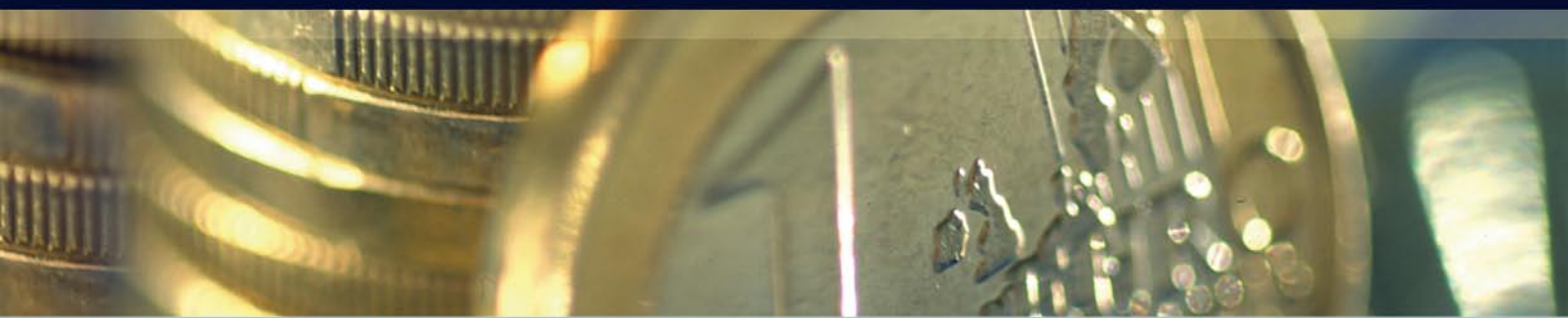


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## Adjustment Dynamics in the Euro Area: A Fresh Look at the Role of Fiscal Policy Using a DSGE Approach

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# **Adjustment Dynamics in the Euro Area—A Fresh Look at the Role of Fiscal Policy Using a DSGE Approach <sup>1</sup>**

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## **Abstract**

Dynamic stochastic general equilibrium (DSGE) models typically (as do most models) treat government spending as wasteful; such spending does not contribute to enhancing private sector utility or productivity. Some researchers have recently introduced productive government investment spending into DSGE models, which has a longer theoretical history, adding a supply channel. This paper takes a similar perspective but it also introduces the government consumption good into the household utility function and this consumption good is supplied by a government production function. While higher government investment can increase private output and household consumption in the future, in the short run household utility is likely to decline because current consumption of private and government goods is shifted into investment. At the same time even though the government consumption good enhances household utility, increased production would shift labor from the private sector to the public sector, reducing the supply of privately produced consumption goods. This adds another supply channel to the usual aggregate demand effects. Although these considerations are generally applicable, they have greater import for Euro-area members because fiscal policy is the only national macroeconomic policy tool.

**Keywords:** Public investment, Public consumption, Government production function, DSGE models, Euro area

**JEL Classification Numbers:** E62; F41; F42; H30; H63

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## I. INTRODUCTION

In November 2006, the European Commission issued its 2006 EU Economy Review—*Adjustment Dynamics in the Euro Area—Experiences and Challenges*.<sup>2</sup> Among its conclusions were that the adjustment process in the Euro-area was dynamically stable, but this channel can operate slowly and it is not exempt from some overshooting. This Review also concluded that procyclical changes in real interest rates could be amplified by asset price movements, but these effects tapered off after two to three years. Meanwhile, country-specific developments in risk premia, credit constraints and wage-price setting behavior along with trends in underlying productivity and labor migration, were powerful explanatory factors. In this connection, attention was drawn to shifts in relative competitiveness of traded and nontraded goods sectors, noting that competitiveness—real exchange rate—adjustment within the Euro-area could be slower than economically or socially desirable causing overshooting and cross-country spillovers within the Euro-area. In addition, a key distinction was observed in the sustainability of the real convergence process between those economies, such as Ireland, that centered on the traded goods sector and those that relied primarily on the nontraded goods sector, such as Portugal.<sup>3</sup>

Based upon this analysis, lessons were drawn for Euro-area policy-makers. (These lessons also seem applicable to policy-makers in the non Euro-area, EU countries that have currencies that are pegged to the Euro or with tight bands around their ERMII parities (e.g., Bulgaria, Denmark, Estonia, Latvia, Lithuania.)) In particular, the efficiency of adjustment dynamics within the Euro-area can be enhanced by an acceleration of structural reforms including more efficient working of labor and product markets to better reflect competitiveness positions. Given the spillover effects, the benefits from policy coordination

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<sup>2</sup> This paper was prepared under the responsibility of Klaus Regling, Director-General for Economic and Financial Affairs, and Marco Buti, Deputy Director General for Economic and Financial Affairs. Mary McCarthy and Max Watson served as co-coordinating editors of the report.

<sup>3</sup> The importance of the traded goods sector in a sustainable real convergence process has been analyzed by Bakker and Faisal in a comparison of real convergence by Ireland and Portugal. This analysis was then applied to the Baltics economies.

among Euro-area members were seen as heightened, while the interplay between macroeconomic and structural policies was viewed as having stronger common concerns. As regards macroeconomic policies, their focus—perhaps unsurprisingly for the EC staff—was on fiscal policy. They advised appropriately that in light of risks of real exchange rate overshooting, it was important to avoid a procyclical fiscal stance, which would aggregate these risks and indeed increased fiscal consolidation during “good times” would dampen swings in the real exchange rate. During country-specific financial booms, the underlying strength of revenue performance risks becomes over estimated.

The foregoing analysis and policy lessons were derived in part by employing calibrated simulations of a two-country-three-sector dynamic stochastic general equilibrium (DSGE) model (see Chapter VII, Annex). This model fits into the more general category of so called New-Open-Economy-Macroeconomics (NOEM).<sup>4</sup> Such general models develop the microeconomic foundations for the non-Ricardian behaviors of the household and corporate sectors, which allow for long-run, non-neutral fiscal and monetary effects that extend beyond the traditional consequences from various nominal (e.g., sticky wages, local currency pricing) and real rigidities (e.g., adjustment costs, habit persistence). Ricardian equivalence typically does not hold for several reasons most importantly: (i) households have a higher discount rate than financial markets, lowering household’s calculated future tax liabilities; (ii) some households spending and labor/leisure decisions are influenced by credit constraints; and (iii) taxes have a distortionary impact, especially related to labor income. In an open economy setting, the resulting long-run differences in the real interest complicate the market clearing conditions for international bonds and the exchange rate.

From an international, or open economy, perspective, several aspects of such models are noteworthy. One, labor and physical capital are not mobile between countries, although labor is mobile—but capital is not—between sectors within a country. Thus, there is complete home-country bias in these factors of production. Two, the existence of traded and nontraded

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<sup>4</sup> See Botman, Laxton, Muir, and Romanov (2007), Casselli (2001), Ganelli and Lane (2002), Blanchard and Perotti (2002), Ganelli (2003), Betts and Devereux (2001), Faruqee and Laxton (2000), and Kumhof, Laxton and Muir (2005).

goods allows expenditure/production switching in response to changes in competitiveness. Multiple definitions of external competitiveness are possible. Three, the modeling of financial assets and markets (e.g., equity, bonds) is relatively incomplete. Typically, complete home bias and home currency denomination exists for both bonds and equity holdings. In the extreme, these assumptions imply no internationally traded assets. In some cases, bonds issued by the private or public sector may be traded internationally and/or denominated in a foreign currency. Asset stock disequilibrium does not give rise to asset flows, rather interest rate parity is assumed, although this may require changing risk premium. Intermediation costs and leveraging are implicitly zero. Term structures and credit risk and equity premia do not exist. As a consequence, these models do not generally capture balance-sheet related credit market frictions (including collateral constraints)—the financial accelerator mechanism (see Bernanke, Gerler, and Gilchrist (1999)).<sup>5</sup> Shortcomings in the financial sector make it difficult to model the impact of joining a currency union (or moving to a peg) in some EU members, such as Portugal and the Baltics.<sup>6</sup> Four, expectations, adjustment parameters, and roles of stock disequilibria are crucial for short-run dynamics, but professional consensus on appropriate specifications and calibrations is elusive. Thus, short-run dynamics must be specified with great care.

While the foregoing indicates clearly that considerable theoretical and analytical work remains ahead, such calibrated models still now provide a very useful tool to help policy-

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<sup>5</sup> An exception is the version of ECFIN's DSGE model developed for the 2006 EU Economy Review. That model contained a nontraded construction sector that links a deepening in the mortgage market—the financial sector—to developments in the real economy. Households borrow to finance housing investment, facing a risk premium that depends on the value of collateral. Newer versions of the IMF's DSGE model incorporate financial accelerator effects.

