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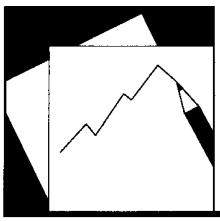

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Monetary and Fiscal Policy Options for Dealing with External Shocks: Insights from the GIMF for Colombia

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Monetary and Fiscal Policy Options for Dealing with External Shocks: Insights from the GIMF for Colombia

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Abstract

This paper utilizes an open-economy New Keynesian overlapping generations model, the Global Integrated Monetary and Fiscal Model (GIMF), to assess the macroeconomic effects of external shocks and the impact of various monetary and fiscal policy responses. The simulations assess the effect of shocks to trade, world income, and risk premia for public debt. The results suggest that under Colombia's inflation targeting regime, which incorporates exchange rate flexibility and a highly responsive monetary policy, the economy is well poised to adjust to different external shocks. They also suggest that the potential role of fiscal policy in responding to shocks depends critically on financing conditions.

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I. INTRODUCTION

What macroeconomic policy options work best in addressing external shocks? Turbulence in financial markets and uncertainty about the outlook for global growth have all increased the importance of understanding the macroeconomic effects of external shocks and how best to respond to them. This is no less important in Colombia than other emerging market countries, as external shocks have historically contributed to a large share of the variance of output (Abrego and Osterholm, 2008).

The Colombian authorities now face the challenge of guiding the economy toward a soft landing in the face of a harsher global environment. Economic growth is projected to slow from over 7 percent in 2007 to about 3 percent in 2008 as a result of less buoyant domestic demand conditions and, more recently, the effects of global shocks. For 2009, growth is projected to ease further. Inflation is projected to decline as well, but is still expected to exceed the Banco de la República (BdR)'s medium-term inflation target of 2-4 percent. As such, the authorities face a difficult macroeconomic landscape in which they attempt to both reduce inflation toward their medium-term target while preventing an excessively sharp decline in growth in the context of an unfavorable global outlook.

The tightening of financial conditions in the wake of global financing turbulence also presents a challenge for macroeconomic stabilization. As in other emerging market countries, equities, sovereign spreads, and exchange rates have been adversely affected since the start of the global crisis in September 2008. In this context, the scope for accommodative fiscal policy—for example, through the operation of automatic stabilizers—is unclear. This is particularly the case in Colombia, where the 2009 fiscal stance already entails a mild fiscal expansion.

While the role of monetary policy in responding to shocks has been extensively studied, relatively little work has been done to empirically assess the role of fiscal policy. A number of central banks have developed large scale models to predict the effects of monetary policy, and these models can be used to assess the effects of monetary policy in response to external shocks. However, as discussed in several recent papers, these models often cannot adequately replicate the dynamic effects of fiscal policy found in the empirical literature.[1] 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. As such, these models are inadequate for assessing the role of different fiscal policy interventions in the face of changes in the external environment.

This paper utilizes an open-economy structural model to assess the impact of different external shocks on Colombia and alternative monetary and fiscal policy responses. The analysis builds on the Global Integrated Monetary and Fiscal (GIMF) model developed at the IMF (see Kumhof and Laxton, 2007) and the Colombia-specific version presented in Leigh

[1] See, for example, Kumhof and Laxton (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.

(2008). 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. The model is used to assess the effects of shocks to world income, an exogenous trade shock, and an increase in global risk aversion on key macroeconomic variables, as well as the effects of differing policy responses.

The paper also addresses the effects of fiscal policy under differing assumptions regarding financing conditions. When financing conditions are normal, a country with a relatively low level of public debt to GDP, a credible fiscal policy framework, and low financing needs may be able to allow automatic stabilizers to function to help soften the output effects of external shocks. However, under less favorable financing conditions—when higher deficits trigger a substantial increase in risk premia—this may not be the case.

The remainder of the paper is structured as follows. Section II presents the key features of the model. Sections III and IV report the results, and Section V concludes with a summary of policy implications.

II. THE MODEL

GIMF is a dynamic general equilibrium model developed at the Fund that is equipped for both monetary and fiscal policy analysis.[2] 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.

Ricardian equivalence is assumed not to hold in the model for four reasons:

- Overlapping generations. 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.

- Life-cycle labor productivity. 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.

- Liquidity-constrained consumers. The model contains liquidity-constrained consumers (LIQ) who do not have access to financial markets to smooth

[2] This section draws on Leigh (2008).

consumption, and change their consumption one-for-one with changes in after-tax income.[3]

- Distortionary taxes. 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.

Monetary policy is effective due to nominal and real rigidities. Model features include nominal rigidities such as a Phillips curve for each sector, wage rigidities, and pricing to market. The model incorporates real rigidities with respect to consumption habits and adjustment costs for changes in investment, imports, and retail sales.

