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A MODEST PROPOSAL FOR INTERNATIONAL NOMINAL TARGETING (INT)

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ABSTRACT

The paper reviews the obstacles to successful international macroeconomic policy coordination, and then offers a proposal for coordination that is designed to have the best chance of overcoming these obstacles: an international version of nominal GNP targeting. There are three sorts of obstacles to coordination: uncertainty, enforcement, and inflation-fighting credibility. Enforcement is always a problem for coordination, but the problem is particularly great in the presence of uncertainty. This is partly because it is difficult to verify compliance if the "performance criteria" are not directly enough under the control of the authorities, and partly because a country may end up regretting ex post the criterion that it agreed to ex ante if the criterion is not directly enough related to the target variables about which it ultimately cares. For example, a country that commits to a narrow range for the money supply may regret the commitment if a shift in velocity occurs.

The time-inconsistency of inflation-fighting has been offered as a third reason why policy-makers would be better off renouncing period-by-period coordination of discretionary policy-making. But the way to establish inflation-fighting credibility is to precommit to some nominal anchor. The paper argues that International Nominal Targeting (INT) is the best choice for nominal anchor, as well as the best choice for the performance criterion by which compliance with international agreements can be monitored. Nominal GNP (or, better yet, nominal demand) is superior to other candidates such as M1 as a candidate for the nominal variable on which policy-makers should focus, because it is far more robust to velocity shifts and other uncertainties.

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I. INTRODUCTION: PLANS FOR WORLD MONETARY REFORM SHOULD BE POLITICALLY PRACTICAL

Designing proposals for world monetary reform was in the 1960s a popular "parlor game" among economists. We have perhaps seen a revival of this sport in the 1980s.

The impetus behind such proposals is a serious one. Exchange rate volatility turned out to be higher than was anticipated before the move to floating exchange rates in 1973, and the swings have been particularly large in the 1980s, prompting proposals for government action to stabilize exchange rates. Among the (allegedly) promised fruits of floating exchange rates that have failed to materialize is insulation of each country's economy from disturbances originating among its partners. This insulation property was supposed to allow countries to set their policies independently. Meanwhile, the need to correct the large macroeconomic imbalances that arose in the 1980s, without setting off a world recession, has reinforced support for the idea that interdependence may be inevitable, and that countries should set their policies cooperatively rather than independently. Proposals for coordination draw support from a burgeoning academic literature that, until recently, was almost unanimous in claiming that each country's economic welfare was necessarily higher under a regime of coordination than under a non-cooperative (Nash) regime in which countries set their policies independently.[1]

Plans for full-fledged coordination, in the sense of cooperative maximization of some joint welfare function, are likely to be too complex to

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[1] Fischer (1988b) surveys much of the coordination literature.

be implemented as literally proposed. Hence the motivation for simpler more practical schemes,[2] for example focussing on a few key "economic indicators." But the ultimate reason for skepticism that coordination proposals will in fact be implemented is that they require nations to give up some degree of sovereignty over policy-making for the sake of cooperation. Looking forward from 1989, it is unlikely for many years to come that countries will be ready for such a commitment. In the first place, enforcement is a problem even when everyone benefits relative to the Nash equilibrium [because each country could do still better by deviating unilaterally from the agreement]. In the second place, given uncertainties about policies and about future disturbances, a coordination regime that guarantees higher welfare for each country ex ante will nevertheless probably entail ex post losses for some countries in some years, creating a great temptation for them to break the agreement. An American government, for example, would be unlikely to maintain policies sacrificing U.S. economic welfare for the sake of an international agreement, for fear of losing political support.

If a cooperative regime is to be successful, it must be built on an accumulation of trust. If countries are in every year to resist the short-run advantages of deviating from the agreement for the sake of the longer-run gains of maintaining the cooperative regime, it is necessary that there be either explicit sanctions for violations, or implicit effects on their long-term reputations. The reputations route requires the passage of time

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[2] Levine, Currie and Gaines (1989) present a general methodology for analysing the sustainability of coordination agreements that take the form of simple rules.

during which countries can establish track records by which they can be judged. The sanctions route requires a commitment to give up national sovereignty, for which, again, countries will not be politically ready for some time. This is one major problem with a proposed return to fixed exchange rates, a gold standard, and others of the ambitious plans for world monetary reform. They presuppose a world of surrendered sovereignty, and there is no evident pathway leading there from our current world. "You can't get there from here."

The most we can anticipate is that coordination will begin on a small scale in the 1990s, with countries giving up just a small amount of sovereignty in return for small expected gains. Such coordination could be pronounced successful if announced international economic agreements were not completely devoid of substance, if the agreements actually caused countries to modify
their policies -- even if only a little -- from what they otherwise would have been, and if the results can be seen to have raised economic welfare-- again, even if only a little.

If coordination on a small scale is successful in the 1990s, then it will establish the prerequisites of trust and confidence needed for coordination on a moderate scale in the 21st century: national track records of compliance with the international agreements, or perhaps sufficient consensus as to the benefits to allow the establishment of sanctions for future non-compliance. The point is that, at each stage, a record of successful coordination will politically allow an increase in the degree of commitment to coordination in the next stage. What is needed, then, is really a proposal for a sequence of coordination regimes, an overall plan in

which the degree of coordination can begin at a small "epsilon" and be gradually raised from there [in theory, someday reaching the level of full coordination of policies].

This paper contains, in addition to a review of the obstacles to future progress toward coordination, a preliminary examination of two modest proposals for the form that successful coordination might take. One is an international version of targeting nominal GNP (or aggregate demand). The proposal might be called INT, for International Nominal Targeting.[3] The other is a supranational bank, sometimes called a Hosomi Fund, which could intervene in the foreign exchange markets, without national central banks surrendering their own rights to operate in the markets. In each case—International Nominal Targeting and a Hosomi Fund — a key element of the proposal is that it could begin on a very small scale, build up trust and confidence in the institution slowly, and thus progress to higher degrees of coordination.

The essence of the argument for the need for coordination is that there are international externalities or spillover effects. If these externalities did not exist, i.e., if each country was unaffected by changes in other countries, then the decentralized noncooperative solution would be optimal; there would be little role for international meetings or a supranational institution to coordinate policies [just as there would be little role for government intervention in the domestic economy if domestic markets functioned competitively and without externalities].

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[3] The INT proposal appears in brief form in Frankel (1988c). Frankel (1988d) offers a version of the proposal of the same length as the present paper.

One cannot know whether or what kind of coordination is desirable without first knowing the nature of the externalities. Is the Nash noncooperative equilibrium too contractionary, because of a proclivity toward "beggar-thy-neighbor" policies? Then joint expansion is called for. This, of course, was the logic of the "locomotive theory" that gave rise to the 1978 Bonn Summit. Or, on the other hand, is the existing equilibrium overly inflationary? In that case joint discipline would be called for. This is the apparent motivation underlying the European Monetary System. Perhaps the problem is that each country seeks by its policy mix to raise real interest rates, attract capital inflows and appreciate its currency, thereby reducing the Consumer Price Index for any given level of output and employment. This description seemed to characterize some major countries in the early 1980s. Or perhaps the problem, rather than "competitive appreciation," is "competitive depreciation," as was feared at Bretton Woods in 1944 on the basis of the experience of the 1930s. Each kind of externality would imply a different kind of appropriate coordination to address it.

In Part II of this paper, we address problems concerning the overall degree of expansion of macroeconomic policies, whether monetary and fiscal policies are too tight or too loose, rather than the proper mix of the two. In Part III of the paper, more briefly, we address the problem of exchange rate variability.[4] It is left as a topic for future work to consider

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[4] If the problem with the Nash noncooperative equilibrium is thought to be competititve appreciation or depreciation, then an agreement to move to a regime of greater exchange rate stability will solve the problem. If, on the other hand, the problem is thought to be overly contractionary or overly expansionary monetary policy, then such a switch in regimes may exacerbate the problem by increasing the degree of international transmission of disturbances.

problems of the degree of expansion simultaneously with problems of the monetary/fiscal policy mix, real interest rates and the exchange rate.

II. OVERCOMING OBSTACLES TO COORDINATED EXPANSION OR CONTRACTION

II.A Domestic Policy-Making

Macroeconomic policy-making is always a tradeoff between the advantages of discretion on the one hand and rules on the other. In the past, writers concerned with either one of the two problems often simplistically assumed away the other. If the aim is to maximize economic welfare (a function of output and inflation) only for a given period, ignoring long-run implications for expected inflation, discretion can be shown to be unambiguously superior to rules; after all, how can one possibly gain by agreeing to limit one's abilities beforehand to respond to developments in the economy? If one ignores the possibility of short-run disturbances, on the other hand, rules can be shown to be unambiguously superior to discretion in a long-run equilibrium; macroeconomic policy cannot affect output in the long run anyway, and precommitting to a nominal anchor can reduce expected inflation and thereby reduce actual inflation.

There are a few excellent surveys of the literature concerning time inconsistency, pre-commitment and reputations, and its implications for the older debate over rules versus discretion. See, for example, Barro (1986),

Fischer (1988a), and Rogoff (1987). It should be clear by now that neither extreme in the debate represents the complete correct answer. On the one hand, if the political system's policy-making process is allowed to optimize on a purely short-run basis, the outcome will be over-expansion. Thus some degree of longer-term commitment to resist inflationary temptations is indicated, even if it is a decision to insulate the Central Bank from the political process rather than formal commitment to a nominal anchor or rule.[5] On the other hand, in a world where new disturbances come along, it is important that the government retain at least some ability to respond to stabilize the economy. The solution is <u>some</u> degree of commitment, but less than 100 per cent, to some nominal anchor.[6]

In the context of domestic policy-making, this paper makes no judgment on the desirable degree of pre-commitment to a nominal target.

