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OBSTACLES TO INTERNATIONAL MACROECONOMIC POLICY COORDINATION

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1 INTRODUCTION

It is possible to define international macroeconomic cooperation quite broadly, to include for example the exchange of information among policymakers. But it is probably desirable to reserve for the term international policy *coordination* the more precise definition that is understood in the academic literature: the agreement by two or more countries to a cooperative set of policy changes, where neither would wish to undertake the policy change on its own but where each expects the package to leave it better off relative to the Nash noncooperative equilibrium in which each sets its policies taking the other's as given.[1] The gains are supposed to come specifically from externalities, or "spillover" effects that one country's policies have on other countries' economies but that the first country would have no incentive to take into account in the absence of coordination. If each country has well-defined objectives and knows the true model of the world macroeconomy, then it follows in general that there will exist cooperative solutions that are Pareto-improving—that do leave all countries better off.[2] This theoretical proposition makes successful coordination sound straightforward, even easy. But when we visualize the practical process of coordi-

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This paper was presented in slightly different form at a conference on Blending Economic and Political Analysis of International Financial Relations that was held by Claremont Colleges and the University of Southern California on May 24-26, 1988. I began it when I was a Consultant in the External Adjustment Division, Research Department, International Monetary Fund. It is a revised version of IMF Working Paper 8729, UC Berkeley Economics Working Paper 8737, and NBER Working Paper 2505. I would like to thank the Institute of International Studies of the University of California at Berkeley for support, and Katharine Rockett for effective research assistance. The views expressed are the author's.

[1] Bryant (1987, p. 5) makes the same distinction between coordination and more general forms of cooperation. But other definitions of coordination are possible as well. For a review of definitions of coordination and related concepts, see Horne and Masson (1988), Corden (1986, Chap. 13), or Kenen (forthcoming). For an introduction to the literature, see Oudiz and Sachs (1984), Cooper (1985), or Fischer (1988). References in the political science literature include Axelrod and Keohane (1985), Odell (1982), and Oye (1985).

[2] There are two important qualifications to the generality of the standard proposition that coordination improves welfare: (1) If policymakers have enough independent instruments to reach their optimum target goals regardless of each other's actions, coordination is moot. (2) Rogoff (1985) has shown that if coordination reduces a government's ability to make a credible precommitment to anti-inflationary policies, coordination can reduce welfare. In Frankel (forthcoming), I argue that an international version of nominal-income targeting is the kind of coordination that can best address the problem of credibility, as well as the other obstacles to successful coordination.

nated policymaking, we can identify serious obstacles at each of three stages.

At the first stage, each country must decide what specific policy changes it would like to ask the other country or countries to undertake, and what, for its part, it would be willing to give up to get them. One can think of this stage as taking place in internal deliberations in advance of a Group of 7 or Summit meeting. At the second stage, the two or more countries must negotiate how the gains from coordination are to be distributed. One can think of this stage as constituting the actual bargaining. The negotiations might result in a set of agreed-upon target economic indicators.[3] At the third stage, the agreement must be enforced, requiring a clear way of verifying which countries are abiding by the agreement, in addition to a specification as to what should be done if the agreement is violated (for example, whether penalties should be imposed).

From a reading of the existing literature, one might think that the only obstacles to coordination occur at the latter two stages: bargaining over the gains from coordination and then enforcing the agreement. But the premise of this study is that the problems that occur at the first stage may be more serious.[4] It is not a trivial task to decide what policy changes are in a country's interest. If a country makes requests of its neighbors based on a misperception of the spillover effects, the true effect of coordination may be to reduce welfare rather than improve it. Furthermore, the gains from convincing trading partners to move their policies in the desired direction, even if they turn out to be positive, may be dwarfed by the potential gains from unilateral domestic changes of policies based on a better understanding of objectives or models.

In this study I consider difficulties at the first stage—uncertainty regarding which changes in the policies of foreign countries are in the home country's interest and what the costs are of the domestic policy changes requested by the other country. I leave the later issues of bargaining and enforcement to other authors. Three things need to be known before the coordination process can begin: (1) Where does the initial position of the

[3] At the Tokyo Summit of May 1986, it was decided that the Group of 5, or henceforth the Group of 7, would focus on a set of "objective indicators." At the September 1986 IMF Annual Meetings, the use of these indicators was publicly discussed. The indicators at the time had more to do with the targets each country hoped to attain using only its own policy instruments than with targets that were set cooperatively. Nevertheless, these indicators might be viewed as prototypes for the variables that the countries would bargain over if coordination were to become more serious.

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

domestic country lie relative to the optimum values of the target variables? (2) What are the correct weights to put on the various possible target variables?[5] (3) What effect does each unit change in the domestic (or the foreign) macroeconomic-policy variables have on the target variables; that is, what is the correct model of the economy?

These three elements follow very simply from the algebraic expression for the welfare function. I specify here a function of three target variables, although I could as easily have more or fewer.

$$W = \tfrac{1}{2}y^2 + \tfrac{1}{2}w_x x^2 + \tfrac{1}{2}w_\pi \pi^2 \tag{1}$$

$$W^* = \tfrac{1}{2}y^{*2} + \tfrac{1}{2}w^*_{x^*}x^{*2} + \tfrac{1}{2}w^*_{\pi^*}\pi^{*2}, \tag{1*}$$

where W is the quadratic loss to be minimized, y is output (expressed relative to its optimum and in log form), x is the current account (expressed as a percentage of GNP and again relative to its optimum), π is the inflation rate, w_x is the relative welfare weight placed on the current account, w_π is the relative weight placed on inflation, and an asterisk (*) denotes the analogous variables for the foreign country. I 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

$$dW/dm = (y)y_m + w_x(x)x_m + w_\pi(\pi)\pi_m \tag{2}$$

$$dW/dg = (y)y_g + w_x(x)x_g + w_\pi(\pi)\pi_g \tag{3}$$

$$dW/dm^* = (y)y_{m^*} + w_x(x)x_{m^*} + w_\pi(\pi)\pi_{m^*} \tag{4}$$

$$dW/dg^* = (y)y_{g^*} + w_x(x)x_{g^*} + w_\pi(\pi)\pi_{g^*} \tag{3}$$

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

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

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

$$dW^*/dg^* = (y^*)y^*_{g^*} + w^*_{x^*}(x^*)x^*_{g^*} + w^*_{\pi^*}(\pi^*)\pi^*_{g^*}, \tag{5*}$$

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 poli-

[5] This includes the question of which variables should be excluded from consideration altogether and which included.

cies 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 suboptimal. These cross-country effects enter only in the determination of the cooperative solution.

