

The Obstacles to Macroeconomic Policy Coordination,
with an Analysis of International Nominal Targeting
(INT)

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Abstract

The paper reviews the recent history of international macroeconomic policy coordination, including examples of three sorts of obstacles to successful coordination: the difficulties of, respectively, compliance, credibility, and certainty. It is argued that nominal-GNP targeting has the best chance of overcoming such obstacles as compared, in particular, to money-targeting. The McKibbin Sachs Global model is used to evaluate an internationally coordinated version of nominal GNP targeting, in the presence of shocks in oil prices, money demand, and goods demand.

The world has seen three phases of international economic policy-making, since the postwar system of fixed exchange rates and U.S. economic hegemony came unravelled in 1973. First, in the 1970s, the prevailing model was Keynesian and the prevailing wind from Washington urged joint worldwide expansion in line with the "**locomotive theory.**" Germany and Japan eventually succumbed to these urgings in 1978 when they agreed to undertake some expansion at the Bonn Summit. But by 1980, worldwide inflation had reached such high levels that the Keynesian model, the locomotive theory, and the Bonn Summit -- indeed, even coordination itself -- had all acquired "bad names".

The second phase, 1980-1984, constituted the **triumph of monetarism.** By the beginning of the 1980s, the Central Banks of the United States, the United Kingdom, Germany, Switzerland and Japan had all largely accepted the monetarist prescription of pre-committing to a fixed rate of growth of M1 or some other monetary aggregate, in an effort to stop inflation. Supporting the switch in emphasis was the accession to power of Margaret Thatcher in Britain in 1979, Ronald Reagan in the U.S. in 1981, and Helmut Kohl in Germany in 1982.

It is perfectly possible for one to be a monetarist and yet favor the international coordination of policy and

management of exchange rates, as Ronald McKinnon shows us. Nevertheless, the monetarist view that in fact dominated was the anti-coordination one that came from Milton Friedman: each country chose its own independent macroeconomic policies, and the market was allowed to determine exchange rates with little or no guidance from policy-makers. During the first Reagan Administration (1981-1984), the United States insisted that this decentralized system, which extended the laissez-faire principles of microeconomics to the platform of global macroeconomic policy-making, worked the best. Other trading partners had their doubts, but could do nothing toward coordination without American participation.

If the inflation problem torpedoed the plans of the 1970s, then the overvaluation of the dollar and the resulting U.S. trade deficit torpedoed the plans of the early 1980s. If excessive monetary expansion was identified as the cause of the problem of the 1970s, then the unusual U.S. monetary/fiscal policy mix and resulting high real interest rates was identified as the cause of the problems of the early 1980s. If the passing of Democrat and Labor governments at the end of the 1970s facilitated the triumph of monetarism, the transition to the next phase in 1985 was a simpler matter of the turnover of some key officials in the U.S. Treasury.

The anti-cooperativeness and monetarism of Donald Regan and Beryl Sprinkel gave way to the pragmatism of James Baker and Richard Darman.

The G-7 Coordination Mechanism

The third phase, **G-7 coordination**, was inaugurated at a meeting of Finance Ministers, at the Plaza Hotel in New York in September 1985. At the time, the membership was confined to the traditional G-5 -- the U.S., Japan, Germany, France and the United Kingdom -- and the focus was on exchange rates. (The meeting produced the "Plaza Accord," under which the United States agreed to cooperate with the others in bringing down the value of the dollar). At the G-7 Summit Meeting the next year in Tokyo, the heads of state agreed to expand the membership of the G-5 Finance Ministers' meetings to include Canada and Italy, and to expand the list of "objective indicators" that the Ministers would focus on. Thenceforth the G-7 would focus in their meetings on a set of 10 variables: the growth rate of GNP, the interest rate, the inflation rate, the unemployment, the ratio of the fiscal deficit to GNP, the current account and trade balances, the money growth rate, international reserve holdings, and the 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." This language would seem to suggest that the indicators were not intended to be merely national forecasts, that the system was intended to include some substantive bargaining over policies, rather than only the exchange of information.

The list of indicators 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 apparently been reduced to six indicators: growth, inflation, trade balances, government budgets, monetary conditions, and exchange rates.¹

Treasury 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."

The G-7 coordination process seems to be stalled in the 1990s. It is not clear what cooperative macroeconomic tasks the existing G-7 body will be called upon to accomplish in the 1990s.

In what direction will it be desirable for the G-7 to agree to move the macroeconomic policies of its members? The desirable direction for coordination depends entirely on what "public good" is missing from the world equilibrium. International spillover effects can render the noncooperative ("Nash") equilibrium unsatisfactory in a variety of ways. A prime example is when the world is in a recession due to inadequate demand, with each country afraid to expand on its own for fear that its trade balance will deteriorate. Then, if they agree to expand simultaneously, they can attain higher levels of output and employment without any one partner suffering a deterioration in its trade balance. This was the logic behind the locomotive theory put forward by the United States at the Bonn Summit in 1978.