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[5] While Milton Friedman has justifiably had more influence on this issue than one human being is usually able to have, there have long been two aspects of his campaign against the Federal Reserve Board that are puzzling. First, his argument against discretion in monetary policy-making is largely based on the analysis in Friedman and Schwartz that the Federal Reserve made the Depression of the 1930s much worse than it otherwise would have been by "allowing" the M1 money supply to fall. Yet in recent decades he has campaigned for the Fed to do precisely what he accuses them of doing in the 1930s: set a firm target for the monetary base rather than for M1. The second, even more puzzling, aspect is that Friedman and his fellow monetarists claim to believe that U.S. money growth would be slower and more stable if monetary policy were placed more under the control of the democratic political process, via the Treasury or the U.S. Congress, than under the control of elitist central bankers like Paul Volcker. It is particularly ironic that, when a member of the monetarist Shadow Open Market Committee finally became Treasury Under-Secretary for Monetary Affairs in the early 1980s, his view that the money growth rate was dangerously high was overruled by a Treasury Secretary and White House who sought to pressure the Fed for faster money growth leading up to the 1984 election.

[6] Rogoff (1985b) shows that some intermediate degree of commitment to a target is optimal for monetary policy.

[Analogously, when we turn to international coordination, we take as given by the political process the degree of commitment to coordination.]

But it can be argued that, whatever the degree of precommitment to a nominal target, nominal GNP (or nominal demand) makes a more suitable target than the four other nominal variables that have been proposed: the money supply, the price level, the price of gold, or the exchange rate. The argument has been made well by others.[7] In the event of disturbances in the banking system, disturbances in the public's demand for money, or other disturbances affecting the demand for goods, a policy of holding nominal GNP steady insulates the economy; neither real income nor the price level need be affected. In the event of disturbances to supply, such as the oil price increases of the 1970s, the change is divided equi-proportionately between an increase in the price level and a fall in output. For some countries, this is roughly the split that a discretionary policy would choose anyway.[8] In general, unless the objective function puts precisely equal weights on inflation and real growth, fixing nominal GNP will not give precisely the right answer. But if the choice is among the available nominal anchors, nominal GNP gives an outcome characterized by greater stability of output and the price level. An Appendix to this paper shows that a nominal GNP

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[7] Gordon (1985), Hall (1985), Taylor (1985) and McCallum (1987, 1988ab), for example, argue in favor of targeting nominal GNP in the closed-economy context. The idea also has proponents in the United Kingdom: Bean (1983), Meade (1984) and Brittan (1987). Miller and Williamson (1987, 7-10) propose targeting nominal demand as part of their "blueprint" for exchange rate target zones.

[8] In 1974, Switzerland can be given as an example of a country that chose to take the adverse supply shock almost entirely in the form of lost income and employment, in order to restore price stability, Sweden as an example of a country that chose to take it almost entirely in the form of inflation, in order to preserve output and employment, and the United States as an example in between.

target strictly dominates a money supply target, in the sense of minimizing a quadratic loss function, regardless how important inflation-fighting credibility is.

To take an example from recent history, the Federal Reserve, citing large velocity shifts, decided beginning in late 1982 to allow M1 to break firmly outside their pre-announced target zone. M1 grew 10.3 per cent per year from 1982:II to 1986:II. Some observers have suggested that the Fed was following a general policy of targeting nominal GNP. For four years the monetarists decried the betrayal of the money growth rule, and warned that a major return of inflation was imminent. Nobody can doubt, in retrospect that the Fed chose the right course. Even with the recovery that began in 1983 and continued through the four years and beyond, nominal GNP grew more slowly than the money supply: 8.0 per cent per year. Thus velocity declined at 2.3 per cent per year, in contrast to its past historical pattern of <u>increasing</u> at roughly 3 per cent a year. If the Fed had followed the explicit monetarist prescription of rigidly pre-committing to a money growth rate lower than that of the preceding period, such as 3 per cent, and velocity had followed the same path, then nominal GNP would have grown at only 0.7 per cent a year. This number is an upper bound, because with even lower inflation than occurred, velocity would almost certainly have fallen even more than it did. The implication seems clear that the 1981-82 recession would have lasted another five years!

II.B Obstacles to International Policy Coordination

After the initial enthusiasm for the gains from coordination, especially at the theoretical level, a number of economists have in recent years been pointing out some of its difficulties [beginning, at the public level, with Feldstein (1983, 1988)].

The obstacles to implementing a successful regime of macroeconomic policy coordination are of three sorts: uncertainty, enforcement, and time-consistent inflation-fighting credibility. Difficulties of enforcement and credibility have received the most attention from economists. Even when a coordination package guarantees that each country will be better off than it would be in the non-cooperative equilibrium, the country will be able to do better still if it "cheats" on the agreement. That is, it will be able to do better in the short-run, assuming that the other countries leave their policies as agreed; in future periods, the other countries will presumably retaliate by also abandoning the agreement. But economists have probably over-emphasized the difficulties of enforcement (Kenen, 1987, 31-36, thinks so [9]), and under-emphasized the difficulties of uncertainty. If policymakers could be certain as to how various policy changes would affect their economic objectives, it might not be very difficult to enforce cooperative agreements. But uncertainty is in fact endemic to international macroeconomic policy-making.

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[9] Holtham and Hughes Hallett (1987, 130) agree: "Economists have perhaps focused on moral hazard problems because of their interesting logical character rather than because of their empirical importance. It seems likely that uncertainty and model disagreement are greater obstacles to international cooperation."

As we will see, uncertainty is of three kinds: uncertainty regarding the current and future position of the economy, uncertainty regarding the desirable optima for the target variables, and uncertainty regarding the effects on the target variables of changes in those policy instruments that the policy-makers directly control. Each of these areas of uncertainty makes it difficult for policy-makers in one country to know what policy changes to ask of its trading partners, and to know what policy changes it itself should be willing to make in return. Even assuming that there are no problems of enforcement, a cooperative package of policy changes that each country thinks will benefit it could, ex post, easily turn out to make things worse rather than better. This could be the outcome if the baseline level of output, for example, turns out to be different than expected, or if the optimum level (e.g., potential output) turns out to be different than expected, or if a foreign expansion of monetary policy, for example, turns out to have a different effect on domestic output than expected.

Uncertainty greatly complicates the enforcement problem as well. In the first place, policy-makers do not have direct control over the variables that we refer to as their "policies." Central banks cannot determine the money supply precisely, because of disturbances within the banking system or in the wider economy's demand for money. Nor can a specific policy-maker who is engaged in international negotiations determine his country's fiscal policies precisely. For this reason, it can be difficult to hold policy-makers accountable for deviations of the policy variables from the cooperative bargain that they agree to.

In the second place, ex ante uncertainty means that there will be some states of the world in which the temptation to cheat is especially great

because the country turns out ex post to lose a lot from abiding by the agreement (relative to unilaterally violating the agreement, and perhaps also relative to never having made the agreement to begin with). In such circumstances, the short-run gains from abrogating may outweigh the longer-term gains from continued cooperation.

A third kind of obstacle has been pointed out by Rogoff (1985). A cooperative agreement that succeeds in raising economic welfare in one period will, if it takes the form of joint reflation, raise expectations of future inflation and may thus reduce economic welfare in the longer run. In such a circumstance, renouncing cooperation may be a way that countries can pre-commit to less inflationary policies.

This part of the paper examines these different obstacles to successful international coordination, and then argues that INT, an international version of targeting nominal GNP (or nominal aggregate demand), is more likely than other types of coordination to surmount these obstacles.

II.B.1 Problems of uncertainty

There are three things that a country ideally needs to know before it even can enter negotiations with other countries on coordinated policy changes. (1) What is the initial position of the domestic economy, relative to the optimum values of the target variables? (2) What are the correct weights to put on the various possible target variables? [This includes the question of which variables should be excluded from consideration altogether, and which included.] (3) What effect does each unit change in

the domestic macroeconomic policy variables (and the foreign) have on the target variables; that is, what is the correct model of the world economy?

These three elements follow simply from the algebraic expression for the economic objective function. We specify here a function of three target variables, although we could as easily have more or fewer.

$$(1) \quad W = (1/2)\ (\ y^2 + w_x x^2 + w_p p^2\ )$$

$$(1^*) \quad W^* = (1/2)\ (y^{*2} + w^*_{x^*} x^{*2} + w^*_{p^*} p^{*2}\ ),$$

where W is the quadratic loss to be minimized, y is output (expressed in log form and relative to its optimum), x is the current account (expressed as a percentage of GNP and again relative to its optimum), p is the inflation rate, w_x is the relative weight placed on the current account objective, w_p is the relative weight placed on the inflation objective, and an asterisk (*) denotes the analogous variables for the foreign country. We will refer to two policy instruments: the money supply, m (in log form), and government expenditure g (as a percentage of GNP).

The marginal welfare effects of changes in these policy variables are then given by:

$$(2) \quad dW/dm = (y)y_m + w_x(x)x_m + w_p(p)p_m$$

$$(3) \quad dW/dg = (y)y_g + w_x(x)x_g + w_p(p)p_g$$

$$(4) \quad dW/dm^* = (y)y_{m^*} + w_x(x)x_{m^*} + w_p(p)p_{m^*}$$

$$(5) \quad dW/dg^* = (y)y_g^* + w_x(x)x_{g^*} + w_p(p)p_{g^*}$$

$$(2^*) \quad dW^*/dm = (y^*)y^*_m + w^*_{x^*}(x^*)x^*_m + w^*_{p^*}(p^*)p^*_m$$

$$(3^*) \quad dW^*/dg = (y^*)y^*_g + w^*_{x^*}(x^*)x^*_g + w^*_{p^*}(p^*)p^*_g$$

(4*) $dW^*/dm^* = (y^*)y^*_{m^*} + w^*_{x^*}(x^*)x^*_{m^*} + w^*_{p^*}(p^*)p^*_{m^*}$

(5*) $dW^*/dg^* = (y^*)y^*_{g^*} + w^*_{x^*}(x^*)x^*_{g^*} + w^*_{p^*}(p^*)p^*_{g^*}$

where the policy multiplier effect of money on output is given by y_m, the effect of money on the current account by x_m, etc. If we wished to solve for the optimum, we would set these derivatives equal to zero (with the target variables (y), (x), etc., first expressed as linear functions of the policy variables m, g, etc.). In the Nash noncooperative equilibrium [in which each country takes the other's policies as given], we would need only equations (2), (3), (4*) and (5*) for the solution. Each country ignores the effect that its policies have on the other country, so equations (4), (5), (2*) and (3*) do not enter. Indeed this is precisely the standard reason why the noncooperative equilibrium is sub-optimal. These cross-country effects enter only in the determination of the cooperative solution.