Monetary and fiscal policy are modeled through reaction functions, including an inflation forecast-based rule (IFB), and a simple fiscal policy rule:

- The central bank targets inflation by adjusting the nominal interest rate following a standard inflation forecast-based (IFB) rule (see Leigh, 2008, for additional details). The specification of this monetary policy rule is consistent with the IFB rule embodied in the BdR's MMT, as described in Gómez, Uribe, and Vargas (2002), and López (2003).

- The government determines how the fiscal balance-to-GDP ratio responds to excess tax revenue using a simple fiscal policy rule:

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

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 $\tau^*{}_t$, 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

[3] These consumers solve an intra-temporal 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.

into a 1 percentage point increase in the fiscal balance, a response consistent with a "structural balance" rule where automatic stabilizers are allowed to operate.[4]

Since financing conditions play a key role in determining the capacity to pursue counter-cyclical fiscal policies, the model incorporates a country-specific risk premia. Domestic interest rates incorporate a country-specific risk premia denoted ρ_t ,which enters the model via a risk-adjusted uncovered interest parity (UIP) equation for foreign currency bonds:[5]

$$i_t = i_t^{RW} E_t \varepsilon_{t+1} (1 + \rho_t) \tag{2}$$

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.[6] The domestic risk premium ρ_t is assumed to have the following non-linear form:

$$\rho_t = \delta_1 + \frac{\delta_2}{\left((debt/gdp)^{\max} - (debt_t/gdp_t)\right)^{\delta_3}} \tag{3}$$

Domestic interest rates are thus a function not only of the level of public debt to GDP, but also an exogenous risk premia factor, δ_1. Given that recent increases in interest rates for emerging market debt have little to do with concerns about debt levels per se—but rather changes in global risk aversion and more generalized concerns regarding financing conditions in emerging market countries—the relationship between fiscal policy and financing conditions may best be simulated by shifts in the parameter δ_1. [7]

[4] The rule is implemented by modifying tax rates to achieve the desired objective.

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

[6] If the risk premium $\rho_t = 0$, then 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.

[7] Another option would be recalibrate the model and assume a more adverse relationship between the debt-to-GDP ratio and interest rates. However, given that the change in the deficit may trigger changes in expectations in a non-continuous fashion, we simulated this with an upward shift in the exogenous component of the interest rate equation.

III. Macroeconomic Effects of External Shocks and Alternative Policy Responses

This section reports on the results of three scenarios under which the external environment deteriorates. 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 shock did not occur. In the first scenario, there is an exogenous shock to exports of about 10 percent. In the second scenario, global growth falls by some 2 percentage points. In scenario three, global financial market turbulence is assumed to lead to an increase in risk premia for public debt of about 100 basis points.

For each of the shocks, the effect on macroeconomic variables of different policy responses is also assessed. In particular, three policy responses are considered: (i) a baseline case in which monetary policy responds rapidly in light of the expected effect of the shock on inflation, as is the case under Colombia's inflation targeting regime; under this scenario, fiscal policy is assumed to follow a constant deficit rule, that is d=0; (ii) a delayed response, whereby monetary policy remains unchanged for a period of time with fiscal policy as in the baseline;[8] and (iii) a cyclically neutral fiscal stance (d=1), under which the budget deficit is allowed to increase in response to the adverse effect of the shock on growth and tax revenues; under this scenario, the monetary policy reaction function is the same as under the baseline. For all shocks, the model results show the impact on macroeconomic variables over a period of 32 quarters.

Under the assumption of favorable financing conditions, the government can run a cyclically neutral fiscal policy without strong adverse effects on interest rates. The model is calibrated as in Leigh (2008), where running temporary deficits—as in the case when automatic stabilizers are allowed to work—has a minor impact on interest rates. Under this scenario, an accommodative fiscal policy can help reduce the output costs of external shocks. Simulations with more adverse financing conditions—which have an important bearing on the results—are presented in section IV.

