IS TIGHTER FISCAL POLICY EXPANSIONARY UNDER FISCAL DOMINANCE?: HYPERCROWDING OUT IN LATIN AMERICA

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We test for hypercrowding out as a signal of market concerns over fiscal dominance in five Latin American countries. Hypercrowding out occurs when fiscally dominated governments' domestic credit demands are perceived as so intrusive to a nation's financial system that a move towards fiscal surplus lowers interest rates and increases growth. We sample five Latin American countries to test for these relationships. Judged by the results of vector error correction models, three nations test clearly positive, suggesting market concern despite their recent efforts towards fiscal balance. (JEL E430, E620, O230, O540)

That the current real value of any government's net liabilities always equals the present discounted value of future primary surpluses is a mathematical condition (See appendix) for solvency. Sometimes markets enforce these equivalences by methods not to a government's liking. Governments that anticipate such enforcement will run *monetarily dominant* regimes, in which primary fiscal balances are adjusted to limit debt accumulation beyond a certain point. That is, the government conditions its fiscal surpluses or deficits on the value of its liabilities.

In contrast, *fiscally dominant* governments set primary fiscal deficits independently of real liabilities – and may persistently run in the red. A fiscally dominant government is one that can fully meet future obligations only through heavy dependence on the inflation or outright default. Without inflation, the governments are or are perceived to be on a trajectory to insolvency.

We examine responses to the fiscal behavior of five Latin American governments – Brazil, Chile, Colombia, Mexico and Peru over the period as evidence of the role that market perceptions of fiscal dominance have played over the last decade. In fiscally dominated countries, responses of a nation's growth and interest rates to changes in fiscal

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balance can be 180º opposite that of monetarily dominated countries. We use multiple empirical models to test for such responses in our five sample countries.

A substantial literature focuses on Brazil as having exhibited signs of fiscal dominance. Our results suggest that Brazil is not alone. Despite Latin American fiscal and monetary reforms over the last fifteen years, financial markets have routinely behaved as if several Latin American countries are fiscally dominated.

We also examine ties between a measure of fiscal dominance and the volatility of a government's primary balance. We discuss why problems with fiscal dominance may incite primary balance volatility – a phenomenon that is consistent with our model results.

Having examined an influence of fiscal dominance, we turn to influences on fiscal dominance. Consistent with Reinhart and Rogoff (2004), whose work suggests capital markets' memories of default are long, we find positive links between how often a nation defaulted over the last century and our measure of market concerns about fiscal dominance. Considering the efforts our sample countries have made over the last decade to achieve fiscal balance, our results may surprise some analysts.

I. CHARACTERISTICS OF FISCALLY DOMINATED COUNTRIES

Because markets identify fiscal dominance on the basis of expected future fiscal behavior, high current debt plays no role in forging fiscal dominance's peculiar links between fiscal balance, interest rates and growth. Some Western European countries – Belgium is an example – have high debt relative to GDP but markets do not treat them as fiscally dominated. Some formerly problematic countries, such as the Republic of Ireland, have reduced their debt burdens dramatically. Even before the adjustment took

place, the market showed signs that it perceived that Ireland's had become a monetary dominant regime.

Conversely, markets may identify fiscal dominance in countries whose debt measures are not currently high, but where a build-up of contingent debt may create incentives to monetize liabilities. An example is Argentina in the middle and late 1990s when it ran fiscal deficits during marked real GDP expansions.

The financial market hallmark of a fiscally dominated country is a special category of crowding out. *Special* is the operative word here. Monetarily dominated regimes can also crowd out the availability of financing for private sector borrowers.

In monetarily dominated regimes crowding out, when it occurs at all, is typically only partial – at least in the short run. As a result, expansionary (contractionary) fiscal policy may cause GDP to expand (contract). In the worst case for monetarily dominant regimes, a rise in interest rates caused by larger fiscal deficits completely crowds out private investment and fiscal policy has no effect on GDP.

That fiscal policy has no effect in the worst case scenario for monetarily dominant regimes is what separates them from fiscally dominated regimes. In fiscally dominated regimes, changes in fiscal policy have such extreme effects on interest rates that they more than swamp whatever direct effects fiscal policy may have. Fiscal deficits accordingly become contractionary rather than expansionary. We refer to this phenomenon as *hypercrowding out* . Viewed from the opposite direction, hypercrowding out in fiscally dominant countries means that fiscal tightening becomes expansionary. Raising the primary fiscal surplus lowers real interest rates so much that GDP expands despite the direct contraction of aggregate demand from fiscal tightening.

To enhance our ability to make legitimate inter-country comparisons of fiscal dominance indicators, we restrict our considerations to countries that did not default within our ten-year sample period. This choice rule nevertheless affords much cross-country variation. Fiscally speaking, ten years is not a very long time to be off the bottle.

A disproportionately large share of the recent literature associated with fiscal dominance (Blanchard, 2004; Favero and Giavazzi, 2004; Ramos and Tanner, 2002; Razin and Sadka, 2004) focuses on Brazil – perhaps because Brazil is perceived to be particularly susceptible to fiscal dominance. We statistically examine some arguments of this literature as part of our testing efforts. In a model explicitly about Brazil, Razin and Sadka (2004) argue that a solution to credibility or uncertainty problems reflected in credit rating shocks is to raise the primary surplus. They argue that this step lowers real interest rates, but their model is purely conjectural. The authors do not base it on derivation, optimization, or computation.

In a Brazil-inspired fiscal dominance paper by Blanchard (2004), both government debt and investor risk aversion are high, and much of the debt is denominated in foreign currency. Under such conditions, Blanchard posits, a real interest rate increase will more probably trigger currency depreciation than currency appreciation. Blanchard argues that other interest rate effects – expressed through demand, output, and inflation – ought not to prove strong.

