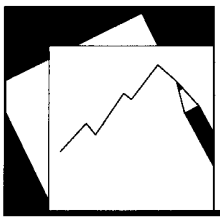
WP/10/163



# IMF Working Paper

# Budget Consolidation: Short-Term Pain and Long-Term Gain

*Kevin Clinton, Michael Kumhof,*
*Douglas Laxton and Susanna Mursula*

INTERNATIONAL MONETARY FUND

 WP/10/163

**IMF Working Paper**

Research Department

# Budget Consolidation: Short-Term Pain and Long-Term Gain

**Prepared by Kevin Clinton, Michael Kumhof, Douglas Laxton and Susanna Mursula**

July 2010

## Abstract



The paper evaluates the costs and benefits of fiscal consolidation using simulations based on the IMFs global DSGE model GIMF. Over the longer run, well-targeted permanent reductions in budget deficits lead to a considerable increase in both the growth rate and the level of output. The gains may be enhanced by shifting some of the tax burden from incomes to consumption. In the short run, credibility plays a crucial role in determining the size of initial output loses. Global current account imbalances would be significantly reduced if budget consolidation was larger in countries with current account deficits.

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

Keywords: Fiscal consolidation; current account imbalances; tax reform.

Author's E-Mail Address: kclinton@rogers.com; mkumhof@imf.org; dlaxton@imf.org; smursula@imf.org

# Contents

# I. INTRODUCTION

An aggressive fiscal expansion in 2009-10 helped to stabilize the global economy in the face of the intense contractionary pressures triggered by the bursting of real estate bubbles, the related financial crises, and a sharp tightening of credit. Stronger-than-anticipated growth in output since mid-2009 suggests that the fiscal stimulus may have been at least as effective as typical model-based estimates of the short-run multiplier effect had suggested.[2] At mid-2010, with private-sector demand picking up, control of budget deficits must now move to the front of the policy agenda. Government finances in many countries were in need of consolidation even before the steep increase in deficits caused by the response to the recession, and by bailouts of ailing financial institutions and other firms. The recent growth rates of public debt, including contingent liabilities, widely exceed that of output, and there are concerns that budget deficits on the current scale will not be sustainable over time. Even if technically sustainable over the medium term, the growth in debt has negative implications for the ability of fiscal policy to stabilize the business cycle, and for longer-run economic growth.

The rationale for budget consolidation has two main aspects. The first is to create room for maneuver, or "fiscal space", by making fiscal deficits more sustainable.[3] This would provide insurance against future shocks, by maintaining the ability of fiscal policy to respond in a countercyclical fashion when the next recession arrives. The second aspect is to provide a foundation for stronger, more balanced, growth over the longer term. Deficit reduction in the major economies, by increasing the supply of world savings, would lower the equilibrium world real interest rate. It would also enable distortionary taxes to be lowered in the longer run, especially if it is accompanied by a switch to less distortionary forms of taxation. Both would have positive longer-run effects on investment and growth. Furthermore, the more quickly the credibility of a well-designed deficit reduction policy is established, the smaller would be any negative short-run impact on the level of economic activity.

Deficit reduction generally involves changes to multiple items on both the revenue and spending sides. Each policy variable has different effects on the level of investment, household wealth, labor supply, the current account deficit, etc. The heightened risk of a prolonged period of slow growth in the aftermath of the financial crisis and recession strengthens the case for a growth-friendly mix of deficit-reduction. Moreover, the existence of large, chronic, current account imbalances suggests a need for larger fiscal consolidation measures in countries with external deficits.

---

[2]Chapter 1 of the April 2010 *World Economic Outlook* describes recent output performance. Freedman and others (2010) provide estimates of multipliers under a wide range of assumptions.

[3]Reduced fiscal space has already had material consequences. In 2009, high government deficit and debt ratios prevented some smaller economies from enacting fiscal stimulus–e.g. the emerging Eastern European economies.

This paper addresses these issues quantitatively, using the IMF's global DSGE model, GIMF (Global Integrated Monetary and Fiscal Model). Section II describes the model. Section III describes a stylized set of deficit reduction policies, and summarizes the simulated effects on macroeconomic variables. Section IV presents our conclusions.

## II. THE MODEL

We keep the model description brief to conserve space. An full description of the theoretical model and its calibration can be found in the Technical Appendix accompanying this paper.

### A. Overview

GIMF is a DSGE model of the world economy[4], with a flexible regional decomposition into up to six regions. For this paper we define 6 regions, the United States (US), Japan (JA), Germany (DE), the euro area excluding Germany (EX), emerging Asia (AS) and remaining countries (RC).[5] Time units represent years. Our exposition of agents' behavior is at the level of an individual region, with variables pertaining to the rest of the world denoted by a superscript asterisk.

Households consume retailed output. They are divided into 2 groups. First, *liquidity-constrained* ($LIQ$) households consume their entire after-tax income each year.[6] Second, *overlapping generations* ($OLG$) households maximize utility subject to an intertemporal budget constraint, but they have finite planning horizons.[7] The consumption of this group is a function of the present discounted value of future income streams, but discounting takes place at a higher rate than the market interest rate, due to a combination of finite planning horizons and lifecycle income effects. Households of both types are subject to uniform taxes on labor income and consumption, as well as several kinds of government lump-sum taxes and lump-sum transfers. Both liquidity constraints and finite planning horizons imply that fiscal policy has non-Ricardian effects. The main effect of liquidity constraints is to dramatically increase the short-run multipliers of tax- or transfer-based stimulus measures, while the main effect of finite planning horizons is to make higher

[4] A complete description of the model can be found in Kumhof, Laxton, Muir and Mursula (2009).

[5] AS comprises China, Hong Kong S.A.R. of China, India, Indonesia, Korea, Malaysia, Philippines, Singapore, and Thailand.

[6] We follow Galí, López-Salido and Vallés (2007) in referring to these households as liquidity-constrained. Other terms used in the literature are rule-of-thumb or hand-to-mouth agents.

[7] This follows Blanchard (1985) and Weil (1989).

government debt more contractionary by increasing long-run crowding-out effects, due to higher real interest rates.

The short- and long-run effects of fiscal policy in GIMF depend on the precise mix of fiscal instruments, and may differ from those of simpler Keynesian models. For example, taxes on labor and capital income have larger negative marginal effects on output than taxes on consumption. This means that a deficit-neutral switch from income to consumption taxes raises output.

The firm and union sectors are multi-layered to capture important aspects of domestic production such as the presence of both tradable and nontradable goods, and also to capture important aspects of international trade such as imports at both the intermediate and final goods levels. Firms and unions face nominal rigidities in price and wage setting, and real rigidities in investment, retail sales and imports. Their production functions and optimality conditions are largely standard. The financial sector in each region features a financial accelerator mechanism whereby entrepreneurs, who provide capital to manufacturers, borrow from banks.

Asset markets are incomplete. There is no traded equity, instead households receive lump-sum dividend payments. Government debt takes the form of one-period bonds denominated in domestic currency. Banks offer households one-period domestic currency fixed-term deposits, their source of funds for loans to entrepreneurs. These financial assets are not tradable across borders. Optimizing households may, however, issue or purchase internationally tradable U.S.-dollar denominated obligations. Banks pay a fixed market rate of return on deposits, and charge a risk premium on loans. Country risk premia enter into the uncovered interest parity condition.

In our derivations, per capita variables are only considered at the level of disaggregated households. When the model's real aggregate variables, say $x_t$, are rescaled, we divide by the level of technology and by population to obtain $\check{x}_t$, with the steady state of $\check{x}_t$ denoted by $\bar{x}$.

## B. Households

### B.1 Overlapping-Generations Households

The share of these households in the population is $1-\psi$. Every year $Nn^t(1-\psi)\left(1-\frac{\theta}{n}\right)$ of such individuals are born, where $N$ is absolute population size in period $0$ and $n$ is the population growth rate. Each faces a constant probability of death $(1-\theta)$ in a given year, which implies an average planning horizon of $1/(1-\theta)$ years. Households' labor productivity declines at a constant rate $\chi < 1$ over their working life. A representative $OLG$ household of age $a$ derives utility at time $t$ from consumption $c_{a,t}^{OLG}$ relative to the

consumption habit $h_{a,t}^{OLG}$, and from leisure $(1-\ell_{a,t}^{OLG})$–the time endowment is set at one. Expected utility has the form

$$\sum_{s=0}^{\infty}(\beta\theta)^s\left[\frac{1}{1-\gamma}\left(\left(\frac{c_{a+s,t+s}^{OLG}}{h_{a+s,t+s}^{OLG}}\right)^{\eta^{OLG}}\left(1-\ell_{a+s,t+s}^{OLG}\right)^{1-\eta^{OLG}}\right)^{1-\gamma}\right], \tag{1}$$

where $\beta$ is the discount factor, $\gamma>0$ is the coefficient of relative risk aversion, and $0<\eta^{OLG}<1$. Consumption $c_{a,t}^{OLG}$ is given by a Dixit-Stiglitz combination of retailed consumption goods, $c_{a,t}^{OLG}(i)$, with a constant elasticity of substitution equal to $\sigma_R$. The consumption habit is given by lagged average per capita consumption.

Household savings in financial assets consist of domestic currency bonds issued by the domestic government, fixed-term deposits at domestic banks, and foreign bonds denominated in U.S. dollars. The outstanding stock of government bonds is $B_{a,t}$, the stock of deposits is equal to $B_{a,t}^N+B_{a,t}^T$[8], and the home currency value of the stock of U.S. dollar bonds is $\mathcal{E}_tF_{a,t}$, where $\mathcal{E}_t$ is the nominal exchange rate vis-a-vis the U.S.-dollar. Participation by households in financial markets requires that they enter into a contract under which the insurer pays a premium of $\frac{(1-\theta)}{\theta}$ on a household's financial wealth for each period in which that household is alive. At death, the household leaves its entire financial wealth to the insurer, which distributes it to surviving households.[9]

$OLG$ household pre-tax labor income is $W_t\Phi_{a,t}\ell_{a,t}$, where $W_t$ is the nominal wage. Productivity of labor declines throughout each household's lifetime, with productivity $\Phi_{a,t}$ of age group $a$ given by $\Phi_{a,t}=\Phi_a=\kappa\chi^a$, where $\chi<1$. $OLG$ households also receive lump-sum remuneration for their services in the bankruptcy monitoring of entrepreneurs, $P_trbr_{a,t}$. The lump-sum after-tax dividend income received from firm $i$ in sector $j$ is denoted by $D_{a,t}^j(i)$.

Labor income is taxed at the rate $\tau_{L,t}$ and consumption at the rate $\tau_{c,t}$. In addition, there are lump-sum taxes $\tau_{a,t}^{ls,OLG}$, and government transfers $\Upsilon_{a,t}^{OLG}$. The consumption tax $\tau_{c,t}$ is payable on the price $P_t$ at which retailers purchase final consumption goods from distributors. Sales by retailers are conducted at the price $P_t^R$.