<sup>6</sup> A simpler calibrated modeling framework has been utilized by Bem and Schellekens (2007) to examine “speed limits” pertaining to financial and real convergence in Emerging Europe. They conclude that while speed limits may be hard to determine, the costs of breaking them are likely substantial. Székely and Watson (2007) also examine the how expanded access to credit by collateral constrained households—a financial accelerator mechanism—can pose new challenges—“speed limits on growth”—for real convergence process of new EU member states. Among the factors that they find limiting convergence potential were wasteful government spending/taxation and government policies that distort the relative price of labor and shift resources to nonproductive uses in the private sector. The “fresh look” at fiscal policy presented in this paper can be viewed as addressing these factors that limit convergence potential.

makers puzzle through complex economic problems. In this spirit, this paper takes a fresh look at fiscal policy, which is particularly germane for economies in the Euro area or pegged tightly to it—that is without an independent monetary or exchange rate policy. Econometric and calibrated general equilibrium models typically view government as only spending and taxing and thereby performing the traditional macroeconomic stabilization function (as described say by Musgrave and Musgrave (1973)). Government spending creates a demand for goods and services that is supplied by the private sector via an aggregate production function (for the whole economy or separate production functions for each sector in multi-sector context). The economic consequences of such higher government spending depends on whether unused factors of production are available—an output gap—and the details of the model, including nominal/real rigidities.

Following Musgrave and Musgrave, public finance theory identifies two other government functions—redistribution and allocation. While the redistribution function has two basic dimensions—intertemporal (e.g., public pensions, interest payments on public debt) and contemporaneous (e.g., lump-sum transfers, subsidies); both types of redistribution payments are financed by current tax and future taxes (e.g., government borrowing). A vast literature exists on demographic change and pensions reform as well as on Ricardian equivalence. In a nutshell, whether these transfers—as opposed to their financing modality—have a macroeconomic impact depends on whether recipients have a different marginal propensity to consume from the rest of society, say because of a different utility function, age cohort, or credit/liquidity constraints. Income transfers to liquidity constrained households will boost real demand more than equivalent transfers to non-liquidity constrained households. Similarly, reducing the share of liquidity constrained households in an economy is one way to model the impact of joining the Euro-area for countries, such as Portugal, or the implications of the increased presence of foreign banks in the Baltics and Balkans.<sup>7</sup>

The allocative function of public finance has its genesis in the provision of public goods or more generally social goods—goods that cannot be provided through the market system by

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<sup>7</sup> A reduction in the country risk premium is also another way to model this phenomenon.

the private sector. The government via the budget—political—process determines the quantum, price, and distribution of such goods. Within this function, a clear distinction should be drawn between the public *provision* of social goods and the public *production* of social goods. Social goods, such as education, highways, and military hardware, may be produced by private firms and sold to the government. Alternatively, the government may produce some social goods directly under public management (e.g., primary schooling, waste disposal, defense), while using intermediate inputs from the private sector. In addition, these two approaches may be combined as a Public Private Partnership (PPP) wherein the private sector builds a certain facility (e.g., road) and operates it for a while and then transfers the facility to the government (or build-operate-transfer (BOT)).<sup>8</sup> In general, structural econometric models (e.g., the Oxford Economic Forecasting Model) and DSGE models (e.g., ECFIN, IMF) assume that the government buys goods and services produced by private firms. This paper takes the alternative approach developing a model where government production has a major role in the allocation of social goods.

## **II. THE BASIC GLOBAL INTEGRATED MONETARY AND FISCAL (GIMF) MODEL**

The GIMF model developed at the IMF (see Kumhof and Laxton (2007)) adopts a multi-country NOEM-DSGE framework to evaluate alternative fiscal and monetary policies and studies the implications of macroeconomic interdependence. This model has many similarities to the multi-country model (Quest II and successors) developed at the EC (see Roeger and In't Veld (1997) and Ratto, Roeger, In't Veld, and Girardi (2006)), although the Fund's GIMF model also has several distinctive features. GIMF is an extension of other NOEM-DSGE models produced at the IMF, including the Global Economy Model (GEM) and the Global Fiscal Model (GFM) (see IMF (2004); Botman, Laxton, Muir, and Romanov;

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<sup>8</sup> For a fuller description, see IMF (2007); Efraim Sadka, *Public-Private Partnerships: A Public Economics Perspective* (IMF Working Paper 06/77); and IMF (2004a, 2004b).



and Botman and Kumar (2006)).<sup>9</sup> For purposes of this paper, it is important to note that at this stage these models emphasize the provision of social goods by the government rather than the production of social goods. What follows will be a streamlined and nontechnical description of the GIMF model; a fuller technical treatment is available in Kumhof and Laxton (2007). In the full GIMF model, the world consists of  $N$  countries but for our purposes a two-country version suffices—Home (HO) and Rest of World (RW).

The *household sector is comprised of two types*: (i) overlapping generations (OG) with finite lives, who have access to financial markets; and (ii) liquidity constrained (LC) households with finite lives, who do not have access to financial markets and therefore consume their current income. Households optimize their expected lifetime utility whose utility function comprises consumption, leisure, and real money balances. Consumption and leisure enter positively into the utility function, implying that households experience disutility from supplying labor; real monetary balances enter separately and consequently the inflation tax does not distort household decisions.<sup>10</sup> Households consume both domestically produced—traded and nontraded—goods and imported goods, which allows a home bias in international trade. The degree of myopia, risk aversion, and habit persistence and the intertemporal elasticity of substitution for consumption govern the solution for OG households. Habit persistence and myopia are not reflected in the optimality conditions of LC households because of their inability to smooth consumption intertemporally through financial markets. Myopia and risk aversion introduce a channel for fiscal policy to have non-Richardan effects.

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<sup>9</sup> These models develop extensive micro-economic foundations for behavioral—optimizing, including intertemporally—equations for households and firms as well as policy reaction functions to stabilize prices and public debt dynamics. With rigorous micro-foundations, these models are not susceptible to the “Lucas critique” as were an earlier generation of macroeconomic models (OEFM and MULTIMOD). GEM was the IMF’s first multi-country DSGE model, focusing on short-run (quarterly) dynamics employing a representative agent paradigm in its initial version. GFM was developed later at the IMF and is an annual DSGE model intended to study the medium- to long-term implications of different fiscal policies. Consequently, it uses an overlapping-generations construct to model non-Ricardian behavior, allowing tax and spending policies to have long-run real implications.

<sup>10</sup> As to the fiscal role of money, changes in the inflation tax revenues are offset by lump-sum taxation, avoiding indirect distortionary effects via distortionary taxes.

OG households hold *two types of financial assets*—domestic government bonds denominated in domestic, and foreign bonds denominated in foreign currency.<sup>11</sup> Complete home bias exists in government debt and only one country's bond is traded internationally. OG households receive gross nominal interest payments as well as labor and dividend income. All households market their labor to firms via unions who pay a competitively determined wage to households, but charge a mark up to firms. The productivity/wage rate of households declines at a constant rate over their life spans. This assumption generates a simplified lifecycle profile to the model and adds an avenue for non-Ricardian effects of fiscal policy. Dividends are distributed in a lump-sum manner from all firms and unions. OG households pay lump-sum transfers to the government, which in turn makes lump-sum payments to LC households. Labor income and consumption are both taxed at different rates, although uniformly across households.

*OG households can also consume out of their wealth*—a combination of financial assets and human capital. Both include the net present value of the after-tax income streams from dividends, interest income and from wages. Households discount their future tax liabilities at a higher rate than government or the market because an individual household dies before some future tax payments are due—the ultimate in tax avoidance!! The infinitely lived government and economy compute the full present value of future taxes. A consumption share parameter determines the split, the consumption of goods and leisure time coming from wealth effects.

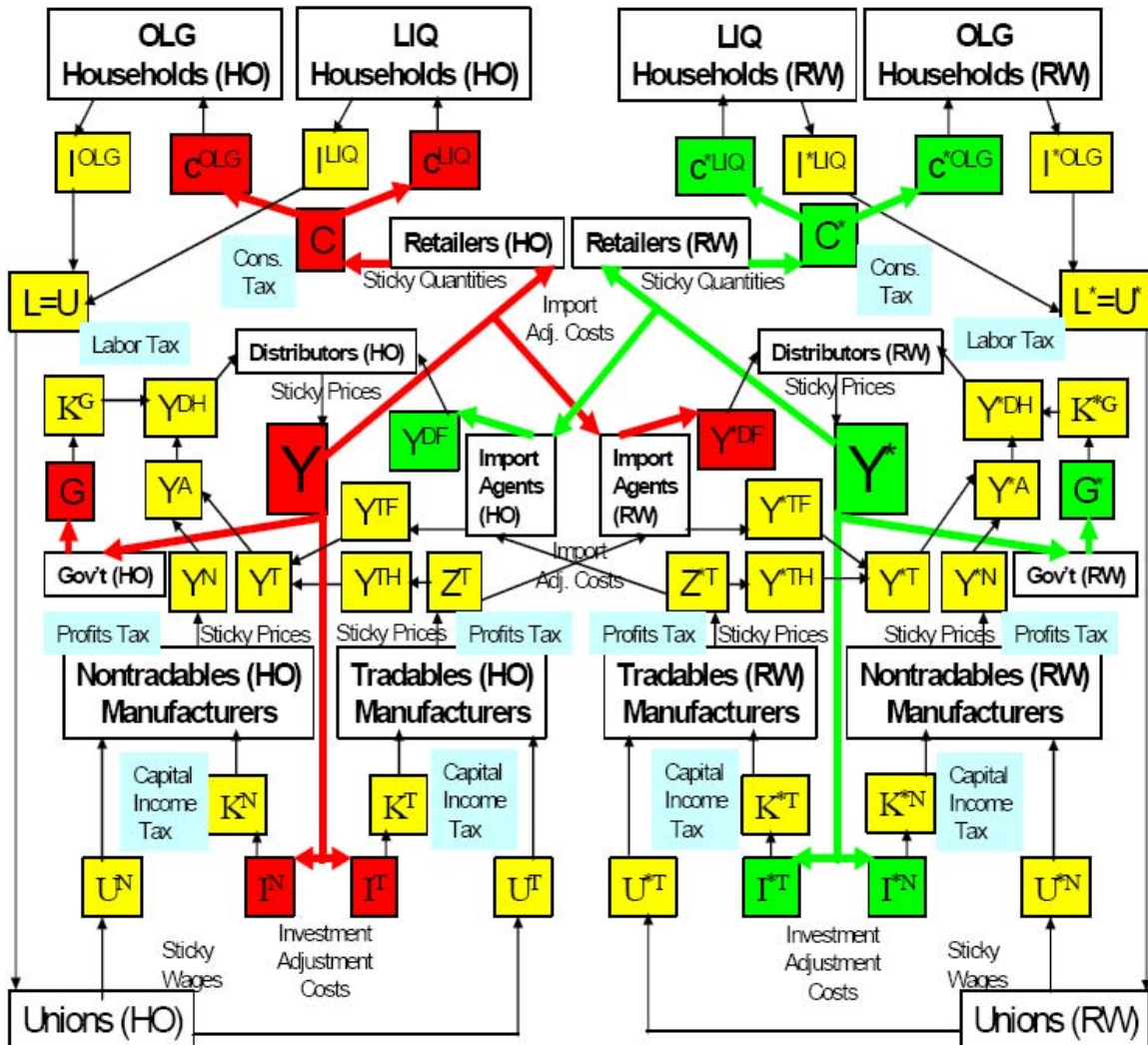
*The corporate sector consists of manufacturing firms, import agents, distributors, and retailers* (see Figure 1). Manufacturing firms produce either tradable or nontradable goods, utilizing CES production functions with capital and labor. Monopolistic competitive markets prevail for the outputs as each firm produces a differentiated output. This implies market power in output pricing and excess profits. Excess profits are distributed to households in a