Before they decide on a policy change, policy-makers must at least know the sign of the corresponding derivative. Equation (2), or any other of the eight derivatives above, neatly illustrates the three kinds of uncertainty. First is uncertainty about the initial position, the variables, y, x and p. Position uncertainty in turn breaks down into three parts: (a) uncertainty about the current value of the target variable in question[10]; (b) uncertainty over how the target variables are likely to move during the forthcoming year or more in the absence of policy changes, the "baseline forecast" (this information is relevant on the assumption that any policy changes agreed upon will have their major impact beginning in a year or

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[10] For example, Mankiw and Shapiro (1986) find that the standard deviation of the revision from the preliminary estimate of the real growth rate to the final number is 2.2 percentage points.

more, rather than immediately[11]); and (c) uncertainty as to the location of the optimum value of the target variable.[12]

The point is clear. The policy-maker's estimates of the current values of y, x or p in his country could easily be off by several percentage points in either direction, which could flip the signs of the corresponding three terms — any one of which could change the sign of the derivative of the objective function — in each of equations (2)-(5). Thus it is entirely possible that the country could ask its partners in negotiations to expand, or that it could agree to a partner's request that it itself expand, when these changes would in fact move the economy in the wrong direction.

To take one historical example, in the late 1970s the U.S. policy-makers, looking at the available economic data, concluded that insufficient growth in the world economy was the problem of the time. This assumption was the basis of the 1978 Bonn Summit agreement for coordinated expansion with Japan and Europe, Germany in particular. By the end of the decade, the consensus had become that fighting inflation was the top priority, not accelerating real growth. A natural way of interpreting the view — widely held in Germany at least — that the results of the Bonn-coordinated

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11 Kenen and Schwartz (1986) have studied the accuracy of current-year forecasts by the IMF World Economic Outlook for the last fifteen years. They find that the root mean squared error among the Summit Seven countries is 0.773 percentage points for real growth and 0.743 percentage points for inflation. These prediction errors, relatively small, are in themselves large enough to reverse the signs of the derivatives of the welfare function equations (2)-(5). Errors would presumably be much larger for the horizons of two years or more that are probably most relevant for policymaking. Many major international econometric models show the effects of monetary and fiscal policy peaking in the second year in the case of output, and not reaching a peak within six years in the case of the price level or current account. See Bryant et al (1988).

12 Economists disagree as to the correct estimate of the natural rate of unemployment or the level of potential output, for example.

expansion turned out in retrospect to have been detrimental, is that unanticipated developments, particularly the large increase in oil prices associated with the sudden Iranian crisis of 1979, moved the world economy to a highly inflationary position where expansion was no longer called for.[13]

The second sort of uncertainty present in the equations is uncertainty regarding the proper weights w_x and w_p to put on the target variables in the objective function.[14] This issue is even more subjective than the issue of the optimal values of the target variables. In a society where the weights that individual actors place on inflation (or the current account) vary from zero to infinity, the likelihood must be judged very high that any given government is using weights that differ from the "correct" ones that would follow from any given criterion. One can see from the equations that putting insufficient weight on fighting inflation, for example, can have the same effect as underestimating the baseline inflation rate: the policy-maker in coordination exercises may ask his trading partners to adopt

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[13] Another unexpected development in the late 1970s was the downward shift in the demand for money in the United States. This disturbance, like the oil shock, meant that the planned growth rate of money turned out ex post to be more inflationary than expected.

[14] One way to obtain estimates for the weights is to follow Oudiz and Sachs (1986), who assume that as of 1984 policy-makers were optimizing their objective functions in a Nash equilibrium, and infer the welfare weights that they must have had in order to produce the observed outcomes for output, inflation and the current account. The estimates turn out to be very sensitive to such things as the model of the economy that the policy-makers are assumed to have. [To equate the inferred weights with the correct rates, as Oudiz and Sachs do, of course requires not only that the policy-makers were indeed seeking to optimize in a Nash equilibrium in that particular year, but also that they know the correct model, the correct weights, and the correct position of the economy relative to the optimum.]

expansionary policies when contractionary policies are in fact called for. This is precisely the mistake that by 1980 some concluded had been made by the United States. From the viewpoint of the Republicans who were elected to the presidency in that year, or the Social Democrats who came to power in Germany about the same time, the policy-makers who had agreed to coordinated reflation at the Bonn Summit of 1978 had put insufficient weight on the objective of price stability.

The third sort of uncertainty pertains to the policy multipliers, the derivatives y_m, y_g, etc., in equations (2)-(5*), telling the effect of changes in the money supply and government expenditure on the target variables. Any given government is likely to be using policy multipliers that differ substantially from the "true" ones, and that may even be incorrect in sign. One way of seeing this is to note the tremendous variation in multipliers according to different schools of thought, or even according to different estimates in models of "mainstream" macroeconomists. They cannot all be correct, and it seems highly probable that no single model is in fact exactly right.[15]

It is possible to illustrate the potential range of multiplier estimates in some detail. In a recent exercise conducted at the Brookings

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[15] The German view that the 1978 Bonn Summit entailed joint reflation which, in retrospect, was inappropriate has been used above to illustrate, alternatively, uncertainty about the baseline forecast (the unanticipated oil shock of 1979) or uncertainty about the objective function (the proper weight to be placed on inflation versus growth). A third possible interpretation is model uncertainty: the Germans believe that the slope of their Aggregate Supply curve turned out to be steeper than they, or at least the Americans, thought it would at the time. This interpretation is plausible if one believes that the German labor market is characterized by a high degree of real wage rigidity, as was pointed out by Branson and Rotemberg (1980).

Institution, 12 leading econometric models of the international macroeconomy simulated the effects of specific policy changes in the United States and in the rest of the OECD.[16] The models participating were the Federal Reserve Board's Multi-Country Model, the European Economic Community's Compact model, the Japanese Economic Planning Agency model, Project Link, Patrick Minford's Liverpool Model, the McKibbon-Sachs Global model, the Sims-Litterman VAR model, the OECD's Interlink model, John Taylor's model, the Wharton Econometrics model, and the Data Resources, Inc., model. The variation in the estimates is large, not just in magnitude but also in sign. The effect of fiscal or monetary expansion on domestic output and inflation is usually at least of the positive sign that one would expect. [Even here there are exceptions as regards inflation: the VAR, Wharton and Link models sometimes show expansion causing a reduction in the CPI, probably due to effects via markup pricing.] But disagreement among the models becomes much more common when we turn to the international effects.

The areas of greatest disagreement among the econometric models regarding international transmission are not the same as one might expect from the theoretical literature. A U.S. fiscal expansion is transmitted positively to the rest of the OECD in 10 out of 11 models, and an expansion in the other countries is transmitted positively to the United States in 9 out of 10 models, whereas in theory fiscal transmission can easily be negative.[17] The greatest amount of disagreement occurs, rather, on the effect of a monetary expansion on the domestic current account, and

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16 See the volume edited by Bryant et al (1988).

17 For example, if capital mobility is sufficiently low and a depreciation of the domestic currency is contractionary for the foreign country.

therefore on the foreign current account and output level. There are two conflicting effects. On the one hand, the monetary expansion raises income and therefore imports. On the other hand, it depreciates the currency, which tends to improve the trade balance. [In the Mundell-Fleming model the net effect on the current account must be positive.[18]] It turns out that a U.S. monetary expansion worsens the current account in 8 out of 11 models, and a monetary expansion in the other OECD countries worsens their current accounts in 5 out of 10 models. [In most models the rest of the Mundell-Fleming transmission mechanism is reversed as well: the foreign current account and foreign income rise rather than fall.]

What happens if U.S., European and Japanese policy-makers proceed with coordination efforts despite disagreements such as these? In Frankel and Rockett (1986, 1988) and Frankel (1988), I used the Brookings simulations [and the welfare weights from Oudiz and Sachs] to consider the possibilities when governments coordinate using conflicting models. Countries will in general be able to find a package of coordinated policy changes that each believes will leave it better off, even though each has a different view of the effects and thus may not understand why the other is willing to go along with the package. The actual effects depend on what the true model is. If we consider ten possible models, there are 1,000 combinations of models that can be used to represent the beliefs of the U.S. policy-makers, the beliefs of non-U.S. policy-makers, and reality. We find that monetary coordination results in gains for the United States in 546 cases, losses in 321 cases and

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[18] A reduction in interest rates causes a net capital outflow which, under a floating exchange rate, implies an increase in the current account balance.

no effect on the objective functions (to four significant digits) in 133 cases. Coordination results in gains for the rest of the OECD countries in 539 cases, as against losses in 327 and no effect in 134.

A number of authors have taken exception to this finding, and its implication that uncertainty constitutes a serious obstacle to successful international policy coordination. Holtham and Hughes Hallett (1987), Frenkel, Goldstein and Masson (1988, 31-32), and Ghosh and Masson (1988ab) argue that, in a world in which different models abound, it is not sensible to assume that each policy-maker acts as if he knows with certainty the correct model. Such criticisms could be applied to the original paper, Frankel and Rockett (1986). But extensions in the published Frankel and Rockett (1988, 337-338) and Frankel (1988, 19-21) papers relax the assumption that each policy-maker acts as if he or she is certain as to the correct model. Policy-makers are assumed to assign probability weights to each of the possible models, and then to maximize their expected welfare.[19] Coordination then turns out to raise U.S. welfare in only 20 per cent of the cases, and to raise non-U.S. welfare in 60 per cent of the cases.

