low debt to GDP ratios. We then estimate and compare the fiscal multiplier across categories.

1.3 Lag Structure

In choosing K, the number of lags included in (1), we conducted a number of specification tests (the results are summarized in Table 1). As is often the case, and as evident from Table 1, the optimal number of lags varies greatly across country-groups and tests, ranging from 2 to 8. For simplicity, and for comparability across regressions, we set $K = 4$ in all reported results. All the paper's results are robust to choosing any of the alternative number of lags shown in the table instead.

Table 1: Optimal Number of Lags Based on Specification Tests

	Model						
Criteria	High Income	Developing	Fixed	Flex	Open	Closed	High/Low Debt
Akaike	8	8	8	8	8	8	8
Schwartz	4	2	4	2	4	1	1
Hannan Quinn	4	4	8	7	8	4	1

1.4 Fiscal Multipliers: Definitions

As there are several ways to measure the fiscal multiplier, a few definitions are useful. In general, the definition of the fiscal multiplier is the change in real GDP or other measure of output caused by a one-unit increase in a fiscal variable. For example, if a one dollar increase

in government consumption in the United States caused a fifty cent increase in U.S. GDP, then the government consumption multiplier is 0.5.

Multipliers may differ greatly across forecast horizons. We therefore focus on two specific fiscal multipliers. The *Impact Multiplier* defined as:

$$\text{Impact Multiplier} = \frac{\Delta y_0}{\Delta g_0},$$

measures the ratio the change in output to a change in government expenditure at the time in which the impulse to government expenditure occurs. In order to assess the effect of fiscal policy at longer forecast horizons, we also report the *Cumulative Multiplier* at time T, defined as

$$\text{Cumulative Multiplier}\,(T) = \frac{\sum_{t=0}^{T} \Delta y_t}{\sum_{t=0}^{T} \Delta g_t},$$

which measures the cumulative change in output per unit of additional government expenditure, from the time of the impulse to government expenditure to the reported horizon. A cumulative multiplier that is of specific interest is the *Long-Run Multiplier* defined as the cumulative multiplier as $T \to \infty$.

2 Data

To our knowledge, this paper involved the first attempt to catalogue available quarterly data on government consumption in a broad set of countries. Until recently, only a handful of countries (the Australia, Canada, the U.K. and the U.S.) collected government expenditure data at quarterly frequency, and classified data into functional categories such as government consumption and government investment.

The use of quarterly data that is collected at a quarterly frequency is of essence for the validity of the identifying assumptions used in a Blanchard-Perotti SVAR. First, while it is reasonable to assume that fiscal authorities require a quarter to respond to output shocks, it is unrealistic to assume that an entire year is necessary. For example, many countries, including developing countries, responded with discretionary measures as early as the first quarter of 2009 to the economic fallout following the collapse of Lehman Brothers and AIG in the fourth quarter of 2008. While in this particular instance the shock and response occurred in

different calendar years, it indicates that an assumption that government's require an entire year to respond to the state of the economy is not generally valid.

Second, data *reported* at a quarterly frequency but *collected* at annual frequency may lead to spurious regression results. One common method of interpolating government expenditure data that was collected at annual frequency is to use the quarterly seasonal pattern of revenue collection as a proxy for the quarterly seasonal pattern of government expenditure (tax revenues are more commonly collected at quarterly frequency).[3] As tax revenues are highly procyclical, this method of interpolation creates a strong correlation between government expenditure and output by construction. An attempt to identify fiscal shocks with an SVAR, using data constructed in such a manner, will obviously give results that are meaningless in an economic sense.

This paper exploits the fact that a larger number of countries have begun to collect fiscal data at a quarterly frequency. Two recent changes made high-frequency fiscal data available for a broader set of countries. First, the adoption in 1996 of a common statistical standard in the European Monetary Union, the ESA95 encouraged Eurozone countries, and countries aspiring to enter the Eurozone, to collect and classify fiscal data at quarterly frequency.[4] In its 2006 *Manual on Non-Financial Accounts for General Government,* Eurostat reports that all Eurozone countries comply with the ESA95, with quarterly data based on direct information available from basic sources, that represents at least 90% of the amount in each expenditure category.[5]

Second, the International Monetary Fund adopted the Special Data Dissemination Standard (SDDS) in 1996. Subscribers to this standard are required to collect and report central government expenditure data at annual frequency, with quarterly frequency recommended. A number of SDDS subscribers have begun collecting fiscal data at quarterly frequency and classifying expenditure data in to functional categories at that frequency.

With these institutional changes, a decade of quarterly data is now available for a cross-section of 44 countries, of which 24 are developing countries (based on World Bank income classifications). While ten years (40 observations) of data are hardly enough to estimate the effect of fiscal policy on output for an individual country, the pooled data contains more

[3] Source: conversations with officials at numerous statistical agencies.

[4] See http://circa.europa.eu/irc/dsis/nfaccount/info/data/ESA95/en/een00000.htm for more details.

[5] Austria was an exception with a coverage of 89.6% and is not included in our sample.

than 2,500 observations–an order of magnitude greater than used in VAR studies of fiscal policy to date.[6]

A country-by-country description of data sources is available in the data appendix. Here we address the use of the data in the empirical analysis that follows. The main specification includes real government consumption and GDP. Other specifications include real government investment, the ratio of the current account to GDP, the real effective exchange rate, and the policy short-term targeted by the central bank. Nominal data was deflated using a corresponding deflator, when available, and using the CPI index when such a deflator was not available. We took natural logarithms of all government expenditure and GDP data and the real effective exchange rate. The data shows strong seasonal patterns. Our selected de-seasonalization method was the SEATS algorithm (see Gómez and Maravall (2000)). In an earlier version of this study we used the X-11 algorithm and obtained similar results. All variables were non-stationary, with the exception of the central bank interest rate and the ratio of the current account to GDP. The data used in the reported regressions are deviations of the non-stationary variables from their quadratic trend. Using a linear trend yielded similar results. The current account and the policy interest rate were included in first-differences. After detrending the data, the series were stationary, with unit roots rejected at the 99% confidence level for all variables in both an Augmented Dickey–Fuller test and the Im, Pesaran and Shin (2003) test.

3 Results

3.1 High-income and developing countries

To exploit the largest possible sample of our government consumption data, we begin with a simple specification of a bivariate Panel VAR where $Y_{n,t} = \begin{pmatrix} g_{n,t} \\ y_{n,t} \end{pmatrix}$, and where $g_{n,t}$ is real government consumption and $y_{n,t}$ is real GDP. As a first cut at the data, we divided the sample into high-income and developing countries.[7] Figures 1 and 2 show the impulse

[6] We ended the dataset at the forth quarter of 2007 as data from 2008-9 may still be subject to significant revisions.

[7] We use the World Bank classification of high income countries in 2000, and include all other countries in the category "developing". The marginal countries are the Czech Republic, defined as developing in 2000, but high-income in 2006; and Slovenia, categorized as high-income in 2000, but as "upper-middle income"

responses to a 1 percent shock to government consumption at time 0 in the first column, and to output in the second column. Figure 1 gives responses for high-income countries and Figure 2 for developing countries.

The response of output to government consumption is in the lower left-hand panel of each figure. Two differences stand out between the impulse responses. First, the impact response of output to government spending is positive in high-income countries (0.04 percent), but is negative in developing countries (-0.3 percent). Both are statistically significant from zero and from each other. Second, the output response to a shock in government consumption is significantly less persistent than that of high-income countries. Indeed, while the output response for high-income countries remains significantly positive for the 24 quarters covered in the plot, it becomes zero (statistically speaking) for developing countries after only six quarters, in only four of which output is positive. It then becomes negative again after approximately three years.

Based on the impulse responses depicted in Figures 1 and 2, we can compute the corresponding fiscal multipliers, using the definitions of Section 1.4.[8] The impact multiplier for high-income countries is 0.20. In other words, an additional dollar of government spending will deliver only 20 cents of additional output in the quarter in which it is implemented. This effect of government consumption, while small, is statistically significant. For developing countries, the impact multiplier is negative at -0.19 and also statistically significant. The difference between the impact multiplier in the two groups of countries is statistically significant at the 99% confidence level.

Focusing on the impact multiplier, however, may be misleading because fiscal stimulus packages can only be implemented over time and there may be lags in the economy's response. To account for these factors, Figure 3 shows the cumulative multipliers for both high-income and developing countries at forecast horizons ranging from 0 to 24 quarters. For example,

(and thus developing by our typology) before 1997. Excluding or reclassifying these two countries does not alter the results. Israel is classified as high income, based on this definition, but was categorized as an "emerging market" in J.P. Morgan's EMBI index. Excluding or reclassifying Israel does not alter the results.

[8] The data is in natural logarithms, so that the ratio $\frac{\Delta y_0}{\Delta g_0}$ gives the ratio of the *percent* change in output and the percent change in government consumption. To renormalize this to units of "multiplier" we then divide this ratio by the average ratio of government consumption to output in the sample of countries in the studied group. The ratio of government consumption to GDP varies from 9.6% in Peru to 28% for Israel. The average and median ratios are 17.7% and 19.1%, respectively. Variation within groups is significantly smaller. In high-income countries the average and median ratios of government consumption to GDP are 20.7% and 19.6%, respectively. In developing countries these are 16.5% and 16.9%, respectively.

a value of 0.5 in quarter 3 would indicate that, after 3 quarters, the cumulative increase in output, in dollar terms, is half the size of the cumulative increase in government consumption. The plots also report the value of the impact and long-run cumulative multipliers. Dashed lines give the 90% confidence intervals, based on Monte Carlo estimated standard errors, with 500 repetitions.

We can see that the cumulative multiplier for high-income countries rises from an initial value of 0.20 (the impact effect) to a long-run value of 0.85. Hence, even after the full impact of a fiscal expansion is accounted for, output has risen less than the cumulative increase in government consumption, implying some crowding out of output by government consumption at every time horizon. The multiplier is statistically different from zero at every horizon, with the exception of a dip in the first quarter. On the other hand, the cumulative long-run multiplier for developing countries is only 0.37. In other words, in the long run, almost two thirds of the increase in government consumption is crowded out by some other component of GDP (investment, consumption, or net exports).

3.2 Exchange rate regimes

As a second cut at the data, we divided our sample of 44 countries into episodes of predetermined exchange rates and those with more flexible exchange rate regimes. We use the de facto classification of Ilzetzki, Reinhart, and Rogoff (2008) to determine the exchange rate regime of each country in each quarter. Table A3 lists for each country the episodes in which the exchange arrangement was classified as fixed or flexible.[9]

The cumulative impulse responses, shown in Figure 4, suggest that the exchange rate regime matters a great deal. Under predetermined exchange rates, the impact multiplier is 0.2 (and statistically significantly different from zero) and rises to 1.6 in the long-run. Under flexible exchange rate regimes, however, the multiplier is indistinguishable from zero both on impact and in the long-run. The difference between the two results is statistically significant at almost every forecast horizon. The results are robust to dividing the sample

[9]We divided the sample into country-episodes of predetermined exchange rates. For each country we took any 8 continuous quarters when the country had a fixed exchange rate as a "fixed" episode and any 8 continuous quarters or more when the country had flexible exchange rates as "flex". As fixed we included countries with no legal tender, hard pegs, crawling pegs,and de facto or pre-anounced bands or crawling bands with margins of no larger than +/- 2%. All other episodes were classified as flexible. Based on this definition, Eurozone countries are included as having fixed exchange rates.

by country, with each country classified based on the exchange rate regime it maintained for the majority of the period.

These results are, in principle, consistent with the Mundell-Fleming model, which would predict that fiscal policy is more effective in stimulating output under predetermined exchange rates than under flexible exchange rates. In this model, the initial effect of a fiscal expansion is to increase output and raise interest rates, which tends to appreciate the domestic currency. Under predetermined exchange rates, the monetary authority must expand the money supply to prevent this appreciation. Such monetary policy accommodation provides an additional boost to output. Under flexible exchange rates, however, the monetary authority keeps a lid on the money supply, and may even contract the supply of money to counteract the inflationary pressures caused by the fiscal expansion. This cuts short any further output expansion.

