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Output Growth and Unexpected Government Expenditures*

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Abstract: This paper takes into account the dynamic feedback between government expenditures and output in a model that separates the effects of expected and unexpected government expenditures on output. We allow for standard determinants based on Solow's growth model, as well as financial globalization and trade openness measures for a sample of 56 industrial and emerging market economies over the 1970-2004 period. We find that unanticipated government expenditures have negative and significant effects on output growth, with higher effects in developed economies. Along with savings responses, we interpret these results based on how fiscal policy reacts to business cycles. Anticipated government expenditures have negative - but smaller effects - on output growth. These results are very robust to a recursive treatment of expectations, which reinforces the role of new information in an increasingly integrated world economy.

Keywords: Dynamic Panels, Economic Growth, Expected and Unexpected Government Expenditures, Globalization.

JEL Classification Numbers: E32, E62, F43.

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1. Introduction

This paper estimates a rational expectations model in the tradition of Barro (1977) to separate the effects of expected and unexpected government expenditures on output. We conduct a new econometric treatment of output growth over the years 1970-2004, which provides a fairly long time span of analysis. Our approach is initially based on the literature on growth empirics that use dynamic panels (e.g., Islam, 1995). We then propose a two-step approach consistent with the feedback mechanism in Bun and Kiviet (2006) where in the first step we identify the expected and unexpected components of government expenditures and then test if they have the same effect on output growth.

A reconsideration of how government size has an impact on economic growth is well deserved for several reasons. First, it is *at the forefront of economic policy debate*, including the way the U.S., for example, chose to fight the 2008-2009 economic crisis with expansionary fiscal policies (mostly through higher government deficits), coupled with loose monetary policy (driving the federal funds target rate to zero). Economists diverge on the effectiveness of these measures and the debate is ongoing. Fiscal policy is one area of attention, which under the Keynesian view argues for a sufficiently large multiplier effect of government purchases.

While U.S. government calculations suggested a fiscal policy multiplier greater than one, Robert Barro strongly criticizes the use of a number around 1.5, stating that there are reasons to believe that the war-based 0.8 multiplier substantially overstates the multiplier that applies to peacetime government purchases.[1] Robert Barro also reports the estimation of a spending

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[1] Robert Barro, Government Spending is no Free Lunch, *The Wall Street Journal*, Jan 22, 2009. He makes the expectations channel clear: "There are reasons to believe that the war-based multiplier of 0.8 substantially overstates the multiplier that applies to peacetime government purchases. For one thing, people would expect the added wartime outlays to be partly temporary (so that consumer demand would not fall a lot). Second, the use of the military draft in wartime has a direct, coercive effect on total employment. Finally, the U.S. economy was already

multiplier of around 0.4 within the same year and about 0.6 over two years.[2] Barro and Redlick (2011) provide detailed evidence for the U.S. economy in the long-run. Ramey (2011) surveys the evidence on the government multiplier. She discusses the multiplier in the neoclassical model as positive or negative (depending on the extent of distortionary taxes), as well as the Keynesian case through the marginal propensity to consume. Since theoretical work gives a wide range of values for the multiplier, she advocates a "turn to the data to see if we can narrow the range." Ramey (2011, p. 676).

Research on other major economies illustrates mixed findings as well. Forni et al. (2009), for example, employ a dynamic stochastic general equilibrium model and find for the Euro area that government purchases of goods and services and compensations for public employees have small and short-lived expansionary effects on private consumption, while innovations in transfers to households show a slightly more sizeable and lasting effect. Afonso and Jalles (2011) report panel results for 108 countries from 1970-2008 using a growth model in which the results show a negative effect of government size on growth. For the European Union, in particular, member states faced a fiscal framework with sound fiscal policies within the Stability and Growth Pact (SGP) guidelines put forward in 1997. They use three indices constructed by the European Commission (overall rule, expenditure, and budget balance indexes) based on surveys and find that these fiscal numerical rules improve GDP growth for these EU countries, while the government size proxy loses significance.

Second, it is clear that *the size of government matters for growth, although the precise effect is difficult to determine*. The positive effect of government activities on output depends in

growing rapidly after 1933 (aside from the 1938 recession), and it is probably unfair to ascribe all of the rapid GDP growth from 1941 to 1945 to the added military outlays. In any event, when I attempted to estimate directly the multiplier associated with peacetime government purchases, I got a number insignificantly different from zero."

[2] Robert Barro, The Stimulus Evidence One Year On, *The Wall Street Journal*, Feb 23, 2010.

theory on the relative efficiency of the public sector. Perhaps the best well known paper is Barro (1990), who extends endogenous-growth models to include tax-financed government services on production and assumes exogenous government actions. In his model variations in the share of *productive* government expenditures in GDP affect the growth and saving rates. Kneller et al. (1999) find strong empirical support for Barro (1990)'s endogenous growth model, in which taxation and public expenditure can affect the steady-state growth rate. Growth regressions in Mueller and Stratmann (2003) from 1960 to 1990 show that there is a positive association between government size and growth in low-income countries, where the government sectors tend to be small, and a negative relationship across high-income countries, where government sector has grown larger. Tagkalakis (2008) examines the effects of fiscal policy on consumption in recessions and expansions in a yearly panel of nineteen OECD countries from 1970 to 2002 and finds that the effect of fiscal policy is more pronounced in countries characterized by a less developed consumer credit market. His explanation is through binding liquidity constraints.

Barro (1991) and López-Villavicencio and Mignon (2011) find that the share of government consumption in GDP is inversely related to GDP growth, while Levine and Renelt (1992) report government consumption expenditures to GDP having a negative effect on GDP growth, but the results are not robust. A host of papers has assessed the role of government expenditures on growth. Different specifications include removing education and defense from government expenditures in Barro (1990) but most previous works in the cross-section tradition have demonstrated the fragile nature of the link between government expenditures on growth.[3]

[3] In time series, Blanchard and Perotti (2002) examine the effects of changes in government spending and taxes on output. Employing a three-variable VAR (with taxes, spending, and quarterly real per capita GDP) for the postwar U.S., they find in all specifications that output responds positively to a spending shock, although the persistence of the impulse responses changes depending on whether a deterministic or stochastic trend is assumed.

Ram (1986) surveys the earlier evidence on the size of government and economic growth. Bergh and Henrekson (2011) survey the more recent literature and report a significant negative correlation in most recent studies: an increase in government size by 10% is associated with a 0.5% to 1% lower annual growth rate. One of the problems that plagued earlier works is the possibility of reverse causation, in which the extent of economic growth could determine the size of government. As Bergh and Henrekson (2011, p. 12) put it: "In general, in times of economic downturn social expenditure provides stabilizers that automatically undermine the government's balanced budget. On the other hand, in boom years when growth rates are higher fewer people will be unemployed, and public expenditure shares will be lower. For this reason, a negative correlation between public expenditure and economic growth is to be expected in the short run. Finding a negative correlation is therefore no proof that high expenditure causes low growth."

Third, previous research on economic growth has outlined *how productivity is enhanced by the extent of trade openness and/or integration to global capital markets*. Edwards (1998) examines nine measures of trade policy in 93 countries on total factor productivity growth and found that more open countries experienced faster productivity growth. Edison et al. (2002) report estimations of international financial integration effects on economic growth per capita for 57 countries. Although they usually find positive growth effects on the capital flows measure, they show mixed results for government balances. For Mishkin (2009) opening to foreign capital directly increases access to capital, lowering its cost. See also the dynamic panels by Chang et al. (2008) and Baltagi et al. (2009). Aizenman (2008) links financial with trade openness and documents highly significant positive association between changes in financial and trade openness in developing countries and Swaleheen (2011) relates the extent of the size of government with economic growth and shows a negative effect of corruption on the growth rate of real per capita income.[4]

Fourth, *most of the existing empirical estimates have assumed that government expenditures are entirely exogenous to economic growth*. We relax this assumption in this paper, exploring the class of estimators developed by Blundell and Bond (1998). Endogeneity has plagued past research on economic growth and Barro (1990, p. S121) mentions in a theoretical paper that "aside from problems of measuring public services and the rates of growth and saving, the empirical implementation of the model is complicated by the endogeneity of government." Perotti (1999) assumes exogenous government expenditures in his treatment of private consumption responding to fiscal shocks and to the state of the economy.

In this paper we reexamine the role of anticipated and unanticipated government purchases in economic growth. With the Solow (1956) model as benchmark, the rate of population growth and the ratio of investment to output are the key determinants of economic growth. Capital flows from abroad and government expenditures can, however, provide additional channels to economic growth, as long as these affect the stock of capital and the savings rate, respectively. Recent research along these lines by Mollick and Cabral (2011) and Cabral and Mollick (2012) sheds light on this channel for a sample of developed and emerging market economies from 1986 to 2004 to capture the globalization years after GATT negotiations in late 1980s.