Ghosh (1987) and Ghosh and Masson (1988a) claim that the presence of model uncertainty -- far from rendering coordination unattractive as in my results -- actually furnishes an argument in favor of coordination, provided policy-makers recognize that they do not know the true model. Their

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19 In the case where the weights are uniform, each policy-maker is playing by the same "compromise" model. One possible way of interpreting such a compromise on the model is as a type of cooperation that consists of negotiating over the correct view of the world rather than negotiating over policies. See Frankel (1988). Kenen (1987, 8-9) and Bryant (1987, 8) stress that exchange of information is a useful function of international cooperation broadly defined.

argument is essentially that if the policy-maker has rational expectations, then the probability weights he assigns to the possible models (1/10 to each of 10 in our experiment) will correspond to the best weights available. This argument is correct (1) assuming that governments do in fact assign the best weights to alternative models (which among other things implies that all governments share the same perceptions, which does not seem to be the case), and (2) as a statement about ex ante welfare only. If governments do not agree on the correct set of weights to assign the models, the implications even for correct ex ante welfare are precisely the same as the original implications of disagreement as to the correct model are for true ex post welfare: coordination could make the country worse off in expected value. Furthermore, even if the countries do know the best weights, it is still quite possible that the true model will turn out to lie far from the weighted-average model and coordination will reduce ex post welfare. It is ex post welfare that should be the ultimate criterion; to argue otherwise would be essentially to argue that what matters is that the President blithely perceives that he has made the best decision, even if the consequences for the economy may in fact be calamitous.

Holtham and Hughes Hallett (1987) and Kenen (1987) argue that we should rule out coordination (i.e., that it will not take place) in cases where the bargain is not "sustainable," defined as cases where one party expects that the other -- even though happy to go along with the bargain -- will in fact lose from it. The supposition is that the first party will expect the other policy-maker to abrogate the agreement next period, when the error becomes evident. To this, one can make two possible responses. First, one can point out that throughout the exercise (that considered by Holtham and

Hughes Hallett, as much as by Frankel and Rockett), it is assumed that policy-makers do not revise their multiplier estimates just because the target variables turn out in the next period to take different values from the ones they expected. (Implicitly, they assign the error to a transitory disturbance. This is the alternative to assuming that they gradually update their multiplier estimates in a Bayesian way until they converge on the true model.[20] It would certainly be foolish to represent anyone as completely revising his multiplier estimates each period so that his model fits perfectly the latest data point.) It follows that it would not be rational to expect the other policy-maker to abrogate the agreement next period, because the other policy-maker is known to believe in a model that will continue to make the agreement appear advantageous. It is not as if the other policy-maker will be able to accuse the first of bad faith. If the first keeps his promise to set his policy instruments in the way agreed upon, it is not his fault if the economy responds in an unexpected way.

The second possible response to the point is to admit that policy-makers in international negotiations are less likely to reach agreement on a coordination package if they have profoundly different views of the world and thus have difficulty communicating at all. This argument does not change the conclusion that uncertainty constitutes a serious obstacle to successful policy coordination. It simply reclassifies some of the 1,000 combinations as cases where coordination does not even get past the talking stage. And there is nothing to guarantee that those "sustainable" cases where the coordination does take place will have a higher incidence of

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[20] Ghosh and Masson (1988b) examine the implications of having the policy-makers update their models in a Bayesian way, an interesting extension of the original problem.

welfare gains than that reflected in the statistics that count all 1,000 cases. [21]

Carrying this logic one step further, we can consider the subset of 100 cases where the two countries agree on a single model. Again, this does not necessarily improve the chances that the chosen model is the correct one. In Frankel and Rockett (1988, 330), for the subset where the countries agree, coordination turns out to result in U.S. gains in 65 percent of the cases, and rest-of-world gains in 59 per cent of the cases. Holtham and Hughes Hallett (1987, 25) reach a similar conclusion: judged by the correct model, only slightly over half the cases result in gains.

Frenkel, Goldstein and Masson (1988, 30-31) offer some further defenses of coordination, these in response to the point made by Oudiz and Sachs (1984) and others that the gains from coordination are empirically found to be small, even under the normal certainty assumption (which is the best case in that the gains are necessarily positive). First, they cite a finding of Holtham and Hughes Hallett (1987) that the gains from coordination turn out larger when other target variables such as the exchange rate are included in

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[21] In any case it would not hurt to try the count on the subset of cases where the countries believe that both will gain. I have not yet done this for all 10 models (100 combinations). But the tables in Frankel and Rockett (1988) can be used to do the count for four models. Out of the 16 combinations, 8 cases are eliminated if it is assumed that coordination does not take place when one partner thinks that the other would lose by the proposed package. Out of the 8 remaining "sustainable" cases, and the corresponding 32 possible outcomes, the U.S. turns out to gain in 24 cases and the rest of the OECD in 22 cases. These are only slightly better odds in favor of coordination than result when all combinations are considered admissible.

the objective function. Against this finding must be balanced the problems that uncertainty poses for choosing the exchange rate as one of the target variables; the econometric record shows even greater uncertainty as to the effects of macroeconomic policies on exchange rates than on output, inflation and the trade balance.

Frenkel, Goldstein and Masson point out two further limitations of the Oudiz-Sachs approach: that it does not provide an explicit standard of comparison when it pronounces the gains from coordination "small," and that it assumes that the "counterfactual" (what would happen in the absence of coordination) is optimization by policy-makers in the Nash noncooperative equilibrium, which is not necessarily realistic. These two points are simultaneously addressed by an experiment reported in Frankel and Rockett (1988, 332, table 7) and Frankel (1988, tables 13 and 14). There the gains from coordination, under the best-case assumption that the policy-maker knows the true model, are compared to the gains to a single policy-maker, who may previously have believed an incorrect model, of discovering the true model and unilaterally adjusting his policies accordingly [while staying within the Nash noncooperative equilibrium]. In a majority of cases, the gains from coordination are small compared to the gains from a unilateral switch to the correct model [9 to 6 for the U.S. and 12 to 4 for the rest of the OECD, in each case assuming that the partner knows the correct model all along].

Thus it remains true that the obstacles to successful coordination are formidable, even in a simplified one-period framework with enforcement assumed to be automatic.

II.B.2 Problems of enforcement and the G-7 indicators

Coming from our consideration of the problems of uncertainty, several conditions would seem to be essential for any cooperative agreement to "stick." First, each round of coordination must specify clearly what is expected of each party. It is hard enough to enforce a clear-cut agreement, because each party has an incentive to cheat; enforcement is hopeless if the parties have not even spelled out what is required of them. [When OPEC ministers come out of a Vienna meeting without having agreed upon oil production quotas for their countries, it is probably a safe bet that the members will not be withholding output in the common interest; enforcement is hard enough even when the agreement is explicit.]

Second, for the parties to be held accountable, the variables that they commit to must, to the maximum extent possible, be both observable and under the control of the government authorities, and in particular under the control of those authorities involved in the international negotiations. It is for this reason that when the International Monetary Fund negotiates a "letter of intent" with the Finance Minister of a borrowing country, the "performance criteria" that are agreed upon tend to be variables directly under the control of the authorities, such as the growth rate of the monetary base, rather than variables that are harder to control like the broad money supply, let alone the ultimate target variables like inflation. Otherwise, the national authorities could always claim that a subsequent failure to satisfy a performance criterion was beyond their control.

It is not essential that the variables be under the precise short-run control of the authorities, especially if compliance with the agreement is only to be checked on a basis of, say, once a year at annual reviews by the IMF ("Article IV Consultations") or at Summit Meetings of the Heads of State, or twice a year at meetings of the Finance Ministers. It is only essential that there be an unambiguous sign to the relationship between the policy instruments that <u>are</u> under direct control and the variable to which the parties commit, and that the lags in the relationship not be too long. When the variable begins to deviate seriously from the agreed-upon range, the policy-makers begin to adjust the policy instruments accordingly. Then the policy-maker at the end of the year can be held accountable for any large deviations from the agreement.

The third necessary condition pulls the opposite direction from the second. The variables that the parties commit to must be closely enough tied to the target variables in their ultimate objective function that if there turns out to be an unexpected disturbance in one of the economic relationships [or if one of the multipliers belonging to an agreed policy change turns out to be different than expected], the country will not be too drastically harmed. If the country commits to a specific number for the monetary base or the money supply, and there are shifts in the money multiplier or velocity that translate that number into a severe and needless recession, it is obvious that the country will break its commitment. There must also be a similar link between the variables that each party commits to and the <u>other</u> country's target variables. A country will not be as impressed when its partner sticks to its money growth target if this turns out to be disadvantageous to it (for example because a disturbance moves it

to the overly inflationary side of full employment, or because the partner's money growth turns out to be transmitted negatively rather than positively).

At the Tokyo Summit of May 1986, it was decided that the G-5 countries, or thenceforth the G-7, would focus in their meetings on a set of 10 "objective indicators": the growth rate of GNP, interest rate, inflation rate, unemployment, ratio of the fiscal deficit to GNP, current account and trade balances, money growth rate, international reserve holdings, and exchange rate. No pretense was made that the members would rigidly commit to specific numbers for these indicators, in the sense that sanctions would be imposed on a country if it deviated far from the values agreed upon. But the plan did include the understanding that appropriate remedial measures would be taken whenever there developed significant deviations from the "intended course." The indicators are viewed as prototypes of the variables that representatives would bargain over if coordination were to become more serious. The current G-7 system could be viewed as an attempted case of the "epsilon-small" degree of coordination mentioned at the beginning of this paper, a necessary stage for building confidence before moving on to more binding forms of coordination.

The list has been further discussed, and trimmed down, at subsequent G-7 meetings. By the time of the Venice Summit in June 1987, the list had been reduced to six indicators: growth, inflation, trade balances, government budgets, monetary conditions, and exchange rates.[22] Treasury

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[22] This list did not appear in the communique, but rather in comments to the press by the U.S. Treasury's Assistant Secretary David Mulford. Funabashi (1988, esp. p.130 ff.) offers a fascinating account of the machinations of the G-7 mechanism from 1985 to 1987.