Favero and Giavazzi (2004) note that the ability of Brazil's economy to withstand international financial shocks depends on investors' perceptions of the country's future fiscal stance. They find that the sensitivity of investors' perception of Brazil's default risk as measured by the Emerging Market Bond Index to changes in the U.S. corporate bond spread is markedly dampened when Brazil's debt-to-GDP ratio is high.[1]

Because the primary fiscal balance in our five countries figures importantly in our testing efforts, and because current debt does not, we emphasize that the recent literature (except Razin and Sadka , 2004) [2] formulates fiscal dominance as a function of debt instead of the primary surplus. As mentioned, we show in the appendix that the current level of debt is the present (discounted by interest rates corrected for nominal GDP growth) value of all future primary surpluses and inflation tax revenue. In a present discounted sense, the two are equivalent if one is sure about future governments' intentions.

In sum, when investors are uncertain and the interest (discount) rate of a country is very high, the current primary surplus becomes more important to them. In this case, strong fiscal effort can have a particularly marked effect on the perception of fiscal solvency and, so, on the discount rate. Hence when the effects of fiscal dominance (here, high discount rates) are pervasive, the current primary surplus becomes a strong predictor of future solvency.[3] Accordingly, fiscally dominated governments may have to overshoot a primary surplus that markets would otherwise (without perceptions of fiscal dominance) assess as starting the debt-GDP ratio on a downward trend without overshooting. In any case, significant improvement in the current primary surplus will have a disproportionate effect on perceptions of solvency and reduction in fiscal dominance.[4] Our examination therefore addresses how markets may react to a country's fiscal stance through the responses of real interest rates to primary surpluses, of growth to primary surpluses and of the various impulses and responses noted in the work of Blanchard (2004), Tanner and Ramos (2002), and Razin and Sadka (2004).

II. GRANGER CAUSALITY TESTS

A comparison of pairwise Granger causality offers preliminary and very rough metrics on which countries seem to suffer from fiscal dominance and which do not. We perform Granger causality tests (Table 1) for four variables: the real (domestic) interest rate (REALIRATE), growth (GROWTH), fiscal surplus as a percentage of GDP (BAL), and the exchange rate (XRATE) - for Brazil, Chile, Colombia, Mexico and Peru. The sample period is 1995Q1-2004Q1. Our first two concerns are for the conventional wisdoms about fiscal dominance – that fiscal surplus drives interest rates and that the fiscal surplus (because of its extreme effect on the crowding out phenomenon) pushes up growth. We also will want to examine Blanchard's (2004) argument that an increase in real rates forces down exchange rates in fiscally dominant countries. Recall that such tests are by their nature not as fully or well specified as the VEC models we subsequently examine.[5]

In the case of Brazil, where analysts' perceptions of fiscal dominance are strong enough to have attracted much literature on the subject, fiscal balance (BAL) Granger causes (at the .05 level of significance or better) real domestic interest rates (REALIRATE, first equation) and growth (GROWTH, second equation) but not exchange rates (XRATE, fourth equation). Perhaps surprisingly to those who imagine Brazil to differ from other Latin American countries, fiscal balance also Granger causes real domestic interest rates for Peru and Mexico.

In contrast, however, fiscal balance does not Granger cause growth (GROWTH) for any of the five nations except for Brazil. Also at the .05 level of significance or better, real interest rates do not Granger cause growth for any of the five nations except for Brazil, although Peru's real interest rate does Granger cause growth at the .0975 level.

To more fully address Blanchard's argument that an increase in real rates forces down exchange rates in fiscally dominated countries, real interest rates (REALIRATE) do not come close to Granger causing exchange rates (XRATE, fourth equation) in any of the five sample countries, regardless of the effect that balance has upon interest rate in them. Note that fiscal balance also has no effect on exchange rates for any country.

Finally it may be useful to consider the effect of all three possible Granger causing variables (ALL) for each country. In the first equation ALL Granger causes Real interest rates for Brazil and Peru but not for any of the other three countries. ALL Granger causes GROWTH in Brazil but not in any other country. Also, ALL fails to Granger cause exchange rates in any country in the fourth equation and fails to Granger cause fiscal balance in any country in the third equation.

III. VECTOR ERROR CORRECTION RESULTS

To address these same issues in a simultaneous equation context we move to a series of vector error-correction models - together with their corresponding impulse response functions – for each of the five countries in our sample. We apply the same four variables as in the Granger Causality model to a VEC model, but with one, two and three lags for each variable. That is, we include the GDP growth rate (GROWTH), fiscal balance (BAL), real interest rates (REALIRATE), and the exchange rate (XRATE). Our sample periods are the same as for the Granger Causality tests, 1995Q1 through 2004Q1. It is important to note that while the Granger Causality tests are estimated in levels, the VEC model performs its estimates in first differences. This difference may be seen as explaining some differences between the Granger Causality test results and those that appear in the VEC model results and in the corresponding impulse-response results.

For this model, we performed one-standard-deviation impulse-response simulations for ten periods out for each of the variables, but report only the results pertinent to fiscal dominance – the effect of BAL on REALIRATE (Chart 1)and the effect of BAL on GROWTH (Chart 2). The complete series of test results including the complete Cholesky decompositions and the five VEC models are available from the authors.

The results from these simultaneous equation models are more complicated and more difficult to interpret than the Granger causality models. To summarize the pertinent results, fiscal surplus (Chart 1) has its strongest negative effect on interest rates for Brazil, but its impact for Mexico is about three-fourths the Brazil's while Peru's is about one-half Brazil's. These results are similar to the Granger causality test results. The results suggest market concerns over fiscal dominance for all three countries, at least for some substantive portion of the sample period.[6] Note, in contrast, that Balance scarcely has any effect in either direction for Chile, although the effect is slightly positive. For Colombia, the relationship between fiscal surplus and interest rates is markedly more positive than for Chile.   In both the cases of Chile and Colombia, then, the effect of Balance on Real Interest Rates does suggest that markets believe fiscal behavior is not consistent with fiscal dominance. Note that while Brazil, Chile, Mexico and Peru all defaulted on their sovereign debt during the "lost decade" of the 1980s, Colombia did not default on any sovereign debt at that time or since.