The focus here is on the fact that the economy may not be at an optimal point, neither the constrained optimum of the Nash noncooperative solution nor the Pareto-improving move to the cooperative solution, owing to the policymakers' lack of knowledge regarding the relevant parameters. Equation (2), or any other of the eight derivations above, neatly illustrates the three kinds of uncertainty: uncertainty regarding the initial position y, x, and π; the welfare weights w_x and w_π; or the policy multipliers y_m, x_m, and π_m. As we will see, the uncertainty is so great that we typically cannot identify the signs of expressions (4) and (5) with confidence; that is, the domestic country cannot be sure whether it should ask the foreign country to expand or to contract its monetary and fiscal policies in order to improve its own welfare. Similarly, as we cannot be sure of the signs in expressions (2) and (3), the domestic country does not know how to respond to foreign requests for changes in its policies. This uncertainty is a serious stumbling block to any effort at coordination.

One might reasonably argue that this uncertainty is no different from the uncertainty that always plagues policymaking, and that the implication for governments is simply that they should maximize expected welfare.[6] But international spillover effects, which are the essence of international coordination, are more subject to uncertainty, particularly with respect to their sign, than domestic effects. One can argue in defense of discretionary domestic policy (as opposed to rules of the monetarist type) that a small policy change in the desired direction is better than none. It is more difficult in the face of uncertainty to make the argument that some international coordination is better than none.

Four conclusions emerge from this study. First, if policymakers in 1989 are serious about activist international coordination, they should begin by specifying clearly in what direction they wish their partners to move their policies and what they are willing to give up for it; otherwise, vague calls for coordination must be considered political grandstanding. Second, we should recognize that the result from the theoretical literature that coordination necessarily improves welfare is too strong. If policymakers are mistaken about their initial position, about the appropriate weights on the targets, or about the policy multipliers, then coordination may reduce welfare instead of increasing it. Third, even when it works out that coordination im-

[6] As in Brainard (1967). Ghosh (1987) is among those who claim that the perils of uncertainty do not apply to international policy coordination any more than to policymaking by national authorities in general.

proves welfare, the gains are so small that they are usually dwarfed by the potential gains from unilateral policy changes unless the authorities know precisely the initial position, target weights, and policy multipliers. Fourth, gains from the exchange of information, for example regarding the multipliers, offer an alternative rationale for international cooperation.

Chapter 2 considers uncertainty regarding the initial position, and Chapter 3 uncertainty regarding the welfare weights. Chapter 4 reviews some results concerning the implications of disagreement over the correct model, and Chapter 5 presents new extensions of the analysis to allow for policymakers' recognition of the uncertainty regarding the model. Chapter 6 considers the effects of unilateral policy changes based on better models and draws some conclusions.

2 UNCERTAINTY REGARDING THE INITIAL POSITION

It is clear from the above equations that uncertainty regarding the initial values of y, x, and π—output, the current account, and inflation—relative to their optima translates into uncertainty regarding the desirability of various policy changes. Uncertainty regarding initial values can, in turn, be broken into three components.

First, there is uncertainty regarding the current value of the target variable in question. It is well known that GNP and the other variables are measured with a lag and are often revised subsequent to the initial estimates.

In a recent study of U.S. GNP revisions, 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 (see also Zarnowitz, 1982, and Zarnowitz and Moore, 1982). Some statistics are reported in Table 1. Since the mean of the true growth rate over the sample period was 2.4 percent per year (and the standard deviation 4.6 percent), the revisions are very large. Mankiw and Shapiro point out that when the preliminary estimate indicates no growth, the probability that the final estimate will exceed 2.0 percent is 18 percent (assuming a normal distribution). Sometimes we do not know whether the economy is currently in a boom or a recession, to within a 90 percent confidence interval. Even the preliminary estimate is available only sixty days after the midpoint of the quarter, not contemporaneously.[1] Furthermore, there could be large errors in the final GNP numbers, owing to both conceptual and measurement problems. The initial estimates of inflation numbers also contain measurement errors, and the trade statistics have been notorious in recent years both for undergoing large revisions, in the case of the United States, and for failing to satisfy "adding up" constraints across countries, which indicates the existence of large measurement errors.

Second to uncertainty regarding the current true values of the variables in question, there is uncertainty regarding how they are likely to move during the next year or more in the absence of policy changes (the "baseline forecast"). This information is relevant under the assumption that any policy

[1] Until 1985, a "flash estimate" was available thirty days after the midpoint of the quarter. Mankiw and Shapiro find that the revision from flash estimate to final number also had a standard deviation of 2.2 percent. Note that the revisions in nominal GNP are larger than in real GNP (because the true variability of nominal GNP is larger).

TABLE 1

FINAL REVISIONS IN U.S. GNP GROWTH RATES FROM EARLY ESTIMATES

(estimation period: 1976:I–1982:IV)

	Nominal (current dollars)	Real (1972 dollars)
Standard deviation of revision from flash estimate	3.1	2.2
Standard deviation of revision from preliminary estimate	2.7	2.2
Mean of final growth rate	9.9	2.4
Standard deviation of final growth rate	5.7	4.6

SOURCE: Mankiw and Shapiro (1986), Tables 2 and 3.

changes agreed upon will have their major impact after a year or more rather than immediately.

Kenen and Schwartz (1986) have studied the accuracy of current-year forecasts by the IMF *World Economic Outlook* for the last fifteen years (1971-85). These forecasts usually appear in April or May of the year in question and are based on information available through February or March. Their results are summarized in Table 2. The root mean squared error among the Summit 7 countries is 0.773 percentage points for real growth and 0.743 percentage points for inflation. These relatively small prediction errors are nevertheless large enough to reverse the signs of the derivatives of the welfare-function equations (2) to (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.

