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ALTERNATIVE MONETARY POLICY RULES

FOR SMALL OPEN ECONOMIES

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ABSTRACT

In this paper we examine the relative merits of simple monetary policy rules in the context of a small open economy. Rules considered are ones that target: the exchange rate, price level, nominal income or a monetary aggregate. The standard framework that has been employed for previous comparisons of these rules fails to take account of important features of small open economies. In particular, the standard framework fails to consider the effects on aggregate supply of exchange rate adjustments that result from adherence to policy rules. Incorporating such effects is shown to weaken the case for targeting nominal income and, more generally, to complicate the ranking of policy rules.

I. Introduction

Recognition of possible time inconsistency problems when monetary policy is conducted in a discretionary setting has led to increased interest in simple policy rules. Suggested simple rules include ones to target: the exchange rate, the price level (or inflation rate), nominal income or a monetary aggregate. A rule to target nominal income has received widespread support among economists [Meade (1978), Tobin (1980), McCallum (1988, 1995a, 1995b) and Hall and Mankiw (1994)]. Hall and Mankiw (1994, p. 77) conclude that "the consensus today favors nominal income as the most suitable object of monetary policy."[1] Frankel and Chinn (1995), within a *workhorse* model for analysis of rules versus discretion, make "a theoretical case in favor of a commitment to a nominal GNP target on the part of the monetary authorities (p. 318)." They conclude that "the nominal GNP rule seems to dominate all the other candidates for nominal target, the money supply, the exchange rate, the price of gold, and the price level (p. 326)." The purpose of this paper is to highlight some features of small (highly) open economies which make the theoretical case for nominal income targeting less clear cut--features not represented in the standard model often used to analyze the relative merits of simple rules.[2]

The standard model, used for example by Frankel and Chinn (1995), does not consider in detail the mechanism via which monetary policy can influence aggregate demand. Specifically, whether the monetary policy instrument is the interest rate or money supply, actions taken to affect aggregate demand result in changes in the interest rate. For small open economies taking the world interest rate as given, interest rate changes lead to exchange rate adjustments. Small open economies import substantial quantities of intermediate inputs. Exchange rate adjustments resulting from monetary policy actions therefore have significant effects

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[1]Clearly others deny that this is the case. Inflation targeting has many supporters. See, for example, Svensson (1996, 1997), Bernanke and Mishkin (1997), as well as the papers in *Achieving Price Stability* (1996). Ball (1996) finds nominal income targeting to be a "disastrous" strategy, a finding disputed by McCallum (1997). Some oppose implementation of any simple rule, e.g. Friedman and Kuttner (1996).

[2]Frankel and Chinn recognize that a number of their simplifying assumptions might bias their results in favor of nominal income targeting, but they have in mind considerations of controllability.

on aggregate supply. Moreover, wage pressures are affected by exchange rate changes. Once such aggregate supply effects are taken into account, a number of desirable properties of nominal income targeting disappear. It is no longer true, for example, that in a regime of nominal income targeting price and output are insulated from the effects of shocks to aggregate demand.

Within a model more suited to a small open economy, we reexamine the relative merits of alternative simple monetary policy rules. We find that it is difficult to rank these alternatives within our model. Our results are more consistent with the original conclusions of Poole (1970) where the choice of the best policy depends on model parameters and the variances of the shocks facing the policymaker.

The paper is organized as follows. In Section II we contrast the standard model (or type of model) that has been used in a comparison of simple policy rules with a model for a small highly open economy. Section III describes the model's solution. Section IV attempts to rank simple rules in the face of various stochastic disturbances. Given that establishing general rankings proves difficult, in Section V we employ some estimates of relevant parameter values from previous studies to see if rankings can be established. Section VI contains concluding comments.

II. A Comparison of Two Models

In this section we first consider a standard framework in which a comparison of simple monetary policy rules has been conducted. The particular model is taken from Frankel and Chinn (1995), but variants of the model

have been used in other studies.[3] We then specify an alternative model, which we believe to be better suited to the analysis of small open economies.

A. A Standard Model

The open-economy version of Frankel and Chinn's (1995) model consists of the following equations

(1.a) $L_t = A p_t^2 + \left(y_t - k y^*\right)^2 + B x_t^2$

(2.a) $y_t = y^* + b_1\left(p_t - p^e_{t,t-1}\right) + u_t$

(3.a) $m_t + v_t = p_t + y_t$

(4.a) $x_t = m_t - y_t + e_t$

where constant terms are omitted and

y_t = real output

p_t = the aggregate price level

$p^e_{t,t-1}$ = expectation of p_t formed at (t-1)

x_t = spot exchange rate relative to some target rate

m_t = nominal money supply

u_t, v_t, e_t = white noise shocks with variances σ_u^2, σ_v^2, σ_e^2, respectively,

with all parameters positive and all variables in logs.

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[3]An early closed economy version of the model is the one-period labor contract model in Fischer (1977). Henderson and McKibbin (1993) use a two-country version of the standard model to rank various policy regimes. Bean (1983), West (1986), and Bradley and Jansen (1989) evaluate nominal income targeting within closed economy models. Bean does consider the open-economy case and the required modification of the aggregate supply schedule for that case. He assumes, however, that the degree of openness is small enough to ignore the modification. Svensson's (1996) analysis of price targeting is in a closed economy framework, as is Ball's (1996) analysis of alternative simple rules. Much of the empirical work evaluating alternative policy rules has also been carried out in closed economy frameworks (Hall and Mankiw (1994), McCallum (1988), Taylor (1985)).

Equation (1) is the policymaker's loss function where A and B are the weights given to price stability (with a target level normalized to zero) and exchange rate stability relative to output stability. Frankel and Chinn impose k > 1 which imparts an inflationary bias to monetary policy under discretion. Equation (2) is the typical Lucas supply function, where u is a supply disturbance. Equation (3) is a quantity theory specification for aggregate demand. Equation (4) is an *ad hoc* equation to determine the exchange rate.

Within the model given by equations (1)-(4), Frankel and Chinn (1995) compare the relative merits of targeting the money supply, the price level, nominal income or the exchange rate.

We use the Frankel and Chinn model only as an example of the type of model which has been employed in previous comparisons of simple monetary policy rules. This type of model downplays important features of the monetary transmission mechanism in a small open-economy setting and in a world of high capital mobility. A shortcoming of such models is that they do not take account of *both* of the following:[4]

1. Whether the monetary policy instrument (short-run operating target) is the interest rate or money supply, policy actions required to achieve the target specified by each of the simple policy rules displace the interest rate. In a world of high capital mobility this requires an exchange rate adjustment.[5]

2. This exchange rate adjustment will have important aggregate supply effects in a small open economy.

B. A Small Open-Economy Model

The model in this section modifies the standard model to include features (1) and (2). The equations for the model are as follows:

(1) $$y_t = -a_1\left(r_t - \left(p^{e}_{t+1,t} - p_t\right)\right) + a_2\left(p_t^{f} + x_t - p_t\right) + v_{1t}$$

(2) $$y_t = b_0 + b_1\left(p_t - x_t - p_t^{f}\right) + b_2\left(p_t - w_t\right) + u_t$$

[4]Henderson and McKibbin (1993) do, for example, include feature 1.

[5]The exception being when the target to be achieved is a target nominal exchange rate.

(3) $m_t - p_t = \gamma_1 y_t - \gamma_2 r_t + v_{2t}$

(4) $r_t = r_t^f + x^e_{t+1,t} - x_t + \epsilon_t$

where in addition to symbols already defined

p_t^f = foreign price level

r_t = nominal interest rate

w_t = money wage

r_t^f = foreign nominal interest rate

$p^e_{t+1,t}$ = expectation of p_{t+1} formed at t

$x^e_{t+1,t}$ = expectation of x_{t+1} formed at t

v_{1t}, v_{2t} and ϵ_t = with noise shocks with variances σ^2_{v1}, σ^2_{v2} and σ^2_{ϵ}, respectively,

and where all variables except interest rates are in logs and all parameters are positive. This model has been employed frequently in the analysis of optimal monetary policy in small open economies, for example, in Turnovsky (1983) and Benavie and Froyen (1991).[6]

Equation (1) is a standard open-economy IS function. Equation (2) is the aggregate supply equation, the derivation of which follows Marston (1985). A Cobb-Douglas production function is used to derive factor demand functions for labor and an imported intermediate good. These demand functions are substituted into the production function to yield equation (2). Labor supply is assumed to depend on the real wage, defined as the money wage deflated by the overall price level (w - i), where i = a p + (1 - a)(p f + x). A labor contracting

[6]Turnovsky (1983) does not include the terms of trade in the aggregate supply function. As in some other papers of this genre, he models imported goods only as consumer goods. In that case, changes in the terms of trade affect aggregate supply via an effect on labor supply. In Turnovsky (1983) the current value of the exchange rate still shifts the aggregate supply function if there is indexation of the money wage to the CPI. Alternatively, in multisector models such as Waller (1992) and Walsh (1995), the current value of the exchange rate would affect aggregate supply via an effect on labor supply in the competitive (as opposed to contract) sector the labor market. For our results the key point is whether the current value of the exchange rate affects aggregate supply not the channel for the effect.

procedure is assumed, such that a contract wage (w_t) is set for period t to equate the expected values at t - 1 of labor supply and demand. Equation (3) specifies a conventional LM schedule. The assumption of perfect capital mobility is contained in the uncovered interest parity (UIP) condition in (4), which equates the expected return on domestic and foreign bonds. The disturbance, ϵ, represents shocks to UIP. The foreign interest rate (r^f) and price level (p^f) are taken to be exogenous.

We complete the model by specifying the following policy rules.

$$(5) \qquad m_t = \overline{m} + \lambda_1 \left(x^* - x_t\right)$$

$$(6) \qquad m_t = \overline{m} + \lambda_2 \left(Y^* - (p_t + y_t)\right)$$

$$(7) \qquad m_t = \overline{m} + \lambda_3 \left(p^* - p_t\right)$$

Equations (5), (6), (7) allow the money supply to respond to deviations from target values for the exchange rate, nominal income (Y) and the price level, respectively. Rules to target the exchange rate, nominal income or the price level are limiting cases of (5), (6), (7) where λ_1, λ_2 or $\lambda_3 \rightarrow \infty$.[7] The case of a money supply target is examined with $\lambda_i \rightarrow 0$ in any one of the policy rules.

III. Model Solution

To solve the model, we first substitute (4) and one of the policy rules into (3) and solve the result for x_t. We then substitute the result into (1) and (2) to eliminate x_t. We postulate trial solutions for y_t and p_t of the following form (omitting constant terms).

