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Disinflation, External Vulnerability, and Fiscal Intransigence: Some Unpleasant Mundellian Arithmetic

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Disinflation, External Vulnerability, and Fiscal Intransigence: Some Unpleasant Mundellian Arithmetic

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Abstract

This paper examines the policy challenges a country faces when it wants to both reduce inflation and maintain a sustainable external position. Mundell's (1962) policy assignment framework suggests that these two goals may be mutually incompatible unless monetary and fiscal policies are properly coordinated. Unfortunately, if the fiscal authority is unwilling to cooperate—a case of *fiscal intransigence*—central banks that pursue a disinflation on a 'go it alone' basis will cause the country's external position to further deteriorate. A dynamic analysis shows that if the central bank itself lacks credibility in its inflation goal, it must rely even more on cooperation from the fiscal authority than otherwise. Echoing Sargent and Wallace's (1981) 'unpleasant monetarist arithmetic,' in these circumstances, a 'go it alone' policy may successfully stabilize prices and output, but only on a short-term basis.

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I. Introduction

In an open economy, macroeconomic stabilization—the elimination of imbalances, both external and internal—is a fundamental goal. Externally, the current account should be at a sustainable value—neither an excessive deficit nor an excessive surplus. Internally, output should be close to its potential and inflation at or near its desired (target) level; neither recession nor overheating is desirable.

Economists have long recognized that both monetary and fiscal policies may be used to achieve that goal in a *coordinated* manner. Our thinking has largely been guided by the work of Robert Mundell. In a seminal (1962) paper, he suggested that policy makers need to combine fiscal and monetary adjustments in a proper way so as to achieve macroeconomic stabilization—the *assignment problem* paradigm.

In some cases, both fiscal and monetary policy should move in the same direction. Consider first a country with a domestic expansion and an excessive external surplus. Tighter fiscal policy will help close the domestic gap. At the same time, an appreciation of the real exchange rate—the consequence of a monetary tightening—will help bring about the decrease in the external surplus that is required to close that gap. Thus, in this case, a tightening of both fiscal and monetary policy may be required. As a converse case, consider a country that jointly runs a domestic recession and an external deficit. A fiscal tightening will help close the external gap, but will worsen the domestic recession; a depreciation of the real exchange rate—looser money—will both reactivate the economy and help reduce the external deficit. In this sense, looser money may reduce the need for a fiscal tightening—and may even permit a fiscal loosening as well.

Arguably, the most 'toxic mix' of economic imbalances is an unsustainable external deficit combined with domestic overheating and/or inflationary pressures. A fiscal tightening will reduce both the external deficit and domestic demand.

Table 1: External Vulnerability and Inflation: Selected Emerging Market Countries

Country	**External Debt*** *(Percent of GDP)*	**Current Account** *(Percent of GDP)*	**Net Exports** *(Percent of GDP)*	**Change in Reserves** *(Percent of GDP)*	**Inflation** *(Percent per year)*	**Inflation Target** *(Percent per year)*
Brazil	15.0%	-3.2%	-2.1%	-0.3%	6.0%	4.5%
India	20.0%	-5.0%	-7.5%	0.2%	10.0%	7.0%
Indonesia	30.0%	-3.2%	-0.6%	-0.8%	7.0%	4.5%
South Africa	35.0%	-6.5%	-3.5%	0.0%	6.0%	5.0%
Turkey	43.0%	-6.2%	-5.4%	-3.1%	7.5%	6.0%

Notes: Flow data are for 2013/14 average; Debt stocks are end-2013. Sources: Central banks of Brazil, India, Indonesia, South Africa, Turkey; Haver Database; IMF Country Staff reports. Inflation targets of India, South Africa are indicative only.
* External debt figure includes private and public.

At the same time, a depreciation of the currency—the consequence of a monetary loosening—will also help close the external deficit (a pure price or 'expenditure switching' effect). In this sense, it is possible that a fiscal tightening should be combined with a monetary *expansion*.

Moreover, countries with such a 'toxic mix' of imbalances are the most vulnerable to adverse external financial pressures—a forced adjustment by the market. Investors are more likely to take their money out of a country – sometimes rapidly and unexpectedly—if its external deficit is unsustainable *and* domestic inflationary pressures are excessive.

For example, consider the cases of Brazil, India, Indonesia, South Africa, and Turkey – the so called 'fragile five.'[1] Data for these countries are shown for 2012-13, shown in Table 1, suggest that all countries had, to varying degrees, both external and internal imbalances that made them vulnerable. All of these countries were running current account and net export deficits. Their external debt obligations, which range from 15 percent of output in Brazil to 43 percent of output in Turkey, have continued to grow. International reserves were falling during the previous year (Brazil, Indonesia, Turkey)—a sign that the central bank was attempting to maintain an overvalued exchange rate. In terms of internal balance, the inflation rate in all countries was higher than desirable.

However, casual observation alone cannot tell us whether internal politics have obstructed an adjustment. For example, if a country resisted a fiscal adjustment, the real exchange rate depreciation required to close the external gap may be even more severe than otherwise. In this sense, countries that appear unlikely to make a *coordinated* adjustment of both fiscal and monetary policy may be even more vulnerable to adverse pressure in external financial markets.

The purpose of this paper is to reconsider some issues related to external and internal stabilization. It focuses mainly on 'toxic' or 'fragile' cases where the external deficits and domestic demand/inflationary pressures are both too high. The paper's analysis includes a policy assignment framework like Mundell's but with some new elements. Specifically, we compare outcomes under a coordinated monetary/fiscal adjustment with those cases where the fiscal authority refuses to cooperate—*fiscal intransigence*. [2]

In such a case, an independent central bank may choose to 'go it alone' and to pursue one of the two goals. At one extreme, a central bank may focus exclusively on internal stabilization (IS) only—consistent with a traditional mandate. However, as a polar opposite, we also consider that country authorities instead focus exclusively on external stabilization (ES). The

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[1] Around the time of the May 2013 'tapering' announcement, the popular financial press coined this moniker.

[2] We use the term "fiscal intransigence" rather than the more frequently used term "fiscal dominance," since the latter typically applies to a more fully fleshed-out model of intertemporal solvency, as discussed in Tanner and Ramos (2003) or Woodford (2001).

purpose of such a calculation is to show the adjustment of the real exchange rate that is required to eliminate the external imbalance *without the help of a corresponding fiscal adjustment*.

At first blush, such an exercise may seem uninteresting, since it assumes that the central bank has essentially abandoned its traditional goal of internal stability. However, the exercise helps us to more correctly interpret an exchange rate assessment tool that is currently used by the International Monetary Fund, namely its External Balance Assessment (EBA 2013). That exercise is similar to the one considered in this paper: in both exercises, the fiscal adjustment is *exogenously* determined. In this paper, that adjustment is assumed to be zero. [3]

The remainder of the paper is structured as follows. In Part II we extend the external sustainability/real exchange rate calculation by including both a monetary (exchange rate) and a domestic absorption (fiscal) component. We combine this equation with a similar one-shot or static "back of the envelope" expression for internal imbalances (inflation, output gap). We solve jointly for the monetary (exchange rate) and fiscal adjustments required to simultaneously eliminate the external and internal imbalances.

As part of that analysis, we examine the effect of monetary policy on the trade balance. A monetary tightening will have two opposing effects on net exports: the appreciation of the real exchange rate will cause net exports to deteriorate while the reduction in output will mean lower imports—an improvement in net exports. We may say that an expanded Marshall-Lerner (EML) condition holds if the price effect dominates the income effect; in this case, the *net* effect of a monetary tightening would be to decrease net exports. To aid the analysis, we revisit Mundell's (1962) graphical exposition of the assignment problem solution. We also consider cases where the fiscal authority refuses to adjust and the monetary authority pursues either the internal or external stabilization goals on a 'go it alone' basis.

This static analysis yields three key findings. First, independent of whether the EML condition holds, coordination between fiscal and monetary policy is essential. Second, if the EML condition does hold, the depreciation of the real exchange rate required to close an external deficit will be more severe in the case of fiscal intransigence than otherwise. Third, if the EML condition does not hold, the monetary tightening required to close the external deficit would also cause an extraordinarily harsh recession as well—an unlikely policy choice.

In Part III we take the analysis from a static to a dynamic setting that yields simulated time paths for the output gap, inflation, net exports, and external debt accumulation. The framework allows for both a risk premium (a penalty for higher external debt) and

[3] A non-zero fiscal adjustment that is exogenously determined will be the correct one *only by chance*. If that adjustment is more timid than the coordinated (Mundell) solution, the remaining burden of adjustment to close the external gap falls on monetary policy – the real exchange rate.

inflationary expectations that vary over time. (Inflation expectations are initially above the inflation target but ultimately converge to that target). In this framework, the central bank's mandate is limited to internal stability (IS): its goal is to bring the inflation rate down to a target rate over the medium term. We compare outcomes with and without cooperation from the fiscal authority. We assume that the EML holds. A key result thus concerns the relationship between disinflation and external debt accumulation. If the fiscal authority fails to cooperate, the central bank will have to tighten even more to reach its inflation objective than otherwise. This means even more real exchange rate appreciation, more deterioration of the net export deficit, and higher external debt. At some point, the risk premium on external debt, which is transmitted to the domestic economy through a parity condition, will squeeze out domestic expenditures. Such adverse effects can be avoided if the fiscal authority bears some of the burden of adjustment. Thus, the key lesson from Mundell's static assignment framework, namely the importance of coordination between the fiscal and monetary authorities, can be extended to a dynamic framework as well.