The broader monetary context of the fiscal stimuli is explored in Figure 5. This figure reports impulse responses to a 1 percent shock to government consumption in VAR that now includes the ratio of the current account to GDP, the real exchange rate, and the short-term interest rate set by the central bank, in addition to government consumption and GDP.[10]

The first row of Figure 5a presents government consumption shocks in episodes of fixed and episodes of flexible exchange rates. The second row presents the response of GDP to these shocks. Although the impulses to government consumption are similar in both cases, the increase in GDP is positive, of a larger magnitude and much more persistent when exchange rates are fixed than under flexible exchange rates. The difference between the two is no longer statistically significant due to a substantial loss of observations due to the availability of the additional controls.[11]

Figure 5b explores the traditional Mundell-Fleming channel. It shows the response of the current account (first row) and the real effective exchange rate (second row). We find only weak evidence for the traditional channel in this figure. The real exchange rate appreciates by a statistically significant margin on impact under flexible exchange rates, but only with

[10] The variables are Cholesky-ordered as follows: government consumption, the central bank's interest rate, GDP, the current account, and the real exchange rate. A discussion of this ordering is discussed in section 4, where full results from multivariate VARs are presented. The ordering of the fiscal variable before the central bank's instrument follows from the assumption that the monetary authority can respond more rapidly to news than can fiscal decision-makers can. The response of the policy interest rates is significantly weakened if the ordering of the fiscal and monetary variables is reversed.

[11] More than 1/3 of the sample is lost in this specification.

a significant lag under predetermined exchange rates. The current account declines in both cases, as could be expected. However, the difference across exchange rate regimes is not statistically significant and the current declines more under fixed exchange rates, contrary to what theory would predict.

On the other hand, we find strong evidence for the "monetary accommodation" channel, as shown in Figure 5c. Monetary authorities operating under predetermined exchange rates lower the policy interest rate by a statistically significant margin, with the short-term nominal interest rate declining by a cumulative 45 basis points in the three years following the 1 percent shock to government consumption. In contrast, central banks operating under flexible exchange rates increase the policy interest rate by a statistically significant margin, with interest rates increasing an average of 15 basis points within the three years following the fiscal shock.

Our results thus relate, more generally, to the notion that monetary accommodation plays an important role in determining the expansionary effect of fiscal policy. Davig and Leeper (2009), for example, show in a DSGE model with nominal rigidities that the effect of fiscal policy differs greatly depending on whether monetary policy is active or passive. Coenen et al (2010) show that monetary accommodation an important determinant of the size of fiscal multipliers in seven different structural models used in policymaking institutions. This result also relates indirectly to the theoretical studies of Christiano, Eichenbaum, and Rebello (2009) and Erceg and Lindé (2010) showing that fiscal multipliers are larger when the central bank's policy interest rate is at the zero lower bound.

3.3 Openness to trade

Next, we divide our sample of 44 countries into "open" and "closed" economies. For our purposes, we defined as "open" a country whose foreign trade (imports plus exports) exceeds 60 percent of GDP. If foreign trade is less than 60 percent of GDP, we defined the country as closed. A list of "open" and "closed" economies by this classification is shown in Table A4. Minor variations of this definition, in terms of the threshold of openness being higher or lower than 60 percent, did not significantly affect our results. Using this criterion, 28 countries are classified as open and the remaining 16 are classified as closed, with approximately half of the sample in either category. Note that this definition of trade openness measures the

magnitude of countries' volume of international trade as a proportion of total production, rather than its de jure openness to trade. We believe that the former is the more relevant measure for our purposes because, in most standard models, actual, rather than potential, trade will be the key determinant of the output effects of fiscal policy.

The cumulative responses, shown in Figure 6, indicate that the degree of openness is a critical determinant of the size of the fiscal multiplier. For the closed economies, the impact response is 0.12 and reaches 1.6 in the long run. For the open economies, the impact was negative and the long-run response is not significantly different from zero. The difference between the two country-groupings is statistically significant at every forecast horizon.

3.4 Financial fragility

Our final cut at the data was to divide developing countries into episodes of high debt and those of low debt. As several countries have been teetering on the verge of default during the current financial crisis, it is reasonable to ask whether a government's level of debt plays a role in the effect of government consumption on output.

A difficulty we confront, however, is that countries' debt-to-GDP ratio differed greatly from year to year. We therefore would like to allow multipliers (and therefore regression coefficients) to vary both across time and across country, depending on the level of debt.

To address this issue, we augment the VAR system of (1) in the following way:[12]

$$AY_{n,t} = \sum_{k=1}^{K} \left[\tilde{C}_k Y_{n,t-k} D_{n,t-k} + C_k Y_{n,t-k} \left(1 - D_{n,t-k}\right) \right] + B u_{t,k} \tag{2}$$

where $D_{n,t}$ is a scalar dummy variable taking the value of one whenever a county's ratio of debt to GDP exceeds a certain threshold. [13] The matrix C_k now gives an estimate of the average autoregressive process of Y_t, when debt is low and $\tilde{C}_k$ gives the evolution of endogenous variables when debt is high. The system (2) assumes that the contemporaneous relations between the variables in $Y_{n,t}$ do not depend on whether debt was high or low. C_k and $\tilde{C}_k$ can be estimated using OLS, while A and B can be estimated using the SVAR decomposition discussed in Section 1.2.

[12] We thank Tomasz Wieladek, who suggested this methodology.

[13] When the threshold is 50 percent of GDP $D_{n,t} = 1$ for 28% of developing country observations.

Figure 7 shows the resulting cumulative multiplier in countries with low- and high-levels of debt. The threshold for $D_{n,t} = 1$ is that the ratio of debt to GDP is 50 percent or greater. For countries with low levels of debt, the cumulative multipliers on impact and in the long run are similar to those estimated for the average developing country in Figure 4. In the lower of panel of Figure 7 the cumulative multiplier for highly indebted country-episodes is shown. Recall that the impact multiplier is identical to that in low-debt countries, by the assumption of homogeneous A and B. In the long run, however, the multiplier declines and limits to -2. While the error bands are admittedly broad, the point estimate is in general consistent with the notion that attempts at fiscal stimulus in highly indebted countries may be greatly counter-productive and their effects are very uncertain. We are reassured that this result is not spurious by the fact that this long run multiplier remains negative when the threshold is to 60 or 70 percent of GDP, while it becomes positive for debt-to-GDP ratios of 30 or 40 percent. We did not find a similar difference countries with high and low levels of debt in high-income countries.[14]

While our data only gives weak support for this channel, these results are consistent with the idea that debt sustainability is an important factor in determining the output effect of government purchases. When debt levels are high, increases in government expenditures indicate that fiscal tightening will be required in the near future. Moreover, as recent events in southern Europe demonstrate, these adjustments may need to be large and sudden. Fiscal stimulus in these conditions may therefore be counter-productive.

4 Extensions and Robustness

4.1 Government Investment

While our focus so far has been on government consumption–partially due to limited availability of government investment data–it is nevertheless interesting to see whether the effects of government investment differ from those of government consumption. To explore

[14] We varied the threshold from 10 percent to 100 percent of GDP. The impulse responses for high and low debt were virtually identical.

this question, we estimate (1), this time with $Y_{n,t} = \begin{bmatrix} g^I_{n,t} \\ g_{n,t} \\ y_t \end{bmatrix}$, where $g^I_{n,t}$ is real government investment, and $g_{n,t}$ and y_t are real government consumption and real GDP as before. We follow Perotti (2004b) in ordering government investment before government consumption in the Cholesky decomposition, although results are not affected by this assumption. The number of countries in the sample declines when including government investment, but the results on government consumption of section 3 hold for this sub-sample as well.

Figure 8 shows the cumulative government investment multiplier for high-income countries in a simple bivariate regression, including only government investment and GDP. The smaller sample size yields estimates that are admittedly less accurate. But the estimated impact- and long-run government investment multipliers are substantially higher than those on government consumption. However, the results in Figure 8 may be somewhat misleading, due to the exclusion of government consumption. As Figure 9 shows, government consumption responds strongly to government investment, so that the multiplier calculated in Figure 8 is attributing the entire increase in output to the increase in government investment, while ignoring the increase in government consumption.[15]

To address this issue, we estimate the multiplier to "pure" government investment multipliers, as suggested by Perotti (2004b). This is done by estimating the full system with the three endogenous variables, but setting all values of $g_t = 0$ in our forecasts of g^I_t and y_t. The resulting cumulative multipliers for high-income countries and developing countries are presented in Figure 10. The estimates of the government investment multiplier remain highly uncertain in high-income countries, in the upper panel of this figure. But their point estimates at all horizons are similar to the government consumption multipliers presented in Figure 3. We thus have no robust evidence that government investment is more productive in its simulative effect on output in high-income countries. This is consistent with the findings of Perotti (2004b).

In developing countries, in contrast, the lower panel of Figure 10 shows the impact multiplier of government investment is 0.6 and statistically significant. While our estimates

[15] This is true of the response of government investment to government consumption. However, the omission of the latter from the regressions of section 3 does not have a significant impact on the estimate government consumption multipliers. This is because government investment is in all countries in our sample a small fraction of government consumption.

have little power to predict the long-run effects of a shock to government investment in developing countries, we can reject (at the 95% confidence level) the hypothesis that the effect of government investment is no higher than that of government consumption. It appears that the composition of government purchases is an important determinant of the impact of government spending shocks on output in developing countries.

Figures 11 and 12 repeat the comparison between predetermined and flexible exchange rates and open and closed economies, respectively, for government investment. As in the case of high-income countries, we find no significant difference between the impact of government consumption and government investment in the long run. Short run impacts do appear greater in the case of government investment, particularly in open economies and economies with flexible exchange arrangements. Figures 11 and 12 show, however, that the multiplier on government investment, like that of government consumption, is larger in countries with predetermined-, relative to countries with flexible exchange rates; and in closed economies relatively to open economies (with the latter result statistically significant at forecast horizons of up to four years).

4.2 Multivariate Regressions

We have so far primarily focused on bivariate panel VARs with real government consumption and real GDP as the endogenous variables. In this section we show that the results reported here are robust to an expanded VAR system, including the real effective exchange rate and the ratio of the current account balance to GDP.[16] As before, our identifying assumption calls for ordering of government consumption before GDP. As for the ordering of the newly added variables, we follow Kim and Roubini (2008) and numerous other studies in ordering the remaining variables after GDP and ordering the current account balance before the real effective exchange rate.

The results are presented in Figures 13, 14 and 15, comparing the cumulative multiplier on government consumption in high-income vs. developing countries, predetermined vs. flexible exchange rates, and open vs. closed economies, respectively. The results are almost identical to those in Figures 3, 4, and 6. All the reported results are robust to the multivariate

[16] Results are similar when including the policy interest rate as in section 3. However, the power of our analysis diminishes significantly as few countries in our sample used short-term policy rates as monetary instuments before the mid-2000s.

specification.

5 Conclusions

This paper is an empirical exploration of one of the central questions in macroeconomic policy in the past few years: what is the effect of government purchases on economic activity? We use panel SVAR methods and a novel data set to explore this question. Our most robust results point to the fact that the size of fiscal multipliers critically depends on key characteristics of the economy studied.

We have found that the effect of government consumption is very small on impact, with estimates clustered close to zero. This supports the notion that fiscal policy (particularly on the expenditure side) may be rather slow in impacting economic activity, which raises questions as to the usefulness of discretionary fiscal policy for short-run stabilization purposes. The medium- to long-run effects of increases in government consumption vary considerably. In particular, in economies closed to trade or operating under fixed exchange rates we find a substantial long-run effect of government consumption on economic activity. In contrast, in economies open to trade or operating under flexible exchange rates, a fiscal expansion leads to no significant output gains. Further, fiscal stimulus may be counterproductive in highly-indebted countries; in developing countries with debt levels as low as 50% of GDP, government consumption shocks may have strong negative effects on output.