[7]Because we assume that in each case the target is achieved without error it would make no difference if the interest rate were the instrument instead of the money supply. Assuming that the target can be achieved without error is unrealistic because it assumes current observability of a variable such as nominal income or the aggregate price level. We make this assumption to abstract from issues of relative controllability of the different targets. Were we to drop this assumption, policy would instead have to be aimed at the forecast of the target variable. Relative forecast errors in different targets would then be a consideration–one which would be most favorable to exchange rate targeting and probably most unfavorable to nominal income targeting.

(8) $y_t = \pi_{11} v_{1t} + \pi_{12} u_t + \pi_{13} v_{2t} + \pi_{14} \epsilon_t + \pi_{15} r_t^f + \pi_{16} p_t^f$

(9) $p_t = \pi_{21} v_{1t} + \pi_{22} u_t + \pi_{23} v_{2t} + \pi_{24} \epsilon_t + \pi_{25} r_t^f + \pi_{26} p_t^f$

Substituting (8) and (9) into (1) and (2), after the substitutions described above have been carried out, provides a set of identities that can be solved for the π_{ij}s. The resulting solutions for p_t and y_t can then be substituted into the exchange rate equation [(4) and one from (5), (6), (7) substituted into (3)] to solve for x_t.

Our interest is in the value of the π_{ij}s and related coefficients in the exchange rate equation for four cases:

1. $\lambda_1 \to \infty$: exchange rate targeting
2. $\lambda_2 \to \infty$: nominal income targeting
3. $\lambda_3 \to \infty$: price level targeting
4. $\lambda_i \to 0$, $i = 1, 2$ or 3: money supply targeting.

IV. Optimal Policy Rules

The coefficients for the reduced-form equations (8) and (9), the π_{ij}s, and the coefficients for the equation determining the exchange rate are given in Tables (1-3) under the four simple policy rules. To start, our comparisons focus on price, nominal income, and exchange rate targeting. We then turn to a comparison of these rules with money supply targeting which brings some additional parameters into the discussion, namely the parameters of the money demand function.[8]

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[8]In the closed-economy version of what we have termed the standard model, nominal income targeting can be shown to dominate money targeting. This result is due to the simplifying assumptions of that approach, most directly the quantity theory assumption. With this assumption, the slope of the aggregate demand curve is unity. Therefore the price and output effects of a supply shock are identical under nominal income and money supply targeting. Velocity shocks displace price and output under money targeting but are automatically offset with nominal income targeting.

This is, however, a somewhat artificial advantage. Nominal income targeting requires that nominal income be observable. With this assumption, velocity shocks are observable. A policymaker targeting money would therefore also offset such shocks, controlling "shift adjusted money" as the U.S. Federal Reserve did in the early 1980s. Within the model employed here, comparisons between money supply targeting and nominal income targeting, as well as the

For our initial comparisons, the loss function remains equation (1.a).[9] This loss function, however, assumes that policymakers have a fixed target value for output, an assumption that may be inappropriate in a model where the terms of trade (and a productivity disturbance) affect aggregate supply. We return to this issue in the last part of this section.

The value of the loss function (1.a or the others considered later) under alternative rules depends on the values of the coefficients in Tables 1-3 and the variances of the shocks. Here we consider the role of the coefficients.[10] The coefficients on each disturbance are considered in turn. For purposes of comparison with the model, one can represent that model as a special case of ours, namely, with $b_1 = a_2 = 0$. In this case, changes in the exchange rate do not affect aggregate supply or demand unless the policymaker responds to such changes with adjustments of the money supply.

A. IS Shocks

For IS (v_1) shocks as well as for other shocks, the case for nominal income targeting or price targeting is considerably stronger relative to exchange rate targeting in the special case representing the standard model ($b_1 = a_2 = 0$). In that case, neither output nor price are displaced by IS shocks under price or nominal income targeting. Both are displaced under exchange rate targeting. Unless a high, and probably unrealistic, weight is placed on exchange rate stabilization, it will be an inferior strategy.

The situation is different in the more general case ($b_1 > 0$, $a_2 > 0$). In this case, IS shocks displace both price and output under either price or nominal income targeting. From the point of view of output stabilization,

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other simple rules, are less clear cut. Frankel and Chinn (1995) also conclude that nominal income targeting dominates money targeting in the open-economy version of the standard model. As pointed out by Ratti (1997), this conclusion is, however, in error. The error results from Frankel and Chinn's neglect of the effect on the exchange rate from the money supply accommodation of velocity shocks under nominal income targeting.

[9]Except that since we will not consider policy under discretion we assume k = 1.

[10]The role that changes in the variances in the different shocks which confront policymakers plays in the choice of policy rules is addressed in the conclusion to the paper.

in general, nominal income targeting is the preferred strategy. From the viewpoint of price stabilization, price targeting is, of course, optimal. Considering only price and output stabilization, nominal income targeting is preferred to exchange rate targeting for most reasonable parameter values. For reasonable parameter values, however, the advantage of nominal income targeting over exchange rate targeting in terms of output or price stabilization in the general case may well not be large enough to outweigh the obvious advantage that with exchange rate targeting the exchange rate is perfectly stabilized. This will be seen in Section V.

The disadvantage of exchange rate targeting from the standpoint of price or output stabilization can be seen by recognizing that given the UIP condition and a fixed foreign interest rate, exchange rate targeting is equivalent to interest rate targeting. Thus, in the presence of positive IS shocks, for example, under exchange rate targeting monetary policy must be accommodative to prevent a rise in the interest rate. In contrast, with price or nominal income targeting the policymaker is led to contract the money supply to offset the aggregate demand effects of the shock. The fall in the money supply will, however, cause the interest rate to rise and consequently the exchange rate to fall. In the general case ($b_1 > 0$), this results in a shift in the aggregate supply and displacement of price and output. The shift in the aggregate supply schedule is prevented under exchange rate targeting.

B. Foreign Interest Rate and UIP Shocks

Shocks to the foreign interest rate (r^f) and equivalently UIP (ϵ) shocks have their direct impact on equation (4). When equation (4) is substituted into the (IS) schedule, these shocks then are equivalent to IS shocks. The analysis of the effects of these shocks and the relative rankings of the simple policy rules in their presence therefore, for the most part, parallels that of (IS) shocks in the previous section.[11]

[11]This will not be the case when we consider money supply targeting. Equation (4) is also substituted into the money demand function which becomes relevant under money supply targeting.

It is noteworthy, however, that because foreign interest rate or UIP shocks enter only via their effect on the domestic interest rate in the IS schedule, the case where the interest elasticity of aggregate demand is zero ($a_1 = 0$) is of special interest. In that case neither r^f or UIP shock displace any of the variables in the loss function under exchange rate, price or nominal income targeting. The domestic interest rate simply adjusts to satisfy the UIP condition with no effects on other variables in the model.

C. Money Demand Shocks

As can be seen from Tables 1-3, under exchange rate, price or nominal income targeting, money demand shocks do not disturb output, price or the exchange rate. As noted previously, given UIP and a fixed foreign interest rate, exchange rate targeting is equivalent to interest rate targeting under which changes in money demand are accommodated by equivalent changes in money supply. Under either price or nominal income targeting, the money supply adjustments to maintain the respective target values in the presence of money demand shocks also stabilize aggregate demand without changes in the domestic interest rate and, therefore, the exchange rate. Thus, aggregate supply and price and output are undisturbed.

D. Aggregate Supply Shocks

In the presence of aggregate supply (u) shocks, there is no clear ranking of exchange rate versus nominal income targeting from the standpoint of output or price stabilization. Which is preferred depends on the response of aggregate demand to the shock, which in turn depends on the parameters of the model, in particular on whether $(a_1 + a_2) \gtrless 1$. Nominal income targeting imposes a unitary tradeoff between real output and the price level in the face of an aggregate supply shock; the slope of the aggregate demand curve is minus 1. For exchange rate targeting, the tradeoff between price and output is also determined by the slope of the aggregate demand curve, in this case minus $1/(a_1 + a_2)$. For $a_1 + a_2 > 1$, the aggregate demand curve is flatter for exchange rate targeting which is thus preferred to nominal income targeting for price stabilization but

inferior from the standpoint of output stabilization. The reverse follows for $a_1 + a_2 < 1$. From the standpoint of output stabilization both nominal income and exchange rate targeting are preferred to price level targeting. (Price level targeting is by definition optimal for price stabilization.)

E. Foreign Price Shocks

In what we have called the standard model ($a_2 = b_1 = 0$) foreign price shocks have no direct effect on aggregate demand or supply and therefore do not displace price or output under price or nominal income targeting. Foreign price shocks are one kind of exchange rate disturbance (e_t disturbances in equation (4a)). In contrast, under exchange rate targeting, foreign price shocks, because they displace the exchange rate, will trigger a response of the money supply which will have an impact on aggregate demand; price and output will be displaced. Consequently unless a high relative weight in the loss function is placed on exchange rate stability, exchange rate stabilization will be an inferior policy rule.

In the more general case ($b_1 > 0$, $a_2 > 0$), little can be said about the relative ranking of the three policy rules from the standpoint of either price or output stabilization. One definite ranking is that nominal income targeting is preferred to price targeting from the standpoint of output stabilization. Price level targeting is, of course, preferred to nominal income or exchange rate targeting from the standpoint of price stability.

A change in the foreign price level shifts both the aggregate supply and demand schedules. Under each of the three rules, this triggers a monetary policy response with further effects on aggregate demand and, except in the case of exchange rate targeting, on aggregate supply. The overall effects on price and output depend on the parameters of the model.[12]

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[12]In the presence of foreign price shocks, the case where the interest elasticity of aggregate demand is zero ($a_1 = 0$) is distinctive. In this case, both nominal income and price targeting completely stabilize price and output in the face of foreign price shocks, even if the terms of trade are included in the aggregate supply function ($b_1 > 0$). Here, the exchange rate can fully adjust to maintain the terms of trade ($p^f + x - p$), while the interest rate adjusts to maintain UIP, with no effect on aggregate demand. Exchange rate targeting does not provide such insulation.

F. A Comparison to Money Supply Targeting

A comparison of money supply targeting with other simple rules brings the coefficients of the money demand function into the picture. This complicates ranking money targeting relative to the other policy rules. One clear result can be seen from Tables 1-3; in the case of money demand shocks all the other simple rules are preferred to money supply targeting. In many countries, it is no doubt the view that money demand has become more unstable that has led to a de-emphasis of monetary aggregates.