II. A Static Open Economy Macroeconomic Model

A New Keynesian model of an open economy has three key elements. An IS curve summarizes equilibrium in the market for goods and services; a real interest parity condition pins down the composition of demand—domestic versus external—through a real exchange rate; a Phillips curve summarizes the output / inflation tradeoff in terms of a capacity constraint.

The demand side of an open economy is summarized by the following IS curve:

$$y = \frac{1}{(\alpha_1 + \alpha_3)} * \left[\alpha_2 * (r - \bar{r}) + \eta * (q - \bar{q}) + \delta_D + \delta_{NX} \right] \tag{1}$$

Note that y is the output gap, measured in percent of potential GDP, α_1 and α_3 are the propensities to save and import, respectively, out of the output gap, r and $\bar{r}$ are respectively the observed and natural domestic real interest rates, q and $\bar{q}$ are respectively the observed and long-run real exchange rates (foreign currency per home currency—appreciation plus), α_2 and η are demand response parameters for domestic expenditures and net exports, respectively, and δ_D , δ_{NX} are demand shift parameters for domestic and net export components, respectively. Note that $0 < \alpha_1 < 1$, and $0 < \alpha_3 < 1$ while $\alpha_2 < 0$ and η <0.

The real interest parity condition is written:

$$q = r - r^{EXT} \tag{2}$$

where r^{EXT} is the external real interest rate. We may rewrite the IS curve by substituting the parity condition (2) into equation (1):

$$y = \frac{1}{(\alpha_1 + \alpha_3)} * \left[\alpha_2 * (r - \bar{r}) + \eta * (r - r^{EXT} - \bar{q}) + \delta_D + \delta_{NX} \right] \tag{3}$$

Equations (1) – (3) imply that net exports of goods and services may be expressed as a fraction of potential output:

$$nx = -\alpha_3 y + \eta(q - \bar{q}) + \delta_{NX} \tag{4}$$

To derive equation (4), assumptions must be made about the steady state ratios of net exports to output. Such a derivation is shown briefly in Appendix A and in more detail in Tanner (2017). The interpretation of this equation is straightforward. When the output gap increases, the country imports more and the trade balance deteriorates. A real exchange rate appreciation discourages exports and encourages imports, causing the trade balance to deteriorate. The last term is an exogenous increase in net exports. Tanner (2017) shows that an increase in δ_{NX} corresponds to an improvement in the external terms of trade.

The inflation rate is determined according to a standard Phillips curve:

$$\pi = \pi^e + \kappa * (y - z) \tag{5}$$

where π and π^e are observed and expected inflation, respectively, and z is an exogenous shock to short-run aggregate supply. As Walsh (2003, pp. 245-247) notes, the parameter κ reflects the proportion of agents that are free to adjust their prices in any period (for example in an environment of Calvo price setting). [4]

A. Net Exports and Inflation—Reduced Form Equations

The authorities have two policies which will have impacts on these variables: monetary policy (the real interest rate r) and autonomous shifts in domestic demand (i.e. fiscal δ_D). To see these effects, we substitute IS equation (3) into the expressions for net exports and inflation, (4) and (5) respectively, and rearrange to isolate the policy components. The reduced form net export equation is:

$$nx = a_{11} * r + a_{12} * \delta_D + k_1 \tag{6}$$

where:

[4] The equilibrium ex-post real interest rate is of course the nominal rate minus inflation $r = i - \pi$, i = nominal interest rate. In this simple framework, we assume that the central bank raises (lowers) the nominal rate *vigorously enoug*h so that the real interest rate moves in the same direction.

$$a_{11} = \left[\frac{-\alpha_3 * (\alpha_2 + \eta)}{(\alpha_1 + \alpha_3)} + \eta \right] \qquad a_{12} = \frac{-\alpha_3}{(\alpha_1 + \alpha_3)} \qquad k_1 = \frac{\alpha_3 * \alpha_2}{(\alpha_1 + \alpha_3)} * \bar{r} - \eta * (\frac{-\alpha_3}{(\alpha_1 + \alpha_3)} + 1) * (r^{EXT} + \bar{e}) - \frac{\alpha_3}{(\alpha_1 + \alpha_3)} * \delta_{NX}$$

The coefficient a_{11} tell us the impact of a change in monetary policy on the net export balance. International macroeconomists have inherited as part of their toolkit a way to think about such a coefficient. The Marshall Lerner (ML) condition. If the ML condition holds, a depreciation of the (real) exchange rate should cause exports to increase, imports to decrease, and hence an improvement in the trade balance.

In this model, the counterpart to the traditional—and narrowly interpreted—ML condition is simply η<0. However, the interest rate/exchange rate nexus summarized by equation (2) adds a new wrinkle to the story. When the central bank raises the interest rate, it squeezes off domestic demand and output; this must be so because $\alpha_2 < 0$.

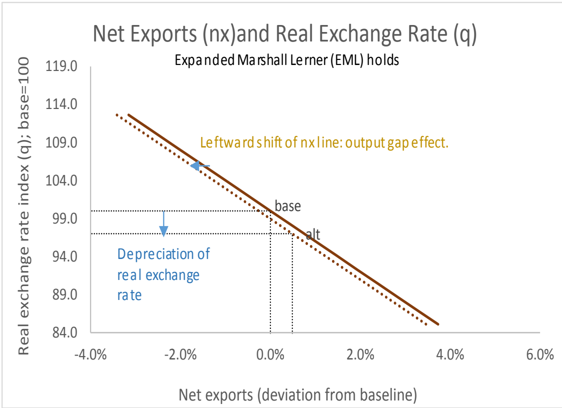
Repeating from above for convenience, the reduced form coefficient for the effect of monetary policy on the trade balance is:

$$a_{11} = \left[\underbrace{\frac{-\alpha_3 * (\alpha_2 + \eta)}{(\alpha_1 + \alpha_3)}}_{\substack{\text{Output gap impact} \\ \text{on imports.}}} + \underset{\substack{\text{'Pure' price} \\ \text{effect}}}{\eta} \right]$$

We may sign the output gap effect (first element on the right-hand side) as positive, while the price effect η is negative.

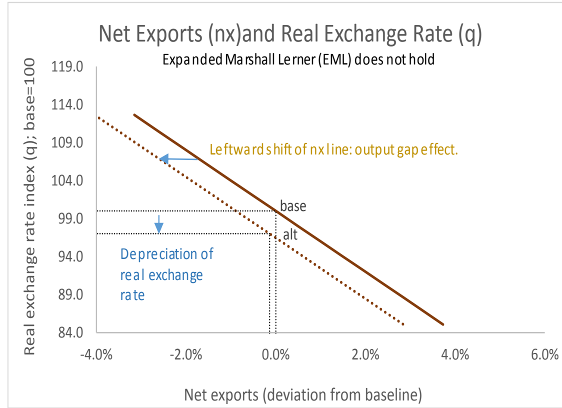
A key question is thus: "Which of these two effects dominates?" In this sense, we may say that an expanded Marshall-Lerner condition (EML) holds if a_{11}<0. Evidence supporting this proposition may be found in Kim (2001). However, for the purposes of understanding policy coordination, we will investigate both cases: where EML holds, and where it does not.

Figure 1: The Expanded Marshall-Lerner (EML) Condition



Source: Author's calculations.

Alternative scenario (alt): effect of monetary loosening relative to the baseline. *The Expanded Marshall-Lerner (EML) condition holds.* The depreciation of the real exchange rate, is reflected as a downward movement along the dotted tan line. This effect is larger than the output gap effect which is reflected in a leftward shift of the tan line, from solid to dotted. Since EML is satisfied, a monetary loosening causes net exports to increase.



Source: Author's calculations.

Alternative (alt) scenario shows the effect of a discretionary monetary loosening relative to the baseline. *The Expanded Marshall-Lerner (EML) condition fails to hold.* The depreciation of the real exchange rate, which is reflected as a downward shift along the tan lines is dominated by the output gap effect -- a leftward shift of the tan line, from solid to dotted. A monetary loosening causes net exports to decrease.

Figure 1 illustrates the effect of a monetary loosening—when the EML holds and when it fails to hold. In the left-hand panel, the alternative scenario (alt) shows the effect of a monetary loosening relative to the baseline. when the Expanded Marshall-Lerner (EML) condition holds. The depreciation of the real exchange rate, which is reflected as a downward movement along the tan lines dominates the output gap effect which is reflected in a leftward shift of the tan line, from solid to dotted. Thus, since the EML condition is satisfied, a monetary loosening causes net exports to increase.

In the right-hand panel, the alternative scenario shows the effect of a discretionary monetary loosening relative to the baseline. when the Expanded Marshall-Lerner (EML) condition fails to hold. The depreciation of the real exchange rate, which is reflected as a downward shift along the tan lines is dominated by the output gap effect which is reflected in a leftward shift of the tan line, from solid to dotted. In this case, a monetary loosening causes net exports to decrease.