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<sup>11</sup> The financial sector is as yet underdeveloped in DSGE models, particularly equity markets, credit and equity premias. The IMF's Research Department is undertaking extensions of its GIMF model particularly related to the financial sector.

lump-sum manner or could be eliminated by assuming fixed costs so that steady state profit shares are consistent with data. Manufacturers buy investment goods from distributors and buy labor from unions. Manufacturers' domestic sales go to domestic distributors, while their foreign sales go to import agents located in the foreign country. Manufacturers are subject to nominal rigidities in prices setting and real rigidities in capital accumulation. Distributors buy goods from manufacturers and import agents, selling final output to retailers, manufacturing firms (as investors), the government, and import agents in their role as providers of final goods. All domestically produced goods and imports must be processed by the distribution sector before they are sold to households.

Figure 1



Unions buy labor from households in a perfectly competitive market, but unions sell differentiated labor skills to manufacturers in a monopolistically competitive labor market. This market power of unions allows them to increase the real wage above the level consistent with perfect competition. Unions distribute to households in a lump-sum in proportion to their share in aggregate labor supply; thus these union “dividends” have a neutral impact in households’ optimization decisions. Similarly, involuntary unemployment is nonexistent because all households supply labor in a perfectly competitive labor market, optimizing their utility functions; hours worked will, nevertheless, be less than under perfect competition, owing to reduced demand from manufacturers. This reduced labor demand is distributed proportionately to households. Wage setting is subject to nominal rigidities in the short run but in the steady state, real wages increase at the rate of technological process and adjustment costs are zero.

Both local currency pricing and producer currency pricing is allowed. As all imported goods sold to households have a domestic cost element from the distribution sector, deviations from the “law of one price” occur even in the long run. Adding a distribution sector for traded goods allows the model to produce the high ratio of trade to GDP observed in small, highly open economies. Unions, import agents, distributors, and retailers do not have production costs (i.e., production functions) although they do face adjustment costs. These adjustment costs prevent international trade from being excessively responsive to movements in the real exchange rate, making it costly to vary the share of foreign produced tradables in total tradables.

The *public sector* consists of the central bank, which conducts monetary and exchange rate policy, and the Treasury or Ministry of Finance, which conducts fiscal policy. When the exchange rate floats, the central bank uses the nominal interest rate to smooth deviations in inflation from its target, the lagged output gap, real growth rate, and fluctuations in the exchange rate from its long run value. Depending on the weights assigned to the foregoing, it is possible to model a variety of approaches including a Taylor rule (i.e., contemporaneous inflation target), inflation targeting or a forward-looking Taylor rule (i.e., forecasted inflation rather than contemporaneous is targeted) and nominal-income targeting. By lengthening the

horizon to respond to forecasted inflation, policy makers can dampen variability in output, while a shorter horizon increases the output volatility and decreases inflation volatility. For a large country, the non-Ricardian nature of fiscal policy means that the real interest rate is not constant and therefore a moving average of past and future real interest rates is added to help anchor the system. For a small country, the world real interest is given. Regardless of a country's size, the risk premium embedded in the nominal interest on government is positively linked to the ratio of gross government debt to GDP; consequently, the real interest rate is not independent of the government debt ratio.

Exchange rate targeting or pegging is also an option for the authorities, particularly for small open economies, allowing them to “import” lower inflation and nominal interest rates. Under a currency union, risk premiums related to exchange rate variability are eliminated and a common risk free nominal interest rate prevails. The monetary policy rule is formulated somewhat differently in a pegged regime from that in a currency union. Under a pegged exchange rate regime, the home central bank sets interest rates based on interest rate developments in the anchor country and risk premia. Under a currency union with imperfect factor mobility, different nominal and real rigidities in two different countries, and home country consumption bias,<sup>12</sup> the common central bank sets the policy interest rate based on area-wide inflation rates and output gaps, which includes developments in the “home” country. Thus, the central bank assigns weight to economic developments in the second country (based on economic size) under a currency union unlike in the case of a currency peg. For a very small country, this difference in specification of monetary policy is minor. Thus with the elimination of exchange rate risk, welfare gains in terms of higher output are greater under currency unions than under exchange rate pegging for small countries. For larger countries, output volatility would also likely be muted in a currency union compared with an exchange rate peg.

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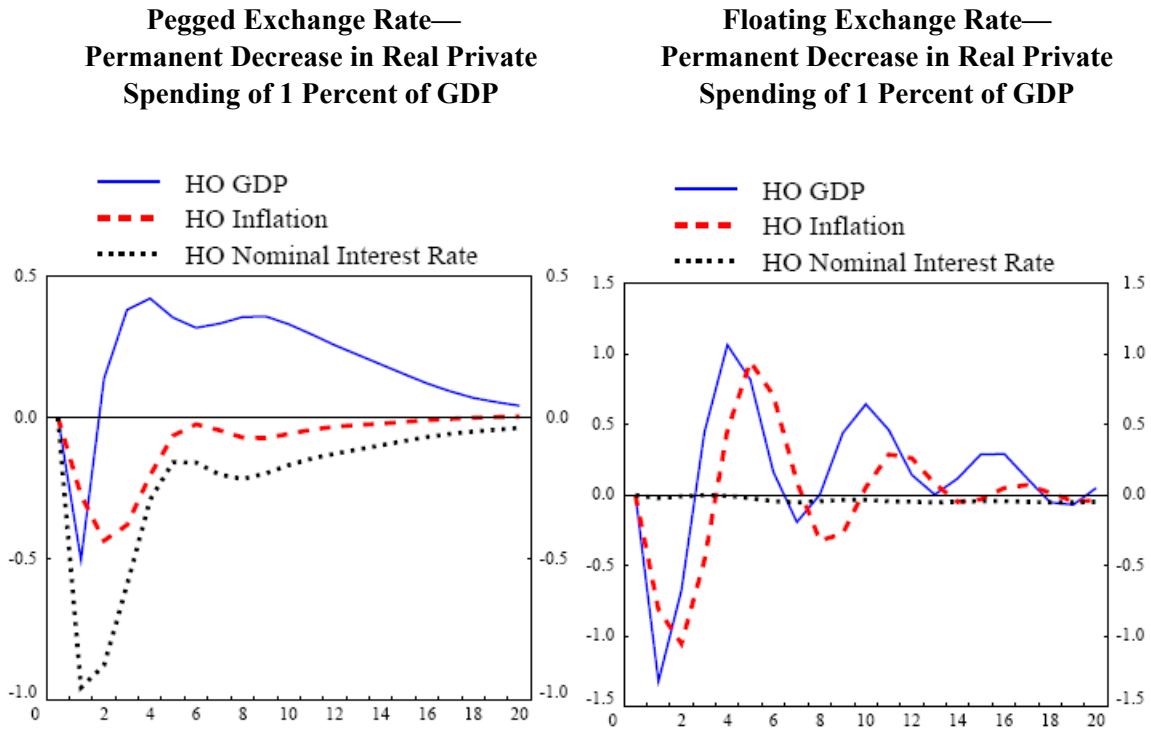
<sup>12</sup> Without these assumptions, it would not be possible to identify one country/economy from another within the union. These assumptions would apply most realistically immediately after a country joins a monetary union.

