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Achieving a Soft Landing: The Role of Fiscal Policy

Daniel Leigh

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Abstract

This paper utilizes an open-economy New Keynesian overlapping generations model to assess the extent to which fiscal policy, along side an inflation-forecast-based monetary policy, could enhance macroeconomic stability in Colombia. The model simulations indicate that, in addition to stabilizing output and inflation, a stronger response of the fiscal balance to excess tax revenue would reduce the burden on the central bank of adjusting interest rates, lessen the associated degree of exchange rate volatility, and contribute to a more stable external current account balance. The analysis also assesses how the success of fiscal policy in enhancing macroeconomic stability depends on the type of shock, the response of monetary policy, and the length of fiscal policy implementation lags.

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I. INTRODUCTION

1. **What are the macroeconomic effects of fiscal policy, and how can fiscal policy help achieve a soft landing for an overheated economy?** While a consensus regarding the role and effects of monetary policy has emerged, there is less agreement regarding fiscal policy.[1] A number of central banks have developed large scale models to predict the effects of monetary policy, but, as discussed in several recent papers, these models often cannot adequately replicate the dynamic effects of fiscal policy found in the empirical literature.[2] Conventional models used for monetary policy typically feature agents with infinite planning horizons, and predict that fiscal policy is ineffective in influencing aggregate demand and external current account balances.

2. **Assessing the macroeconomic effects of fiscal policy is relevant for Colombia, given evidence of overheating pressures**. Real GDP growth is estimated at 6.8 percent in 2006, and Fund staff project the same growth for 2007. Average CPI inflation is expected to rise 1 percentage points to 5½ percent in 2007, despite an increase in the Banco de la República's (BdR) policy interest rate by 350 basis points from 6 percent in April 2006 to 9½ percent in November 2007. Overheating pressures are also evident in the increase in the external current account deficit, which is projected to double to about 4 percent of GDP in 2007. Output is estimated at about 3 percent above potential as of the second quarter of 2007. While the tightening of monetary policy is expected to help reduce growth in 2008 to about 5 percent, a positive output gap is nevertheless projected to remain in that year.

3. **This paper utilizes an open-economy structural model to assess the extent to which fiscal policy could enhance macroeconomic stability in Colombia.** The model, developed at the International Monetary Fund (IMF), is called the Global Integrated Monetary and Fiscal (GIMF) model (Kumhof and Laxton, 2007a). Ricardian equivalence does not hold in the model as consumers are assumed to have finite lifetimes and lifecycle income. GIMF reflects the latest advances in new open economy macroeconomic theory, and embodies a number of nominal and real rigidities that permit it to make empirically plausible predictions regarding the dynamic effects of fiscal and monetary policy.

4. **The paper provides quantitative assessments of the effects of changes in fiscal policy on key macroeconomic aggregates, such as real activity and the current account, using GIMF**. In addition, the paper assesses how the effects of macroeconomic shocks depend on the response of fiscal policy. In particular, the analysis focuses on assessing (i) how a stronger fiscal policy response to the cyclical position can reduce the burden on monetary policy in responding to shocks; (ii) to what extent a stronger response of fiscal

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[1] Recent papers on the new consensus in monetary policy include Goodfriend (2007), and Mishkin (2007).

[2] See, for example, Kumhof and Laxton (2007a), and Gali, López-Salido and Valles (2007). Examples of large-scale models used for monetary policy analysis include the Banco de la República's Model of Transmission Mechanisms (MMT), the IMF's FPAS and GEM, the Federal Reserve's SIGMA, and the ECB's NAWM.

policy to the cyclical position can induce an inflation-output volatility tradeoff; and (iii) how the effectiveness of fiscal policy in enhancing macroeconomic stability depends on the response of monetary policy, and on fiscal policy implementation lags.

5. **The remainder of the paper is structured as follows.** Section B presents the key features of the model. Sections C and D report the results, and Section E concludes.

II. Methodology

The model

6. **GIMF is an open economy general equilibrium model developed at the Fund that is equipped for both monetary and fiscal policy analysis**. The model's multiple non-Ricardian features, nominal and real rigidities, monetary policy reaction function, and fiscal policy reaction function yield plausible macroeconomic responses to changes in fiscal and monetary policy.

7. **Ricardian equivalence is assumed not to hold for four reasons**:

- First, the model features overlapping generation agents (OLG) with finite lifetimes. These agents are myopic in the sense that they perceive debt-financed tax cuts as an increase in their human wealth, and attach a low probability to having to pay for them in the future.

- Second, workers have a life-cycle labor productivity pattern that implies a declining rate of productivity as workers age. This feature means that workers discount the effects of future payroll tax increases as the latter are likely to occur when they are older and less productive.

- Third, the model contains liquidity-constrained consumers (LIQ) who do not have access to financial markets to smooth consumption, and change their consumption one-for-one with changes in after-tax income.[3]

- Finally, the model includes payroll and capital income taxes that are distortionary because labor effort and private investment respond to relative price movements that result directly from variations in tax rates.

[3] These consumers do solve an intratemporal optimization problem for choosing consumption and leisure levels. However, without access to financial markets, they cannot smooth consumption in response to temporary changes in disposable income.

8. **Importantly, GIMF relaxes the conventional assumption that all government spending is wasteful and does not contribute to aggregate supply**. Instead, GIMF allows for productive public infrastructure spending that adds to the public capital stock, and enhances the productivity of private factors of production. Real rigidities embedded in the model include consumer habits that induce consumption persistence, investment adjustment costs that induce investment persistence, and import adjustment costs. Nominal rigidities include sticky inflation Phillips curves in each sector of the economy.[4]

9. **The government determines how the fiscal balance-to-GDP ratio responds to excess tax revenue using a simple fiscal policy rule**. The rule for the fiscal balance-to-GDP ratio is of the following form:

$$\frac{fbal_t}{gdp_t} = \phi^* + d\left(\frac{\tau_t - \tau_t^*}{gdp_t}\right) \tag{1}$$

where $\frac{fbal_t}{gdp_t}$ is the fiscal balance-to-GDP ratio. If the response parameter $d = 0$, the fiscal balance is kept equal to ϕ^* at all times. For example, if $d = 0$ and the economy experiences an upswing with actual tax revenue τ_t exceeding steady-state tax revenue τ^*_t, the fiscal balance remains unchanged, and the excess tax revenue is spent. Such a response corresponds to a "balanced budget" rule and is here defined as procyclical. A response of $d < 0$ would also qualify as procyclical. As the response parameter d increases in the positive range, a greater share of the excess tax revenue is saved. When $d = 1$, a 1 percentage point of GDP increase in excess tax revenue translates into a 1 percentage point increase in the fiscal balance, a response consistent with a "structural balance" rule. The rule can be implemented by adjusting taxes or spending. A response of $d > 1$ implies that a 1 percentage point of GDP increase in excess tax revenue induces an improvement in the fiscal balance of more than 1 percentage point of GDP, and is, for the purposes of this paper, defined as being countercyclical.