For the inflation rate, the corresponding reduced form equation is:

$$\pi = \pi^e + a_{21} * r + a_{22} * \delta_D + k_2 \qquad (7)$$

where

$$a_{21} = \frac{\kappa * (\alpha_2 + \eta)}{(\alpha_1 + \alpha_3)} \qquad a_{22} = \frac{\kappa}{(\alpha_1 + \alpha_3)} \qquad k_2 = \frac{\kappa}{(\alpha_1 + \alpha_3)} * \left[-\alpha_2 * \bar{r} - \eta * (r^{EXT} + \bar{e}) + \delta_{NX} \right] - \kappa z$$

III. Economic Stabilization: Eliminating External and Internal Imbalances

The Mundellian assignment framework emphasizes that policy makers must address issues related to macroeconomic imbalances—both external and internal. We may think of an external imbalance as a situation where net exports deviate from some reference level nx^*. For example, consistent with the external sustainability (ES) approach of the International Monetary Fund's External Balance Assessment (EBA, 2013) nx^* may be that level of net exports that stabilizes external debt (or net foreign assets) relative to GDP. Alternatively, we might interpret nx^* as the non-policy or "norm" level relative to comparator countries (based on multiple regression analysis). Hence, $nx < nx^*$ might reflect a deficit that is either unsustainable or larger than the comparative norm, while $nx > nx^*$ might represent a surplus that is unsustainable or higher than the comparative norm.

In the same vein, we may portray internal imbalances in terms of the inflation rate. Assume that the country's inflation target is π^*. A country has an inflationary imbalance if $\pi > \pi^*$ and a deflationary imbalance if $\pi < \pi^*$.

We may evaluate equations (6) and (7) at target values for nx^* and π^* and then subtract off those same equations expressed for actual values of nx and π. Thus, we obtain expressions for net exports and the inflation rate as *deviations* from their reference levels:

$$\begin{bmatrix} nx^* - nx \\ \pi^* - \pi \end{bmatrix} = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \begin{bmatrix} \Delta r \\ \Delta \delta_D \end{bmatrix} \tag{8}$$

Then, we may solve out for the policy adjustments required to achieve the internal and external targets—simultaneously:

$$\begin{bmatrix} \Delta r^* \\ \Delta \delta_D^* \end{bmatrix} = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}^{-1} \begin{bmatrix} nx^* - nx \\ \pi^* - \pi \end{bmatrix} \tag{9}$$

Thus, we may think of (9) as a *general* solution to Robert Mundell's (1962) assignment problem: adjustments to both monetary (exchange rate) and fiscal policies will each have a role to play in jointly addressing both external and internal imbalances. Implicitly, external and external balance are given equal weight in the policy maker's objective function. Kydland (1976) discussed cases where two competing authorities (fiscal, monetary) attach different weights on these goals in a game theoretic framework.

A. Graphical Treatment in the Spirit of Mundell (1962) [5]

System (8) can be represented graphically—as Mundell did in his original article. Figure 2 shows the internal balance relationship (equation 7). Monetary policy adjustments Δr are shown on the horizontal axis: a movement to the right means tighter money (higher interest rates, more appreciated currency).

Fiscal policy adjustments $\Delta\delta_D$ are shown on the vertical axis. Looser fiscal policy—an increase in the fiscal deficit—are reflected in an upward movement along that axis.

The upward sloping solid blue line in the diagram reflects combination of monetary and fiscal policy that are consistent with internal balance. This line passes through the origin; both the interest rate and fiscal stance are at their neutral levels. If there is a fiscal expansion, tighter money is required to maintain internal balance; in the case of a fiscal tightening, money must be loosened. Points along the dotted and dashed line represent the monetary and fiscal adjustments required to eliminate an expansion or a contraction, respectively. *Only by taking these policy measures can the economy return to the solid blue line internal balance line.*

Figure 3 shows the external balance line (equation 6) for the case where the EML condition holds. [6] The downward sloping solid red line in the diagram reflects combination of monetary and fiscal policy that are consistent with external balance.

The line passes through the origin; both the interest rate and fiscal stance are at their neutral levels. If there is a fiscal expansion, looser money is required to maintain external balance; in the case of a fiscal tightening, money must be tightened as well.

Points along the dotted and dashed line represents the monetary and fiscal adjustments required to eliminate an external deficit and an external surplus, respectively. *Only by taking these policy measures can the economy return to the solid red external balance line.*

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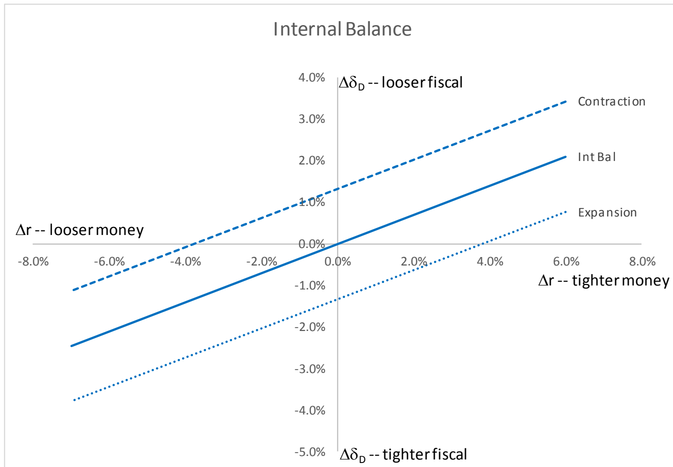
[5] Mundell's work builds heavily on previous discussions by Salter (1959) and Swan (1960). A spreadsheet-based tool which generates these charts is available online at: http://www.evanctanner.com/mundell-arithmetic .

[6] In this analysis, we focus on the case where EML holds. There is good reason to do this: for any given imbalance, internal or external, EML yields the most likely combination of adjustments. For example, if EML holds and there is a positive internal imbalance (inflation above target), but net exports are in balance, the necessary adjustment would be a tightening of both fiscal and monetary policy. This makes sense: tightening fiscal alone without any monetary adjustment would reduce the output gap but increase the external surplus. As an offset, a monetary tightening, which appreciates the exchange rate, would help reduce the surplus. By contrast, if the EML fails, this model would recommend a combination of tighter monetary policy and looser fiscal policy (assuming that the IS line is steeper than the ES line). Such a policy corresponds to the intersection of the dotted blue and solid red line in Figure 5. It is a policy prescription that seems unlikely.

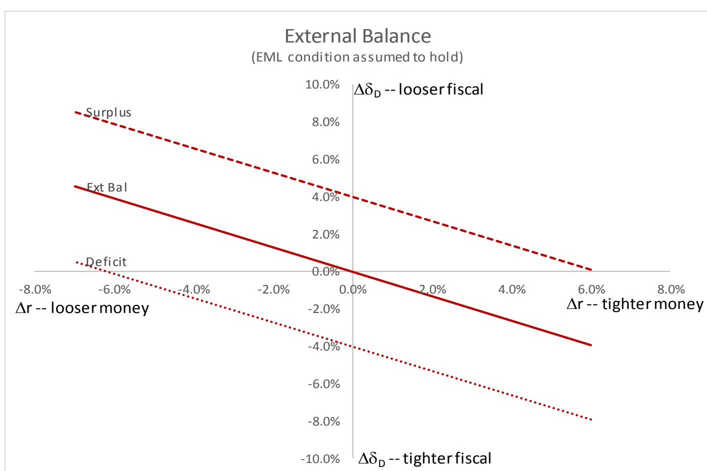
Figure 2: Required Adjustments to Attain Internal Balance ($\pi=\pi^*$)



Source: Author's calculations.

The blue lines in the diagram reflects combinations of monetary and fiscal policy adjustments that are required to attain internal balance. The lines are upward sloping: if there is a fiscal expansion, tighter money is required to maintain internal balance.

Figure 3: Required Adjustments to Attain External Balance ($nx=nx^*$)



Source: Author's calculations.

The red lines in the diagram reflects combinations of monetary and fiscal policy adjustments that are required to attain external balance. The lines are downward sloping: if there is a fiscal expansion, looser money (a more depreciated exchange rate) is required to maintain external balance.

Figure 4 shows the adjustment solution implied by the system *when the EML condition holds*. The figure shows the fiscal and monetary adjustment that will jointly eliminate both internal and external imbalances (expansion, deficit)—the intersection of the red and blue dotted lines. In this case, the optimal policy couples a fiscal tightening with a monetary loosening.

Finally, figure 5 shows the adjustment solution implied by the system *when the EML condition fails to hold*. [7] As before, the figure shows the fiscal and monetary adjustment that will jointly eliminate both internal and external imbalances (expansion, deficit)—the intersection of the red and blue dotted lines. Despite the failure of EML, the optimal policy is remains the same as in the previous case: a fiscal tightening combined with a monetary loosening.

B. The Perils of Fiscal Intransigence

The essence of the assignment problem is that the two independent authorities, the central bank and the government, coordinate their respective policy mandates. Often, the central bank is more nimble and able to adjust than the government; fiscal adjustments occur less frequently than monetary adjustments.

Thus, we compare the outcomes under a coordinated monetary/fiscal adjustment a case where the fiscal authority refuses to cooperate—*fiscal intransigence*. In this case, the central bank nonetheless chooses to 'go it alone' and to pursue one of the two goals.