Secretary James Baker, however, in October 1987 told the IMF Annual Meeting that "the United States is prepared to consider utilizing, as an additional indicator in the coordination process, the relationship among our currencies and a basket of commodities, including gold...." At the Toronto Summit of June 1988, "the G-7 countries welcomed the addition of a commodity price indicator and the progress made toward refining the analytical use of indicators."[23]

The French Finance Minister Edouard Balladur singled out five indicators after the G-7 meeting of December 23, 1987 (a "Louvre Agreement II"). He writes of "a system based on international cooperation building on the spirit of the Louvre Agreements. Their enforcement requires close surveillance of each of the major economies on the basis of such economic indicators as growth rates, fiscal balance, balance of payments, interest rates and exchange rates. This surveillance is already being established gradually."[24]

It is somewhat difficult to reconcile these optimistic statements that some amount of substantive coordination is already taking place with the fact that G-7 meetings do not publicly announce the targets agreed to for the indicators. How can any pressure be brought to bear on countries that stray from the agreed-upon targets (whether it is moral suasion, embarrassment, the effect on long-term reputations, or outright sanctions)

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23 IMF Survey, September 26, 1988, p.292.

24 "Rebuilding an International Monetary System," Wall Street Journal, Feb. 23, 1988, p.28.

if the targets themselves are not made public?[25]

Indeed, the G-7 guards with tremendous secrecy the values of the indicators, even more so than the central banks guard the secrecy of their foreign exchange market interventions. Theory says that the success of a target zone, for exchange rates for example, is enhanced when speculators are made aware of the boundaries.[26] Why does the G-7 keep them secret? One possible answer -- drawn from central bankers' view of the financial markets, not from economists' -- is that the G-7 believe that short-term foreign exchange speculation is destabilizing, and that creation of short-term uncertainty as to what the authorities will do is a way of discouraging such speculation.[27] Another possible answer is that they do not want to lose face when the exchange rate subsequently breaks outside the band. This answer fits in well with one's suspicion that the G-7 meetings may in fact reach no substantive agreements, but find it politically useful to issue communiques nevertheless; the communiques are sufficiently vague that each member can interpret them to his own advantage. [28]

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[25] To take a recent example, in the Baker-Miyazawa Agreement reached in San Francisco in September 1986 [and subsequently broadened to include Germany and the others at the Louvre in February 1987], the Japanese apparently agreed to a fiscal expansion in exchange for a promise from the U.S. Treasury Secretary that he would stop "talking down" the dollar (plus the usual U.S. promise to cut the budget deficit). In the months that followed, each side viewed the other as not living up to the agreement. (The episode is described in Funabashi (1988)). But it was difficult for anyone to verify the extent of compliance, because the precise terms of the original agreement had not been public.

[26] See Krugman (1988) for the application of the latest "smooth pasting" technology to this problem.

[27] Dornbusch and Frankel (1988, section III.6).

[28] It is clear from Funabashi (1988) that the various members held differing views as to which indicators were most important, what responses were called for if indicators strayed from the agreed-upon path, and how

The G-7 list of indicators is not especially well-suited to the desirable conditions for workable coordination stated above. It is difficult to imagine a G-7 meeting applying moral censure to one of its members for having experienced a higher rate of real growth during the year than had been agreed upon in the preceding meeting, or a lower rate of inflation.

The main problem with the list is that it is too long to be practical. When each country has ten indicators but only two or three policy instruments, it is virtually certain that the indicators will give conflicting signals and that the national authorities will feel no constraint on their setting of policy instruments. Frenkel, Goldstein and Masson (1988, 22) note that one argument in favor of choosing a single indicator is the point that when multiple indicators send conflicting signals, authorities can hide behind the confusion. They also observe that multiple indicators can encourage "overcoordination:" setting a single indicator allows each country to retain some degree of freedom in setting its monetary and fiscal policies. In this light, a serious coordination scheme might begin in the 1990s by setting only one indicator, and then only progress to commitments to multiple variables when and if sufficient political consensus and confidence has developed to justify that degree of sacrifice of sovereignty.

Perhaps the true list has been, or will be, winnowed down to a smaller number of indicators? No item on the list is a good candidate to be the

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binding the agreement should be. It is also clear that each was able to interpret the Plaza and Louvre Agreements afterwards so as to reflect his own views.

single variable on which negotiation under a future coordination regime would focus. Each would seem to be dominated by nominal GNP (or nominal demand). We consider each in turn. Real output, employment, inflation and the trade balance are less directly affected by policy instruments than is nominal GNP, aside from the fact that focussing exclusively on any one would destabilize the others. The money supply is more under the control of the authorities (at least on an annual basis), but is much less directly linked to target variables: it is one unambiguous step further away from the two fundamental target variables of real output and the price level than is nominal GNP (that step, of course, being the existence of shifts in velocity, as discussed in section II.A and demonstrated in the Appendix). Furthermore we saw in the preceding section that the effects of money on all three target variables [output, price level, and trade balance] in the other country are completely ambiguous in sign. Thus it is a less suitable choice of focus for international coordination, even, than for domestic policy-making.

Fiscal policy is more easily linked to the foreign target variables (or would be, if the high-employment deficit were used as the indicator). But it is less directly under the control of the policy-makers than is the money supply. Among G-7 countries, the inability to control the budget deficit has been most striking in the case of the United States in the 1980s. Feldstein (1987, p. 23-24) offers a reason why the United States will never be able to participate in serious international bargaining over fiscal policy:

"A primary reason why such macroeconomic policy coordination cannot work as envisioned is that the United States is constitutionally incapable of

participating in such a negotiation. The separation of powers in the American form of government means that the Secretary of the Treasury cannot promise to reduce or expand the budget deficit or to change tax rules. This power does not rest with the President or the administration but depends on a legislative agreement between the President and the Congress."

Exchange rate policy is of course a very large topic in itself, to be considered briefly in the last part of this paper. But we can note some difficulties with the exchange rate being the single indicator that G-7 countries commit to in policy-coordination agreements. If the dollar/mark rate begins to stray outside the announced target zone, which of the two governments should suffer sanctions or a loss in reputation? The "n-1" problem means that one country would have to sit out, presumably the United States, which is not what is wanted.[29] Countries could commit to certain targets for their foreign exchange intervention, or more generally to monetary and fiscal policies, which in theory would determine the exchange rate. But — as already noted — the link from macroeconomic policies to the exchange rate is fraught with even greater uncertainty than the link to output and inflation, even if one were to assume that the exchange rate might have as great a claim to being in the objective function as the other target variables.

In the second part of the Appendix to this paper, the exchange rate is added in to the objective function along with output and the price level. It is shown that the penalty that goes with stabilizing the exchange rate is following a monetary policy that destabilizes the overall price level, relative to a regime of stabilizing nominal GNP. Within this framework, to

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[29] Miller and Williamson (1987) address the n-1 problem.

opt for a fixed exchange rate regime, one has to put tremendous weight on the exchange rate objective. (One has to be prepared to argue that a ten percent fluctuation in the exchange rate causes greater trouble than a ten per cent fluctuation in the price level.) The only other way out would be to assume that much of the disturbances in the exchange rate equation will disappear when the regime changes, rather than having to be accommodated by the money supply.[30] If we were to make the more practical comparison of exchange rate target zones versus nominal GNP target zones, rather than literally fixed exchange rates versus fixed nominal GNP, the advantages of INT would be further boosted by the accountability point: if a country's exchange rate strays outside the target zone to which it has committed itself, it can always claim that the movement is beyond its control. Such claims would be completely credible, in light of the large disturbances in the exchange rate equation.

As for the remaining three indicators on the G-7 list, the interest rate, international reserves, and the price of gold, the last is the only one that has been proposed as a candidate for the sole variable around which countries should coordinate. Proponents of a central role for gold do not seem to appreciate the analytical point that shifts in the demand function for gold, and in the other economic relationships that link it to the target variables that we ultimately care about, are even more unstable than shifts in the demand for money or the demand for foreign exchange, and are likely to remain so in the future.

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[30] Miller and Williamson (1987, 54-55; 1988) do precisely this: assume that there is a large "fad" component to exchange rate fluctuations under the current floating regime, and that it would disappear under their target zone proposal. [The idea is not absurd. But it certainly "stacks the deck" in an empirical comparison of the two regimes.]

This does not mean that the price of gold and other commodities is not a good indicator in the sense of an early warning signal as to the likely future course of a true target variable, namely the overall price level.[31] In this sense it belongs with the money supply, the interest rate and the yield curve, and many other leading indicators, on the list of variables that policy-makers may want to monitor on a short-term basis in attempting to hit their targets, whether under a regime of coordination (e.g., International Nominal GNP Targeting), decentralized national policy-making with some commitment to a nominal anchor (e.g., regular nominal GNP targeting), or complete discretion.

In short, if coordination is to begin -- on a scale that is small, but goes beyond the stage of mere rhetoric -- by some degree of commitment to a single variable, then nominal GNP (or nominal demand) would seem to dominate each of the eleven indicators that the G-7 has apparently been discussing as the natural candidate for that variable.

II.B.3 Problems of inflation-fighting credibility

The third of the existing critiques of international coordination, after problems of uncertainty and problems of enforcement and political practicality, is the point made by Ken Rogoff (1985a): if governments set up the machinery for joint welfare maximization period-by-period, the

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31 Indeed there is some evidence that the prices of gold and other commodities react instantaneously to changes in expectations regarding whether monetary policy will be tight or loose in the future. (Frankel and Hardouvelis, 1985.)

cooperative equilibrium in each period is likely to entail a greater degree of expansion, and thereby in the long run to undermine the governments' inflation-fighting credibility and to result in a higher inflation rate for a given level of output. In the Rogoff view, renouncing the machinery of coordination is one of the ways that governments can credibly pre-commit to less inflationary paths.