The locomotive theory can be illustrated as a game between national policymakers, which we refer to as the game of "Exporting Unemployment." Consider two countries, the

United States and Europe. Each must decide whether or not to follow expansionary demand policies. Table I shows the four possible outcomes. If Europe has a trade balance objective, it will be reluctant to expand, for fear that the U.S. will be less expansionary and leave Europe with a trade deficit. Similarly, the United States will be reluctant to expand, for fear that Europe will be less expansionary and leave the U.S. with a trade deficit. The result is that each country will hold back its level of demand, in an effort to improve its trade balance at its neighbor's expense. This policy is self-defeating when the countries try it simultaneously, plunging the world into a recession where everyone loses. This non-cooperative equilibrium occurs in the first cell of the table.

A particular variety of the Exporting Unemployment game, called "Competitive Depreciation," arises when fiscal policy is the tool used and exchange rates are floating. Then each country has an especially strong temptation to contract, because a fiscal contraction will lower interest rates, cause its currency to depreciate, and provide further improvement in its trade balance at its neighbor's expense. This is known as a "beggar-thy-neighbor" policy.

The solution to the "Exporting Unemployment" problem is

the Locomotive Strategy: both countries should agree to expand simultaneously (whether by means of fiscal policy, or some combination of fiscal and monetary policy), so that output is higher everywhere with no change in the trade balance. This is represented by a movement from the noncooperative first cell in Table I, to the cooperative last cell.

Figure 1 shows the more complete analysis of the "Exporting Unemployment" game that is relevant when each country has a continuous range of macroeconomic expansion or contraction from which to choose, as opposed to the simple choice presented in Table I (expand vs. contract). Each country prefers to leave the expansion to the other. The two countries' reaction lines intersect at the Nash non-cooperative equilibrium, point *N*. Coordination consists of a cooperative decision to undertake joint expansion, moving to the "bargaining" equilibrium, *B*, where both attain higher levels of welfare.

Other games are possible as well. An opposite sort of example is when the Nash non-cooperative equilibrium is overly inflationary, with no single leader willing to accept the role of supplying the "public good" of a currency that is stable in purchasing power. This is often thought to be the logic that originally lay behind the founding of the European Monetary

System. Yet another possibility is the game of "competitive appreciation," described in Appendix 1.²

While it is not clear whether the 1990s will require coordinated expansion or coordinated discipline, I believe that it is clear that the present G-7 mechanism is in some ways not well-designed to respond to future developments. The current mechanism of coordination is vulnerable to serious obstacles of three sorts: compliance, inflation-fighting credibility, and uncertainty. These obstacles are so severe that, if the system is not improved, the institution of international coordination is as likely to make the world economy worse-off as better-off.³

Three Obstacles to International Macroeconomic Policy Coordination

The first obstacle to successful and meaningful coordination is the difficulty of ensuring compliance. In terms of Table I, each country, if it takes the other's policy as given, has an incentive to "defect" by following a restrictive policy and leaving the burden of expansion to the other. They seek to move from the last cell of the Table to an off-diagonal cell. In terms of Figure 2 the United States, for example, has an incentive to move unilaterally downward

from point *B* toward its reaction line, at point *C*. Of course, cheating only succeeds until the other country retaliates, and we are back in the non-cooperative equilibrium.

If the member countries make commitments to attainable macroeconomic targets that can be monitored -- which requires that they be explicit, measurable, and preferably public -- then they are unlikely to cheat on them. The theory of reputations can be used to show why. But problems arise when commitments cannot be unambiguously monitored. Under the current system, the presence of so many different indicators on the G-7 list, the vagueness as to whether these variables are in fact forecasts, goals or commitments, and the secrecy surrounding the whole procedure, all imply that substantive enforceable agreements are unlikely to emerge from G-7 meetings.

A primary drawback of 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. Thus the national authorities will feel little constraint on their setting of policy instruments; they can always find at least one indicator to justify the course action that they prefer to take.

The next drawback is that on the G-7 list no distinction is made as to whether the variables are forecasts, goals, or commitments. It is difficult to imagine a G-7 meeting, for example, applying moral censure to one of its members for having experienced a lower rate of inflation during the year than had been agreed upon in the preceding meeting, or a higher rate of real growth. The third drawback of the G-7 list is that explicit targets are not made public. 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) if the targets are kept secret?

To take an example, in the Baker-Miyazawa Agreement reached in San Francisco in September 1986 [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 fully living up to the agreement. (The episode is described by Funabashi.) But it was difficult for anyone to verify the extent of compliance, because the precise terms of the

original agreement had not been public.

The second danger that threatens the success of coordination efforts is the risk that cooperative agreements will be biased in favor of expansion, with the result that high inflation rates will re-emerge. The argument is that if governments set up the machinery for joint welfare maximization period-by-period, the cooperative equilibrium in each period is likely to entail a greater degree of expansion than the Nash non-cooperative equilibrium, as countries lose the inhibitions of worsened trade balances. Governments may find this joint expansion advantageous within any given period, but in the long run it will undermine the governments' inflation-fighting credibility and result in a higher inflation rate for a given level of output. In this view (developed by Kenneth Rogoff⁴), renouncing the machinery of coordination is one of the ways that governments can credibly pre-commit to less inflationary paths.