Finally, the composition of government expenditure does appear to impact its stimulative effect, particularly in developing countries. While increases in government consumption decrease output on impact in developing countries, increases in government investment cause an increase in GDP.

With the increasing importance of international trade in economic activity, and with many economies moving towards greater exchange rate flexibility (typically in the context of inflation targeting regimes), our results suggest that seeking the Holy Grail of fiscal stimulus could be counterproductive, with little benefit in terms of output and potential long-run costs due to larger stocks of public debt. Moreover, fiscal stimuli are likely to become even weaker, and potentially yield even negative multipliers, in the near future, because several countries are now carrying very high public debt ratios.

On the other hand, emerging countries – particularly large economies with some degree

of "fear of floating" – would be well served if they stopped pursuing procyclical fiscal policies. Indeed, emerging countries have typically increased government consumption in good times and reduced it in bad times, thus amplifying the underlying business cycle – what Kaminsky, Reinhart, and Végh (2004) have dubbed the "when it rains, it pours" phenomenon. The inability to save in good times greatly increases the probability that bad times will turn into a full-fledged fiscal crisis. Given this less-than-stellar record in fiscal policy, an a-cyclical fiscal policy – whereby government consumption and tax rates do not respond to the business cycle – would represent a major improvement in macroeconomic policy. While occasional rain may be unavoidable for emerging countries, significant downpours would be relegated to the past.

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Data Appendix

The greatest challenge of this high-frequency study of fiscal policy in a large number of countries was collecting and vetting the data. We have gone to great lengths to ensure that data included in the dataset was originally collected at a quarterly frequency, covered a large proportion of the government expenditure category studied. Tables A1 and A2 summarize the sources, time frame, and definitions of the two main government expenditure categories studied. In all cases, the integrity of the data was confirmed directly through correspondence or conversation with national statistical agencies, central banks, or fiscal authorities. While some of the time series extend to 2008 or 2009, data from these last two years were not used in the empirical analyses in this paper, as recent data may still be subject to significant revisions.

One inconsistency across countries in the data set is in the level of government included. In most cases, data for the general government was available, but in some cases, only the expenditures of the central government were available. The exclusion of regional government consumption risks biasing our results, as fiscal multipliers may be overstated or understated, depending on whether the excluded expenditures are positively or negatively correlated with central government consumption, and whether they have similar effects on economic activity. We opted to keep coverage as broad as possible and included all countries in the sample, regardless of the level of government for which data was available. The results reported in this paper did not change when only countries for whom general government consumption data was available.

Another possible concern is that in some cases data was deflated directly by the local statistical agencies. In other cases, we deflated the data using a CPI deflator. This both creates an inconsistency across countries, but moreover raises the question of whether consumer prices are the appropriate measure of the ratio between the nominal value of government purchases and their real value. Finding an appropriate government consumption deflator is not a simple task, but we were reassured by the fact that in countries where more than one deflator was available (e.g. GDP deflator, CPI, or a government consumption deflator) the correlation of the series when deflated using different price indexes was close to 1. Other variables are as follows.

Gross Domestic Product Whenever possible, GDP data are taken from the same data source as the government expenditure data. Elsewhere, IFS series 99B was used for developing countries and real GDP from OECD Statistics was used for high-income countries.

Consumer Price Index IFS series 64.

Current Account OECD Statistics, when available, and IFS series 75 elsewhere. Current account to GDP ratio was created by dividing this series using nominal GDP from OECD statistics or from IFS series 99B converted to US dollars using the average interest rate for that year.

Central Bank Discount Rate Central bank discount rates were taken from IFS series 60 whenever available. Series 60P (repurchase agreement rate) was used for France, series 60A (rate on advances) was used for the Netherlands, and 60A for Romania (National Bank of Romania Structural Credit rate). Central bank data was used to obtain the policy rates for Australia, El Salvador, the Eurozone, Estonia, Mexico, and the United Kingdom. Series for Eurozone countries were created by splicing interbank rates of the national central banks until the later of 1998 or the date of Euro adoption, with the ECB's deposit facility rate thereafter. In Estonia, the average between the one-month Talibid and Talibor rates was used (bid and ask rates), as the overnight rate was used as a policy tool starting only in 2007. For Mexico, the 30-day interbank rate (TIIE) was used.

Debt to GDP Debt of the central government (external only for developing countries) as a proportion of GDP from the OECD, Eurostat, the Joint External Debt Hub, and the Federal Reserve Bank of St. Louis and ONS for the United States and United Kingdom, respectively.

Real Effective Exchange Rate A CPI-based real exchange rate was used. Where ever available, the narrow real exchange rate index of the Bank for International Settlements was used. Otherwise, the broad index was used. Elsewhere, IFS series RECZF was used.

Trade to GDP The ratio of the sum of imports (IFS series 70) and exports (IFS series 71) to GDP (IFS series 99).

Table A1: Government Consumption

Country	Start	End	Source	Series and Comments
Argentina	1993q1	2006q4	MECON	Real General Government Consumption. Seasonally Adjusted and deflatedby MECON
Australia	1960q1	2008q4	OECD	General Government Consumption
Belgium	1991q1	2008q4	Eurostat	General Government Consumption
Botswana	1993q3	2008q4	Statistical Agency	General Government Consumption (Constant Prices)
Brazil	2000q1	2008q4	IBGE	General Government Consumption
Bulgaria	1999q1	2008q2	Finance Ministry	General Government Consumption . Calculated as the sum of compensation of public employees, social benefits provided in kind that were purchased from the private sector, and final consumption of the public sector (both indivudual and collective)
Canada	1961q1	2008q4	OECD	General Government Consumption expenditure, chained volume estimates, Seasonally adusted
Chile	2003q1	2009q1	Hacienda	Real General Government Consumption Expenditure
Colombia	2000q1	2008q4	Central Bank	Real General Government Consumption Expenditure
Croatia	2004q1	2008q2	Ministry of Finance	Central Government Consumption. Calculated as the sume of compensation of employees and use of goods and serivices by the central government.
Czech Republic	1999q1	2009q1	Eurostat	General Government Consumption
Denmark	1999q1	2009q1	Eurostat	General Government Consumption
Ecuador	1990q1	2007q2	Central Bank	General Government Consumption (Constant Prices)

El Salvador	1994q1	2007q4	Ministry of Finance	Central Government Consuption. Caclulated as the sum of public renumeration and purchases and goods and services.
Estonia	1999q1	2008q4	International Monetary Fund	Central Government Consuption. Calculated as the sum of compensation of public employees and purchases and goods and services.
Finland	1998q1	2008q4	Statistics Finland	General Government Consumption Expenditure
France	1991q1	2008q4	Eurostat	General Government Consumption Expenditure
Germany	1991q1	2008q4	OECD	Real General Government Consumption Expenditure, Chain-Valued
Greece	1999q1	2009q1	Eurostat	General Government Consumption Expenditure
Hungary	1999q1	2009q1	Eurostat	General Government Consumption Expenditure
Iceland	2004q1	2007q4	Statistics Iceland	General Government Consumption Expenditure
Ireland	1999q1	2009q1	Eurostat	General Government Consumption Expenditure
Israel	1999q1	2008q4	Central Bank	Real General Government Consumption
Italy	1999q1	2009q1	Eurostat	General Government Consumption Expenditure
Latvia	1993q1	2006q4	IMF	General Government Consumption
Lithuania	1995q1	2008q4	Statistics Lithuania	General Government Consumption
Malaysia	1999q1	2008q1	Central Bank	Central Government Consumption. Calculated the sum of compensation of public employees (including both emoluments and pensions); and supplies and services of the central government.

Mexico	1991q1	2008q4	Finance Ministry	Central Government Consumption. Calculated as the sum of wages and sallaries and acquisitions.
Netherlands	1988q1	2009q1	Statistical Agency	Real General Government Consumption. Public compensation and purchases of goods and services are deflated separately and seasonally adjusted by the statistical agency.
Norway	1996q1	2009q1	Eurostat	General Government Consumption
Peru	1995q1	2008q2	Ministry of Finance	Central Government Consumption. Calculated as public renumeration and final consumption of goods and services
Poland	1999q1	2009q1	Eurostat	General Government Consumption
Portugal	1999q1	2009q1	Eurostat	General Government Consumption
Romania	1998q1	2008q4	Eurostat	General Government Consumption
Slovak Republic	1999q1	2008q2	International Monetary Fund	Central Government Consuption. Calculated as the sum of compensation of public employees and purchases and goods and services.
Slovenia	2000q1	2008q4	Ministry of Finance	General Government Consumption
South Africa	1993q1	2009q1	Statistics South Africa	Real General Government Consumption
Spain	2000q1	2009q1	Eurostat	General Government Consumption
Sweden	1993q1	2008q4	Statistics Sweden	Central Government Consumption
Thailand	1993q1	2006q4	Central Bank	Real Central Government Consumption
Turkey	1998q1	2009q1	Central Bank	
United Kingdom	1960q1	2008q4	OECD	Real General Government Consumption, Chain Valued, Seasonally Adjusted
United States	1988q1	2008q4	OECD	Real General Government Consumption, Chain Valued, Seasonally Adjusted
Uruguay	1960q1	2008q4	Central Bank	Real General Government Consumption

Table A2: Government Investment

Country	Start	End	Source	Series and Comments
Argentina	1993q1	2006q4	INDEC	Central government investment.
Australia	1959q3	2009q3	OECD	Real general government investment. Seasonally adjusted.
Belgium	1991q1	2009q2	Eurostat	General government gross fixed capital formation.
Canada	1961q1	2009q3	OECD	Real general government investment. Seasonally adjusted.
Chile	1990q1	2008q1	Central Bank	Central governmentL Inversión pública + Transferencias de capital.
Colombia	1994q1	2007q2	DANE	Obras civiles. Real and seasonally adjusted in original series.
Czech Republic	1999q1	2009q2	Eurostat	General government gross fixed capital formation.
Denmark	1999q1	2009q2	Eurostat	General government gross fixed capital formation.
El Salvador	1994q1	2007q4	Central Bank	Central government gross investment.
Estonia	1995q1	2009q2	Eurostat	General government gross fixed capital formation.
Finland	1998q1	2009q3	Statistics Finland	Gross fixed capital formation
France	1991q1	2008q4	Eurostat	General government gross fixed capital formation.
Germany	1999q1	2008q4	Eurostat	General government gross fixed capital formation.
Hungary	1999q1	2009q2	Eurostat	General government gross fixed capital formation.
Ireland	1999q1	2009q1	Eurostat	General government gross fixed capital formation.
Italy	1999q1	2009q2	Eurostat	General government gross fixed capital formation.
Latvia	1999q1	2009q2	Eurostat	General government gross fixed capital formation.

Lithuania	1999q1	2009q3	Statistics Lithuania	General government capital investments.
Mexico	1991q1	2009q1	Secretaría de Hacienda y Crédito Público	Central government investment.
Netherlands	1988q1	2009q1	Central Bureau of Statistics - Netherlands	Real fixed capital formation by general government.
Norway	1996q1	2009q2	Eurostat	General government gross fixed capital formation.
Romania	1995q1	2009q2	Eurostat	General government gross fixed capital formation.
South Africa	1993q1	2009q1	Statistics South Africa	Real General Government Consumption
Sweden	1993q1	2009q2	Statistics Sweden	Central government investment
Turkey	1987q1	2006q4	Central Bank	Public Sector Investment (index)
United Kingdom	1991q1	2009q3	Eurostat	General government gross fixed capital formation.
United States	1960q1	2009q3	OECD	Real general government investment. Current prices. Seasonally adjusted. Millions of national currency.
Uruguay	1992q1	2009q3	Central Bank	Real general government investment.