Moving to the impulse-response values for the link between fiscal balance and growth (Chart 2), the simulations show that Brazil is not an outlier, as it was in the Granger causality tests. Granger causality tests showed only Brazil with positive relation between fiscal balance and growth (hyper-crowding out), but the VEC impulse response-

simulations show a positive link between fiscal surplus and growth for every country but Colombia .[7] Recall that Colombia was also the outlier in impulse-response function tests of the effect of fiscal balance on real interest rates and that these tests contradicted the notion that Colombia might suffer from fiscal dominance. Footnotes 5 and 6 present the 10-quarter sums of the effects of BAL on REALIRATE and of BAL on GROWTH.

Moreover, in the vector error correction impulse-response functions the strongest positive relation (the outlier if one can really be called that) of all between fiscal balance and growth obtains for Mexico, not Brazil. A certain global detail, however, makes the Mexico result less surprising that it may seem at first glance. In the latter portions of our 1995Q1-2004Q1 sample, drastic increases in oil prices resulted in an upturn in growth for Mexico. Even though oil production over the last decade has played a smaller role in Mexico's economy than in previous decades, this role is still significant. Meanwhile, the marked expression of oil revenues from Mexico's state-owned oil company (Pemex) in Mexico's government revenues meant a significantly positive move in fiscal balance. The result, of course, is a very special case of correlation between a move in the direction of fiscal surplus with GDP growth.

With respect to the magnitude of the positive relation between fiscal balance and growth, Peru is in second place and Brazil is third. More generally, the vector error-correction model results showing a positive connection between fiscal surplus and growth seem to imply that markets are concerned about fiscal dominance possibilities for all but one of the five countries.   The two impulse-response results jointly offer an instructive perspective on Colombia's fiscal performance. Colombia has far and away the most positive impulse response results for the effect of a one-standard-deviation shock to fiscal balance upon real interest rates. The relation was positive, suggestive of an absence of

fiscal dominance. The same interpretation may be directed to Colombia's uniquely negative (of the five sample countries) relation between fiscal balance (surplus) upon growth. Indeed, this last result is more consistent with what one might discover for an industrial country.

While this paper focuses on how and when the relation between a nation's fiscal balance and interest rates signal market concerns about a nation's solvency, examining factors that are influenced by this relation also proves instructive. Recall that the current real value of a government's net liabilities must ultimately equal the present discounted value of future primary surpluses. More fiscally dominated countries may have to make proportionately larger fiscal efforts when struggling to maintain a steady debt-to-GDP ratio without resorting to inflation. Chart 3 presents a least squares line depicting the link between (1) fiscal balance's effect on interest rates (as measured by each of the five sample nations' ten-period sum of interest rate responses to a one-standard deviation positive shock to fiscal balance) and (2) the standard deviation of fiscal balance for the same five sample countries. Here, the stronger the measure of fiscal dominance (i.e. the negative connection between primary fiscal balance and real interest rates), the greater is the volatility of fiscal balance.

Having addressed effects of a measure of fiscal dominance upon primary fiscal balance volatility, we reverse the direction of our considerations to treat what may affect market perceptions of fiscal dominance. One factor that may link past experiences with expectations about future fiscal balance is a nation's number of past debt defaults. Chart 4 presents a least squares trend line depicting the connection between (1) the effect of fiscal balance upon interest rates (measured in the same way as in the description above of Chart 3) and (2) the number of defaults a nation underwent between 1901 and 2002.

Note the markedly negative relation between the two variables. The greater the number

of past defaults, the more a given increase in the fiscal surplus results in falling interest

rates – a signal of market perceptions of the current value of a nation's future liabilities.

This result is consistent with Reinhart and Rogoff (2004), whose work suggest that

markets' memories of defaults are very long.

IV. SUMMARY AND CONCLUSIONS

Our modeling efforts support the conclusion that while the strong crowding out

typical of fiscal dominance may be particularly characteristic of Brazil, this general

phenomenon also applies to other Latin American countries.   In the Granger causality

tests Brazil, Mexico and Peru showed strong links between fluctuations in fiscal balance

and changes in real interest rates. Similarly, in the vector error correction models'

impulse response functions the inverse relation between fiscal balance changes and

interest rate fluctuations showed its most decisive expression in Brazil, but Mexico and

Peru also showed markedly negative links.

The results for the connection between fiscal balance and overall GDP growth

were less straightforward.   The Granger causality test results singled out Brazil in

showing the strong positive relation one would expect between fiscal balance and growth

in the case of fiscal dominance.   Other countries showed no such effect.

By contrast, the vector error correction models revealed that all but one of the five

sample countries (Colombia, the only country that has not defaulted at any time since

1980) had positive links between fiscal balance and growth. Mexico and Peru

demonstrated more positive relations between these variables than Brazil did, while Chile

showed only a very slight (positive) relation. In sum, this evidence suggests the

possibility of market concerns about fiscal balance not only for Brazil but for Peru and

Mexico. In Mexico the relation between fiscal balance and growth appear to have had other determinants besides what was typical in other countries, but the relation between fiscal balance and real interest rates does not seem to warrant those caveats.

The consequences of and influences on the markedly negative associations between primary fiscal balance and interest rates were also instructive. A clear consequence of these associations and of governments' attempts to react to them was higher variance of the primary fiscal balance (Chart 3). Finally, as Chart 4 demonstrates, the strength with which markets set these associations for each country seems linked to each country's history of debt default.

APPENDIX: DEBT AND DEFICITS

Simulations of Brazil's debt-to-GDP ratio are based on an identity-based model that has now become common.[8] We start with continuous time and build to discrete time. Changes in most variables, especially money issuance, are closer to continuous processes than to discrete jumps at the end of the month. But models based in discrete time – by far the majority of exercises – essentially assume that variables stay unchanged until the end of the period (month or year) and then jump. When nominal variables change quickly, as has occurred often during the last ten years in Latin America, these two characterizations are very different from each other.