Letting the index $j$ run over the different firm and union sectors of the model, the $OLG$ household budget constraint, in nominal terms, is given by

---

[8]Because banks are assumed to have zero net worth, this equals the value of their loans to nontradables and tradables proucers.

[9]We assume that turnover in the population is large enough that the receipts of the insurers exactly equal their payouts.

$$P_t^R c_{a,t}^{OLG} + P_t c_{a,t}^{OLG} \tau_{c,t} + P_t \tau_{a,t}^{ls,OLG} + B_{a,t} + B_{a,t}^N + B_{a,t}^T + \mathcal{E}_t F_{a,t} \tag{2}$$

$$= \frac{1}{\theta}\left[i_{t-1}\left(B_{a-1,t-1} + B_{a-1,t-1}^N + B_{a-1,t-1}^T\right) + i_{t-1}^* \mathcal{E}_t F_{a-1,t-1}\left(1 + \xi_{t-1}^f\right)\right]$$

$$+ W_t \Phi_{a,t} \ell_{a,t}^{OLG}(1 - \tau_{L,t}) + \sum_j \int_0^1 D_{a,t}^j(i)di + P_t rbr_{a,t} + P_t \Upsilon_{a,t}^{OLG} \,,$$

where $i_t$ is the nominal domestic interest rate, $i_t^*$ is the nominal foreign interest rate, and $\xi_t^f$ is a foreign exchange risk premium.

$OLG$ households maximize (1) subject to (2). Aggregation over the resulting optimality conditions takes account of the initial size of each age cohort, and the remaining size of each generation. The condition for optimal consumption is a function of real aggregate financial wealth $fw_t$, and non-financial wealth $hw_t^L + hw_t^K$, with a marginal propensity to consume out of wealth that depends on the time paths of real interest rates and consumption tax rates. The term $hw_t^L$ represents human wealth, or the present discounted value of household time endowments valued at the after-tax real wage, while $hw_t^K$ represents the present discounted value of dividend income net of government lump-sum transfers and taxes. This condition implies that the time profile of tax changes affects the time profile of consumption, and that in the long run government debt crowds out private capital and net foreign assets.

A fiscal stimulus through initially lower taxes, accompanied by a permanent increase in debt, represents a tilting of the tax payment profile from the near future to the more distant future. The present discounted value of the government's future primary deficits has to remain equal to the current debt $b_{t-1}/\pi_t$ when future deficits are discounted at the real market interest rate, $r_t$. But for households the same tilting of the tax profile represents an increase in human wealth because an increasing share of future taxes becomes payable beyond the household's planning horizon. This perceived increase in human wealth leads to an increase in current consumption. But in the longer run the additional government debt, which is perceived as net wealth, reduces the supply of savings and thereby crowds out other forms of investment. First, lower world savings raise the world real interest rate and thereby reduce investment in physical capital. And second, non-Ricardian household behavior means that lower government saving (higher deficits) is not offset one-for-one by higher private saving, which means that current account deficits increase and investment in net foreign assets falls.

The intertemporal elasticity of substitution $1/\gamma$, for the conventional assumption of $\gamma > 1$, implies that the income effect of an increase in the real interest rate is stronger than the substitution effect and increases the marginal propensity to consume out of wealth. This partly offsets the contractionary effects of a higher real interest rate on human wealth. A larger $\gamma$ therefore requires larger interest rate changes to clear markets following fiscal shocks.

### B.2 Liquidity-Constrained Households and Aggregate Households

The objective function of liquidity-constrained ($LIQ$) households is assumed to be identical to that of $OLG$ households. These agents can consume at most their current income, which consists of their after tax wage income plus net government transfers. Their budget constraint is given by

$$c_t^{LIQ}(P_t^R + P_t\tau_{c,t}) = \ell_t^{LIQ}W_t(1-\tau_{L,t}) + P_t\Upsilon_t^{LIQ} - P_t\tau_t^{ls,LIQ} \ . \tag{3}$$

This group of households has a very high marginal propensity to consume out of income, so that fiscal multipliers of revenue based stimulus measures such as tax cuts and increases in transfers are particularly high whenever such agents have a high population share. Aggregate consumption and labor supply are given by $\check{C}_t = \check{c}_t^{OLG} + \check{c}_t^{LIQ}$ and $\check{L}_t = \check{\ell}_t^{OLG} + \check{\ell}_t^{LIQ}$.

## C. Firms

Firms and unions are managed in accordance with the preferences of their owners, $OLG$ households, and therefore also have finite planning horizons. Except for capital goods producers, entrepreneurs and retailers, they are monopolistically competitive and subject to nominal rigidities in price setting. Manufacturers produce differentiated tradable and nontradable goods, which they sell to domestic distributors and to foreign import agents. They hire labor, provided by households through a union sector, and rent capital services from entrepreneurs, who rent the stock of capital from capital goods producers, financed partly by borrowing from banks. Capital accumulation is subject to investment adjustment costs. Distributors combine public capital, which is provided free of charge, with manufacturing output, to supply retailers, investment goods producers and foreign import agents. Investment goods producers sell to capital goods producers. Retailers sell to households. Both use a combination of domestic and foreign inputs. Retailers face sales adjustment costs which, together with habit persistence in preferences, generate inertia in consumption dynamics. Import adjustment costs imply lags in the response of imports to changes in the real exchange rate.

## D. Financial Sector

The modeling of the bank and entrepreneur sectors is based on Bernanke and others (1999), and Christiano and others (2007). Entrepreneurs in the tradables and nontradables sectors purchase capital stocks from capital goods producers and rent them to manufacturers. Each entrepreneur finances his capital with a combination of net worth and bank loans. Loans are risky because the return on an entrepreneur's capital is subject to idiosyncratic risk. Entrepreneurs are risk-neutral, and this is reflected in a loan contract under which they bear all

aggregate risk. They maximize profits subject to a zero profit constraint. The contract specifies a state-contingent schedule of gross interest rates to be paid if productivity is above a cut-off level. Entrepreneurs below the cutoff go bankrupt, and cede their entire capital stock to the bank. The bank, however, can only recover a fraction of the fair value of this capital.

Banks profits are constrained to equal zero in each state of nature, in that the fixed rate paid to depositors is equal to the stochastic return from lending. This return includes interest receipts from surviving firms, plus the liquidation receipts from bankruptcies, minus monitoring costs. The external finance premium is the difference between the rate paid by entrepreneurs to banks, including the liquidation of the assets of bankrupt firms, and the rate paid by banks to depositors. Since banks make zero profits at all times, the difference between the net return to capital and the rate of interest on household deposits accrues to entrepreneurs. The latter pay regular dividends to households, and therefore do not accumulate retained earnings to the point that they no longer require bank loans. The external finance premium increases with the leverage ratio of borrowers. The nonlinear setup of GIMF generates an increasing marginal effect on the risk premium from shocks to net worth.

## E. Government

### E.1 Budget Constraint

Fiscal policy consists of a specification of consumption and investment spending $G_t = G_t^{cons} + G_t^{inv}$, lump-sum taxes $\tau_{ls,t} = \tau_t^{ls,OLG} + \tau_t^{ls,LIQ}$, lump-sum transfers $\Upsilon_t = \Upsilon_t^{OLG} + \Upsilon_t^{LIQ}$, and tax rates $\tau_{L,t}$, $\tau_{c,t}$ and $\tau_{k,t}$.

Government consumption spending is unproductive, while government investment spending augments a stock of publicly provided infrastructure capital that depreciates at the rate $\delta_G$. Tax revenue $\tau_t$ is endogenous and given by the sum of labor, consumption, capital and lump-sum taxes. The government budget constraint, presented here in real normalized form because this facilitates the following exposition, is given by

$$\check{b}_t = \frac{i_{t-1}}{\pi_t gn}\check{b}_{t-1} + \check{G}_t + \check{\Upsilon}_t - \check{\tau}_t = \frac{i_{t-1}}{\pi_t gn}\check{b}_{t-1} - \check{s}_t \quad , \tag{4}$$

where $\check{s}_t$ is the primary surplus.

### E.2 Fiscal Policy

A fiscal policy rule stabilizes deficits and the business cycle. First, it stabilizes the interest inclusive government deficit to GDP ratio $gd_t^{rat}$ at a long-run level $gdss^{rat}$, thereby ruling out default and fiscal dominance. Second, it stabilizes the business cycle by letting the deficit fall

with the output gap. We have

$$gd_t^{rat} = gdss_t^{rat} - d^{gdp} \ln\left(\frac{g\check{d}p_t}{g\check{d}p_{pot}}\right) \quad . \tag{5}$$

Here $gd_t^{rat}$ is given by

$$gd_t^{rat} = 100\frac{\frac{(i_{t-1}-1)\check{b}_{t-1}}{\pi_t gn} - \check{s}_t}{g\check{d}p_t} = 100\frac{\check{b}_t - \frac{\check{b}_{t-1}}{\pi_t gn}}{g\check{d}p_t} \quad , \tag{6}$$

and $gdss_t^{rat}$ is the long-run target (structural) government deficit to GDP ratio. Shocks to this target represent changes in government savings preferences. We denote the current value and the long-run target of the government debt to GDP ratio by $\check{b}_t^{rat}$ and $\check{b}ss_t^{rat}$. The relationship between $bss_t^{rat}$ and $gdss_t^{rat}$ follows directly from the government's budget constraint as

$$bss_t^{rat} = \frac{\bar{\pi} gn}{\bar{\pi} gn - 1} gdss_t^{rat} \ , \tag{7}$$

where $\bar{\pi}$ is the inflation target of the central bank. In other words, for a given trend nominal growth rate, choosing a deficit target $gdss_t^{rat}$ implies a debt target $\check{b}ss_t^{rat}$ and therefore keeps debt from exploding. We note that the implied long-run autoregressive coefficient on debt, at $1/\left(\bar{\pi} gn\right)$, is quite close to one.

The automatic stabilizer component of fiscal policy is captured by the coefficient $d^{gdp} \geq 0$.[10] Our model allows for permanent shocks to technology and to private saving, which have permanent effects on potential GDP due to the non-Ricardian features of the model. Potential output $g\check{d}p_{pot}$ is therefore modeled as a moving average of past actual values of GDP to allow for the gap to close over time.

The rule (5) is not an instrument rule but rather a targeting rule. Any of the available tax and spending instruments can be used to make sure the rule holds. The default setting in this paper is that this instrument is general transfers $\check{\Upsilon}_t$, meaning transfers that are not specifically targeted at one of the two household groups.

### E.3 Monetary Policy

Monetary policy uses an interest rate rule to stabilize consumer price inflation over time. The rule is similar to a conventional inflation forecast rule which responds to one-year-ahead inflation, but with the important exception that the equilibrium real interest rate needs to be formulated as a moving average, similar to potential output above.

[10] The OECD has produced estimates of $d^{gdp}$ for a number of countries. See Girouard and André (2005).

