INTERNATIONAL NOMINAL TARGETING (INT):
A PROPOSAL FOR COORDINATION IN THE 1990S

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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 unraveled 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. But 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.

¹ 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.
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."

As we enter the 1990s, the G-7 coordination process seems to be stalled. It is not that some specific new economic problem has replaced the U.S. dollar as the topic of concern. The problem of U.S. international over-borrowing will no doubt continue to condition international policy-making in the coming decade (together with the new promise posed by Eastern Europe and the not-so-new threat posed by the global environment). But 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. 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.

The potential gains from coordination are elegantly illustrated by the standard theory. Assume for purposes of illustration that there are two countries, America and Japan, that each country seeks to attain two objectives, internal balance $Y = Y$ and external balance $TB = 0$ and that each has only one policy instrument, the money supply $M$.\(^2\) We show how

\(^2\) We do the theory with two targets and one instrument, to keep it simple. We could introduce additional policy targets for each country, such as the exchange rate or the CPI. We could also introduce additional policy instruments for each
the two countries set their monetary policies in Figure 1, with Japan's money supply $M_J$ on the horizontal axis and America's, $M_A$ on the vertical axis.

We consider first the problem from the American point of view. There is some combination of the two money supplies that is optimal from the American viewpoint, represented by point A in the figure. We have placed A in the lower right area, indicating that America would prefer that the other country be the one to do the expanding, enabling America to run a trade surplus at the same time as having high output.\(^3\) Of course the other country will not in general set its money supply at the level desired. How should America set $M_A$, if it has to take $M_J$ as given? Radiating out from point A are a series of concentric indifference curves that represent successive levels of American economic welfare that are farther and farther from the optimum. For any given level of $M_J$, America should choose the level of $M_A$ that brings it to the highest indifference curve possible; this will be the point

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\(^3\) We will assume for purposes of discussing Figure 1 that a monetary expansion in one country has a positive effect on the other country's trade balance and income, even though this is only true in some models. Otherwise, the curves might look different.
where the vertical line corresponding to $M_J$ is tangent to an indifference curve. Thus if we trace out the set of points where America's indifference curves run vertically, we will have traced out its reaction line, which tells how it will set its money supply as a function of Japan's. This gives us half the story.

Now we consider the problem from Japan's viewpoint. Japan's optimum is the point $J$, which we have placed in the upper left area indicating that it, too, would prefer that its trading partner be the one to expand. Successive indifference curves radiate out from $E$. How should Japan set $M_J$, if it takes $M_A$ as given? To get as close to the optimum as it can, it should choose the point where the horizontal line corresponding to $M_A$ is tangent to one of its indifference curves. Thus if we trace out the set of points where Japan's indifference curves run horizontally, we will have traced out Japan's reaction line, which tells how it will set its money supply as a function of America's.

We represent the state without coordination by the Nash noncooperative equilibrium, defined as the point at which each country is setting its money supply at the optimal level given what the other country is doing. It is represented by the point $N$ in Figure 1, where the two reaction lines intersect. We can now see why the noncooperative point is sub-optimal. There is a package of policy changes that will leave both countries better off. As we have drawn the diagram, the
Pareto-superior package consists of joint expansion by the two countries, moving in the northeastward direction. This is an illustration of the locomotive theory discussed above, where each country is afraid to expand on its own for fear of adverse trade balance consequences. (We could as easily have drawn the figure in such a way so that coordination dictated some other combination of policy changes.) We can see that this package raises welfare in both countries, because it moves both to higher indifference curves. Ideally they will agree to a bargain that is Pareto optimal -- such as the point B where the indifference curves are tangent -- i.e., a bargain that maximizes some weighted sum of the two countries' welfares as an omniscient world social planner would do. At such a point there are no further changes in policy that could help one country without hurting the other. But any point in the "lens" shaped area (the area bounded by the two indifference curves that run through point N) will entail gains from cooperation for both countries.