The Relationship between Debt and Deficits

The relationship between government debt and deficits derives from the government's dynamic budget constraint. Under this paradigm, the government must finance its deficits by issuing interest bearing debt D_t, i.e., bonds, and noninterest bearing debt - monetary base M_t. We divide government accounts into two components, the primary

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account δ that excludes interest payments, and interest payments. These last are equal to the average interest rate on the debt i_t multiplied by the level of the debt at any time t.

$$\dot{D}_t + \dot{M}_t = -\Delta_t + i_t D_t$$

Dividing by nominal GDP equal to $P_t y_t$ yields

$$\frac{\dot{D}_t}{P_t y_t} + \frac{\dot{M}}{P_t y_t} = -\delta_t + i_t \frac{D_t}{P_t y_t}$$

where $\delta_t = \Delta/Py$. Defining d=D/Py, m=M/Py and differentiating each of them with respect to time yields

$$\dot{d}_t = \frac{\dot{D}_t}{P_t y_t} - (\pi_t + \tilde{y}_t) d_t$$

$$\dot{m}_t = \frac{\dot{M}_t}{P_t y_t} - (\pi_t + \tilde{y}_t) m_t$$

Inverting this last relationship shows that real seigniorage is the sum of the change in the real monetary base and the inflation tax. In the steady state, that is when individuals have found their optimal real balances, seigniorage equals the inflation tax.

$$\frac{\dot{M}_t}{P_t y_t} = \dot{m}_t + (\pi_t + \tilde{y}_t) m_t$$

Substituting these into the expression above yields:

$$\dot{d}_t = -\delta_t + (i_t - \pi_t - \tilde{y}_t) d_t - (\pi_t + \tilde{y}_t) m_t$$

To find the long run sustainable debt to GDP ratio, we integrate this expression out to infinity:

$$\int\limits_{s=t}^{\infty}(\dot{d}_s)ds = \int\limits_{s=t}^{\infty}[-\delta_s + (i_s - \pi_s - \tilde{y}_s)]ds - \int\limits_{s=t}^{\infty}[(\pi_s + \tilde{y}_s)m_s]ds$$

Assuming no debt bubbles, integration yields:

$$d_t = \int\limits_{s=t}^{\infty}\delta_s e^{-(i_s - \pi_s - \tilde{y}_s)(s-t)}ds + \int\limits_{s=t}^{\infty}(\pi_s + \tilde{y}_s)m_s e^{-(i_s - \pi_s - \tilde{y}_s)(s-t)}ds$$

The sustainable level of debt is equal to the present discounted value of all future primary surpluses and inflation tax revenue with the growth adjusted real interest rate as the discount rate. If we assume a constant primary surplus, constant inflation and nominal interest rates, and a constant rate of real GDP growth, real money demand will also be constant. Solving the equation yields:

$$\bar{d} = \frac{\bar{\delta} + (\bar{\pi} + \tilde{\bar{y}})\bar{m}}{(\bar{i} - \bar{\pi} - \tilde{\bar{y}})}$$

This expression represents the maximum level of debt to GDP that a given primary surplus can sustain for given nominal interest rate, and nominal GDP growth rate. In this context, the inflation tax deserves attention. For example in Brazil, with nominal GDP growth of 12% and m of 5% of GDP, the inflation tax is around 0.4% of GDP. With growth adjusted real interest rates of 4%, the inflation tax allows the government an additional 10% of GDP in debt. We can add foreign and USD-linked debt rather easily but doing so here adds nothing to our discussion. Inasmuch as the analysis up to now is only identity based, a full theoretical analysis demands the introduction of behavioral

relationships. In the next section, we look at one particular relationship between primary surpluses and real interest rates.

When Real Interest Rates Depend on Primary Surpluses

Suppose now that the real interest rate is dependent in some linear and negative way on primary surpluses.[9]

$$r_t = (i_t - \pi_t) = \beta - \alpha \delta_t$$

Substituting this relationship into the debt-GDP growth difference equation yields

$$\dot{d}_t = -\delta_t + (\beta - \alpha \delta_t - \tilde{y}_t)d_t - (\pi_t + \tilde{y}_t)m_t$$

The long run solution becomes

$$d_t = \int_{s=t}^{\infty} \delta_s e^{-(\beta - \alpha \delta_s - \tilde{y}_s)(s-t)} ds + \int_{s=t}^{\infty} (\pi_s + \tilde{y}_s)m_s e^{-(\beta - \alpha \delta_t - \pi_s - \tilde{y}_s)(s-t)} ds$$

The discount rate thus falls with an increase in the primary surplus expanding more than proportionately the maximum sustainable debt-GDP ratio. To see this, consider the solution for constant growth, primary surpluses, monetary base and inflation.

$$\bar{d} = \frac{\bar{\delta} + (\bar{\pi} + \bar{\tilde{y}})\bar{m}}{(\beta - \alpha \bar{\delta} - \bar{\tilde{y}})}$$

Here, increases in the primary surplus offer a markedly stronger effect:

$$\frac{\partial \bar{d}}{\partial \delta} = \frac{\beta - \bar{\tilde{y}} + \alpha(\bar{\pi} + \bar{\tilde{y}})\bar{m}}{(\beta - \alpha \bar{\delta} - \bar{\tilde{y}})^2}$$

Recall that when there are no interest rate effects

$$\frac{\partial \bar{d}}{\partial \delta} = \frac{1}{(\bar{i} - \bar{\pi} - \bar{\bar{y}})} = \frac{1}{(\beta - \alpha \bar{\delta} - \bar{\bar{y}})}$$

As long as long-run real interest rates β are larger than long run growth – a condition for

Pareto optimality – for every increase in the primary surplus as a percent of GDP, the

maximum sustainable debt to GDP ratio will increase by more than in the credible case.[10]

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FOOTNOTES

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[1] Favero and Giavazzi find that the elasticity of the EMBI spread with respect to the US corporate spread is 0.4 for a debt-to-GDP ratio below 0.55 and increases asymptotically to 0.8 as the debt ratio rises

[2] Razin and Sadka (2004) see current primary surpluses as decreasing future taxes including the inflation tax. They assume a negative relation between future taxes and real interest rates. That is, they assume the same negative relationship between primary surpluses and real interest rates for which we test.