The forecasting record of other agencies or private-sector firms is not noticeably better than that of the Fund (see McNees, 1979, and Zarnowitz, 1984). Such uncertainty need not accrue to the discredit of the economics profession: forecasting future disturbances is by its nature a near impossible task.

The third component of uncertainty regarding the initial position of the economy relative to its optimum is the location of the optimum. The location of full employment and potential output can be given relatively objective-sounding definitions: the nonaccelerating inflation rate of unemployment and the level of output when the factors of production are fully

TABLE 2

ANALYSIS OF IMF FORECASTS IN INDUSTRIAL COUNTRIES

(error measured as forecast less actual)

Variable	Canada	France	Germany	Italy	Japan	United Kingdom	United States	Summit 7	All Countries
Real GNP growth current year: [a]									
Mean actual GNP growth	3.513	2.971	2.233	2.380	4.440	1.907	2.667	3.150	2.833
Mean algebraic error	0.067	0.164	0.480	−0.253	0.813	−0.160	0.240	0.192	0.247
Mean absolute error	1.227	0.621	1.107	1.280	1.533	0.880	1.160	0.658	0.647
Root mean squared error	1.535	0.781	1.319	1.722	2.221	1.143	1.314	0.773	0.767
Real growth one year ahead: [b]									
Mean absolute error	1.833	1.142	1.508	2.058	2.033	1.442	1.691	0.967	1.217
Root mean squared error	2.353	1.460	1.889	2.661	3.683	1.911	2.031	1.198	1.629
Inflation (GNP deflator) current year: [b]									
Mean actual inflation	8.067	9.480	4.580	14.633	5.800	11.680	6.687	6.558	7.200
Mean algebraic error	−0.900	−0.900	0.153	−1.080	−0.007	−0.640	−0.527	−0.275	−0.293
Mean absolute error	1.687	1.127	0.513	1.920	1.513	1.573	0.713	0.608	0.573
Root mean squared error	2.407	1.155	0.687	2.738	2.242	2.016	0.924	0.743	0.776
Inflation one year ahead: [c]									
Mean absolute error	2.175	1.467	0.800	3.400	2.525	3.258	1.058	1.044	1.167
Root mean squared error	3.170	1.780	1.077	4.145	3.502	4.069	1.410	1.172	1.634
Current-account balance (billions of $) current year: [d]									
Mean actual current account	−1.915	−1.400	2.754	−2.246	9.454	1.746	−21.825		
Mean algebraic error	−0.354	−2.067	−0.785	−0.454	−1.569	−1.531	0.600		
Mean absolute error	2.308	2.917	4.000	2.592	6.261	2.485	10.667		
Root mean squared error	3.105	4.009	5.083	2.972	7.967	3.430	13.962		

[a] 15 annual observations (14 for France and Germany and 12 for Summit 7).

[b] 15 annual observations (12 for Summit 7).

[c] 12 annual observations (9 for Summit 7).

[d] 13 annual observations (12 for France and the United States).

SOURCE: Kenen and Schwartz (1986), Tables 1, 3, 9, and 13.

employed, respectively. But estimates nevertheless vary widely.[2] Zero seems an obvious choice for the optimum value of inflation. Estimates for the optimum current account are much more problematic. Zero again seems a natural choice under the Polonius principle of international finance: "Neither a borrower nor a lender be."[3] But estimates of optimal current account balances can vary widely; theoretical analyses suggest that the optimal rate of borrowing (or lending) can be quite large, to finance either longer-term investment and growth or shorter-term shortfalls in real income.

The point is clear. The policymaker's estimates of the current values of y, π, and x in his country could easily be off by several percentage points in either direction, which would flip the signs of the three terms—any one of which could change the sign of the derivative of the welfare function—in equations (2) to (5). Thus, coordinated policy changes could move the economy in the wrong direction.[4]

To take an historical example, 1974 was a year of sharp recession in the United States. But, because of misleading initial data (and because of unfamiliarity with the effects of an oil shock), President Ford declared inflation to be "Public Enemy Number One," even though we know in retrospect that the recession had already begun. He subsequently had to reverse his policy priorities and enact expansionary fiscal policies. If, as part of a coordination process, the United States had asked trading partners in 1974 to adopt measures that would have deflationary effects, soon thereafter it would have wanted precisely the opposite.

[2] For example, estimates of the U.S. natural rate of unemployment vary from 5 to 7 percent. Moreover, there is no particular reason why the natural rate of unemployment or potential output should be the optimum value relative to which society measures y in the objective function (1). The official target for U.S. economic policy under the Humphrey-Hawkins Act of 1978 is 3 percent unemployment (for workers over twenty years of age).

[3] Dooley and Isard (1986) argue that whenever one country incurs substantial net indebtedness to another, the creditor runs the risk that the debtor will find the temptation irresistible either to default explicitly or to impose other taxes on foreign holdings. This argument suggests that a zero current-account balance might be desirable. Summers (1988) argues that governments, for political reasons, do indeed seek current accounts of zero. (See also Shakespeare.)

[4] Of course, misperception of the baseline position relative to the goal will cause problems for *uncoordinated* policymaking as well. Hughes Hallett (1987) argues that welfare in the coordinated policymaking equilibrium may be relatively more robust to such "information errors" than in the Nash noncooperative equilibrium.

3. UNCERTAINTY REGARDING WEIGHTS ON TARGET VARIABLES

The issue of the correct relative weights w_x and w_π for the target variables in the objective function (1) is even more subjective than the issue of the optimal values of the target variables.

Some would argue that the only appropriate objective is to maximize the value of income, or consumption, and that the correct weight on the other variables is zero. To be more correct theoretically, it is the present discounted value of consumption that should be maximized. One can then view the inclusion of the current account in the one-period analysis as foreshadowing events in all the future periods.[1] If the country maximized current consumption while running a large current-account deficit, it would have to undergo lower consumption in the future to service the debt incurred. One can view the motivation for including inflation in the same way. If higher output could be attained with no welfare costs beyond the contemporaneous resource loss from higher inflation, then the cost might be viewed as negligible. But the true cost in fact includes a higher level of inflation inherited in the future, which will eventually necessitate a recession to eliminate it.[2] Thus a one-period objective function that includes inflation and the current account in addition to output seems to capture the relevant elements.