If international policy coordination were really as easy as Figure 1 makes it appear, one might wonder why such agreements do not take place more often than they do. There are a number of obstacles that make coordination difficult in practice.

Three Obstacles to Successful International Coordination

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 system 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.

The first obstacle to successful and meaningful coordination is the difficulty of ensuring compliance. In terms of Figure 1, it would be in the immediate self-interest of the United States, assuming that the other country were going to abide by the agreement and keep its money supply at \( M_J \), to deviate from the agreement by cutting back its money supply \( M_A \); then the U.S. would move vertically downward in the graph until it reached its reaction line, where it would attain a higher level of welfare.

Of course if the agreement was explicit, this deviation from it would constitute cheating on a bargain. The gains would be at most short run; when Japan realizes that America has broken the agreement, it too will change its policy settings, and we will be back in the noncooperative state. Even if no automatic penalty is built in for cheating, America is not likely to decide to break the agreement if it is concerned that it would acquire an undesirable reputation as
an untrustworthy party in potential future agreements. If 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. But a number of drawbacks under the current system imply that substantive enforceable agreements are unlikely to emerge from G-7 meetings: 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.

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. In this light, a serious coordination scheme might begin in the 1990s by setting only one target, 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.

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. It is somewhat difficult to reconcile 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) 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.

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. Why does the G-7 keep them secret? One possible answer is that the members do not want to lose face when the economic variables subsequently break outside the target 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.

Even if compliance is successfully assured, 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 inflation 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 and therefore more inflation than the Nash non-cooperative equilibrium, as countries lose the inhibitions of worsened trade balances. Of course, if the current period is the only one that matters, then the policy-makers will have

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4 See Krugman (1988) for the application of the latest "smooth pasting" technology to this problem.
already correctly factored in the inflation when mapping out their indifference curves. But it will also raise expected inflation in the next period, so that workers will demand higher wages, and there will be a higher level of actual inflation in the future for any given level of output. In such circumstances, coordinating period-by-period may actually reduce welfare in the long run. In this view, developed by Kenneth Rogoff, 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 a small number of

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explicitly-agreed and publicly-announced intermediate targets. The inflation-fighting credibility problem suggests that the intermediate targets to which the governments commit should be nominal variables. 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). Major econometric models of the world economy disagree, for example, on whether a foreign monetary expansion has a positive or negative effect on domestic trade and output. All three kinds of uncertainty 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.⁶

⁶ Jeffrey Frankel and Katharine Rockett, "International Macroeconomic Policy Coordination When Policy-makers Do Not Agree on the True Model," American Economic Review, June 1988,
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 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

[Furthermore, even if the effects of coordination are as anticipated, the gains are generally estimated to be small, as first shown by Gilles Oudiz and Jeffrey Sachs, "Macroeconomic Policy Coordination among the Industrial Economies," Brookings Papers on Economic Activity 1, 1984, 1-64.]
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 \textit{ex post} the criterion that it agreed to \textit{ex ante} if it is not directly enough related to the target variables 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 recent 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 \textit{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!

**Nominal GNP as an Alternative to Other Anchors**

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 other nominal variables that have been proposed. The general argument has been made well by others. 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

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7 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.
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.
Warwick McKibbin and I have begun to apply the McKibbin-Sachs Global model of the world economy to an evaluation of a nominal GNP rule. The experiment presented here captures uncoordinated setting of target paths, though one could interpret the simultaneous decision of Japan, Germany and the United States 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. We begin by considering the comparison of a money supply rule and a nominal GNP rule.

Consider the effects that would follow if there were 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 (2.8 per cent in Japan), and a somewhat smaller decrease in the level of output (1.1 per cent in Japan). Since the monetary authorities hold firm, the interest rate rises. The contraction of output continues in the second year for the United States and Germany and into the third year for Japan, and the price levels begin to fall back toward their original levels. In the long run, there is no effect on either output or the price level.