We find that unanticipated government expenditures have negative and significant effects on output growth. Anticipated government expenditures have negative - but almost negligible

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[4] The link between government size and openness has been extensively studied as well. Rodrik (1998) finds a positive relationship between trade openness and the size of government, and Alesina and Wacziarg (1998) document a negative covariation of country size with trade openness and with the ratio of government expenditures to output. Ram (2009) uses 41-year panel data covering the period 1960-2000 for 154 countries to find support for the direct relationship in Rodrik (1998), while Benarroch and Pandey (2008) find the opposite to Rodrik (1998).

effects - on output growth. We also find that, in developed economies, the unanticipated output effects of government expenditures are much higher than in emerging markets. These results are very robust to a recursive treatment of expectations.

In contrast to Tagkalakis (2008), who used as proxy for credit constraints the maximum ratio of the loan to the value of the house in housing mortgages for first time buyers in OECD economies, we verify the role of credit constrains distinguishing between developed and emerging market economies as did Lane and Milesi-Ferreti (2007): economies can be more or less open depending on the extent of financial (and trade) flows. This may complement the government-output channel in fiscal policy. It is natural to expect that developed and developing countries may have different causal mechanisms when exploring economic growth when *both* external flows and the government sector are present. Gourinchas and Jeanne (2006) use a calibrated neoclassical growth model and found that developing countries do not benefit greatly from international financial integration and Adam and Bevan (2005) report threshold effects of fiscal deficits on growth for a panel of 45 developing countries.

This paper has four more sections. Section 2 introduces the data employed in this work; section 3 contains the empirical methodologies and the dynamic panel data models used; section 4 discusses the results; and section 5 concludes the paper.

2. The Data

The data set for this paper comes from a yearly panel including 56 countries for over 35 years, from 1970 to 2004. Cabral and Mollick (2012) contain more detailed discussion of this dataset. The main source of data is the World Bank Development Indicators database and the data set on foreign assets compiled by Lane and Milesi-Ferreti (2007). The variables in the data set are the Gross Domestic Product Y_{it} for country i at year t, total population L_{it}, government expenditures G_{it}, investment I_{it}, and three measures of globalization. The first is trade openness TO_{it}, calculated as the sum of imports and exports, divided by Y_{it}. The second and third measures follow Lane and Milesi-Ferreti (2007). The second is international financial integration IFI_{it}, calculated as the stock of external assets plus the stock of external liabilities, divided by Y_{it}. The third is a financial integration measure based on portfolio equity and Foreign Direct Investment (FDI) stocks. It is calculated as the stock of portfolio equity assets plus the stock of portfolio equity liabilities plus the stock of direct investment assets plus the stock of direct investment liabilities, all divided by Y_{it}. Openness measures vary considerably across countries: they are much higher for industrial economies if measured by capital flows and are about the same for emerging markets if measured by trade considerations.

[Table 1 here]

The correlation coefficients between our three measures of globalization and the output per worker are mostly positive and on average larger for industrial economies. These are not shown in the table but can be summarized. There are weak negative correlations between G/Y and output growth, varying from -0.08 in emerging markets to -0.15 in industrial economies. Correlation between G/Y and I/Y is negative in industrial economies (-0.43) supportive of a large crowding-out and very weak (-0.02) for emerging markets. Finally, correlation coefficients between G/Y and our measures of openness are negative in industrial economies (except for 0.19 with TO) and close to zero throughout for emerging markets.

The within-countries sample averages of the main variables are presented in Table 1, in which we divide the sample between developed and emerging economies according to the classification in Lane and Milesi-Ferreti (2007). The figures presented in the table are country level sample averages of GDP per capita (Y/L), rate of population growth ($\Delta L_t/L_{t-1}$), government expenditures to GDP (G/Y), and expected government expenditures to GDP ($E[G/Y]$) based on recursive estimation as explained below. Three differences can be easily derived from this table. Developed economies have a nearly six time larger GDP per capita, emerging economies have about three times larger population growth rate, and government expenditures to GDP is about 44% larger in developed economies (G/Y average ratios of 18.88 versus 13.10). In order to keep the tradition of long-run growth regressions in Mankiw et al. (1992), the series are not filtered. We decompose, however, government size into expected and unexpected components, thus adding misperceptions to growth determinants.

3. Empirical Methodology

Under the small open economy assumption, Abel et al. (2011) show that desired savings (S^d) and investment (I^d) depend positively and negatively, respectively, on the world real interest rate (r^w). If G goes up, savings (S = Y – C – G) decrease and the saving function decreases, shifting to the left. For a given r^w, current account (CA) incurs a deficit, which can be offset by either higher trade surplus (TB) or higher capital account (KA) surplus. The financial globalization measures used in this paper take this offsetting factor of CA into account when government undertakes higher or lower deficits in response to the business cycle. While Perotti (1999) assumes exogenous government expenditures for simplification, we believe it is more interesting to allow government expenditures to be endogenous (in the feedback mechanism specified below) and respond to all new information available. Our results hold of course with simpler autoregressive processes for G.

The basic empirical models below build on Mankiw et al. (1992)'s treatment of Solow (1956). In this paper we modify this framework for anticipated and unanticipated government expenditures in the tradition of the rational expectations model by Barro (1977), who showed that only unanticipated money has real effects on unemployment. In doing so, we briefly compare our strategy to two empirical works, who have identified unexpected government shocks differently. For instance, as for the identification of *anticipated fiscal shocks* within a VAR framework, Blanchard and Perotti (2002) draw two conclusions: "First, identifying and tracing the effects of anticipated fiscal shocks can be done within a VAR framework but requires stronger identification restrictions. These restrictions may be too strong. Second, under these identification restrictions, we find that allowing for anticipated fiscal policy does not alter substantially the results we have obtained so far, … , our impulse responses suggest only weak effects of anticipated tax changes on output, a result consistent, for example, with the findings by Poterba (1988) for the Reagan tax cuts." Blanchard and Perotti (2002, p. 1355). In the context of cross-section regressions over 1960-2000, Woo (2011) puts forward a fiscal policy volatility channel, in which excessive discretionary changes in fiscal policy take place for reasons other than smoothing out fluctuations or responding to macroeconomic conditions. He first estimates time series regressions for final government expenditures (for each country) as a function of real GDP and controls. The country-specific measure of discretionary spending policy volatility is the log of standard deviation of the residuals of this equation.

We propose below a way to separate expected from unexpected components of government expenditures in a completely different fashion than these VAR and two-step OLS procedures to fiscal policy. Initially our estimation of the main output growth equation follows the literature on growth empirics that use dynamic panel data methods (see, e.g., Islam, 1995).

We then propose a two-step procedure where in the first step we estimate a government expenditures equation that follows the feedback mechanism in Bun and Kiviet (2006). This first step serves to separate government expenditures into its expected and unexpected components. In the second step we reestimate the output growth equation by allowing the marginal effects of government expenditures on output to be different if the expenditures are expected or if they are shocks.

3.1. Output Dynamics

The dynamic specification that captures the effect government expenditures on output is given by:

$$y_{it} = \alpha y_{i,t-1} + \beta g_{it} + \theta' X_{it} + \eta_i + \varepsilon_{it} \tag{1}$$

where y_{it} is the logarithm of the real output per capita in country i at time t, g_{it} is the logarithm of the ratio of government expenditures to GDP ($g_{it} = \log(G_{it}/Y_{it})$), and X is a vector of controls that contains the logarithm of the investment-to-output ratio ($s_{it} = \log(I_{it}/Y_{it})$), the rate of population growth ($n_{it} = \Delta L_{it}/L_{i,t-1}$), and any of our three measures of globalization ($open_{it} = IFI_{it}$, GEQ_{it}, or TO_{it}). Our measures of globalization are the logarithm of assets related globalization (IFI_{it}), the logarithm of equity related globalization (GEQ_{it}), and the logarithm of trade openness (TO_{it}). η_i is the time-invariant country-specific characteristic and ε_{it} is the remainder stochastic term.

Although the coefficient on the lagged dependent variable is not of direct interest, allowing for dynamics in the underlying process may be crucial for recovering consistent estimates of the effect of government expenditures on output. The correlation between government expenditures and output may reflect a common driving force that arises from a dynamic adjustment process. Hence, to take into account that government expenditures during period t may be affected by previous levels of output and previous output shocks, we will treat g_{it} first as weakly exogenous and then as endogenous in the estimation of Equation (1).[5] That is, we allow for a dynamic feedback between government expenditures and output and obtain consistent estimates of the coefficient of interest by using the difference and system GMM estimators as proposed by Holtz-Eakin et al. (1988), Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1998). In addition, these estimators are specifically designed to deal with a predetermined (or endogenous) g_{it}, and the joint endogeneity of $y_{i,t-1}$, s_{ti}, and $open_{it}$. We will treat the population growth rate as exogenous.