10. **The central bank targets inflation by manipulating the nominal interest rate following a standard inflation forecast-based (IFB) rule**. The specification of this monetary policy rule is consistent with the IFB rule embodied in the BdR's MMT, as described by Gómez, Uribe, and Vargas (2002), and López (2003), and is of the following form:

$$i_t = i_{t-1}{}^{\mu_i} (r_t^* \overline{\pi}_{t+4})^{1-\mu_i} \left(E_t \frac{\overline{\pi}_{t+4}}{\pi^*_{t+4}}\right)^{(1-\mu_i)\mu_\pi} \tag{2}$$

[4] For further details regarding household preferences and firm technology in the model's traded and non-traded sectors, see Kumhof and Laxton (2007a).

where the gross policy interest rate is i_t, the inflation forecasting horizon is 4 quarters, the inflation target, π^* is for total 4-quarter gross inflation, $\overline{\pi}_{t+4} = \pi_{t+1}\pi_{t+2}\pi_{t+3}\pi_{t+4}$, and E_t denotes expectations based on information available at time t.[5] Coefficient $\mu_i \in [0,1)$ denotes the degree of nominal interest rate inertia. If μ_i =0, equation (2) implies that when the inflation forecast exceeds the target by 1 percentage point, the nominal interest rate increases by $1+\mu_\pi$. Monetary policy responds to output, but only to the extent that it is relevant for forecasting inflation. The equilibrium real interest rate r_t^* is endogenous, and is determined by the global market for loanable funds, as well as a country-specific risk premium.

11. **Given the importance of risk premiums in emerging markets, and their possible relationship with fiscal policy, the model includes an endogenous country-specific risk premium**. In particular, the risk premium on the interest paid on domestic debt is denoted ρ_t and enters the model via a risk-adjusted uncovered interest parity (UIP) equation for foreign currency bonds:[6]

$$i_t = i_t^{RW} E_t \varepsilon_{t+1}(1+\rho_t) \tag{3}$$

where i_t^{RW} is the gross nominal interest rate in the rest of the world, and ε_{t+1} denotes future gross nominal exchange rate depreciation.[7] The domestic risk premium ρ_t is assumed to have the following non-linear form:

$$\rho_t = \delta_1 + \frac{\delta_2}{\left((debt/gdp)^{\max} - (debt_t/gdp_t)\right)^{\delta_3}} \tag{4}$$

If $\delta_2 = 0$, then the risk premium always equals the exogenous level δ_1, regardless of the level of the debt-to-GDP ratio $(debt_t/gdp_t)$. If $\delta_2 > 0$, a decline in government debt reduces the risk premium. As the debt-to-GDP ratio rises towards the level $(debt/gdp)^{\max}$, the risk premium rises at an increasing rate. The assumption of an increasing slope is broadly consistent with empirical studies that find a positive linear relationship between the *logarithm* of the risk premium and the debt ratio, such as Arora and Cerisola (2001). Such

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[5] The gross rate equals one plus the rate. For example, an inflation rate of 3 percent corresponds to a gross rate of 1.03.

[6] There are two financial assets in the model, private bonds that are traded internationally, and government bonds that are subject to complete domestic bias.

[7] If the risk premium $\rho_t = 0$, an expected depreciation of the domestic currency by 1 percent is, via arbitrage, associated with an increase in the domestic interest rate by about 1 percentage point above the rest-of-the-world interest rate.

estimates imply that the *level* of the risk premium grows at an increasing rate as the debt ratio rises. The parameter $\delta_3 > 0$ determines the curvature of the risk premium function.[8]

Calibration

12. **The model is calibrated to contain two countries, Colombia and the rest of the world.** Each period corresponds to one quarter. Colombia is assumed to comprise 0.3 percent of world GDP, and to have a steady state inflation rate of 3 percent per year. The rest of the world is assumed to have a steady state inflation rate of 2 percent per year. The steady-state rate of technological progress is assumed to be 2 percent per year, population is assumed to grow at 1 percent per year, and the real interest in the rest of the world is assumed to be 3 percent per year in the initial steady state. The structural parameters regarding household preferences and firm technology are set following Kumhof and Laxton (2007b), who calibrated GIMF for the case of Chile and the rest of the world. In particular, the parameters that govern the degree of household myopia, a key non-Ricardian feature of the model, are calibrated as follows. Households in both Colombia and the rest of the world are assumed to have a planning horizon of 15 years, i.e., a probability of death of 6.7 percent per year, and a decline in lifecycle worker productivity of 5 percent per year. Fifty percent of Colombian households are assumed to be liquidity constrained. This proportion is the same as that assumed for Chile by Kumhof and Laxton (2007b), and is larger than that assumed for the United States by Kumhof and Laxton (2007a), 33 percent. Given that financial development is lower in Colombia than in the United States, a larger share of liquidity constrained households in Colombia seems plausible.[9]

13. **Fiscal parameters, such as the ratios to GDP of government transfers, purchases of goods and services, and public investment are calibrated based on data from the Colombian authorities**. The productivity of public capital is calibrated following Ligthart and Suárez (2005) who present a meta analysis of a large number of studies (for OECD countries including Mexico) on the elasticity of aggregate output with respect to public capital, and estimate this elasticity at 0.14. Accordingly, the model is calibrated so that a 10 percent real increase in public investment is associated with a long-run increase in real GDP net of depreciation of about 1.4 percent. The depreciation of public capital is set at 4 percent per year.

14. **Regarding the parameter that governs the fiscal policy response to the business cycle, *d*, this paper considers a range of values**. In particular, the analysis evaluates macroeconomic and external current account volatility for values of d ranging from the strongly procyclical response of $d = -0.5$ to the strongly countercyclical response of

[8] While the risk premium function is assumed to be continuous, a sudden, discontinuous change in the risk premium could be simulated by changing the exogenous component of the premium δ_1.

[9] A fully satisfactory calibration of these parameters would require the model to be estimated.

$d = 4.5$. For the purposes of this paper, the fiscal rule is implemented by adjusting payroll, consumption, and capital income tax rates by the same proportion.

15. **In the absence of business cycle shocks, the fiscal balance is assumed to equal the value that stabilizes the debt-to-GDP ratio at the projected end-2007 level of 38 percent**. In particular, in the steady state, there is a one-to-one correspondence between the fiscal deficit-to-GDP ratio and the government debt-to-GDP ratio that depends on the rate of nominal GDP growth, i.e.:

$$\left(\frac{fdef}{gdp}\right)^* = \frac{NG^*}{1+NG^*}\left(\frac{debt}{gdp}\right)^* \tag{5}$$

where NG^* denotes the steady state nominal growth rate, and *fdef* denotes the fiscal deficit. For example, if the steady state nominal growth rate is 6 percent, and the steady state debt-to-GDP ratio is 38 percent, then the steady state debt-stabilizing fiscal deficit equals 2.2 percent of GDP ($\phi^* = -2.2$). A decline in the fiscal deficit by 0.5 percentage points of GDP would be associated with a long-run decline in the debt-to-GDP ratio of 8.8 percentage points.[10]

16. **The monetary policy response function is calibrated in line with previous work on monetary policy in Colombia and other countries.** In particular, the baseline calibration of the inflation response parameter is $\mu_\pi = 1.5$. An inflation response of 1.5 is in the range of coefficients found to be "efficient" for Colombia, 1.0-2.0, (in terms of minimizing a weighted function of inflation, output, and interest rate volatility) by Lopez (2003) using stochastic simulations of the BdR's MMT model. For sensitivity analysis, the paper also considers a less aggressive inflation response of $\mu_\pi = 0.25$, and a more aggressive response of $\mu_\pi = 4$. The nominal interest rate inertia parameter is set at $\mu_i = 0.5$, a value consistent with empirical evidence for a number of countries.[11]