[3] In a recent conversation, Guillermo Mondino offered another reason why the primary surplus is a predictor of future solvency in a discount rate context. Mondino's focus involves how the evolution of investor perceptions about solvency affect the recovery value of government debt at different maturities.

[4] See the appendix. If the discount rate is a negative function of the primary surplus, the maximum debt-GDP increases by more than when the discount rate is independent of fundamentals.

[5] We always performed the Granger Causality tests using first differenced data because ADF tests for most of the variables for most of the countries could not reject unit roots in levels. In 7 of the 28 variables, ADF tests did reject unit roots in levels. These cases include: Brazil, Realirate and Growth; Chile, Realirate; Colombia, Realirate and Growth; Mexico, none; Peru, Realirate and Growth.

[6] The effect of a one std. dev. shock to BAL upon variation in REALIRATE over a ten-quarter period is: Brazil -32.02809 , Chile 2.806225, Colombia 10.41389, Mexico -24.02322, Peru -16.17642.

[7] Effect of a one std. deviation shock to BAL upon variation in GROWTH over ten quarters is: Brazil 5.623662, Chile 1.766032, Colombia -4.562899, Mexico 13.63276, Peru 10.46617.

[8] See Welch, Primo Braga, and Afonso André (1987).

[9] For now we have no interpretation for β. On the face of things, it represents the equilibrium real interest rate compatible with no primary surplus.
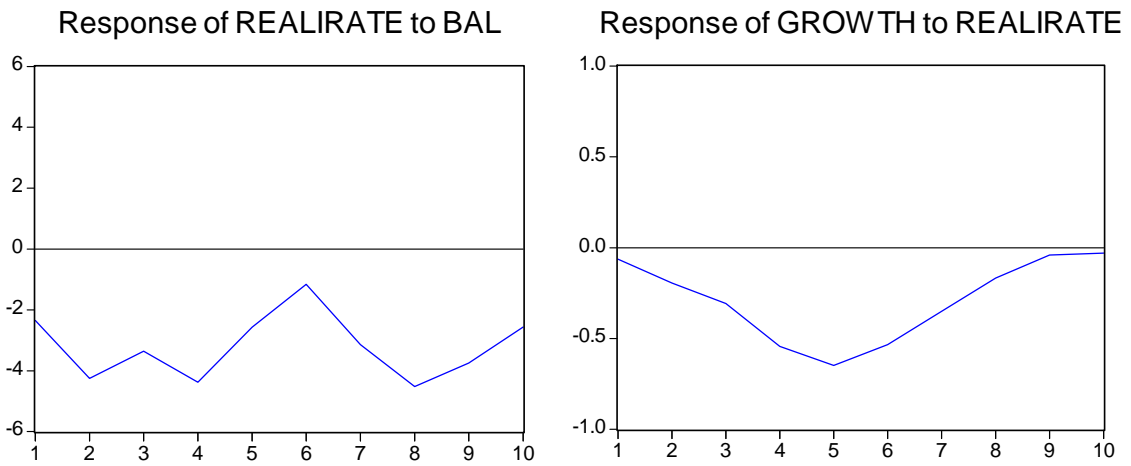
[10] The condition reduces to $\bar{\pi} + \bar{\bar{y}} + \alpha\delta > 0$ which obtains sufficiently if nominal GDP growth and primary surpluses are positive.

		Brazil	Chile	Colombia	Mexico	Peru

TABLE I
VAR PAIRWISE GRANGER CAUSALITY/BLOCK EXOGENEITY WALD TESTS

		Brazil	Chile	Colombia	Mexico	Peru
Dep. Variable: REALIRATE						
BAL	Chi sq	11.0312	2.6594	6.0534	7.874	12.3705
	sig level	(0.0116)	(0.4472)	'(0.1090)	(0.0487)	(0.0062)
GROWTH	Chi sq	2.8502	1.0347	0.7517	0.7527	27.3774
	sig level	'(0.4153	(0.7929)	(0.8610)	' (0.8607)	(0.0000)
XRATE	Chi sq	11.9874	1.842	5.0757	1.4781	6.0045
	sig level	(0.0074)	' (0.6058)	(0.1663)	(0.6873)	(0.1114)
ALL	Chi sq	24.8896	5.3233	13.4656	10.0995	54.5524
	sig level	'(0.0042)	(0.8053)	'(0.1426)	(0.3425)	(0.0000)
Dep. Variable: GROWTH						
BAL	Chi-sq	12.0243	4.8404	2.7666	2.6096	2.5038
	sig level	(0.0073)	(0.1839)	(0.4290)	(0.4558)	(0.4746)
REALIRATE	Chi-sq	18.8168	4.6974	5.6527	2.4573	6.3089
	sig level	(0.0003)	(0.1953)	(0.1298)	(0.4831)	(0.0975)
XRATE	Chi-sq	21.7117	3.4277	1.7328	1.6958	0.1345
	sig level	(0.0000)	' (0.3303)	(0.6296)	(0.6379)	(0.9874)
ALL	Chi sq	44.4735	12.9355	10.1651	9.5607	9.3303
	sig level	(0.0000)	'(0.1655)	(0.3372)	(0.3872)	(0.4074)
Dep. Variable: BAL						
GROWTH	Chi-sq	8.17335	2.8898	1.883876	0.87749	3.4545
	sig level	(0.0426)	(0.4089)	(0.5968)	(0.8309)	(0.3267)
REALIRATE	Chi-sq	0.16145	2.1391	4.672917	2.996343	1.0925
	sig level	(0.9836)	'(0.5441)	(0.1974)	(0.3922)	(0.7789)
XRATE	Chi-sq	0.5916	0.1115	3.654469	7.072936	1.8443
	sig level	(0.8984)	(0.9904)	(0.3013)	(0.0696)	(0.6053)
ALL	Chi-sq	11.7931	7.71612	10.4266	10.69745	8.1379
	sig level	(0.2252)	(0.5630)	(0.3171)	(0.2970)	(0.5203)
Dep. Variable: XRATE						
BAL	Chi sq	0.8549	0.9153	1.1356	0.8943	2.9221
	sig level	(0.8363)	(0.8217)	(0.7685)	' (0.8268)	(0.4038)
GROWTH	Chi sq	1.6833	0.7832	0.1372	1.3552	0.6644
	sig level	(0.6407)	(0.8535)	(0.9870)	'(0.7161)	(0.8815)
REALIRATE	Chi sq	1.5704	0.6149	1.0546	3.9582	1.8432
	sig level	(0.6661)	(0.8930)	(0.7880)	(0.2660)	(0.6056)
ALL	Chi sq	6.3482	2.7218	2.6562	6.8627	7.0581
	sig level	' (0.7046)	(0.9743)	(0.9764)	(0.6514)	'(0.6311)