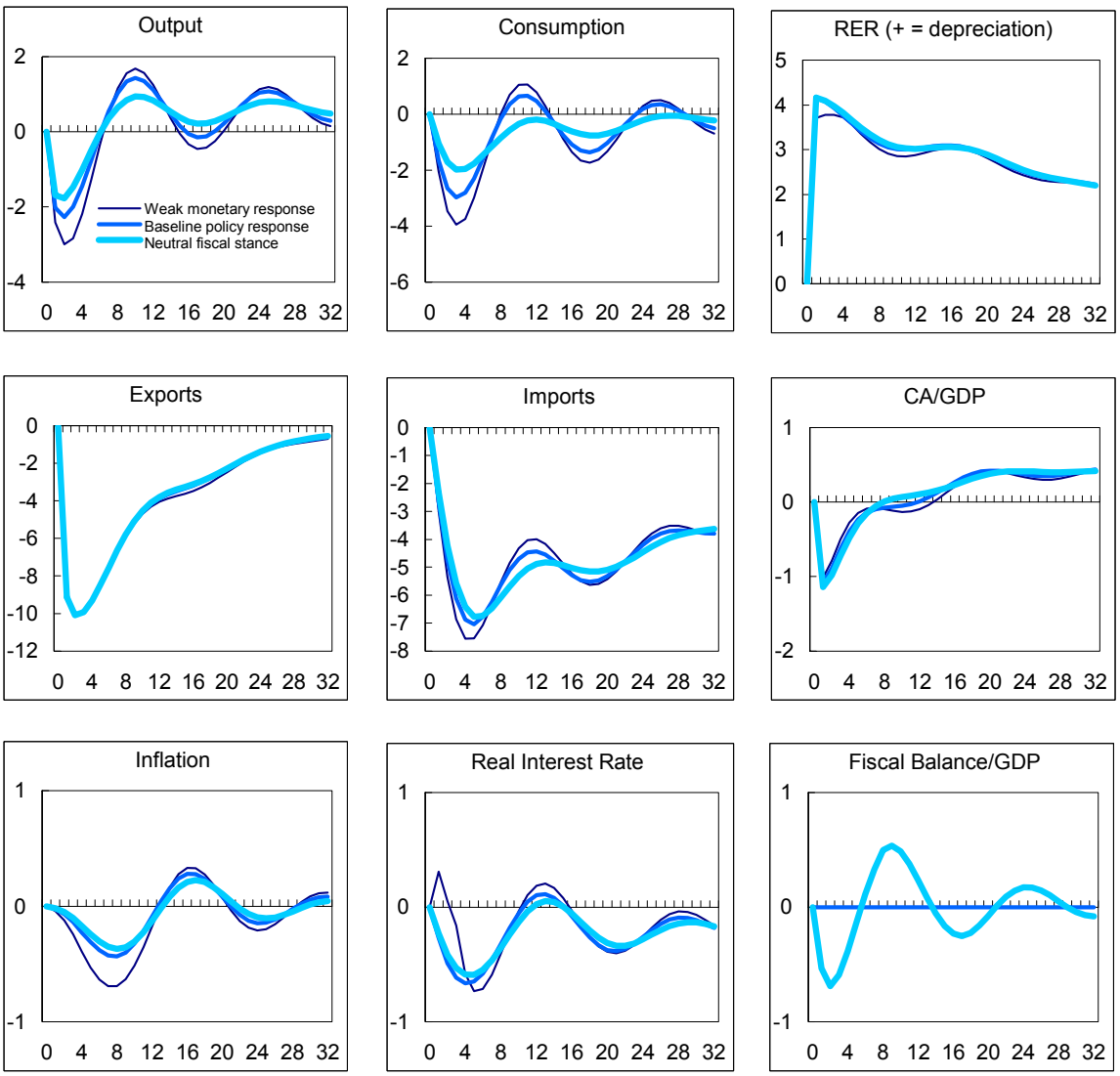
The exchange rate is assumed to be fully flexible. The monetary policy reaction is not a function of the exchange rate, so exchange rate flexibility plays an important role in helping the economy adjust to these shocks, and helps minimize their adverse effect on output and the external accounts.

[8] The delayed response is simulated by mechanically increasing the inertia of monetary policy for the two quarters following the shock.

Case 1: Exogenous reduction in trade

Under this scenario, the shock is simulated as an exogenous decline in Colombian exports. This is modeled as an increase in the home bias of the rest of the world, that is, an adverse shock to "tastes." The shock is assumed to be temporary in nature and to follow an AR(1) process with a half-life of five years. The size is calibrated such that net exports are initially reduced about 10 percent (2 percent of GDP). The macroeconomic effects of the shock are presented in Figure 1.

Figure 1. Macroeconomic Response to a Decline in the Demand for Colombian Exports under Different Policy Responses
(Deviation from the baseline)



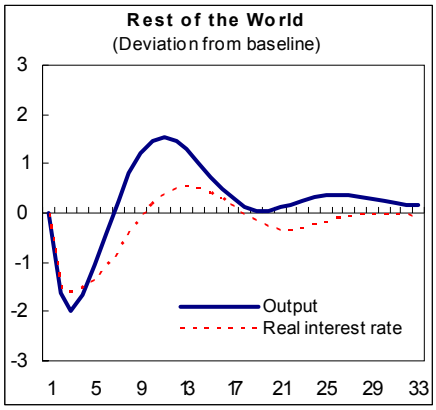
As expected, the results suggest that a decline in foreign demand for Colombian exports provokes both a contraction in output and a real depreciation. In the first year, the real exchange rate depreciates by about 4 percent, while output deteriorates about 1¾–3 percent, depending on the policy response. The depreciation, as well as the temporary nature of the shock, leads to a recovery of exports over time. Imports decline following the depreciation, owing to a decline in household consumption, but not enough to avoid a deterioration in the current account deficit of about one percentage point of GDP. Given Colombia's ample level of reserves (about 10 percent of GDP) and relatively low level of external debt (about 20 percent of GDP), the increase in the current account deficit could easily be accommodated, under the assumption of normal financing conditions.