It is important to realize that the introduction of longer-term issues of credibility, time-inconsistency and pre-commitment can just as easily run in favor of coordination as against it. [32] If the perceived externality or shortcoming of the Nash noncooperative equilibrium is that it is overly expansionary, then the coordination equilibrium, even when arrived at on a period-by-period basis, will entail less expansion, not more. This is often argued to be the basis underlying the European Monetary System. The rhetoric that Schmidt and Giscard originally used in proposing the EMS in the late 1970s suggested that they were doing so because the United States was neglecting its duty to supply to the world the public good of a stable, non-inflating, currency. Ten years later, many observers of the EMS have decided that its success lies precisely in giving inflation-prone countries like Italy and France a credible nominal anchor for their monetary policies.[33] Committing to an exchange rate parity or band vis-a-vis a hard-currency country like Germany constitutes precisely the sort of time-consistent low-inflation policy sought by those who worry that central

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[32] Another of Frenkel-Goldstein-Masson's arguments against the claim that the gains from coordination are small is to cite results of Currie, Levine and Vidalis (1987) to the effect that a comparison of the cooperative equilibrium allowing scope for governments to establish reputations with the analogous noncooperative equilibrium shows large gains to coordination.

[33] For example, Giavazzi and Pagano (1988).

bankers left to their own discretion will be overly expansionary.

In the case of the EMS, there is an asymmetry. It is accepted that Germany is simply known to place very large weight on price stability, due to its history or for whatever other reasons. The weaker-currency countries can then peg to the "greater mark area", if they wish to import inflation-fighting credibility. [There is a close analogy with the idea in Rogoff (1985b) that if a particular individual -- say Paul Volcker -- is known to have extreme aversion to inflation, then the country can gain by appointing him as Central Banker, even if the country's objective function puts less weight on fighting inflation; his tight-money credibility will reduce the public's expectations of inflation, and in long-run equilibrium will produce a lower level of actual inflation for any given level of output.] In the case of proposals for worldwide coordination, there is no presumption that the United States (the natural "Stackleberg" leader) in fact has as much inflation-fighting credibility as Germany and Japan. Thus there is no automatic presumption that year-by-year coordination would lower the average world inflation rate rather than raise it.

The implication of the credibility issue is that a scheme for coordination is more likely in the long-run to produce gains if the plan has the national governments making, not just commitments to each other on a period-by-period basis, but also some degree of commitment to a nominal anchor on a longer term basis. Hence the arguments for coordinating around the price of gold (Baker, Mundell, et al) or around the global money supply (McKinnon's proposal). But then all the arguments from the closed-economy context [discussed in part II.A] as to why nominal GNP as a nominal anchor

dominates the money supply, price of gold, or overall price level, apply equally to the world economy.

II.C How International Nominal GNP Targeting (INT) Would Work

The INT framework laid out in Frankel (1988c,d) is a very simple one. The G-7 would put aside their list of 10 indicators, and would instead focus on nominal demand [defined as nominal GNP minus the balance on goods and services]. At each meeting the national authorities would (a) commit themselves, without any obsessively great degree of firmness, to target rates of growth, or ranges, for their countries' levels of nominal demand for five years into the future, and (b) commit themselves, with somewhat greater firmness, to targets for the coming year. In the first stage, i.e., the early 1990s, there would be no explicit enforcement mechanism. But the targets would be publicly announced, and if a country's rate of growth of nominal demand turned out to err significantly in one direction or the other, the fact would be noted disapprovingly at the next G-7 meeting. This does not happen under the current system. If the first stage were successful, a future stage might add another variable or two to the list, or might even commit countries firmly to specific policy responses in the event that their level of nominal demand begins to stray from the year's target.

A plan that called for targeting nominal GNP rather than nominal demand might be more readily and more widely understood, and thus might stand a better chance of succeeding politically. The advantage of focussing on nominal demand is the assumption that when the cooperative equilibrium

entails expansion, countries need to be discouraged from the temptation to accomplish the expansion of output through net foreign demand, for example through protectionist trade measures, as opposed to domestic demand. In some years the cooperative equilibrium may entail contraction rather than expansion, and then a nominal GNP target might be preferable to a nominal demand target. But it is usually thought that the political pressure for protectionist trade remedies is greater in recessions than in expansions,[34] which points to nominal demand as the superior choice.[35]

Countries could attain their nominal GNP or nominal demand targets through any of several routes. One possibility, for example, is the Williamson-Miller (1987) "blueprint", which assigns fiscal policy in each country the responsibility for attaining a nominal demand target (and assigns monetary policy in each country responsibility for the exchange rate[36]). But at least one serious problem arises if fiscal policy is explicitly specified as the policy instrument with which countries are expected to attain the nominal demand targets that they agreed to. When their economies stray away from the target the authorities will claim that it is not politically possible to adjust fiscal policy quickly. Such claims

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[34] Dornbusch and Frankel (1987) note some qualifications, relevant for the U.S. political process, to this standard view of protectionist pressures.

[35] Besides subtracting from total GNP that part going to the foreign sector (the trade balance), it might also be a good idea to subtract that part going to inventories as suggested by Gordon (1985).

[36] The Miller-Williamson blueprint also specifies that the G-7 should set the average level of their interest rates so as to attain a target for the aggregate level of their GNPs. This part of their plan is similar to Part (a) of my proposal. It is my part (b), cooperative yearly setting of each country's nominal demand target, to be attained primarily through monetary policy, that differs the most from their plan [aside from my treatment of exchange rate stability as a separable issue].

will be completely credible, because they will generally be true.[37]

An agreement is more likely to stick if monetary policy is specified as the policy instrument that countries are expected to use, rather than fiscal policy. Even if fiscal policy is assumed to be no more subject to lags and political encumbrances than is monetary policy, there is another reason for assigning monetary policy to the nominal demand target. If countries also pursue trade balance targets (and it seems that they do, whether or not they should), then the classic "assignment problem" is relevant. The general rule is to assign responsiblity for the trade balance target to that policy instrument that has a relatively greater effect on it (Mundell, 1962). I agree with Boughton (1989) that under modern conditions of floating exchange rates, which work to decrease the effectiveness of monetary policy with respect to the trade balance and increase the effectiveness of fiscal policy, this means assigning fiscal policy to the trade balance target and monetary policy to the domestic target.

What is the precise instrument of monetary policy that should be adjusted when nominal demand drifts away from the target? The monetary base or level of unborrowed reserves would be better than the broader monetary aggregates because the central bank controls them more directly. (The short-term interest rate is another possible instrument.) McCallum (1988, 15) has

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[37] For attempts to evaluate empirically the stabilizing properties of the blueprint plan, see Miller and Williamson (1988) and Frenkel, Goldstein and Masson (1988, 33-49). Frenkel and Goldstein (1986) survey target zone proposals. Miller and Williamson also consider a floating rate regime and the McKinnon (1984) proposals to use monetary policy to target the aggregate money supply -- or in a later version the aggregate price level -- among the G-3 countries. McKibbon and Sachs (1988) also compare these regimes. As yet, I am not aware of empirical work evaluating the likely outcome if countries cooperatively set nominal GNP targets [and use monetary policy to attain them].

suggested a specific feedback rule in the context of closed-economy policy-making that might do well here. His proposal is that for each one per cent that nominal GNP deviates from its target in a given quarter, the monetary base be expanded an additional .25 per cent over the subsequent quarter. He suggests setting a trend growth rate in the target of 3 per cent per year, and subtracting from this the average growth rate of base velocity over the preceding four years. An alternative possibility would be to replace the 3 per cent target with "a number to be negotiated for each member of the G-7 each year, with a planned long-run tendency of 3 per cent."

The central bank would be better able to hit its annual nominal demand target if it was allowed to respond to other available information, besides just the most recent monthly figure for nominal demand itself. Ben Friedman (1984, 183-84), for example, shows that such indicators as the money supply and the stock of credit can be used to predict more accurately deviations from a nominal income target. Many other "leading indicators" could be added to the list. The conclusion seems to be that it would be better in practice to leave the means of attaining the nominal demand target up to the national authorities, rather than requiring that they follow a particular rule like McCallum's.

It might be objected that this entire discussion of coordination via INT has neglected important questions of the mix between monetary and fiscal policy, the real interest rate, and the exchange rate.[38] These questions

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[38] A related objection is that a plan for using monetary policy to target nominal GNP would have done little to prevent the major disequilibrium that arose in the early 1980s, the U.S. budget and trade deficits. But I agree with Feldstein (1983) that this disequilibrium was not a "coordination failure," that the U.S. Administration did not to any

are considered next.

III. POLICY INDEPENDENCE AND EXCHANGE RATE FLEXIBILITY

One measure of the degree of macroeconomic policy convergence among countries is the magnitude and variability of the real interest differential. Rogoff (1985c) for example shows that real interest rates are not perfectly correlated across European countries, and argues that this shows that European countries retain some policy independence. One question, posed by observers of the European Monetary System in particular, is whether such independence is attributable to capital controls and other remaining barriers to the free movement of capital across national boundaries, or whether it is attributable to exchange rate flexibility.[39]

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extent pursue the policies it did as a result of insufficient expansion by trading partners. Indeed the Administration did not even want Europe and Japan to expand, until after 1985. No international bargain would have brought about a U.S. fiscal correction. Only a recognition by the Administration and Congress of the link between their fiscal policies and the trade deficit (together with the political will necessary to make difficult budget choices) would have done so. By the same token, neither INT nor any other proposals for coordination should now be allowed to distract attention from the point that the most important policy changes to be made in 1989 can be made unilaterally by the United States. Such thoughts are supported by the findings in Frankel and Rockett (1988) and Frankel (1988) that the gains from coordination are usually smaller than the gains from the United States discovering the true model and unilaterally adjusting its policies accordingly.

[39] A number of authors, including Rogoff (1985c) and Giavazzi and Giovannini (1988), have pointed out that European plans to decrease both the remaining degree of exchange rate flexibility and the remaining level of barriers to financial integration may run into trouble, if the individual

III.A Financial Integration, Monetary Integration, and Independence

Frankel and MacArthur (1988) studied real interest differentials for 24 countries, from 1982 up to early 1987, and decomposed them into a component attributable to imperfect financial integration (the "country premium") and a component attributable to exchange rate variability (the "currency premium"). Table 1 shows real interest differentials for 25 countries, vis-a-vis the Eurodollar, updated through the beginning of 1988. [It is taken from Frankel (1989).] Both the mean of the differential and the measures of variability show substantial independence for each of the countries. Table 2 uses forward exchange rate data for each currency to separate out the covered interest differential, which represents the component due to imperfect financial integration. The covered interest differential is very small for the G-10 countries (including Switzerland) except for France and Italy, and is also very small for Austria, Singapore and Hong Kong. Even for the other countries, which often have significant barriers to international financial integration, the country premium is in most cases smaller than the currency premium. This says that for the major countries, and many others as well, exchange rate variability is a greater source of policy independence than is imperfect financial integration.