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 monetary or **nominal**

anchor on a longer term basis. There are four nominal variables on the G-7 list of indicators: the money supply, the price level, the price of gold, and the exchange rate. We must develop grounds for choosing among candidates for the nominal variable around which coordination should focus.

To review our conclusions so far, the compliance problem suggests that coordination should involve an explicitly-agreed and publicly-announced intermediate target. The inflation-fighting credibility problem suggests that the intermediate target to which the governments commit should be a nominal variable. There exists a third obstacle to successful coordination, uncertainty, and it leads to the suggestion that the nominal intermediate target to which the countries should best commit is one that does not even appear on the current G7 list at all: nominal GNP.

Uncertainty makes it difficult for each country to know what policy changes are in its interest. This difficulty arises whether the uncertainty centers on the initial position of the economy (the "baseline forecast"), the desired policy targets (e.g., full employment), or the changes in monetary and fiscal policy necessary to produce desired effects (the multipliers). All three kinds of uncertainty, which are

explored in more detail in the next section, make it difficult for each country in the bargaining process to know even what policy changes it should want its partners to make. A number of pessimistic conclusions emerge. Given differing perceptions, the policy-makers may not be able to agree on a coordination package; and even if they do agree, the effects may be different from what they anticipated.⁵

The standard German view of the joint expansion agreed upon at the 1978 Bonn Summit is that it turned out to have been undesirable, because by 1980, as we have seen, the priority had shifted back to fighting inflation. One possible way to think of this view is as an example of uncertainty about the baseline position of the economy relative to the optimum: the 1979 oil price increase associated with the crisis in Iran moved the world economy to a more inflationary position than had been anticipated at the time of the Summit.

Another way to think of it is as an example of disagreement over the correct model. In the model that the representatives of the United States and some smaller countries have in mind, a monetary expansion can raise output and employment, whereas in the Germans' model monetary expansion simply goes into prices.

Compliance can always be a problem for coordination, as

noted above, because each country stands to benefit in the short run by deviating from an agreement and leaving its trading partners to carry the burden. But the problem is particularly great in the presence of uncertainty. This is true for two reasons. First, it is difficult to verify compliance if the "performance criteria" that are used to monitor compliance are not directly enough under the control of the authorities, because they can always claim plausibly that failure to meet the targets that they agreed to was not their fault. For this reason, the inflation rate or price level is not a good candidate to be the nominal target to which countries commit. Secondly, a country may end up regretting ex post the target that it agreed to ex ante if it is not directly enough related to the goals that it ultimately cares about. For this reason, the money supply is not a good candidate to be the nominal target to which countries commit.

A country that commits to a narrow range for the money supply will regret it if there is a shift in velocity.

To take an example from U.S. 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. [They did not publicly admit that they had abandoned monetarism until several years later.] M1 grew

10.3 per cent per year from 1982:II to 1986:II. 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 increasing 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!

Three Kinds 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? (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:

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

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

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

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

$$(2^*) \quad dW^*/dm = (y^*)y_{m^*}^* + w_{x^*}^*(x^*)x_{m^*}^* + w_{p^*}^*(p^*)p_{m^*}^*$$

$$(3^*) \quad dW^*/dg = (y^*)y_{g^*}^* + w_{x^*}^*(x^*)x_{g^*}^* + w_{p^*}^*(p^*)p_{g^*}^*$$

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

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

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 .¹ Position uncertainty in turn breaks down into three parts: (a) uncertainty about the current value of the target variable in question²; (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";³ and (c) uncertainty as to the location of the

¹ Uncertainty about the position where the economy would be in the absence of policy changes is the same thing as uncertainty regarding the disturbance terms in the model of the economy, such as the disturbances in Appendix 2 to this paper. The Appendix, though it considers uncertainty in an open economy, deals only with a country's unilateral policy-making problem. In this section we are considering the problems that uncertainty creates for coordination per se.

² 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.

³ Kenen and Schwartz (1986) have studied the accuracy of

optimum value of the target variable.⁴

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.

Let us return to the historical example of the 1978 Bonn Summit. In the late 1970s the U.S. policy-makers, looking at the available economic data, concluded that insufficient

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).

⁴ Economists disagree as to the correct estimate of the natural rate of unemployment or the level of potential output, for example.

growth in the world economy was the problem of the time. This assumption was the basis of the 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 promoting real growth. A natural way of interpreting the view -- widely held in Germany at least -- that the results of the Bonn-coordinated 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.⁵

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.⁶ This issue is even more subjective than the issue of the optimal values

⁵ 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.

⁶ 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.

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 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 two years later, 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.⁷

It is possible to illustrate the potential range of multiplier estimates in some detail. In an exercise conducted at the Brookings 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.⁸ The models participating were the Federal Reserve Board's Multi-Country Model, the European Economic Community's Compact model, the Japanese Economic Planning

⁷ The German view that the 1978 Bonn Summit entailed joint reflation which, in retrospect, was inappropriate has been used above to illustrate two possible kinds of uncertainty: 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).