A rapid easing of monetary policy softens the effect of the shock on output and contributes to further depreciation. The baseline policy response—which seeks to replicate the typical response of the Banco de la República to a decline in output—implies a reduction in real interest rates of about 65 basis points in the first year.[9] To illustrate how such a policy helps stabilize macroeconomic aggregates, a weaker monetary response—simulated by reducing the speed of adjustment of nominal rates during the first year—is also simulated in Figure 1.[10] Under the assumption of a more sluggish monetary policy response, there is a sharper decline in output and consumption in the initial years, an increase in output volatility in the medium term, and the need for an even stronger monetary response to stabilize output in the long run.

Under normal financing conditions, allowing the budget deficit to rise in response to the shock also helps reduce short-run output losses. To illustrate this point we simulate a neutral fiscal stance,[11] which implies a deterioration in the fiscal deficit—owing to the reduction in output and decline in revenues—of almost ¾ percent of GDP. This fiscal response reduces the decline in output by about ½ percentage point and household consumption by about 1 percentage point for the first year. At the same time, it lowers the volatility of both aggregates over the medium-term.

Case 2: A decline in global growth of two percentage points

In this simulation, we assume a temporary increase in the preference for savings in the rest of the world. This leads to a decline in world growth of two percentage points. Over time, the decline is reversed as monetary policy eases and the



[9] Fiscal policy is assumed to follow a constant deficit rule.

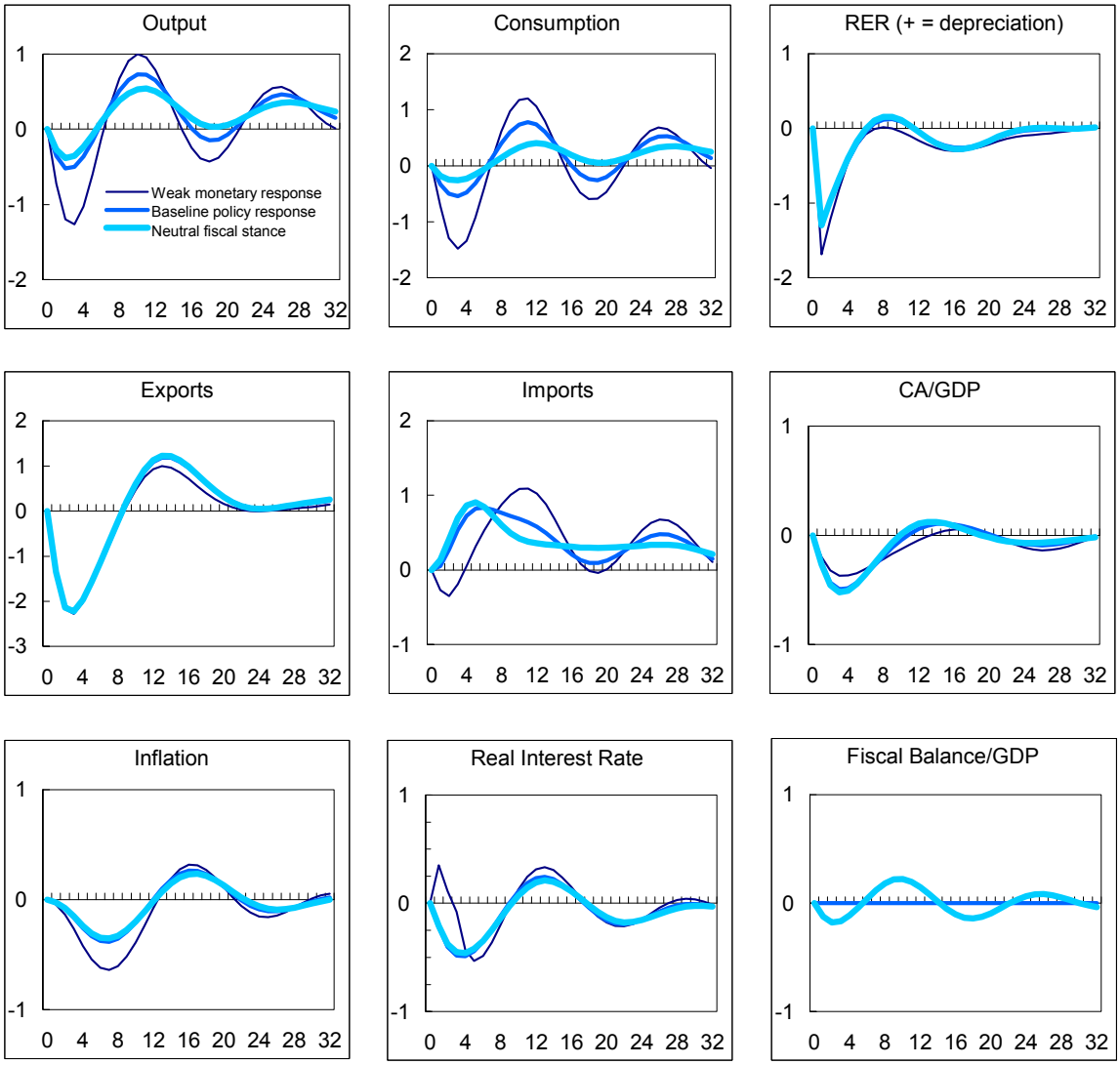
[10] The coefficient of persistence of nominal rates is increased to .99 in the first and second quarters following the shock and to .75 in the third and fourth quarter. The coefficient is set to 0.5 in the following years.