17. **Regarding the elasticity of the domestic risk premium to changes in government debt, calibration is complicated by the scarcity of empirical evidence for emerging market countries**. Based on a sample of data for 16 emerging market including Colombia, Rowland and Torres (2004) find that a 1 percentage point increase in the debt-to-GDP ratio is associated with an increase in the risk premium, proxied by the EMBI spread, of 7–8.26 basis points after controlling for a number of other explanatory variables.[12] Guided by this estimate, the baseline calibration of this paper implies that, starting from the end-2007

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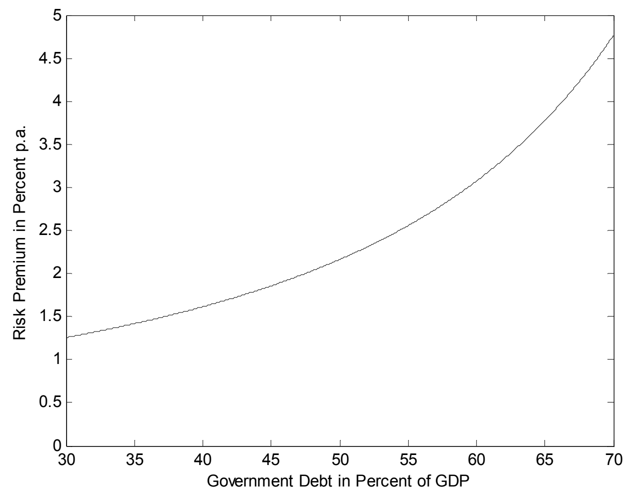
[10] The long-run decline in the debt-to-GDP ratio of 8.8 is found as follows: 8.8 = 0.5 × (1.06/0.06).

[11] See, for example, Clarida, Gali, and Gertler (1998) who estimate an interest rate inertia parameter of about 0.8 using monthly data for Germany, Japan, and the United States. This value corresponds to about 0.5 at a quarterly frequency ($0.8^3 = 0.51$).

[12] See Rowland and Torres (2004), Tables 5.3a and 5.3b.

position, a 1 percentage point increase in the debt-to-GDP ratio raises the risk premium by 8 basis points. For example, raising the debt ratio from the end-2007 expected level of 38 percent of GDP by 5 percentage points to 43 percent of GDP—the end-2006 level—increases the risk premium by about 40 basis points. This calibration is broadly consistent with the observed change in the Colombia EMBI spread from 2006 to 2007.[13] The assumed degree of curvature of the risk premium function is illustrated in Figure 1.

Figure 1. Domestic Risk Premium and the Debt-to-GDP Ratio



III. Results: Macroeconomic Effects of Fiscal Policy Tightening

18. This section reports the results of a fiscal tightening experiment in which the fiscal balance is improved permanently by 0.5 percentage points of GDP. In the base case, the government implements the consolidation by cutting public consumption by 0.5 percentage points of GDP, and the sensitivity analysis explores how the results depend on the composition of the adjustment. In each case, the results are reported in terms of the deviation from the baseline, i.e., the steady state that would occur if the fiscal consolidation were not implemented.

[13] The Colombia EMBI spread declined from an average level of 196 basis points during 2006 to an average of 159 basis points during January–September 2007, a change of 40 basis points, although a number of factors besides Colombia's debt-to-GDP ratio probably contributed to this change.

Base case: a cut in government consumption

19. **A fiscal consolidation based on a cut in government consumption is associated with a short-run decline in aggregate demand, but a medium-term increase in GDP**. The baseline experiment implements a permanent cut in real government consumption by 3 percent (the equivalent of 0.5 percent of GDP), which improves the overall fiscal balance-to-GDP ratio by 0.5 percentage points on impact (Figure 2). As debt and the associated cost of interest obligations decline, taxes are reduced to keep the overall fiscal balance unchanged at 0.5 percentage points of GDP above the initial position. The improvement in the fiscal balance, as well as the reduced interest cost, reduces the government debt-to-GDP ratio by eventually 8.8 percentage points.

20. **The cut in government consumption retards aggregate demand, although the effect is short-lived**. In particular, real GDP declines by 0.58 percent on impact, a response that implies a short-run multiplier of 1.15[14]. This response is broadly consistent with the effect of government spending shocks estimated for Colombia using a Bayesian VAR approach (Abrego and Österholm, 2007).[15] Monetary policy responds to the associated decline in expected inflation by reducing interest rates, which stimulates private spending, and contributes to a real depreciation. This monetary policy stimulus reduces the disinflationary effect of the fiscal contraction, while the resulting improvement in net exports increases net foreign assets as overall Colombian savings rise. Consequently, the current account improves by 0.36 percentage points of GDP within the first year, illustrating a strong reversed "twin deficit" phenomenon. Note that in conventional infinite horizon models, the fiscal tightening would have a negligible effect on the current account as the increase in public savings would be offset by lower private savings.

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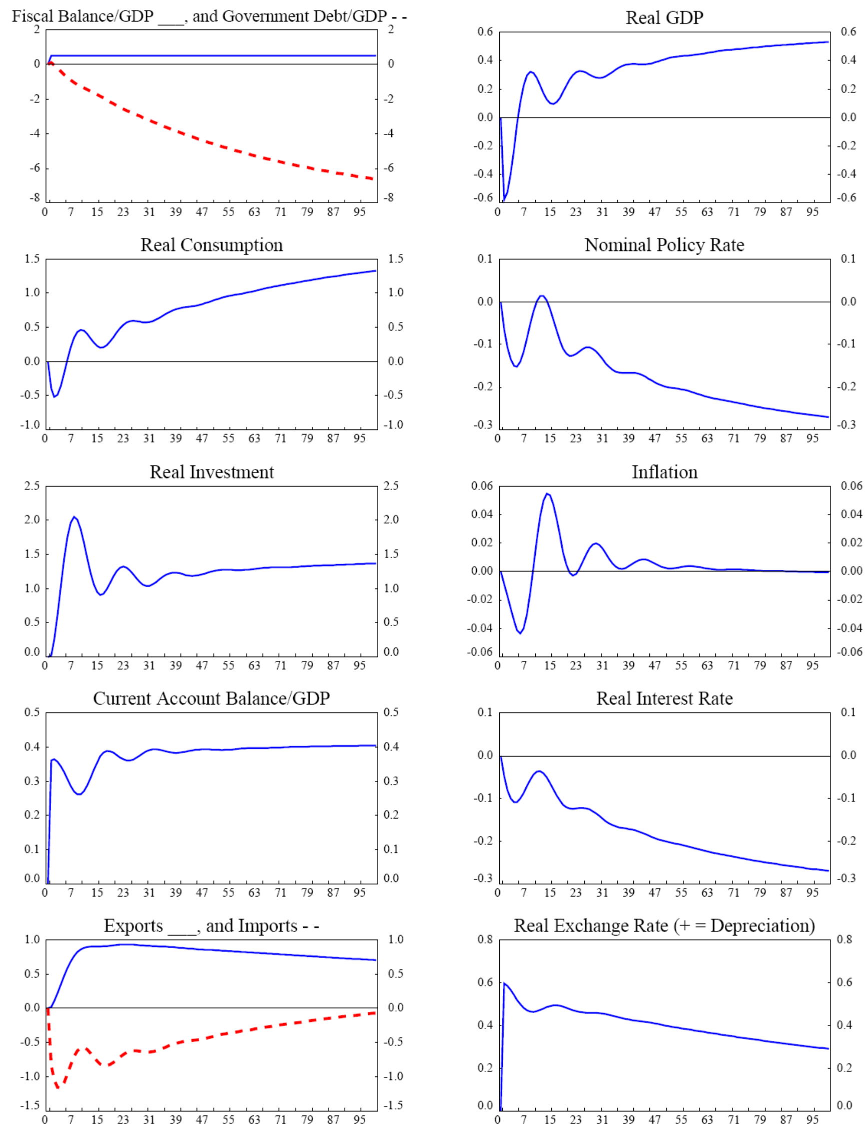
[14] The short-run multiplier of 1.15 is obtained by dividing the impact on GDP (0.58 percent) by the cut in government consumption in percent of GDP (0.5 percent).