Chart 1: Impulse Responses of Real Interest Rate to a One Standard Deviation Positive Change in the Primary Balance
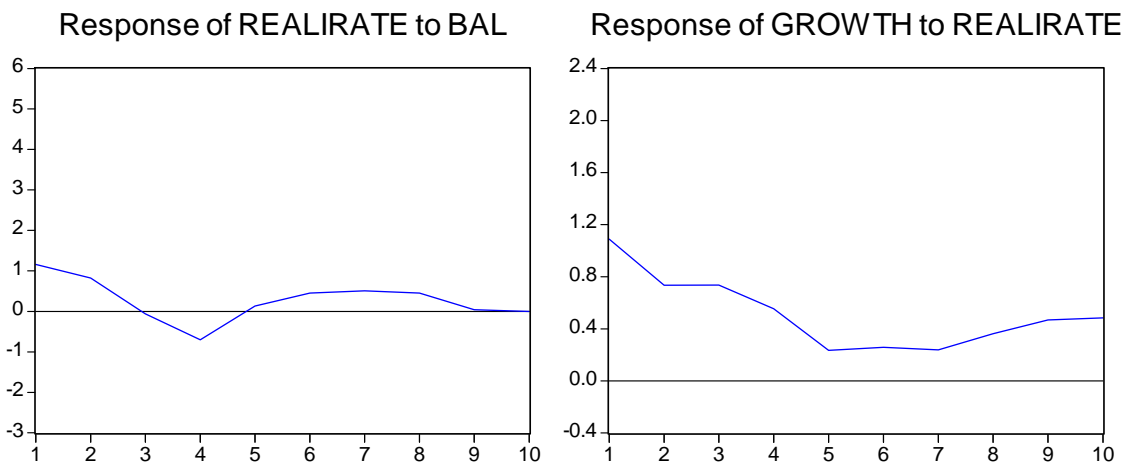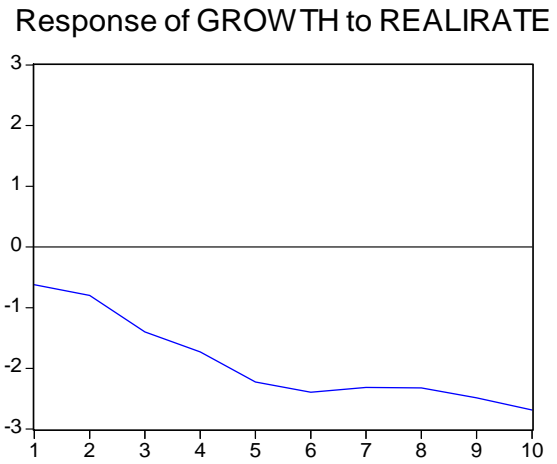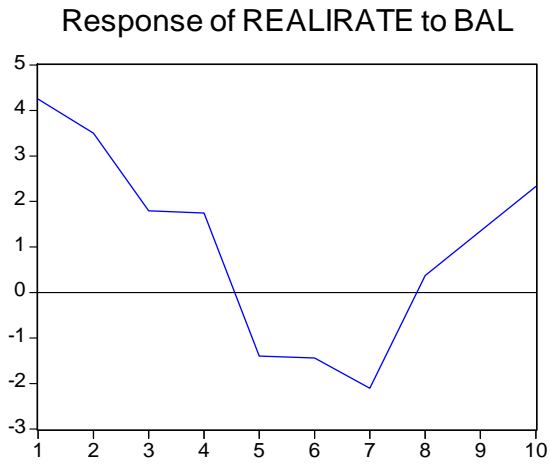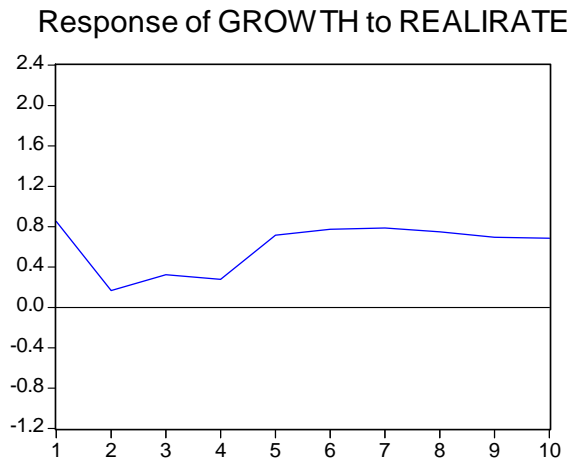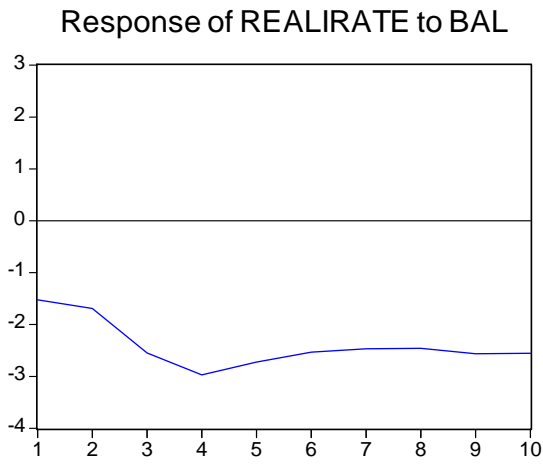
Brazil