It can also be seen from the tables, that the case for nominal income targeting relative to money supply targeting is very strong in the standard model which neglects the effect of the exchange rate on aggregate supply ($b_1 = 0$). In this case nominal income targeting completely insulates price and output from IS shocks, UIP shocks and foreign price shocks, while such shocks displace both price and output under money targeting. Unless the structural parameters are such that money targeting provides greater exchange rate stability and a large weight is placed on exchange rate stability, nominal income dominates money supply targeting in the presence of these shocks.

In our open economy model ($b_1 > 0$), IS, UIP and foreign price shocks displace price and output under both money supply targeting and nominal income targeting. For these shocks as well as aggregate supply shocks, which strategy is preferred depends on the values of the structural parameters, as well as variances of the shocks.[13,14]

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[13]From Table 1 it can also be seen that taking account of the effect of the exchange rate on aggregate supply weakens the case for price level targeting relative to money targeting from the standpoint of output stabilization. The reasons for this parallel those for the comparison of nominal income and money targeting.

[14]Two special cases of parameter values produce interesting comparisons between money supply targeting and alternative simple rules. If the (semi) interest elasticity of money demand is extremely large ($\gamma_2 \rightarrow \infty$), money supply targeting converges to interest rate targeting and, therefore, to exchange rate targeting for all shocks except those to UIP or r^f. Alternatively, if the interest elasticity of money demand is close to zero ($\gamma_2 \rightarrow 0$) and the income elasticity approaches one ($\gamma_1 = 1$), money supply targeting converges to nominal income targeting, except in the case of money demand shocks. If the former condition held while the latter did not, the relative merits of nominal income versus money supply targeting for a number of shocks would depend on the relative weights placed on output versus price stabilization and on whether γ_1 was greater or less than one, the value of γ_1 influencing the slope and displacement of the aggregate demand schedule in the presence of shocks.

G. Alternative Loss Functions

The loss function (1.a), which we have taken from Frankel and Chinn (1995) is typical in the literature on the time inconsistency problem and consequent role for simple policy rules. With the type of model considered here, however, other studies have employed alternative loss functions. In particular, given the inclusion of the terms of trade and/or a domestic supply shock, studies such as Aizenman and Frenkel (1985) and Benavie and Froyen (1991) consider a loss function where the target level of output is not constant.[15] One alternative loss function focuses on the goal of minimizing the variance of output around full-information output $(\hat{y})$.

(10) $L = (y - \hat{y})^2$

This formulation has a clear basis in utility maximization because minimizing (10) minimizes the welfare loss from nonoptimal levels of output and employment (see Aizenman and Frenkel (1985)).[16] In our model, full-information output is derived under the assumption that the labor market clears, while actual output is derived on the basis of the fixed contract wage. Full-information output responds to changes in the terms of trade and supply shocks in a way that allows the wage to respond to current period shocks.

The gap between actual and full-information output can be expressed (omitting time subscripts and constants) as

(11) $y - \hat{y} = b_2\ \beta_1\ p + b_2\ \beta_2\ (p^f + x) + b_2\ \beta_3\ u$

where the β_i's are coefficients from the market-clearing wage

(12) $w = \beta_1\ p + \beta_2\ (p^f + x) + \beta_3\ u$

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[15]The loss function (1.a) could still be justified by the assumption that the policymaker desires to hold output fixed to avoid adjustment costs in the face of *temporary* shocks to productivity or the terms of trade.

[16]Within this particular utility maximization framework, the additional goals of exchange rate and price level stabilization play no role, so they are left out of equation (10).

By substituting solutions for p and x (along with p^f or u if relevant) into (11), we evaluate (10) under each of our simple policy rules. It is again difficult to rank the different rules for almost all shocks.[17]

A second alternative loss function simply adjusts the output goal for changes in the terms of trade. In this case shocks (other than domestic supply shocks), displace output from the desired level only via a price level *surprise*. This produces another set of comparisons among the simple rules which certainly do not show a dominance for nominal income targeting. The most striking result in such comparisons is that, because there are no price surprises with price targeting, under this rule only supply (u_t) shocks displace price and output. Other shocks, of course, displace the exchange rate.

V. Using Econometric Evidence to Rank the Policy Rules

The previous section summarized the responses of the endogenous variables in the policymaker's loss function to shocks of the model. The attempt to rank the policy rules in terms of their ability to stabilize real output, the price level, and the exchange rate for the most part yielded inconclusive results. The focus of this section is therefore on determining circumstances in which policies can be ranked using estimated values of key parameters of the model. In this exercise we employ the loss function (1.a) which is taken from Frankel and Chinn (1995). As noted in the previous section, this has been the typical loss function in the literature on ranking simple rules and can be justified on grounds that policymakers wish to avoid the output adjustment costs due to temporary shocks to the terms of trade or domestic productivity.

The expected value of the loss function under each policy rule appears in Table 4. Row entries give the coefficient on the variances of the exogenous disturbances which appear in the expected loss function. It is obvious that a clear ranking of the different policy rules will not emerge unless we introduce a simplifying

[17] An exception is the money demand shock. In that case because nominal income, exchange rate, and price targeting all stabilize p and x, these rules stabilize y around $\hat{y}$; money supply targeting does not.

assumption regarding the weights attached to the final objectives of the policymaker and obtain information on the size of the parameters of the model.

To facilitate a comparison of the different monetary policy rules, we first, attach equal weights to the variables entering the loss function and, second, we draw on empirical estimates of the relevant parameters.[18] Table 5 lists a number of studies which have reported estimates of the elasticities of the demand for output with respect to the real rate of interest and the real exchange rate for various countries.[19, 20]

Comparing the size of the coefficients of the variances in the expected loss function necessitates having estimates of both $b_1$and b_2. We are not aware of any reliable empirical estimates of b_1 and b_2 for small open economies.[21] To get around this problem, we carry out an exercise which produces numerical estimates of the size of the coefficient on the variance of the disturbances under each policy rule. A pairwise comparison of monetary policy strategies is then carried out based on these estimates. The comparison entails first picking values for the demand elasticities (a_1 and a_2) and for b_1.[22] Then we choose b_2 so as to make the coefficient on the variance of a given shock equal under the two strategies of monetary policy. Proceeding in this way traces out a policy frontier along which the two policy rules are equally preferred. The policy frontier divides up the space of admissible parameter values into separate regions where one monetary policy strategy dominates the other.

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[18]As an alternative to bring out the role that the goal of exchange rate stabilization plays, at a later point we consider the case where B = 0; no weight is placed on the exchange rate.

[19]Ghosh and Masson also report parameter estimates for γ_1 and γ_2.

[20]In comparisons of different monetary policy regimes based on model simulation, Henderson and McKibbin (1993) impose values of $a_1 = a_2 = .2$. Buiter and Miller (1983) choose .5 for both parameters.

[21]Either the reported parameter estimates are extremely sensitive to the method of computation (as are those in the appendix to Frankel and Chinn) or they are for the United States only.

[22]The parameter estimates in Table 5 provide starting values for a_1 and a_2. Informed guesses guide the choice of b_1. Comparisons involving a fixed money rule also require parameter values for γ_1 and γ_2.

A. Exchange Rate vs Nominal Income Targeting

Figures 1-4 illustrate the performance of exchange rate targeting relative to nominal income targeting for a range of values of the relevant parameter estimates.[23] Figure 1 traces out the policy frontier for IS disturbances. If the empirical estimates of a_1 and a_2 in Table 5 are representative of the response of the demand for output to changes in the real rate of interest and the real exchange rate, then exchange rate targeting dominates nominal income targeting in the face of IS shocks (region A). The latter is preferred only if both the sum of the demand elasticities is significantly greater than one and b_2 is approximately greater than two (region B). Notice though that the superiority of exchange rate targeting declines as the size of b_1 decreases. A less pronounced response of output supplied to changes in the real exchange rate forces the policy frontier to shift towards the origin.

Figure 2 delineates the regions where nominal income targeting and exchange rate targeting are the appropriate strategies of monetary policy for aggregate supply disturbances (AS). Each policy rule dominates the other in two regions. For $a_1 + a_2 < 1$ and $b_1=1$ nominal income targeting is preferred to exchange rate targeting provided that b_2 does not exceed two (region C). Nominal income targeting is also superior to exchange rate targeting in case $a_1 + a_2 > 1$ as long as b_2 is greater than two (region D). The policymaker is indifferent between following a nominal income targeting rule and an exchange rate targeting rule if $a_1 + a_2 = 1$ irrespective of the size of b_2. The policy frontier shifts inward toward the vertical axis as b_1 becomes smaller, thus lessening the attractiveness of nominal income targeting if $a_1 + a_2 < 1$.

Figure 3 depicts the policy frontier for foreign price disturbances (FP). Unlike in the previous two cases, the size of a_1 relative to a_2 matters in determining the policymaker's choice of policy rule. As three of the four studies listed in Table 4 put the elasticity of the demand for output with respect to the real exchange rate at or close to .2, we base our calculation of the policy frontier on $a_2 = .2$. Nominal income targeting is

[23]Recall that both exchange rate and nominal income targeting completely offset money demand shocks. Hence only four policy frontiers need to be considered.

preferred only for certain combinations of b_2 and a_1. Specifically, low values of b_2 must be matched by values of a_1 which remain well below 1.5 (region C). Nominal income targeting is also superior to exchange rate targeting for relatively high values of a_1 (exceeding approximately 1.3) and b_2 (exceeding approximately 1.5) (region D). As b_1 decreases in size, the policy frontier shifts up and to the left, making nominal income targeting somewhat less attractive relative to exchange rate targeting for values of a_1 similar in size to those reported in Table 5.

The shape of the frontier for UIP shocks, shown in Figure 4, is similar to the frontier for IS disturbances. However, compared to the case of IS disturbances, nominal income targeting is less likely to dominate exchange rate targeting if UIP shocks constitute an important source of disturbances. For nominal income targeting to be the preferred strategy, either a_1 must be very large or, for values of a_1 around one or less, b_2 must be inordinately large (region B). Changes in b_1 have only a negligible effect on the position of the policy frontier.