[11] The constant deficit rule assumed under the baseline policy response is procyclical, as the decline in taxes resulting from the reduction in output would need to be matched by spending cuts.

preference shock dies out. In Colombia, the shock leads to a decline in growth of about ½ percentage point (Figure 2). Exchange rate appreciation and monetary policy easing in Colombia help to ameliorate the shock by allowing for higher consumption and imports, and result in a correspondingly higher current account deficit. A neutral fiscal policy, allowing an increase in the deficit as tax revenues and output decline, helps ease the effect of the shock on growth.

The model suggests that Colombia is well suited to deal with this kind of shock. The decline in Colombian output growth during the first year of the shock is between a quarter and a third of that in the rest of world under the inflation targeting framework. This finding is roughly in line with that of Banco de la República (2008), which focuses on the effect of a global slowdown through trade links. The result is somewhat at odds with Abrego and Osterholm (2008), however, which estimates that a shock to world growth would imply a 40 percent larger decline in Colombian growth. However, their estimates are based on a Bayesian VAR that also includes the impact realized through financial linkages.

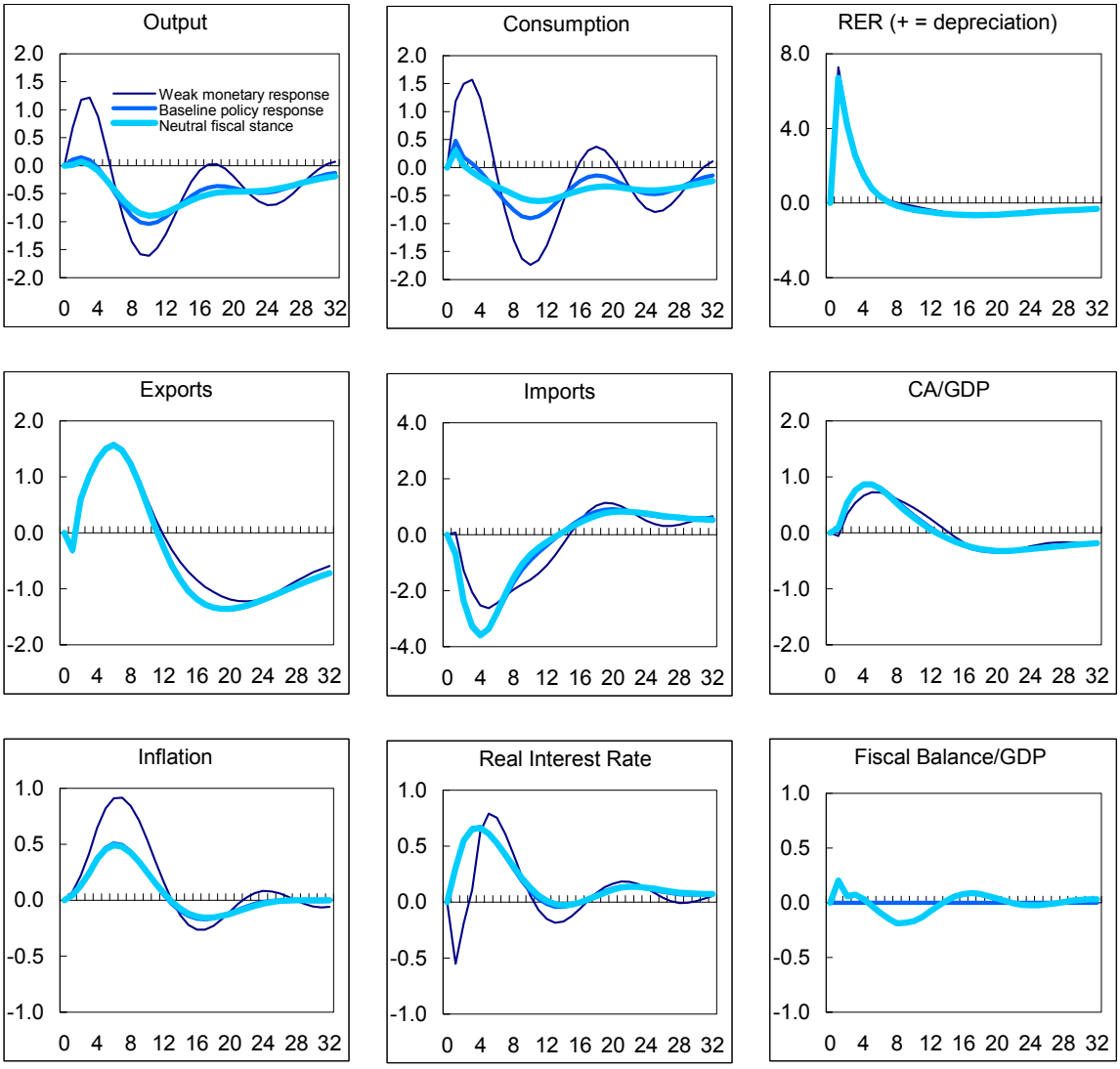
Figure 2. Macroeconomic Response to a Decline in World Growth
(Deviation from the baseline)