These estimators control for time-invariant country-specific characteristics, η_i, and maintaining that the disturbances are serially uncorrelated g_{it} is endogenous in the sense that it is correlated with ε_{it} and earlier shocks, but uncorrelated with future shocks. That is, $E(g_{is}\varepsilon_{it}) = 0$ for $s < t$ and for all i, and $E(g_{is}\varepsilon_{it}) \neq 0$ for $s \geq t$ and for all i. Serially uncorrelated ε_{it} means that the error term is an unexpected change in output and that previous unexpected changes cannot be used to predict future unexpected changes. Furthermore, weak exogeneity or endogeneity of g_{it} is consistent with rational expectations models and does not restrict agents from adopting a forward-looking perspective about the evolution of any of the variables in the model with the exception of n_{it}, of course, which is modeled as strictly exogenous.

If the value of the lagged dependent variable is close to 1, then we would have a high degree of persistence. Following recent Monte Carlo results by Hauk Jr. and Wacziarg (2009)

[5] In an innovative approach to deal with the endogeneity of cyclicality of fiscal policy Svec and Kondo (2012) use the stringency of balance budget rules across U.S. states as instruments in a cross-section growth regression. While in their case the U.S. state level dataset extends until 2009, they limit the analysis to 1977-1997 due to changing variable definitions. In our dataset for countries of the world, there is a surprisingly lower level of (uniform) data availability for tax revenues, as can be checked at http://data.worldbank.org/indicator/GC.TAX.TOTL.GD.ZS This constraint implies that tax revenues data would only be available from 1990 onwards (and not for all countries studied herein), which prevents us from using tax revenues in the equation for government expenditures below.

showing that not only fixed effect but also difference GMM estimators overstate the speed of convergence (in growth regressions), we report the estimates under fixed effects and system GMM estimators.

3.2. Government Expenditures Dynamics

The dynamic output characterization of (1) does not require specifying any models for g_{it} to obtain estimates of the parameters *(*α, β, θ*)*. However, formalizing the feedback mechanism from output to government purchases serves two objectives. First, it can be used to show why g_{it} needs to be treated as weakly exogenous or endogenous in the estimation of equation (1). Second, characterizing the evolution of g_{it} is useful to separate expenditures into expected and unexpected government expenditures. Our simplest specification of the feedback mechanism follows one of the characterizations in Bun and Kiviet (2006) and models government expenditures using:[6]

$$g_{it} = \rho g_{i,t-1} + \delta y_{i,t-1} + \gamma' X_{i,t-1} + \nu_i + u_{it}. \qquad (2)$$

Equation (2) indicates that the government decides expenditure levels at the beginning of the period based on the realization of last period's variables. When $\delta = 0$, g_{it} in (1) is strictly exogenous. When $\delta \neq 0$, g_{it} it should be modeled as endogenous or weakly exogenous and depends via $y_{i,t-1}$ on all past disturbances; not just on ε_{it}.

As (2) suggests, government expenditures today can be affected by previous realizations of output. Moreover, equation (1) indicates that output can be affected by previous realizations of the right-hand side variables. This feedback mechanism between output and government expenditures means that agents can behave dynamically. Weak exogeneity or endogeneity of g_{it}

[6] Bun and Kiviet (2006) formalize the feedback mechanism to analyze the finite sample behavior of particular least squares and method of moments estimators. A similar characterization is used in Blundell et al. (2000) in some Monte Carlo simulations.

only implies that government expenditure decisions today must be uncorrelated with future realizations of unexpected output shocks. This does not restrict the government or other agents from adopting a forward-looking perspective. Moreover, weak exogeneity and endogeneity are consistent with rational expectations models in which agents' beliefs would be equal to the true data-generating process. Under rational expectations, government sets expenditures according to equation (2), while output evolves according to (1). However, agents may have their own subjective beliefs about the evolution of g_{it} and y_{it}, and not necessarily following (1) and (2).[7] Even if all agents have rational expectations, private information drives variance on when (and how much) governments spend. Notice that equation (2) can be used to assess the cyclicality of fiscal policy, for example, as in Woo (2011), who uses time series data to estimate the responses of government expenditures to real GDP.

3.3. Output and the Role of Expectations

Equation (2) can be written to emphasize the existence of the two additive separable components of g_{it}:

$$g_{it} = E\left[\, g_{it} | g_{i,t-1}, y_{i,t-1}, X_{i,t-1}, \rho, \delta, \gamma, \nu_i \right] + u_{it}\ . \qquad (3)$$

The first term on the right-hand side is the expected or anticipated component, while the second term is the unanticipated component of government expenditures. We can then rewrite (1) to identify the effect of each of these two components on output:

$$y_{it} = \ \alpha y_{i,t-1} + \beta_E E[g_{it}] + \beta_U (g_{it} - E[g_{it}]) + \theta' X_{it} + \eta_i + \varepsilon_{it}. \qquad (4)$$

Note that (1) is a restricted version of Equation (4), where the restrictions are $\beta_E + \beta_U = \beta$ and $\beta_E = 0$. The expected evolution of g_{it}, $E[g_{it}]$, is obtained as the fitted values in the

[7] Tortorice (2012) finds that while households' expectations can depart dramatically from VAR forecasts, professional forecasters' expectations do not depart much.

estimation of (3), while the shock, $(g_{it} - E[g_{it}])$, is obtained as the regression residuals. Note that because the output equation controls for time-invariant country-specific characteristics η_i, we do not need estimates of the time-invariant components of the error term ν_i in (3). This two-step procedure means that $E[g_{it}]$ and $(g_{it} - E[g_{it}])$ are derived from a first-stage estimation of the government expenditures equation. Including only the fitted values on (3) would yield incorrect standard errors because of the additional variation that arises when estimating $E[g_{it}]$.[8]

It is interesting to note that Equation (1) follows the existing literature on growth empirics that use dynamic panels (e.g., Islam, 1995). This literature is concerned with explaining economic growth and it is largely motivated by the theoretical models in Solow (1956) and Mankiw et al. (1992). These models involve not only long-run growth but also short-run convergence towards steady-states. While Equation (1) is the typical economic growth equation with a long-run interpretation, Equation (4) also models short-term dynamics. This is the case because unanticipated government expenditures are, of course, short-run. Moreover, the intermediate step of estimating Equation (2) prior to estimation of Equation (4) can be interpreted as a filtering of g_{it}.[9] While the most common use of filters is to calculate trends or detrend a variable, Equation (2) 'filters' g_{it} in the sense that it separates its expected and its unexpected components in a model that considers forward looking agents and it is consistent with rational expectations.

3.4. Recursive Estimation of Expectations

[8] Equation (4) follows Model 4 in Pagan (1984) and accounts for the estimation error associated with the first-step estimation, $(g_{it} - E[g_{it}])$, explicitly by including it in the estimated equation. More recent implementations of Model 4 in Pagan appear in Abowd et al. (1999) and Escobari (2012).

[9] Some panel studies (e.g., Furceri and Mourougane, 2012) use the Kalman filter to obtain structural unemployment or univariate filters (such as the Hodrick-Prescott filter) to smooth variables. In this paper we follow Islam (1995) and we do not use those filters.

The two-step procedure just described assumes that agents know the parameters (ρ, δ, γ) when they form their expectations of g_{it}. Equation (3) is estimated only once using the whole set of usable observations in the sample. However, even if agents know the true data-generating process when forming their expectations, at time t they do not know the future realizations of the variables that are actually being used if we estimate (ρ, δ, γ) only once. A more realistic approach is to condition the formation of expectations on the same information set agents have. Formally, (3) becomes

$$g_{it} = E\left[\, g_{it} | \Omega_{i,t-1}\right] + u_{it} \qquad (5)$$

where

$$\Omega_{i,t-1} = \left\{g_{i,t-1-s}, y_{i,t-1-s}, X_{i,t-1-s}, \rho_{t-1-s,}\delta_{t-1-s}, \gamma_{t-1-s}, \nu_i\right\} \quad \text{for all} \quad s \geq 0. \qquad (6)$$

This last equation indicates that the information set at the end of period $t-1$, $\Omega_{i,t-1}$, includes all previous realizations of the variables (including previous shocks), but does not include contemporaneous shocks. In addition, notice that the coefficients $(\rho_t, \delta_t, \gamma_t)$ are allowed to change over time because they are updated every period as additional new information becomes available. To reflect this process we construct $E[g_{it}]$ and $(g_{it} - E[g_{it}])$ using time-varying $(\rho_t, \delta_t, \gamma_t)$, that are obtained from a recursive estimation of (5); i.e., we estimate (5) every period using only the observations detailed in (6).