That said, output variability is greater under pegged exchange rates than under flexible exchange rates with inflation targeting where the exchange rate and interest rates act as buffers.<sup>13</sup> In this DGSE model, the larger markups in labor and product markets and greater nominal and real rigidities increase the importance of the exchange rate and nominal interest rates as shock absorbers (see Bayoumi, Laxton, and Pesenti (2004)). For an economy with the same structure, both output and the current account balance oscillate considerably under a pegged exchange rate when shocked say by higher real private spending (Figure 2), although they converge relatively smoothly when the exchange rate and nominal interest rates are flexible (see Karam, Laxton, Rose, and Tamirisa). Such reverberations could lead to an oscillating adjustment dynamic over the medium term even if in the long run the adjustment process is dynamically stable. Reducing nominal rigidities and market mark ups would dampen these oscillations under a currency peg, pointing to heightened contributions from structural reforms. Of course as these two countries become similar in structure and preferences as well as enhanced factor mobility between them, their common economy adapts quicker and more smoothly to nominal and real shocks. In the interim for the country without a monetary or exchange rate policy, fiscal policy could strengthen the operation of its automatic stabilizers and could engage in well-timed and calibrated counter-cyclical discretionary fiscal policy as warranted. However, if discretionary fiscal policy is not well-timed and calibrated, it could exacerbate the economy's oscillations.

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<sup>13</sup> Kirsanova, Vines, and Wren-Lewis (2006) conclude that for small economies with fixed exchange rates, if the share of consumers with backward-looking inflation expectations is large enough coupled with a sufficiently large demand impact from real interest rates, cycles including unstable ones can be produced. In more open economies, this positive feedback loop is diminished, reducing *ceteris paribus* the risk of instability.

Figure 2



In DSGE models, fiscal policy has several instruments. Primary spending consists of investment, consumption, and transfers, while four different taxes—labor income, consumption, capital income, and lump-sum—are specified. Transfers are paid to LC households by redistributing a small fraction of dividend income accruing to OG households. This transfer mechanism is assumed not to be distortionary. Interest payments added to primary spending represents total government spending. One period nominal bonds are issued to cover any budget deficit. To ensure debt stability and thereby avoiding problems with monetary policy posed by fiscal dominance, the fiscal policy rule has the primary surplus increase when the ratio of government debt to GDP exceeds its desired level. Either taxes or spending can be adjusted to implement this rule. The adjustment coefficient for the primary surplus is calibrated to avoid large swings in the primary surplus stemming from large deviations between actual and desired levels in the debt ratio.

### III. A SECOND LOOK AT FISCAL POLICY

The contribution of fiscal policy in DSGE models is typically limited to demand management, reducing the volatility of output, and to the maintenance of public debt sustainability.<sup>14</sup> Government services have no impact on consumer utility and therefore social welfare. In addition, government services do not enhance private sector productivity. In this framework, the tax distortions created by government could only be balanced against the utility gains achieved by the government from lower output volatility. To simplify matters, this analysis will focus on small countries within the Euro area (or pegged to the Euro), assuming therefore that nominal interest rates are determined exogenously by area wide considerations.

The study of utility-adding and productivity-enhancing government services goes back at least to Adam Smith and had a resurgence with for example Barro (1990), Baxter and King (1993), and Turnovsky and Fisher (1995). Barro employs a simple growth model with government services entering both the consumption and production function. Government services are provided free of charge—their costs are paid by a flat-rate income tax—and no congestion externalities are present. Government services are a normal consumption good subject to diminishing marginal utility, while the Cobb-Douglas production function exhibits constant returns to scale. To simplify matters, Barro assumes no population growth and a fixed labor supply.

$$Y = f(K, G; L) = f(k, g) L \quad y = Y/L$$

$$y = f(k, g) = k \cdot g$$

Barro derives the conditions for optimal size of government as:

$$g/y = \alpha$$

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<sup>14</sup> The focus on aggregate demand rather than the contributions of composition holds generally in the economic literature on fiscal policy as observed by Alesina and Perotti (1995). Some exceptions to this generalization include Finn (1998), Lane and Perotti (2003) and van der Ploeg (2006).



The ratio of government services per capita to income per capita is equal to the coefficient on government services given by the Cobb-Douglas production function. The government sets its share of gross domestic product ( $g/y$ ) equal to the share that would derive if government services were produced under competition by the private sector. As there is no government debt in this model, the ratio of government taxes to income is equal to the ratio of government services to income, or  $\alpha$ . Barro also demonstrates that decentralized decision-making can lead to suboptimal rates of economic growth and social welfare, introducing a role for government into this class of models.

From a macroeconomic policy perspective, Baxter and King (1993) developed a quantitative neoclassical model wherein government service enhanced utility and productivity but without altering the marginal utility of private consumption or the marginal product of private factors of production. Thus, government capital does not affect, on the margin, consumption or production decisions by the private sector. Following Barro, no government debt is assumed and the budget is therefore always balanced. Within this construct and given the parameter values, Baxter and King find that the long-run multipliers for a permanent increase in government infrastructure spending is substantially higher—by 4 to 13 times, depending on the productivity of government capital. Their highest value replicated highest estimate obtained by Aschauer (1989). Not surprisingly, they conclude that the composition of government spending can play an important role in determining the evolution of economic activity and that further empirical work was needed to determine the impact of various types of government spending on private sector productivity. In this discourse, the role of infrastructure investment by government in enhancing growth received considerable attention prompted by the seminal contribution by Aschauer (1989) and surveyed by Gramlich (1994). Some have disputed the empirical evidence for a positive link between public capital and private output (e.g., Tatom (1991), Garcia-Mila, McGuire, and Porter (1996)) or found the results from various studies to be less than clear cut (IMF (2004)).

The above models assume perfect competition, no nominal or real rigidities, Ricardian equivalence, and perfect foresight. More recently, efforts have been made to embed utility-adding and productivity-enhancing government services into DSGE frameworks for open

economies that relax these assumptions. In particular using a two country new open economy macroeconomic model, Ganelli and Tervala (2007) focus on the intertemporal tradeoff between public spending that adds to private utility now or later (i.e., productivity-enhancing). They assume that the utility provided by public consumption is low compared to that provided by private consumption and that it enters the household utility function in an additive and separable manner. (The first assumption implies that the provision of government services exceeds the optimum or its composition is not targeted adequately to the needs of consumers. This outcome could result from the political economy processes associated with budget formulation. The second assumption means that government services are not substitutes for privately provided goods, simplifying the analytical problem. It is also consistent with the idea that the government provides services such as the common defense, domestic security, and legal protection.) The productivity of public capital was parameterized to be less than the intertemporal discount rate. No private capital exists in this model; thus, any productivity enhancement is effectively labor augmenting. A one-for-one shift from public consumption—utility adding now—to public investment—productivity enhancing—increases the present value of social welfare of the home country.<sup>15</sup> The higher the productivity enhancement, the greater is the increase in the present value of social welfare. This combination of productivity shock and lower consumption utility widens the current account deficit of the home country.

Productivity-enhancing public spending has also been introduced into GIMF (Kumhof and Laxton (2007)). Both consumption and investment spending by the government could enhance private productivity, although the latter is substantially more than the former; in earlier specifications, government consumption spending had zero impact. For expositional ease and because public capital makes a more durable contribution, we will focus only on government investment spending, which augments public capital,  $K_t^G$ , which is also subject to depreciation,  $\delta$ :

$$K_{t+1}^G g_{t+1} = (1 - \delta)K_t^G + G_t^{inv}$$

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<sup>15</sup> A negative impact could occur when the productivity of public capital is relatively low and the weight of public consumption in utility is relatively high.

Public capital is available to the private sector without a user fee, which is effectively paid by the taxpayer. Public capital is assumed to enhance the productivity of the distribution system. In particular, the domestically-produced, tradables-nontradables composite is scaled up by the public capital stock:

$$Y_t^{DH}(i) = Y_t^A(i)(K_t^G)^{\alpha_G} S$$

Final output consists of this domestically-produced composite and the foreign-produced final output composite. Under this framework, public capital does not effect the domestic production processes for traded and nontraded goods themselves. Instead, public capital enhances the productivity of the distribution system—the creation of the domestically-produced composite of tradable and nontradables. This treatment of productivity enhancement by public capital is different from the approach adopted by Barro and others wherein public capital enters the firms’ production function just like labor and private capital (i.e., public capital can substitute for private capital and labor), rather it is separable and multiplicative for distributors. This means that distributors’ input decisions on the margin are not influenced by the availability of public capital. Moreover, manufacturing firms—both in the tradable and nontradable sectors—do not benefit directly from public capital. Clearly therefore, these firms’ input decisions are not influenced by the availability of public capital.

In calibrating this model, the depreciation rate  $\delta$  is assumed equal to 4 percent, while the public capital stock is assumed to scale-up private sector productivity in factor neutral manner.<sup>16</sup> As already noted, the empirical literature on public investment/capital and real growth has yielded a wide range of estimates. Indeed as observed by Gramlich (1994), In’t Veld (2007), Straub and Tchakarov (2007) and others, the upper end of this range implies extremely high elasticities for the long-run output response to public capital. Such

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<sup>16</sup> A 4 percent depreciation rate for public capital was employed by Kumhof and Laxton (2007), drawing upon evidence from Kamps (2004). Subsequently Botman, Karam, Laxton, and Rose (2007), and Straub and Tchakarov (2007) have used the same depreciation rate. In’t Veld (2007) modifies the DGFIN’s QUEST model to add public capital to the aggregate Cobb-Douglas function. Their accumulation equation for public capital is the same as presented here and utilized a depreciation rate of 4 percent.

elasticities appear implausible because easy gains on output could be achieved by increasing investment.<sup>17</sup> On the other hand, as shown by Kumar, Leigh, and Plekhanov (2007), an output elasticity of 0.14 coupled with a depreciation rate of 4 percent and public investment of 3 percent of GDP implies an average annualized rate of return on public investment of about 3.1 percent. This rate of return is low compared to the risk-free long-run real interest rate (2 percent), the rate of return on private investment; and households' discount rate. The global private equity premium—the difference between the risk-free real interest rate on government bonds and rate of return on private equities—has averaged around 4-5 percent, although it has varied considerably decade to decade. Therefore, the output elasticity for public investment was set at 0.20.