⁸ See the volume edited by Bryant et al (1988).

Agency model, Project Link, Patrick Minford's Liverpool Model, the McKibbin-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.⁹ The greatest amount of disagreement

⁹ For example, if capital mobility is sufficiently low and a depreciation of the domestic currency is contractionary for the foreign country.

occurs, rather, on the effect of a monetary expansion on the domestic current account, and 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.¹⁰] 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), we use 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

¹⁰ A reduction in interest rates causes a net capital outflow which, under a floating exchange rate, implies an increase in the current account balance.

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 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.

Thus, even assuming that there are no problems of enforcement and no intertemporal problems of inflation-fighting credibility, 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 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 turns out to have a

different effect on domestic output than expected.

The Proposal for Nominal GNP-Targeting

It can be argued that, whatever the degree of precommitment to a nominal target, nominal GNP makes a more suitable target than the other nominal variables that have been proposed. The general argument has been made well by others.⁶ 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. In general, unless one believes that precisely equal weights should be placed on the two objectives of stabilizing 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. The inflation rate is too far outside

the direct control of the authorities; the money supply is too distantly related to the price level, output, or other objectives; and the exchange rate and the price of gold are too distant both from the control of the authorities and from the objectives.

An Appendix 2 to this paper considers the problem formally, for the special case where the objective function puts equal weight on percentage variation in output and variation in the inflation rate. We make no judgment on the desirable degree of pre-commitment to a nominal target, so long as it is greater than zero and less than infinity.⁷ But the Appendix 2 shows that if the central bank does commit to a nominal target, nominal GNP (or nominal demand) makes a more suitable target than the other nominal variables that have been proposed. [The Appendix in Frankel (1989) shows that a nominal GNP target also dominates an exchange rate or price-of-gold target (unless extraordinarily high weight is placed on the objective of stabilizing the exchange rate or price of gold).]

The model of the economy to which the Appendix 2 applies nominal GNP targeting is greatly oversimplified, consisting as it does of only one country and essentially only two equations (aggregate supply and money market equilibrium). It is able

to show that targeting nominal GNP is superior to targeting the money supply, under fairly general conditions. But, in the absence of a full parameterized model, the Appendix does not contain enough information to choose between a targeting rule and discretion.

Warwick McKibbin and I have begun to apply the McKibbin-Sachs Global model to these problems. Appendix 3 describes simulation results comparing nominal GNP targeting and other regimes. Nominal GNP targeting comes out fairly well.

The Proposal for Coordination by International Nominal Targeting (INT)

The version of nominal-GNP targeting that we have evaluated in this paper is a restricted one. As with the version of money supply targeting that was evaluated, it was assumed that the countries eternally fixed their rate of nominal growth. There was no sense in which the setting of nominal GNP reported in Table 4 was cooperative, unless one wished to think of the simultaneous decision by the U.S., Japan and Germany to switch to a nominal GNP rule to be a coordinated decision. In the case considered in Table 3, where the countries did coordinate, we assumed that the jointly-optimizing policy could be chosen after all

disturbances occurred, so that it was immaterial whether the countries chose to express the cooperative policy settings in terms of money supplies, nominal GNPs, or ultimate objectives.

I have proposed a cooperative international version of a nominal-GNP rule that I call INT, for International Nominal Targeting, which is intended to be robust with respect to disturbances that occur after a cooperative agreement is set.⁸

According to the proposal, at each G-7 meeting, the national authorities would (a) loosely commit themselves to broad target ranges for their collective and individual rates of growth of nominal demand, for five years into the future, and (b) commit themselves to somewhat narrower targets for the coming year. It would be up to each country how to attain the target to which it committed, though the tools of monetary policy must presumably take precedence over the tools of fiscal policy for purposes of short-run adjustments. The targets would be publicly announced, in the manner that the Chairman of the Federal Reserve Board announced to the U.S. Congress target ranges for the M1 money supply until recently. 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.⁹

The next step in future research is to add to the list of

regimes the cooperative setting of nominal GNPs and the cooperative setting of money supplies. This could be done both using the theoretical context of the Appendix 2 and using the simulation approach of the MSG model.

To study cooperative setting of targets, in a way that is meaningfully distinct from cooperative discretion, requires that we have the sort of long-lasting disturbances studied here that push the world economy away from its optimum goals, which governments then respond to in a discretionary way (with or without coordination), but also that we have subsequent short-term disturbances in addition. Only if there are disturbances subsequent to the cooperative agreement will it make a difference whether the decisions that are made at the first stage are expressed in terms of nominal GNP, the money supply, or some other variable. [The option of having the precise coordinated policies conditional on the revealed second-stage disturbances is assumed to be not a practical option at all. For a government's commitment to be credible vis-a-vis its partners in international cooperation, it must be explicit and observable. There may be an analogy here with the inadmissability of a government's attempt to commit to a low-inflation policy when it is not credible vis-a-vis the public because it is not time-consistent.] The goal would be

to show, when the long-term situation is one of recession for example, that if the G-7 wish to reap the potential benefits of joint expansion, they are better off seeking to do so by agreeing on expansion in terms of nominal GNP than in terms of M1, because the former strategy is much more robust to possible future disturbances.