3.5. Estimation Methodology and Assumptions

In order to estimate equations (1), (2) (only once and recursively), and (4), we use the generalized-method-of-moments (GMM) estimators for dynamic panel data models proposed in Holtz-Eakin et at. (1988), Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1998). These estimators are consistent with rational expectations models, include dynamics, and address the potential endogeneity of the regressors. To show the importance of the assumptions behind these estimators, consider the estimation of (2). Taking first differences eliminates the time-invariant country-specific characteristics:

$$\Delta g_{it} = \rho \Delta g_{i,t-1} + \delta \Delta y_{i,t-1} + \gamma' \Delta X_{i,t-1} + \Delta u_{it}. \quad (7)$$

We need instruments to deal with the potential endogeneity of the explanatory variables. By construction Δu_{it} is correlated with $\Delta g_{i,t-1}$, $\Delta y_{i,t-1}$, and $\Delta X_{i,t-1}$. Under the assumptions that u_{it} is not serially correlated and that $y_{i,t-1}$ and $X_{i,t-1}$ are predetermined, the difference GMM dynamic panel estimator uses the following moment conditions:

$$E[g_{i,t-s} \Delta u_{it}] = 0 \quad \text{for } s \geq 2; t = 3, \dots, T, \quad (8)$$

$$E[y_{i,t-s} \Delta u_{it}] = 0 \quad \text{for } s \geq 2; t = 3, \dots, T, \quad (9)$$

$$E[X_{i,t-s} \Delta u_{it}] = 0 \quad \text{for } s \geq 2; t = 3, \dots, T. \quad (10)$$

Blundell and Bond (1998) point out a statistical shortcoming with this GMM difference estimator. If the variables are persistent over time, lagged levels of these variables are weak instruments for the regression equation in differences. To avoid the imprecision associated with this estimator, we will use the system GMM estimator as proposed in Arellano and Bover (1995) and Blundell and Bond (1998). This system estimator combines the regression in differences with the regression in levels. The instruments of the regression in levels are the lagged values of $\Delta g_{i,t-1}$, $\Delta y_{i,t-1}$, and $\Delta X_{i,t-1}$. The validity of these instruments relies on the following additional assumption: The first differences of $g_{i,t-1}$, $y_{i,t-1}$, and $X_{i,t-1}$ are uncorrelated with the time-invariant country-specific effect (ν_i), but their levels may be correlated with ν_i. The additional moment conditions for the levels equations are:

$$E[\Delta g_{i,t-1}(\nu_i + u_{it})] = 0 \quad \text{for } t = 3, \dots, T, \quad (11)$$

$$E[\Delta y_{i,t-1}(\nu_i + u_{it})] = 0 \quad \text{for } t = 3, \dots, T, \quad (12)$$

$$E\left[\Delta X_{i,t-1}(\nu_i + u_{it})\right] = 0 \quad \text{for } t = 3, \ldots, T. \tag{13}$$

Therefore, the system GMM uses moment conditions (8) through (13) to obtain consistent and efficient estimates of (ρ, δ, γ).[10] To address the validity of the instrument list we report the Hansen test for over-identifying restrictions, which tests the overall validity of the instruments by analyzing the sample analog of the moment conditions. Because we have a large number of time periods we are concerned that the Hansen test may be weakened due to the large instrument collection (see, e.g., Roodman, 2009a). To avoid weakening the Hansen test we "collapse" the instrument list as suggested in Roodman (2009b, p. 107). To test the hypothesis that the error term u_{it} is not serially correlated we test whether Δu_{it} is second-order serially correlated. This test is critical not only for the validity of one of the assumptions behind the estimator, but also for $(g_{it} - E[g_{it}])$ in (4) to truly represent a shock. Serially uncorrelated u_{it} means that $(g_{it} - E[g_{it}])$ corresponds to an unexpected change in government expenditures, and that previous unexpected changes and previous realizations of the variables cannot be used to predict $(g_{it} - E[g_{it}])$.

4. Results

4.1. Dynamic Output Equation

The results from the estimation of (1) are presented in Table 2. For comparison purposes the first two columns report sets of estimates that assume strict exogeneity of all the right-hand side variables. The first column presents the Pooled OLS and the second the Within specification, which additionally controls for time-invariant country-specific characteristics. To relax the strict exogeneity assumption columns (3) and (4) present the two-step difference and

[10] Analogous moment conditions are used to estimate (α, β, θ) and $(\alpha, \beta_E, \beta_U, \theta)$ in equations (1) and (4), respectively.

the system GMM estimators respectively, which allow $y_{i,t-1}$, $y_{i,t-2}$, to be endogenous and $g_{i,t-1}$ and $s_{i,t-1}$ to be weakly exogenous (we continue treating the population growth n_{it} as strictly exogenous). The difference estimator in column (3) uses moment conditions analogous to equations (7), (8), and (9), while the system estimator in column (4) additionally uses moment conditions analogous to equations (11), (12), and (13). The validity of these specifications is addressed with two tests. We include the second lag of the dependent variable to help comply with the assumption of no serial correlation of the estimators; in subsequent tables the second lag is also included in the estimations for the g_{it} and y_{it} equations for the same reason. Across all GMM specifications we observe that the high p-values in the second-order serial correlation test in $\Delta\varepsilon_{it}$ provide strong support for the assumption that the errors ε_{it} are not serially correlated. Moreover, the Hansen test of over-identifying restrictions to test the overall validity of the instruments shows that, across all specifications, the null hypothesis that the instruments are not correlated with the residuals is not rejected.

Notice that while the estimates on the first lagged dependent variable are consistently above one, the long-run effect (which is typically the focus on convergence literature) is obtained by summing the coefficients on all the lags of the dependent variable. In our case the sum is in most cases less than one. This is a concern because if the sum is greater than one then there is a unit root and the difference GMM estimator will not be able to identify the coefficients on the lagged dependent variables because lagged values of y_{it} would be uncorrelated with its first differences. This is another reason why the system GMM is our preferred estimator, where the identification in this case would come from the levels equations (Equations 11 to 13).

[Table 2 here]

Consistent with the Monte Carlo simulation results in Blundell et al. (2000), the estimate on g_{it} in the difference specification appears to be biased downwards. Blundell et al. (2000) find that the bias is large when the regressor is persistent, which we will see is the case for g_{it} once we estimate equation (2). Columns (6) through (8) consider our measures of globalization ($open_{it} = IFI_{it}$, GEQ_{it}, or TO_{it}) and focuses on the system estimator that models g_{it} and as potentially endogenous.[11] The estimates appear robust across all specifications; the exogenous component of government expenditures has a negative effect on output. The point estimate in column (5) indicates that a 1% increase in government expenditures to GDP decreases real income per capita by 0.081%. The sign of this coefficient is consistent with the cross-section studies by Barro (1991) and with Levine and Renelt (1992), but the latter finds that the negative sign is not robust. The negative sign associated with g_{it} is also in line with the dynamic panels by Mollick and Cabral (2011) and Cabral and Mollick (2012). The estimates in Table 2 show that higher investment-to-output ratio leads to higher output and that the rate of population growth affects output negatively. According to column (5), a one percent increase in the investment-to-output ratio leads to an increase in real output per capita by 0.016%, while a one percent increase in the rate of population growth decreases real output per capita by 0.018%. Finally, from our measures of globalization, in columns (6) and (8) international financial integration and trade openness have negative effects on output.

4.2. Government Expenditures

[11] To illustrate the difference between predetermined and endogenous consider the instrument list in the specification in column 4, where g_{it} and s_{it} are treated as weakly exogenous and n_{it} is treated as strictly exogenous. Instruments for the first-differenced equations are Δn_{it}, and the first and further lags of $y_{i,t-1}$, g_{it}, and s_{it}. The instruments in the levels equations are $\Delta y_{i,t-1}$, Δg_{it}, and Δs_{it}. Treating g_{it} as potentially endogenous rather than predetermined invalidates $g_{i,t-1}$ and Δg_{it} as instruments. Hence, the instruments formed with g_{it} have one additional lag when compared to the ones based on the predetermined g_{it}.

In order to separate the evolution of g_{it} into its expected and unexpected components Table 3 reports the estimates of the feedback mechanism from output to government expenditures discussed in Equation (2). As in the output equation, Table 3 also reports the Pooled OLS and the Within estimates. All the GMM specifications pass both tests: the Hansen test for the overall validity of the instrument list and the serial correlation test. The latter also validates the use of $(g_{it} - E[g_{it}])$ as the unexpected component of government expenditures, which cannot be predicted from previous realizations of variables and shocks. In this estimation of Equation (2) the population growth is treated as strictly exogenous, while the lagged output and lagged measures of openness are treated as predetermined. This is reasonable because all are lagged one period and it is consistent with the government deciding g_{it} after observing government expenditures and the realizations of the other right-hand side variables. A predetermined (or weakly exogenous) $y_{i,t-1}$ does not mean that governments are not forward looking. They may have their own beliefs about y_{it} and the future evolution of output, which under rational expectations is given by Equation (1).

[Table 3 here]

The third column of Table 3 presents a simple panel second-order autoregressive model for g_{it} with lagged output and lagged investment-to-output ratio, while the fourth column additionally includes lagged population growth $n_{i,t-1}$. Columns five through seven present the results using our different measures of openness. Columns five and six appear with a positive and statistically significant output effect on government expenditures. A statistically significant effect validates modeling g_{it} as predetermined or endogenous in the estimation of Equation (1). There is some evidence that population growth impacts negatively government expenditures; the estimate in column 6 indicates that a one percent increase in the rate of population growth reduces the ratio of government expenditures to GDP by 0.004%. Our first two measures of globalization, assets related globalization and equity related globalization included in columns (5) and (6), respectively, show a negative effect of globalization on government expenditures. However, trade openness reported in column (7) shows a positive and statistically significant effect.