Table A3: Episodes of De-Facto Fixed and Flexible Exchange Rates

Country	Fixed	Flex
Argentina	1993q1:2001q4; 2003q2:2006q4	-
Australia	1960q1:1982q4	1983q1:2007q4
Belgium	1991q1:2007q4 (Euro since 1999)	-
Botswana	1993q3:2001q4	2002q1:2007q4
Brazil	-	2000q1:2007q4
Bulgaria	1999q1:2007q4	-
Canada	1961q1:2002q2	2002q3:2007q4
Chile	-	2003q1:2007q4
Colombia	-	2000q1:2007q4
Croatia	-	2004q1:2007q4
Czech Republic	1999q1:2001q4	2003q1:2007q4
Denmark	1999q1:2007q4	-
Ecuador	2000q2:2007q4	1990q1:2000q1
El Salvador	1994q1:2007q4	-
Estonia	2000q1:2007q4	-
Finland	1998q1:2007q4 (Eurozone from 1999)	-
France	1991q1:2007q4 (Eurozone from 1999)	-
Germany	1999q1:2007q4 (Eurozone)	1991q1:1998q4
Greece	1999q1:2007q4 (Eurozone from 2000)	-
Hungary	1999q1:2007q4	-
Iceland	-	2004q1:2007q1
Ireland	1999q1:2007q4 (Eurozone)	-
Israel	-	1999q1:2007q4
Italy	1999q1:2007q4 (Eurozone)	-
Latvia	2001q4:2007q4	1999q1:2001q3

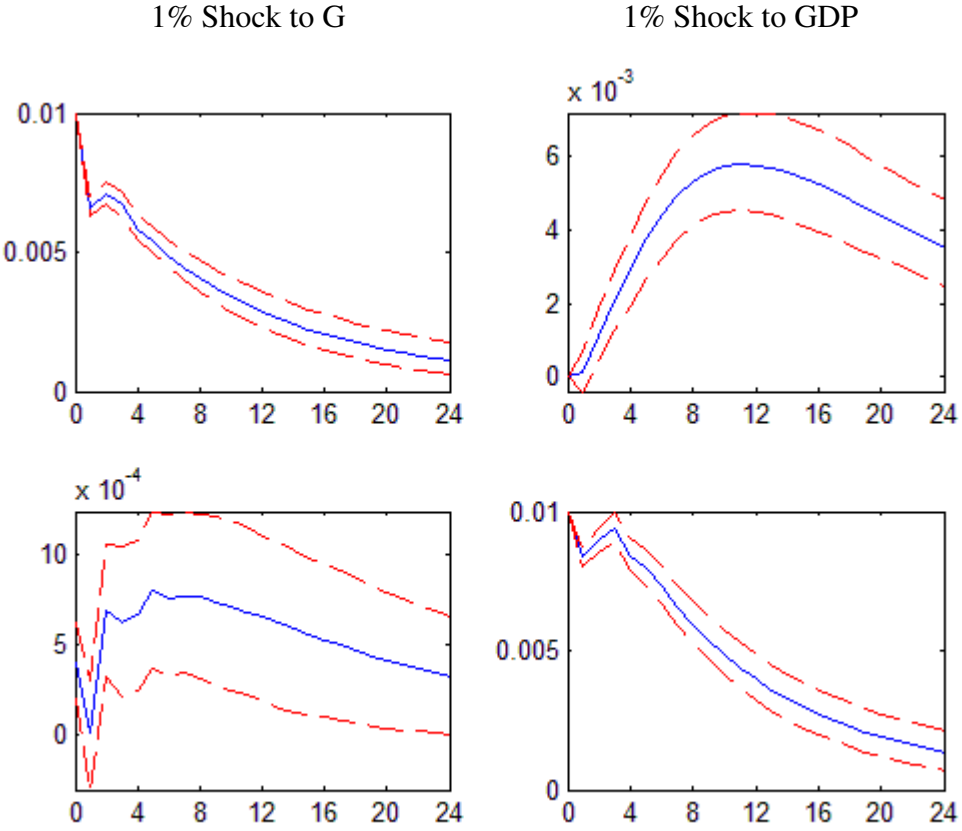
Lithuania	1995q2:2007q4	-
Malaysia	1999q1:2007q4	-
Mexico	-	1991q1:2007q4
Netherlands	1988q1:2007q4 (Eurozone from 1999)	-
Norway	-	1996q1:2007q4
Peru	1995q1:2007q4	-
Poland	-	1999q1:2007q4
Portugal	1999q1:2007q4 (Eurozone)	-
Romania	-	1998q1:2007q4
Slovak Republic	1999q1:2007q4	-
Slovenia	2000q1:2007q4	-
South Africa	-	1993q1:2007q4
Spain	2000q1:2007q4 (Eurozone)	-
Sweden	-	1993q1:2007q4
Thailand	1993q1:1997q2	1997q3:2007q4
Turkey	-	1998q1:2007q4
United Kingdom	1960q1:1972q2	1972q3:2007q4
United States	1960q1:1971q3	1971q3:2007q4
Uruguay	1995q4:2001q4; 2005q3:2007q4	1988q1:1990q4; 1992q1:1995q3; 2002q1:2005q2
Total Observations	1501	1119

Table A4: Open and Closed Economies

(De-facto: Economies with a ratio of exports+imports to GDP greater than or less than 60%

Open	Trade/GDP	Closed	Trade/GDP
Belgium	108.9%	Argentina	19.4%
Bulgaria	112.3%	Australia	33.2%
Botswana	100.0%	Brazil	18.6%
Chile	64.2%	Canada	54.8%
Croatia	87.4%	Colombia	31.9%
Czech Republic	125.0%	Ecuador	46.5%
Denmark	69.9%	Finland	56.3%
El Salvador	63.3%	France	40.8%
Estonia	154.7%	Germany	59.9%
Hungary	79.4%	Greece	42.0%
Iceland	74.4%	Italy	41.3%
Ireland	118.0%	Mexico	34.5%
Israel	80.8%	Peru	36.3%
Latvia	98.6%	Poland	52.9%
Lithuania	111.6%	Romania	58.3%
Malaysia	132.5%	South Africa	52.2%
Netherlands	217.1%	Spain	37.8%
Norway	76.9%	Turkey	42.7%
Portugal	60.1%	United States	18.2%
Slovak Republic	141.5%	Uruguay	37.9%
Slovenia	118.4%		
Sweden	63.4%		
Thailand	63.4%		
United Kingdom	60.1%		
Total Observations	1366		1234

Figure 1: Impulse responses in high-income countries

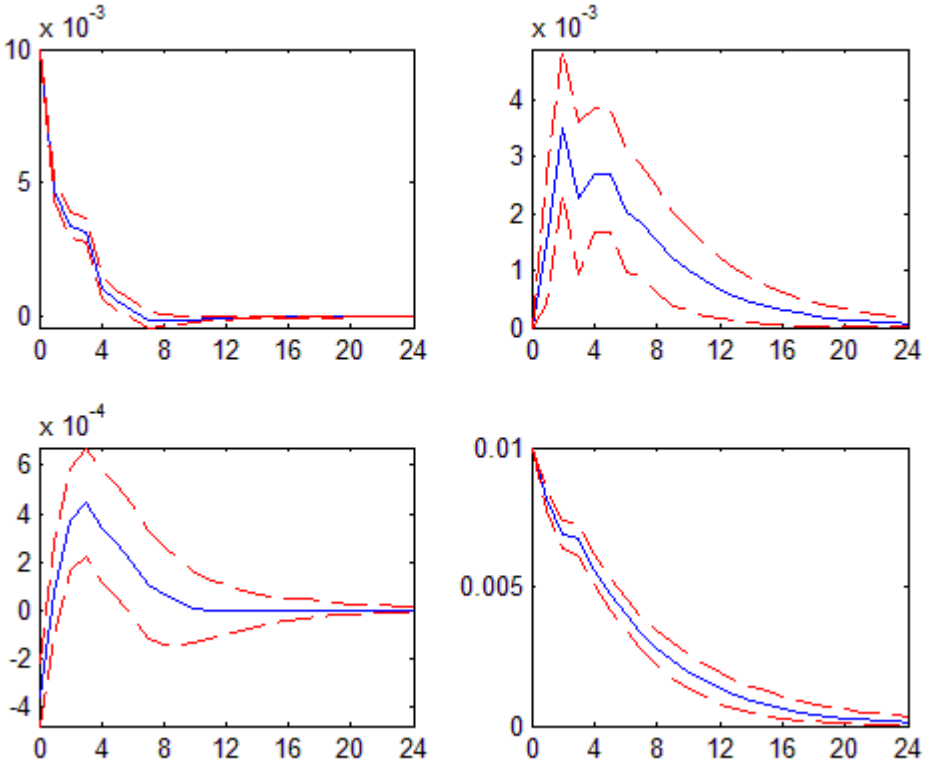


Responses are G in the first row and GDP in the second. 90% confidence intervals in dashed lines.