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[7] It is straightforward to show that, even if both the external balance (EB) and the internal balance (IB) lines slope upward, the IB line must be steeper than the EB line. To see this, note again that

$$Slope\,(IB) = \left[\frac{-a_{21}}{a_{22}}\right] \qquad Slope\,(EB) = \left[\frac{-a_{11}}{a_{12}}\right]$$

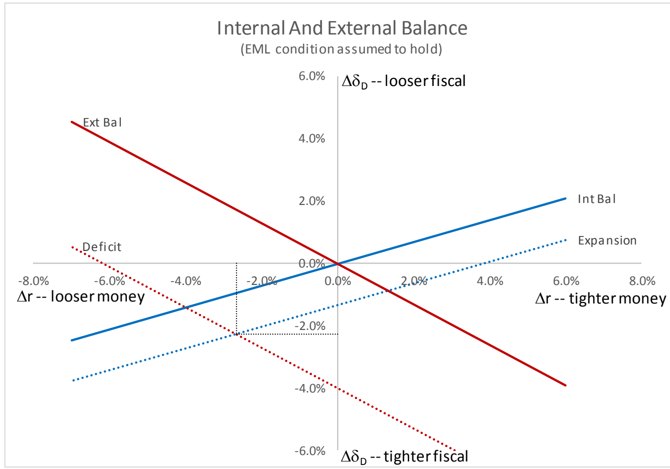
Next, note the following coefficient ratios:

$$-\frac{a_{21}}{a_{11}} = \left[\frac{\dfrac{-\kappa^*(\alpha_2+\eta)}{(\alpha_1+\alpha_3)}}{\left[\dfrac{-\alpha_3{}^*(\alpha_2+\eta)}{(\alpha_1+\alpha_3)}+\eta\right]}\right] \qquad \frac{a_{22}}{a_{12}} = -\frac{\kappa}{\alpha_3}$$

Finally, since $\eta < 0$, we may write:

$$-\frac{a_{21}}{a_{11}} > -\frac{a_{22}}{a_{12}} \xrightarrow{\text{which implies}} \underbrace{-\frac{a_{21}}{a_{22}}}_{Slope(IB)} > \underbrace{-\frac{a_{11}}{a_{12}}}_{Slope(EB)}$$

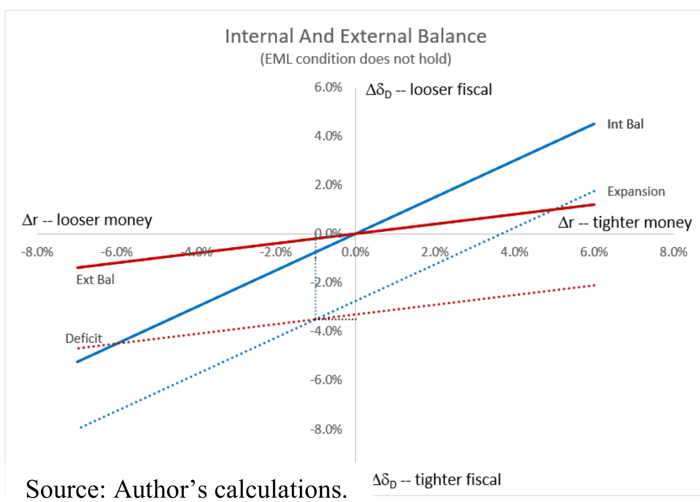
Figure 4: Required Adjustments for Joint Stabilization – EML holds



Source: Author's calculations.

The figure shows the fiscal and monetary adjustment that will jointly eliminate both internal and external imbalances (expansion, deficit)—the intersection of the red and blue *dotted* lines. In this case, the optimal policy couples a fiscal tightening with a monetary loosening.

Figure 5: Required Adjustments for Joint Stabilization – EML fails



Source: Author's calculations.

The figure shows the fiscal and monetary adjustment that will jointly eliminate both internal and external imbalances (expansion, deficit)—the intersection of the red and blue *dotted* lines. In this case, the extended Marshall Lerner condition fails to hold. Even so, the optimal policy is still fiscal tightening that is combined with a monetary loosening.

Thus, we compare the outcomes under a coordinated monetary/fiscal adjustment a case where the fiscal authority refuses to cooperate—*fiscal intransigence*. In this case, the central bank nonetheless chooses to 'go it alone' and to pursue one of the two goals.

Consider first the case in which the monetary authority focuses entirely on issues related to internal stabilization (IS) rather than external sustainability, but the fiscal authority is uncooperative. In this case, the central bank adjusts the interest rate (and appreciates the currency) so as to bring inflation back to the target:

$$\Delta r^{IS} = \frac{\pi - \pi^*}{a_{21}} \tag{10}$$

The impact of such a policy on net exports (combining income and expenditure switching effects) is:

$$nx^{IS} = nx + a_{11} * \Delta r^{IS} \tag{11}$$

In this case, we may think of the difference $nx^* - nx^{IS} < nx^* - nx$ as a *latent* vulnerability: it is the value of the external gap that we would observe if the central bank tightened monetary policy without the cooperative fiscal policy - the policy that is indicated in (9). Put differently, if the EML holds, and the net export deficit is initially too high, such a policy will be destabilizing—it will further deteriorate the trade balance (since it further appreciates the real exchange rate).

Alternatively, consider first the case where the monetary authority focuses entirely on issues related to external stabilization (ES) rather than internal sustainability; again, the fiscal authority is uncooperative. In this case, the central bank adjusts the interest rate (and appreciates the currency) so as to bring net exports back to the target:

$$\Delta r^{ES} = \frac{nx - nx^*}{a_{11}} \tag{12}$$

This special case arises when two elements are omitted from the more general analysis. First, the authority focuses entirely on solving the external sustainability issues and ignores any implication for inflation or the domestic output gap. Second, the case portrays a situation of fiscal intransigence: there is no fiscal adjustment ($\Delta\delta_D = 0$). Equation (12) thus tells us the extent of real exchange rate misalignment—the growth in the real exchange rate required to eliminate the external balance—holding all else constant.

Of course, closing an external deficit gap will have implications for the inflation rate:

$$\pi^{ES} = \pi + a_{21}\Delta r^{ES} \tag{13}$$

That is, if the authority chooses to loosen / devalue the exchange rate, inflation must rise. The difference between the new, higher inflation rate and the target is $\pi^* - \pi^{ES} > \pi^* - \pi$.

The IMF's External Balance Assessment (EBA)

We may now also see that the International Monetary Fund's template for diagnosing exchange rate misalignments, the External Balance Assessment (EBA, IMF, 2013), is a special case of the assignment problem. That template first provides methods to calculate a 'norm' for the current account. That norm can then be adjusted to reflect a fiscal adjustment that is exogenously determined $\Delta\bar{\delta}_D$. Thus, the required exchange rate adjustment implied by the EBA would be:

$$\Delta r^{ES/EBA} = \frac{nx - nx^*}{a_{11}} - \frac{a_{12}}{a_{11}} * \Delta\bar{\delta}_D \tag{12a}$$

In this sense, the EBA may be thought of as a special case where policy makers care only about the external problem, with no weight placed on the inflation problem; the exogenously chosen fiscal adjustment $\Delta\bar{\delta}_D$ would only *by chance* match the solution implied by (9).

Table 2: Adjustments Required for External and Internal Stabilization: Alternative Scenarios

		Scenarios:					
		(i)	(ii)	(iii)	(iv)	(v)	(vi)
External gap (deficit +)	$nx^* - nx$	0.5%	0.5%	1.5%	1.5%	-1.5%	-1.5%
Internal (inflation) gap	$\pi^* - \pi$	0.0%	-1.5%	0.0%	-1.5%	0.0%	-1.5%
Required monetary adjustment, general case	Δr^*	-2.0%	-1.0%	-6.0%	-5.0%	6.0%	7.0%
Required fiscal adjustment, general case	$\Delta\delta_D^*$	-0.7%	-2.1%	-2.1%	-3.5%	2.1%	0.7%
Required monetary adjustment, ES/Fiscal Intransigence	Δr^{ES}	-2.5%	-2.5%	-7.5%	-7.5%	7.5%	7.5%
Internal inflation gap	$\pi^* - \pi^{ES}$	-0.8%	-2.3%	-2.3%	-3.8%	2.3%	0.8%
Required monetary adjustment, IS/Fiscal Intransigence	Δr^{IS}	0.0%	5.0%	0.0%	5.0%	0.0%	5.0%
External gap	$nx^* - nx^{IS}$	0.5%	1.5%	1.5%	2.5%	-1.5%	-0.5%

Note: Net exports (nx) and fiscal adjustment (δ^D) are expressed as percent of output.

Source: Author's calculations.

C. Some Illustrative Examples (EML holds)

Table 2 presents six illustrative scenarios *assuming that EML holds*. (Assumed parameter values are presented in Appendix B). Scenario (i) assumes a modest deficit-side gap on net exports, $nx^* - nx$=0.5 percent of output, but the inflation target is met $\pi^* - \pi$=0. The 'general case' refers to one where the fiscal and monetary authorities cooperate—each do their part. For scenario (i), that general policy combines some monetary easing/real depreciation with some fiscal tightening: Δr^* = -2 percent, $\Delta\delta_D^*$=-0.7 percent of output. The external sustainability (ES) objective would indicate even more monetary loosening and exchange rate depreciation, Δr^{ES}=-2.5 percent, at the expense of boosting inflation above the target $\pi^* - \pi^{ES}$=-0.8 percent (i.e. an increase in the inflation rate of 0.8 percent).

Scenario (ii) assumes a net export gap identical to that in (i) b.5 percent of output, but the inflation rate is above the target $\pi^* - \pi$=-1.5 percent. Unsurprisingly, since above-target inflation is also treated as a problem that needs to be addressed, the policy solution suggested by (9) relies less on monetary easing / real depreciation and puts more substantially more emphasis on fiscal tightening than in scenario (i): Δr^* = -1 percent, $\Delta\delta_D^*$=-2.1 percent of output. That is, when inflation exceeds the target, the central bank has less monetary space for policy loosening; the burden of adjustment will thus be shifted to the fiscal authority.