The functional form in the estimates in Table 3 follows directly from (2), which is consistent with the feedback mechanism in Bun and Kiviet (2006) and treats $n_{i,t-1}$ as exogenous and the rest as predetermined. These specifications imply that government expenditures are set at the beginning of the period as in Tagkalakis (2008) and respond to last period's realizations of the right-hand side variables. An alternative assumption is to model government expenditures as jointly determined with the contemporaneous right-hand side variables. Different sets of estimates under this alternative assumption are presented in Table 4. The previous results on Table 3 hold but now all globalization measures have negative effects: a higher level of globalization contributes to lower government size, all else constant.

[Table 4 here]

4.3. Output, and Expected and Unexpected Government Expenditures

After estimating (2) we use these results to construct estimates of the expected evolution of government expenditures $E[g_{it}]$ and unexpected government expenditures $(g_{it} - E[g_{it}])$. Table 5 provides the results of the estimation of (4) using two different specifications to obtain $E[g_{it}]$ and $(g_{it} - E[g_{it}])$. Columns 1 through 4 use the feedback mechanism reported in column 7, Table 3, while columns 5 through 8 use the specification in column 7, Table 4. All of the columns in Table 5 pass both specification tests, the instrument lists are validated using the

Hansen test, while the serial correlation test in the difference equation shows strong evidence that the errors are not second-order serially correlated. The results show that when separating the effect of g_{it} on output in two (expected g_{it} and unexpected g_{it}) the latter has a much larger negative effect on output. The effect of expected g_{it} has about half the magnitude and it is negative in the first four columns and positive or not statistically significant in the last four columns. Column 1 indicates that a one percent unexpected increase in g_{it} decreases output by 0.072%, while a one percent expected increase in g_{it} decreases output by 0.034%. When additionally controlling for openness, the magnitude of the coefficients is about the same. The last row in Table 5 reports the p-values for the test of the null hypothesis that the effects of expected and unexpected g_{it} on output are the same. The p-values of zero across all specifications provide strong evidence against the null. The rest of the estimates in this table are largely consistent with the ones in Table 2, the ratio of investment to output has a positive effect and the population growth has a negative effect. Moreover, equity related globalization has a significant positive effect and trade openness has a negative effect.

[Table 5 here]

To account for the possibility that economic agents may update their expectations formations in the form of the data-generating-process of g_{it} over time as more information becomes available, we estimate the coefficients $(\rho_t, \delta_t, \gamma_t)$ to obtain estimates of $E[g_{it}]$ and $(g_{it} - E[g_{it}])$ recursively as specified in equations (5) and (6). When implementing this more realistic estimation strategy we assume that the econometrician has the same information set as the agents when they form their expectations. In particular, we first estimate equation (2) using data available only from 1970 to 1975. Once we estimate the coefficients $(\rho_{75}, \delta_{75}, \gamma_{75})$ we use them to separate next period $g_{i,76}$ into $E[g_{i,76}]$ and $(g_{i,76} - E[g_{i,76}])$. When an additional period of data becomes available we estimate $(\rho_{76}, \delta_{76}, \gamma_{76})$ using the observations from 1970 to 1976 and then obtain $E[g_{i,77}]$ and $(g_{i,77} - E[g_{i,77}])$. We repeat this iterative process until the data are exhausted, so we have sequences $\{E[g_{it}]\}$ and $\{g_{it} - E[g_{it}]\}$ that go from 1976 through 2004 for every country i in the sample.

[Table 6 here]

Table 6 reports estimates of Equation 4 when $E[g_{i,t}]$ and $(g_{i,t} - E[g_{i,t}])$ are obtained recursively using the process just described. The results are very similar to the ones in Table 5. All columns pass both specification tests and both components of g_{it} have a negative and statistically significant effect on output. Moreover, the p-values in the last row indicate that the unexpected component of g_{it} has a significantly larger effect on output than the expected component of g_{it}.

The estimates in column 1, for example, indicate that the magnitude of the effect is about 40% larger when the expenditures are unexpected than when they are expected. A 1% unexpected increase in g_{it} decreases output by 0.111%. Comparing the magnitude of the coefficients in Tables 5 and 6 we can observe that the recursive treatment of expectations increases slightly the magnitude of the unexpected components in columns (1) to (4), while the expected component has now a negative and statistically significant effect across all specifications. The rest of the coefficients have the expected signs and are consistent with previous results, including the globalization measures.

An additional set of estimates is reported in Table 7, where the goal is to test for differences in the effects of unexpected g_{it} on output between developed (22 economies) and emerging markets (34 economies).[12] The key result obtained previously holds: unexpected g_{it} has a negative and larger effect on output than expected g_{it}. Moreover, the negative effect of unexpected g_{it} appears to be much larger for developed economics; however, this result is not robust to different specifications of the government equation. The indicator variable I_{DEV} is equal to one if the country is developed and equal to zero otherwise. Hence, the coefficient on the interaction term $(g_{it} - E[g_{it}]) \times I_{DEV}$ captures the differential effect of the unexpected g_{it} on output. The estimates in column 5, for example, indicate that an unexpected one percent increase in g_{it} leads to a decrease in output in emerging economies by 0.055%, but to a much larger decrease in developed economies, 0.213% (adding the coefficients of -0.055 and -0.158).

[Table 7 here]

Tagkalakis (2008) found that spending shocks have more pronounced effects in bad times in the case of the low loan-to-value group, which is evidence for the important role that fiscal policy plays in periods of economic distress in less financially developed economies. In our estimates of Table 7 unexpected government purchases have larger negative effects for developed economies in columns (5) to (8). We further regress g_{it} on GDP growth and controls in an alternative specification to (2).[13] Table 8 contains this alternative and reports GDP growth-coefficients varying from -0.910 (with the trade openness measure) to -0.952 (with the IFI measure) for industrial economies. This suggests a relatively strong countercyclical response: as real GDP falls, fiscal policy appears to be very expansionary (either by increases in G or by tax cuts) in industrial economies. The same figures for emerging markets are as follows: real GDP growth-coefficients varying from -0.380 (with the trade openness measure) to -0.427 (with both

[12] A similar test, but for the expected component of g_{it}, found no difference between developed and emerging economies.

[13] This can be accomplished by differencing (1) and re-estimating the equation with output growth as the dependent variable on lagged GDP and current government expenditures and controls. In the same way, we can regress government expenditures on GDP growth and controls for a variant of (2).

financial globalization measures). In emerging markets, the two financial globalization measures have a negative but small effect on G/Y. Higher openness implies lower government size, all else constant.

This modification of the feedback equation (2) to allow for real GDP growth suggests that fiscal policy does not respond as much to GDP growth in emerging markets, perhaps because of a longer lag between fiscal policy decisions and implementation by federal, state, and local governments in developing economies. Recent evidence along these lines, yet with an alternative theoretical framework than the one in this paper, is provided by Byrne et al. (2011) for a study on debt sustainability for 15 industrial countries from 1978 to 2005 and 27 emerging markets from 1990 to 2005. Byrne et al. (2011) document with system GMM the ability of industrial countries to go into debt when there is an economic downturn; on the other hand, emerging markets do not appear to be able to run deficits when there are downturns.

[Table 8 here]

5. Concluding Remarks

We model the dynamic feedback between government expenditures and output in a rational expectations model along the lines of Barro (1977). Allowing agents to behave dynamically, we find that unexpected government expenditures affect output negatively and expected government expenditures have negative, yet smaller, effects. The GEQ measure of FDI and equity flows has a positive impact on output. When allowing agents to update their beliefs about the data-generating process, we find that the positive output effects of globalization remain with the FDI and equity measure of financial globalization. The survey by Bergh and Henrekson (2011) on the size of government and economic growth suggests a significant negative correlation in most recent studies: an increase in government size by 10% is associated with a 0.5% to 1% lower annual economic growth rate. The results in this paper are much closer to the upper range of these figures. Overall, the negative effects found herein for 56 major economies of the world from 1970 to 2004 are consistent with Barro (2010), who reports government spending multipliers substantially less than one for the U.S. experience. Ramey (2011) suggests a range of plausible estimates for the government multiplier in the case of a temporary increase in G that is deficit financed (not accompanied by an increase in taxes) to be probably from 0.8 to 1.5. Our estimates for a panel of countries from 1970-2004 are more in line with a lower than 1 magnitude for the multiplier.