Figure 2: Impulse responses in developing countries

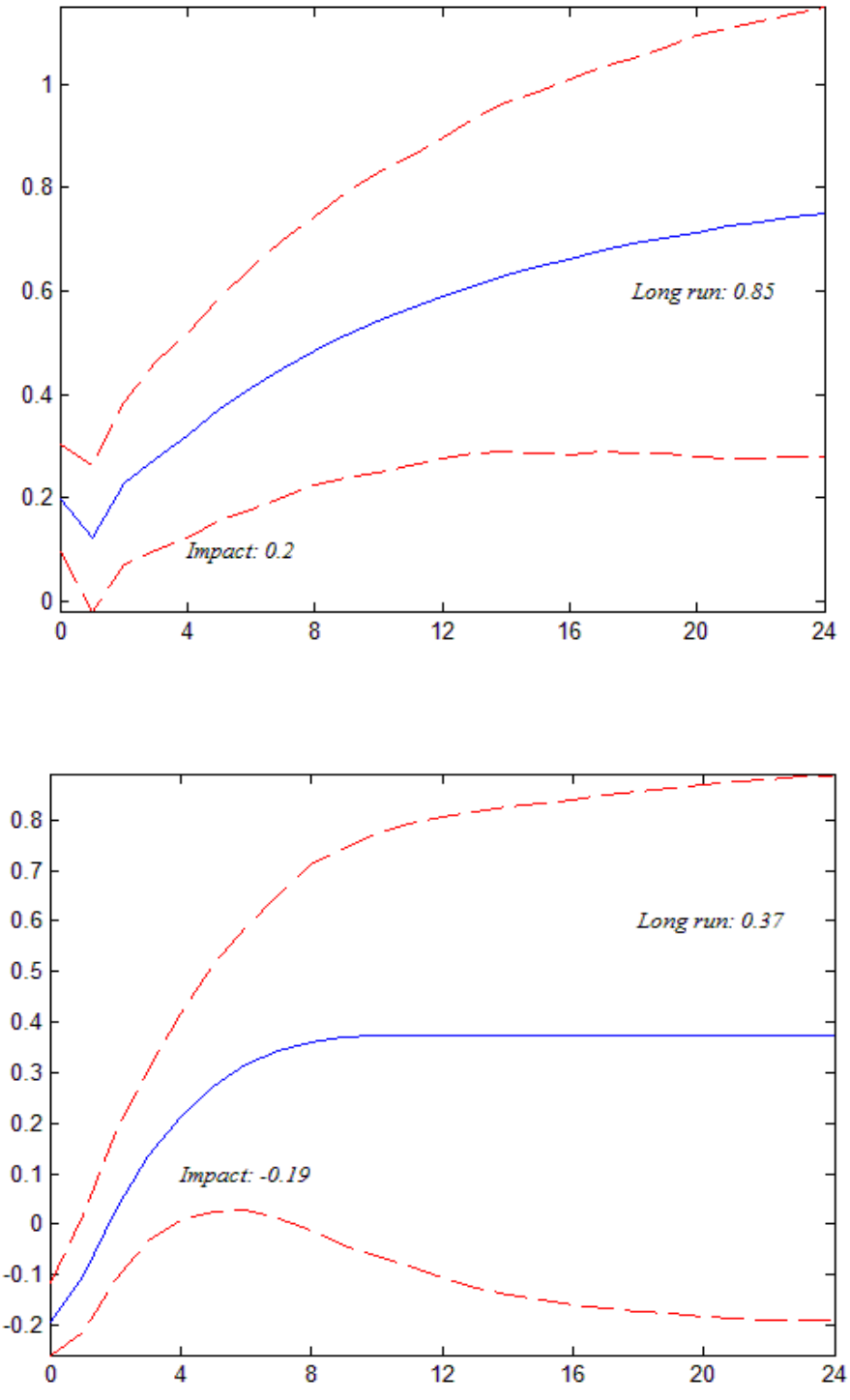
1% Shock to G

1% Shock to GDP



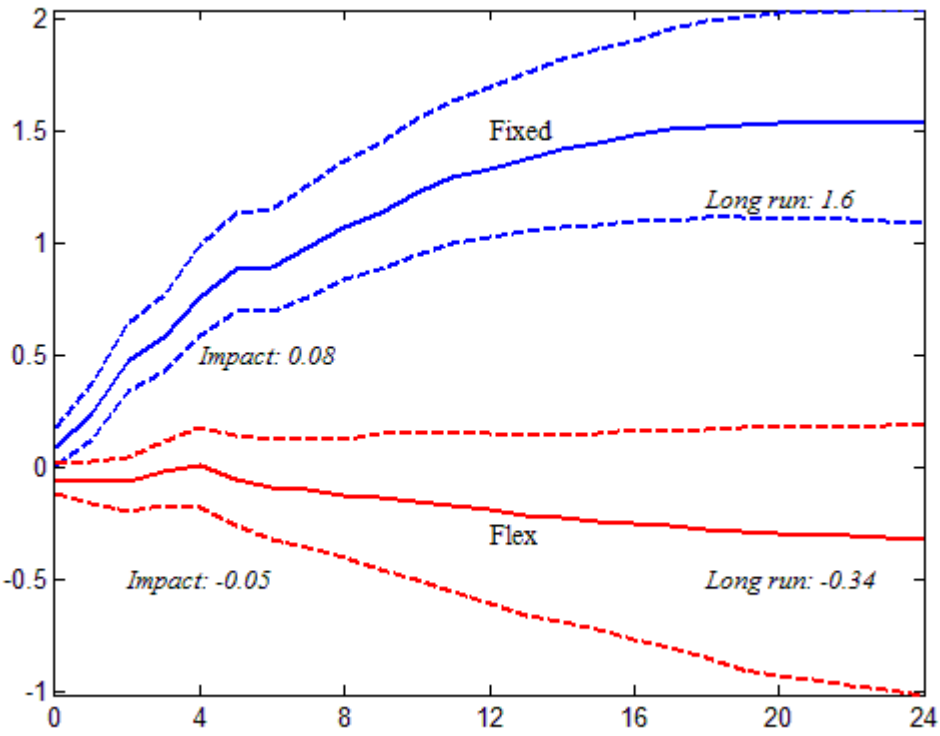
Responses are G in the first row and GDP in the second. 90% confidence intervals in dashed lines.

Figure 3: Cumulative multiplier—high income and developing countries



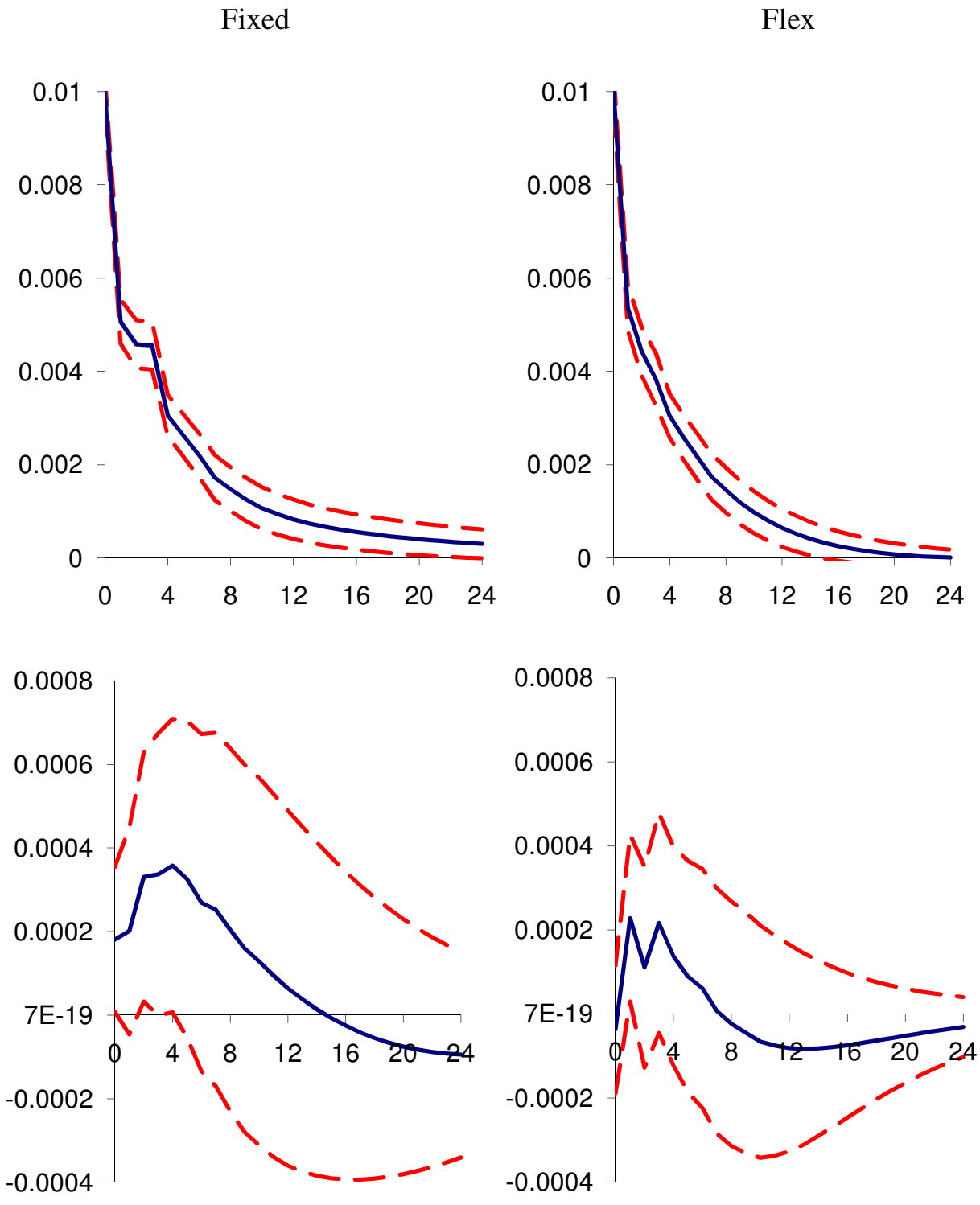
High income countries in top panel, developing countries in lower panel. 90% confidence intervals in dashed lines.

Figure 4: Cumulative multiplier—predetermined (fixed) and flexible (flex) exchange arrangements



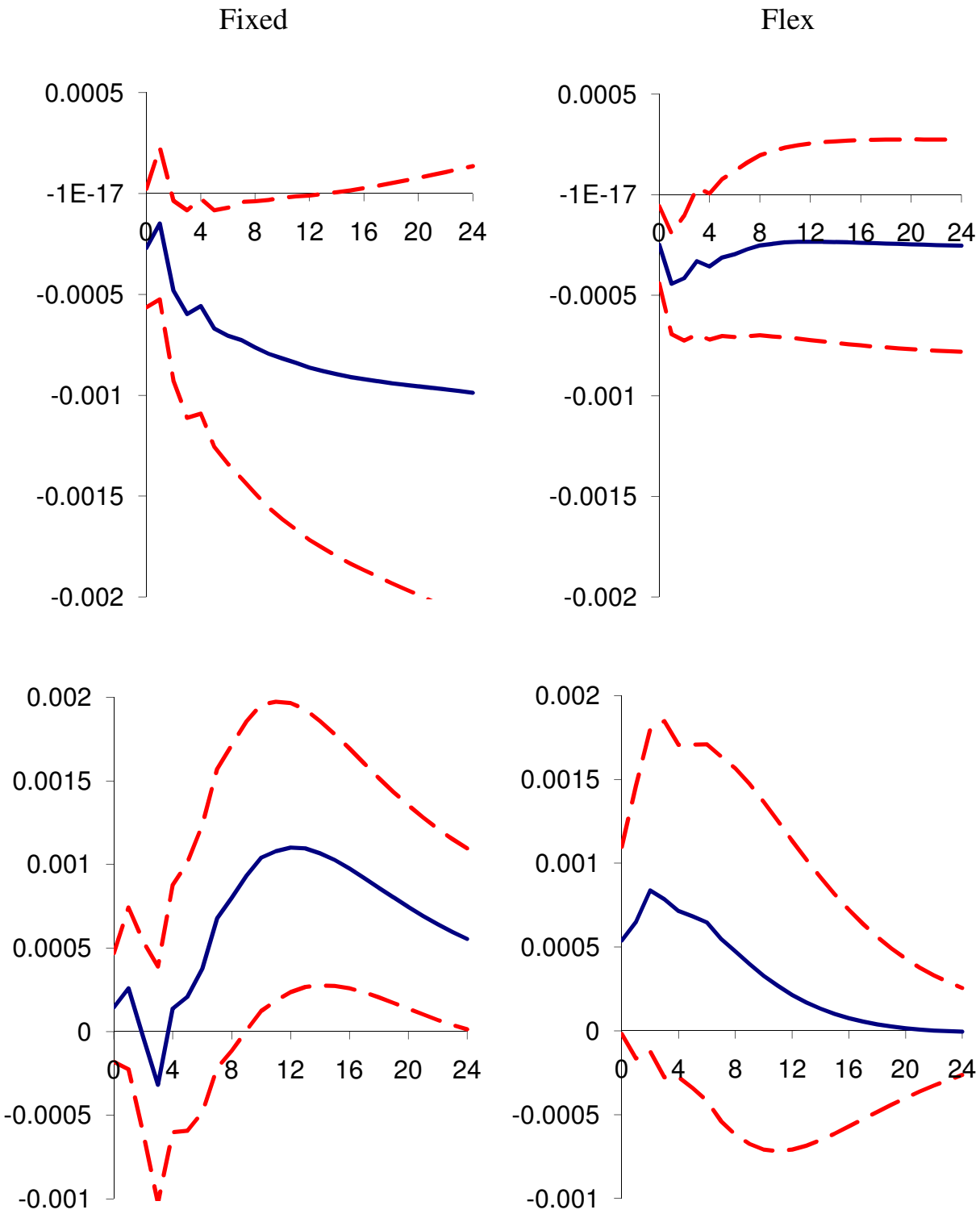
90% confidence intervals in dashed lines