## F. Calibration

Here we discuss only the key parameters. The Technical Appendix contains a complete list. The real per capita growth rate is 1.5 percent, the world population growth rate is 1 percent, and the long-run real interest rate is 3 percent. Household utility functions are the same across countries. The intertemporal elasticity of substitution is $0.25$ ($\gamma = 4$), and the wage elasticity of labor supply is $0.5$. Parameters $\psi$, $\theta$ and $\chi$ are critical for the non-Ricardian behavior of the model. The shares of liquidity-constrained agents are 25 percent in US, JA, DE and EX, and 50 percent in AS, to reflect the less developed financial markets in the latter region. The average remaining time at work is 20 years ($\chi = 0.95$). The planning horizon is also equal to 20 years ($\theta = 0.95$). The main criterion used in choosing $\theta$ and $\chi$ is the empirical evidence of Laubach (2003), Engen and Hubbard (2004) and Gale and Orszag (2004) on the effect of government debt on real interest rates. They find that a one percentage point increase in the government debt to GDP ratio in the U.S. leads to an approximately one to 6 basis points long-run increase in the U.S. real interest rate. Our calibration for $\theta$ and $\chi$ implies an effect at the lower end of that range, about one basis point. This implies, in turn, that our estimates of the long-run crowding-out effect of higher fiscal deficit are conservative.

Elasticities of substitution between capital and labor equal $1$, between domestic and foreign goods $0.75$, and between tradables and nontradables $0.5$. Steady-state gross markups equal $1.1$ in manufacturing and wage setting, $1.05$ in retailing, investment and consumption goods production, and $1.025$ for import agents. Steady-state GDP decompositions, the matrix of bilateral trade flows, and debt ratios are based on recent historical averages. For the public capital stock accumulation we adopt Kamps' (2004) 4 percent per year estimate of $\delta_G$. Ligthart and Suárez (2005) estimate the elasticity of aggregate output with respect to public capital at 0.14. This is incorporated into GIMF through the productivity of public capital in the distribution sector. Calibration of the financial accelerator sector is based on Bernanke and others (1999) and Christiano and others (2009). We fix two key ratios. First, leverage, the ratio of corporate debt to corporate equity, equals $100$ percent in all sectors and regions. Second, the steady-state external finance premium equals $2.5$ percent.

For fiscal rule parameters, the calibration assumes target deficit to GDP ratios consistent with historically observed ratios. We use OECD estimates for the output gap coefficients $d^{gdp}$, which capture the automatic stabilizer effect. We estimate the region-specific values for monetary rule parameters based on annual data.

# III. Fiscal Consolidation, Growth and External Imbalances

## A. Scenarios

In many economies around the world the need for medium-term fiscal consolidation and current account rebalancing is now acknowledged. The stylized scenarios below explore the consequences of a fiscal consolidation for both growth and current account imbalances. We assume that the consolidation is worldwide, but with its size differentiated by region to reflect different urgencies of reducing government debt to more prudent levels. For many economies consolidation will have to be large in size, but for expositional purposes we standardize the deficit reduction to 1 percent of pre-consolidation GDP for the largest assumed programs, the United States and Japan. Implementation is assumed to be gradual over a period of four years, to reflect the fact that a dramatic immediate fiscal contraction at the present juncture may unnecessarily endanger a still fragile recovery. Both the size of the deficit reduction and the size of its individual components are scaled down by factors between 0 and 1 for the four remaining regions, specifically 0.83 for the euro area excluding Germany, 0.33 for Germany and the group of remaining countries, and zero for emerging Asia.

We divide our policy experiments into two parts, a pure fiscal consolidation and a fiscal consolidation accompanied by a growth-supporting tax reform. We describe the two fiscal packages below for the United States and Japan, and note that the above mentioned factors are applied to all individual components of those packages for the remaining regions.

Fiscal consolidation is accomplished by a permanent cut in general transfers equal to 0.5 percent of pre-consolidation GDP, and a permanent cut in government consumption equal to 0.33 percent of pre-consolidation GDP. To maintain the interest-inclusive government deficit at the targeted improvement of 1 percent of pre-consolidation GDP, labor and capital income taxes are adjusted, by equal amounts in terms of percentage point changes in their tax rates, as the economy adjusts to lower deficits. For the short run this means that income taxes have to increase slightly, because initially the reduction in the primary deficit has to equal the reduction in the overall deficit. But over time debt falls, and as we will see so does the real interest rate on debt, which means that debt servicing costs eventually fall by more than 1 percent of pre-consolidation GDP. As a result, in the medium- to long-run labor and capital income taxes fall substantially over time.

Fiscal consolidation accompanied by tax reform maintains the assumptions of the previous paragraph, but adds a redistribution of the tax burden, away from income (capital and labor) and towards consumption. As is well known from public finance theory, consumption taxes are less distortionary in terms of their effect on output than labor and especially than capital income taxes. The reason is that capital is in perfectly elastic supply in the long run, labor supply elasticity is intermediate, while consumption demand is fairly inelastic. We therefore

assume that, in addition to lowering deficits through the measures discussed above, the United States and Japan increase consumption tax revenue by 1.7 percent of pre-consolidation GDP, which corresponds to a long-run increase in the consumption tax rate of over 2.5 percentage points. Labor and capital income taxes behave as in the previous experiment to achieve the targeted 1 percentage points deficit reduction, but given the additional revenue generated by consumption taxes they can now fall immediately, and they fall much more substantially in the long run. Figure 1 displays the evolution of tax rates implied by the fiscal consolidation scenarios without and with tax reform.

Credibility is of key importance for the success of fiscal consolidation during its early stages. Given the short-run pain it inflicts, it will be reasonable for agents to hold their judgement as to whether a program will really be carried through to the end. Our scenarios reflect this problem, by assuming that the program only becomes credible after all its components have been fully enacted, that is in the fourth year. For each prior year we assume that the program enjoys no credibility, in the sense that agents assume that the program will be discontinued in the following year. But we also explore alternatives to this assumption, with higher or lower credibility.

The dynamics of fiscal consolidation are extremely long-lived, given that changes in flows (government deficits and current account deficits) take several decades to be fully reflected in changed stocks (government debt and net foreign liabilities). To nevertheless adequately display both the short- to medium-run dynamics and the long-run dynamics in one chart, we show impulse responses by way of lines for the first 20 years, followed by bars representing outcomes at the 40- and 60-year horizon.

The package of fiscal measures discussed up to this point represents what at the present juncture looks like a reasonable set of policies to get the world economy back to growth while addressing global current account imbalances.[11] But it combines a number of different fiscal instruments, and it would he helpful to also understand their individual contributions. We therefore conclude the paper by adding some illustrative simulations that isolate the effects of different fiscal instruments on growth and global current account imbalances under a consolidation equal to 1 percent of pre-consolidation GDP. In total we compare three types of spending and three types of distortionary taxes to a benchmark of using lump-sum transfers or lump-sum taxes.

---

[11]It is important to re-emphasize that these are stylized simulations that have been normalized to a one percentage point cut in the deficit-to-GDP ratio in the United States and Japan, and proportionately smaller cuts elsewhere.

## B. Growth: Global Effects

Before we turn to the consequences of consolidation at the level of individual countries, we examine the performance of the world economy as a whole in response to the combined fiscal packages. To do so we aggregate over regions using PPP GDP weights. Figure 2 summarizes the effects.

The combined effect of larger consolidation packages in many advanced economies and much smaller packages in the other regions is to raise global government surpluses by around 0.5 percent of world GDP. Given that the model assumes steady-state nominal growth rates of around 5 percent, this corresponds to an eventual decline in government debt-to-GDP ratios of around 10 percentage points. Because private saving does not offset this increase in government saving, the result is a worldwide drop in real interest rates of around 60 and 80 basis points in the two scenarios, fiscal consolidation without and with tax reform. But this takes several decades to be achieved, with interest rates dropping by 15 to 40 basis points over the 5- to 20-year horizon. The combined longer-run effect of lower debt and lower interest rates is lower government debt servicing charges. This frees up fiscal space for reductions in the primary surplus while maintaining an overall surplus improvement of 0.5 percent of GDP, in other words it frees up space for tax cuts. Eventually lower distortionary taxes and lower real interest rates therefore provide a major boost to aggregate supply and demand. But in the shorter run this is only true to the extent that consumption and investment demand anticipate the effects of more favorable future incentives on household wealth and on the future payoffs to private investment. In our scenarios this anticipation, in other words the credibility of the fiscal consolidation, only takes hold by year four. Prior to that the negative short-run multipliers of lower government spending, higher income taxes, and lower transfers especially to liquidity-constrained households, prevail to make output fall slightly. In the case of a pure fiscal consolidation this phase lasts for seven years, while under a fiscal consolidation combined with tax reform it last for only 5 years. The reason for this difference is that the tax reform starts to reduce distortions and therefore to boost output immediately, even if its continuation is in doubt. The long-run effects on output are substantial, reaching over 2.5 percent relative to the baseline under the fiscal consolidation alone, and almost 4 percent under fiscal consolidation combined with tax reform. The long-run tax cuts under fiscal consolidation with tax reform are around twice as large as without tax reform, at 5 versus 2.5 percentage points, but the corresponding output gains are less than twice as large. This is because a substantial share of the output gains is due to lower world real interest rates, and for interest rates the differences between the two packages are much smaller than for tax cuts. The difference between real interest rates that we do observe is however not negligible, at around 15 basis points in the very long run. The reason for this difference is that, as we will discuss later, private saving increases substantially more in the presence of a tax reform package.

### C. Growth: Short-Run Costs and Credibility

Figure 3 focuses on short-run output performance by limiting impulse responses to only five years. It considers only the case of fiscal consolidation combined with tax reform. This and all subsequent figures breaks results down by region.

The solid line corresponds to our baseline scenario, where full credibility is established by year four. We observe that GDP drops in all regions on the announcement of the fiscal consolidation measures, and, for all regions except emerging Asia, reaches a trough in year 3 and thereafter quickly recovers. Initial output losses are largest (around 0.2-0.3 percent relative to baseline) in the regions with the largest consolidations, and much smaller in regions with small or zero consolidations. This is due to the operation of negative multiplier effects, which depend on the size of the deficit reduction given that the compositions of deficit reductions are assumed to be equal. Subsequent output gains are rapid and reflect the perception of higher household wealth and investor profitability when the programs become credible.

Germany's recovery is particularly rapid because it receives an additional monetary stimulus due to its membership in the European Monetary Union. The reason is that the initial inflation response in the euro area excluding Germany is negative due to its larger and therefore initially more contractionary fiscal package, while the initial inflation response in Germany is negligible prior to year four, and then positive. Because policy interest rates in EMU reflect the average of inflationary pressures in Germany and the rest of the euro area, this implies that short-term real interest rates in Germany fall more strongly than in the rest of the euro area, which stimulates an earlier and stronger recovery.