[15] The response is also consistent with Blanchard and Perotti (2002) who estimate a government spending multiplier between 0.9 and 1.29 using a mixed structural VAR/event study approach for the United States that identifies fiscal shocks based on institutional information (see Table 4 of their paper). While the predictions of GIMF—as calibrated for the purposes of this paper—are in line with empirical studies such as Blanchard and Perotti (2002), they differ from the estimates of some other studies, such as Giavazzi and Pagano (1990) that find negative multipliers for some European countries.

Figure 2. Exogenous Permanent Cut in Public Consumption of 0.5 Percent of GDP
(In Deviation from Steady State Baseline)



21. **Over the medium run, the savings generated by lower government consumption and lower interest payments permit reductions in payroll and capital income taxes**. These tax reductions, and the decline in risk premiums due to the lower debt-to-GDP ratio have positive effects on labor supply, investment, GDP, and consumption.[16] Using the baseline calibration, a permanent improvement of the fiscal balance by 0.5 percent of GDP

[16] Using the additional fiscal space to increase productive public investment rather than to reduce taxes also results in long-run output gains. Results are not shown here, but are available on request.

that reduces the debt-to-GDP ratio by, eventually, 8.8 percentage points raises real GDP in the long-run by 0.56 percent (Figure 2).

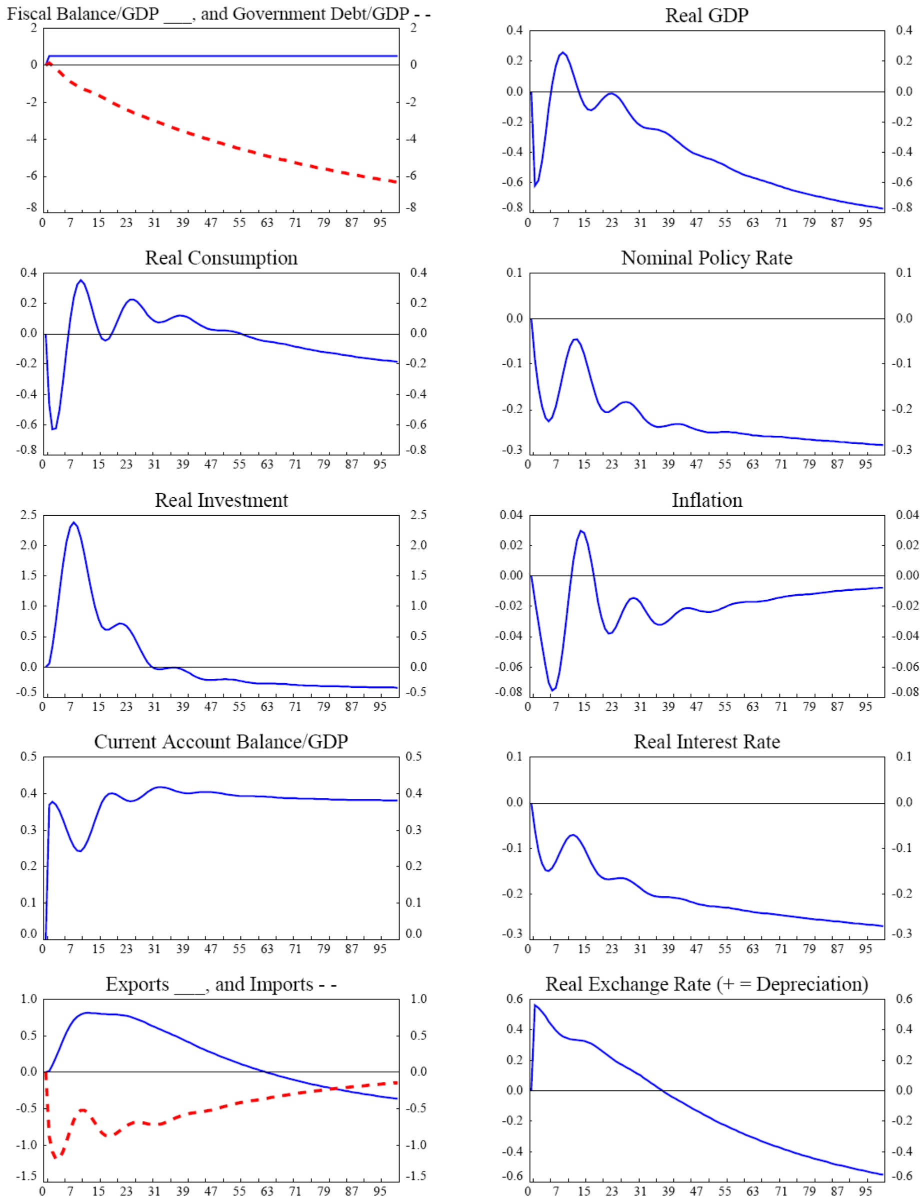
Sensitivity analysis: composition of fiscal tightening

22. **Variations on the baseline experiment reveal that the long-run positive effects of fiscal consolidation depend strongly on the composition of the adjustment**. In particular, implementing the consolidation by cutting productive public investment by 0.5 percentage points of GDP can jeopardize the long-run gains. As Figure 3 reports, a permanent cut in public investment leads to an aggregate demand contraction of 0.62 percent on impact, but GDP now also declines in the long run by 0.86 percent due to a contraction in the economy's supply capacity. If public investment is not productive, however, fiscal adjustment based on cuts in capital expenditure has a broadly similar effect as a reduction in public consumption.

23. **Similarly, the short-run contractionary effects of the consolidation depend on its composition**. When the fiscal consolidation is implemented by raising taxes or cutting transfers, the short-run contraction in GDP is smaller and more gradual than when the burden of tightening falls on government purchases. The difference in magnitude stems from the fact that after-tax disposable income and transfers can be spent by households on both domestic and foreign output, while government purchases have a strong domestic bias. The more gradual effect results from the assumption that households in the model have consumption habits, and respond gradually to a change in after-tax disposable income. In particular, a payroll tax increase of 0.5 percent of GDP is found to lower GDP by 0.39 percent after three quarters, compared to a 0.58 percent decline in GDP on impact when public consumption is cut.[17] An increase in consumption taxes has a smaller negative effect, reflecting the broader tax base, with GDP falling by 0.24 percent in the first year following a 0.5 percent-of-GDP increase in consumption taxes. A 0.5 percent of GDP cut in lump-sum transfers leads to a decline in GDP by 0.17 percent within the first year.