The implications can be illustrated by comparing a government investment shock in situations where public capital does not enhance private sector productivity and where it does. In this simulation, the higher level of government investment (equivalent to 1 percent of GDP) is financed by an offsetting reduction in government consumption, leaving total spending government constant. (This simulation is different from the analysis under taken by In't Veld (2007) wherein higher government investment spending was financed by EU transfers. While the initial impact of this higher spending on the debt-financed deficit is zero, such spending adds to domestic demand unlike simulation considered here. Both simulations have modeled the supply impact in similarly.) If the public capital does not enhance private-sector productivity, the demand impact of higher government investment is zero because consumption spending is reduced correspondingly (Figure 3).

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<sup>17</sup> For example, In't Veld (2007) in modifying the QUEST model set the marginal product of public capital equal to the marginal product of private capital for each EU economy but allowing it to vary across economies. He argued that if the marginal product of public capital (e.g., for infrastructure) were greater than private capital, then the level of output could be increased by raising corporate taxes, which would lower private capital, to finance greater the accumulation of a larger public capital stock. Thus, the assumption of an equal marginal productivity requires a socially optimal level of public capital. For government education and research and development expenditures, total factor productivity is raised over time. Implicitly, this means that investment in human capital and R&D was socially suboptimal initially. Kumhof and Laxton (2007) employ an elasticity of aggregate output with respect to public capital of 0.14 based upon a meta analysis by Ligthart and Suárez (2005). This estimate is lower than found in some other studies (e.g., Aschauer (1989) or Gramlich (1994)). Straub and Tchakarov (2007) calibrate their model such that the long run multiplier for government investment gradually rises to 2.

Figure 3. Output Response to Government Investment  
(percent deviation from baseline)

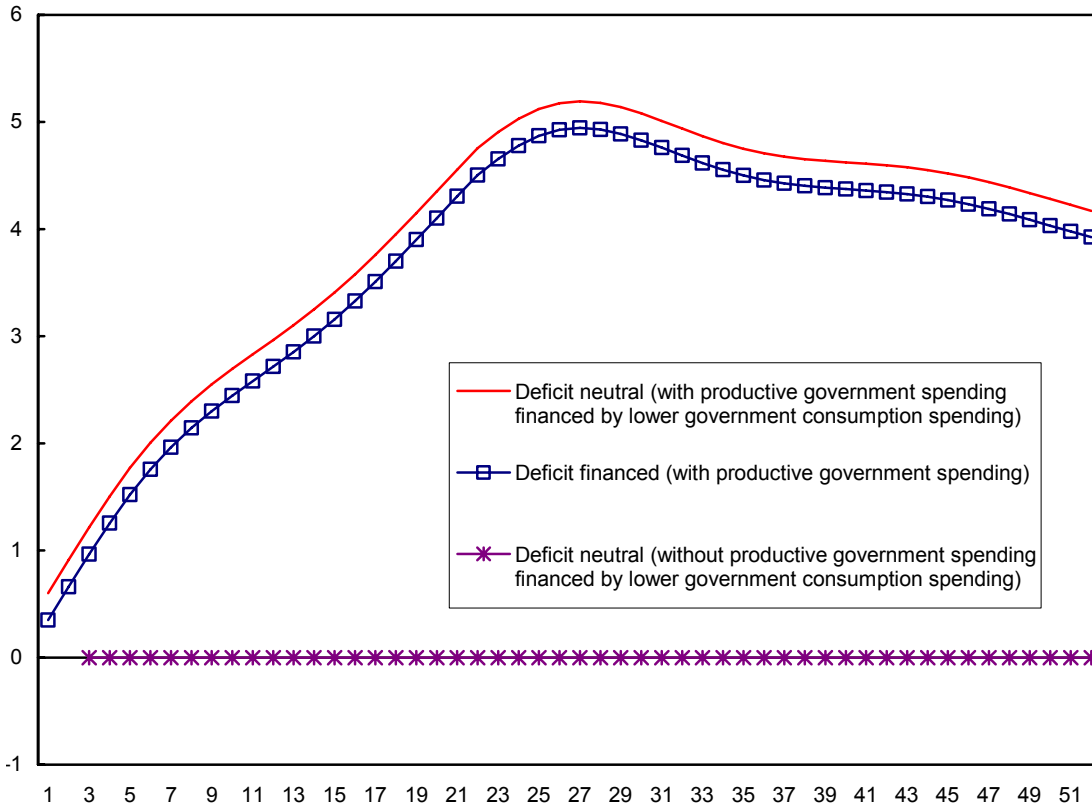
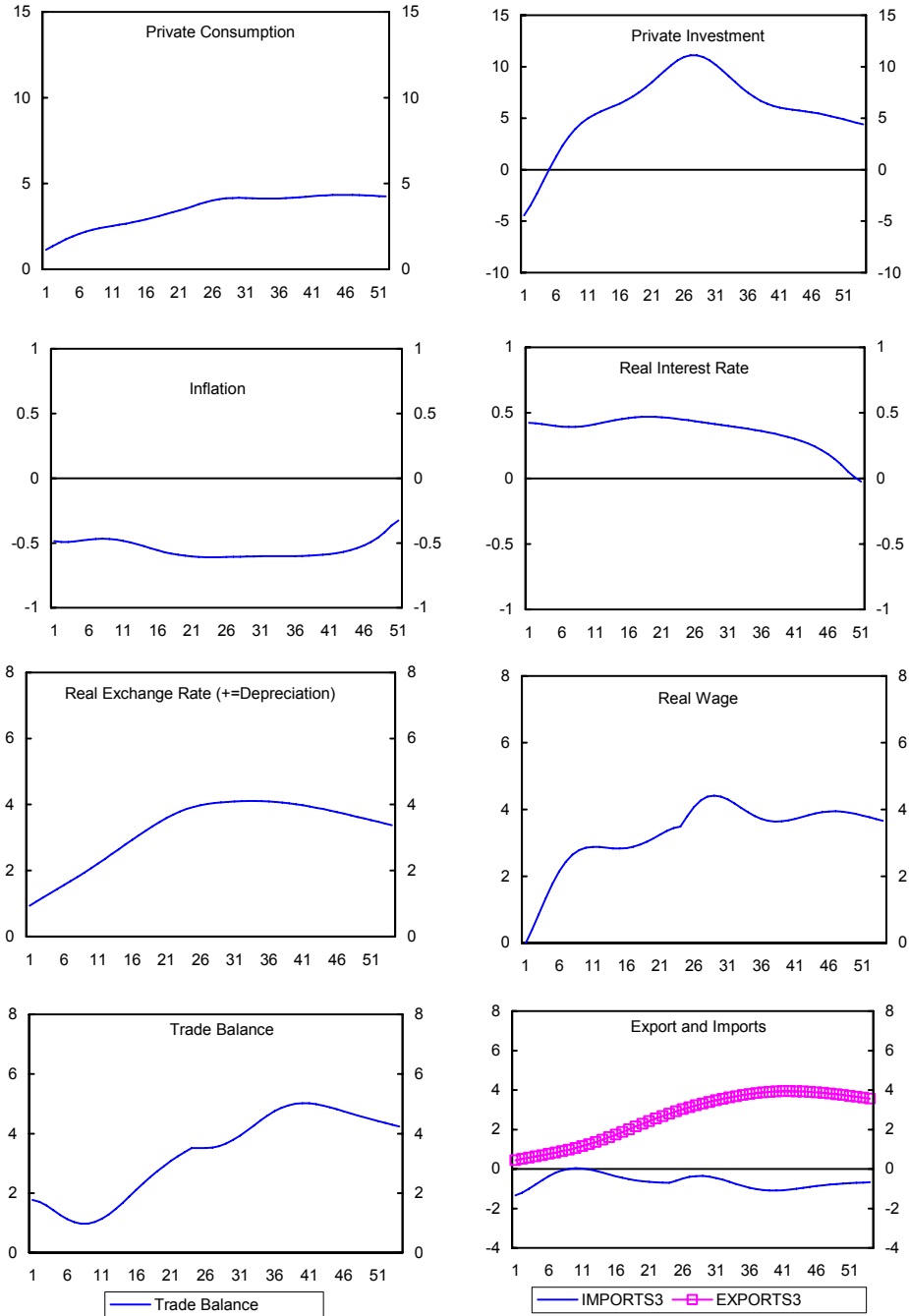
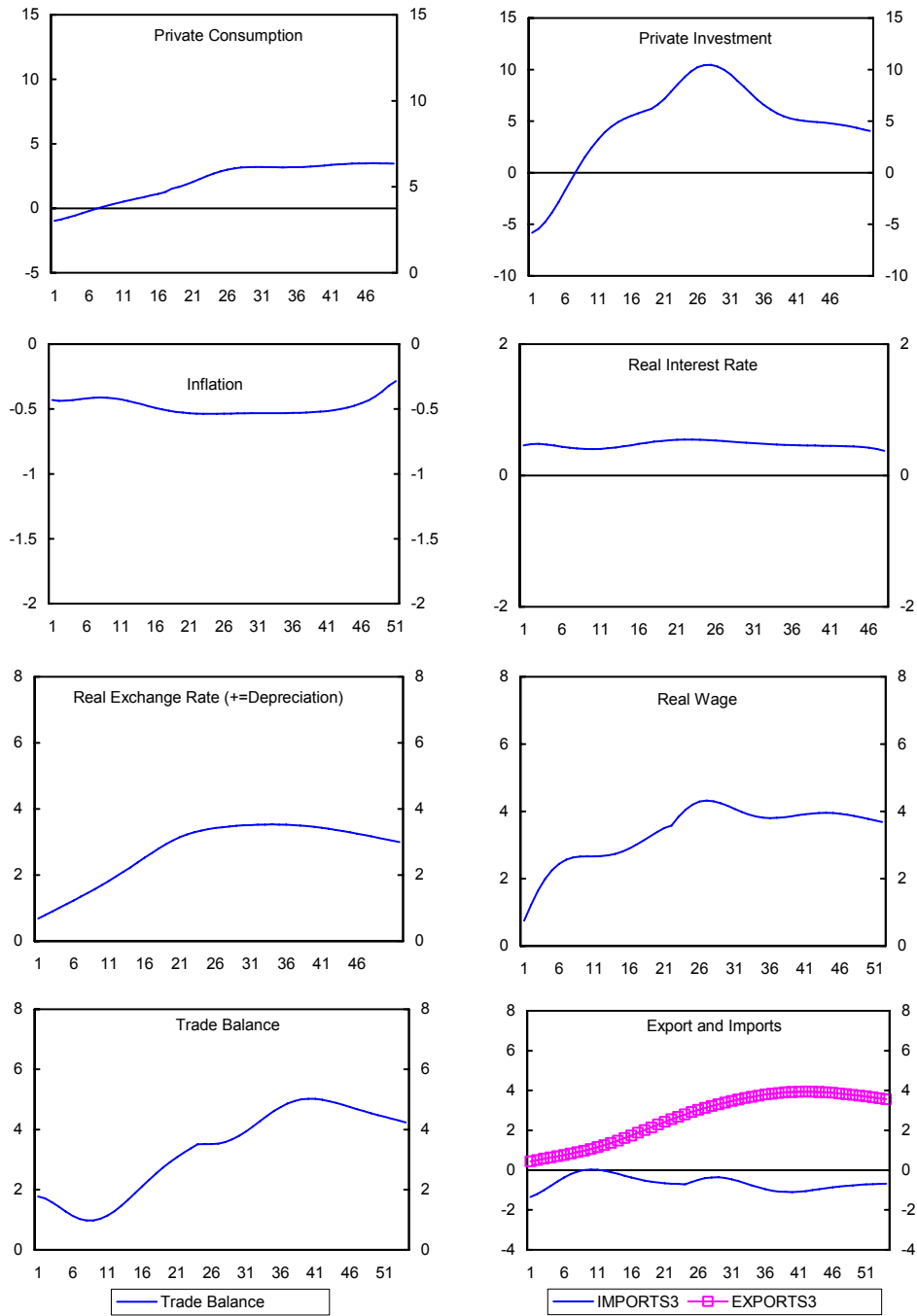