Since the external sustainability (ES) calculation does not consider inflation, the monetary policy prescribed therein is identical to that in scenario (i). Instead, it is the internal stabilization (IS) calculation differs from scenario (i). To bring the inflation rate back to its target under the assumption of no fiscal adjustment, interest rates must rise—and the real exchange rate must *appreciate*—by 500 basis points. While the inflation rate returns to the target, the trade balance deteriorates by 1 ½ percent of GDP—$nx^* - nx^{IS}$=1.5 percent.

As we illustrate in the next section, such a policy implies that the country's net foreign asset position will deteriorate precisely because the central bank has diligently attacked the inflation problem—but on a 'go it alone' basis, without any help from the fiscal authority.

The implications of a higher trade balance deficit are clear: at some point in the future, the country will have to run an even higher trade balance *surplus* to service its obligations.

Foreign investors will likely view both excess inflation and fiscal intransigence unfavorably—*even though these are not external sector factors per se.* They will see that, as a result of the central bank's 'go it alone' disinflation policy, the deficit will be larger than otherwise by the amount $nx^{IS} - nx$=1 percent and the real exchange rate will be even more overvalued than otherwise by the amount $\Delta r^{IS} - \Delta r^*$=7.5 percent (5 percent plus 2.5 percent). Thus, the calculation developed herein permits us to quantify the *latent* external vulnerability brought about by excess inflation and fiscal intransigence.

We can also apply this framework to surplus countries. Scenario (v) assumes a moderate *surplus* (negative gap) on net exports, $nx^* - nx$=-1.5 percent of output—the country is acquiring claims on the rest of the world on an unsustainable basis. At the same time, the inflation target is met $\pi^* - \pi$=0. Unsurprisingly, under the general (cooperative) policy, the monetary tightening / real appreciation is combined with a more expansionary fiscal policy: Δr^* = 6 percent, $\Delta\delta_D^*$=2.1 percent of output. The external sustainability framework would indicate even more monetary tightening and exchange rate appreciation, Δr^{ES} =7.5 percent; such a policy would bring on a recession and pull inflation substantially *below* the target: $\pi^* - \pi^{ES}$ =2.3 percent.

In the same vein, scenario (vi) maintains the *surplus* assumption from the above: as before the country is acquiring foreign assets. At the same time, the country's inflation rate exceeds its target: $\pi^* - \pi$=-1.5 percent. Now, under the general (cooperative) policy, the monetary authority must tighten even more while there is less room for a fiscal expansion: Δr^* = 7 percent, $\Delta\delta_D^*$=0.7 percent of output. The external sustainability (ES) objective again indicates that monetary policy should be tightened and the real exchange rate should appreciate: Δr^{ES} =7.5 percent; such a policy will bring the inflation rate closer to its target $\pi^* - \pi^{ES}$ =0.8 percent—modestly below target. Importantly, using monetary policy exclusively to reduce inflation would mean a monetary tightening of Δr^{IS} = 5 percent; doing so would also bring net exports closer to their target value: $nx^* - nx^{IS}$ =-0.5 percent.

D. Coordination versus Fiscal Intransigence if the EML Fails

The previous analysis confirmed that if the EML condition holds (a_{11}<0) and the country's external imbalance is one of a deficit (i.e. scenarios (i)-(iv) in Table 1, above), a monetary loosening is called for. Without a corresponding fiscal tightening, the monetary loosening (and hence exchange rate depreciation) required to close the gap will be even higher; this means higher inflation. Put differently, if the EML holds, the external gap can *never* be closed with a tighter monetary policy.

However, a failure of the EML does not mean that monetary and fiscal policy do not need to be coordinated. Rather, even if the EML fails, a fiscal adjustment may be still be an important component of a strategy to close an external deficit and bring inflation back to its target. It is possible that, without the fiscal adjustment, the monetary adjustment required to close the external gap will be severe—enough so as to generate a recession. To see how this might happen, insert equation (12) into equation (13):

$$\pi^{ES} = \pi + a_{21}\Delta r^{ES} = \pi + a_{21}\left[\frac{nx - nx^*}{a_{11}}\right] = \pi + \frac{a_{21}}{a_{11}}(nx - nx^*) \qquad \text{(13a)}$$

Note that a_{21}< 0. If EML fails to hold, a_{11}>0. Therefore, the monetary tightening required to reduce the net export gap will reduce the inflation rate (i.e. the ratio of a_{21} to a_{11}) is negative. Note also that this ratio is proportional to the ratio of the Phillips curve parameter κ to the import response parameter α_3. A relatively low value for the latter will raise in absolute terms the impact on inflation. The intuition on this is clear: for a given deficit on net exports, the less responsive are imports to output ($abs(\alpha_3)$ small) implies that the required interest rate adjustment is more severe—as is the recessionary impact of that adjustment. Conversely, under the general cooperative policy implied by equation (9), the interest rate adjustment will be less severe than the restricted policy implied by equation (12)—precisely because the fiscal authority is shouldering part of the adjustment burden.

IV. Disinflation, the External Position, and Credibility: A Dynamic Analysis

The above calculations are designed to convey a sense of an economy's imbalances and external vulnerabilities as a snapshot—in the spirit of a "back of the envelope" assessment. Even while assessments in this vein can be powerful communication tools they also suffer from several deficiencies. First, inflation is in part determined by expectations which can change over time. In the calculations above, expected inflation is assumed to remain constant—clearly an unrealistic assumption. Second, the idea of external sustainability cannot be adequately captured by such a static framework: as external obligations are accumulated (holding all else constant), the target (or debt stabilizing) net export ratio must also change. Third, some of the proposed policy adjustments might be too draconian to take place on a one-shot basis.

For this reason, we extend the analysis to incorporate multiple periods in a way that permits us to track over time the model's variables, including inflation and external debt, under alternative disinflation scenarios. To do so, we use a simple framework which incorporates many features of the familiar workhorse New Keyesian model, for example, see Walsh (2003, pp 245-247).

As is true with most New Keynesian models, we focus on the demand side. An interesting extension would be to also incorporate supply side effects of fiscal policy. However, the model does extend current literature insofar as it is augmented with several hybrid elements.

The dynamic IS curve is written:

$$y_t = \frac{\alpha_2(i_t - E\pi_{t+1} - \bar{r}) + \eta(q_t - \bar{q}) + \delta_t + \theta E y_{t+1}}{(1+\alpha_3)} \tag{14}$$

where $\delta_t = \delta_{D,t} + \delta_{NX,t}$ is the demand shift parameter, q_t is the logarithm of the real exchange rate index, $\bar{q}$ is the natural value thereof (assumed to be zero), E is the expectations operator, and θ links current and expected future expenditures ($(0 < \theta < 1)$.[8] Note that the real exchange rate remains linked to the real interest differential minus a time-varying risk premium rp_t . In its log-level form, the real interest parity condition links the current real exchange rate to its expected future value Eq_{t+1} according to the forward-looking relationship:

[8] According to the standard interpretation, in a closed economy model with no capital accumulation or government spending, if the intertemporal (Euler) relationship holds θ =1.

$$q_t = i_t - E\pi_{t+1} - i_t^{EXT} + E\pi_{t+1}^{EXT} - rp_t + Eq_{t+1} \tag{15}$$

where π^{EXT} is the external (exogenous) rate of inflation. The interpretation of all other parameters is identical to that of the static model of the previous section. Monetary policy is expressed in terms of a Taylor-type reaction function:

$$i_t = \bar{r} + E\pi_{t+1} + \beta_\pi(\pi_t - \pi^*) + \beta_y y_t + i_t^{DISC} + rp_t \tag{16}$$

where i is the nominal interest rate, β_π and β_y reflect the central bank's dual mandate of both price and output stability, and i^{DISC} captures any discretionary deviation from the rule. The Phillips curve is modified to read:

$$\pi_t = \psi E\pi_{t+1} + (1-\psi)\pi_{t-1} + \kappa * (y_t - z_t) \tag{17}$$

Following Gali and Gertler (1999), we may think of the Phillips curve as a 'hybrid' that includes both a forward-looking element to expectations $\psi E\pi_{t+1}$ and an inertial or backward-looking component $(1-\psi)E\pi_{t-1}$, where $0 < \psi < 1$. In this context, ψ has a commonsense interpretation: *internal credibility*. If ψ equals unity, forward looking agents incorporate the fact that the central bank will bring inflation to its target level – with full credibility. For lower values of ψ, economic agents doubt the central banks' intentions or its willpower; instead, such agents take a skeptical or "show-me" attitude: they do not fully believe in the central bank's ability bring inflation to the target – until it finally happens. This interpretation of the hybrid Phillips curve has come to be a standard one (see, for example Berg, Karam, and Laxton, 2006). *This paper this adopts such an interpretation as the correct one.*