We also provide evidence that the negative effect of unexpected government expenditures on output is much larger in developed economies. While Tagkalakis (2008) recently proposed a liquidity constraint channel, his analysis was confined to OECD economies. Giavazzi et al. (2000) compare OECD countries with a larger dataset of developing economies and find that national savings are more responsive to government consumption in the former (coefficient of -0.735) than in the latter (-0.493). Byrne et al. (2011) have also recently suggested by system GMM the ability of industrial countries to go into debt when there is an economic downturn; on the other hand, emerging markets do not appear to be able to run deficits when there are downturns in the economy. Svec and Kondo (2012) find across U.S. states that a more counter-cyclical primary deficit increases state's long-run average growth rate per capita. Together with the sensitivity of savings, our most likely explanation is that government expenditures respond differently across the two groups of countries to the business cycles: as real GDP falls, fiscal policy is found to be expansionary in industrial economies. The same figures for emerging markets are much smaller, perhaps because of longer lags associated with fiscal policy actions. We take our results as evidence that fiscal policy does not respond as much to GDP growth in emerging markets.

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Table 1: Sample Averages

Developed Economies				
COUNTRY	Y/L	$\Delta L_t/L_{t-1}$	G/Y (%)	$E[G/Y]$ (%)
Australia	16436.6	1.42	17.75	17.45
Austria	18318.6	0.29	18.22	18.04
Belgium	17530.5	0.23	21.44	20.35
Canada	18577.8	1.20	21.12	20.14
Denmark	23238.0	0.28	25.15	23.59
Finland	17809.0	0.35	20.05	19.61
France	17829.9	0.53	21.80	20.89
Germany	17964.2	0.19	19.75	19.33
Greece	9770.5	0.66	14.53	14.76
Iceland	24298.7	1.04	19.72	19.26
Ireland	14448.1	0.94	17.26	16.81
Italy	14954.1	0.24	18.18	18.06
Japan	28898.5	0.61	14.46	14.80
Netherlands	18170.4	0.67	23.16	21.70
New Zealand	11465.4	1.08	18.07	17.62
Norway	26914.4	0.50	20.10	19.65
Portugal	7744.5	0.41	15.31	15.41
Spain	10646.7	0.70	15.17	15.43
Sweden	22051.8	0.35	26.64	24.75
Switzerland	30465.7	0.53	10.70	11.21
United Kingdom	18798.5	0.22	20.36	19.44
United States	26539.2	1.05	16.51	16.32
Average	18766.9	0.61	18.88	18.39

Notes: The sample is from 1970 to 2004. $E[G/Y]$ is based on the recursive estimation of $g_{it} = \rho g_{i,t-1} + \delta y_{i,t-1} + \gamma_1 n_{i,t-1} + \gamma_2 GEQ_{i,t-1} + \nu_i + u_{it}$.

Emerging Economies				
COUNTRY	Y/L	L_t/L_{t-1}	G/Y (%)	$E[G/Y]$ (%)
Argentina	6966.3	1.39	10.13	10.81
Bangladesh	264.81	2.30	4.88	5.40
Brazil	3293.74	1.93	14.30	14.37
Bulgaria	1582.97	-0.23	16.53	16.32
Chile	3225.92	1.54	12.58	12.88
China	459.74	1.39	13.17	14.72
Colombia	2041.71	1.88	12.40	12.59
Costa Rica	3241.23	2.50	14.11	14.04
Czech Republic	5324.48	0.11	21.63	20.78
Dominican Republic	1968.28	2.10	6.88	7.56
Ecuador	1281.57	2.29	13.39	13.44
Egypt, Arab Rep.	1028.61	2.22	16.13	15.66
El Salvador	1898.22	1.44	11.50	12.00
Hungary	3902.84	-0.05	10.50	11.29
India	312.68	2.01	10.88	11.54
Indonesia	559.3	1.83	8.78	9.56
Israel	14803.29	2.46	32.83	28.77
Korea, Rep.	6405.68	1.23	11.44	12.18
Malaysia	2594.99	2.48	14.12	14.04
Mexico	4924.76	2.10	9.94	10.53
Morocco	1126.41	2.05	16.83	16.39
Nigeria	382.1	2.76	7.93	8.52
Pakistan	416.95	2.71	11.43	11.94
Panama	3341.96	2.21	16.76	16.13
Peru	2066.59	2.18	10.46	10.81
Philippines	903.02	2.46	10.17	10.57
Poland	3852.66	0.46	15.85	18.33
Singapore	13543.88	2.04	10.69	10.99
South Africa	3179.84	2.18	17.22	16.83
Thailand	1262.98	1.69	11.02	11.58
Tunisia	1506.13	1.94	15.90	15.62
Turkey	3088.42	1.97	10.88	11.36
Uruguay	5624.05	0.48	12.98	13.26
Venezuela, RB	5355.87	2.64	11.01	11.19
Average	3286.235	1.79	13.10	13.29

Table 2: Output Equation

g_{it} treated as:	Strictly exogenous		Weakly exogenous		Endogenous			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Pooled	Within	Dif	Sys	Sys	Sys	Sys	Sys
$y_{i,t-1}$	1.296***	1.217***	1.363***	1.429***	1.291***	1.341***	1.302***	1.297***
	(0.0423)	(0.0480)	(0.0177)	(0.0157)	(0.0133)	(0.0170)	(0.0176)	(0.0124)
$y_{i,t-2}$	-0.299***	-0.233***	-0.387***	-0.459***	-0.276***	-0.317***	-0.285***	-0.276***
	(0.0422)	(0.0468)	(0.0174)	(0.0162)	(0.0125)	(0.0151)	(0.0158)	(0.0112)
g_{it}	-0.00406	-0.0284***	-0.107***	-0.0431***	-0.0807***	-0.0915***	-0.0851***	-0.0929***
	(0.00410)	(0.00949)	(0.00652)	(0.00306)	(0.00255)	(0.00336)	(0.00289)	(0.00365)
s_{it}	0.0225***	0.0171***	-0.0522***	0.0166***	0.0157***	0.00839**	0.0164***	0.0182***
	(0.00498)	(0.00612)	(0.00698)	(0.00291)	(0.00287)	(0.00381)	(0.00352)	(0.00198)
n_{it}	-0.00499***	-0.00847***	-0.0145***	-0.0214***	-0.0182***	-0.0208***	-0.0205***	-0.0203***
	(0.00160)	(0.00177)	(0.000854)	(0.00118)	(0.000934)	(0.00108)	(0.00106)	(0.00109)
IFI_{it}						-0.00758***		
						(0.00145)		
GEQ_{it}							-0.000200	
							(0.000963)	
TO_{it}								-0.0144***
								(0.00237)
Observations	1765	1765	1708	1765	1765	1736	1730	1757
Instruments			47	52	52	53	53	53
Serial correlation			-0.654	-0.549	-1.331	-1.202	-1.332	-1.341
Serial correlation (p-value)[a]			0.513	0.583	0.183	0.229	0.183	0.180
Hansen			51.65	53.74	53.25	53.34	52.96	52.60
Hansen (p-value)[b]			0.146	0.202	0.215	0.213	0.223	0.234

Notes: The dependent variable is y_t. Figures in parentheses are standard errors of the GMM two-step estimates. * significant at 10%; ** significant at 5%; *** significant at 1%. [a] The null hypothesis is that the errors in the first-difference regression exhibit no second-order serial correlation (valid specification). [b] The null hypothesis is that the instruments are not correlated with the residuals (valid specification).

Table 3: Government Expenditures

VARIABLES	(1) Pooled	(2) Within	(3) Sys	(4) Sys	(5) Sys	(6) Sys	(7) Sys
$g_{i,t-1}$	0.980***	0.896***	0.902***	0.903***	0.873***	0.857***	0.945***
	(0.0606)	(0.0621)	(0.00439)	(0.00656)	(0.00908)	(0.00642)	(0.00544)
$g_{i,t-2}$	-0.0186	-0.0537	-0.0453***	-0.0455***	-0.0267***	-0.0365***	-0.0645***
	(0.0552)	(0.0546)	(0.00451)	(0.00394)	(0.00480)	(0.00475)	(0.00345)
$y_{i,t-1}$	0.00761***	0.0123	0.0202***	0.0194***	0.0394***	0.0528***	0.00421
	(0.00212)	(0.00873)	(0.00318)	(0.00269)	(0.00247)	(0.00293)	(0.00306)
$s_{i,t-1}$	0.0166*	0.0257	0.0780***	0.0770***	0.0513***	0.0542***	0.0632***
	(0.00947)	(0.0213)	(0.00279)	(0.00270)	(0.00357)	(0.00373)	(0.00343)
$n_{i,t-1}$				-0.000499	-0.00470	-0.00363**	0.00503
				(0.00232)	(0.00292)	(0.00184)	(0.00334)
$IFI_{i,t-1}$					-0.0230***		
					(0.00174)		
$GEQ_{i,t-1}$						-0.0190***	
						(0.00121)	
$TO_{i,t-1}$							0.0549***
							(0.00473)
Observations	1764	1764	1764	1764	1730	1725	1755
Instruments			51	52	53	53	53
Serial correlation			-1.361	-1.367	-1.408	-1.359	-1.059
Serial correlation (p-value)[a]			0.173	0.172	0.159	0.174	0.290
Hansen			55.00	54.99	54.66	53.97	55.09
Hansen (p-value)[b]			0.171	0.171	0.179	0.196	0.168

Notes: The dependent variable is g_t. Figures in parentheses are standard errors of the GMM two-step estimates. * significant at 10%; ** significant at 5%; *** significant at 1%. [a] The null hypothesis is that the errors in the first-difference regression exhibit no second-order serial correlation (valid specification). [b] The null hypothesis is that the instruments are not correlated with the residuals (valid specification).