Figure 4  
 Response of Key Macroeconomic Variables to  
 Permanent Government Investment Increase 1/  
 (percent deviation from baseline)



1/ Deficit neutral with productive government spending  
 financed by lower government consumption

Figure 5  
 Response of Key Macroeconomic Variables to  
 Permanent Government Investment Increase 1/  
 (percent deviation from baseline)



1/ Deficit financed with productive government spending

If public capital does enhance private sector productivity, the supply impact of increased government investment builds up over time as the public capital stock reaches its new higher steady state level; the direct demand impact from government spending is still zero in this case. However, enhanced productivity in the private sector means that real output in the long run is lifted by more than 4 percent compared to its steady state. Higher consumption and investment by the private validate this supply response. This result is broadly similar to those obtained by In't Veld (2007) on average for New Member States. One interesting difference is that his analysis included countries that had independent monetary policy with flexible exchange rates, which *ceteris paribus*, mutes the output and inflation responses in the near term (as observed in In't Veld's paper and separately confirmed here in unpublished findings). If the government financed its higher spending on productive investment by borrowing, the output response will be somewhat dampened, owing to the need for higher future taxes, but with less than full-Ricardian offset by consumers.

The responses of key macroeconomic variables to a permanent increase in productive government investment are shown in Figures 4 and 5 for deficit neutral and debt financed, respectively. Given their similarity in outcomes between these two scenarios, we will focus only on the deficit-neutral scenario (Figure 4) in order to highlight the behavior of the private sector. As the productivity-enhancing effects of government investment spending is known to all economic agents, they respond immediately within the constraints posed by various adjustment costs and credit-constraints. In particular, private consumption by OG households rises immediately reflecting their higher net wealth—the present value of higher output. Their higher wealth and income will increase their consumption of leisure, reducing their hours worked and pushing up real wages. As public capital reaches its new steady state level, the productivity of private capital rises, exerting a positive impact on the marginal productivity of labor and equilibrium real wage. Owing to its increased productivity, private investment will increase in the steady state—as will the private capital stock—contributing thereby to the permanently higher output level. However, the initial impact on private investment is negative because it is postponed to the future in order to capture more of the benefits from the rising stock of productivity-enhancing public capital. After a period of investment “shortfall”, a “catch up” period follows before the new steady state is reached.



With increased domestic supply and a fixed nominal exchange rate, inflation diminishes slightly, lifting the equilibrium real interest rate. Greater domestic supply also improves the trade balance as production of tradables is enhanced along with nontradables.

Building infrastructure is not the only avenue by which government spending can enhance private sector productivity. Current government spending on education and healthcare can also increase private sector productivity, increasing effectively labor supply. To model, this avenue current government spending is split between consumption goods (e.g., fire and policies protection) and current spending on education and healthcare. A dynamic equation for public human capital formation from government current spending on education/health services was specified along the same lines as for government investment spending and public capital. Output elasticity for human capital is calibrated to be somewhat higher than the elasticity for public capital based on various empirical studies (for example, European Commission (2003)). However, this spending accumulates net human capital more slowly than public physical capital, which still continues to enhance private sector productivity. Kumhof and Laxton (2007), Straub and Tchakarov (2007) and In't Veld (2007) have also introduced productivities current government spending into DSGE models. Qualitatively, this introduction produces similar results as the introduction of productive public physical capital. Thus, at this stage, this approach serves primarily as an essential reminder of the importance of government current spending, avoiding an artificial characterization of government investment as productive and current spending as unproductive, albeit possibly utility-enhancing. This distinction would allow in the future to treat government spending on education/healthcare as a labor-augmenting and government spending on infrastructure as capital-augmenting. Such treatments would add an instrument to the policy toolkit.

The differential effects of productive government spending and a pure government consumption spending is explained by private wealth effects stimulating private consumption of OLG households. When public consumption is increased on a permanent basis, OLG households recognized that the intertemporal government budget constraint means that taxes will need to be raised in the future, increasing the net value of tax liabilities and reducing net wealth. On the other hand, when productive government spending is increased on a

permanent basis, the productivity of the private sector is increased, rising output. The present value of this higher output path adds to wealth net of increased tax liabilities, if the productivity elasticity is sufficiently high. The private sector supply-response associated in with higher public capital will tend to lessen pressures on prices and given a nominal interest rate set based on area wide considerations, real interest rate variability will decline.

To introduce an explicit role for government in the economy other than demand management, it is assumed that government goods and services enter into the household utility function in an additive and separable manner from privately supplied goods and services. This treatment of the household utility function is consistent with previous studies (see Barro (1990), Baxter and King (1993), Ganelli and Tervala (2007)). This treatment implies that current government spending is not wasteful. Instead it is utility enhancing, providing a obvious justification for such government spending within the model. Furthermore at the previously calibrated steady state, it is assumed that the households' marginal utilities are equal at the existing ratios to GDP of government consumption spending and private consumption spending.<sup>18</sup> Government spending on education/healthcare is assumed not to be consumed, but it continues to be treated as an investment in public human capital. (This treatment of education/healthcare is made to simplify the analysis and is not intended to deny the consumption or utility enhancing characteristics of either.) The government supplies public goods and services only in kind, expanding the households' budget constraints in a nonfungible manner. As a consequence, the households' solution to their utility maximization problem is not affected, including the labor-leisure trade off and intertemporal choices. The political-economy of the budget process determines the desired composition of government spending, including assessing the ramifications for income distribution and social welfare. The level and composition of government spending and taxes are therefore given exogenously to the model.

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<sup>18</sup> One could assume that households' marginal utility of government consumption goods is higher/lower than the marginal utility of private consumption goods and calibrate the slopes of those marginal utility curves. Using a search algorithm over this utility calibration, the "optimal" split between government and private consumption could be determined by the model. This approach reveals in a quantitative form the otherwise implicit preferences of the modeler/decision-maker.

Endogenous determination—optimization—of government spending and taxes is left for future research. This optimization problem could be further enriched by moving from a composite government good to disaggregate consumption goods with differentiated utility gains; making government-produced goods substitutes for privately-produced goods in the household utility function; and introducing cash government transfers, allowing households to maximize their utility by shifting between public and private goods. Even without these extensions, the present model can provide some insights into choices between government consumption spending and government spending on education/healthcare and investment.