In summary, the choice of the preferred strategy for monetary policy is more complicated for AS and FP disturbances compared to IS and UIP disturbances. Ultimately, the choice between exchange rate targeting and nominal income targeting in the face of stochastic disturbances hinges on a set of parameter values. None of the studies listed in Table 5 puts the sum of the estimates of a_1 and a_2 above one. Three of the four studies find $a_1 + a_2$ to be less than .75. For these parameter estimates, an exchange rate targeting regime is the preferred choice in economies subject to frequent IS and UIP disturbances. Interestingly, supply side parameters are of relatively minor importance if only IS and UIP shocks matter. The size of b_1 and b_2, however, play a much more important role alongside the demand for output elasticities, in case the economy is buffeted by AS disturbances and FP disturbances. Then we find exchange rate targeting is more likely to be superior to nominal income targeting for smaller values of b_1 but larger values of b_2.

B. Money Stock vs Nominal Income Targeting

Within a closed economy framework, the attractiveness of nominal income targeting relative to money stock targeting is attributable to its ability to shield the economy from the effects of aggregate demand disturbances.[24] In an open economy, a strategy of nominal income targeting no longer sustains this insulating property. As shown in Section IV, in the open economy disturbances arising in the goods market affect output and the price level by altering the real exchange rate. Changes in the real exchange rate in turn directly affect the supply side of the economy through their effect on the price of imported inputs. Although nominal income targeting no longer perfectly stabilizes real output and the price level in the face of IS disturbances it maintains its superiority over money stock targeting in the face of money demand shocks.

The reduced attractiveness of nominal income targeting in an open economy prompts us to reexamine the performance of a nominal income rule relative to a fixed money rule. Our approach is largely the same as in part A of this section except that coefficient estimates of the parameters appearing in the money demand function now enter the discussion. Ghosh and Masson (1991) estimate the income elasticity of money demand to be .7 and the semi-elasticity of money demand with respect to the interest rate (measured as percent per year) to be 1.077. Both estimates are used in constructing the policy frontiers.

Comparing the coefficients of the variance of IS disturbances in the loss functions under the two rules reveals that a fixed money target is preferred to a nominal income target for all plausible values of $a_1 + a_2$ and b_2.[25] For aggregate supply disturbances, the policy frontier is depicted in Figure 5. In shape it is similar to the frontier produced by the comparison of exchange rate targeting with nominal income targeting. It is upward

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[24]Previous comparisons of money stock targeting with nominal income targeting (Bean (1983), West (1986), Asako and Wagner (1992)) emphasize this insulating property of a nominal income rule. Bean and West also clearly identify the conditions under which one strategy of monetary policy unambiguously dominates the other. Asako and Wagner take issue with these results by pointing out that in addition to the source of disturbances, information on their persistence and the information advantage enjoyed by the monetary authorities play an important role in determining the superiority of nominal income targeting over money stock targeting.

[25]Nominal income targeting becomes equally effective relative to money stock targeting only for inordinately large values of b_2 and $a_1 + a_2$. For instance, equality between the two strategies prevails if $b_2 = 64$ for $a_1 + a_2 = 1.9$. Lower values of $a_1 + a_2$ would necessitate even larger values of b_2.

sloping up to a certain critical value for b_2 beyond which it becomes backward bending. Again there is one critical value for $a_1 + a_2$, .7821, at which the two policy strategies are equally preferred regardless of the size of b_1 or b_2.[26] There are two regions where one rule dominates the other. For b_1 =1 money supply targeting dominates nominal income targeting for very low values of b_2 and fairly low values of $a_1 + a_2$ (region A). Money supply targeting is also preferred if $a_1 + a_2$ exceeds .7821 and b_2 remains of modest size (region B). Nominal income targeting clearly dominates money stock targeting once $a_1 + a_2$ exceeds the critical value of .7821 and b_2 is sufficiently large (region C). Nominal income targeting is also preferred to money stock targeting in the wedge-shaped area for combinations of low and steadily increasing values of b_2 provided that $a_1 + a_2 < .7821$ (region D). A decrease in the size of b_1 shifts the frontier inward toward the vertical axis, making money stock targeting more attractive for $a_1 + a_2 < .7821$.

Money stock targeting dominates nominal income targeting for a wide range of values of a_1 and b_2 in the presence of foreign price disturbances. As shown in Figure 6, money stock targeting is preferred for $b_2 > 1$ provided that a_1 is not unusually large (region A). For $b_2 < 1$ money stock targeting is superior as long as the demand for output is sufficiently interest-elastic (region B). More generally, we find that the shape of the policy frontier resembles the one produced by the comparison of exchange rate with nominal income targeting. Again we find that nominal income targeting appears to dominate the alternative strategy for rather low or relatively large values of the parameters (regions C and D).

It is easier to make a policy prescription in case of UIP shocks. According to Figure 7, the policymaker is advised to opt for nominal income targeting given reasonable values of a_1 and b_2 (region B). It is of interest to note the difference in shape of the policy frontiers which emerges from the two comparisons. While the policy frontier produced by the exchange rate vs nominal income targeting comparison is downward sloping the policy frontier produced by the money stock vs nominal income targeting comparison is upward

[26]This value changes as the elasticities in the money demand function change.

sloping. Notice further that for UIP shocks the area where nominal income is preferred to exchange rate targeting lies above the frontier while the area where nominal income targeting is preferred to money stock targeting lies below the frontier.

Taken altogether, we find that money stock targeting is a viable alternative to nominal income targeting in view of the parameter estimates of Table 5. The case for money stock targeting is strongest if the economy is subject to IS disturbances. Given that the majority of the empirical studies mentioned above put the sum of the elasticities of the demand for output below .75 it is also likely that money stock targeting is preferred to nominal income targeting in the case of AS and FP disturbances barring exceedingly small values of b_2. The case for nominal income targeting is strongest if money demand is highly unstable. In addition a nominal income targeting strategy most likely offers better protection against UIP disturbances.

C. Price Level vs Nominal Income Targeting

In the standard model a strict price level rule and a nominal income targeting rule prove equally effective in shielding the economy from demand-side disturbances. In the small open economy model, in contrast, the performance of a price level rule relative to a nominal income rule depends primarily on the origin of the disturbances. Again drawing on the parameter estimates listed in Table 5, we find that a price level rule dominates a nominal income rule for IS disturbances and UIP disturbances. In both cases the dominance of a price level rule is underscored by the absence of a policy frontier along which the monetary policy strategies are equally preferred.[27] A quite different pattern emerges from the comparison of the two rules for foreign price and aggregate supply shocks. As illustrated in Figures 8 and 9, a nominal income targeting rule is very likely

[27]For UIP shocks, if $a_1 = 0$, both strategies yield the same results. We consider only values of $a_1 > .01$. Just as in the previous comparisons $a_2 = .2$. Larger values for a_2 would make price level targeting less attractive. However, it remains superior to nominal income targeting.

to dominate a price level rule in both cases. The latter is preferred only for combinations of large values of a_1+a_2 (a_1 for foreign price shocks) and very low values of b_2.[28]

VI. Conclusion

In the model of a small open economy analyzed here, none of the simple policy rules we consider dominates the others. Frankel and Chinn's (1995) conclusion concerning the dominance of nominal income targeting, for example, does not carry over to a more realistic framework for small open economies. Even narrowing the analysis to individual shocks leads to few definite rankings among policy rules. In the presence of *IS* shocks, for example, in a model such as that of Frankel and Chinn (1995), the perfect stabilization of aggregate price and output leads to a presumptive preference for nominal income targeting. Within our model, the advantage of nominal income targeting from the standpoint of price and output stabilization—an advantage that persists for most relevant parameter values—might likely be superseded by the costs of the large displacement of the exchange rate made necessary by adherence to this rule.

Section V, which makes use of estimates of relevant structural parameters for small open economies, supports the conclusion that which policy rule is preferred depends on the sources of uncertainty facing the policymaker as well as the values of these parameters--a ubiquitous result in the earlier literature, going back to Poole (1970), on optimal monetary policy in the presence of uncertainty.

From the standpoint of the choice among simple rules, this result suggests a tradeoff, somewhat different than that examined in previous literature, between optimal stabilization and the anti-inflation

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[28]As noted in footnote 18, to highlight the role that the goal of exchange rate stabilization plays in our analysis, policy frontiers have also been constructed for the case where in the loss function B = 0; no weight is placed on exchange rate stability. Policy frontiers for this case, corresponding to those in Figures 1-9, are presented in an appendix to the paper (available from the authors on request).

To summarize the implications of making this alternative assumption, if the policymaker attaches no weight to exchange rate deviations: nominal income targeting becomes more attractive relative to exchange rate targeting as a monetary policy strategy; the performance of nominal income targeting relative to price level or money supply targeting also improves in the presence of IS and UIP disturbances.

credibility gained by ironclad adherence to a rule. The credibility goal may be best achieved by a New Zealand type commitment--in that case to inflation targeting. If stabilization properties of a rule are highly state contingent, however, such a commitment is not without potential costs. Also, the dependence of the optimal choice of a rule (or frame-work) on the values of model parameters suggests the need for empirical research. Existing parameter estimates differ both across countries and for some parameters across studies of the same country complicating the choice of an optimal monetary policy strategy.

TABLE 1
COEFFICIENTS FOR THE OUTPUT EQUATION

	Exchange Rate Target $\lambda_1 \to \infty$	Nominal Income Target $\lambda_2 \to \infty$	Price Level Target $\lambda_3 \to \infty$	Money Supply Target $\lambda_1 = 0$
IS-Shock (v_{1t})	$\frac{b_1 + b_2}{b_1 + b_2 + a_1 + a_2}$	$\frac{b_1}{(a_1 + a_2) b_2 + b_1 + a_1 + a_2}$	$\frac{b_1}{b_1 + a_1 + a_2}$	$\frac{(b_1 + b_2) \gamma_2 + b_1}{[(a_1 + a_2) \gamma_1 + \gamma_2] b_2 + (b_1 + a_1 + a_2)(1 + \gamma_2)}$
LM-Shock (v_{2t})	0	0	0	$\frac{-b_2 (a_1 + a_2)}{[(a_1 + a_2) \gamma_1 + \gamma_2] b_2 + (b_1 + a_1 + a_2)(1 + \gamma_2)}$
AS-Shock (u_t)	$\frac{(a_1 + a_2)}{b_1 + b_2 + a_1 + a_2}$	$\frac{(a_1 + a_2)}{(a_1 + a_2) b_2 + b_1 + a_1 + a_2}$	$\frac{(a_1 + a_2)}{b_1 + a_1 + a_2}$	$\frac{(a_1 + a_2)(1 + \gamma_2)}{[(a_1 + a_2) \gamma_1 + \gamma_2] b_2 + (b_1 + a_1 + a_2)(1 + \gamma_2)}$
UIP-Shock (ϵ_t) or r^f Shock	$\frac{-a_1 (b_1 + b_2)}{b_1 + b_2 + a_1 + a_2}$	$\frac{-a_1 b_1}{(a_1 + a_2) b_2 + b_1 + a_1 + a_2}$	$\frac{-a_1 b_1}{b_1 + a_1 + a_2}$	$\frac{\gamma_2 (a_2 b_2 - a_1 b_1) - a_1 b_1}{[(a_1 + a_2) \gamma_1 + \gamma_2] b_2 + (b_1 + a_1 + a_2)(1 + \gamma_2)}$
Foreign Price Shock (p_t^f)	$\frac{a_2 b_2 - a_1 b_1}{b_1 + b_2 + a_1 + a_2}$	$\frac{-a_1 b_1}{(a_1 + a_2) b_2 + b_1 + a_1 + a_2}$	$\frac{-a_1 b_1}{b_1 + a_1 + a_2}$	$\frac{\gamma_2 (a_2 b_2 - a_1 b_1) - a_1 b_1}{[(a_1 + a_2) \gamma_1 + \gamma_2] b_2 + (b_1 + a_1 + a_2)(1 + \gamma_2)}$