Appendix 1: The Competitive Appreciation Game

Under a system of floating exchange rates, one possibility is the game of "Competitive Appreciation" [the opposite of the "Competitive Depreciation" game]. It is illustrated in Table II. This game depends on the assumption that each country has as an ultimate objective, in addition to high output and employment, low inflation as measured by the CPI. It can, of course, be difficult to attain both of these objectives simultaneously. But there is a trick whereby a country can attain both objectives, to keep the overall CPI stable even if output is growing rapidly and thereby putting upward pressure on the prices of domestically produced goods.

The trick is to appreciate the currency, for example through a combination of tight monetary policy and loose fiscal policy that drives up interest rates and makes the country's assets attractive to international investors. The point is that the strong currency will reduce the prices of imports, when expressed in domestic currency. To the extent that imports have a share in the CPI, the overall inflation rate can be kept down, even if the prices of domestic goods are rising. Some economists have attributed such a motive to the U.S. government's adoption of its 1980s policy mix of tight money

and loose fiscal policy.¹¹

Notice however that this trick can only be brought about at the expense of the country's neighbors, by "exporting inflation." If the first country experiences an appreciation and downward pressure on its CPI, then its neighbors are experiencing depreciation and upward pressure on their CPIs. The noncooperative equilibrium again appears in the first cell of Table II. Both countries are keeping interest rates high in unsuccessful attempts to appreciate their currency. The result is worldwide recession. The solution is for both to agree simultaneously to lower interest rates. Then they can attain stronger economies with no adverse effect on their exchange rates or CPIs.

A more permanent solution to problems of competitive appreciation or depreciation would be for the countries to agree to a system of fixed exchange rates. Then the leaders do not have to get together to negotiate over specific macroeconomic policies. Perceptions that competitive depreciation had helped prolong the Depression of the 1930s were a major reason why the delegates to the Bretton Woods

¹¹ Jeffrey Sachs, "The Dollar and Policy Mix: 1985," Brookings Papers on Economic Activity 1, 1985: 117-86.

conference of 1944 chose a system of fixed exchange rates for the postwar international monetary system. In the language of the Articles of Agreement of the International Monetary Fund, the members agreed to refrain from manipulating thier exchange rates to seek "unfair advantage."

Table I: The Game of "Exporting Unemployment"

	United States contracts	United States expands
Europe contracts	Recession in both countries; $TB = 0$	TB favors Europe
Europe expands	TB favors U.S.	Boom in both countries; $TB = 0$

Table II: The Game of "Competitive Appreciation"

	U. S. raises interest rates, i	U.S. lowers interest rates, i
Europe raises i^*	Recession in both; no change in exchange rate or CPI	Dollar depreciates; U.S. import prices and CPI go up; European CPI down
Europe lowers i^*	Dollar appreciates; U.S. CPI down; European CPI up.	Boom in both countries; no change in ex- change rate or CPI

APPENDIX 2

In this appendix we compare three possible policy regimes: (1) full discretion by national policy-makers (taken to be the current regime), (2) a rigid money supply rule, and (3) a rigid nominal GNP rule. The approach, incorporating the advantages both to rules and discretion, follows Rogoff (1985b) and Fischer (1988a), who in turn follow Kydland and Prescott, and Barro and Gordon. [This problem is studied in a two-country world by Leder (1992).]

We assume an aggregate supply relationship:

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

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.

We represent economic welfare by a quadratic loss function in output and the price level:

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

where we have assigned a unit weight to the inflation objective,¹⁰ 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.

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

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.

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

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

Under rational expectations,

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

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

$$(A7) \quad p = -y^*(1-k)b - u(b/1+b^2)$$

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

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

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.¹¹

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.)

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

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 E_p at the target value for p , namely 0. Thus they will set the money supply m at E_y , which in this case is y^* . The Aggregate Demand equation thus becomes

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

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

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

Substituting into (A2), the expected loss function is

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

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 and so $\text{var}(v)$ enters. Which regime is better depends on how big the shocks are, and on how big b is.

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:

$$(A13) \quad EL = (1-k)^2 y^{*2} + 2\text{var}(u)/(1+b)^2.$$

The expected loss in (A13) is less than in (A12). We thus see the central theorem: the nominal GNP rule unambiguously dominates the money rule case. It is still not possible, without knowing $\text{var}(u)$ and b , the size of the supply shocks and the flatness of the short-run supply relationship, to say that the rule dominates discretion (to compare the expected losses in A8 and A13). For this question, we need the full model simulations described in the text.

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.

Appendix 3

An International Analysis of Nominal GNP Targeting

The McKibbin-Sachs Global model (MSG) fully articulates the household, firm, asset-market, wage-setting, balance-of-payments, and government sectors, and covers seven regions: the U.S., Japan, Germany, the rest of the European Monetary System, the rest of the OECD, non-oil developing countries and OPEC. It is state-of-the-art in that it keeps track of the cumulating stocks of domestic and foreign debt over time, and assumes model-consistent (i.e., rational) expectations. Expositions and applications of the MSG model include McKibbin and Sachs (1986 and 1989ab).