The ultimate argument for putting weight on inflation and the current-account deficit comes not from theory but from consideration of the economist's place in the policymaking process. Society views these variables as "bads" and can be said to have a utility function that includes them in the same way that consumers have utility functions for the goods (and bads) they consume. An economist who maximizes a theoretical welfare function that excludes such variables is not solving a problem that society wants answered.

One way to obtain estimates for the weights w_x and w_π is to carry one step further the argument that the choices of the political process should be

[1] The assumption that governments should seek to attain both "internal balance" (full employment) and "external balance" (trade balance) is part of the venerable Meade-Mundell framework of policymaking. See Obstfeld (1988) regarding the appropriate definition of external balance.

[2] One could make an analogous argument for including the budget deficit as a fourth target variable, as McKibbon and Sachs (1988) do.

accepted on its own terms. Oudiz and Sachs (1984) assume not only that governments have the correct objective function but that, as of 1984, they were succeeding in optimizing it in a Nash noncooperative equilibrium. These assumptions allow them to infer what the welfare weights must have been in order to produce the actual outcomes for output, inflation, and the current account.

Table 3 reports the weights w_π and w_x estimated by Oudiz and Sachs for three countries' objective functions. To get a specific answer, we need some further assumptions beyond the strong ones on which the methodology is based. Their calculations feature two alternative sets of weights (depending on which of two econometric models the governments are assumed to have been using). Other assumptions could give very different estimates.

The preferences of different actors vary widely. Political conservatives tend to put heavy weight on inflation; their w_π might be close to infinite. Political liberals tend to put higher weight on output; their w_π might be close to zero. Although it is difficult to generalize, it might be said that a central bank tends to have higher values of w_π than the finance ministry or the rest of the government. (Similarly, Germany, Japan, and—in the early 1980s—the United States seem to have had higher values of w_π than do most smaller countries.) The question of how to aggregate the varying preferences of actors within a country is as difficult to resolve as it is well known, and it is not addressed here. The point here is only this: in a society where the weights of individual actors vary from zero to infinite, the likelihood must be judged very high that any given government is using weights different from the "correct" ones for any given criterion. One can see from

TABLE 3

WELFARE WEIGHTS ESTIMATED AT NASH EQUILIBRIUM

Country	Economic Planning Agency Model		Multicountry Model	
	Inflation $w\pi$	Current Account Ratio w_x	Inflation $w\pi$	Current Account Ratio w_x
United States	−5.9	2.9	−4.5	0.0
Japan	−2.9	4.6	−3.6	5.9
West Germany	−4.9	1.0	−3.0	1.9

NOTE: Weights show the inflation and current-account deviations that give the same marginal utility as a 1% GNP increase (relative to baseline) sustained for three years. The Nash equilibrium is taken as the baseline in the multicountry model (MCM).

SOURCE: Oudiz and Sachs (1984), Table 9.

the equations that putting insufficient weight on fighting inflation, for example, can have the same effect as underestimating the baseline inflation rate. As a result, the policymaker in coordination exercises may ask his trading partners to adopt expansionary policies when contractionary policies are in fact called for. Indeed, by 1980 many had concluded that the United States had made precisely this mistake in the late 1970s.

4 UNCERTAINTY REGARDING THE POLICY MULTIPLIERS

The policy multipliers—the derivatives y_m, y_g, etc., in equations (2) to (5*)—show the effect on the target variables of changes in the money supply and government expenditure. In theory, they should be more susceptible to measurement than the subjective factors considered so far. But, in fact, any given government is likely to be using policy multipliers that differ substantially from the "true" ones and 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 the models of "mainstream" macroeconomists. They cannot all be correct, and it seems highly probable that no single model is exactly right.

It is possible to illustrate the potential range of multiplier estimates in some detail. In a recent exercise conducted at the Brookings Institution, twelve 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 (see, e.g., Frankel, 1988, and the other papers in Bryant et al., 1988). The models participating were the Federal Reserve's multicountry model (MCM), the European Economic Community's compact model (EEC), the Japanese Economic Planning Agency model (EPA), Project Link (LINK), Patrick Minford's Liverpool model (LIVPL), the McKibbon-Sachs global model (MSG), the Haas-Masson smaller approximation of the MCM model (MINIMOD), the Sims-Litterman vector auto-regression model (VAR), the OECD interlink model (OECD), John Taylor's model (Taylor), the Wharton econometrics model (Wharton), and the Data Resources, Inc., model (DRI). Table 4 summarizes the results for a change in government expenditure and Table 5 for a change in the money supply. All effects are reported for the second year after the policy change.

The range of estimates is large. The effect of fiscal or monetary expansion on domestic output and inflation usually has 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 owing 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 are not those one might expect from the theoretical literature. In the literature, there are two very common ambiguities, (1) the effects of a fiscal expansion on the exchange rate, and (2) the effects of a change in the exchange rate on

TABLE 4

ESTIMATES OF FISCAL-POLICY MULTIPLIERS: SIMULATION EFFECT IN SECOND YEAR OF INCREASE IN GOVERNMENT EXPENDITURE

(1 percent of GNP)

Fiscal Expansion in U.S.	Y	CPI	i (points)	Currency Value	CA ($b)	CA* ($b)	i^* (points)	CPI*	Y*
	Effect in U.S.					Effect in Non-U.S. OECD			
MCM	+1.8%	+0.4%	+1.7	+2.8%	−16.5	+8.9	+0.4	+0.4%	+0.7%
EEC [a]	+1.2%	+0.6%	+1.5	+0.6%	−11.6	+6.6	+0.3	+0.2%	+0.3%
EPA [b]	+1.7%	+0.9%	+2.2	+1.9%	−20.5	+9.3	+0.5	+0.3%	+0.9%
LINK	+1.2%	+0.5%	+0.2	−0.1%	−6.4	+1.9	NA	−0.0%	+0.1%
LIVPL	+0.6%	+0.2%	+0.4	+1.0%	−7.0	+3.4	+0.1	+0.6%	−0.0%
MSG	+0.9%	−0.1%	+0.9	+3.2%	−21.6	+22.7	+1.0	+0.5%	+0.3%
MINIMOD	+1.0%	+0.3%	+1.1	+1.0%	−8.5	+5.5	+0.2	+0.1%	+0.3%
VAR [c]	NA	NA	NA	NA	NA	NA	NA	NA	NA
OECD	+1.1%	+0.6%	+1.7	+0.4%	−14.2	+11.4	+0.7	+0.3%	+0.4%
TAYLOR [d]	+0.6%	+0.5%	+0.3	+4.0%	NA	NA	+0.2	+0.4%	+0.4%
WHARTON	+1.4%	+0.3%	+1.1	−2.1%	−15.4	+5.3	+0.6	−0.1%	+0.2%
DRI	+2.1%	+0.4%	+1.6	+3.2%	−22.0	+0.8	+0.4	+0.3%	+0.7%