[17] The size of the effect of changes in taxes, which implies a multiplier of 0.78 after three quarters, is consistent with the empirical estimates of Blanchard and Perotti (2002) for the United States, who estimate a tax multiplier between 0.78 and 1.3 (see Table 3 of their paper), but is smaller than that of Romer and Romer (2007).

Figure 3. Exogenous Permanent Cut in Public Investment of 0.5 Percent of GDP
(In Deviation from Steady State Baseline)



IV. Results: Fiscal Policy and Macroeconomic Stability

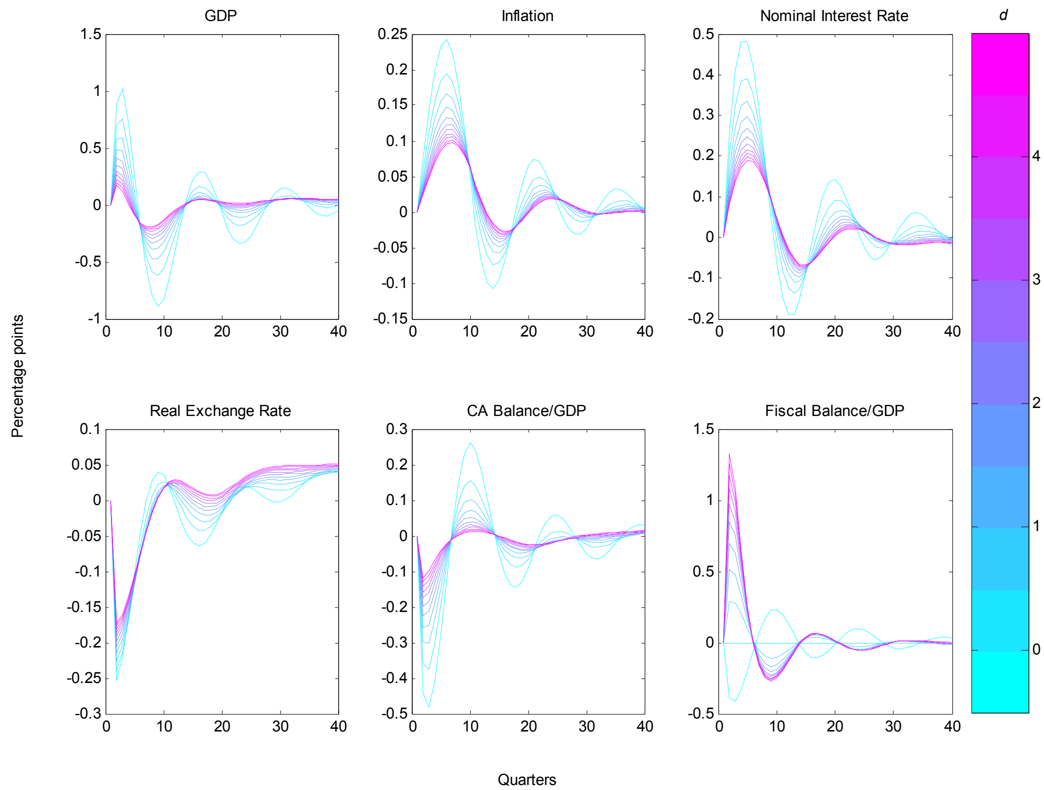
24. **Having discussed the dynamic effects of fiscal policy in the model, this section investigates how the impact of macroeconomic shocks depends on the strength of the fiscal policy response**. In particular, the section quantifies how the effectiveness of a fiscal policy response in contributing to macroeconomic stability depends on the type of shock, the strength of the monetary policy response, and the length of fiscal policy implementation lags. Regarding the type of shocks considered, the analysis focuses on three types that have different implications for output and inflation: (i) a "demand" shock due to a change in private savings; (ii) a "supply" shock due to a change in firms' markups; and (iii) a risk premium shock.

Demand shock: a reduction in private savings

25. **Following a demand shock due to a reduction in private savings, a stronger response of fiscal policy helps to stabilize both output and inflation, reducing the burden on monetary policy for stabilizing inflation.** Figure 4 reports the dynamics of GDP, inflation, interest rates, exchange rates, and the current account following a reduction in private savings that is due to an exogenous increase in the consumer rate of time preference.[18] The increase in private spending raises inflation, and results in a deterioration in the external current account balance. Monetary policy tightens in response to the higher inflation, inducing a real appreciation of the currency, and further worsening the current account balance. For each variable, Figure 4 reports how the effects of the shock depend on how cyclical fiscal policy is. A stronger response of the fiscal balance to excess tax revenue (a move from a small to a larger *d*) implies, due to the effect of fiscal policy on aggregate demand, that smaller interest rate increases are required to stabilize inflation. Consequently, the exchange rate appreciates less, and the external current account deteriorates less and then converges more smoothly towards the steady state.

[18] The shock involves a 4 percentage point increase in the consumer rate of time preference, and is assumed to follow an AR(1) process with a persistence coefficient of 0.9, implying a half-life of about 7 quarters.

Figure 4. Private Savings Shock and Strength of Fiscal Policy Response
(Deviation from Steady State Baseline)



Note: darker lines in the figure correspond to a stronger response of the fiscal balance to excess tax revenue (larger values of parameter *d*).

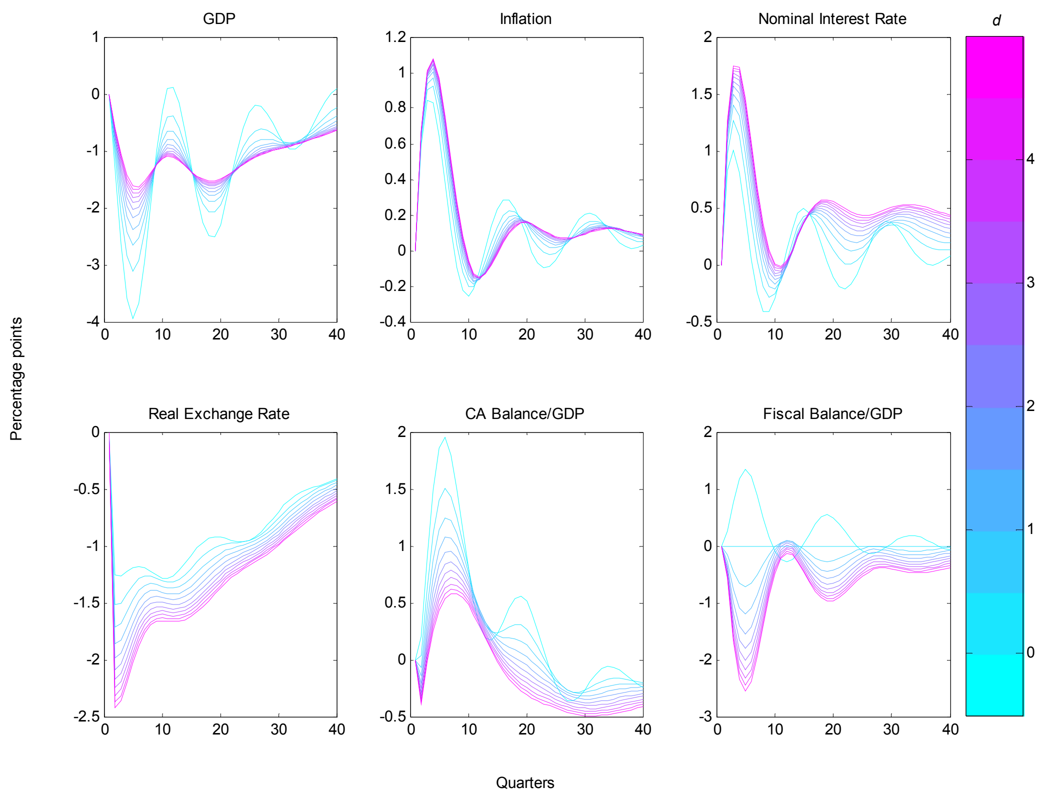
Supply shock: an increase in firms' markups