While recovery in advanced economies is fast, recovery in the remaining countries and especially in emerging Asia takes much longer to arrive. The reason can be seen in the behavior of real exchange rates, which experience large jumps as soon as fiscal consolidations become credible. In the advanced countries this jump is a large initial depreciation, followed by further depreciation as taxes fall further (see Figure 9). This pattern is explained by three facts. First, in the short run the positive demand effect of credible larger consolidations in advanced economies, which arrives before the supply-side benefits are in fact realized, means that real exchange rates are appreciated relative to their long-run values. Second, in the long run the positive supply side effects of tax cuts and tax reform lower costs in the advanced economies and therefore imply a long-run depreciation. Third, as discussed below, because larger fiscal consolidations imply larger increases in domestic savings, they imply more positive current account balances in the longer run, and real exchange rates jump to generate the trade surpluses consistent with these changed long-run savings preferences. The flipside of these advanced country depreciations is strong real appreciations in emerging Asian and remaining countries, which depress their export sectors for a long period. Combined with smaller or zero direct gains from fiscal consolidation and tax reform, this explains the sluggish

output performance of these regions at the beginning of worldwide fiscal consolidation. Ideally therefore, but this is beyond the scope of this paper, these regions would do well to accompany the advanced country fiscal measures with domestic demand- and supply-stimulating policies.

The dotted line in Figure 3 assumes that the policy packages become credible in year three instead of year four. In all but one case this means a substantial drop in short-run costs, with the return to positive growth rates also happening one year earlier, and with the period of output losses relative to baseline shortened by one year in the United States and the euro area, including Germany. In Japan and the remaining country group, the dynamics are more sluggish, but the earlier credibility clearly has a positive impact. But in emerging Asia higher credibility in year three actually reduces output further in that year. The reason is that the expenditure switching effect of the large appreciation initially outweighs the eventual benefits of higher world demand and lower world interest rates.

At the current juncture it seems too optimistic to assume that households and investors around the world would consider consolidation programs to be perfectly credible at the outset, that is in year one rather than year three. Nevertheless, it can be shown that in that case there would be no short-run loss of output, as the anticipated growth-friendly switch from income to consumption taxes would have an immediate strong positive short-run effect on output. Figure 3 also considers the case of even lower credibility than in the baseline, with the packages becoming credible in year five. This is simply the reverse of the higher credibility case, with a return to positive growth now being delayed by another year.

### D. Growth: Long-Run Gains

As illustrated in Figure 4, the simulated fiscal consolidation, especially if accompanied by tax reform, has strongly positive effects on the levels of output in the longer run. For the United States under the full package, real GDP is 1.4 percent above baseline in year 10. Moreover, for 3 decades after that, a higher growth rate implies a growing gain relative to the baseline, due to persistently higher levels of investment and labor supply in the presence of lower capital and labor income taxes. The euro area and Japan show somewhat stronger gains than the United States, while Germany, due to its smaller fiscal package, shows somewhat weaker gains. The results for the remaining country group are less positive, with GDP not quite 0.5 percent above baseline by year 10. Emerging Asia, due to the absence of fiscal measures, shows a substantially worse profile - by year 10 its GDP has not yet recovered to its baseline value, and in the long run it only gains 2.5 percent relative to the baseline, relative to between 5 and 6 percent for the advanced economies. But of course this has to be qualified by the fact that the baseline itself, on the fiscal side, is considered more sustainable in emerging Asia than in the other regions.

The positive implications for investment and labor supply of a shift from income to consumption taxes are evident in the comparison of consolidation without and with tax reform. In the long run tax reform adds roughly a quarter to a half to the output gains achieved without tax reform. This is because even under consolidation without tax reforms we observe a large long-run decline in tax rates, but this takes decades to materialize as the interest savings on debt happen over time. Therefore, in the short- to medium-run, say by year 10, the GDP gains without tax reform are only a small fraction of the gains with tax reform.

The rightmost three columns of Figure 4 focus on the monetary policy response to the inflationary consequences of the fiscal package. Inflation goes through medium-term cycles of modest amplitude, with monetary policy taking considerable time to finally stabilize the rate. The short-run downward movements in inflation without tax reform reflect the longer-lived contractionary effects of such a policy in advanced countries, while with tax reform inflationary demand pressures start to build as soon as the policies become credible, as spending anticipates future income. The euro area is special in that monetary policy is tight (relative to the case of independent monetary policy) for the euro area excluding Germany, and loose for Germany alone, leading to a monetary policy induced stimulus to output in the latter and a contractionary effect in the former.

Figures 5 and 6 turn to a breakdown of the output performances into their domestic and external components. On the domestic side, the composition of the tax packages in advanced and strongly consolidating economies favors investment and initially depresses consumption.

Consumption in the United States and the euro area excluding Germany initially drops and then takes about 8 years to return to baseline, while the same takes about 15 years in Japan. This is due mainly to higher consumption taxes but also to lower transfers, especially to liquidity-constrained households. On the other hand, consumption in the regions that consolidate much less or not at all is flat for the first three years and then starts to rise as the packages become credible. Concentrating on the scenario with tax reforms, the reason is that these regions experience only relatively small changes in consumption taxes, but large increases in wealth due to higher demand, partly due to the wealth effect of real appreciations (see Figure 9) that happen once credibility is established.

Investment on the other hand is initially fairly flat in all regions, and then starts to boom as soon as credibility is established. The boom happens due to a combination of lower capital income taxes, especially in the strongly consolidating regions, and lower world real interest rates in the long run, which benefit all regions equally. At year 10, U.S. investment is 5.2 per cent above baseline, the euro area (including Germany) is almost 5 percent above, Japan about 4 percent, the remaining country group about 3 percent, and emerging Asia less than 2 percent.

The behavior of the trade balance again differs according to the degree of fiscal consolidation, with the advanced and strongly consolidating regions experiencing short- to medium-run trade

surpluses accompanied by real depreciations. To understand the behavior of external trade better we now turn to the evolution of savings and investment in the world economy.

## E. External Imbalances

Figure 7 displays the evolution of government and private saving, private investment, and the current account. Figure 8 displays the corresponding stocks, where private financial wealth is the sum of household holdings of government and foreign bonds. Figure 9 displays the evolution of nominal and real exchange rates that accompanies the current account developments.

The time paths of government saving reflect the size of the fiscal consolidation, with short-run fluctuations driven by the gradual initial implementation of the programs and by the operation of automatic stabilizers in response to output gaps. Due to non-Ricardian household behavior, private dissaving does not offset higher government saving. This is true especially in the presence of tax reform, which reduces the marginal propensity to consume due to higher consumption taxes, but increases income due to lower income taxes. This significantly increases private saving rates in several regions, both in the medium run and in the long run, and in several regions turns lower private saving relative to baseline into higher private saving.

With higher government and private saving in all regions except emerging Asia, the world real interest rate, as shown in Figure 2, drops by between 60 and 80 basis points, depending on the scenario, and this is the second reason, apart from lower capital income taxes, why investment experiences a worldwide boom. Current accounts on the other hand reflect *relative* increases in saving in different regions, so that the regions experiencing the strongest fiscal consolidations see current account surpluses that reach levels close to their long-run values after about 10 years. For the scenario with tax reform, the United States current account improves by around 0.3 percentage points of GDP, while the improvements in the euro area excluding Germany and in Japan are around 0.5 percentage points. On the other hand, current accounts in Germany, remaining countries and emerging Asia deteriorate by 0.4, 0.3 and 0.7 percentage points. Fiscal consolidation therefore contributes greatly to a global current account realignment where, with one exception, deficits and surpluses decline to lead to more balanced external positions. The exception is Japan, whose current account surplus improves further, but given the perceived urgency of fiscal consolidation in Japan there may be no alternative to this outcome.

Figure 8 shows the stocks corresponding to the flows in Figure 7. In all regions we have assumed nominal growth rates of 5 percent, so that a one percentage point increase in a flow ratio leads, in the very long run, to a 20 percentage points increase in the corresponding stock ratio. We emphasize that capital grows strongly relative to GDP in all regions, but especially in regions that implement sizeable tax reforms.

The behavior of exchange rates in Figure 9 has already been discussed in Section III.C. The main point is that even the short-run direction of real effective exchange rates is mainly driven by the pull of permanent changes in equilibrium real exchange rates, due to changed savings preferences, rather than by short-run demand considerations. The larger fiscal consolidations in many advanced economies imply larger increases in domestic savings and therefore in current account surpluses. Real exchange rates jump to generate the trade surpluses consistent with these changed long-run savings preferences, with the largest real effective depreciation happening in Japan, where it equals around 4 percent after 10 years and beyond. The United States, where we assume a consolidation of the same size as in Japan, experiences a similar-sized depreciation, while that in the euro area excluding Germany is about half in size. Of course the remaining regions experience real appreciations of corresponding magnitudes.

### F. Different Fiscal Instruments

The consolidation and tax reform scenarios presented so far were based on a very specific set of policy measures but, as we will now show, those measures were selected partly on the basis of their growth-stimulating effects. Figures 10 and 11 present scenarios of a fiscal consolidation equal to 1 percent of pre-consolidation GDP, as in the scenario without tax reform presented above. But instead of selecting a combination of fiscal instruments, we present seven different consolidation scenarios that are each based on only one fiscal instrument being used at a time to bring about the initial reduction in deficits. Thereafter the instrument is permanently left at its new level (except for the case of general transfers), and increases in general transfers are used to take advantage of interest savings due to lower debt. As the focus of our paper is on outcomes for growth and external imbalances, the figures present plots for levels of real GDP and current account to GDP ratios.

Figure 10 focuses on four different spending measures, with all tax rates being held constant. We observe that, even in the best case, the output effects are not nearly as favorable as in our baseline consolidation without tax reform scenario (compare Figures 10 and 3). The best result is achieved by using general transfers, where long-run output gains of around 1 to 2 percent are achieved in advanced consolidating regions, compared to around 5 percent in our baseline. Output recovers to its baseline level in around 6 or 7 years, which is similar to the baseline. The worst result is observed when using government investment, as this deprives the economy of productive capital and therefore acts similarly to a negative productivity shock. Here output immediately and permanent drops below the baseline, and in the long-run GDP in the largest consolidating regions drops 5 percent below baseline. Government consumption and targeted transfers are intermediate, with a very prolonged period of output remaining below the baseline, but by significantly less than 1 percent, and with long-run effects very close to zero. There is a reason for this similarity. A reduction in government spending of one unit represents a direct negative demand effect of one unit, while a reduction in targeted

transfers of one unit represents an indirect negative demand effect that is however of a very similar magnitude. This is because liquidity-constrained households who receive this additional unit have a marginal propensity to consume goods of very close to one, except for a leakage due to consumption taxes. The only other difference is in the import composition of the goods consumed by liquidity-constrained agents and the government, but that difference is not very significant.

Differences in the external imbalances implications of different spending instruments, as shown in the right column of Figure 10, are generally small, except that the use of general transfers makes the current account movements, whose directions we already commented on in connection with Figure 6 above, at least 50 percent larger. The reason is that it provides a more powerful stimulus to private saving rates than the other instruments.