TABLE 2
COEFFICIENTS FOR THE PRICE EQUATION

	Exchange Rate Target $\lambda_1 \to \infty$	Nominal Income Target $\lambda_2 \to \infty$	Price Level Target $\lambda_3 \to \infty$	Money Supply Target $\lambda_1 = 0$
IS-Shock (v_{1t})	$\frac{1}{b_1 + b_2 + a_1 + a_2}$	$\frac{-b_1}{(a_1 + a_2)\, b_2 + (b_1 + a_1 + a_2)}$	0	$\frac{\gamma_2 - b_1 \gamma_1}{[(a_1 + a_2)\, \gamma_1 + \gamma_2]\, b_2 + (b_1 + a_1 + a_2)(\gamma_2 + 1)}$
LM-Shock (v_{2t})	0	0	0	$\frac{-(b_1 + a_1 + a_2)}{[(a_1 + a_2)\, \gamma_1 + \gamma_2]\, b_2 + (b_1 + a_1 + a_2)(\gamma_2 + 1)}$
AS-Shock (u_t)	$\frac{-1}{b_1 + b_2 + a_1 + a_2}$	$\frac{-(a_1 + a_2)\, 1}{(a_1 + a_2)\, b_2 + (b_1 + a_1 + a_2)}$	0	$\frac{-[(a_1 + a_2)\, \gamma_1 + \gamma_2]\, 1}{[(a_1 + a_2)\, \gamma_1 + \gamma_2]\, b_2 + (b_1 + a_1 + a_2)(\gamma_2 + 1)}$
UIP-Shock (ϵ_t) or r^f Shock	$\frac{-a_1}{b_1 + b_2 + a_1 + a_2}$	$\frac{a_1 b_1}{(a_1 + a_2)\, b_2 + (b_1 + a_1 + a_2)}$	0	$\frac{(b_1 + a_2)\, \gamma_2 + a_1 b_1 \gamma_1}{[(a_1 + a_2)\, \gamma_1 + \gamma_2]\, b_2 + (b_1 + a_1 + a_2)(\gamma_2 + 1)}$
Foreign Price Shock (p_t^f)	$\frac{b_1 + a_2}{b_1 + b_2 + a_1 + a_2}$	$\frac{a_1 b_1}{(a_1 + a_2)\, b_2 + (b_1 + a_1 + a_2)}$	0	$\frac{(b_1 + a_2)\, \gamma_2 + a_1 b_1 \gamma_1}{[(a_1 + a_2)\, \gamma_1 + \gamma_2]\, b_2 + (b_1 + a_1 + a_2)(\gamma_2 + 1)}$

TABLE 3

COEFFICIENTS FOR THE EXCHANGE RATE EQUATION

	Exchange Rate Target $\lambda_1 \to \infty$	Nominal Income Target $\lambda_2 \to \infty$	Price Level Target $\lambda_3 \to \infty$	Money Supply Target $\lambda_i = 0$
IS-Shock (v_{1t})	0	$\frac{-(1 + b_1 + b_2)}{b_1 + (a_1 + a_2)(1 + b_2)}$	$\frac{-1}{b_1 + a_1 + a_2}$	$\frac{-[1 + \gamma_1 (b_1 + b_2)]}{(b_1 + a_1 + a_2)(1 + \gamma_2) + [\gamma_2 + (a_1 + a_2)\gamma_1] b_2}$
LM-Shock (v_{2t})	0	0	0	$\frac{-(a_1 + a_2 + b_1 + b_2)}{(b_1 + a_1 + a_2)(1 + \gamma_2) + [\gamma_2 + (a_1 + a_2)\gamma_1] b_2}$
AS-Shock (u_t)	0	$\frac{[1 - (a_1 + a_2)]}{b_1 + (a_1 + a_2)(1 + b_2)}$	$\frac{1}{b_1 + a_1 + a_2}$	$\frac{(1 - \gamma_1 (a_1 + a_2))}{(b_1 + a_1 + a_2)(1 + \gamma_2) + [\gamma_2 + (a_1 + a_2)\gamma_1] b_2}$
UIP-Shock (ϵ_t) or r^f Shock	0	$\frac{a_1 (1 + b_1 + b_2)}{b_1 + (a_1 + a_2)(1 + b_2)}$	$\frac{a_1}{b_1 + a_1 + a_2}$	$\frac{(a_1 + a_2 + b_1 + b_2)\gamma_2 + [1 + \gamma_1 (b_1 + b_2)] a_1}{(b_1 + a_1 + a_2)(1 + \gamma_2) + [\gamma_2 + (a_1 + a_2)\gamma_1] b_2}$
Foreign Price Shock (p_t^f)	0	$\frac{a_1 b_1 - a_2 b_2 - a_2 - b_1}{b_1 + (a_1 + a_2)(1 + b_2)}$	$\frac{-(a_2 + b_1)}{b_1 + a_1 + a_2}$	$\frac{\gamma_1 [a_1 b_1 - a_2 b_2] - b_1 - a_2}{(b_1 + a_1 + a_2)(1 + \gamma_2) + [\gamma_2 + (a_1 + a_2)\gamma_1] b_2}$

TABLE 4
THE COEFFICIENTS OF THE EXPECTED LOSS FUNCTIONS

	Nominal Income Targeting	Price Level Targeting:	Exchange Rate Targeting:	Money Supply Target:
IS	$\frac{(A+1)b_1^2+B(1+b_1+b_2)^2}{[b_1+(a_1+a_2)(1+b_2)]^2}$	$\frac{B[1]+b_1^2}{(b_1+a_1+a_2)^2}$	$\frac{A[1]+(b_1+b_2)^2}{(b_1+b_2+a_1+a_2)^2}$	$\frac{A[(\gamma_2-b_1\gamma_1)^2]+B[1+\gamma_1(b_1+b_2)]^2+[(b_1+b_2)\gamma_2+b_1]^2}{\{[(a_1+a_2)\gamma_1+\gamma_2]b_2+(b_1+a_1+a_2)(1+\gamma_2)\}^2}$
LM	0	0	0	$\frac{A[b_1+a_1+a_2]^2+B[a_1+a_2+b_1+b_2]^2+[b_2(a_1+a_2)]^2}{\{[(a_1+a_2)\gamma_1+\gamma_2]b_2+(b_1+a_1+a_2)(1+\gamma_2)\}^2}$
AS	$\frac{(A+1)[(a_1+a_2)^2]+B[1-(a_1+a_2)]^2}{[b_1+(a_1+a_2)(1+b_2)]^2}$	$\frac{[B[1]+(a_1+a_2)^2]}{(b_1+a_1+a_2)^2}$	$\frac{[A[1]+(a_1+a_2)^2]}{(b_1+b_2+a_1+a_2)^2}$	$\frac{\{A[(a_1+a_2)\gamma_1+\gamma_2]^2+B[1-\gamma_1(a_1+a_2)]^2+[(a_1+a_2)(1+\gamma_2)]^2\}}{\{[(a_1+a_2)\gamma_1+\gamma_2]b_2+(b_1+a_1+a_2)(1+\gamma_2)\}^2}$
UIP	$\frac{(A+1)[(a_1b_1)^2]+B[a_1^2(1+b_1+b_2)^2]}{[b_1+(a_1+a_2)(1+b_2)]^2}$	$\frac{B[a_1^2]+a_1^2b_1^2}{(b_1+a_1+a_2)^2}$	$\frac{A[a_1^2]+a_1^2(b_1+b_2)^2}{(b_1+b_2+a_1+a_2)^2}$	$\frac{A[(b_1+a_2)\gamma_2+a_1b_1\gamma_1]^2+B[(a_1+a_2+b_1+b_2)\gamma_2+(1+\gamma_1(b_1+b_2))a_1]^2+[\gamma_2(a_2b_2-a_1b_1)-a_1b_1]^2}{\{[(a_1+a_2)\gamma_1+\gamma_2]b_2+(b_1+a_1+a_2)(1+\gamma_2)\}^2}$
FP	$\frac{(A+1)[a_1b_1]^2+B[a_1b_1-a_2b_2-a_2-b_1]^2}{[b_1+(a_1+a_2)(1+b_2)]^2}$	$\frac{B[a_2+b_1]^2+a_1^2b_1^2}{(b_1+a_1+a_2)^2}$	$\frac{A[b_1+a_2]^2+(a_2b_2-a_1b_1)^2}{(b_1+b_2+a_1+a_2)^2}$	$\frac{A[(b_1+a_2)\gamma_2+a_1b_1\gamma_1]^2+B[\gamma_1(a_1b_1-a_2b_2)-b_1-a_2]^2+[\gamma_2(a_2b_2-a_1b_1)-a_1b_1]^2}{\{[(a_1+a_2)\gamma_1+\gamma_2]b_2+(b_1+a_1+a_2)(1+\gamma_2)\}^2}$

TABLE 5[a]

Author(s):	Country	a_1	a_2
Alexius (1993)	Sweden	0.5	0.2
Duguay (1994)	Canada	0.77	0.2
Ghosh & Masson[b] (1991)	Multimod Model (United States and Rest of the World)	0.378	0.167
Nadal-De Simone (1995)	New Zealand	0.03	0.52

[a]The coefficient on the real exchange rate (a_2) is an elasticity while that on the real interest rate is a semi-elasticity where the interest rate is measured in percent per year.

[b]The parameter estimates reported by Ghosh and Masson apply to the Rest of the World countries.