Jointly, these equations are combined to form a system:

$$A * \begin{bmatrix} Ey_{t+1} \\ E\pi_{t+1} \end{bmatrix} = B * \begin{bmatrix} y_t \\ \pi_t \end{bmatrix} + C * \begin{bmatrix} i_t^{DISC} \\ (i_t^{EXT} - E\pi_{t+1}^{EXT} - Eq_{t+1} + \bar{q} - \bar{r}) \\ \delta_t \\ z_t \\ \pi^* \\ \pi_{t-1} \end{bmatrix} \tag{18}$$

where:

$$A = \begin{bmatrix} \dfrac{-\theta}{[1-\beta_y(\alpha_2+\eta)](1+\alpha_3)} & 0 \\ 0 & \psi \end{bmatrix} \qquad B = \begin{bmatrix} -1 & \dfrac{(\alpha_2+\eta) * \beta_\pi}{[1-\beta_y(\alpha_2+\eta)] * (1+\alpha_3)} \\ \kappa & -1 \end{bmatrix}$$

$$C=\begin{bmatrix} \frac{(\alpha_2+\eta)}{[1-\beta_y(\alpha_2+\eta)](1+\alpha_3)} & \frac{-\eta}{[1-\beta_y(\alpha_2+\eta)](1+\alpha_3)} & \frac{1}{[1-\beta_y(\alpha_2+\eta)](1+\alpha_3)} & 0 & \frac{-\beta_\pi(\alpha_2+\eta)}{[1-\beta_y(\alpha_2+\eta)](1+\alpha_3)} & 0 \\ 0 & 0 & 0 & -\kappa & 0 & -(1-\psi) \end{bmatrix}$$

This dynamic model allows us to track the evolution of foreign obligations; for simplicity, we assume that all foreign obligations take the form of debt whose interest rate is r^{EXT}. We assume that the *initial* ratio of debt to output is: $d_0^F = D_0^F / Y_0$. In subsequent periods, external debt evolves according to a standard dynamic equation:

$$d_t^F = d_{t-1}^F \frac{(1+r^{EXT}+rp_t)}{(1+\hat{y})(1+\hat{e})} - nx_t \tag{19}$$

where $\hat{y}$ and $\hat{e}$ are growth rates of real domestic output and the real exchange rate, respectively. Note that equation (19) corresponds to a simplified relationship between the current account and the net international investment position – under the assumption that primary and secondary income are both zero and deficits are financed exclusively by debt flows. The derivation of net exports is shown in Appendix A.

External credibility is modeled in a very simple way:

$$rp_t = \begin{cases} \upsilon * (d_{t-1}^F - \bar{d}^F) \text{ if } d_{t-1}^F - \bar{d}^F > 0 \\ 0 \text{ otherwise} \end{cases} \tag{20}$$

Where υ >0. That is, the risk premium increases when external debt rises above some critical value $\bar{d}^F$ but remains zero otherwise. A larger value for υ indicates lower credibility: market participants require compensation for the risk that the country will not be able to generate the net export surpluses require to repay the debt.

A. The Toxic Mix Again: High Inflation, External Deficits, and Low Credibility

The analysis focuses on what is arguably the most toxic mix of circumstances: inflation above the target and external deficits. The analysis suggests that, if central bank enjoys high credibility—as reflected in greater weight on the forward-looking component of inflation forecasts (higher values of ψ)—it is better poised to reduce inflation while also keeping external debt stable under a ‘go it alone’ strategy—*without* a fiscal adjustment. By contrast, if some members of the public take a skeptical or “show-me” attitude towards disinflation, despite the declared inflation target, the assumption of forward-looking expectations may be ‘unjustifiably strong’ (Woodford, 2013). Instead, in an environment where such a ‘show me’ attitude is more prevalent, values of ψ will be lower than otherwise, suggesting that expectations will have an adaptive component—they are 'sticky.'

Even though the interpretation of the Galí/Gertler hybrid curve is standard, the question remains: which value of ψ is appropriate? In answering this question, it is natural to refer to evidence relevant to emerging market countries. Even though estimates of ψ tend to be near unity for industrialized countries (estimates of ψ for the United States were 0.7 or higher were reported by Galí/Gertler themselves), there may be more inflationary inertia in emerging markets. For example, in several transition economies, Basarać, Škrabić, and Petar Sorić find that there is substantial weight on the backward-looking component of inflation (ψ close to zero). Likewise, Cerisola and Gelos (2009) note that, in Brazil, there is a positive and statistically significant relationship between survey data for $E\pi_{t+1}$ and π_{t-1}.

Importantly, Cerisola and Gelos (2009) and also present evidence that the ψ is time-varying: it rises when the inflation rate itself rises. Such a finding brings to mind what might be a broader question to ask when choosing a value for ψ: Are inflation expectations in these countries tightly anchored to their target, or are they sensitive to short-term economic developments. On this broader question, De Pooter, e Robitaille, Walker, and Zdinak (2014) do provide evidence that short-term economic developments can indeed unhinge inflationary expectations away from the target. If so, and if those short-term developments are reflected in the observed inflation rate, *a lower value of ψ is justified.*

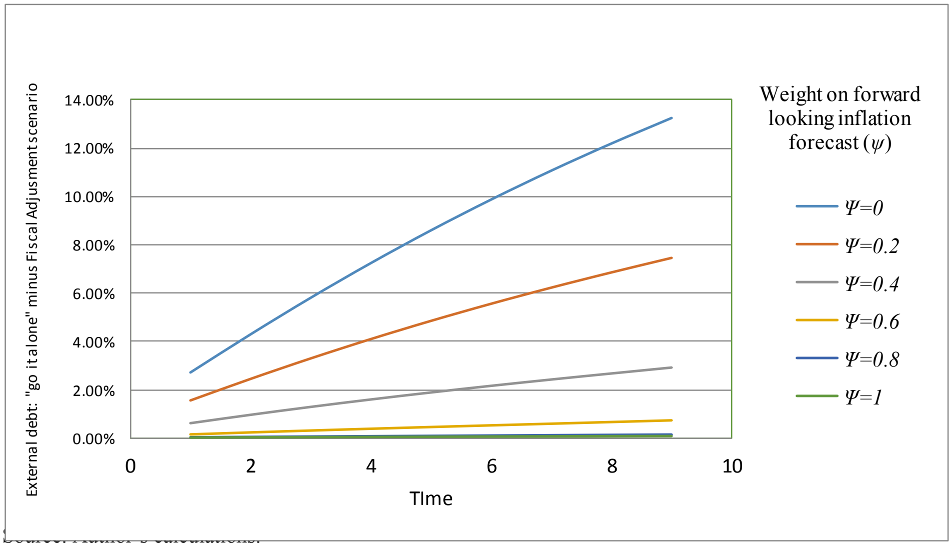
We examine results for several scenarios where the value of ψ for several alternative values that range from zero to unity: ψ = (0.0, 0.2, 0.4,0.6, 0.8,1). In all scenarios, the country's initial debt ratio is 15 percent of GDP, the initial inflation rate is 6.8 percent, and the target is 4.5 percent. Under all scenarios, inflation reaches the target in just over two years (9 quarters). The results are summarized graphically in Figures 6 through 11.

Figure 6 shows the trajectory of external debt (as a ratio to GDP) over the disinflation period under a 'go it alone' (no fiscal adjustment) scenario, for alternative values of ψ. The debt ratio rises more rapidly for lower values of ψ—f inflation forecasts are less forward looking. If inertial inflation is assumed to take on only moderate values – ψ =0.4, debt accumulation is modest but non-trivial. However, for values of ψ near unity, the debt ratio barely rises.

Figure 7 compares trajectories for real interest rates between a 'go it alone' scenario and a fiscal adjustment scenario. Under the 'go it alone' scenario the central bank must raise interest rates more severely than if fiscal adjustment takes place as well. The gap between these scenarios is higher for scenarios where inflation forecasts are less forward looking—low values of ψ. As ψ approaches unity, the gap between interest rates under the two scenarios falls to low levels.

Figure 6: External Debt (Percent of GDP)

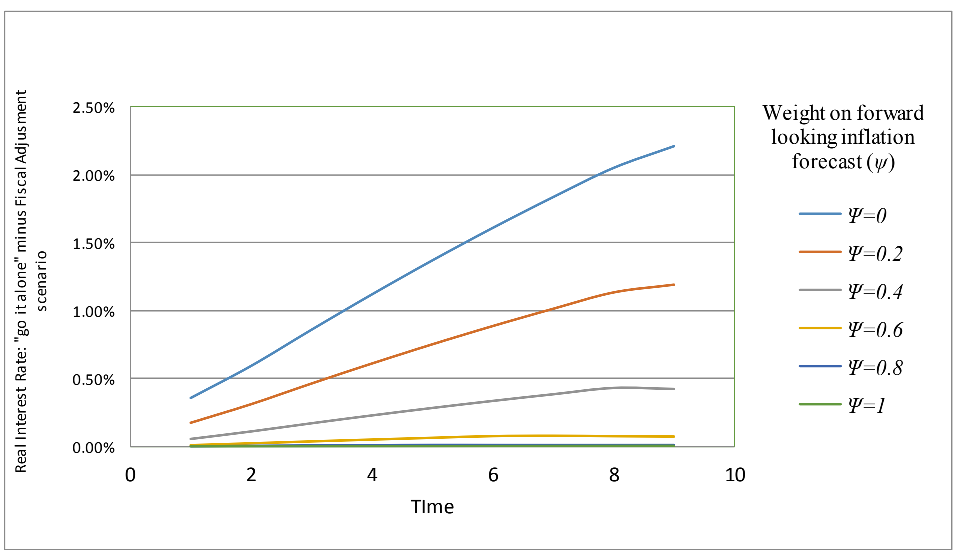
"Go it alone" minus fiscal adjustment



Under a 'go it alone scenario'—no fiscal adjustment—the ratio of external debt to GDP rises more if inflation forecasts are less forward looking—low values of ψ. For moderate values of ψ (0.4) debt accumulation is modest but non-trivial. As ψ approaches unity, the increase in the debt ratio becomes inconsequential.