If we reinterpret changes in general transfers as negative changes in lump-sum taxes, then Figure 11 displays the effects of four different tax measures. As before, consolidation through lump-sum taxes provides the most beneficial effect on GDP, both in the short run and in the very long run. Among the distortionary taxes consumption taxes are least distortionary, but even so output recovery to baseline in the advanced consolidating regions takes between 10 and 20 years. This period is roughly twice as long with labor income taxes, where the long-run effect is close to zero or slightly positive. With capital income taxes however we observe a similar effect to government investment above, with immediate and permanent output losses. However, at around 0.5 percent to 1 percent, these are not as dramatic as for government investment.

We note that for both government investment and capital income taxes we observe a prolonged period not only of sub-baseline output but of negative growth. The reason is that both policies have progressively worsening effects on a capital stock, either public or private, until that stock reaches a new long-run value.

The external imbalances implications of different tax instruments are again in line with our discussion of Figure 6 above, in that higher income taxes reduce the private saving rate and therefore reduce the current account surpluses due to fiscal consolidation.

There are a number of important policy lessons from the above. First, fiscal consolidation that involves higher capital income taxes, and even more so lower government investment, is very harmful to growth, both in the short run and the long run, while higher labor income taxes are also harmful for a prolonged period. Fiscal consolidation designed to raise growth on a sustainable basis should therefore be structured in such a way that income taxes can in fact fall, and government investment rise, while other instruments reduce the deficit. This was part of the motivation behind our baseline scenarios in the previous subsections. Second, consolidation through lower unproductive government spending or higher consumption taxes has smaller but non-negligible negative short-run multiplier effects, and close to zero long-run effects. Third, consolidation through a reduction in transfers appears attractive both from the

growth and the external imbalances angles, but this needs to be done with great care. Lower transfers to the relatively less well-off, the liquidity-constrained households in our model, have effects almost exactly as large as lower government spending, both in the short run and the long run. Our simulations suggest that the best results can be obtained by identifying entitlement cuts that affect, as much as possible, the unconstrained agents.

## IV. CONCLUSIONS

This paper presents a set of simulations that explore options for fiscal consolidation in the post-crisis world economy, where concerns about fiscal sustainability have assumed a similar urgency to concerns about the financial system. The paper emphasizes that with fiscal consolidation there is generally a fundamental trade-off between short-run pain and long-run gain. Pain arises from the negative short-run multiplier effects of lower spending or higher taxes, while gain arises from lower world real interest rates and lower distortionary taxes associated with lower debt levels. However, the results on both pain and gain are subject to important qualifications.

First, if a fiscal package is very well-designed, with favorable long-run incentives for investment and labor supply, then pain only arises if the package suffers from an initial lack of credibility, and the length of the period of pain corresponds closely to the length of the period during which credibility needs to be established. Sound medium-term fiscal frameworks therefore have payoffs beyond their direct eventual effect on incentives and interest rates. Second, if a fiscal package should be badly designed, for example by sharply raising taxes on income or cutting essential government investment, the long-run gain could be much lower or even non-existent, as higher distortions and/or productivity offset the gains from lower real interest rates. This emphasizes that attention needs to be paid not only to overall deficit levels, but also to the composition of spending and taxation programs, to obtain favorable growth outcomes.

A balanced return to growth is however not the only concern of policymakers at this point. Another major issue is with more sustainable levels of current accounts around the world. To the extent that existing current account deficits have been caused, at least partly, by fiscal deficits, a reversal of the same fiscal deficits should be able to contribute to lowering current account deficits. Concentrating fiscal consolidation efforts in regions with large external imbalances would therefore make a useful contribution to reducing current account imbalances, except for the case of Japan. Furthermore, as we have seen, this is helped by adopting a growth-friendly package of tax reforms, because such a package tends to increase private savings rates.

## REFERENCES

Bernanke, B.S., Gertler, M. and Gilchrist, S. (1999), "The Financial Accelerator in a Quantitative Business Cycle Framework", in: John B. Taylor and Michael Woodford, eds., *Handbook of Macroeconomics, Volume 1C.* Amsterdam: Elsevier.

Blanchard, O.J. (1985), "Debt, Deficits, and Finite Horizons", *Journal of Political Economy*, **93**, 223-247.

Freedman**,** C., M. Kumhof, D. Laxton, D. Muir and S. Mursula (2010), "Fiscal Multipliers Galore", IMF Working Paper (forthcoming).

Galí, J., J.D. López-Salido and J. Vallés (2007), "Understanding the Effects of Government Spending on Consumption", *Journal of the European Economic Association*, **5(1)**, 227-270.

Gale, W. and P. Orszag (2004), "Budget Deficits, National Saving, and Interest Rates", *Brookings Papers on Economic Activity*, **2**, 101-187.

Girouard, N. and C. André (2005),"Measuring Cyclically-Adjusted Budget Balances for OECD Countries", OECD Economics Department Working Papers, No. 434, OECD Publishing.

Ireland, P. (2001), "Sticky-Price Models of the Business Cycle: Specification and Stability", *Journal of Monetary Economics*, **47**, 3-18.

Kumhof, M., D. Laxton, D. Muir, and S. Mursula (2009), "The Global Integrated Monetary and Fiscal Model - Theoretical Structure", IMF Working Papers (forthcoming).

Laubach, T. (2003), "New Evidence on the Interest Rate Effects of Budget Deficits and Debt", Finance and Economics Discussion Series 2003-12, Board of Governors of the Federal Reserve System.

Laxton, D. and P. Pesenti (2003), "Monetary Rules for Small, Open, Emerging Economies", *Journal of Monetary Economics*, **50(5)**, 1109-1152.

Ligthart, J.E. and Suárez, R.M.M. (2005), "The Productivity of Public Capital: A Meta Analysis", Working Paper, Tilburg University.