Different views are possible on whether or not policy independence makes for a more smoothly-running world economy. Corden (1983) argues that decentralized decision-making among countries is more efficient, because each country knows better its own situation. His is an argument in favor of

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countries are not ready to give up their remaining policy independence.

Table 1:
Interest Differential Less Realized Inflation Differential
September, 1982 to January, 1989

	1		2	3	4
	# of Obs.	Mean	Standard Error	Series Standard Deviation	Root Mean Squared Error	95% Band
Open Atlantic DCs						
Canada	63	0.09	0.38	2.09	2.09	3.96
Germany	63	-1.29	0.65	2.77	3.06	5.95
Netherlands	62	-0.71	0.86	3.91	3.97	7.63
Switzerland	62	-2.72	0.81	3.39	4.36	8.43
United Kingdom	63	0.46	0.79	3.45	3.48	5.69
Group	313	-0.83	0.66	3.16	3.46	
Liberalizing Pacific LDCs						
Hong Kong	62	-2.89	0.94	4.80	5.62	11.61
Malaysia	62	0.83	1.00	4.61	4.68	8.19
Singapore	61	0.08	0.68	3.33	3.34	6.71
Group	185	-0.67	0.82	4.28	4.62	
Closed LDCs						
Bahrain	60	2.19	1.46	7.10	7.44	12.93
Greece	56	-9.22	1.91	9.36	13.19	21.77
Mexico	62	-20.28	9.43	21.19	29.45	52.13
Portugal	61	-3.90	2.97	11.28	11.95	23.62
South Africa	61	-4.84	1.17	4.85	6.88	11.16
Group	300	-7.25	1.30	12.16	16.06	
Closed European DCs						
Austria	64	-2.20	0.83	3.84	4.43	7.32
Belgium	63	0.53	0.68	2.90	2.95	4.99
Denmark	61	-3.42	0.90	4.34	5.54	9.64
France	64	-0.48	0.72	2.94	2.98	5.54
Ireland	61	1.53	1.03	3.95	4.24	7.13
Italy	61	1.01	0.86	3.62	3.76	5.83
Norway	50	-0.64	0.84	3.23	3.29	6.83
Spain	63	0.53	1.44	5.92	5.95	11.90
Sweden	63	-0.21	1.07	4.52	4.53	8.28
Group	550	-0.37	0.81	4.00	4.29	
Liberalizing Pacific DCs						
Australia	60	1.16	0.90	3.69	3.87	7.43
Japan	63	-0.58	0.62	3.41	3.46	6.03
New Zealand	60	1.04	1.83	7.15	7.23	11.36
Group	183	0.52	0.73	5.00	5.09	
All Countries	1531	-1.74		6.47	8.07	

Table 2:
Interest Differential Less Forward Discount
September, 1982 to April, 1988

	1			2	3	4
	# of Obs.	Mean	Standard Error	Series Standard Deviation	Root Mean Squared Error	95% Band
Open Atlantic DCs						
Canada	68	-0.10	0.03	0.21	0.24	0.44
Germany	68	0.35	0.03	0.24	0.42	0.75
Netherlands	68	0.21	0.02	0.13	0.25	0.45
Switzerland	68	0.42	0.03	0.23	0.48	0.79
United Kingdom	68	-0.14	0.02	0.20	0.25	0.41
Group	340	0.14	0.01	0.21	0.34	
Liberalizing Pacific LDCs						
Hong Kong	68	0.13	0.03	0.28	0.31	0.60
Malaysia	63	-1.46	0.16	1.28	1.95	3.73
Singapore	64	-0.30	0.04	0.31	0.43	0.73
Group	195	-0.52	0.05	0.76	1.14	
Closed LDCs						
Bahrain	64	-2.15	0.13	1.06	2.41	4.17
Greece	58	-9.39	0.80	6.08	11.26	20.39
Mexico	43	-16.47	1.83	12.01	20.54	28.86
Portugal	61	-7.93	1.23	9.59	12.49	27.83
South Africa	67	-1.07	1.17	9.55	9.61	2.68
Group	293	-6.64	0.48	8.23	11.82	
Closed European DCs						
Austria	65	0.13	0.05	0.39	0.41	0.39
Belgium	68	0.12	0.03	0.26	0.29	0.59
Denmark	68	-3.53	0.19	1.57	3.89	6.63
France	68	-1.74	0.32	2.68	3.20	7.18
Ireland	66	-0.79	0.51	4.17	4.24	7.80
Italy	68	-0.40	0.23	1.92	1.96	4.11
Norway	50	-1.03	0.11	0.76	1.29	2.10
Spain	67	-2.40	0.45	3.66	4.39	7.95
Sweden	68	-0.23	0.06	0.45	0.51	0.81
Group	588	-1.10	0.09	2.25	2.77	
Liberalizing Pacific DCs						
Australia	68	-0.75	0.23	1.94	2.08	2.59
Japan	68	0.09	0.03	0.21	0.23	0.43
New Zealand	68	-1.63	0.29	2.42	2.92	5.24
Group	204	-0.76	0.12	1.78	2.06	
All Countries	1620	-1.73	0.09	3.81	5.36	

the current floating-rate system. McKinnon (1988), on the other hand, takes it for granted that world economic efficiency requires that real interest rates be equalized across countries [presumably so that the marginal product of capital is equalized across countries]. His is an argument in favor of reform of the system so as to reduce exchange rate variability.

III.B A Proposal for Beginning to Stabilize Exchange Rates: The "Hosomi Fund"

Would-be reformers of the world monetary system have a choice. If they wish to allow each country enhanced policy independence, they can seek to decrease the degree of financial market integration. Alternatively, like McKinnon (1983, 1988) and Williamson (1983), they can opt for increased policy convergence and exchange rate stability. [Frenkel, Goldstein and Masson (1988) refer to a choice between decreasing the demand for policy coordination and increasing the supply.] Frankel (1988b) considers one of the most-mentioned proposals for decreasing the degree of financial integration, the "Tobin tax" on foreign exchange transactions. Here I discuss another particular proposal that others have made for stabilizing exchange rates.[40]

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[40] Dornbusch and Frankel (1988) discuss ten proposals for world monetary reform. Four entail decentralized policy rules: new classical fatalism, a gold standard, national monetarism, and national nominal income targeting as discussed in section IIA. Four foresee enhanced coordination: the G-7 indicators as discussed in section Part IIB, Williamson's target zones, McKinnon's "world monetarism," and the Hosomi Fund. Two propose enhanced independence: the Tobin tax on transactions and the Dornbusch proposal for a dual exchange rate.

Several years ago, Takashi Hosomi (1985) proposed the creation of a new supranational fund that could intervene in foreign exchange markets. The Japanese Vice-Minister of Finance for International Affairs, Toyoo Gyoten, has recently floated precisely this sort of proposal.[41] Some recent talk of a European Central Bank, heard both in official and academic circles, strikes a similar note.[42]

The proposal envisions a fund that could undertake operations in the open international markets, but would not replace the individual countries' central banks. A plausible motivation for this approach is precisely the one presented in the Introduction to this paper: the need for proposals for monetary reform that are politically practical in that they could begin on a very small scale, gradually build up confidence among the players, and then increase the scale of coordination accordingly. In this case, the size of the fund constitutes the variable that would begin with a small "epsilon" and subsequently increase to reflect however much political consensus exists.

Decisions could be made by an "Open Market Committee" consisting primarily of representatives of the individual central banks, with votes presumably awarded in proportion to the size of their economies or the size

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41 "A New Collar for Currency Markets," The International Economy, May/June 1988, pp.36-38. (See also Wall Street Journal, September 25, 1987, p.22.)

42 In the case of Europe, it seems that a unified currency is the ultimate goal (and a strengthened role for the ecu is considered the first step). In August 1988, a European Community summit meeting agreed to establish a committee that would study creation of a monetary union and to examine the issue at a Madrid meeting scheduled for June 1989. See Casella and Feinstein (1988) for a theoretical analysis.

of their contribution of international reserves to the fund, as is the case with the International Monetary Fund, but with operations decided by a median voter rule. [The Bank for International Settlements could also serve as a model; indeed it is conceivable that an expanded BIS could serve, in place of founding yet another international institution.] In the event that France, say, wishes to dampen depreciation of the franc against the dollar but is outvoted by a majority in favor of dollar purchases, the Bank of France is still free to intervene in the opposite direction on its own. Countries will at first be giving up very little sovereignty when they agree to the establishment of such a fund because it will be on a small scale. Only if all parties are happy with the outcome would the size of the portfolio — and therefore the potential loss of national sovereignty — be increased.

III.C Conclusion

This paper has examined two possible reforms of the world monetary reform. Both are designed so as to try to overcome the serious obstacles to successful coordination that are outlined in section II.B. In particular, both are designed in such a way that they can begin on a small scale, and then grow as the degree of political consensus grows.

The INT proposal is the appropriate one if the shortcoming of the Nash noncooperative equilibrium is thought to be either insufficient or excessive expansion. The Hosomi proposal is the appropriate one if the shortcoming is thought to lie with the exchange rate. The question arises whether the two are compatible, whether they can be implemented simultaneously if the

noncooperative equilibrium is thought to be characterized by both sorts of shortcomings.

If the Hosomi Fund is foreseen to affect exchange rates only via changes in money supplies, and monetary policy is also foreseen to be the instrument whereby countries attain their nominal demand targets, it might seem that there is an overdeterminacy in the system. But I am not sure that there is in fact a problem. There are some obvious policy instruments that would introduce extra degrees of freedom into the system: the Hosomi Fund's intervention could be non-sterilized, thus changing the international supplies of bonds rather than supplies of money, or the countries could use fiscal policy alongside monetary policy to attain their nominal demand targets.