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What are 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. 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 (2.1 per cent in Japan), while the increase in the consumer price index is smaller (2.2 per cent). Assuming that equal weight is placed quadratically on the two objectives, the nominal GNP rule's success at reducing inflation is enough to yield welfare gains in the long run.

Next consider a five per cent increase in Japanese money demand. Under a fixed-money-growth rule, the excess demand for money raises the interest rate in the first year, causing a fall in output (1.1 per cent in Japan) and in the price level (.9 per cent). In the other countries, the price level rises somewhat rather than falls, as the tight Japanese monetary conditions are transmitted inversely via an appreciation of the yen. It is here that the superiority of the nominal GNP rule comes through the most strongly. The recession is avoided completely under a nominal GNP rule, as the Japanese money supply is automatically increased by 5 per cent to offset the increase in money demand.
The choice is almost as clear-cut for the case of a one per cent decrease in Japanese real demand for goods. Under the money rule, the impact is a fall in output (1.5 per cent) and inflation (0.5 per cent). The Japanese contraction expansion is transmitted positively to the other countries via a Japanese trade surplus. Under the nominal GNP rule by contrast, an automatic contraction of the money supply leads to much smaller changes on output and inflation. In sum, the nominal GNP rule seems to dominate the money rule, regardless of the origin of the disturbance.
The Proposal for Cooperation via International Nominal Targeting

Regardless whether the focus is on the money supply, nominal GNP, or some other macroeconomic variable, there is the separate issue of whether the major countries set their policies cooperatively or independently. To repeat the most common of the examples illustrating the potential gains from coordination, if the world finds itself in recession at some point in the 1990s, governments acting independently may be reluctant to expand demand adequately, for fear of adverse consequences to their foreign sector. It is an open question whether substantive coordination is politically probable in the 1990s, in the sense of governments adopting policies -- different from those that they would otherwise adopt -- for the sake of international cooperation. It is even an open question whether such coordination would be desirable, given the triple obstacles of compliance, inflation-fighting credibility, and uncertainty. But I believe that, for any given degree of commitment to targets that the G-7 feels prepared to make, the consequences are more likely to be favorable if the commitment focuses on nominal GNP (or nominal demand).

I have proposed an international version of a nominal-GNP rule that I call INT, for International Nominal Targeting.¹

¹ Frankel, "International Nominal Targeting (INT): A Proposal for Overcoming Obstacles to Policy Coordination," in Global Disequilibrium, John McCallum and Robert Mundell, eds.,
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.\(^{10}\) A new focus on nominal GNP or nominal demand might serve the G-7 Finance Ministers well in the 1990s.

\(^{10}\) 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 net foreign demand -- for example, through protectionist measures -- as opposed to domestic demand.
References


For a longer version of the paper the following, together with the corresponding tables, could substitute for pages 18-19 above.

**An International Analysis of Nominal GNP Targeting**

Warwick McKibbin and I have begun to apply the McKibbin-Sachs Global model to these problems. 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 the same three shocks as in the Appendix: 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 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).

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 12.1A 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 12.4A 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 12.1B 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 12.4B) 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 12.1C), 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 12.4C) 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, tables 1E, 1G, 4E and 4G that originates in Japan or Germany are available on request.] 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 12.2. 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 for simplicity, as in the appendix]. 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].

Discretion for the oil-shock case is shown in table 12.2A. 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 12.2B) is able to accomplish the same feat, insulation of the economy, as the nominal GNP rule (Table 12.4B).

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 12.2C), 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 12.3 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 12.3A) 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.¹

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]. 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 12.5 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 12.2 plus the effect of the bias in Table 12.5. 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 12.1 through 12.4, 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 12.3 from the output and inflation effects in Table 12.5, 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 12.6. We then simply add the results to the effects of the various disturbances in Table 12.4 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. For a review of the literature, see Fischer (1988a).