Figure 1. Scenarios: Tax Rates

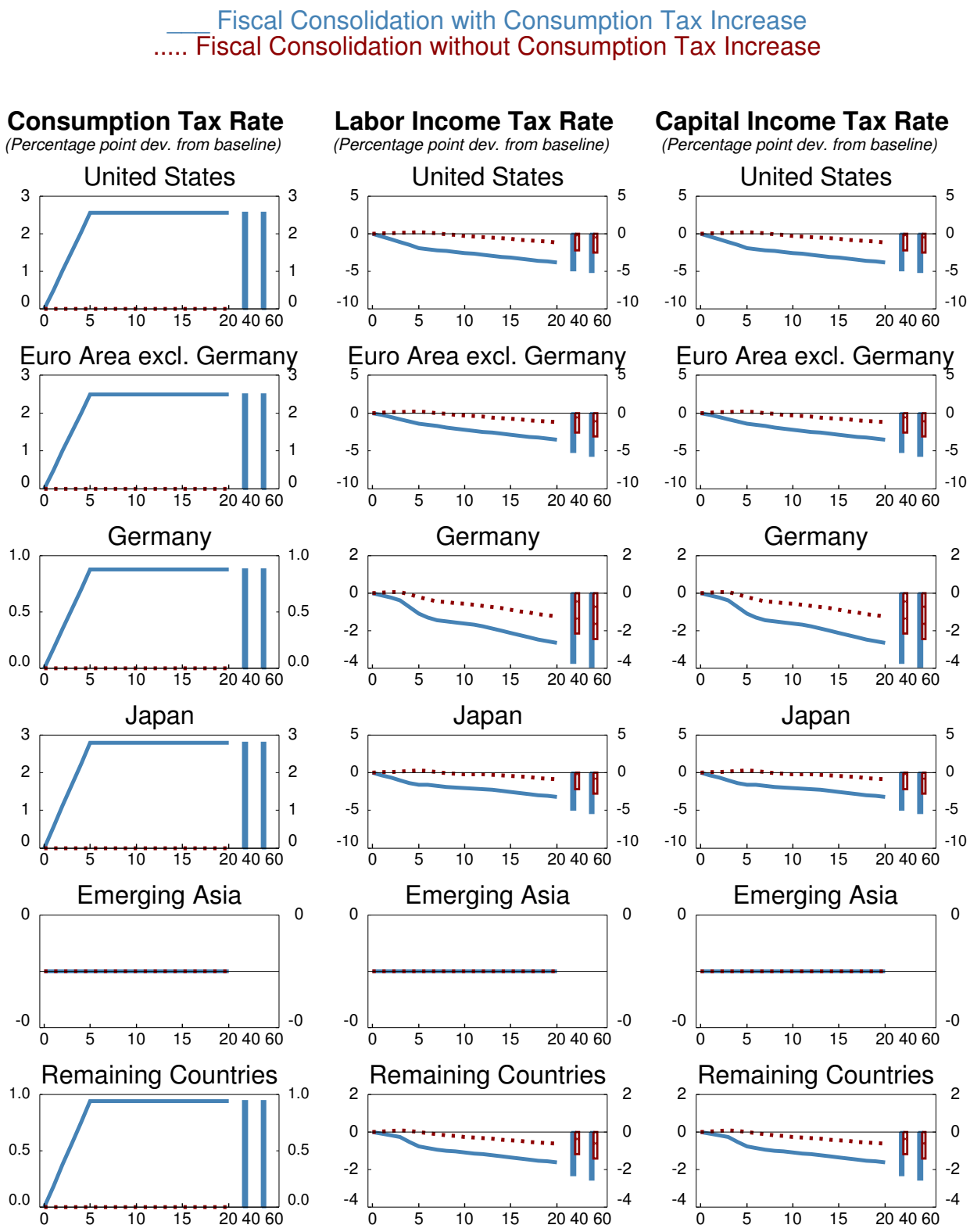


Figure 2. Global Effects

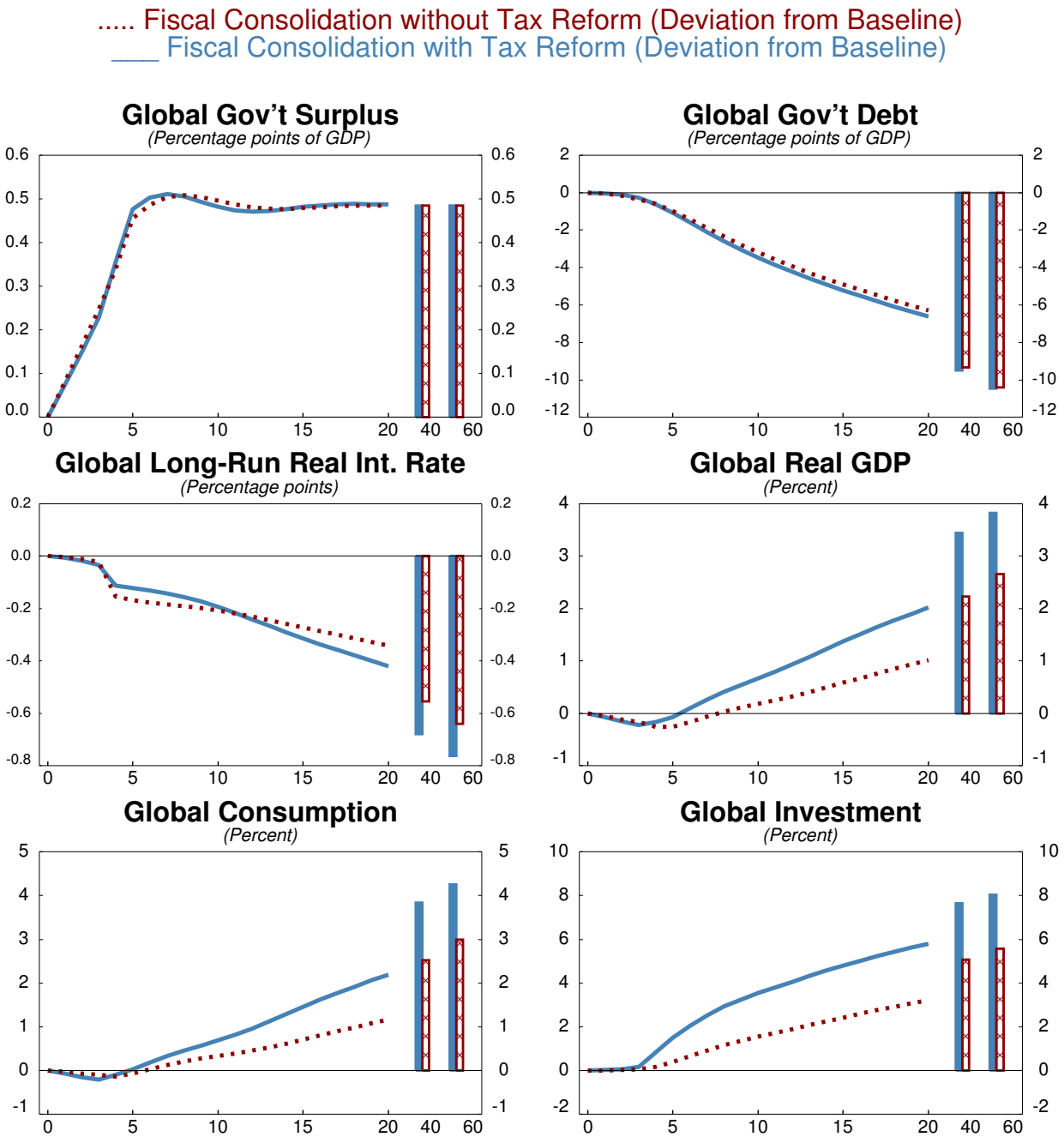


Figure 3. Short-Run Costs and Credibility

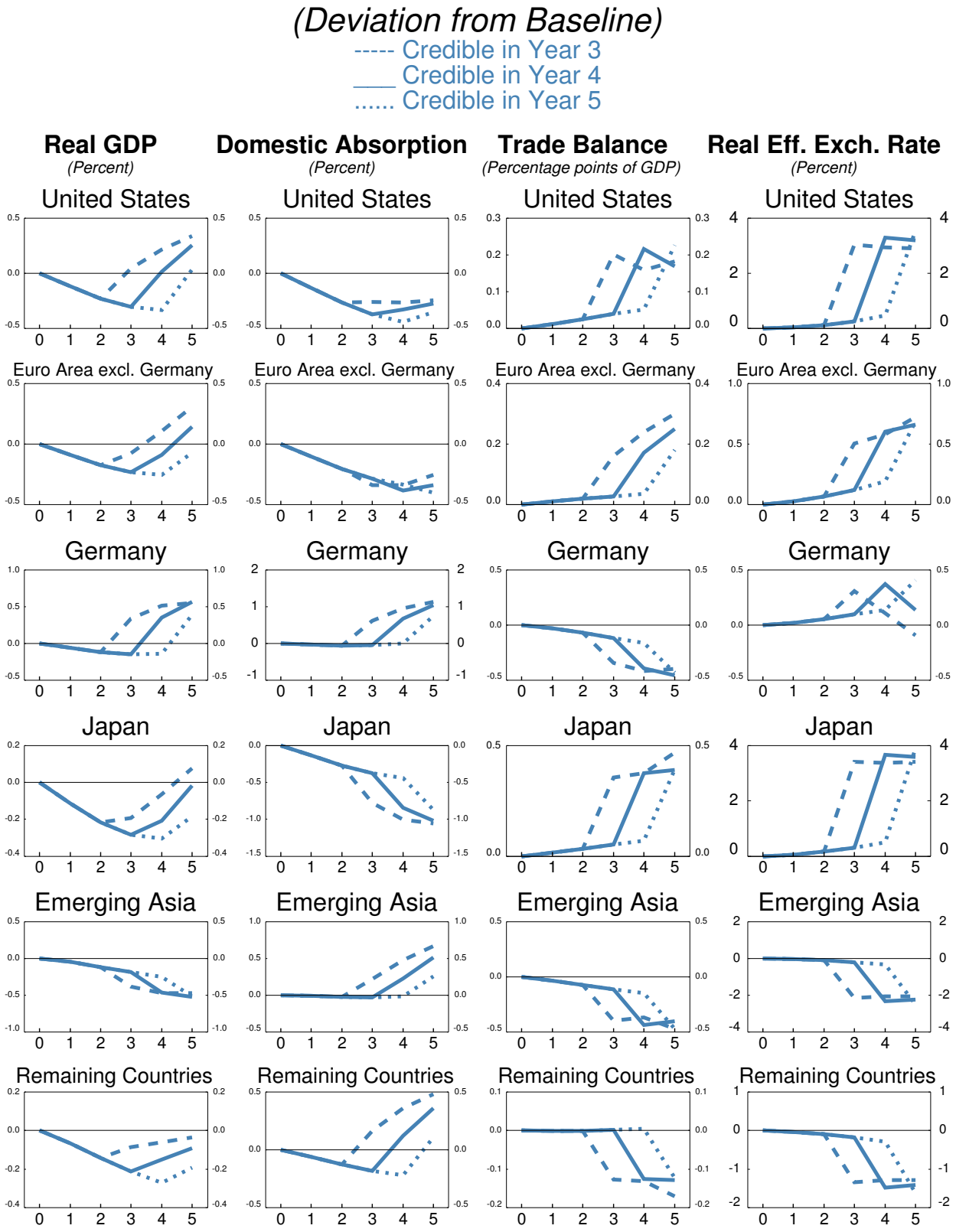


Figure 4. Long-Run Gains: Output and Inflation

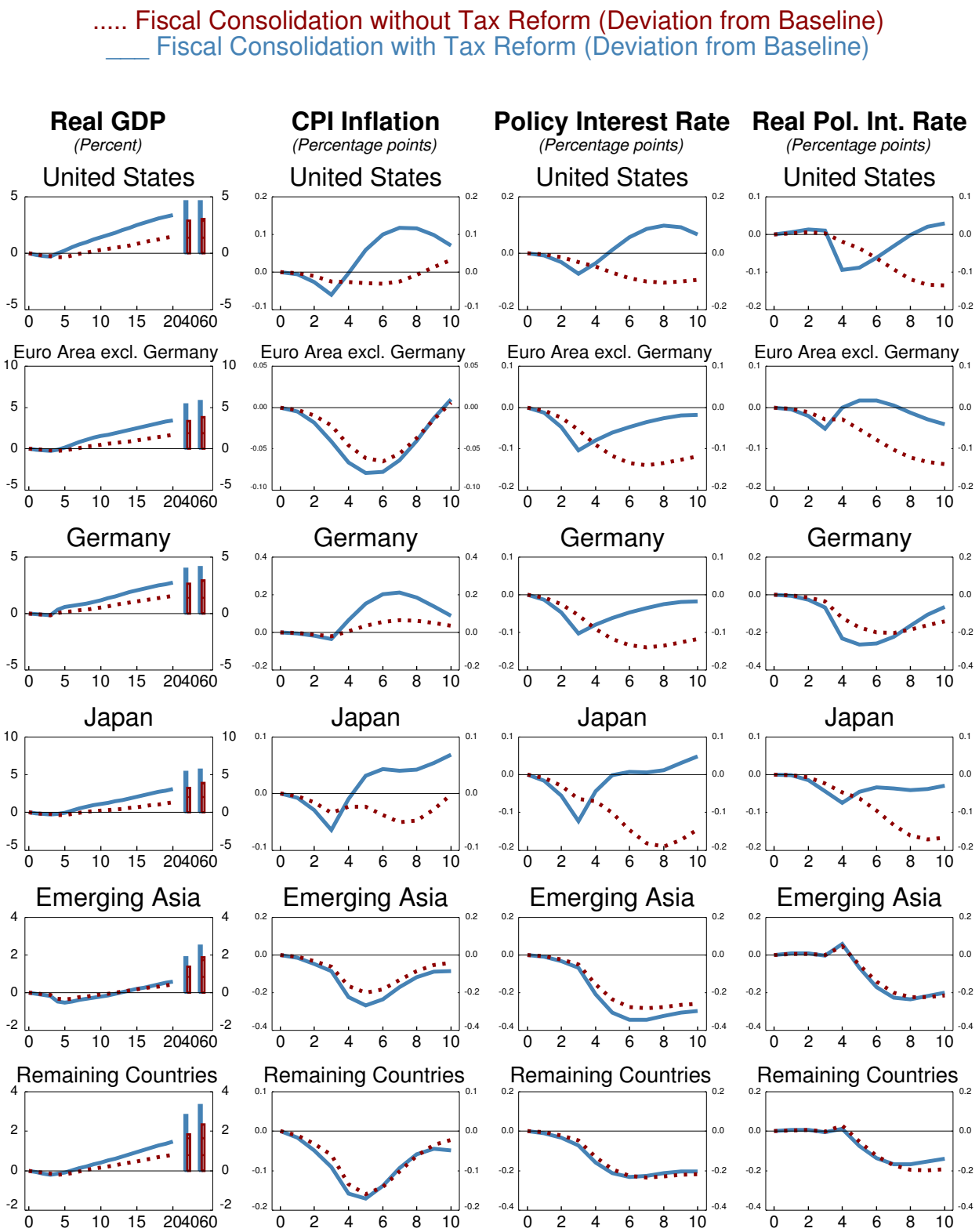