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FIGURE 1
POLICY FRONTIER: IS SHOCK

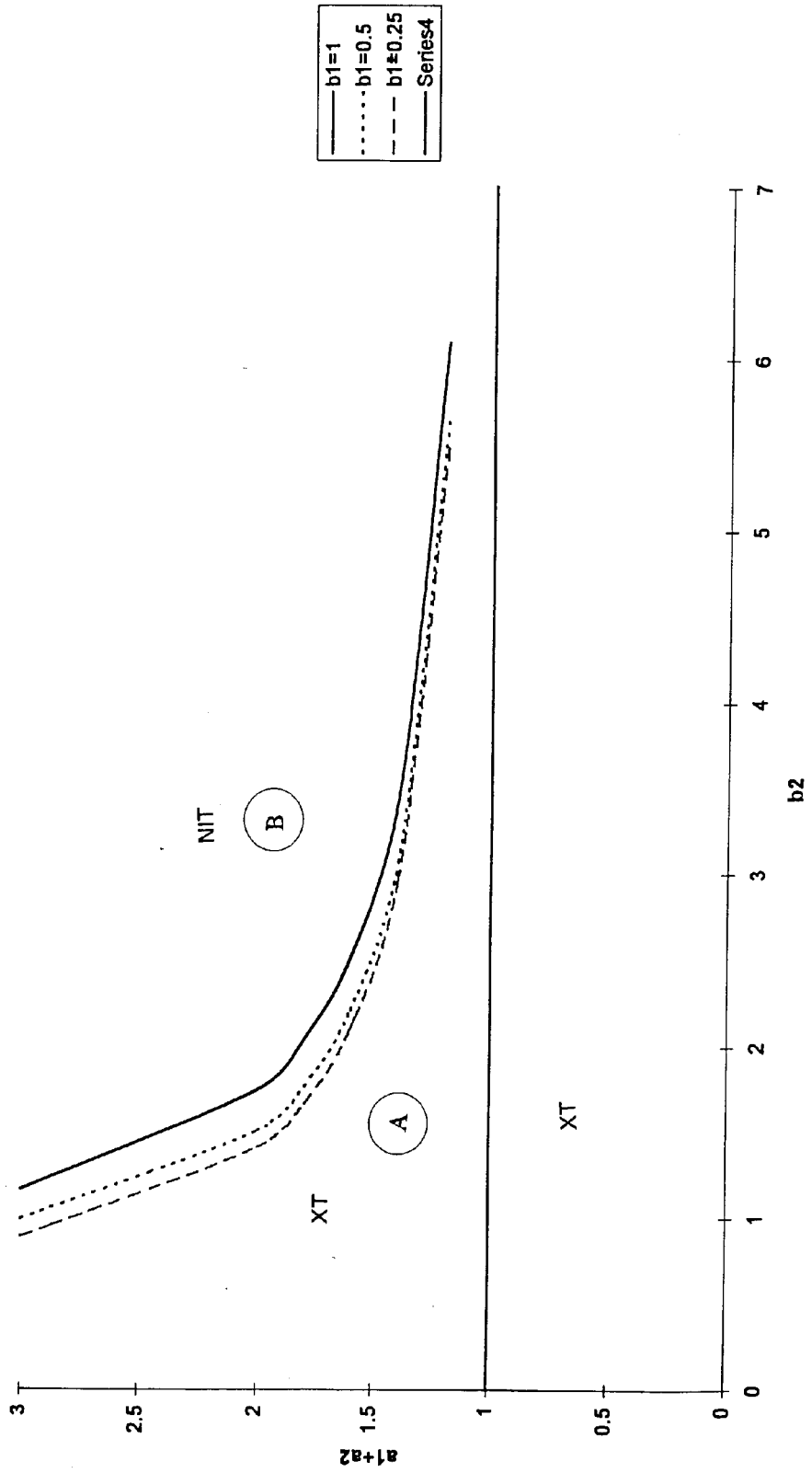

FIGURE 2
POLICY FRONTIER: AS-SHOCK

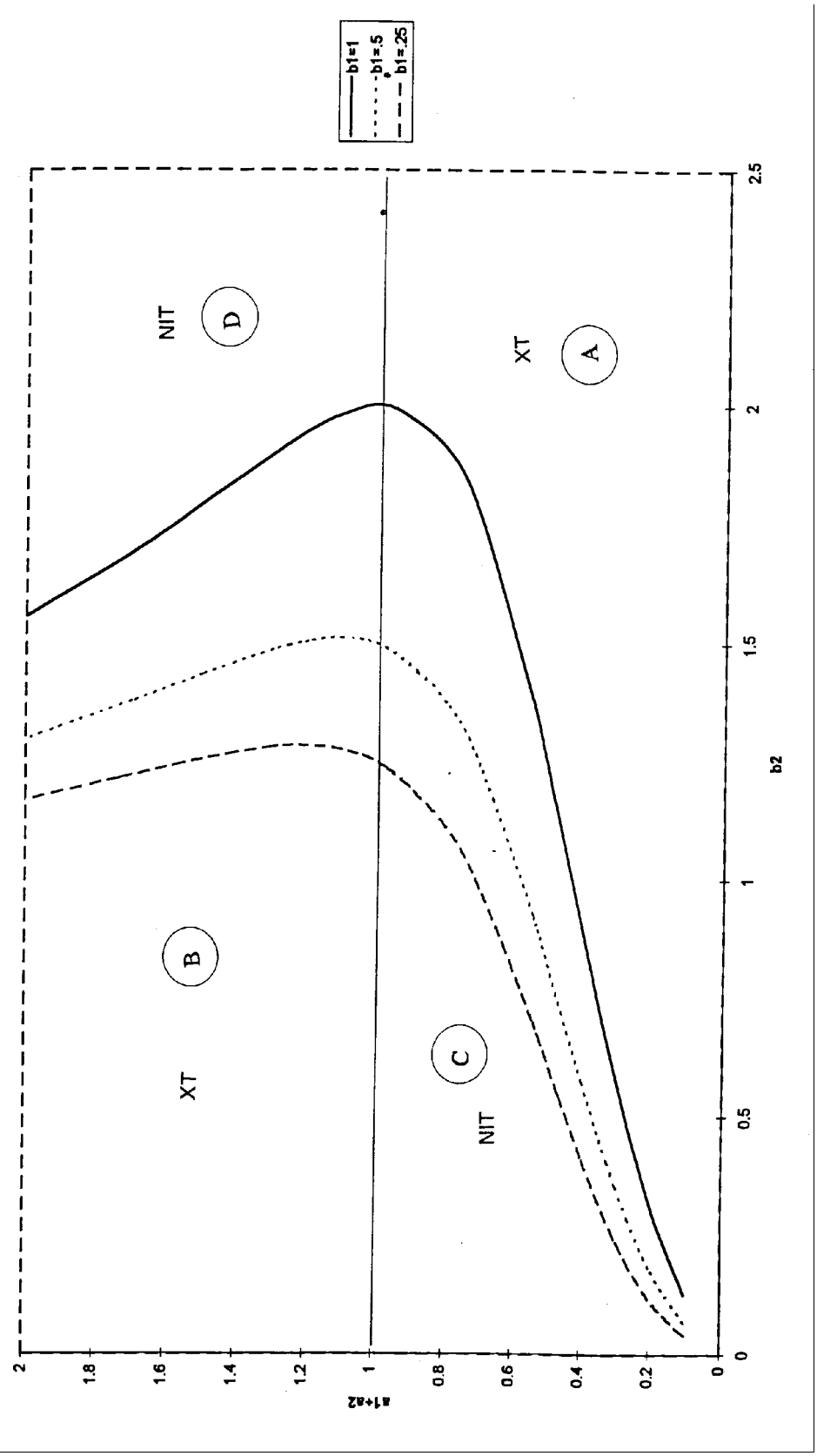

FIGURE 3
POLICY FRONTIER: FP SHOCK a_2 = .2