Table 4: Government Expenditures

VARIABLES	(1) Pooled	(2) Within	(3) Sys	(4) Sys	(5) Sys	(6) Sys	(7) Sys
$g_{i,t-1}$	0.895***	0.794***	0.766***	0.774***	0.702***	0.691***	0.673***
	(0.0703)	(0.0773)	(0.00965)	(0.0103)	(0.0105)	(0.0105)	(0.0122)
$g_{i,t-1}$	0.0530	0.00373	-0.0527***	-0.0486***	-0.0152***	-0.0477***	0.0103***
	(0.0637)	(0.0585)	(0.00194)	(0.00222)	(0.00229)	(0.001000)	(0.00249)
y_{it}	0.00961***	0.00587	0.0515***	0.0585***	0.0994***	0.100***	0.0866***
	(0.00352)	(0.0105)	(0.00420)	(0.00459)	(0.00439)	(0.00717)	(0.00489)
s_{it}	0.0330**	0.0567**	-0.0215***	-0.0200***	-0.103***	-0.0737***	0.0150
	(0.0130)	(0.0255)	(0.00626)	(0.00646)	(0.00882)	(0.00974)	(0.00954)
n_{it}				0.0130***	0.00705***	-0.00200	-0.0113***
				(0.00131)	(0.00142)	(0.00150)	(0.00204)
IFI_{it}					-0.0648***		
					(0.00307)		
GEQ_{it}						-0.0408***	
						(0.00230)	
TO_{it}							-0.142***
							(0.00471)
Observations	1767	1767	1767	1767	1738	1732	1759
Instruments			51	52	53	53	53
Serial correlation			-0.864	-0.866	-1.253	-0.948	-1.442
Serial correlation (p-value)[a]			0.388	0.386	0.210	0.343	0.149
Hansen			55.29	55.34	54.91	54.65	54.82
Hansen (p-value)[b]			0.164	0.163	0.173	0.179	0.175

Notes: The dependent variable is g_t. Figures in parentheses are standard errors of the GMM two-step estimates. * significant at 10%; ** significant at 5%; *** significant at 1%. [a] The null hypothesis is that the errors in the first-difference regression exhibit no second-order serial correlation (valid specification). [b] The null hypothesis is that the instruments are not correlated with the residuals (valid specification).

Table 5: Output Equation with Expectations

g_{it} process:	$g_{it} = \rho g_{i,t-1} + \delta y_{i,t-1} + \gamma' X_{i,t-1} + \nu_i + u_{it}$				$g_{it} = \rho g_{i,t-1} + \delta y_{it} + \gamma' X_{it} + \nu_i + u_{it}$			
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$y_{i,t-1}$	1.271***	1.307***	1.227***	1.263***	1.477***	1.482***	1.439***	1.441***
	(0.0178)	(0.0153)	(0.0106)	(0.0207)	(0.0143)	(0.0135)	(0.00978)	(0.0189)
$y_{i,t-2}$	-0.300***	-0.325***	-0.261***	-0.288***	-0.499***	-0.508***	-0.477***	-0.464***
	(0.0176)	(0.0144)	(0.00924)	(0.0202)	(0.0148)	(0.0136)	(0.00968)	(0.0191)
$E[g_{it}]$	-0.0340***	-0.0347***	-0.0132***	-0.0425***	0.0177***	0.0295***	0.0474***	-0.00155
	(0.00287)	(0.00372)	(0.00371)	(0.00364)	(0.00420)	(0.00501)	(0.00558)	(0.00514)
$(g_{it} - E[g_{it}])$	-0.0715***	-0.0761***	-0.0501***	-0.0863***	-0.0811***	-0.0759***	-0.0639***	-0.0859***
	(0.00370)	(0.00328)	(0.00286)	(0.00304)	(0.00545)	(0.00390)	(0.00333)	(0.00325)
s_{it}	0.0360***	0.0396***	0.0458***	0.0404***	0.0302***	0.0355***	0.0398***	0.0337***
	(0.00190)	(0.00310)	(0.00202)	(0.00211)	(0.00244)	(0.00221)	(0.00271)	(0.00245)
n_{it}	-0.0208***	-0.0199***	-0.0189***	-0.0226***	-0.0171***	-0.0180***	-0.0175***	-0.0200***
	(0.00137)	(0.00111)	(0.000830)	(0.00152)	(0.000664)	(0.000765)	(0.000847)	(0.000994)
IFI_{it}		-0.000367				0.00538***		
		(0.00165)				(0.00157)		
GEQ_{it}			0.00914***				0.00929***	
			(0.000962)				(0.000630)	
TO_{it}				-0.0221***				-0.0181***
				(0.00250)				(0.00212)
Observations	1753	1724	1718	1753	1757	1728	1722	1757
Instruments	52	53	53	53	52	53	53	53
Serial correlation	-1.105	-1.078	-1.221	-1.213	-0.654	-0.678	-0.687	-0.741
Serial correlation (p-value)[a]	0.269	0.281	0.222	0.225	0.513	0.497	0.492	0.459
Hansen	54.65	54.44	53.37	54.97	51.76	53.34	52.46	53.09
Hansen (p-value)[b]	0.153	0.158	0.184	0.147	0.227	0.184	0.207	0.191
H_0: $\beta_E = \beta_U$ (p-value)[c]	0	0	0	0	0	0	0	0

Notes: The dependent variable is y_t. $E[g_{it}]$ and $(g_{it} - E[g_{it}])$ for columns 1 through 4 are based on the estimates on column 7, Table 3, for columns 5 through 8 are based on column 7, Table 4. Figures in parentheses are standard errors of the GMM two-step estimates. * significant at 10%; ** significant at 5%; *** significant at 1%. [a] The null hypothesis is that the errors in the first-difference regression exhibit no second-order serial correlation (valid specification). [b] The null hypothesis is that the instruments are not correlated with the residuals (valid specification). [c] The null hypothesis is that the coefficients on expected and on unexpected g_{it} are the same.

Table 6: Output Equation with Recursive Estimation of Expectations

g_{it} process:	$g_{it} = \rho g_{i,t-1} + \delta y_{i,t-1} + \gamma' X_{i,t-1} + \nu_i + u_{it}$				$g_{it} = \rho g_{i,t-1} + \delta y_{it} + \gamma' X_{it} + \nu_i + u_{it}$			
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$y_{i,t-1}$	1.390***	1.357***	1.311***	1.347***	1.454***	1.373***	1.353***	1.396***
	(0.0136)	(0.0126)	(0.00823)	(0.0112)	(0.0163)	(0.0167)	(0.0170)	(0.0121)
$y_{i,t-2}$	-0.389***	-0.367***	-0.324***	-0.346***	-0.469***	-0.387***	-0.380***	-0.410***
	(0.0150)	(0.0117)	(0.00894)	(0.0116)	(0.0166)	(0.0162)	(0.0159)	(0.0126)
$E[g_{it}]$	-0.0790***	-0.0644***	-0.0558***	-0.0816***	-0.0324***	-0.0312***	-0.00757*	-0.0491***
	(0.00514)	(0.00564)	(0.00474)	(0.00581)	(0.00419)	(0.00418)	(0.00434)	(0.00531)
$(g_{it} - E[g_{it}])$	-0.111***	-0.0985***	-0.0915***	-0.113***	-0.0736***	-0.0743***	-0.0551***	-0.0879***
	(0.00490)	(0.00316)	(0.00412)	(0.00575)	(0.00445)	(0.00545)	(0.00554)	(0.00653)
s_{it}	0.0296***	0.0388***	0.0398***	0.0308***	0.0244***	0.0407***	0.0399***	0.0313***
	(0.00424)	(0.00491)	(0.00352)	(0.00326)	(0.00219)	(0.00389)	(0.00268)	(0.00195)
n_{it}	-0.0181***	-0.0201***	-0.0176***	-0.0165***	-0.0213***	-0.0221***	-0.0214***	-0.0231***
	(0.000500)	(0.00124)	(0.000819)	(0.000925)	(0.00127)	(0.00118)	(0.00103)	(0.00136)
IFI_{it}		0.00651***				0.00164		
		(0.00226)				(0.00149)		
GEQ_{it}			0.00744***				0.00662***	
			(0.000837)				(0.000770)	
TO_{it}				-0.00400				-0.0209***
				(0.00374)				(0.00350)
Observations	1603	1580	1574	1603	1607	1584	1578	1607
Instruments	52	53	53	53	52	53	53	53
Serial correlation	-0.803	-0.804	-0.878	-0.961	-0.604	-0.847	-0.767	-0.849
Serial correlation (p-value)[a]	0.422	0.421	0.380	0.337	0.546	0.397	0.443	0.396
Hansen	53.31	53.01	53.41	53.45	54.26	53.94	54.59	54.13
Hansen (p-value)[b]	0.185	0.193	0.182	0.182	0.162	0.170	0.155	0.165
H_0: $\beta_E = \beta_U$ (p-value)[c]	1.99e-10	1.71e-09	0	2.70e-10	0	0	0	0