Figure 5. Long-Run Gains: Domestic Absorption

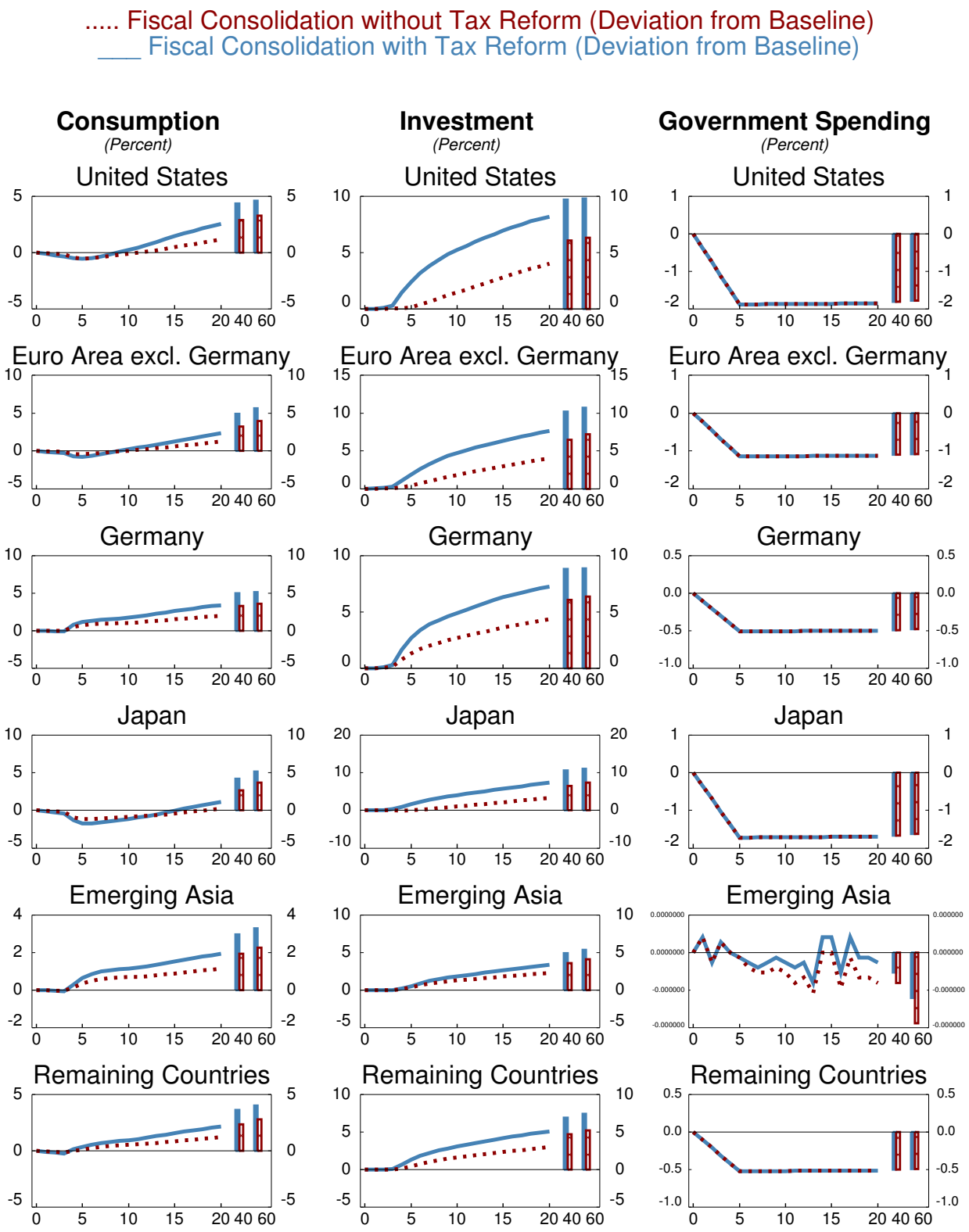


Figure 6. Long-Run Gains: Foreign Trade

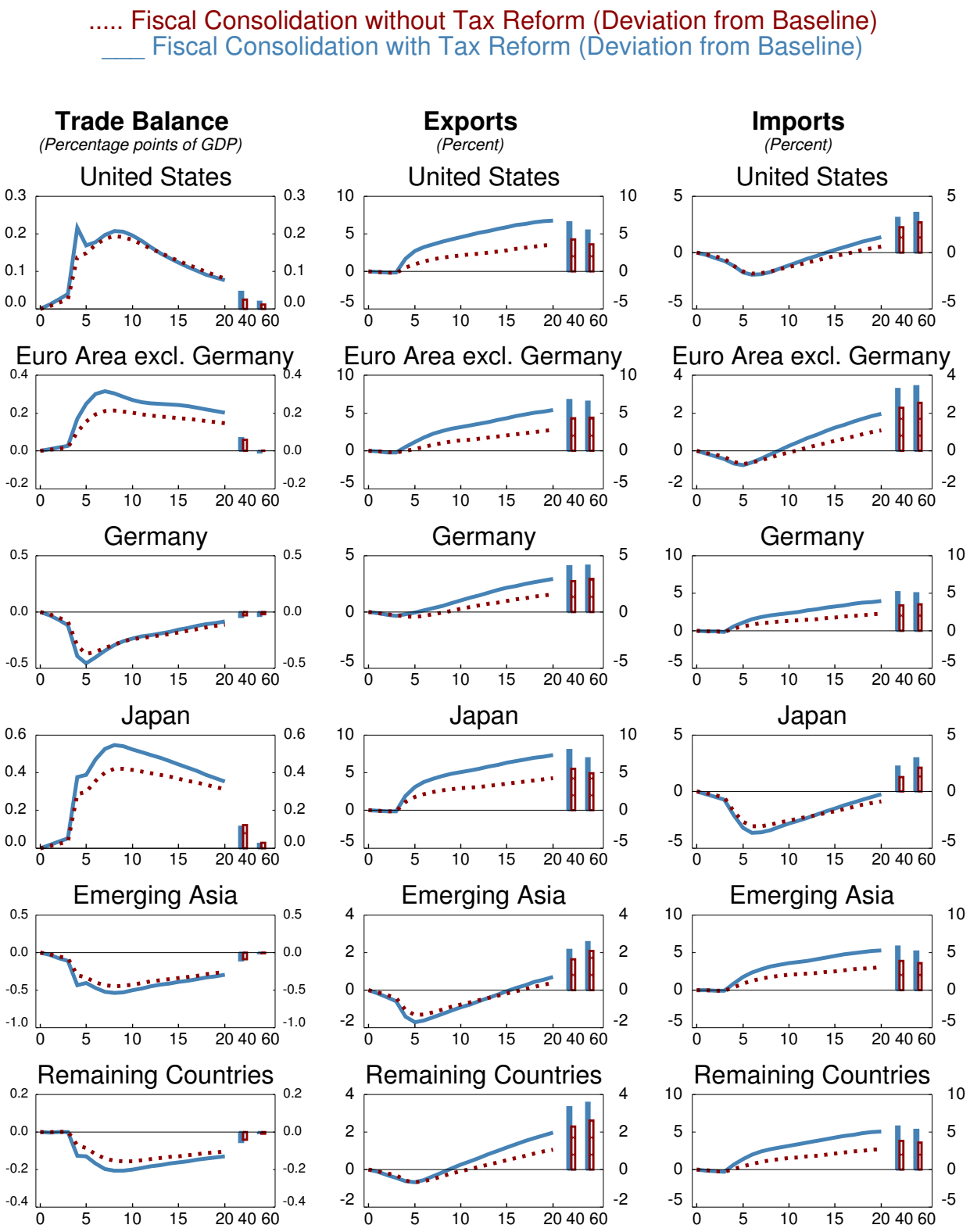


Figure 7. External Imbalances: Saving, Investment and Current Account

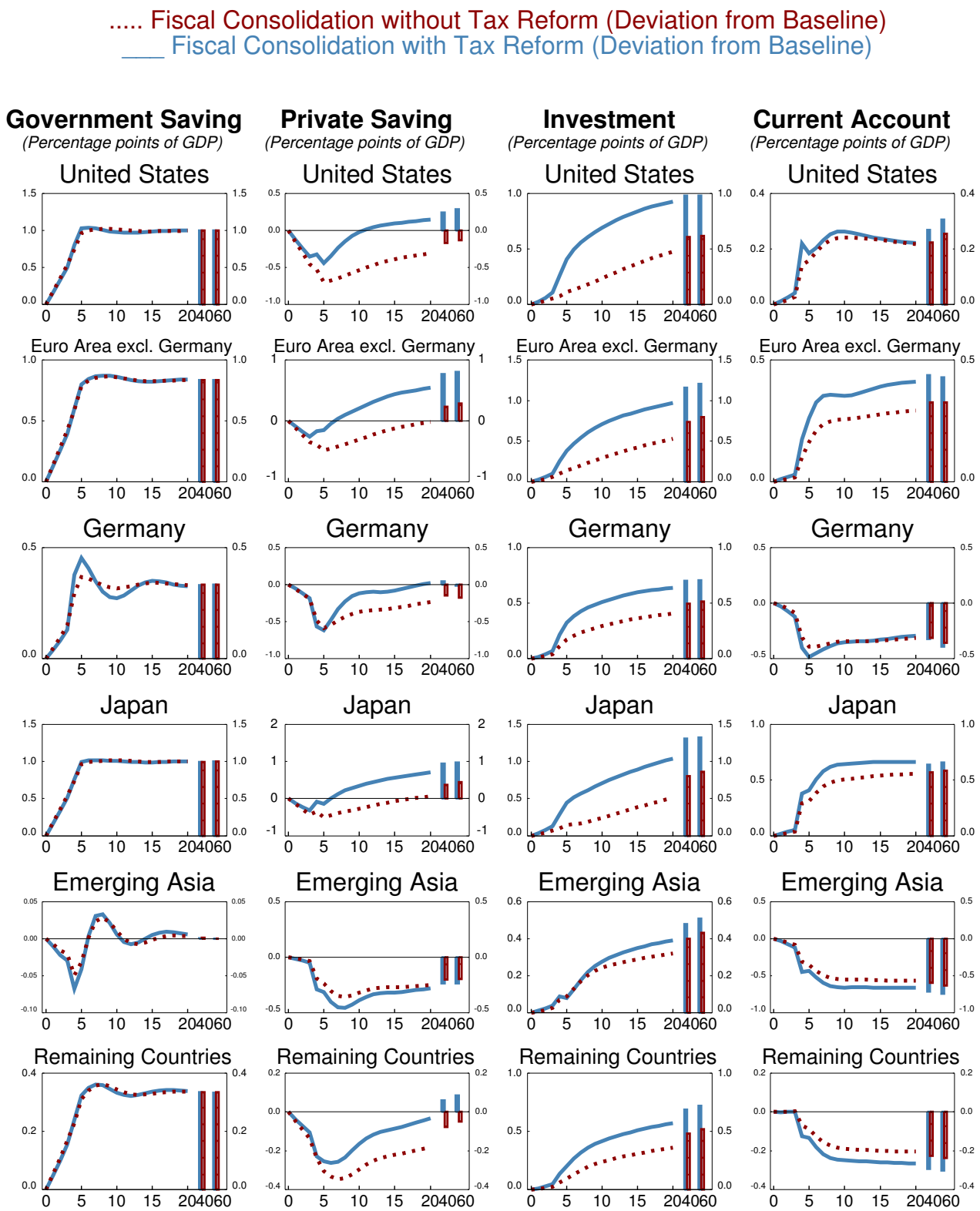