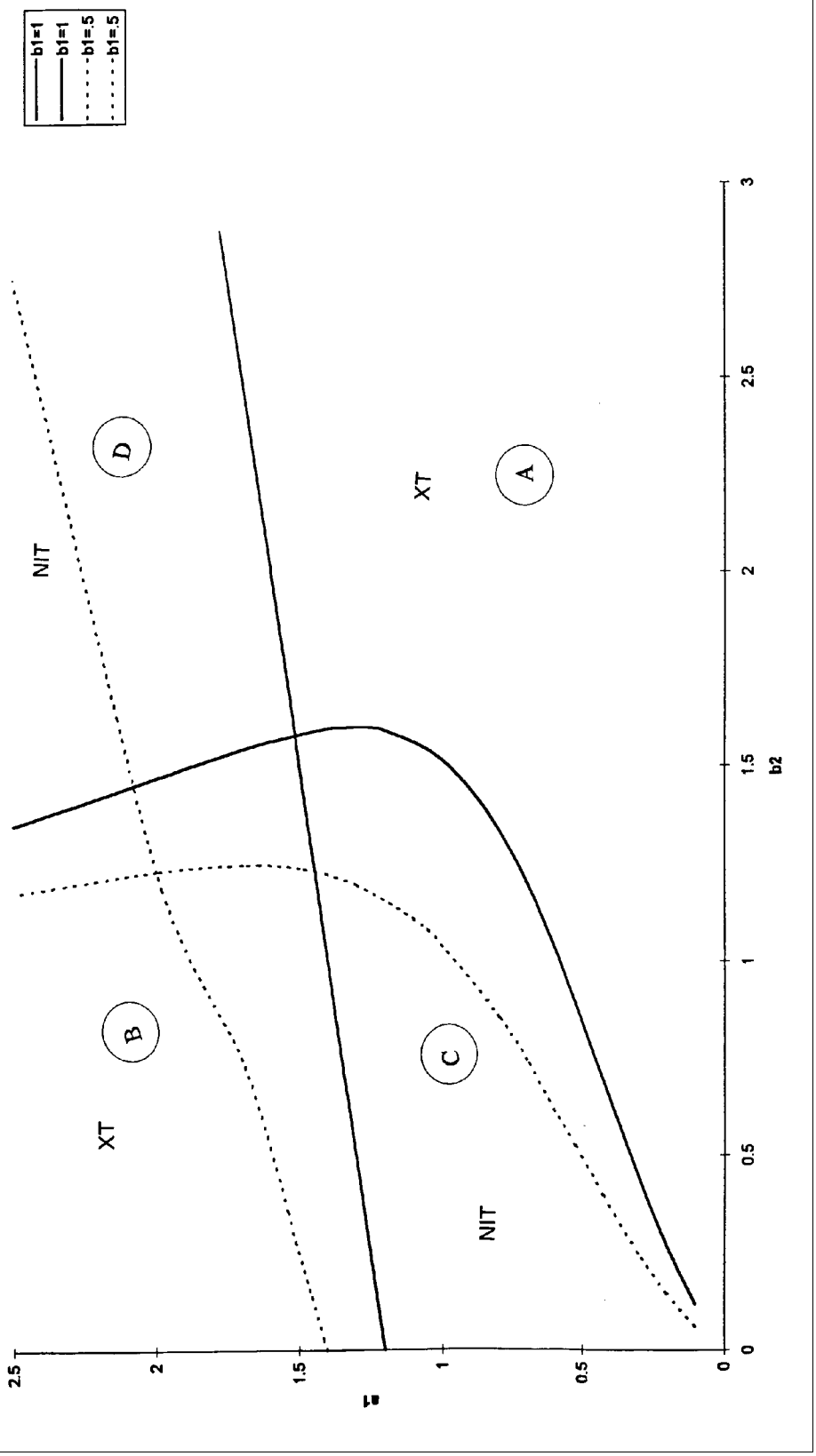

FIGURE 4
POLICY FRONTIER: UIP SHOCK a_2 = .2

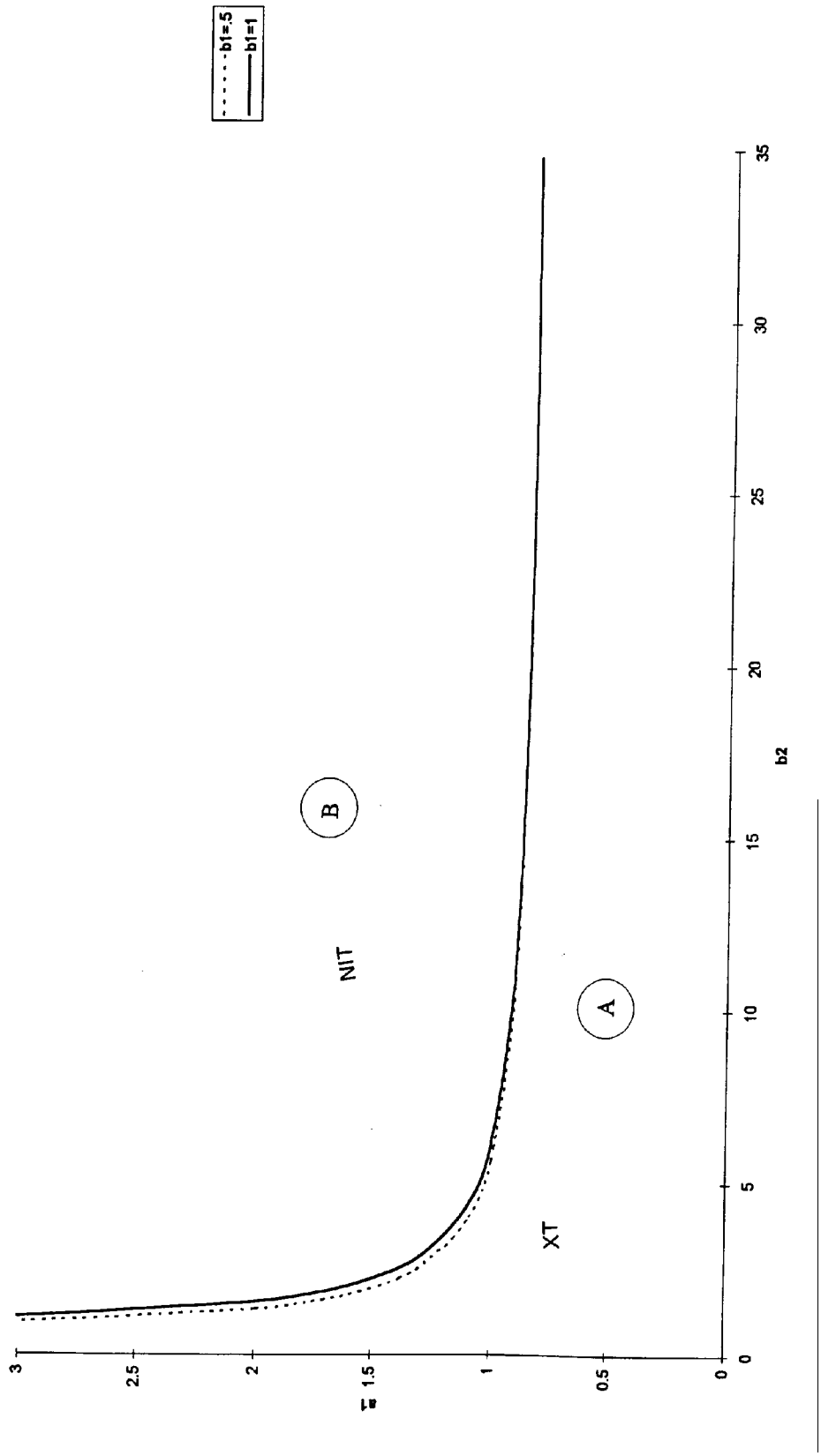

FIGURE 5
POLICY FRONTIER (MS/NIT): AS SHOCK

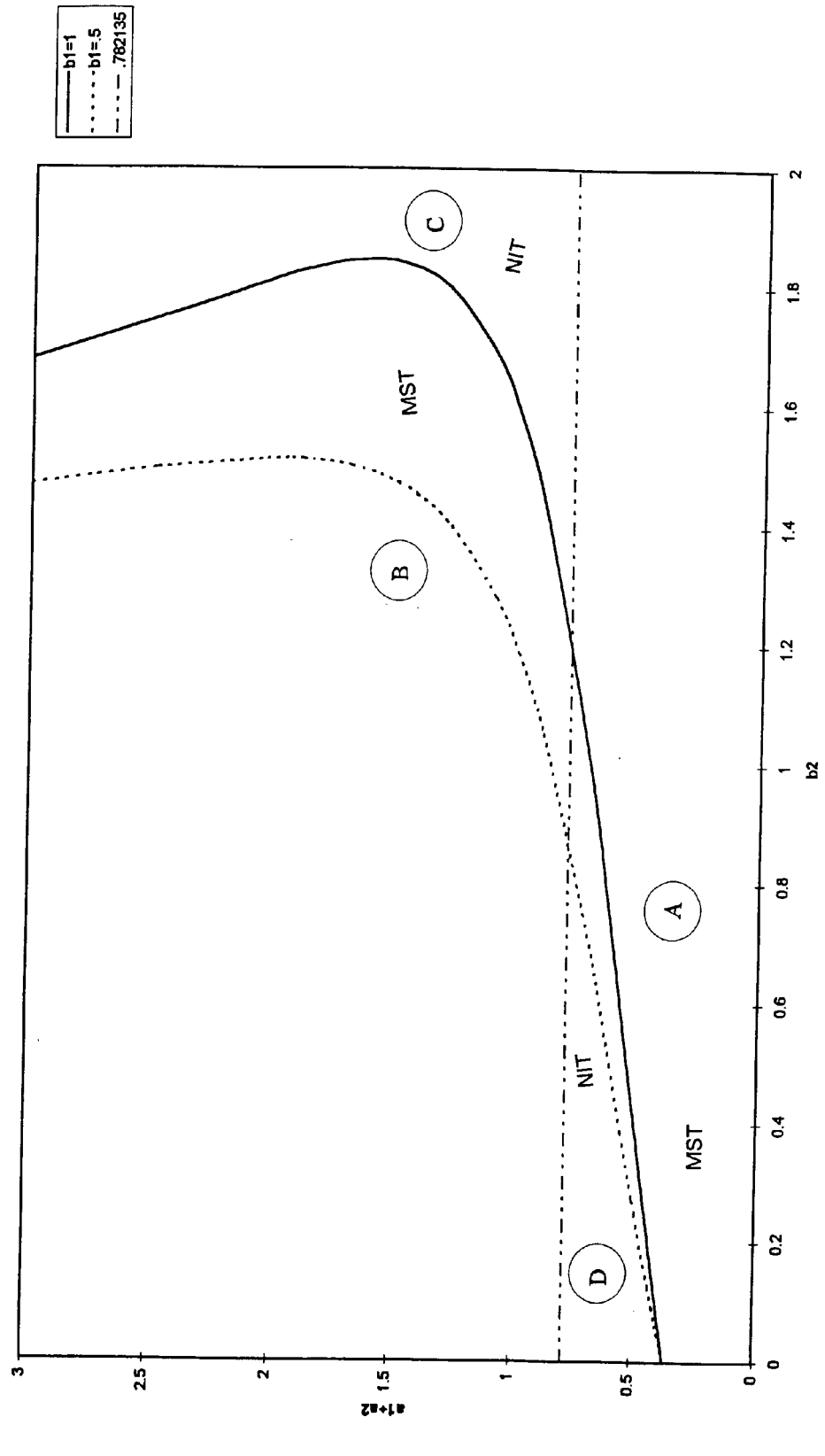

FIGURE 6
POLICY FRONTIER (MST/NIT): FP-SHOCK a_2 = .2