Response of REALIRATE to BAL

Response of GROWTH to REALIRATE

Chile

Response of REALIRATE to BAL

Response of GROWTH to REALIRATE

Colombia

Response of REALIRATE to BAL

Response of GROWTH to REALIRATE

Mexico

Response of REALIRATE to BAL

Response of GROWTH to REALIRATE

Peru

Response of REALIRATE to BAL

Response of GROWTH to REALIRATE

Chart 2: Impulse Response of Growth to a one Standard Deviation Positive Change in the Primary Balance.

Brazil   Chile

Response of GROWTH to BAL

Response of GROWTH to BAL

Peru

Response of REALIRATE to BAL

Response of GROWTH to REALIRATE

Chart 2: Impulse Response of Growth to a one Standard Deviation Positive Change in the Primary Balance.
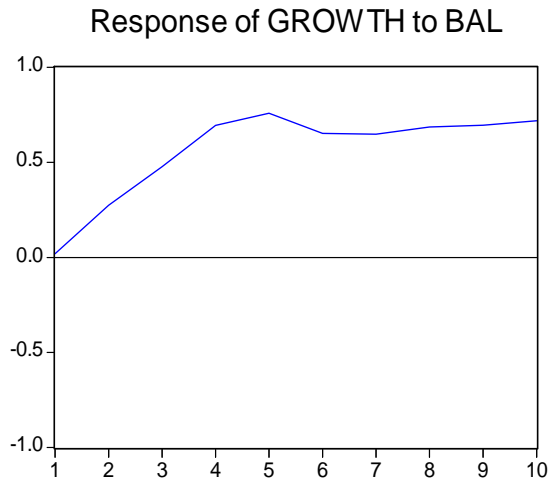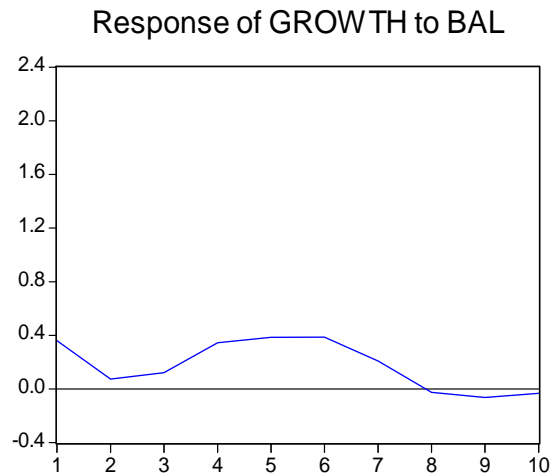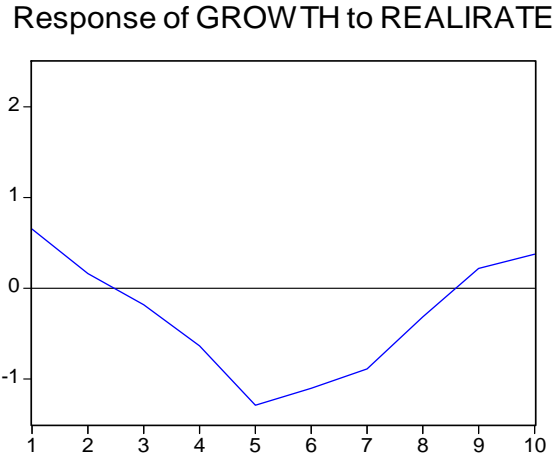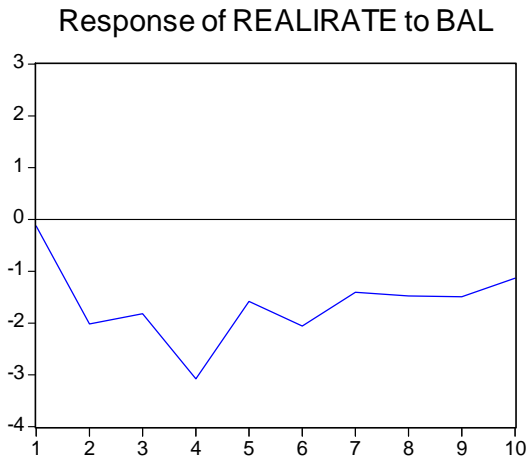
Brazil   Chile
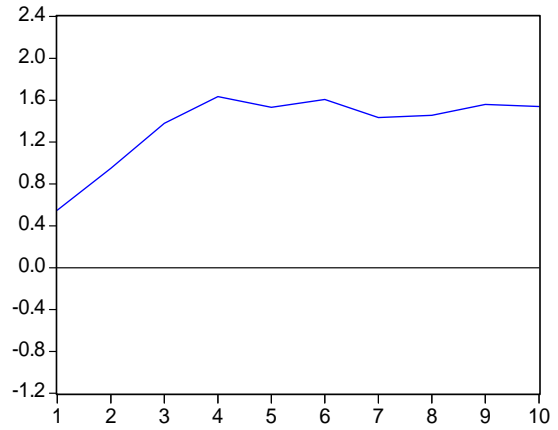
Response of GROWTH to BAL
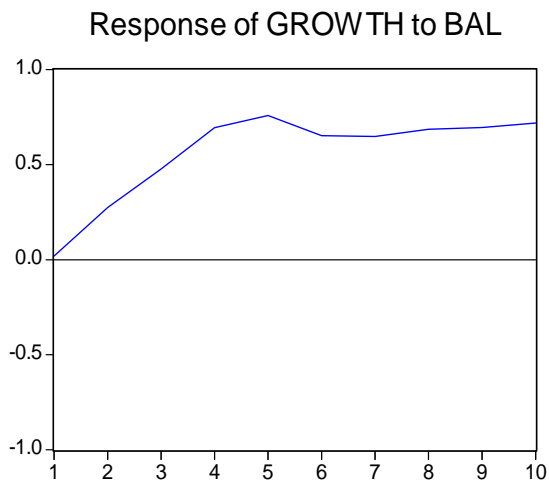
Response of GROWTH to BAL
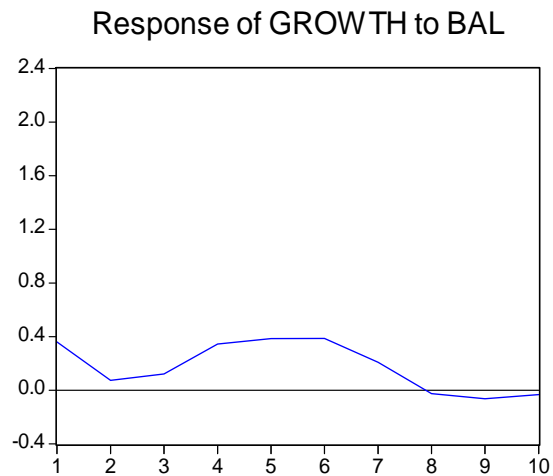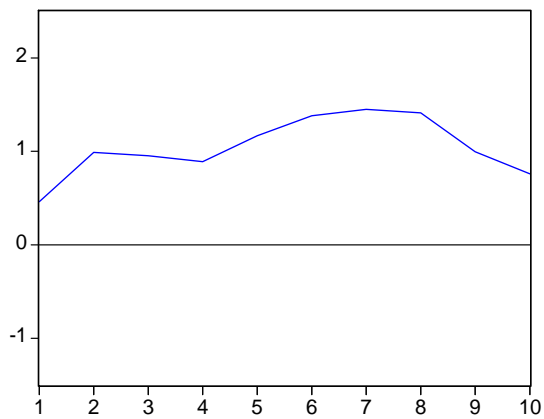
Colombia   Mexico
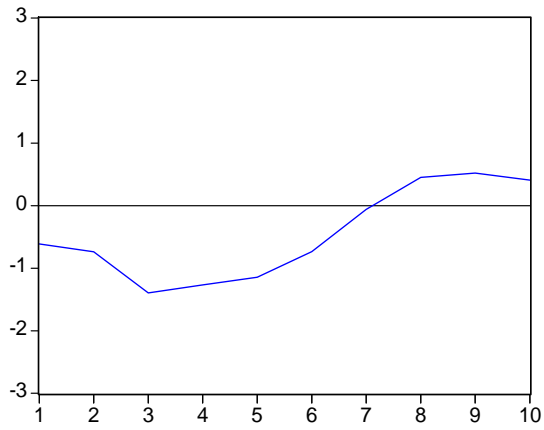
Response of GROWTH to BAL