Figure 7: Real Interest Rate (Domestic, in Percent)

"Go it alone" minus fiscal adjustment



Source: Author's calculations.

Under a 'go it alone scenario'—no fiscal adjustment, the central bank must raise interest rates by more than under a comparable fiscal adjustment scenario where debt is stabilized. The gap between these scenarios is higher for scenarios where inflation forecasts are less forward looking—low values of ψ. As ψ approaches unity, the gap between interest rates under the two scenarios falls to low levels.

Figure 8 shows the fiscal adjustment required to stabilize debt (keeping the inflation target constant). The fiscal adjustment is assumed to be spread equally over time. The figure shows that the required fiscal adjustment is higher for cases where inflation forecasts are less forward looking—low values of ψ. As ψ approaches unity, the required fiscal adjustment becomes small.

Figure 9 compares trajectories for the real exchange rate between a 'go it alone' scenario and a fiscal adjustment scenario. Under a 'go it alone scenario' the central bank must keep the real exchange rate at a more appreciated level than under a comparable fiscal adjustment scenario where debt is stabilized.

To a large degree, the gap between these scenarios reflects the cross-scenario gap for the real interest rate. Where inflation forecasts are less forward looking—low values of ψ, the real exchange rate appreciates more. However, since the real exchange rate must ultimately depreciate in order to generate future trade balance surpluses, the observed appreciation is temporary—and leads to an unsustainable net export deficit.

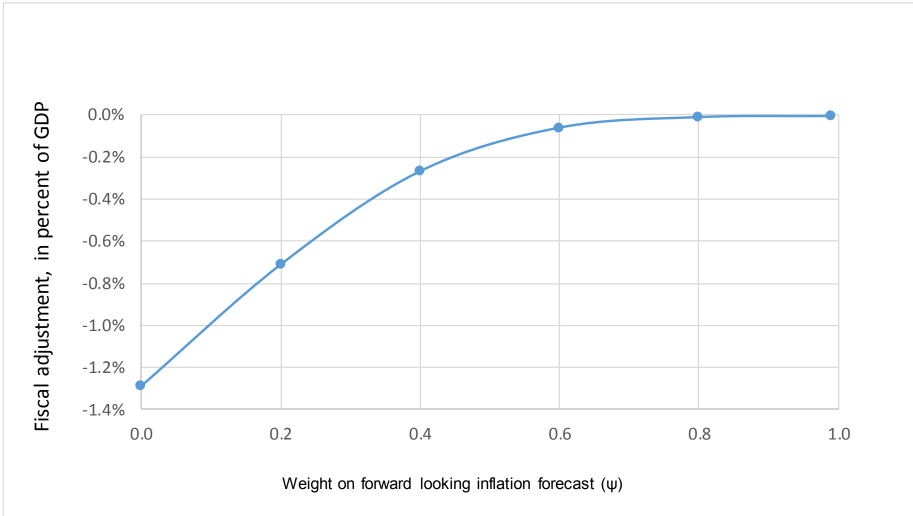
Figure 10 compares trajectories for the external risk premium between a 'go it alone' scenario and a fiscal adjustment scenario. Under a 'go it alone scenario' the risk premium on external debt rises, mirroring the ratio of external debt to GDP which is also rising. The risk premium—which reflects external sustainability concerns—is more severe for cases where inflation forecasts are less forward looking—low values of ψ.

Figure 11 compares trajectories for the output gap between a 'go it alone' scenario and a fiscal adjustment scenario. For most cases, the output gap tends to be somewhat higher under a 'go it alone scenario' than under the comparable fiscal adjustment (deficit reduction) scenario. However, for lower values of ψ, the output is higher during the early periods but lower during the later periods.

What explains this seemingly paradoxical result? During the early periods, higher interest rates have a smaller adverse impact on output than the severe fiscal adjustment which must take place. During the later periods, the impact of higher risk premium is more severe than the fiscal adjustment.

The policy implications of this result are important: for low values of ψ the authorities will find a 'go it alone' strategy to be more attractive – but only temporarily. However, such a strategy will ultimately backfire. When world markets impose higher interest rates, through a higher risk premium on the country, its output must fall.

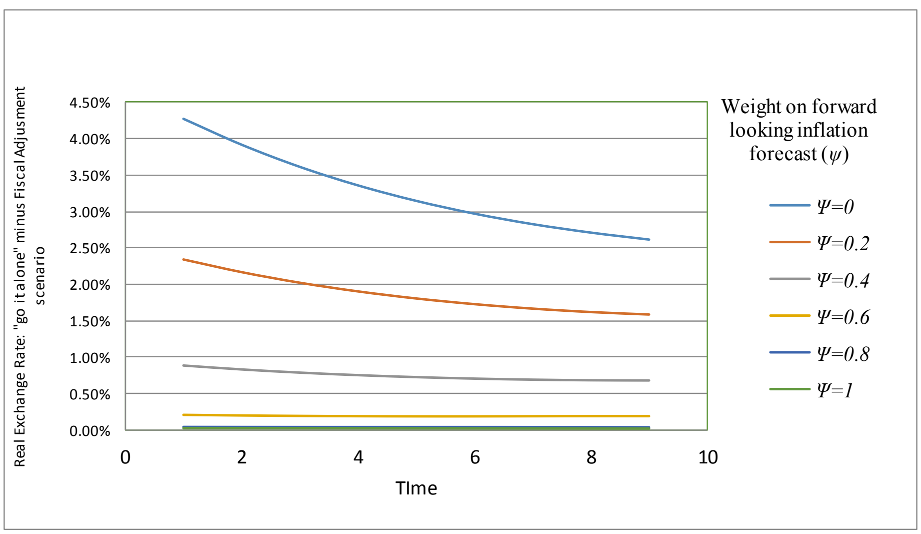
Figure 8: Fiscal Adjustment (% of GDP)



Source: Author's calculations.

The fiscal adjustment required to stabilize debt (keeping the inflation target constant) is higher for cases where inflation forecasts are less forward looking—low values of ψ. As ψ approaches unity, the required fiscal adjustment becomes small.

Figure 9: Real Exchange Rate (Appreciation +)
"Go it alone" minus fiscal adjustment

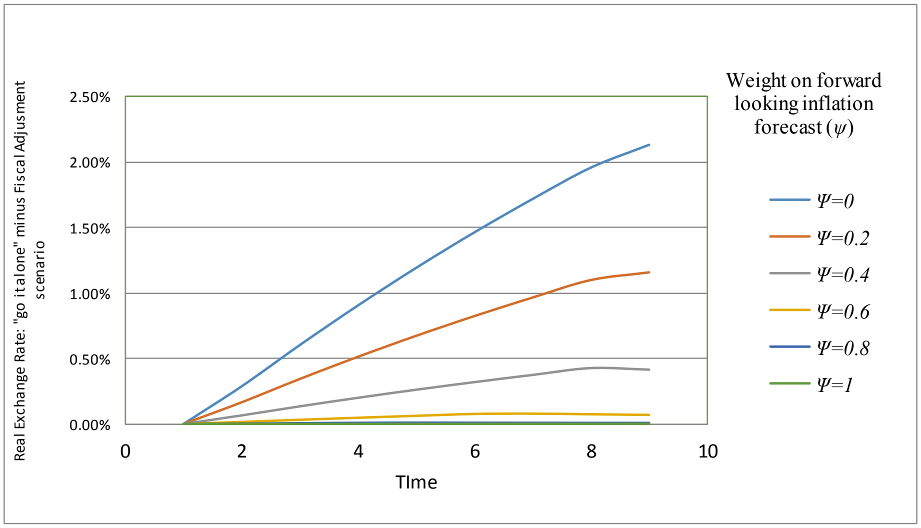


Source: Author's calculations.

Under a 'go it alone scenario' the central bank must keep the real exchange rate at a more appreciated level than under a comparable fiscal adjustment scenario where debt is stabilized. To a large degree, the gap between these scenarios reflects the cross-scenario gap for the real interest rate. Where inflation forecasts are less forward looking—low values of ψ, the real exchange rate becomes even more appreciated—albeit on a temporary and unsustainable basis.

Figure 10: Risk Premium (in Percent)

"Go it alone" minus fiscal adjustment

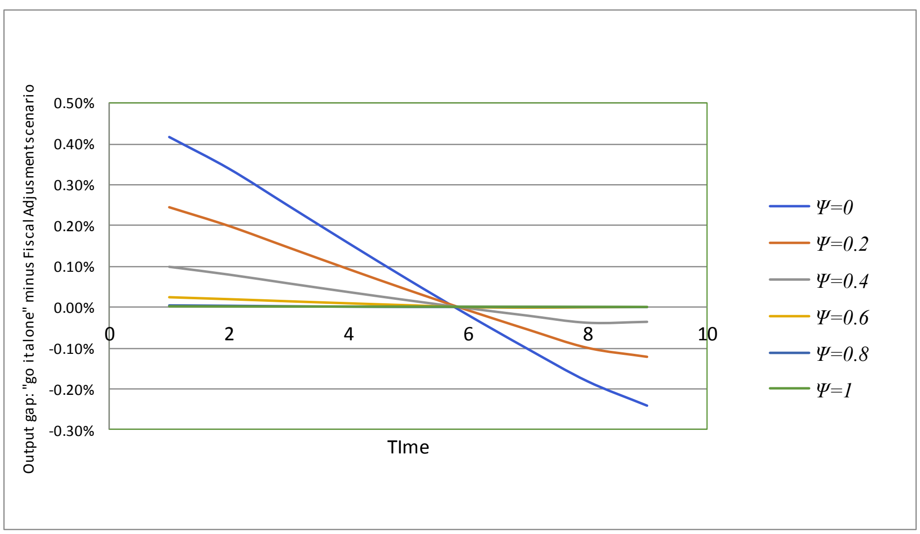


Source: Author's calculations.