We consider several alternative plans, in each case assuming that the three member countries (the U.S., Japan, and Germany) adopt the same policy regime. (The rest of the OECD countries, which are reported as a unit, are assumed to leave their money supplies unaltered.) We consider three shocks: an increase in oil prices or other supply shock, a money demand shock, and a goods demand shock. The tables report implications over the subsequent five years for eight macroeconomic variables (all of which are on the G-7 list of indicators). We will follow the Appendix 2 in considering only the first two variables as ultimate objectives: output and inflation. All effects are reported as percentage deviations from baseline. The effects should then be squared for use in a quadratic loss function, where it is assumed that it is optimal to get as close as possible to the baseline path for output and inflation. The last column conveys the overall magnitude of the effect over time; it is the square root of the sum of the yearly squared effects. The quadratic loss function can be thought of as the sum of the number in the first row squared and the number in the second row squared (either for a given year or for the long run). The tables referred to are reported in Chapter 12 of International Trade and Global Development, a book in honor of Jagdish Bhagwati, edited by K.A. Koekkoek and L.B.M.Mennes, Routledge House, and in the working paper version thereof.

We consider first the comparison of the money supply rule and the nominal GNP rule. The experiment captures uncoordinated setting of target paths, though one could interpret the decision of the three countries to settle on nominal GNP (or the money supply) as the variable on which each will independently target, as itself the outcome of a

cooperative international decision.

Table 1A reports the effects of a doubling of the world price of oil under a money rule. All countries experience a sharp increase in the price level in the first year (roughly 3 per cent), and a somewhat smaller decrease in the level of output [with the largest effects felt in the United States]. Since the monetary authorities hold firm, the interest rate rises. The contraction of output continues in the second year, and the price level begins to fall back toward its original level. In the long run, there is no effect. [The effect becomes essentially zero 15 or 20 years out].

Table 4A reports the effects of the same-sized supply shock under a nominal GNP rule. The effects on output and inflation are equal in magnitude (approximately) and offsetting, so as to keep the effect on nominal GNP equal to zero. [For any given year, the effect on the level of nominal GNP, relative to the baseline, is the number in the top row plus the cumulation of the numbers in the second row up to that year.] Achieving the outcome of a fixed nominal GNP requires a monetary contraction in each country. For each of the three large countries, the short-run output loss is greater than under the money rule (and by more on a percentage basis than the gain in inflation). But, assuming that equal weight is placed on the two objectives in the quadratic loss function, the nominal GNP rule's success at reducing inflation is enough to yield welfare gains in the long run, especially in the case of Germany. [In the first year, welfare is higher only in the case of Germany.]

Next we consider a five per cent increase in U.S. money demand. In table 1B we see that the excess demand for money raises the interest rate in the first year, causing a fall in output and in the price level of roughly one per cent each in the United States. [In the other countries, output and inflation rise somewhat rather than fall, as the tight U.S. monetary conditions are transmitted inversely via an appreciation of the dollar and a worsening of the U.S. trade balance]. It is here that the superiority of the nominal GNP rule (table 4B) comes through the most strongly. The U.S. recession is avoided completely, as the money supply is automatically increased by 5 per cent to offset the increase in money demand. When the increase in money demand originates in Japan or Germany, similar results obtain in those countries [tables 4D vs. 1D, or 4F vs. 1F, omitted to save space, but available on request].

The choice is almost as clear-cut for the case of a one per cent increase in U.S. real demand for goods. Under the

money rule (table 1C), the impact is a rise in output and inflation. The U.S. expansion is transmitted positively to the other countries via a U.S. trade deficit. Under the nominal GNP rule (Table 4C) by contrast, an automatic contraction of the money supply leads to much smaller changes on output and inflation. The reported fall in the price level on impact is somewhat greater than the rise in output, even though total nominal GNP is held constant. The explanation is that the inflation numbers that are reported refer to the CPI, not the GNP deflator, and an appreciation of the dollar against the other currencies puts downward pressure on U.S. import prices. [Again, the results for an increase in goods demand, that originates in Japan or Germany are available on request (tables 1E, 1G, 4E and 4G).] In sum, the nominal GNP rule seems to dominate the money rule, regardless of the origin of the disturbance.

Either sort of rule, nominal GNP targeting or money targeting, necessarily loses the advantage of discretionary policy that it can respond to the shocks. We now consider how the nominal GNP rule fares against a regime of full discretion, which is shown in Tables 2. The discretion is assumed to be exercised by a benevolent far-sighted government, which maximizes a present discounted value of the objective function [a quadratic function of deviations of output and inflation from the baseline, with equal weights on the two, as in the Appendix 2]. We do not yet incorporate any "inflationary bias", that is, any temptation for the government to expand irresponsibly for the short-run gain of higher output [as in the Appendix 2].