Figure 5a: Responses to a 1% shock to government consumption



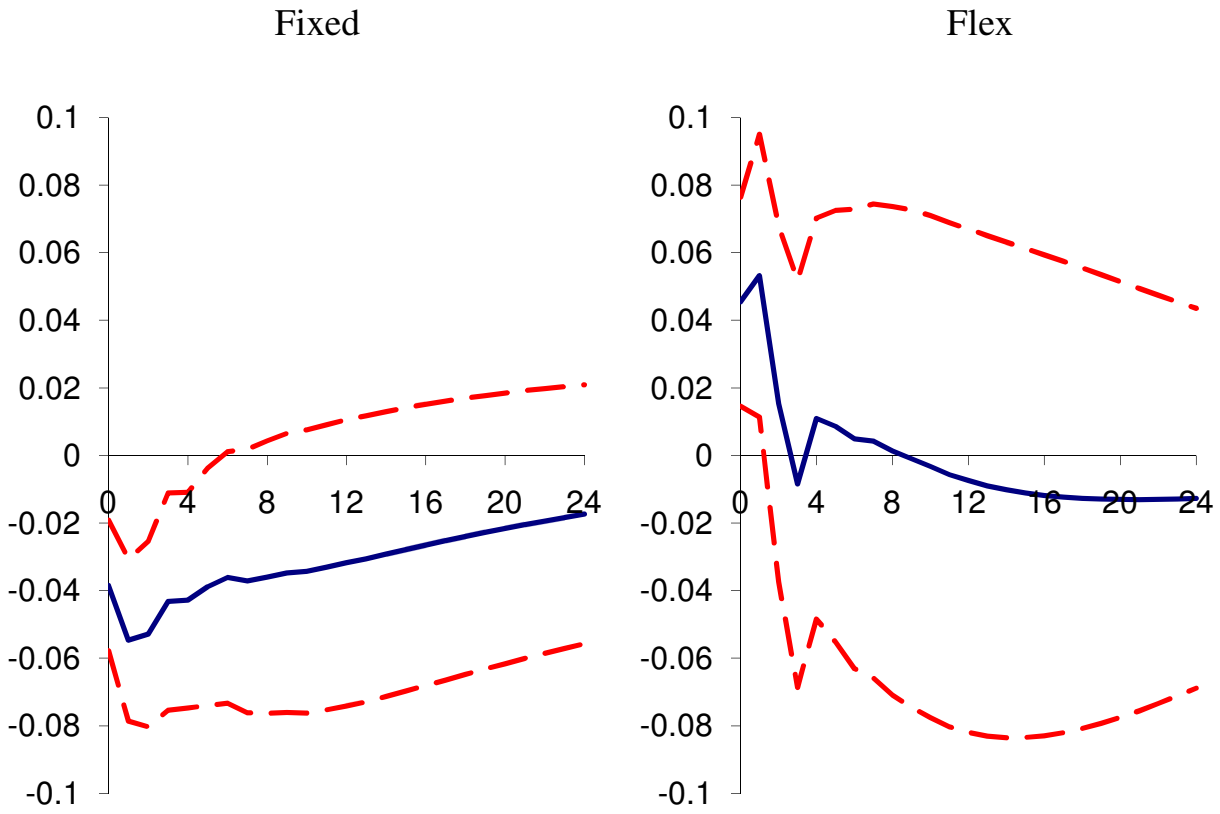
Responses are G in the first row and GDP in the second. 90% confidence intervals in dashed lines.

Figure 5b: Responses to a 1% shock to government consumption



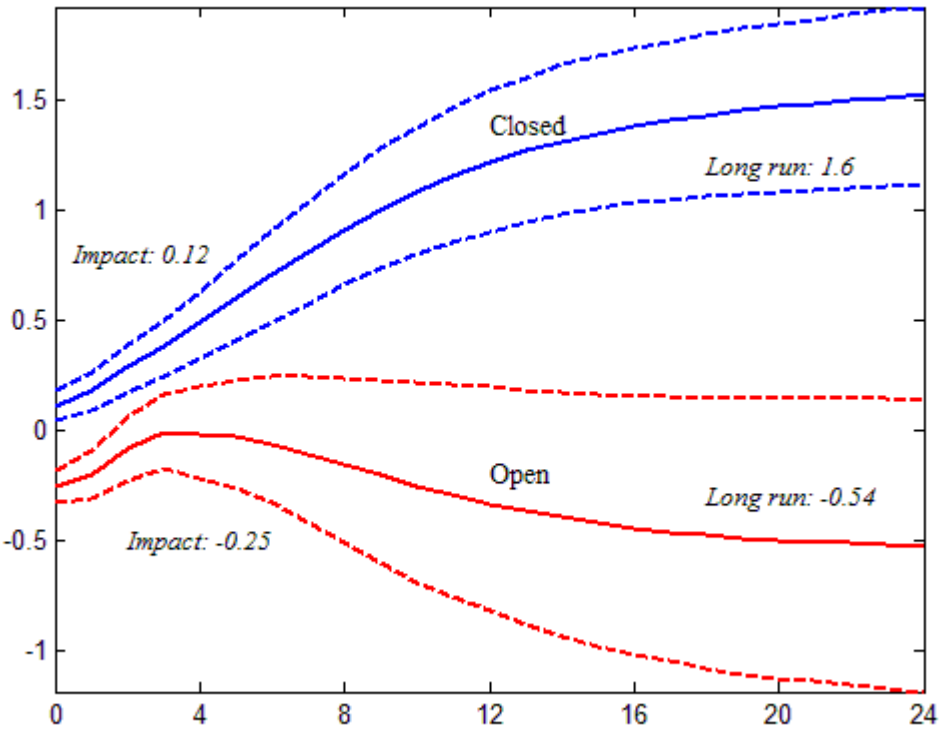
Responses are the current account as a percentage of GDO in the first row and the real effective exchange rate in the second. 90% confidence intervals in dashed lines.

Figure 5c: Responses of the policy interest rate to a 1% shock to government consumption



Units: percentage points. 90% confidence intervals in dashed lines.

Figure 6: Cumulative multiplier—open and closed economies



90% confidence intervals in dashed lines.

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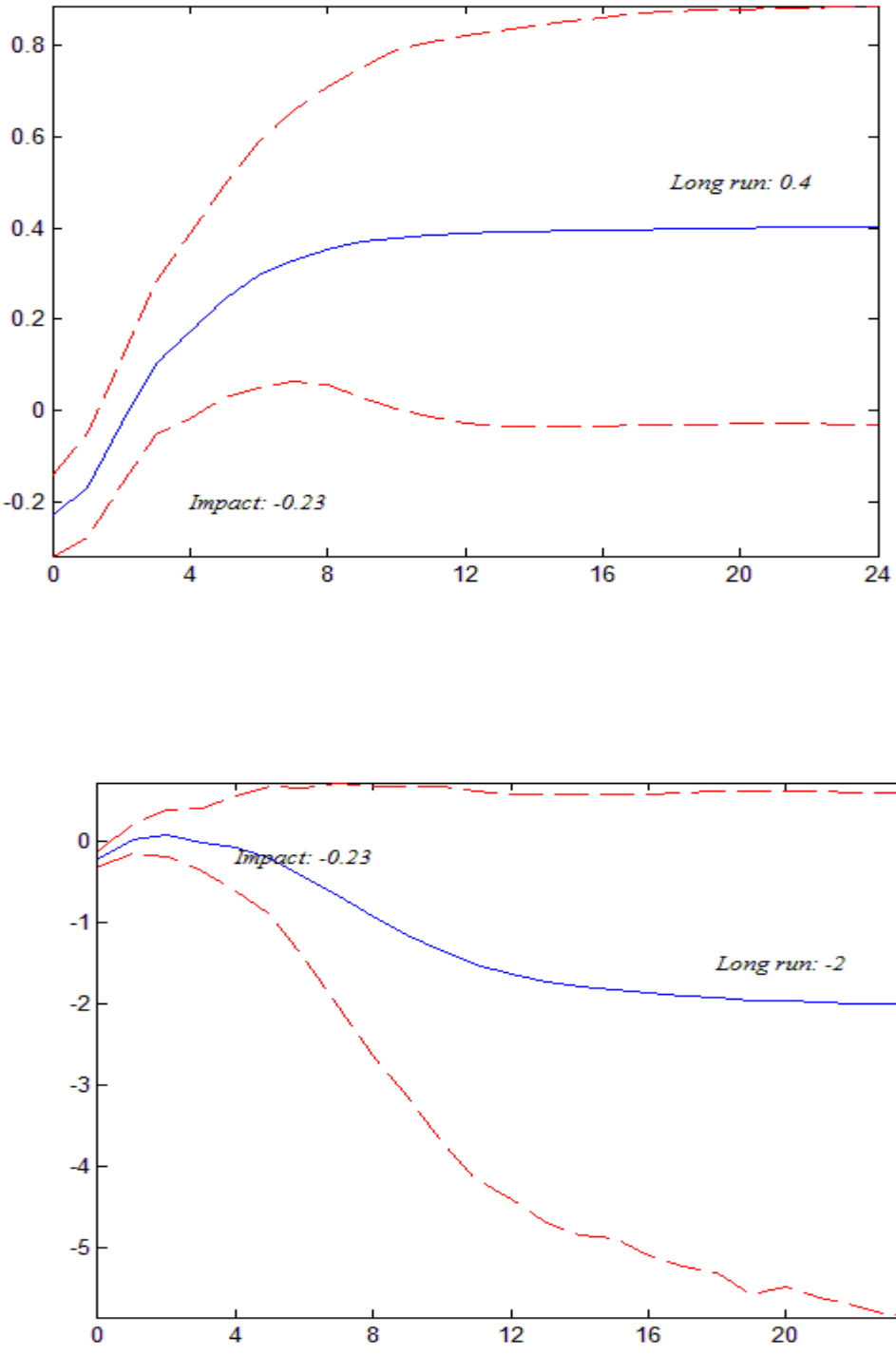
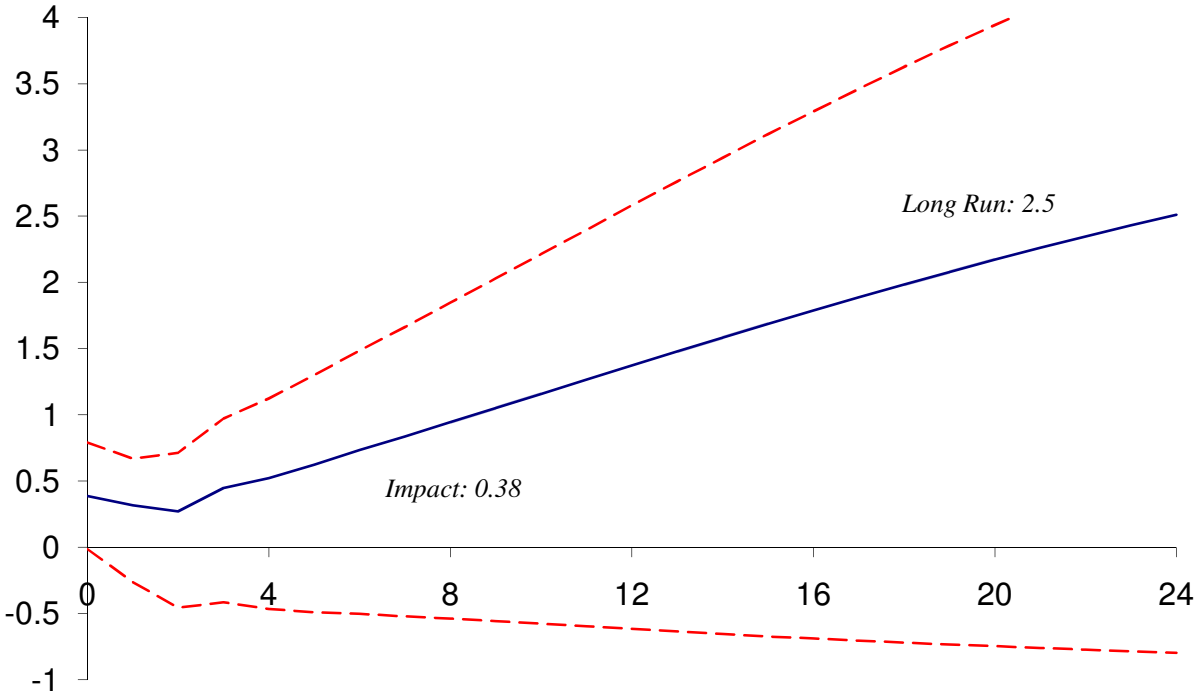
Figure 7: Cumulative multiplier—developing countries: low and high debt



Top panel is debt/GDP < 50%, lower panel is debt/GDP > 50%. 90% confidence intervals in dashed lines.