Case 3: An increase in the risk premium

This scenario assumes an exogenous 100 basis point increase in the risk premium. The increase in δ_1 (equation 3) is assumed to follow an AR(1) process with a half-life of 1½ years. The increase in the risk premium implies a decrease in the risk-adjusted return on Colombian bonds, which, via arbitrage, lowers demand for Colombian assets and induces currency depreciation. The results for this simulation are presented in Figure 3.

Figure 3. Macroeconomic Response to Temporary Increase in Risk Premia
(Deviation from the baseline)



Under this scenario, the real depreciation triggered by the increased risk premia has an inflationary effect, which prompts a tightening of monetary policy. The inflationary pressure is in part offset by deflationary pressures associated with the decline in aggregate demand.

The higher cost of borrowing from the rest of the world depresses consumption and increases the cost of capital. This reduces the profitability of private capital and dampens investment. The depreciation also leads to higher exports and lower imports in order to improve the external account and the international investment position. The overall decline in private spending also improves the external current account balance. Over the medium run, stabilizing net foreign liabilities requires a weakening of the trade balance, an adjustment that implies an exchange rate appreciation.

The increase in the risk premia has a long-lasting effect on output. In some ways, the increase in the risk premia acts like a supply shock, as the depreciation of the currency leads to an increase in inflation while also reducing output. The increase in inflation also requires a tightening of monetary policy to return inflation to the long-run target. Output returns to the baseline level after a very long period. These results underscore the importance of the risk premia and financing conditions for macroeconomic stability, themes which are further explored in section IV.

Monetary policy helps to ameliorate the shock. The increase in real rates is smaller than the increase in the risk premium, which reduces the impact of the negative shock. The simulations suggest that a more pronounced easing of monetary policy (as under the "weak monetary policy response") would be ill-advised, as this exacerbates the inflationary pressures generated by the devaluation. With a weak response in the immediate aftermath of the shock, an even stronger tightening would be needed later, and an even deeper decline in output.

Under a shock to the risk premia, a cyclically neutral fiscal stance is not very effective in helping stabilize output. As indicated in Figure 3, the return of output to the baseline is largely similar under both the neutral fiscal stance and a stance in which the deficit is unchanged. The reason is that under such a scenario, there is a tradeoff between the objectives of returning inflation to the long-term target and stabilizing output. In the case where the fiscal stance is neutral, monetary policy is tighter than under the baseline, offsetting the effect of automatic stabilizers on economic activity.

This analysis has important implications in the context of the recent increase in global risk aversion. Under this kind of shock, accommodative fiscal policy may not be effective. The results also foreshadow the analysis in the following section, where we assess the impact of financing conditions on the effectiveness of fiscal policy in responding to a trade shock.

IV. The Role of Fiscal Policy Under Different Financing Conditions

The effectiveness of fiscal policy is linked to the availability of financing and the credibility of the fiscal framework. In this section, we assess the effectiveness of fiscal policy by combining a trade shock with an exogenous shock to the risk premia.