Using the GIMF's calibrations, intertemporal tradeoffs can be analyzed, particularly the choice between less consumption of government goods and services now, which would reduce household utility, and investment in public human capital and infrastructure, which would increase private output in the future, rising household utility. This choice depends crucially upon the rate of return of these government investments, the marginal utility of consumption of government goods, and the households' discount rate; Ganelli and Tervala (2007) reach a similar conclusion using a different model. Moreover, the government could decide to increase government consumption goods financing the increase by the higher spending by distortionary taxes, which would reduce labor supply or private investment, or debt creation, which would rise real interest rates, crowding out private investment. Households would gain by consuming more government goods initially but at a cost of less private sector goods either now or in the future. If the rate of return on public investment was higher than on private investment, it could make sense to tax private capital to finance higher public investment. Deficit-financing of higher public investment provides another option to reducing government current expenditure. These results are very similar because firms are Ricardian in assessing the future tax liabilities unlike households.

Simulations show that the output response to a permanent increase in productive government spending of 1 percentage point of GDP would lift output by over 5 percent in the long run. This outcome contrasts with the unchanged long run impact of government spending when it has no productive effect on the private sector. This result appears robust to changes in how

that increase in productive government spending is financed—lower consumption spending, higher corporate taxes, or a wider deficit. A lower output elasticity for government productive spending would dampen the long-run output response but does not change these qualitative conclusions. Do these results imply that governments are under spending on productivity enhancing programs? Possibly but not necessarily. A complete answer depends on households' marginal utility of consumption from goods and services provided by the government and private sectors as well as the households' discount rate, myopia, risk aversion, and life spans. The government may also have a longer time horizon than households and risk tolerance.

Turning from spending to production, it is assumed that the government produces two outputs—a consumption good ( $s^1$ ) and education/health services ( $s^2$ ). Both government outputs can be provided through a single government production function, which utilizes labor that is purchased from unions, competing directly with private firms.<sup>19</sup> The labor force which is always fully employed in DGSE models, is divided between those employed by the private sector and the public sector. Households are assumed to be indifferent between working for the government or the private sector and households are assumed to have the same labor-leisure preference as previously—the Frisch elasticity of labor supply is unchanged. This implies that the government must pay households the same wage rate as the private sector. The government's demand for labor depends on the scale of its production and the labor intensity of production.

Data on government production of goods and services is not readily available. From the national income accounts, data on government spending for goods and services, which excludes transfers, was obtained as a proxy. Under the assumption that the government produces all or a fixed share of government consumption spending, a very rough calibration is possible. As is well known, considerable cross-country variation exists in the size of

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<sup>19</sup> At the cost of considerable complication, public investment could be dedicated to accumulating public capital (e.g., infrastructure) that benefits the private sector and separately public capital that is utilized by the government (e.g., schools, hospitals).

government based on expenditures, although once transfers for social programs (e.g., pensions, social safety nets) are excluded, cross-country differences in the share of public consumption expenditure in GDP are narrowed but eliminated. The lowest ratios for 2006 are found in Hungary, Ireland and the United States and the highest ratios in Denmark, the Netherlands, and Sweden (Table 1). For the New Member States, these 2006 ratios were on average lower by about 3½ percentage points than in the unweighted average for the other European countries. (Excluding Hungary, which is an outlier, the difference would be about 2¼ percentage points.) Over the period, these spending ratios have tended to move lower among the New Member States, while for other countries in this sample, including Canada and the United States, these ratios have tended to be stable on average.

Turning to government employment, statistics exist for general government but this data does not permit a further functional disaggregation. Government employment data can be a significant share of total employment. This share has varied widely across selected countries during 2000-2006 (Table 2). The period average lows were found in United States (14.2 percent), Italy (15.1 percent) and Spain (15.6 percent), while the period average highs were in Denmark (36.8 percent), Sweden (34.8 percent), and Finland (32.3 percent). Turning to New Member States, their unweighted period average was slightly about 30 percent, but this average masks a wide range and a generalized decline over the period albeit to different degrees. Over the period 2000-2006, the largest declines in government employment shares was observed in Slovak Republic (9 percentage points) and the Baltic countries (about 7½ percentage points); modest declines (on the order of slightly more than 1 percentage

Table 1. Public Consumption Expenditure in Constant Prices  
(In percent of GDP)

Country	Year						
	2000	2001	2002	2003	2004	2005	2006
<b>Europe – EU Members</b>							
Denmark	25.1	25.5	25.9	26.0	25.9	25.3	24.9
Finland	20.3	20.0	20.2	20.2	19.8	19.6	18.8
France	22.9	22.7	22.9	23.1	23.1	22.9	22.8
Germany	19.0	18.9	19.1	19.3	18.8	18.7	18.4
Greece	15.7	15.1	15.5	14.6	14.3	13.7	13.6
Ireland	14.6	15.2	15.3	14.8	14.4	14.2	14.1
Italy	18.4	18.8	19.1	19.5	19.6	19.9	19.4
Luxembourg	15.1	15.6	15.7	16.2	16.1	16.2	15.6
Netherlands	22.0	22.5	23.3	23.9	23.3	23.0	24.4
Portugal	19.3	19.6	19.9	20.1	20.3	20.7	20.3
Spain	17.4	17.4	17.8	18.0	18.6	18.9	19.1
Sweden	26.3	26.3	26.4	26.1	25.2	24.5	24.0
U.K.	20.4	20.4	20.7	20.8	20.8	21.0	20.8
<b>New Member States</b>							
Czech Republic	21.1	21.3	22.3	23.1	21.4	20.5	19.5
Estonia	21.0	20.2	19.3	18.2	17.3	16.2	15.1
Hungary	10.1	9.8	9.9	10.0	9.5	9.1	8.8
Latvia	20.8	19.8	19.0	18.0	17.0	15.7	14.6
Lithuania	21.3	20.5	19.5	18.4	18.4	18.0	17.9
Poland	17.4	17.7	17.7	17.8	17.5	17.7	17.4
Slovak Republic	20.9	21.1	21.4	21.3	20.9	19.5	18.7
Slovenia	18.2	18.3	18.3	18.1	17.9	17.7	17.5
<b>Other Countries</b>							
Canada	19.2	19.6	19.5	19.7	19.6	19.4	19.5
U.S.	14.4	14.8	15.2	15.2	14.9	14.5	14.3

Source: *World Economic Outlook (WEO)*.

Table 2. Government Employment in Selected Industrial Countries  
(In percent of total employment)

Country	Year						
	2000	2001	2002	2003	2004	2005	2006
<b>Europe – EU Members</b>							
Denmark	37.3	36.7	36.9	36.6	36.9	36.9	36.4
Finland	31.4	31.7	32.0	32.4	33.0	32.9	32.8
France	22.3	22.1	22.3	22.5	22.6	22.6	22.7
Germany	26.9	26.9	27.3	27.6	27.5	27.8	27.8
Greece	21.1	21.0	21.3	21.5	23.0	22.0	22.6
Ireland	19.0	19.6	19.8	19.7	19.5	18.8	18.4
Italy	15.5	15.4	15.3	15.1	14.9	14.9	14.7
Luxembourg	11.4	11.0	10.9	11.0	11.0	10.9	...
Netherlands	25.1	26.1	26.6	27.5	27.3	27.3	27.3
Portugal	22.5	22.9	23.6	24.1	25.0	25.7	25.6
Spain	15.7	15.5	15.4	15.6	15.6	15.5	15.6
Sweden	35.7	34.6	35.1	35.2	35.0	34.8	34.4
U.K.	19.2	19.4	19.7	20.0	20.3	20.4	20.1
<b>New Member States</b>							
Czech Republic	22.8	22.0	21.7	21.6	21.6	...	...
Estonia	34.0	32.0	30.0	29.0	29.0	27.0	27.0
Hungary	30.8	30.8	31.2	31.5	31.4	...	...
Latvia	41.6	40.0	39.5	38.4	36.3	35.1	33.9
Lithuania	34.0	33.5	30.1	28.1	27.9	27.7	26.3
Poland	34.4	32.0	32.5	32.2	30.5	29.9	29.4
Slovakia	33.2	31.5	29.4	27.3	26.2	24.6	24.1
Slovenia	30.5	30.5	30.3	31.3	31.2	30.8	29.4
<b>Other Industrial Countries</b>							
Canada	19.0	19.0	19.0	18.9	19.1	19.3	19.4
U.S.	14.1	14.1	14.4	14.3	14.3	14.4	14.1

Sources: National statistical websites and LABORSTA (ILO).

point) were recorded in Slovenia and the Czech Republic.<sup>20</sup> The largest increase in the share of government employment was seen in Portugal (slightly over 3 percentage points). This data shows that significant shifts in employment shares can take place over short time span. Thus, changes in government employment can materially add or subtract from the pool of labor available to the private sector, opening a supply-side impact to go along with the traditional aggregate demand impact. This supply-side impact can be viewed as a technology shock to the firms' production function or as shock to the economy's labor endowment.