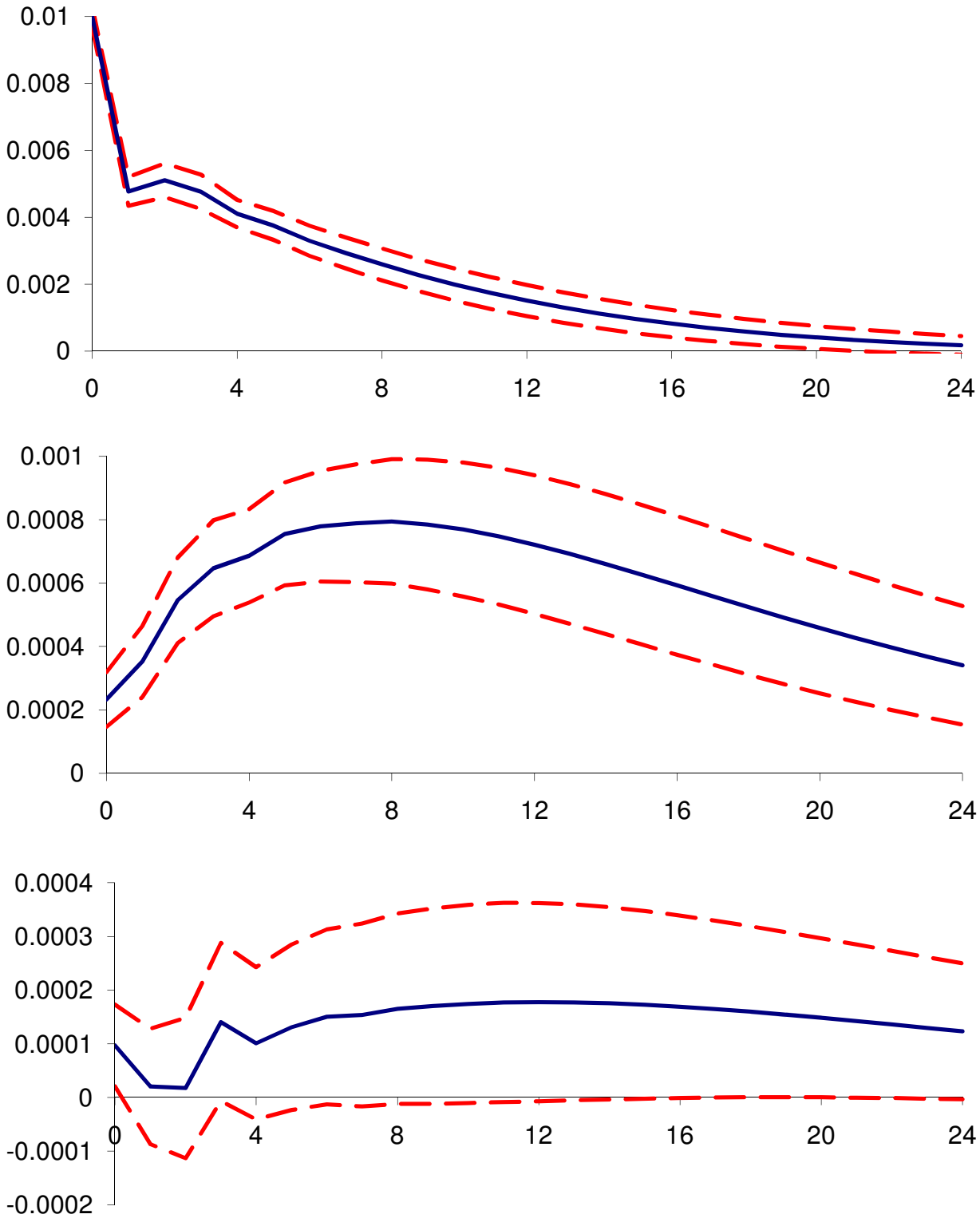
Figure 8: Cumulative government investment multiplier

High-income countries; includes indirect effects of government consumption



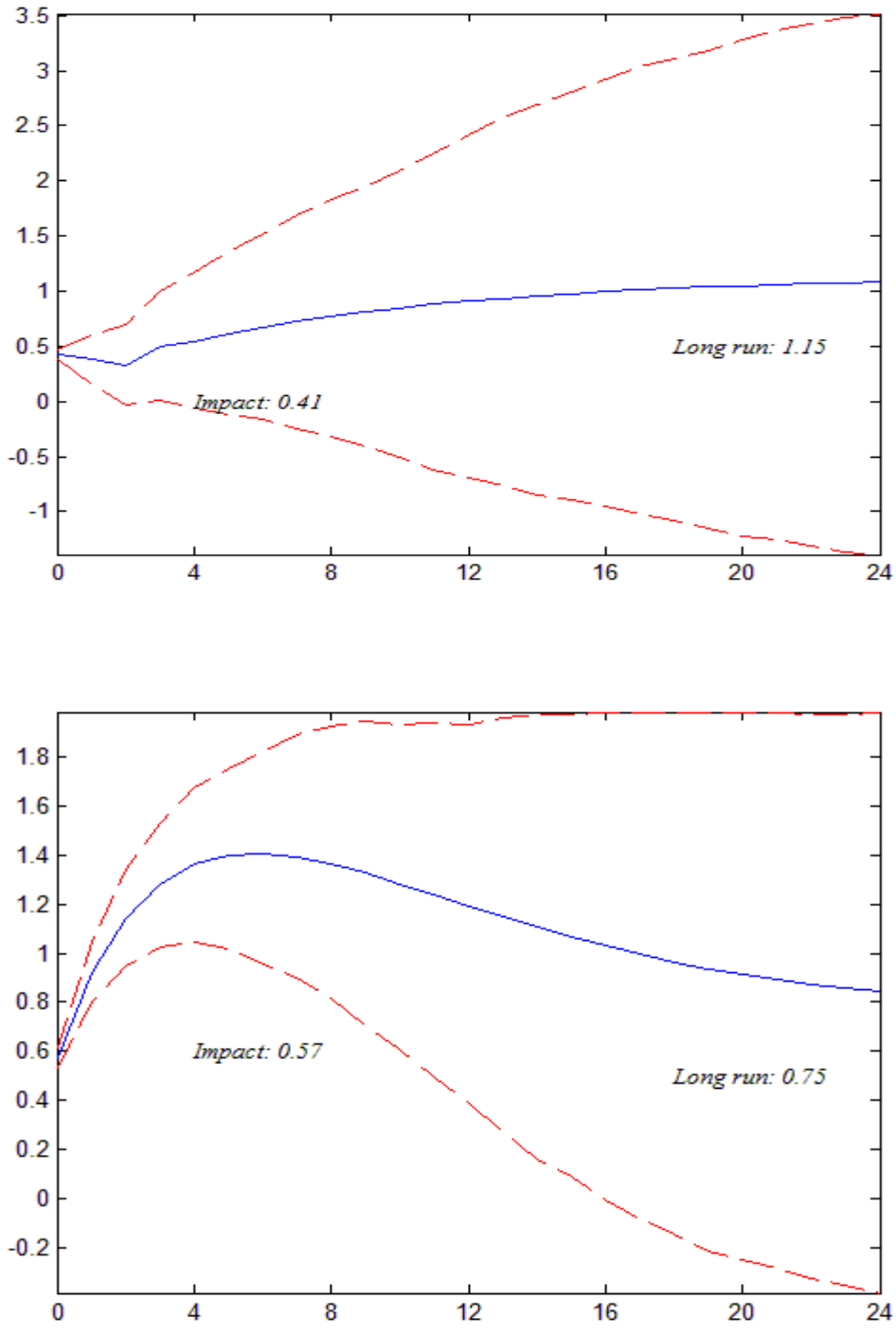
90% confidence intervals in dashed lines.

Figure 9: Responses to a 1% government investment shock



Responses from top to bottom: government investment, government consumption, and GDP. 90% confidence intervals in dashed lines.

Figure 10: Cumulative multiplier to a "pure" government investment shock: high-income and developing countries



High income countries in top panel, developing countries in lower panel. 90% confidence intervals in dashed lines.

Figure 11: Cumulative multiplier to a "pure" government investment shock: predetermined (fixed) and flexible (flex) exchange arrangements

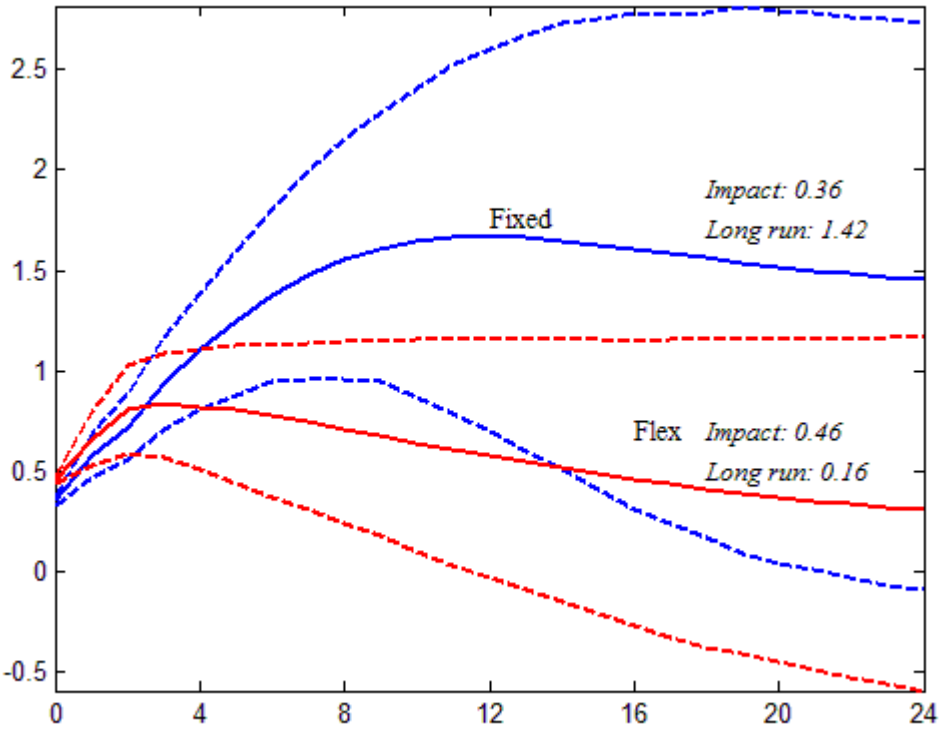


Figure 12: Cumulative multiplier to a "pure" government investment shock: open and closed economies