Discretion for the oil-shock case is shown in table 2A. Even without a built-in inflationary bias, the government opts to take the supply shock more in the form of higher inflation than in the form of output loss. The recession lasts only one year, while it lasts two years in the case of the nominal GNP rule [or the money rule]. In the fourth and fifth years, however, output does not increase as much under discretion as it does under the nominal GNP rule. [As our discretionary government optimizes its intertemporal objective function, it smooths out the path of output slightly, relative to the nominal GNP rule. Doing so requires a more variable path for the money supply, however: a sharp initial contraction, followed by an offsetting expansion beginning in the second year. This property of the money path must be a result of rational expectations.] The squared loss function shows that the outcome under discretion is more desirable than the outcome under the nominal GNP rule, in the long run. [In the

short run, discretion dominates for the case of the U.S., but not for Japan or Germany.] Evidently, the advantages of letting the optimizing government respond to the oil shock are greater than the advantages of being able to reduce inflation by pre-committing to an intermediate nominal target.

In the case of a money demand shock, discretion (Table 2B) is able to accomplish the same feat, insulation of the economy, as the nominal GNP rule (Table 4B).

In the case of a real demand shock, the differences between the regimes are relatively small. The discretionary government responds with a first-year monetary contraction that is great enough to push the price level down rather than up (Table 2C), the same thing that happens under the nominal GNP rule. The government is not able to nullify the effects of the demand shock altogether, apparently because of the appreciation of the dollar, which operates on the CPI relatively more than on output. But discretion succeeds in making the absolute effects on output and the price level (the CPI) even more nearly equal than does the nominal GNP rule, when the demand shock originates in the United States. The squared loss function makes discretion look a little better in the long run (though it makes the nominal GNP rule look slightly better on impact). When the demand shock originates in Japan [Table 2E, not reported] or Germany [2G], however, the initial fall in inflation, and the subsequent rise, are exacerbated in those respective countries.

Summing up the results across the three shocks, the case in favor of pre-commitment to a rule is not clearcut, if the alternative is discretion by a far-sighted government without an inflationary bias. Below, we will build in an inflationary bias to the discretion regime, which will change the conclusions.

None of the cases so far concerns international coordination, interpreted as joint policy-setting on a year-by-year basis. Tables 3 consider coordination among the U.S., Japan and Germany, or its equivalent, the maximization by a G-3 central planner of a world objective function, which in this case weights the countries' individual objective functions by their shares of GNP.

Each country responds to the oil price shock (Table 3A) with a more expansionary monetary policy than in the non-cooperative discretionary case (or than in the case of a nominal GNP rule). Apparently the non-cooperative equilibrium is handicapped by a tendency of each country to raise its interest rates in a (collectively futile) attempt to bid up

the value of its currency and thereby attain lower import prices and a lower CPI. As a result, inflation is slightly higher and the initial fall in output slightly smaller in the cooperative equilibrium, for the U.S., Japan, and Germany. The effect of coordination on the objective function (relative to non-cooperative discretion) is relatively small -- a slight improvement for the U.S., slight deterioration for Japan and Germany -- both in the long run and in the short run. Evidently the standard advantages of coordination, that it allows each country to expand without fear of the implications for their external sector, are fully offset by the "Rogoff" effect, the undermining of public expectations that the monetary authorities will hold the line against inflation.

The nominal GNP rule is better able to resist the temptation to inflate. But the impact on output is considerably bigger. The objective function shows that coordination dominates in the long run, especially for the U.S. [though the nominal GNP rule dominates for Japan and Germany in the short run].

In the case of the money demand shock, as usual, the regimes are all equally good (except for the money rule, which, it will be recalled, produces a needless recession). The coordinated response to a U.S. real demand shock involves monetary contraction in all three countries, just barely more so than the non-cooperative case. The effects are virtually identical.

We saw above that, even though the nominal GNP rule was superior to the money rule, rules in general did not fare well in comparison with discretion. But the regime evaluated was discretion by a benign far-sighted government that maximized the present discounted sum of future welfare. Those who argue the superiority of rules believe that governments left to themselves are in fact more inflation-prone than this, and thus need to be constrained from expanding. There are two natural ways of modelling the inflation bias under unconstrained discretion. The first is to assume that the government has a high discount rate -- in the extreme that it cares only current output and inflation -- for example because it is only expecting to be in office a short time or because the electorate only reacts to the current state of the economy. The second is to assume that the target rates of output and employment that the political system produces are higher than the level of potential output and the natural rate of unemployment, for example because of the power of labor unions. Either approach can yield the result that a country will attain a higher value for its intertemporal objective

function if the government is constrained from expanding.¹²

A credible constraint reduces public expectations of future inflation, thereby reducing the rate of actual inflation that corresponds to a given level of output. Of course this still leaves the fact that if there are unanticipated future disturbances, a rule prevents the government from responding. The choice between rules and discretion depends on the relative advantages of inflation-fighting credibility and the ability to respond to future disturbances [as shown in the Appendix 2]. It is ultimately an empirical question.