Even if money supplies are the only available policy instruments, there are n money supplies to be determined and n national opinions as to what they should be. So it sounds like there is no overdeterminacy problem. At any given time, the median voter on the International Open Market Committee will simply receive extra weight in determining what the money supplies will be. It is true that if the median voter wants the fund to buy a particular currency to increase its exchange value, at the same time that the country in question is obligated to increase its monetary base in order to correct slower-than-targeted growth in its nominal GNP, then the country will be put in an untenable position. It seems unlikely that the Open Market Committee would choose to "pick on" a particular member in this way. But this is merely speculation at this stage. It would be desirable for future research to study the implications of such a Hosomi Fund with a median voter rule, just as it would be desirable for future research to study a regime of

cooperative ex ante setting of nominal demand targets. This paper has only tried to point the way, with an examination of some advantages of these two approaches.

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APPENDIX

In this appendix we compare four possible policy regimes: (1) floating exchange rates, with full discretion by national policy-makers (the current regime), (2) a rigid money supply rule, (3) a rigid nominal GNP rule, and (4) a rigid exchange rate rule. [In the case of each of the three possible nominal anchors, proponents sometimes have in mind a target zone system; the assumption of a rigid rule just makes the analysis simpler.] The approach, incorporating the advantages both to rules and discretion, follows Rogoff (1985b) and Fischer (1988a), who in turn follow Kydland and Prescott (1977) and Barro and Gordon (1983).

Throughout, we assume an aggregate supply relationship:

(A1) $y = y^* + b(p-p^e) + u,$

where y represents output, y* potential output, p the price level, p^e the expected price level (or they could be the actual and expected inflation rates, respectively), and u a supply disturbance, with all variables expressed as logs.

Output and the Price Level in the Objective Function

We begin without the exchange rate. The loss function is simply:

(A2) $L = a\,p^2 + (y - ky^*)^2$,

where a is the weight assigned to the inflation objective, and we assume that the lagged or expected price level relative to which p is measured can be normalized to zero. We impose $k > 1$, which builds in an expansionary bias to discretionary policy-making.

(A3) $L = a\,p^2 + [y^*(1-k) + b(p-p^e) + u]^2$.

1. Discretionary policy

Under full discretion, the policy-maker each period chooses Aggregate Demand so as to minimize that period's L, with p^e given.

(A4) $(1/2)\ dL/dp = ap + [y^*(1-k) + b(p-p^e) + u]b = 0$.

(A5) $p = [-y^*(1-k)b + b^2p^e - bu] / [a+b^2]$.

Under rational expectations,

(A6) $p^e = Ep = -y^*(1-k)b/a$.

So we can solve (A5) for the price level:

(A7) $p = -y^*(1-k)[b/a] - u\,b/[a+b^2]$.

From (A2), the expected loss function then works out to:

(A8) $EL = (1 + b^2/a)[y^*(1-k)]^2 + [a/(a+b^2)]\ var(u)$.

The first term represents the inflationary bias in the system, while the second represents the effect of the supply disturbance after the authorities have chosen the optimal split between inflation and output.

2. Money rule

To consider alternative regimes, we must be explicit about the money market equilibrium condition. (In case 1, it was implicit that the money

supply m was the variable that the authorities were using to control demand.)

(A9) $m = p + y - v$,

where v represents velocity shocks. (We assume v uncorrelated with u.) If the authorities pre-commit to a fixed money growth rule in order to reduce expected inflation in long-run equilibrium, then they must give up on affecting y. The optimal money growth rate is the one that sets Ep at the target value for p, namely 0. Thus they will set the money supply m at Ey, which in this case is y*. The Aggregate Demand equation thus becomes

(A10) $p + y = y^* + v$.

Combining with the Aggregate Supply relationship (A1), the equilibrium is given by

(A11) $y = y^* + (u + bv)/(1+b)$, $\quad p = (v - u)/(1+b)$.

Substituting into (A2), the expected loss function is

(A12) $EL = (1-k)^2 y^{*2} + ((1+a)\text{var}(u) + [a+b^2]\text{var}(v))/(1+b)^2$.

The first term is smaller than the corresponding term in the discretion case, because the pre-commitment reduces expected inflation; but the second term is probably larger, because the authorities have given up the ability to respond to money demand shocks. Which regime is better depends on how big the shocks are, and how big a weight (a) is placed on inflation-fighting.

3. Nominal GNP rule

In the case of a nominal GNP rule, the authorities vary the money supply in such a way as to accommodate velocity shocks. (A10) is replaced by the condition that p + y is constant. The solution is the same as in case 2, but with the v disturbance dropped. Thus the expected loss

collapses from (A12) to:

(A13) $EL = (1-k)^2y^{*2} + [(1+a)/(1+b)^2]var(u)$.

This unambiguously dominates the money rule case. It is still not possible, without knowing var(u) or (a), to say that the rule dominates discretion. It is quite likely, especially if the variance of u is large, that an absolute commitment to a rule would be unwisely constraining. Hence the argument for a target zone rather than a single number, and for subjecting the Central Bank Chairman to a mere loss of reputation if he misses the target rather than a firing squad. But it seems clear that, to whatever extent the country chooses to commit to a nominal anchor, nominal GNP dominates the money supply as the candidate for anchor.

Adding the Exchange Rate to the Objective Function

We reconsider here a likely objection to choosing nominal GNP or nominal demand as the focus of international coordination, that it neglects the exchange rate. The alternative of setting monetary policy so as to stabilize the exchange rate will not look attractive unless the exchange rate enters the objective function, perhaps indirectly via the consumer price index or the trade balance. Here we confront the argument head-on, and include the exchange rate directly in the loss function along with output and the price level. Thus we replace (A2) with:

(A14) $L = a\,p^2 + (y-ky^*)^2 + c\,s^2$,

where s is the spot exchange rate measured relative to some equilibrium or target value and c is the weight placed on exchange rate stability per se.

There is no point in specifying an elaborate model of the exchange rate.

All the empirical results say that most of the variation in the exchange rate cannot be explained (even ex post; we say nothing of prediction) by measurable macroeconomic variables, and thus can only be attributed to an error term that we here call e. But we must include the money supply in the equation; otherwise we do not allow the authorities the possibility of affecting the exchange rate. Our equation is simply:

(A15) $s = m - y + e$.

(We assume that e is uncorrelated with the other disturbances.)

From (A9),

(A16) $s = p - v + e$.

We assume that the same Aggregate supply relationship holds as before, equation (A1).

So we can write the loss function (A14) as:

(A17) $L = ap^2 + [(1-k)y^* + b(p-p^e) + u]^2 + c(p-v+e)^2$.

We proceed as before to consider possible regimes.

1. Discretion

$$(1/2)dL/dp = ap + [y^*(1-k) + b(p-p^e) + u]b + c(p-v+e) = 0.$$

(A18) $p = [-y^*(1-k)b + b^2p^e - bu + c(v-e)] / [a+b^2+c]$.

The rationally expected p is given by $p^e = Ep$:

(A19) $p^e = -(1-k)by^*/(a+c)$.

Substituting into (A19) yields:

(A20) $p = -(1-k)y^*[b/(a+c)] + [c(v-e)-bu]/[a+b^2+c]$.

The loss function is

(A21) $EL = [(1-k)y^*]^2 (a+b^2+c)/(a+c) +$

$\{(a+c)\text{var}(u) + c(a+b^2)[\text{var}(v) + \text{var}(e)]\}/(a+b^2+c)$.

2 Money rule

As when we considered a money rule before, so that expected inflation is zero the authorities set m at y*, and (A10) applies. Thus the same solution (A11) for y and p also applies. The exchange rate is given by substituting the solution for p from (A11) into (A16):

(A22) $s = e - [(u+bv)/(1+b)]$

The additional s term is the only difference from (A12) in the expected loss function:

(A23) $EL = [y^*(1-k)]2 + [(1+a+c)/(1+b^2)]var(u) +$

$[(a+b^2+cb^2)/(1+b)^2]var(v) + [c]var(e).$

Again the comparison with discretion depends on the various magnitudes.

3 Nominal GNP rule

When the monetary authorities are able to vary m so as to keep p + y constant, the velocity shocks v drop out. The expected loss function becomes

(A24) $EL = [y^*(1-k)]2 + [(1+a+c)/(1+b)^2]\ var(u) + c\ var(e).$

As before, the nominal GNP rule unambiguously dominates the money rule.

In practice the e shocks in the exchange rate equation are very large. They certainly dwarf the u shocks in the aggregate supply equation. (The exchange rate often moves ten per cent in a year, without corresponding movements in the money supply or other observable macroeconomic variables; try to imagine similar movements of real output.) If the weight c on the s target is substantial, then the last term in the expected loss equation may be important.

4 Exchange rate rule

Again, the authorities can't affect y in long-run equilibrium. But now it is the exchange rate that they peg in such a way that $Ep = 0$, which from (A16) is $s = 0$. The ex post price level is then given by

(A25) $p = v - e$.

From (A1),

(A26) $y = y^* + b(v-e) + u$.

From (A14),

(A27) $EL = (a+b^2)Var(v-e) + [y^*(1-k)]^2 + Var(u)$.

The coefficient on var(e) is $(a+b^2)$, as compared to the coefficient c in the expected loss (A24) under the nominal GNP rule. We made the point above that e shocks in practice dwarf u shocks. Reasoning on this basis, even if v shocks are also small and a=c (the objective function puts no greater weight on a 10 per cent fluctuation of the price level than on a 10 per cent fluctuation of the exchange rate), which is extremely conservative, the expected loss from fixing s is greater than the expected loss from fixing nominal GNP. The reason is that under an exchange rate rule e shocks are allowed to affect the money supply and therefore the overall price level. Once we allow for v shocks (which are probably in between u and e shocks in magnitude), the case for nominal GNP targeting is even stronger. One would have to put extraordinarily high weight on the exchange rate objective to prefer an exchange rate rule.

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