26. **Following a supply shock due to an increase in markups that shifts inflation and output in opposite directions, a fiscal policy response to the excess tax revenue induces an inflation-output volatility tradeoff**. Figure 5 reports the dynamics of GDP, inflation, interest rates, exchange rates, and the current account following a temporary increase in firms' markups. The source of the markup shock is assumed to be an increase in the degree of market power of firms in the distribution sector, which results in a restriction of activity, and an increase in firms' prices.[19] The decline in real demand for goods and services in response to the markup shock implies an increase in private savings, and an improvement in the external current account balance. At the same time, monetary policy tightens in response to the inflationary effect of the markup shock. A stronger response of the fiscal balance to the cyclical position (a move from a smaller to a larger *d*) implies a larger fiscal loosening,

[19] The supply shock involves a 5 percentage point increase in the markup of prices over marginal cost in the distribution sector, and is assumed to follow an AR(1) process with a persistence parameter of 0.9, implying a half-life of about 7 quarters.

which moderates the decline in output, but slightly raises inflation. However, the output-inflation volatility tradeoff associated with a fiscal policy response is modest under the baseline calibration of the model which assumes a strong monetary policy response to inflation expectations. In addition, a stronger easing in fiscal policy during the downturn moderates the improvement in the current account balance.

Figure 5. Markup Shock and Strength of Fiscal Policy Response
(Deviation from Steady State Baseline)



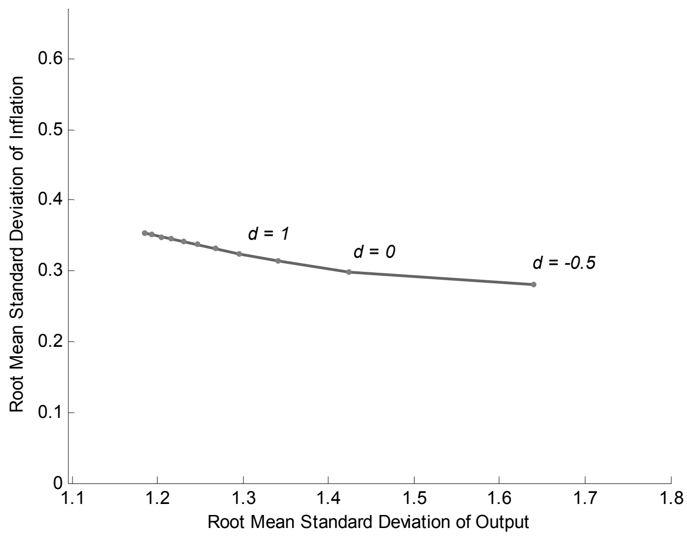
Note: darker lines in the figure correspond to a stronger response of the fiscal balance to excess tax revenue (larger values of parameter *d*).

27. **To quantify the inflation-output volatility tradeoff, an efficiency frontier is constructed**. The efficiency frontier identifies the policies that minimize a weighted average of inflation and output volatility given the model and shock structure. The weighted average, denoted ℓ, takes the following form:

$$\ell = \sigma(inflation) + \lambda\sigma(gdp) \tag{6}$$

where σ denotes the root mean squared deviation about the steady state, and λ is the weight on output. Figure 6 shows the efficiency frontier in inflation-output volatility space, where moving "southwest" implies a decline in both inflation and output volatility.[20] The slope of the efficiency frontier indicates that, for the range of fiscal response parameters considered ($d \in [-0.5, 4.5]$), a 1 percent decline in output volatility is associated with an increase in inflation volatility of about 0.2 percent. Note that in the case of the demand shock, a stronger fiscal policy response (a move from a low value of *d* to a large value of *d*) would, in Figure 6, imply moving "southwest" reducing both output volatility and inflation volatility.

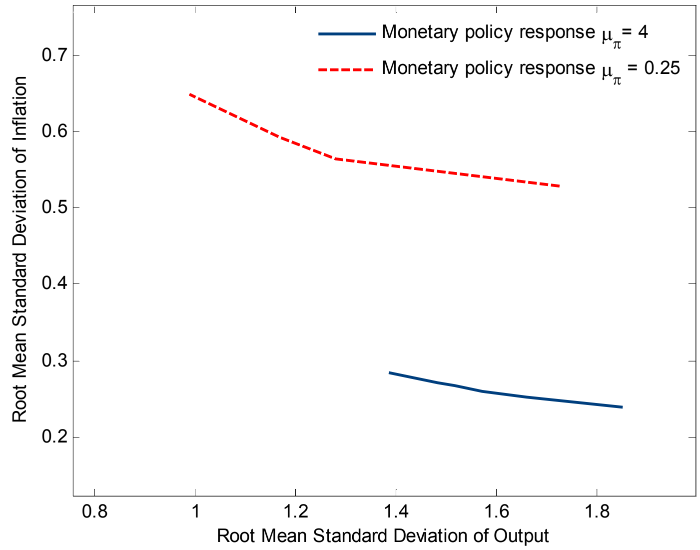
Figure 6. Efficiency Frontier: Markup Shock



28. **However, the inflation-output volatility tradeoff is sensitive to the strength of the monetary policy response to inflation expectations**. In particular, a weaker monetary policy response to inflation expectations substantially increases the inflationary consequences of an accommodative fiscal response to the supply shock. To illustrate this point, the supply shock experiment is repeated with two alternative monetary policy rules: (i) a weak monetary policy response corresponding to a value of $\mu_{\pi} = 0.25$ in the policy rule; and (ii) a more aggressive monetary policy response corresponding to $\mu_{\pi} = 4$. As Figure 7 reports, the efficiency frontier is twice as steep with the weak monetary policy response, a result that underlines the importance of a strong commitment by the central bank to stabilizing inflation expectations. In addition, for any given fiscal policy response, a weaker monetary policy response implies a higher level of inflation volatility.

[20] The efficiency frontier is constructed as follows: (i) the markup shock is simulated multiple times, each time with an alternative fiscal rule parameter *d*; (ii) for a given value of λ, the policy rule (and associated inflation-output volatility pair) that minimizes the function ℓ is identified; and (iii) step (ii) is repeated for a range of λ values (from 0 to 30 in steps of 0.0001).