Fiscal Expansion in Non-U.S. OECD	Y	CPI	*i* (points)	Currency Value	CA ($b)	CA* ($b)	*i** (points)	CPI*	Y*
	Effect in Non-U.S. OECD					Effect in U.S.			
MCM	+1.4%	+0.3%	+0.6	+0.3%	−7.2	+7.9	+0.5	+0.2%	+0.5%
EEC [a]	+1.3%	+0.8%	+0.4	−0.6%	−9.3	+3.0	+0.0	+0.1%	+0.2%
EPA [b]	+2.3%	+0.7%	+0.3	−0.7%	−13.1	+4.7	+0.6	+0.3%	+0.3%
LINK	+1.2%	+0.1%	NA	−0.1%	−6.1	+6.3	+0.0	+0.0%	+0.2%
LIVPL	+0.3%	+0.8%	+0.0	+3.3%	−17.2	+11.9	+0.8	+3.1%	−0.5%
MSG	+1.1%	+0.1%	+1.4	+2.9%	−5.3	+10.5	+1.3	+0.6%	+0.4%
MINIMOD	+1.6%	+0.2%	+0.9	+0.6%	−2.2	+3.2	+0.3	+0.2%	+0.1%
VAR [c]	NA	NA	NA	NA	NA	NA	NA	NA	NA
OECD	+1.5%	+0.7%	+1.9	+0.9%	−6.9	+3.3	+0.3	+0.2%	+0.1%
TAYLOR [d]	1.6%	+1.2%	+0.6	+2.7%	NA	NA	+0.4	+0.9%	+0.6%
WHARTON	+3.2%	−0.8%	+0.8	−2.4%	−5.5	+4.7	+0.1	−0.0%	+0.0%
DRI	NA	NA	NA	NA	NA	NA	NA	NA	NA

[a] Long-term; non-U.S. short-term interest rate NA.

[b] Canada, Germany, Japan, and United Kingdom.

[c] Earlier versions of this table reported the effects for VAR model, but Christopher Sims has retracted his simulation results when government expenditure is changed.

[d] CPI NA; GNP deflator reported instead.

SOURCE: Frankel (1988).

TABLE 5

ESTIMATES OF MONETARY-POLICY MULTIPLIERS:
SIMULATION EFFECT IN SECOND YEAR OF INCREASE IN MONEY SUPPLY
(4 percent, phased in over 4 quarters)

Monetary Expansion in U.S.	Y	CPI	*i* (points)	Currency Value	CA ($b)	CA* ($b)	*i** (points)	CPI*	Y*
	Effect in U.S.					Effect in Non-U.S. OECD			
MCM	+1.5%	+0.4%	−2.2	−6.0%	−3.1	−3.5	−0.5	−0.6%	−0.7%
EEC [a]	+1.0%	+0.8%	−2.4	−4.0%	−2.8	+1.2	−0.5	−0.4%	+0.2%
EPA [b]	+1.2%	+1.0%	−2.2	−6.4%	−1.6	−10.1	−0.6	−0.5%	−0.4%
LINK	+1.0%	−0.4%	−1.4	−2.3%	−5.9	+1.5	NA	−0.1%	−0.1%
LIVPL	+0.1%	+3.7%	−0.3	−3.9%	−13.0	+0.1	−0.1	−0.0%	−0.0%
MSG	+0.3%	+1.5%	−0.8	−2.0%	+2.6	−4.4	−1.2	−0.7%	+0.4%
MINIMOD	+1.0%	+0.8%	−1.8	−5.7%	+2.8	−4.7	−0.1	−0.2%	−0.2%
VAR [c]	+3.0%	+0.4%	−1.9	−22.9%	+4.9	+5.1	+0.3	+0.1%	+0.4%
OECD	+1.6%	+0.7%	−0.8	−2.6%	−8.4	+3.1	−0.1	−0.1%	+0.3%
TAYLOR [c]	+0.6%	+1.2%	−0.4	−4.9%	NA	NA	−0.1	−0.2%	−0.2%
WHARTON	+0.7%	+0.0%	−2.1	−1.0%	−5.1	+5.3	−1.3	−0.1%	+0.4%
DRI	+1.8%	+0.4%	−2.3	−14.6%	−1.4	+14.5	−1.1	−1.3%	−0.6%

Monetary Expansion in Non-U.S. OECD	Y	CPI	i (points)	Currency Value	CA ($b)	CA* ($b)	i* (points)	CPI*	Y*
	Effect in Non-U.S. OECD					Effect in U.S.			
MCM	+1.5%	+0.6%	−2.1	−5.4%	+3.5	−0.1	−0.2	−0.2%	−0.0%
EEC [a]	+0.8%	+1.0%	−1.0	−2.3%	−5.2	+1.9	+0.0	+0.1%	+0.1%
EPA [b]	+0.0%	+0.0%	−0.1	−0.1%	−0.1	+0.1	−0.0	−0.0%	+0.0%
LINK [d]	+0.8%	−0.6%	NA	−2.3%	−1.4	+3.5	+0.0	−0.0%	+0.1%
LIVPL	+0.4%	+2.8%	−0.9	−8.4%	+7.1	−8.2	−1.1	−3.4%	+1.6%
MSG	+0.2%	+1.5%	−0.7	−1.4%	−15.9	+12.0	−1.2	−0.6%	+0.3%
MINIMOD	+0.8%	+0.2%	−1.8	−4.8%	+3.6	−1.4	−0.6	−0.5%	−0.3%
VAR [c]	+0.7%	−0.5%	−3.0	−5.5%	+5.2	−10.0	+0.6	−0.7%	+1.2%
OECD	+0.8%	+0.3%	−1.3	−2.1%	−1.6	+2.3	−0.2	−0.1%	+0.1%
TAYLOR [c]	+0.8%	+0.7%	−0.3	−3.5%	NA	NA	−0.2	−0.5%	−0.1%
WHARTON	+0.2%	−0.1%	−0.8	+0.2%	+2.6	+0.5	+0.0	+0.0%	+0.0%
DRI	NA	NA	NA	NA	NA	NA	NA	NA	NA