Figure 8. External Imbalances: Asset Stocks

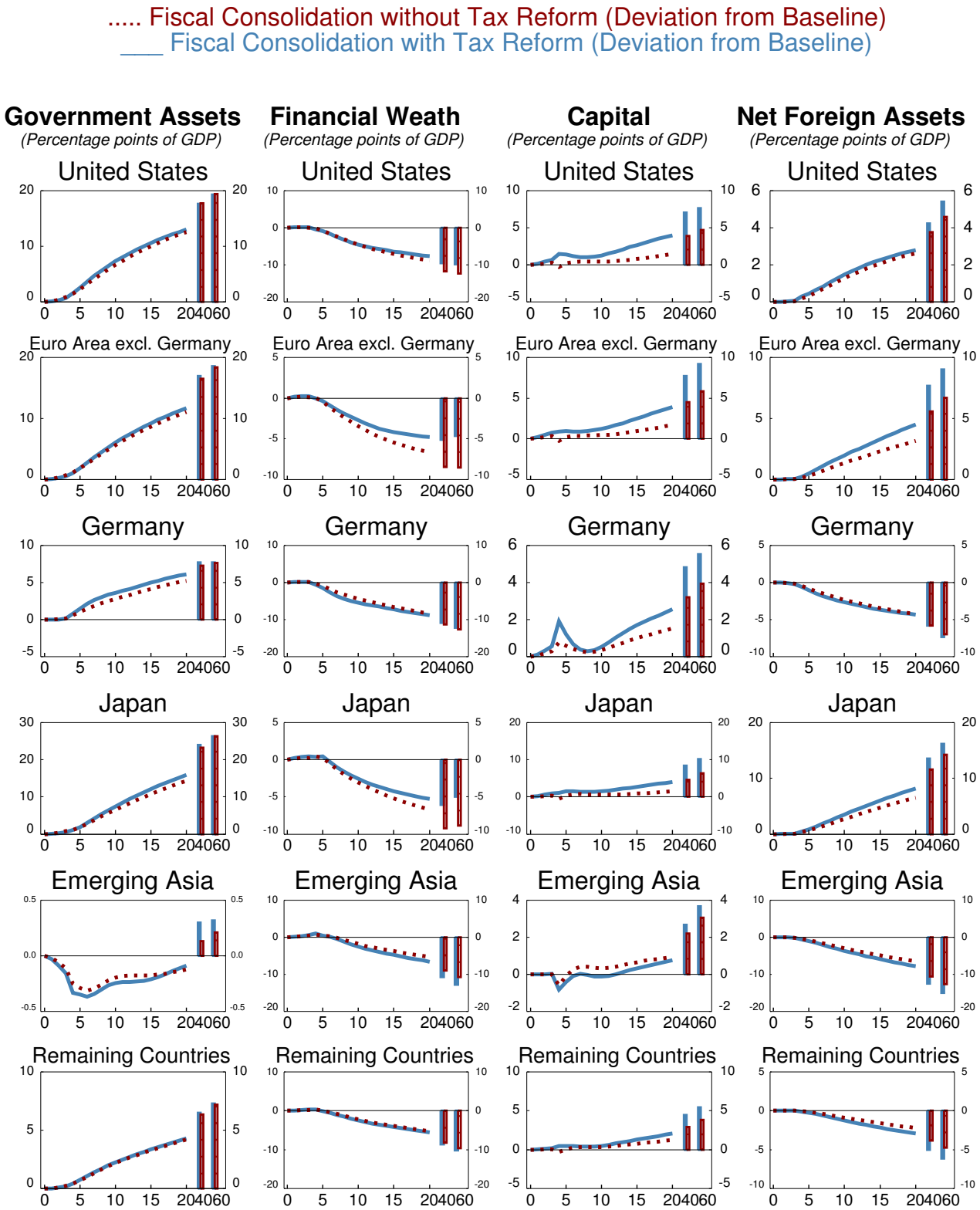


Figure 9. External Imbalances: Exchange Rates

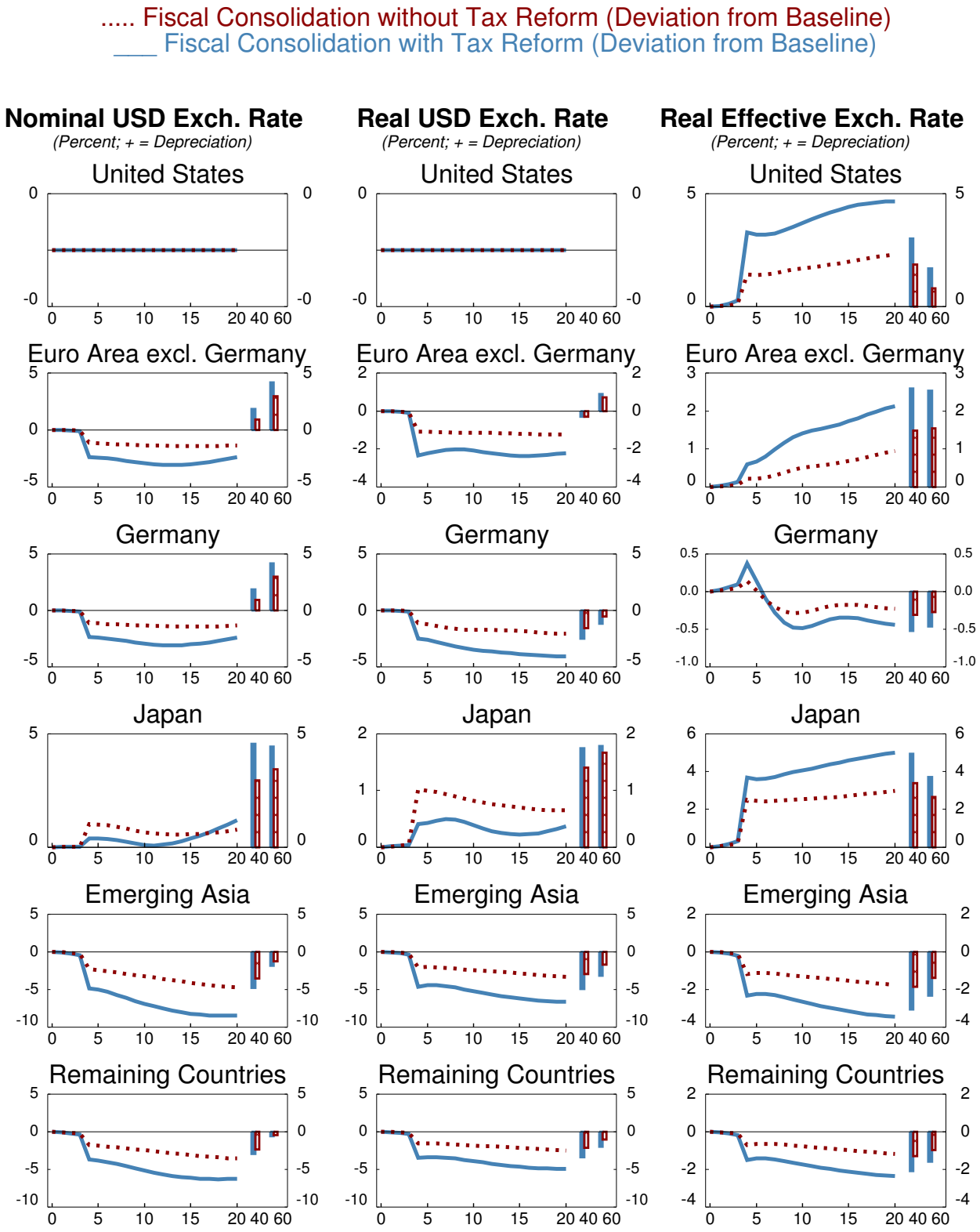


Figure 10. Different Fiscal Instruments: Spending

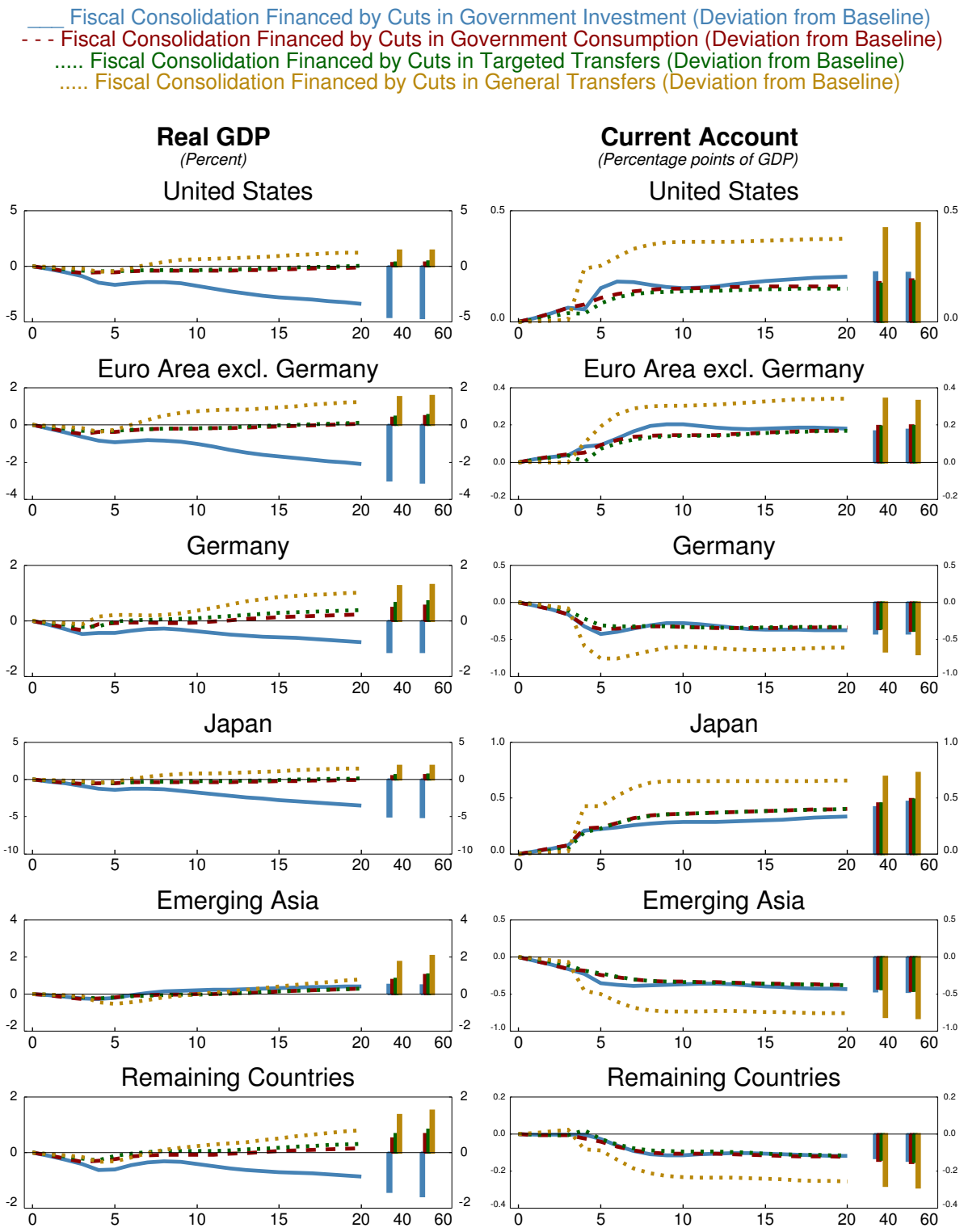


Figure 11. Different Fiscal Instruments: Taxes