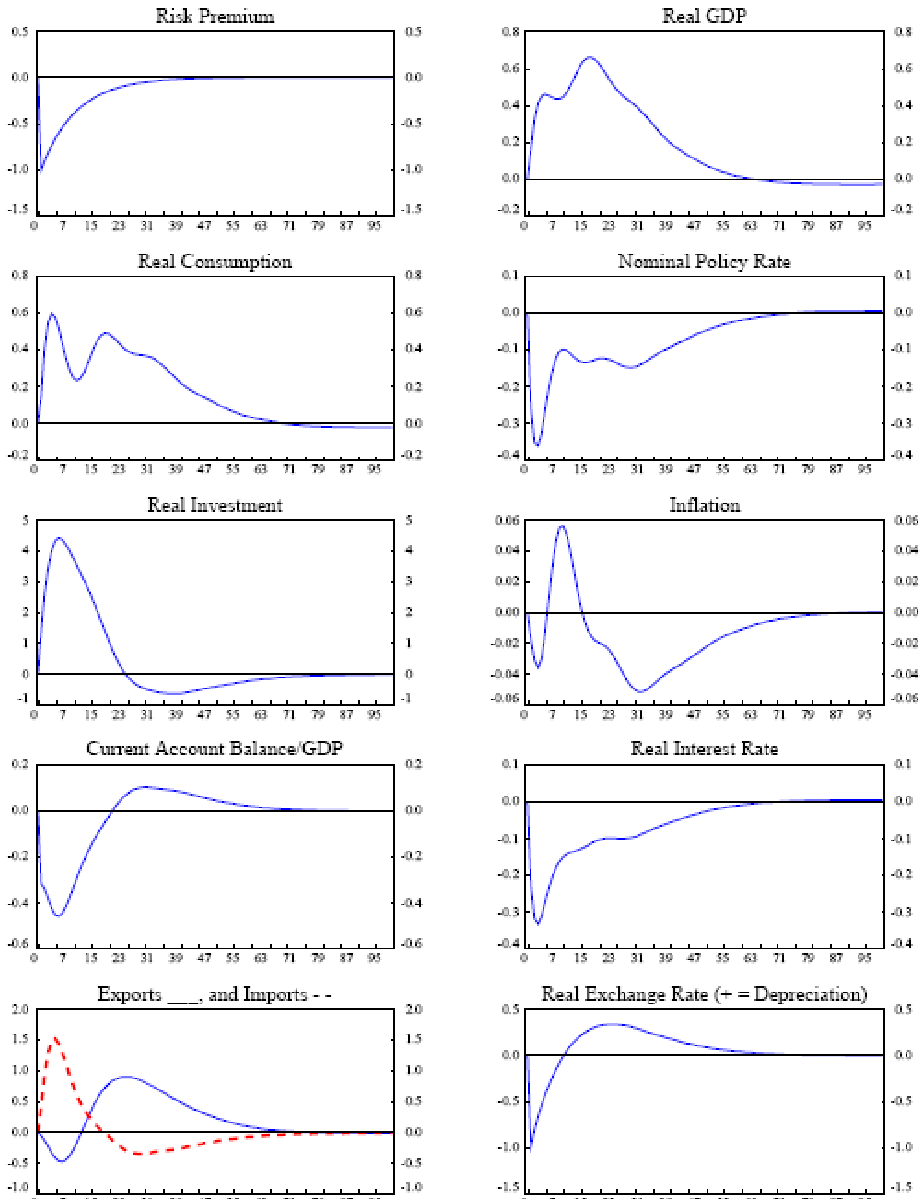
Figure 7. Efficiency Frontier for Different Monetary Policy Response Parameters



Risk premium shock

29. **An exogenous fall in the risk premium induces a real appreciation, an increase in investment and consumption, and a deterioration in the external current account balance**. The experiment involves an exogenous 100 basis-point fall in the exogenous risk premium component δ_1, and is assumed to follow an AR(1) process with a persistence parameter of 0.9. Figure 8 reports the dynamic responses of key macroeconomic variables with no change in the fiscal balance ($d = 0$). In particular, the decline in the risk premium ρ_t implies an increase in the risk-adjusted return on Colombian bonds $\frac{i_t}{(1+\rho_t)}$, which, via arbitrage Equation (3), raises demand for Colombian assets and induces a domestic currency appreciation. The lower risk premium also lowers the interest rate on borrowing from the rest of the world, which stimulates consumption, both of domestic and of foreign output. In addition, the lower risk premium reduces the cost of capital, and raises the profitability of private capital, which stimulates investment. Due to quadratic investment adjustment costs, the response of investment is hump-shaped. Overall, the rise in private spending demand worsens the external current account balance. Over the medium run, stabilizing net foreign liabilities requires an improvement in the trade balance, an adjustment that implies an exchange rate depreciation. The initial appreciation also has a disinflationary effect, which prompts an easing in monetary policy. The disinflationary pressure is in part off-set by inflationary pressures associated with the increase in aggregate demand, and the overall response of inflation is therefore modest.

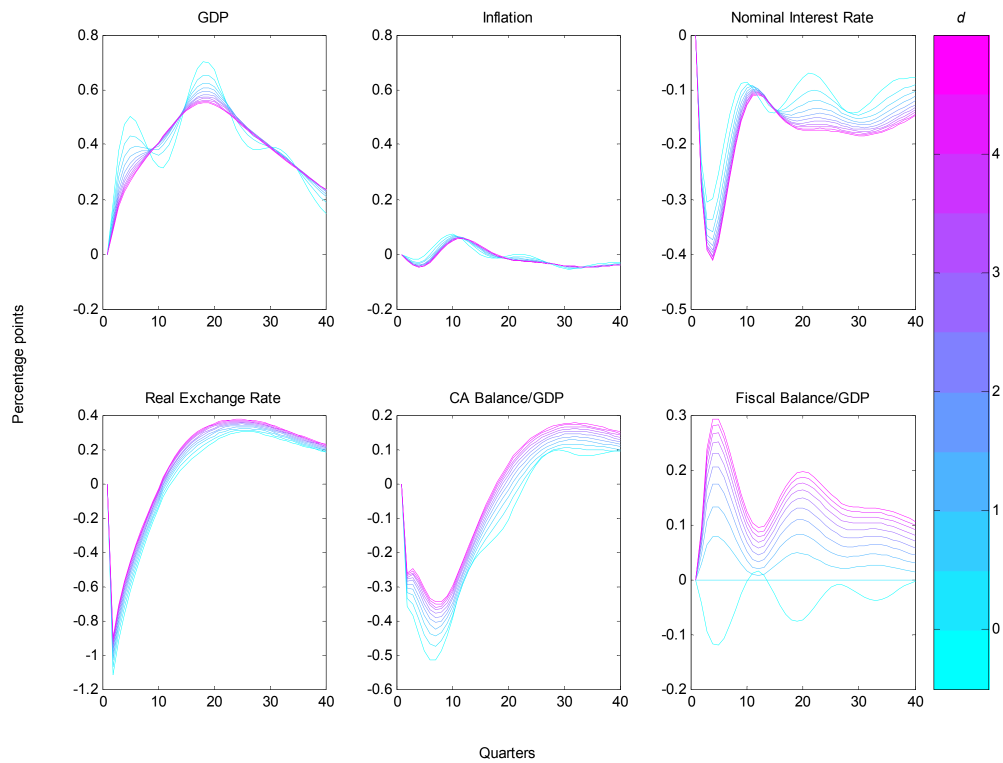
Figure 8. Temporary Fall in Risk Premium by 100 Basis Points
(In Deviation from Steady State Baseline)



30. **Faced with the risk premium shock, and the associated expansion in activity, a stronger fiscal policy response dampens the deterioration in the external current account balance, and stabilizes output.** As Figure 9 reports, a stronger response of the fiscal balance to the increase in fiscal revenue (a move from a smaller to a larger *d*) moderates the increase in output, and slightly lowers inflation. In addition, the tighter fiscal

position moderates the exchange rate appreciation, and reduces the deterioration in the external current account balance.