Under a 'go it alone scenario'—no fiscal adjustment—the risk premium on external debt rises, mirroring the ratio of external debt to GDP which is also rising. The risk premium—reflects external sustainability concerns—is more severe for cases where inflation forecasts are less forward looking—low values of ψ.

Figure 11: Output Gap (in percent)

"Go it alone" minus fiscal adjustment



Source: Author's calculations.

For most cases, the output gap tends to be higher under a 'go it alone scenario' than under the comparable fiscal adjustment scenario. However, for lower values of ψ, the output is higher during the early periods but lower during the later periods. During the early periods, higher interest rates have a smaller impact on output than the severe fiscal adjustment (which is assume to be evenly spread across periods). During the later periods, the impact of higher risk premier is more severe than the fiscal adjustment. Thus, for low values of ψ the authorities will find a 'go it alone' strategy to be more attractive—but only temporarily. Ultimately, this strategy means tighter monetary policy and lower output.

V. Summary and Conclusions

This paper has focused on the policy challenges a country faces when it wants to both reduce inflation and maintain a sustainable external position. According to Robert Mundell's (1962) policy assignment framework, we know that these two goals can conflict with one another unless monetary and fiscal policies are properly coordinated. Unfortunately, if the fiscal authority is unwilling or unable to cooperate—a case of *fiscal intransigence*—reconciling these two goals can be difficult. Central banks that pursue a disinflation on an 'go it alone' basis—without a supporting fiscal adjustment—will likely help widen the country's external deficits and worsen its net external liability position.

In this case, the country becomes more vulnerable to a sudden reversal of flows in the external financial account, potentially causing an abrupt depreciation of the exchange rate that may also be transmitted to increased domestic inflation. In this sense, the analysis echoes Sargent and Wallace's (1981) observation that, without cooperation from the fiscal authority, "although fighting current inflation with tight monetary policy works temporarily, it eventually leads to higher inflation."

The paper first presents a static 'back of the envelope' calculation that yields a joint assessment of the adjustments to the real exchange rate (i.e. exchange rate misalignment) and domestic absorption (i.e. fiscal adjustment) required to reach both inflation and external goals simultaneously. It is shown that a familiar approach to estimate misalignment of the real exchange rate—an approach that is part of the Fund's External Balance Assessment (EBA)—is a special case that implicitly treats inflation goals and fiscal policy as exogenously determined. As another case, if the central bank tightens monetary policy in order to reduce inflation on a 'go it alone' (fiscal dominant) basis, the degree of real exchange rate overvaluation will be more severe than otherwise.

The paper then examines the same issues in a dynamic setting. We introduce alternative assumptions regarding how forward looking are inflation forecasts. When the central bank is more credible, economic agents will form their expectations of inflation in a forward looking manner. When the central bank lacks credibility, agents will instead take a skeptical "wait and see" approach, basing their expectations on what they have already observed.

Central banks that enjoy more credibility will have an easier time reducing inflation than those with less credibility. For higher credibility central banks, the monetary tightening required to reach the inflation target will be lower; the degree of appreciation of the real exchange rate and hence external debt accumulation will be smaller. However, if the fiscal authority chooses to cooperate, the fiscal adjustment required to stabilize the debt will also be less severe when central bank credibility is higher.

On the other hand, lower central bank credibility means that the monetary tightening required to reach the inflation target will be more severe, the degree of real exchange rate appreciation and hence external debt accumulation will be higher, and the fiscal adjustment required to stabilize foreign debt will be more severe.

The analysis in this paper might be applied to certain emerging market countries with external deficits and inflation rates above the target (formal or informal), such as the 'fragile five' that were considered in Table 1. While all countries had inflation rates that were higher than desirable, only some of them appeared to have excessive external debt or current account deficits. A key question posed by this paper is thus: "How might these countries bring their inflation rates back to the target (or desirable) level without further jeopardizing their already precarious external position." In this sense, it is critical that fiscal and monetary policies are coordinated with one another—*a la* Mundell.

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VII. APPENDIX

A. Translating Percent of Potential Output into Currency Units

A key feature of this paper is that model results are available in both percent of potential output (i.e. the output gap) and real currency units (real Dollars, Peso, Bhat, and so on). The bridge between these two seemingly disparate units requires a simple assumption: in the steady state – when output equals potential, and both the interest rate and the real exchange rate are at their natural values – expenditure components are also pinned down to steady state values. Such an idea, while straightforward, may not be generally recognized; see Tanner (2017) for further elaboration on this point.

To see how such an idea is applied in this paper, we reconsider the static IS curved developed herein (all results discussed in this appendix extend to the dynamic model as well). Note that output (gross domestic product) identically equals domestic expenditures (*DE*) and net exports (*NX*) – expressed in currency units:

$$Y = DE + NX \tag{A.1}$$

We may write the demand-side expression for each as:

$$DE = Y^P[\overline{de} + (1-\alpha_1)*y + \alpha_2*(r-\bar{r})] \tag{A.2}$$

and

$$NX = Y^P[\overline{nx} - \alpha_3 y + \eta(e-\bar{e}) + \delta_{NX}] \tag{A.3}$$

where $\overline{de}$ and $\overline{nx}$ denote steady-state ratios to potential output for domestic expenditures (consumption plus investment plus government expenditures) and net exports, respectively. Substituting (A.2) and (A.3) into (A.1) and solving, we obtain:

$$Y = DE + NX = Y^P\{\overline{de} + (1-\alpha_1)*y + \alpha_2*(r-\bar{r}) + \overline{nx} - \alpha_3 y + \eta(e-\bar{e}) + \delta_{NX}\} \tag{A.4}$$

Utilize the fact that hat $\overline{de} + \overline{nx} = 1$. Note also that we may think of steady state currency values for domestic expenditures and net exports, namely: $\overline{DE} = \overline{de}*Y^P$ and $\overline{NX} = \overline{nx}*Y^P$, respectively. This implies:

$$\frac{\overline{DE}+\overline{NX}}{Y^P}=1 \tag{A.5}$$

By using identity (A.5), divide equation (A.4) by potential output Y^P and then subtract one from both sides. Then, fully solving for the output gap y we obtain the output-gap expression for the IS curve – equation (1) in the paper, repeated below for convenience:

$$y=\frac{1}{(\alpha_1+\alpha_3)}*\left[\alpha_2*(r-\bar{r})+\eta*(q-\bar{q})+\delta_D+\delta_{NX}\right] \tag{1}$$

Then, we substitute values for the equilibrium output gap, real interest rate, and real exchange rate into equation (A.3) to obtain equilibrium values for net exports – consistent with equation (4) in the body of the paper, again repeated for convenience:

$$nx=-\alpha_3 y+\eta(q-\bar{q})+\delta_{NX} \tag{4}$$

And, as mentioned before, the logic above extends to the dynamic model. This feature is critical, insofar as it permits us to obtain the dynamics of external debt – equation (19) repeated for convenience:

$$d_t^F=d_{t-1}^F\frac{(1+r^{EXT}+rp_t)}{(1+\hat{y})(1+\hat{e})}-nx_t \tag{19}$$

Thus, to know how external debt evolves, it is required that we make assumptions regarding the steady state composition of output, namely $\overline{de}$ and $\overline{nx}$. However, a key question remains: from where do we get those steady-state values? What is the equilibrium composition of expenditures – domestic versus foreign? In the existing literature, we see several approaches to this question. One would be to take the observed long-run values for such variables – an empirical approach based on the so-called 'great ratios,' a concept first proposed by Klein and Kosobud (1961) and later expanded upon by King, Plosser, Stock, and Watson (1991), Ahmed and Rogers (2000), and Mills (2001). More recently such an approach has been applied to a dynamic stochastic general equilibrium (DSGE) setting; see Vitek (2015).

The empirically-driven 'great ratio' approach may be supported with theoretical foundations. For example, Tanner (2017) appeals to some basic elements of theoretical economic growth models. For example, the steady-state investment ratio should correspond to the volume of depreciation on the steady state capital stock. Also, as suggested in that paper, the steady state net export ratio should be one that ensures a sustainable trajectory for net foreign assets.

B. Model Parameters

Parameters: Static model (Part II of paper; EML holds)

Propensity to save	α_1	0.3
Interest rate impact	α_2	-0.1
Propensity to import	α_3	0.05
Exchange rate impact	η	-0.25
Phillips Curve parameter	κ	0.3

Parameters: Dynamic model (Part III of paper)

Dynamic IS Curve Parameters		
Expenditure Smoothing	θ	0.01
Domestic expenditure/real int. rate	α_2	-0.80
Net Exports/real int. rate	η	-0.35
Net Exports/gap	α_3	0.50
Taylor Rule Parameters		
Inflation	β_π	1.5
Output Gap	β_y	0.5
Phillips Curve output parameter	κ	0.15
Risk Premium, external debt	ν	0.2
Natural rate of interest	$\overline{r}$	2.8%
External real interest rate	$i_t^{EXT} - E\pi_{t+1}^{EXT}$	2.8%