We now examine an inflationary bias that takes the form of the adoption of a target level of output that is one per cent above baseline. One can think of the experiment as the result of a change in political parties or of an increase in the power of labor unions. First we consider the effect of the inflationary bias in the case of non-cooperative discretion (by a government maximizing an intertemporal objective function with the same discount rate as above). Table 5 considers the bias in isolation (no disturbances). In each of the three countries, output initially goes up by almost one per cent, and the price level by somewhat less. In the United States, output comes back down slowly over time thereafter, while the price level continues to rise. This path is between the extremes of Japan, where output comes back down rapidly [but the price level rises by 5.6 per cent], and Germany, where output stays high; the differences arise because the MSG model has market-clearing wages in Japan and hysteresis in Germany.

Now we consider the inflationary bias in conjunction with the same sorts of disturbances considered above. Because of linearity in the model, the effect of a given disturbance in the presence of the bias is simply the sum of the effect of the corresponding disturbance from Table 2 plus the effect of the bias in Table 5. In the case of the oil shock, for example, the result of the inflationary bias is that the discretionary government expands so that the fall in output (1.72 per cent) is smaller, and the increase in the price level (3.48 per cent) larger, than was the case when the political goal for output was the same as the baseline.

Unexpected changes in oil prices, money demand, or goods demand can, of course, be negative as easily as positive. When we were evaluating the quadratic loss function that corresponded to the experiments in Tables 1 through 4, it did not matter whether the disturbance was positive or negative. This is because, when the political goal (the value of the

target variable in the absence of disturbances) coincides with the baseline path that is the reference point for the quadratic loss function, the absolute magnitudes of positive and negative deviations from the optimum value of the target variables are the same. But now that we are allowing the political goal to exceed the baseline, it is important to allow for negative shocks. A fall in goods demand in the presence of an inflationary bias, for example, might coincidentally look much better than a rise in goods demand. To find the effects of a negative oil shock, negative money demand shock and negative goods demand shock, respectively, we subtract the corresponding effects in Table 3 from the output and inflation effects in Table 5, rather than adding them. Then, to evaluate the welfare under the discretionary regime, we average the two values of the loss function, to recognize that positive and negative shocks are equally likely. [We report welfare results based only on the loss function in the first year.]

In the presence of the inflationary bias, discretion is now considerably worse than the nominal GNP rule in the event of real demand shocks, because the government is unable to resist the urge to inflate [whereas in the absence of inflationary bias, discretion was only slightly worse than the rule]. In the event of money demand shocks, discretion is again considerably worse than the nominal GNP rule because the government is unable to resist the urge to inflate [whereas in the absence of inflationary bias, the two were equivalent]. Only in the event of supply shocks does discretion still dominate the nominal GNP rule, because the fall in output is small in the event of an increase in the price of oil. The superiority of discretion in the last case is relatively small, however. It seems likely that if money demand or real demand shocks are at all important, then the nominal GNP rule would result in higher welfare overall.

The drawbacks of discretion in the presence of the inflationary bias change little when we allow the three countries to coordinate. [The results for coordination under the inflationary bias, without other disturbances, are given in Table 6. We then simply add the results to the effects of the various disturbances in Table 4 to see the results of coordination in the presence of both the inflationary bias and the disturbances.] Indeed, regardless of the disturbance, the loss function looks slightly worse than when the countries set their policies independently. The reason is that the Rogoff problem is exacerbated: the United States and Japan both inflate [Germany too, beginning in the second year], more than

they do in the non-cooperative regime, where they are inhibited by the threat of depreciated currencies. The advantages of pre-committing to a nominal target as a way of resisting the temptation to inflate thus look even greater.

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Footnotes

. 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, p. p.130 ff.) offers a fascinating account of the machinations of the G-7 mechanism from 1985 to 1987.

. For a review of the literature on international macroeconomic policy coordination, see Fischer (1988b).

. For skeptical views on international coordination, see Feldstein (1983, 1984) and Frankel (1988).

. Rogoff, Kenneth, 1985, "International Macroeconomic Policy Coordination May Be Counterproductive," Journal of International Economics, February, 18, 199-217.

. Jeffrey Frankel and Katharine Rockett, "International Macroeconomic Policy Coordination When Policy-makers Do Not Agree on the True Model," American Economic Review, June 1988, 318-340. See also Holtham and Hughes Hallett (1987).

. In the domestic context, nominal GNP targeting has many adherents. In the international context, Miller and Williamson (1987) propose targeting nominal demand as part of their "blueprint" for exchange rate target zones.

. Analogously, in the context of international coordination, we can take account given by the political process the degree of commitment to coordination.

. Frankel (1989).

. There is a reason for choosing nominal demand (defined as GNP minus the trade balance) as the target variable, in place of nominal GNP, even though the latter is a more familiar concept. In the event of a recession, countries need to be discouraged from the temptation to accomplish their expansion of output through increased foreign demand -- for example, through protectionist measures -- as opposed to increased domestic demand.

.. The Appendix to Frankel (1989) allows the weights on the output and inflation objectives to differ.

.. Note that the higher is b , the greater the inflationary bias. The reason is that, under rational expectations, people know that the government will be motivated to expand, the flatter is the supply relationship.

.. For a review of the literature, see Fischer (1988a).