Response of GROWTH to BAL

Peru

Response of GROWTH to BAL

Chart 3
Standard Deviation of Fiscal Balance versus Real Interest Rate Response to Fiscal Balance

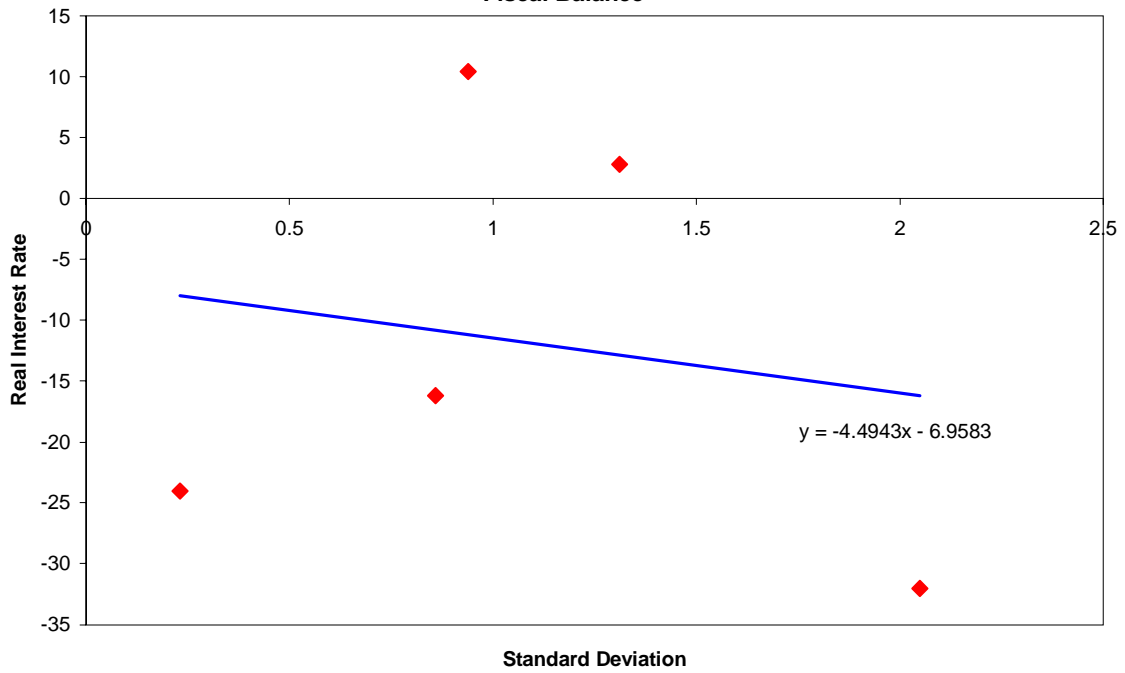$y = -4.4943x - 6.9583$

Standard Deviation

Chart 4
Number of Defaults from 1902 to 2002 versus Real Interest Rate Response to Fiscal Balance

$y = -8.8626x + 20.104$

Number of Defaults 1901-2002