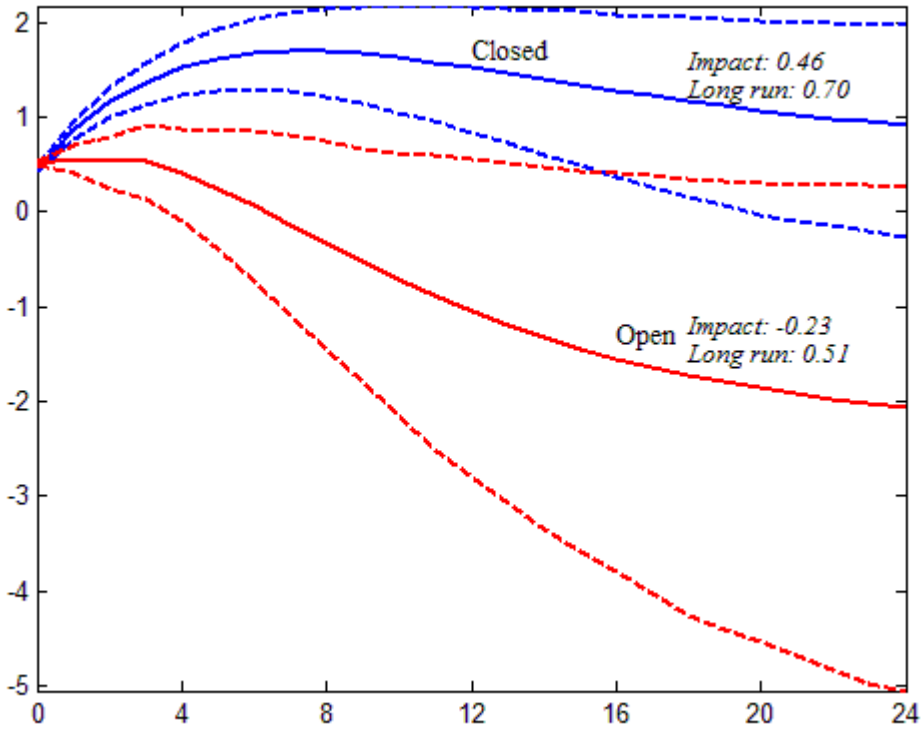
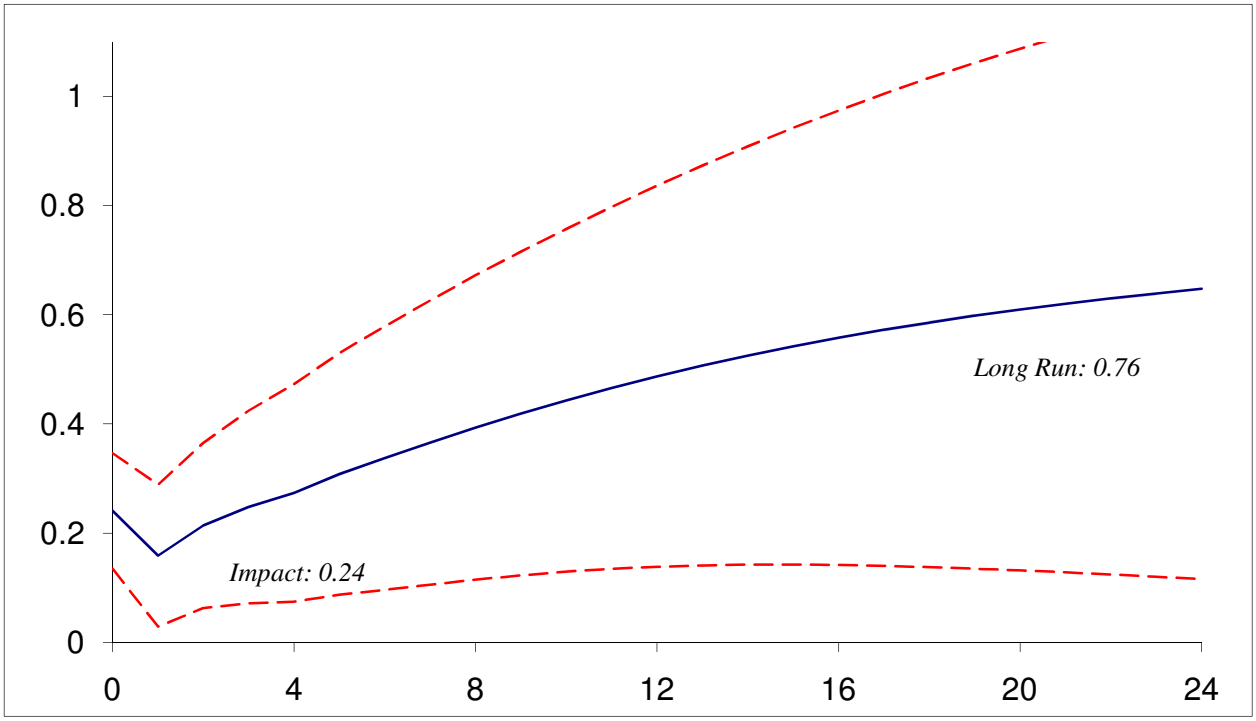
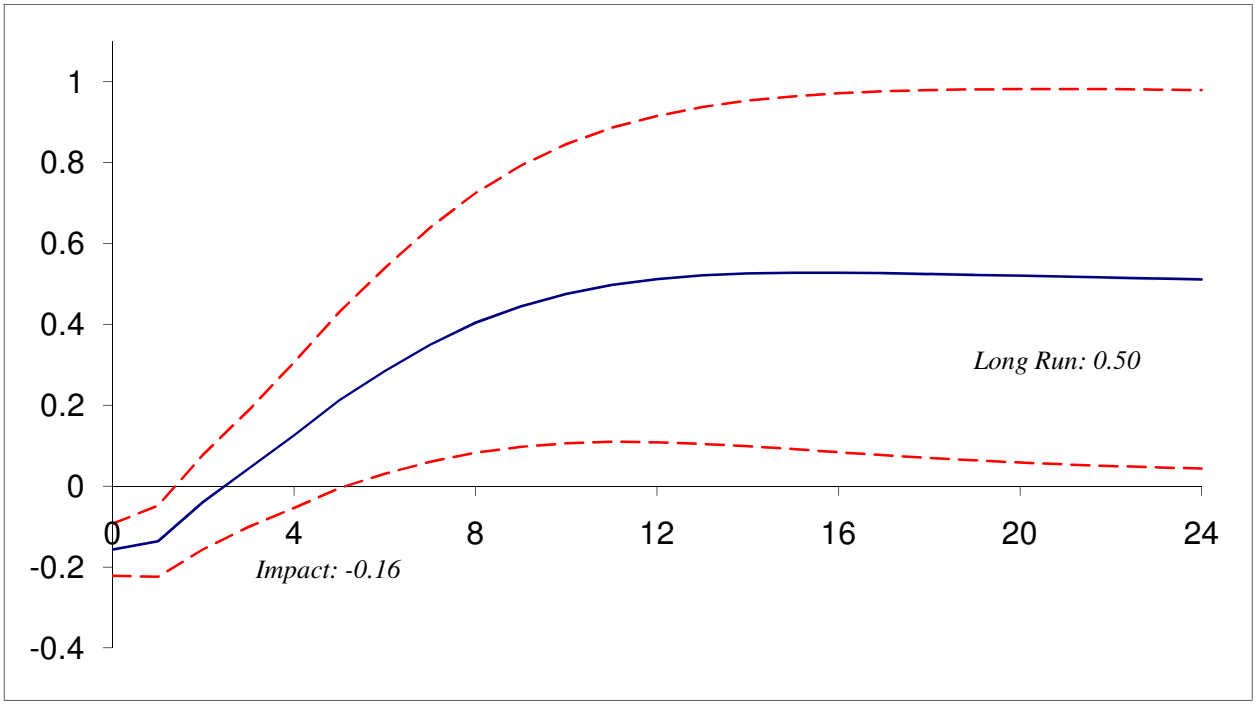


Figure 13: Cumulative multiplier—high income and developing countries

Multivariate Regression

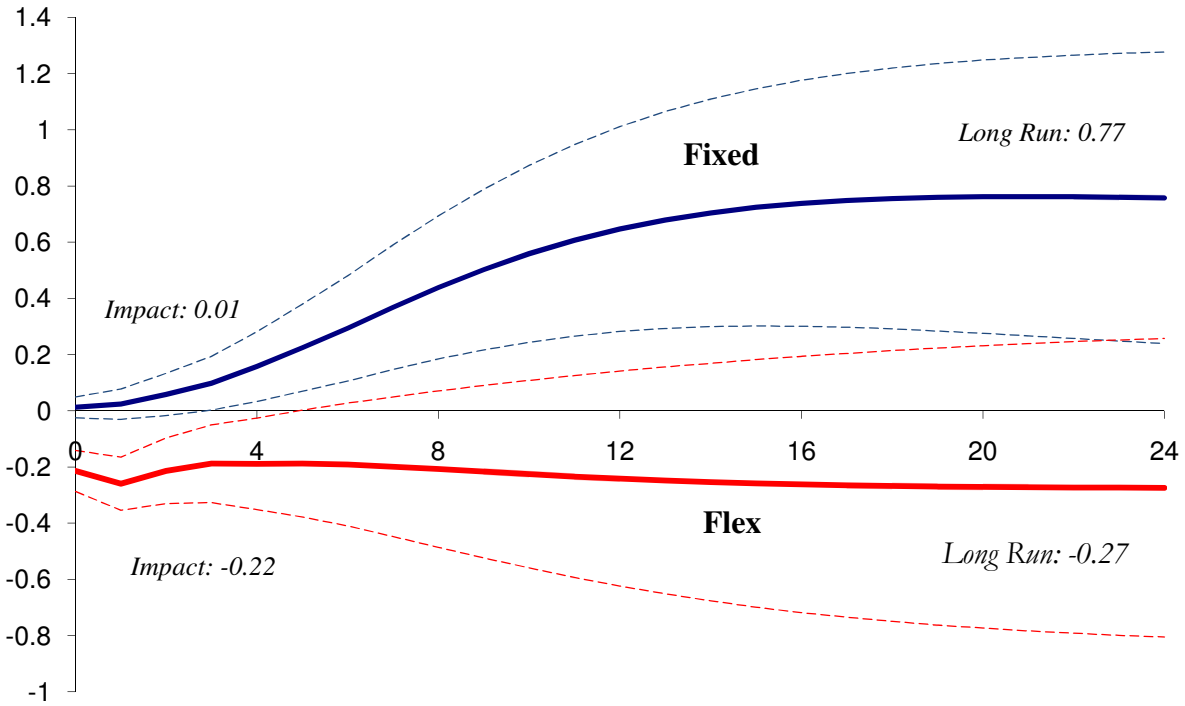




High income countries in top panel, developing countries in lower panel. 90% confidence intervals in dashed lines.

Figure 14: Cumulative multiplier—predetermined (fixed) and flexible (flex) exchange rates

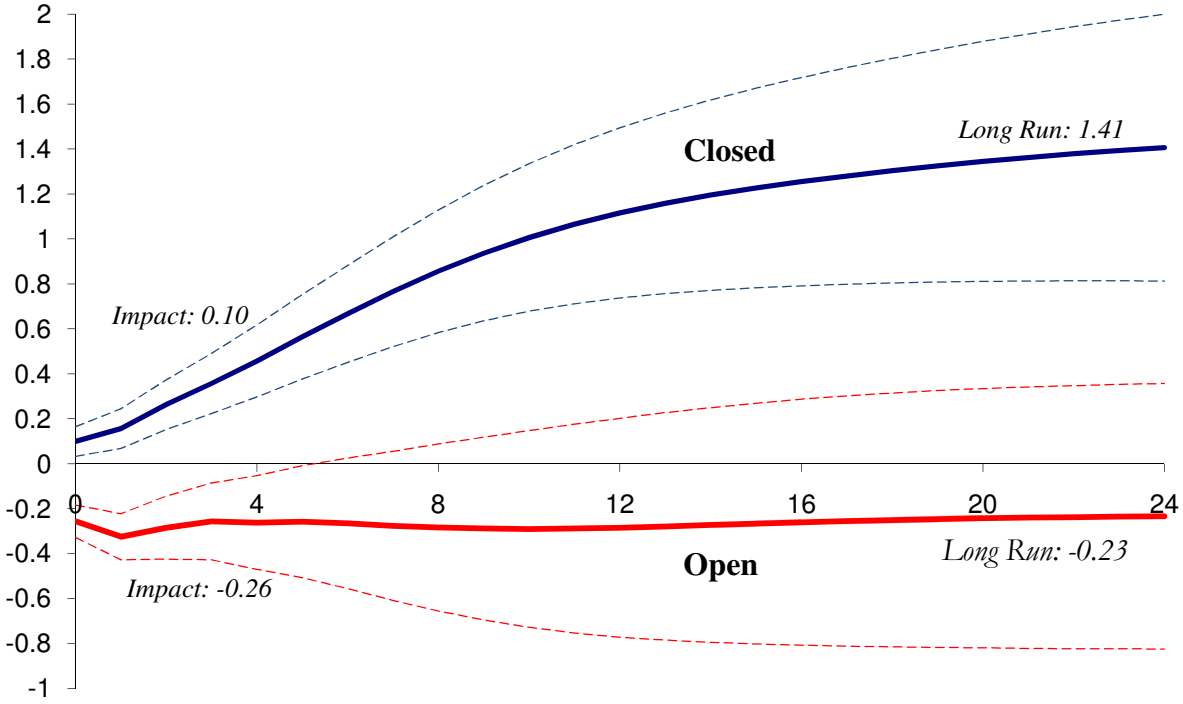
Multivariate Regression



90% confidence intervals in dashed lines.

Figure 15: Cumulative multiplier—open and closed economies

Multivariate Regression



90% confidence intervals in dashed lines.