Case 1: Exogenous shock to the external environment

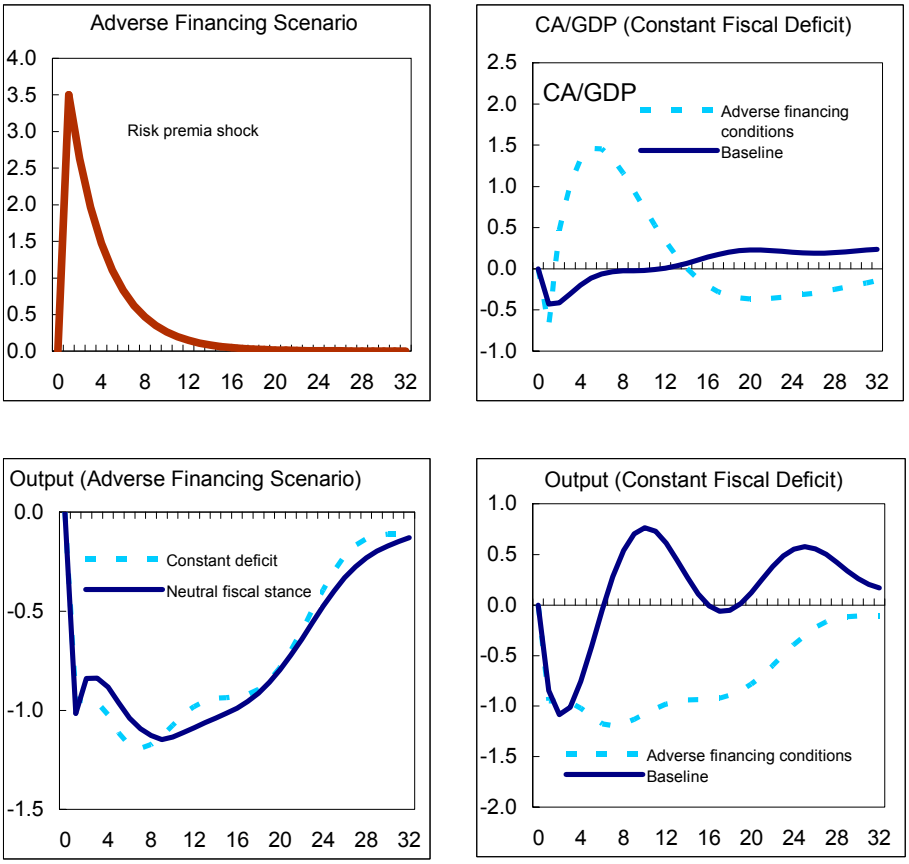
Under this scenario, we assess the effects of different fiscal policy responses to a trade shock (as described in case 1), but under adverse financing conditions. To simulate this we add a relatively sharp (350bp) but short-lived (half-life of ½ year) risk premium shock (Figure 4). This helps simulate the situation confronted by many emerging market countries—including Colombia—in the current global context, where export growth is projected to decline while sovereign debt spreads have risen. In effect, the analysis attempts to combine elements of both case one (the trade shock) and case three (the risk premia shock) discussed above.

Under the scenario of both a trade shock and increase in risk premia, inflationary pressures increase. Under normal financing conditions, the trade shock leads to a small devaluation; but inflationary pressures are not high, as the trade shock leads to a decline in demand pressures. This allows some room for monetary easing. Under the scenario with adverse financing conditions, however, the devaluation and accompanying inflationary pressures are quite large. Although domestic demand initially declines in this scenario, the increase in inflation allows little scope for monetary accommodation. Under normal financing conditions, the trade shock would lead to an increase in the current account deficit. With the combined shocks, the devaluation is large enough to lead to an improvement in the current account balance.

Adverse financing conditions also hinder the effectiveness of fiscal policy in responding to a trade shock. Under normal financing conditions, a neutral fiscal policy reduces the squared deviation of output from the steady state by 44 percent, compared to a constant deficit rule. Under adverse financing conditions, the reduction is less than 1 percent, implying that fiscal policy is of little help in stabilizing output.[12] The reason for this is broadly similar to that described under the case of an increase in the external risk premia in case three above: an increase in the budget deficit is at cross purposes with monetary policy and the objective of bringing inflation back toward the long-run target.

[12] Calculated for the first five years following the shock.