Notes: The dependent variable is y_t. $E[g_{it}]$ and $(g_{it} - E[g_{it}])$ for columns 1 through 4 are based on the recursive estimation of $g_{it} = \rho g_{i,t-1} + \delta y_{i,t-1} + \gamma_1 s_{i,t-1} + \gamma_2 n_{i,t-1} + \nu_i + u_{it}$, for columns 5 through 8 are based on the recursive estimation of $g_{it} = \rho g_{i,t-1} + \delta y_{it} + \gamma_1 s_{it} + \gamma_2 n_{it} + \nu_i + u_{it}$. Figures in parentheses are standard errors of the GMM two-step estimates. * significant at 10%; ** significant at 5%; *** significant at 1%. [a] The null hypothesis is that the errors in the first-difference regression exhibit no second-order serial correlation (valid specification). [b] The null hypothesis is that the instruments are not correlated with the residuals (valid specification). [c] The null hypothesis is that the coefficients on expected and on unexpected g_{it} are the same.

Table 7: Output Equation with Recursive Estimation of Expectations: Developed and Emerging Economies

g_{it} process:	$g_{it} = \rho g_{i,t-1} + \delta y_{i,t-1} + \gamma' X_{i,t-1} + \nu_i + u_{it}$				$g_{it} = \rho g_{i,t-1} + \delta y_{it} + \gamma' X_{it} + \nu_i + u_{it}$			
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$y_{i,t-1}$	1.387***	1.353***	1.316***	1.328***	1.352***	1.300***	1.290***	1.304***
	(0.0155)	(0.0151)	(0.0193)	(0.0177)	(0.0161)	(0.0143)	(0.0161)	(0.0140)
$y_{i,t-2}$	-0.391***	-0.366***	-0.332***	-0.335***	-0.367***	-0.315***	-0.314***	-0.317***
	(0.0160)	(0.0154)	(0.0187)	(0.0155)	(0.0161)	(0.0149)	(0.0158)	(0.0145)
$E[g_{it}]$	-0.0627***	-0.0465***	-0.0426***	-0.0558***	-0.0322***	-0.0303***	-0.0116	-0.0454***
	(0.00534)	(0.00384)	(0.00583)	(0.00592)	(0.00456)	(0.00602)	(0.00823)	(0.00579)
$(g_{it} - E[g_{it}])$	-0.104***	-0.0852***	-0.0825***	-0.0963***	-0.0553***	-0.0545***	-0.0428***	-0.0620***
	(0.00508)	(0.00395)	(0.00543)	(0.00695)	(0.00521)	(0.00546)	(0.00688)	(0.00476)
$(g_{it} - E[g_{it}]) \times I_{DEV}$	0.0199*	0.0150***	0.00956	0.0196**	-0.158***	-0.159***	-0.143***	-0.196***
	(0.0111)	(0.00554)	(0.01000)	(0.00834)	(0.0175)	(0.0182)	(0.0166)	(0.0160)
s_{it}	0.0266***	0.0402***	0.0401***	0.0309***	0.0363***	0.0487***	0.0486***	0.0420***
	(0.00462)	(0.00511)	(0.00487)	(0.00283)	(0.00326)	(0.00350)	(0.00338)	(0.00326)
n_{it}	-0.0176***	-0.0197***	-0.0179***	-0.0163***	-0.0196***	-0.0209***	-0.0202***	-0.0210***
	(0.000610)	(0.000784)	(0.000721)	(0.000637)	(0.000872)	(0.00114)	(0.00110)	(0.000909)
IFI_{it}		0.00759***				-0.000163		
		(0.000820)				(0.00155)		
GEQ_{it}			0.00776***				0.00505***	
			(0.000688)				(0.000930)	
TO_{it}				-0.000244				-0.0171***
				(0.00542)				(0.00440)
Observations	1603	1580	1574	1603	1607	1584	1578	1607
Instruments	54	55	55	55	54	55	55	55
Serial correlation	-0.810	-0.820	-0.853	-1.007	-0.921	-1.098	-1.030	-1.166
Serial correlation (p-value)[a]	0.418	0.412	0.393	0.314	0.357	0.272	0.303	0.243
Hansen	52.28	54.17	54.32	52.67	54.09	54.07	54.59	54.11
Hansen (p-value)[b]	0.243	0.191	0.187	0.232	0.193	0.193	0.180	0.192
H_0: $\beta_E = \beta_U$ (p-value)[c]	0	0	0	0	5.24e-08	9.30e-09	0	3.02e-05

Notes: The dependent variable is y_t. $E[g_{it}]$ and $(g_{it} - E[g_{it}])$ for columns 1 through 4 are based on the recursive estimation of $g_{it} = \rho g_{i,t-1} + \delta y_{i,t-1} + \gamma_1 s_{i,t-1} + \gamma_2 n_{i,t-1} + \gamma_3 GEQ_{i,t-1} + \nu_i + u_{it}$, for columns 5 through 8 are based on the recursive estimation of $g_{it} = \rho g_{i,t-1} + \delta y_{it} + \gamma_1 s_{it} + \gamma_2 n_{it} + \gamma_3 GEQ_{it} + \nu_i + u_{it}$. Figures in parentheses are standard errors of the GMM two-step estimates. * significant at 10%; ** significant at 5%; *** significant at 1%. [a] The null hypothesis is that the errors in the first-difference regression exhibit no second-order serial correlation (valid specification). [b] The null hypothesis is that the instruments are not correlated with the residuals (valid specification). [c] The null hypothesis is that the coefficients on expected and on unexpected g_{it} are the same.

Table 8: Government Expenditures: Developed and Emerging Economies

g_{it} process:	Developed Economies				Emerging Economies			
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$gi,t-1$	0.795***	0.782***	0.789***	0.810***	0.769***	0.736***	0.750***	0.731***
	(0.0452)	(0.0460)	(0.0391)	(0.0309)	(0.0265)	(0.0266)	(0.0285)	(0.0329)
$g_{i,t-2}$	0.0561	0.0487	0.0575*	0.0438	0.0693***	0.0703***	0.0710***	0.120***
	(0.0359)	(0.0421)	(0.0300)	(0.0283)	(0.0165)	(0.0162)	(0.0214)	(0.0171)
$\Delta GDP_{i,t-1}$	-0.926***	-0.952***	-0.927***	-0.910***	-0.398***	-0.427***	-0.427***	-0.380***
	(0.0341)	(0.0372)	(0.0313)	(0.0362)	(0.0602)	(0.0602)	(0.0487)	(0.0569)
s_{it}	0.0163	-0.00190	0.0105	0.0225	-0.0119	-0.0378***	-0.0294***	0.0107
	(0.0215)	(0.0236)	(0.0234)	(0.0200)	(0.0109)	(0.00907)	(0.00650)	(0.00738)
n_{it}	-0.00433***	-0.00599**	-0.00365**	-0.00439***	0.0106***	-0.00257	-0.00120	0.0128***
	(0.00147)	(0.00268)	(0.00175)	(0.00163)	(0.00368)	(0.00655)	(0.00767)	(0.00412)
IFI_{it}		-0.00282				-0.0309***		
		(0.00210)				(0.00655)		
GEQ_{it}			-0.000717				-0.0155***	
			(0.000931)				(0.00457)	
TO_{it}				0.0116				0.0236
				(0.00887)				(0.0170)
Observations	726	725	726	726	1038	1005	999	1029
Instruments	19	20	20	20	31	32	32	32
Serial correlation	-1.070	-1.000	-1.137	-0.955	-1.917	-1.762	-1.823	-2.013
Serial correlation (p-value)[a]	0.285	0.318	0.255	0.339	0.0552	0.0780	0.0683	0.0441
Hansen	16.56	16.34	16.32	17.26	32.47	31.75	31.18	32.68
Hansen (p-value)[b]	0.220	0.231	0.233	0.188	0.145	0.165	0.183	0.139

Notes: The dependent variable is g_t. Figures in parentheses are standard errors of the GMM two-step estimates. * significant at 10%; ** significant at 5%; *** significant at 1%. [a] The null hypothesis is that the errors in the first-difference regression exhibit no second-order serial correlation (valid specification). [b] The null hypothesis is that the instruments are not correlated with the residuals (valid specification).