If the government reduces production of consumption goods (say to finance more productive spending), it will release government labor into the private sector work force. The labor force is assumed homogenous across sectors and firms and labor market adjustment costs/rigidities are the identical for all workers regardless of past employers. The influx of labor available for the private sector production will increase output in the short-run even with a fixed capital stock. For a CES production function, the input intensity parameter and the elasticity of substitution ( $\sigma$ ) determine the output response; assuming an elasticity of substitution equal to one or above implies that marginal product of labor will not approach zero as labor increases.<sup>21</sup> At the same time, the marginal product of capital will increase, increasing the incentive for firms to invest and for OLG households to save. As a result, the private-output response will be greater than when government labor is not released to the private sector.

To isolate this labor-shedding channel, we have only stimulated the deficit-neutral case—wherein a reduction in government consumption spending releases labor to the private sector, while at the same time a corresponding increase in government spending occurs that enhances the productivity of private sector capital. The output response path is shown in

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<sup>20</sup> Elsewhere, government employment shares during this period exhibited mixed trends. Canada, Finland, France, Germany, Greece, the Netherlands, Portugal, and the United Kingdom ended the period with a higher share than they began the period. Denmark, Ireland, Italy, and Sweden had lower shares in 2006 than in 2000. Spain and the United States exhibited no trend over this period.

<sup>21</sup> For a Cobb-Douglas production function ( $\sigma = 0$ ), the marginal product of labor is always positive but it will decrease monotonically to zero. A Cobb-Douglas production function results in constant labor/capital shares. In the steady state, GIMF is calibrated to achieve specified labor/capital shares but these shares can be allowed to move in the short run consistent with CES production functions.



Figure 6, while the implications for other key macroeconomic variables is presented in Figure 7. Real output in the long run is above  $\frac{1}{2}$  percentage point higher with government labor shedding than without it, although the shorter run gains can be larger—at roughly 1 percentage point. The channels through which the increased labor supply to the private sector affects this economy are several. One, the marginal productivity of private capital is higher owing to greater availability of labor to firms at unchanged real wage. The unchanged equilibrium real wage stems from the assumption that workers in the government or private sector are paid their marginal product and households have no (risk) preference for working in one sector or the other. Consequently, the private investment responds faster in the near term with government labor shedding than without. With the stronger output response with government labor shedding, inflation is moderated by slightly more than  $\frac{1}{2}$  percentage point, lifting real interest rates commensurately in light of the assumed fixed nominal interest rate. Lower real interest rates will contribute to higher private investment and increased consumption by OG households along with the wealth effects. Liquidity-constrained households will not raise their consumption because their real wages (income) remain basically unchanged compared with the scenario with no labor shedding by the government.

Private output trends do not necessarily correspond to welfare developments. Lower output for government consumption goods will reduce household utility even as higher private output of consumption goods increases household utility. The net impact on welfare depends on the marginal utilities associated with consumption of the private and public goods and the marginal productivities of labor in the two sectors. If as commonly assumed labor is more productive in the private sector than in the public sector,<sup>22</sup> lower government production of its consumption good is welfare enhancing unless the government consumption good has a sufficiently higher marginal utility for households than private goods.

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<sup>22</sup> Data on real GDP (less government consumption) divided by private employment compared to public consumption divided by public employment support this conjecture for some countries but not for others. However, the shortcomings with this simple measure and the data do not allow this question to be settled.

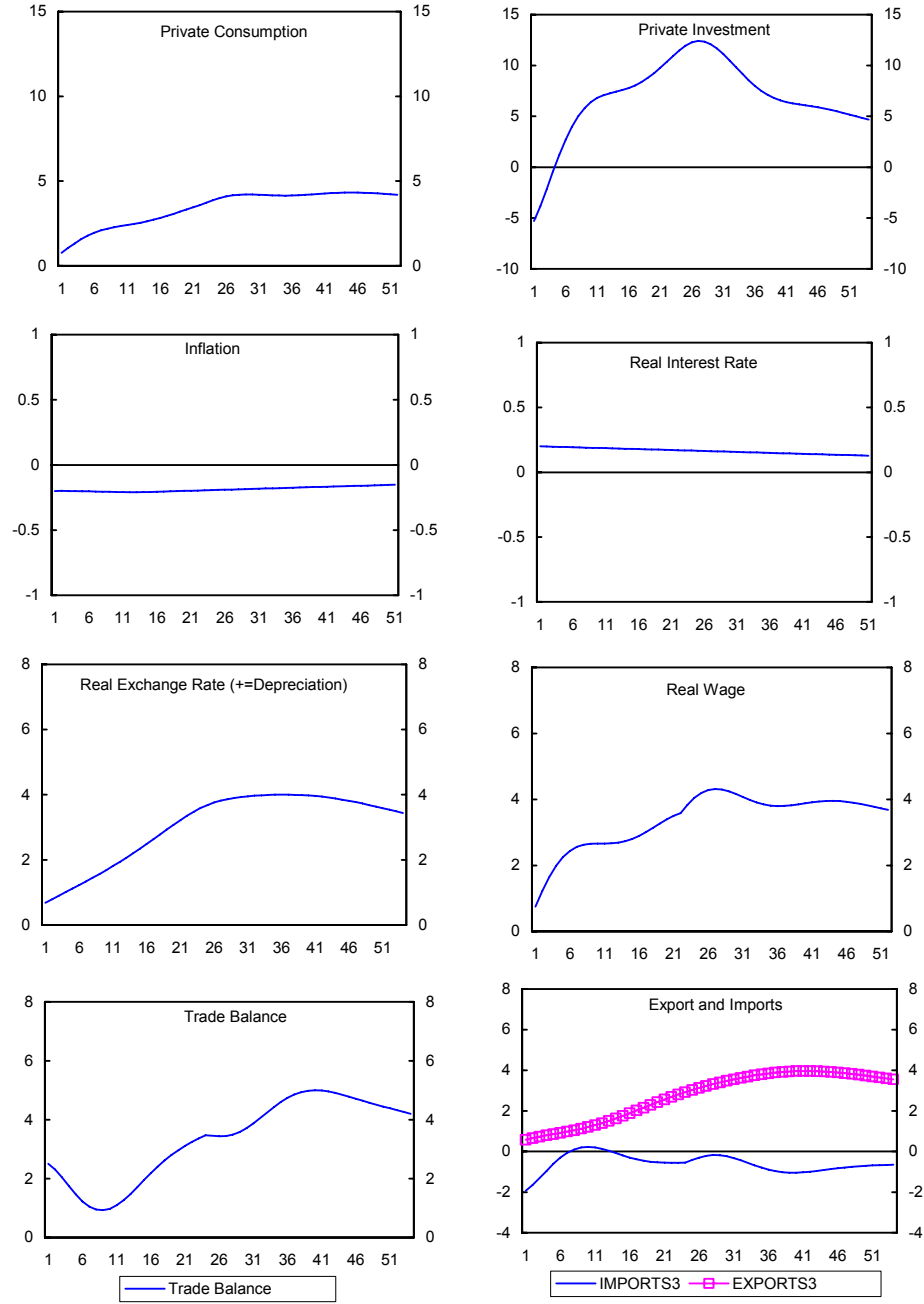
Figure 6. Output Response to Permanent Government Investment with/without Government Labor Shedding  
(percent deviation from baseline)



#### IV. CONCLUSIONS

In this paper, the role of government in the economy has been examined within a DSGE approach, in particular the Fund's Global Integrated Monetary and Fiscal (GIMF) Model, which was calibrated for a small Euro-area economy or small EU member with a pegged exchange rate. This calibration was not intended to formulate policy advice for specific EU members but to illustrate that the influence of fiscal policy can extend beyond demand management. The composition of government spending can be important for household utility, for private sector productivity, and for labor availability to the private sector. Governments therefore need to confront several tradeoffs when deciding the composition of public spending (and taxes) even if the deficit is not changed. This framework can also provide a quantitative tool to examine the optimal size of government—the split between consumption goods provided by the government and by the private sector. These decisions

Figure 7  
 Response of Key Macroeconomic Variables to  
 Permanent Government Investment Increase 1/  
 (percent deviation from baseline)



1/ Deficit financed with productive government spending financed by lower government consumption with labor shedding.

have an intertemporal dimension in part owing to the choice between supplying government consumption goods now or investing to enhance the productivity of the private sector, which permits higher future consumption. In addition, the government can borrow (equivalent to taxing future households) to finance current consumption by households or government spending to enhance private sector productivity. In a world with distortionary taxes and nominal and real rigidities, it is no easy task for policy makers to find a solution that maximizes social welfare even without uncertainty about calibrations!

Nonetheless, this analysis demonstrates that the composition of productive public spending can have significant implications for the economy and social welfare in the long run; this contrasts with the unchanged long-run impact of government spending when it has no productive effect on the private sector. Based on the calibrations employed, the impact of permanently higher productive government spending dominates considerations of how it is financed—lower consumption spending, higher corporate taxes, or a wider deficit—so long as fiscal sustainability is preserved. Does this conclusion imply that governments are under spending on productivity enhancing programs? Not necessarily. A complete answer depends on households' marginal utility of consumption from goods and services provided by the government and private sectors as well as the households' discount rate, myopia, risk aversion, and life spans. The government may also have a longer time horizon than households and risk tolerance. Income distribution considerations, including social safety nets, which have not played a role in the present analysis, are important elements in budget deliberations.

A key message from this analysis is that while traditional macroeconomic stabilization objectives remain a central element of fiscal policy, the allocative (and distributional) aspects can be studied using a DSGE approach. For countries whose only macroeconomic tool is fiscal policy, the size and composition of government spending can provide important channels for improving economic performance and social welfare.

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