[a] Long-term; non-U.S. short-term interest rate NA.
[b] Canada, Germany, Japan, and United Kingdom.
[c] CPI NA; GNP deflator reported instead.
[d] Appreciation of non-U.S. currency NA; depreciation of dollar reported instead.
SOURCE: Frankel (1988).

income: (1) Is the incipient capital inflow attracted by higher interest rates enough to offset the trade deficit due to higher income, so that the currency appreciates? (2) Is the expansionary effect of a depreciation on the trade balance enough to offset any contractionary effects via real income, the real money supply, real wealth, imported-input prices, or indexed wages, so that income rises? A negative answer to either of these questions could reverse, for example, the well-known Mundell-Fleming conclusion that a domestic fiscal expansion is transmitted positively to other countries via a shift in the trade balance.

Table 4 suggests that there is relatively little disagreement in the econometric models on these questions. A U.S. fiscal expansion is transmitted positively to the rest of the OECD (the "other country") in 10 out of 11 models, and an expansion in the other country is transmitted positively to the United States in 9 out of 10 models. The greatest disagreement occurs, rather, on a subject about which the standard theoretical literature is mostly unanimous: 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 must be positive: a reduction in interest rates causes a net capital outflow, which, under a floating exchange rate, implies an increase in the current-account balance. (For example, many believe that the U.S. trade deficit began to deteriorate as early as 1982 because a monetary contraction had raised real interest rates and the real value of the dollar after 1980.) It would then follow that the foreign current account, and therefore foreign income, move in the opposite direction: monetary policy is transmitted inversely in Mundell-Fleming. But Table 5 shows a monetary expansion in the United States worsening its current account in 8 out of 11 models, and a monetary expansion in the non-OECD worsening the other country's current account 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.

Differing views of policy multipliers imply differing views of desirable policy changes, even in cases in which there is no disagreement over objective functions or initial positions. Perhaps the most enduring disagreement in OECD policymaking is the perception by other countries that there is room for demand expansion in the German economy (and often in the Japanese economy as well), in contrast to the perception by the responsible policymakers in those countries that there is not.

One could interpret the disagreement in terms of initial position, as in

Chapter 2 (the Germans seeing themselves as closer to the natural rate of unemployment than others see them) or in terms of the objective function, as in Chapter 3 (the Germans putting more weight on inflation and less on output than others), but it is perhaps most interesting to interpret the disagreement in terms of models. The Germans may believe that their inflation-output tradeoff is steeper than others believe it to be. For example, perhaps the German tradeoff is indeed steeper than the U.S. tradeoff because of a greater degree of wage indexation, but Americans—lacking familiarity with other economies—tend to project from their own economy.[1] In connection with proposals for German or Japanese expansion via monetary policy, in particular those urged by U.S. Treasury Secretary James Baker in 1986-87, we have just seen how reasonable models disagree about the implications for the U.S. trade balance and output: 3 of 11 econometric models, as well as the Mundell-Fleming theory, imply negative transmission because the trade balance is dominated by the exchange-rate effect rather than the income effect, but 8 of the 11 (and many alternative theoretical models) imply positive transmission. The ambiguity about the sign of the transmission of monetary policy is particularly damaging for international coordination. It means that even if the United States succeeds in getting Germany to agree to take measures that would stimulate the U.S. trade balance and output, the two countries could still disagree over whether this requires German policy to be more expansionary or less.[2]

[1] Branson and Rotemberg (1980), attributing the idea to Herbert Giersch, suggest that the difference between the United States and Germany in real wage rigidity, and therefore in the slope of the aggregate supply curve, may explain Germany's reluctance to accept U.S. urging in 1977 to expand under the "locomotive theory." But there is nothing in their paper to suggest that the Americans were less aware than the Germans of the difference in structure. So, in urging German expansion, they may simply have been making the sort of self-interested proposal that is a common part of any bargaining process. This is different from the situation that can arise when policymakers disagree about the model and therefore about whether the proposed policy change is in *Germany's* interest. Such disagreement *is* blamed by Willett (1978, p.90) for the "locomotive" debate: "Much of the current international policy debate is really about what kinds of macro-economic policies governments should follow in their own narrow national economic interests. If U.S., German, and U.K. officials shared similar views about the workings of their economies and similar risk attitudes toward inflation and unemployment, there might be little difference in their views about appropriate macroeconomic policies for each other."

[2] Almost all models agree that if all countries expand monetary policy simultaneously, the effect will be expansionary. Thus Baker's 1986 proposal for simultaneous reductions in discount rates could be beneficial even if the international transmission is negative (or, in any case, close to zero), as in some of the models. But the implication is that the United States could reap the full benefits by reducing interest rates unilaterally. Thus the proposal would not be an example of coordination, precisely defined. It is possible that international fora provide a means for generating the necessary political momentum for policy changes, such as changes in the monetary/fiscal mix to reduce real interest rates, that could in theory be made unilaterally.