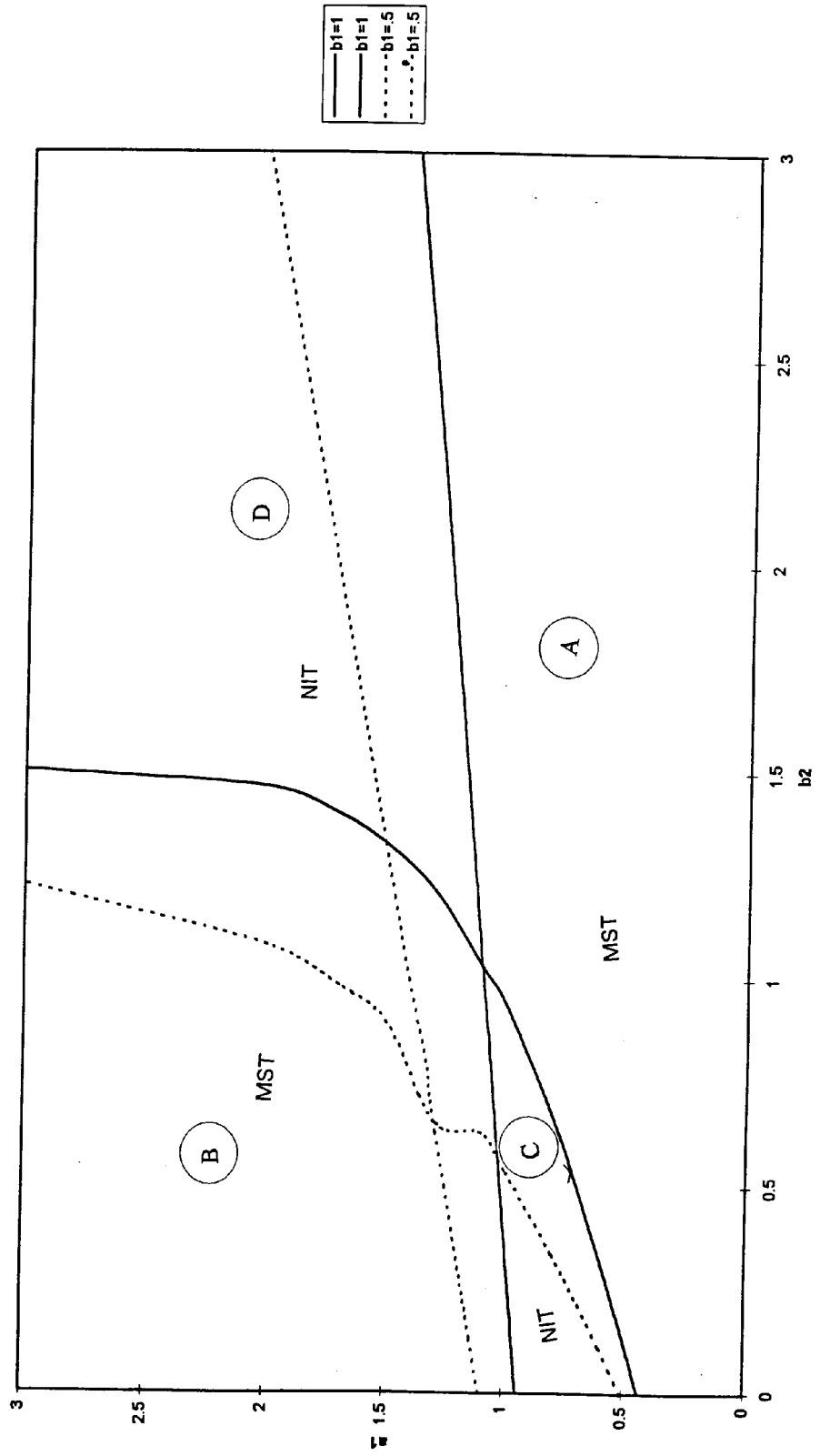

FIGURE 7
POLICY FRONTIER (MST/NIT) UIP SHOCK a_2 = .2

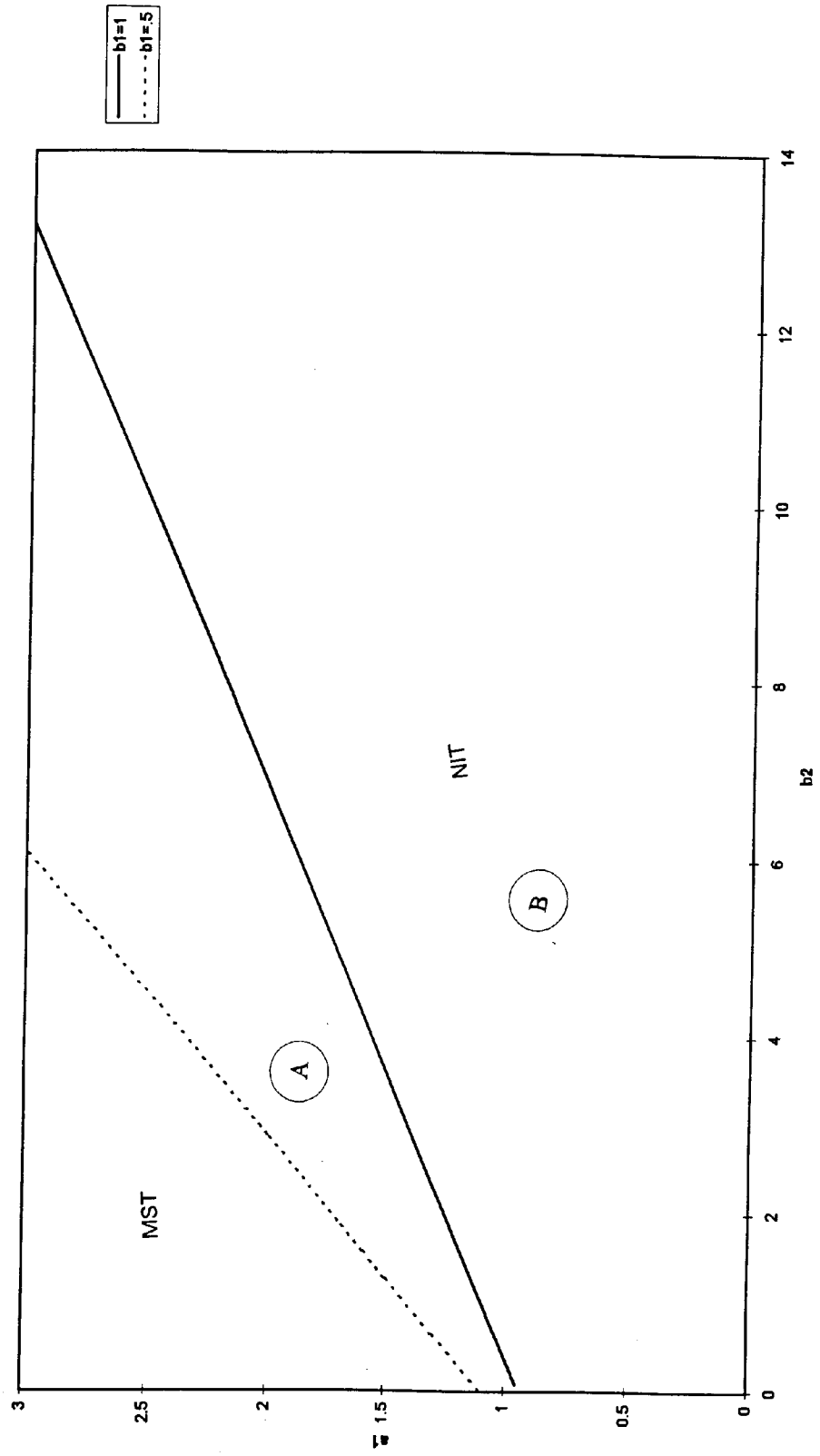

FIGURE 8
POLICY FRONTIER (PT/NIT): AS-SHOCK

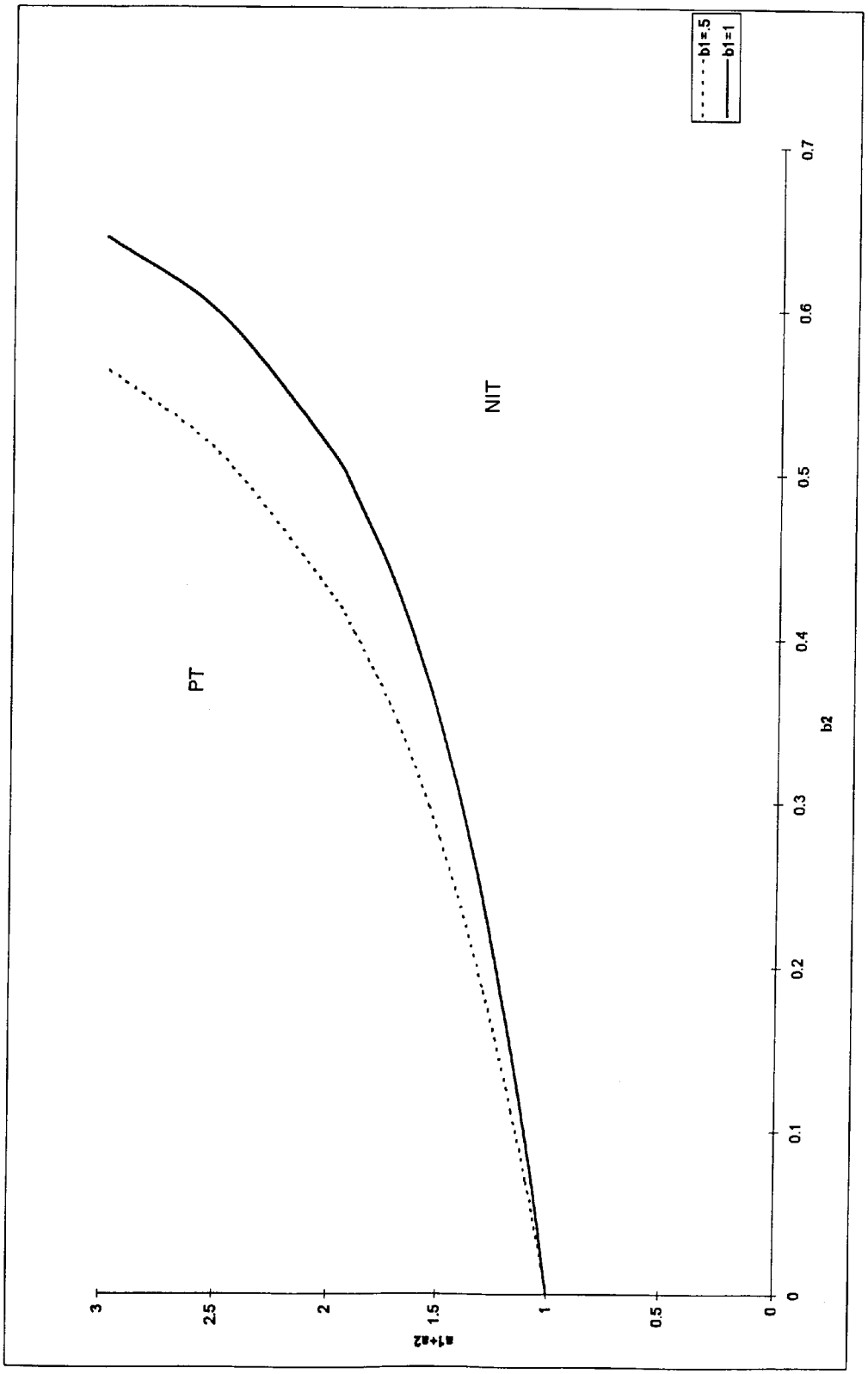

FIGURE 9
POLICY FRONTIER (PT/NIT): FP-SHOCK a_2 = .2