Figure 9. Risk Premium Shock and Strength of Fiscal Policy Response
(Deviation from Steady State Baseline



Note: darker lines in the figure correspond to a stronger response of the fiscal balance to excess tax revenue (larger values of parameter *d*).

Sensitivity analysis: length of fiscal policy implementation lags

31. **The capacity of fiscal policy to contribute to macroeconomic stability depends on the speed with which it can respond**. To illustrate this point, the fiscal response function in Equation (1) is altered to incorporate adjustment lags as follows:

$$\frac{fbal_t}{gdp_t} = \phi^* + d\left(\frac{\tau_{t-L} - \tau^*_{t-L}}{gdp_{t-L}}\right) \qquad (7)$$

where L denotes the implementation lag in quarters. The fiscal surplus now responds with a lag of L quarters to changes in excess tax revenue. The results (not shown, but available on request) suggest that, for implementation lags of 1 or 2 quarters, a countercyclical fiscal policy continues to enhance macroeconomic stability, although by less than in the absence of implementation lags. However, when the fiscal response is delayed by 3 quarters or more, an aggressive response to excess tax revenue ($d > 1$) can be counter-productive, and destabilize output.

V. CONCLUSIONS

32. **This paper quantifies the dynamic effects of fiscal policy using a structural model, GIMF, and finds that while fiscal consolidation retards aggregate demand in the short run, it can also yield long-run output gains**. The short-run slowdown is smaller when the consolidation is based on transfer cuts than when it involves cuts in government purchases, and when the central bank responds strongly to the associate easing of inflation pressures. In particular, the contraction of output within one year following a 0.5 percent-of-GDP increase in the fiscal surplus is estimated to reduce GDP by 0.17–0.62 percent within one year, depending on the composition of the fiscal tightening. The long-run gains accrue due to lower risk premiums that crowd in private activity, and are particularly strong if the savings from lower debt-interest payments are used to lower distortionary taxes or to increase productive public investment. The long-run output gains from a permanent improvement in the fiscal balance by 0.5 percentage points of GDP is estimated at 0.56 percent of GDP when the consolidation is based on cuts in government consumption. However, a fiscal consolidation based on productive public investment cuts alone can jeopardize such long-run gains, and reduce long-run output.

33. **The paper also finds that fiscal policy can substantially contribute to a smooth landing for an overheated economy**. In addition to stabilizing output and inflation, a stronger response of the fiscal balance to excess tax revenue reduces the burden on the central bank of raising interest rates and lessens the associated degree of exchange rate appreciation. The stronger response of the fiscal balance also contributes to a more moderate deterioration in the external current account balance during expansions in domestic demand. A stronger fiscal response also moderates the deterioration in the current account balance in response to a fall in risk premiums, highlighting the stabilizing role fiscal policy can play following external shocks.

34. **Moreover, the analysis finds that the success of fiscal policy in enhancing macroeconomic stability depends on the type of shock, the response of monetary policy, and the length of fiscal policy implementation lags**. In particular, while a stronger fiscal policy response can lower both output and inflation volatility during aggregate demand shocks, a supply shock introduces an inflation-output volatility tradeoff. This tradeoff is modest if monetary policy is strongly committed to stabilizing inflation expectations. Regarding fiscal policy implementation lags, the analysis suggests that with lags of up to 2 quarters, less procyclical policy still enhances macroeconomic stability given the persistence of business-cycle shocks considered here. However, an aggressive countercyclical response that is delayed by 3 quarters or more can be counter-productive, and destabilize output.

References

Abrego, Lisandro, and Pär Österholm, 2007, "External Linkages and Economic Growth in Colombia: Insights from a Bayesian VAR Model," forthcoming IMF Working Paper (Washington: International Monetary Fund).

Arora, Vivek, and Martin Cerisola, 2001, "How Does U.S. Monetary Policy Influence Sovereign Spreads in Emerging Markets?" *Staff Papers*, International Monetary Fund, Vol. 48, No. 3.

Bayoumi, Tamim, and Silvia Sgherri, 2006, "Mr. Ricardo's Great Adventure: Estimating Fiscal Multipliers in a Truly Intertemporal Model," IMF Working Paper 06/168 (Washington: International Monetary Fund).

Blanchard, Oliver, and Roberto Perotti, 2002, "An Empirical Characterization of the Dynamic Effects of Changes in Government Spending and Taxes Output," *Quarterly Journal of Economics*, Vol. 107, pp. 1329–68.

Clarida, Richard, Jordi Gali, and Mark Gertler, 1998, "Monetary Policy Rules in Practice: Some International Evidence," *European Economic Review*, Vol. 42, pp. 1033–67.

Gomez, Javier, José Darío Uribe, and Hernando Vargas, 2002, "The implementation of Inflation Targeting in Colombia" Borradores Semanales de Economía, No. 202.

Goodfriend, Marvin, 2007, "How the World Achieved Consensus on Monetary Policy," NBER Working Paper No. 13580 (Cambridge, Massachusetts: National Bureau of Economic Research).

Kumhof, Michael, and Douglas Laxton, 2007a, "A Party Without a Hangover? On the Effects of U.S. Government Deficits," IMF Working Paper No. 07/202 (Washington: International Monetary Fund).

———, 2007b, "Chile's Structural Fiscal Balance Rule: A Model-Based Evaluation" (unpublished manuscript; Washington: International Monetary Fund).

Ligthart, Jenny E., and Rosa M. Martin Suárez, 2005, "The Productivity of Public Capital: A Meta Analysis," manuscript, University of Groningen, and Tilburg University.

López, Martha, 2003, "Efficient Policy Rules for Inflation Targeting in Colombia" Borradores Semanales de Economía, No. 240.

Mishkin, Frederic S., 2007, "Will Monetary Policy Become More of a Science?" NBER Working Paper No. 13566 (Cambridge, Massachusetts: National Bureau of Economic Research).

Romer, David, and Christina D. Romer, 2007, "The Macroeconomic Effects of Tax Changes: Estimates Based on a New Measure of Fiscal Shocks," NBER Working Paper No. 13264 (Cambridge, Massachusetts: National Bureau of Economic Research).

Rowland, Peter, and Jose L. Torres, 2004, “Determinants of Spread and Creditworthiness for Emerging Market Sovereign Debt: A Panel Data Study,” Borradores de Economía, Banco de la República, Bogotá.

Giavazzi, Francesco, and Marco Pagano, 1990, “Can Severe Fiscal Contractions be Expansionary? Tales of Two Small European Countries,” *NBER Macroeconomic Annuals* 5, pp. 75–111 (Cambridge, Massachusetts: National Bureau of Economic Research).