What happens if the policymakers of the United States and the rest of the OECD proceed with coordination efforts despite disagreements such as these? We can use the Brookings simulations to consider the possibilities when they use conflicting models. In the analysis that follows, the optimal values of the target variables and the weights in the objective function are taken from Oudiz and Sachs (1984).[3]

It turns out that the countries will in general be able to find a package of coordinated policy changes that each believes will leave it better off, even though each has a different view of the effects and thus may not understand why the other is willing to go along with the package.[4] To take a typical outcome, if the U.S. monetary authority believes in the MCM model and the other country's monetary authority believes in the OECD model, they will find the Nash noncooperative equilibrium to be overly contractionary; each country will be afraid of expanding on its own for fear of worsening its current-account balance. They will consider a coordinated package under which each undertakes monetary expansion to be mutually beneficial and will agree to it (provided any problems of bargaining and enforcement can be overcome). This is the kind of coordination urged by the United States in recent years. But whether a joint monetary expansion actually succeeds in improving the countries' objective functions depends on the true model. If the true model is the MCM, the United States will indeed be better off; otherwise it would not have agreed to the change. Similarly, if the true model is the OECD, then the other country will be better off. But if the LIVPL, VAR, or MSG model is the correct one, the coordinated monetary expansion will not have the effects anticipated and will actually leave both countries worse off.

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. policymakers, the beliefs of the other country's policymaker, and reality. We find that, for the United States, coordination results in gains in 546 cases and losses in 321 cases, and has no effect on the objective function (to four significant dig-

[3] The remainder of this chapter draws on Frankel and Rockett (1988).

[4] Holtham and Hughes-Hallett (1987) argue that we should rule out coordination (i.e., that it will not take place) when the bargain is not "sustainable," defined as when one party expects that its opponent will lose from the bargain. The supposition is that the first party will expect the opponent to abrogate the agreement next period when the error becomes evident. But throughout this exercise we are assuming, as do Holtham and Hughes-Hallett, that the policymakers do not revise their multiplier estimates just because the target variables take different values from the ones they expected. (Implicitly, they assign the error to a transitory disturbance; this is the alternative to assuming that they update their multiplier estimates in a Bayesian way until they converge on the true model.) It follows that it would not be rational to expect the opponent to abrogate the agreement next period, because the opponent is known to believe in a model that makes the agreement appear advantageous.

TABLE 6

EFFECTS ON WELFARE OF CHANGES IN MONETARY POLICY

(total number of combinations = 1,000)

	Number of Cases					
	U.S. Welfare			Non-U.S. OECD Welfare		
	Gains	Losses	No Effect	Gains	Losses	No Effect
1. Cooperative solution compared with noncooperative solution	546	321	133	539	327	134
2. Averaging to estimate opponent's model compared with knowing it with certainty, under non-cooperative solution	478	519	3	404	595	1
3. Cooperative solution compared with noncooperative solution, while averaging to estimate opponent's model	600	398	2	643	355	2
4. Averaging to estimate own model compared with believing one with certainty, under noncooperative solution	568	432	0	513	487	0
5. Cooperative solution compared with noncooperative solution, while averaging to estimate own model	200	800	0	600	400	0
6. Cooperative solution with averaging to estimate own model compared with non-cooperative solution with model certainty	563	437	0	511	489	0
7. Averaging to estimate own model compared with believing one with certainty, under cooperative solution	548	452	0	505	495	0

its) in 133 cases. For the non-U.S. OECD, coordination results in gains in 539 cases, losses in 327 cases, and no effect in 134 cases. (The statistics are reported in row 1 of Table 6.)[5]

If the countries are able to include fiscal policy along with monetary policy in the bargaining package, the odds do not improve for this particular combination of starting point and welfare weights. To take an example, if the United States subscribes to LINK and the other country to LIVPL, the resulting package of coordinated policy changes takes the form favored by many economists in the 1980s: a U.S. fiscal contraction accompanied by a fiscal expansion in Europe and Japan, and monetary expansion all around. The usual argument is that this package will reduce the value of the dollar, and therefore the U.S. trade deficit, without causing a world recession. Again, if the true model is different from the one to which the policymaker subscribes, this change in monetary/fiscal mix often turns out to reduce welfare rather than improve it. Out of all 1,000 combinations, coordination turns out to raise U.S. welfare in 494 cases and to raise non-U.S. OECD welfare in 477 cases.

[5] In a sense, these statistics are biased in favor of gains from coordination; they include the one-eighth of the cases in which the policymaker had the correct model, so that coordination necessarily improves his welfare. Statistics that count only cases in which the policymakers' models are different from the true one are reported in Frankel and Rockett (1988, p. 330).

5 EXTENSIONS OF THE ANALYSIS OF DISAGREEMENT REGARDING MULTIPLIERS

Some readers have suggested that in a world with many different models it is not sensible to assume that each policymaker acts as if he knows with certainty what model his opponent subscribes to (the opponent having no incentive to reveal his beliefs in the absence of cooperation), or even which model he himself considers to be correct. (See, e.g., Holtham and Hughes Hallet, 1987.) We now consider extensions in each of these two directions.

In the first extension, we retain the assumption that each policymaker believes in his own model with certainty, but we allow for uncertainty regarding the other's model. The policymaker will set his policies so as to maximize *expected* welfare, a weighted average of the economic consequences of each of the policy settings that the opponent would choose under each of the models to which it might subscribe.[1]

Tables 7 and 8 report the effects on the United States and on the rest of the OECD, respectively, of allowing for uncertainty regarding each other's models, still under the Nash noncooperative equilibrium of monetary policies.[2] Each country is assumed to give equal weight to all the possible models to which the opponent can subscribe. Table 7 reports the movement from the baseline specified in the Brookings simulations to the Nash noncooperative equilibrium under 16 combinations (4 models subscribed to by the United States and 4 by the other country). The changes in money supplies to get to the equilibrium are usually quite close to what they were in the earlier case in which each knew the other's model. The effect of this movement, depending on the true model, is reported for U.S. welfare and for non-U.S. OECD welfare in Table 8.

The interesting question is the effect of coordination under the assumption that each player averages to estimate the other's model. Table 9 reports how money supplies change (and with them perceived values of the target variables and welfare) in the movement from the Nash noncooperative point under averaging to the Nash cooperative point. It is assumed that each player reveals its model to the other as part of the cooperation. One player or the other may lose bargaining power by having both their models

[1] The algebra is spelled out in section 4 of Frankel and Rockett (1988).

[2] Although equations (2) to (5*) were presented in terms of two policy instruments for each country, Tables 7 to 12 refer to monetary policy alone. Frankel and Rockett (1988) report further effects of coordination when both monetary and fiscal policies are used.