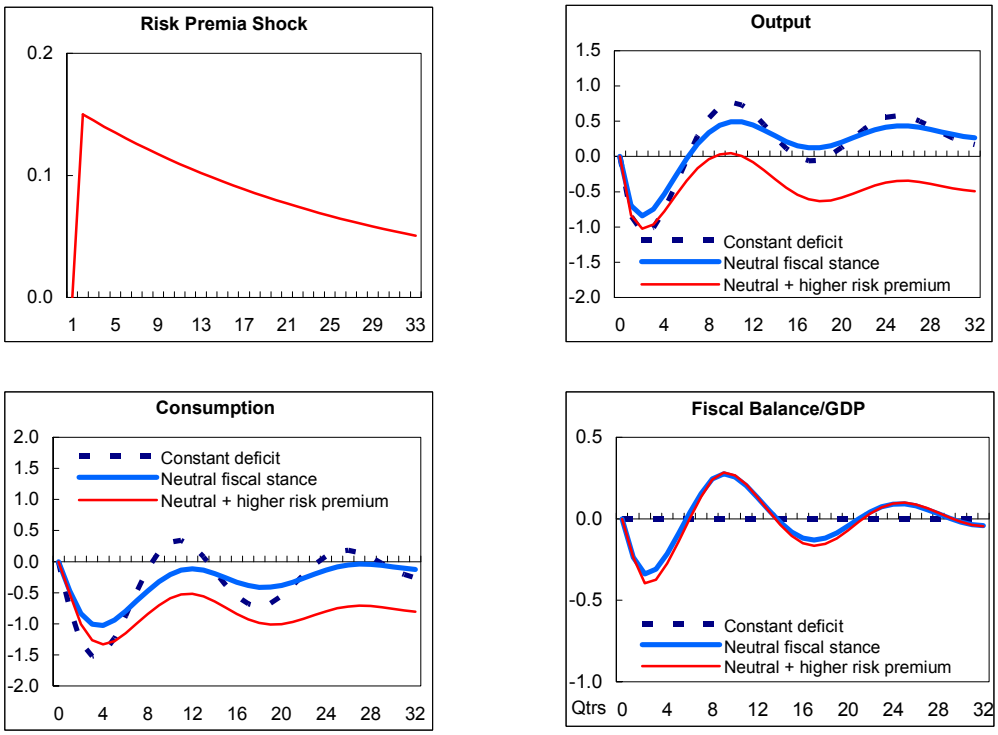
Figure 4. Macroeconomic Response to a Decline in the Demand for Colombian Exports under Adverse Financing Conditions
(Deviation from the baseline)



Case 2: Credibility problems

Fiscal policy could also be less effective if an increase in the budget deficit itself triggers an increase in risk premia. The prospect of a higher budget deficit and public financing requirement may alter expectations about the government's commitment to its long-term fiscal targets and lead to somewhat higher interest rates. We simulate this with a small (15bp) but rather long-lived (5-year half-life) increase in the risk premia. In these circumstances, the policy choice we simulate is either to maintain a constant deficit or a neutral stance. We then show the effect on output and consumption when an accommodative fiscal stance (in response to a trade shock) is undertaken in favorable financing conditions, and when the increase in the deficit triggers a higher risk premium. The results (Figure 5) suggest that even a small increase in the risk premia—if long-lived—can render fiscal policy largely ineffective. This underscores the importance of a credible medium-term fiscal policy framework to help anchor market expectations regarding the government's commitment to fiscal targets over the longer term.

Figure 5. Macroeconomic Response to a Decline in the Demand for Colombian Exports under a Prolonged Financing Shock
(Deviation from the baseline)



The results depend on the size and duration of the financing shock that is incorporated into the analysis. If the risk premia shock is of very short duration and of a small size, then there may still be a case in favor of allowing the automatic stabilizers to work; to the extent that the risk premia shock is long-lived or large, the effectiveness of fiscal policy is hampered.

V. Summary of Policy Implications

External shocks can have a significant effect on key macroeconomic variables, but with a flexible exchange rate and an agile response by monetary policy, the adverse effects are manageable. The simulations presented in the paper, using the GIMF, indicate that all three of the simulated shocks—an exogenous reduction in export demand, a decline in world growth, and an increase in risk premia—would each have a significant effect on growth in the short run. At the same time, the rapid response of monetary policy—along with a flexible exchange rate—help to limit the adverse effects on output losses, consumption, and the external accounts.

The potential role of fiscal policy in responding to external shocks depends on financing conditions. The simulations indicate that adopting a cyclically neutral stance can reduce the output costs of external shocks under normal financing conditions. If financing conditions are

adverse, then the case in favor of allowing automatic stabilizers is less clear-cut. The results suggest that the case for and against accommodative fiscal policy is an empirical question, and would need to judged cautiously in light of the availability of financing and market expectations.

References

Abrego, Lisandro, and Pär Österholm, 2008, "External Linkages and Economic Growth in Colombia: Insights from a Bayesian VAR Model," IMF Working Paper WP 08/46 (Washington: International Monetary Fund).

Banco de la República, 2008, *Informe de Inflación* (March).

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

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

Leigh, Daniel, 2008, "Achieving a Soft Landing: The Role of Fiscal Policy," IMF Working Paper WP/08/69 (Washington: International Monetary Fund).

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