TABLE 7

AVERAGING TO ESTIMATE OPPONENT'S MODEL: NONCOOPERATIVE EQUILIBRIUM

Model Subscribed to by U.S.	Model Subscribed to by Non-U.S. OECD			
	MCM	VAR	OECD	LINK
MCM				
Deviation from baseline:				
Non-U.S. money supply	36.075	−64.930	41.669	50.929
U.S. money supply	10.117	10.117	10.117	10.117
Perceived deviation of target from baseline:				
Non-U.S.: Y	11.757	−10.401	9.069	9.950
CA	0.233	−6.616	−0.205	−0.316
U.S.: Y	3.794	3.794	3.794	3.794
CA	−0.177	−0.382	−0.224	−0.216
Perceived deviation of target from goal:				
Non-U.S.: Y	1.592	−20.566	−1.096	−0.216
CA	−1.378	1.435	−1.124	−0.786
U.S.: Y	−1.057	−1.057	−1.057	−1.057
CA	−2.855	−3.060	−2.902	−2.894
Perceived gain for:				
Non-U.S.	1.1007	5.1703	0.9654	0.9800
U.S.	0.1583	0.0769	0.1401	0.1433
VAR				
Deviation from baseline:				
Non-U.S. money supply	36.075	−64.930	41.669	50.929
U.S. money supply	−14.651	−14.651	−14.651	−14.651
Perceived deviation of target from baseline:				
Non-U.S.: Y	16.005	−12.828	7.249	10.557
CA	0.450	−9.454	−0.631	−0.517
U.S.: Y	65.693	−30.467	43.629	47.456
CA	−16.655	3.660	−11.994	−12.802
Perceived deviation of target from goal:				
Non-U.S.: Y	5.839	−22.993	−2.916	0.391
CA	−1.161	−1.403	−1.550	0.988
U.S.: Y	60.842	−35.318	38.788	42.606
CA	−19.395	0.921	−14.733	−15.542
Perceived gain for:				
Non-U.S.	0.8587	4.1255	0.7405	0.9314
U.S.	−61.5191	−11.7915	−28.8638	−33.6214

(Continued on next page)

TABLE 7—(Continued)

Model Subscribed to by U.S.	Model Subscribed to by Non-U.S. OECD			
	MCM	VAR	OECD	LINK
OECD				
Deviation from baseline:				
Non-U.S. money supply	36.075	−64.930	41.669	50.929
U.S. money supply	6.825	6.825	6.825	6.825
Perceived deviation of target from baseline:				
Non-U.S.: Y	12.279	−10.699	8.846	10.025
CA	0.259	−6.965	−0.258	−0.341
U.S.: Y	5.610	−2.403	3.772	4.091
CA	1.326	−3.382	0.246	0.433
Perceived deviation of target from goal:				
Non-U.S.: Y	2.114	−20.864	−1.320	−0.141
CA	−1.351	1.086	−1.176	−0.811
U.S.: Y	0.759	−7.254	−1.079	−0.760
CA	−1.726	−6.435	−2.807	−2.619
Perceived gain for:				
Non-U.S.	1.0911	5.1640	0.9440	0.9750
U.S.	0.6549	−2.4442	0.3204	0.3945
LINK				
Deviation from baseline:				
Non-U.S. money supply	36.075	−64.930	41.669	50.929
U.S. money supply	5.641	5.641	5.641	5.641
Perceived deviation of target from baseline:				
Non-U.S.: Y	12.421	−10.780	8.785	10.045
CA	0.267	−7.059	−0.272	−0.347
U.S.: Y	4.203	−3.810	2.364	2.683
CA	2.302	−4.917	0.645	0.933
Perceived deviation of target from goal:				
Non-U.S.: Y	2.255	−20.945	−1.380	−0.121
CA	−1.344	0.992	−1.190	−0.818
U.S.: Y	−0.647	−8.661	−2.486	−2.167
CA	−1.032	−8.250	−2.688	−2.400
Perceived gain for:				
Non-U.S.	1.0875	5.1564	0.9379	0.9736
U.S.	0.9052	−4.3362	0.4343	0.5472

NOTE: Welfare gains are expressed in squared percentage points of GNP. All other numbers are percentage points.

TABLE 8

EFFECT OF AVERAGING TO ESTIMATE OPPONENT'S MODEL UNDER NASH NONCOOPERATIVE SOLUTION: TRUE GAINS FROM MOVING FROM NASH NONCOOPERATIVE EQUILIBRIUM WITH CERTAINTY

(in squared percentage points of GNP)

Model Subscribed to by U.S.	Model Subscribed to by Non-U.S. OECD			
	MCM	VAR	OECD	LINK
Gains for the United States				
MCM				
Model representing reality:				
MCM	0.0007	−0.0016	−0.0005	0.0002
VAR	−1.7580	−0.6498	−0.9890	−0.3846
OECD	0.0118	−0.0963	−0.0098	0.0068
LINK	0.0114	−0.1757	−0.0180	0.0083
VAR				
Model representing reality:				
MCM	8.7852	0.4686	8.3527	6.3119
VAR	−38.9078	−11.4509	−7.1553	−16.3723
OECD	9.7551	0.8063	8.8546	6.9320
LINK	4.2285	1.1034	3.5820	2.9604
OECD				
Model representing reality:				
MCM	0.0816	0.0136	0.0444	0.0492
VAR	−9.2433	−1.4683	−0.7280	−3.6714
OECD	−0.0230	−0.1127	−0.0439	−0.0117
LINK	0.0277	−0.1641	−0.0371	0.0157
LINK				
Model representing reality:				
MCM	0.0193	−0.0100	0.0103	0.0123
VAR	−4.7546	−1.2786	0.8803	−1.5277
OECD	0.0003	−0.1517	−0.0279	0.0015
LINK	0.0187	−0.2530	−0.0329	0.0129
Gains for Non-U.S. OECD				
MCM				
Model representing reality:				
MCM	−0.0130	−5.4240	−0.3877	0.1590
VAR	−3.9770	−0.0809	2.2117	−0.9462
OECD	−0.1710	−1.2194	−0.0022	−0.0081
LINK	−0.1481	−1.2656	−0.0177	−0.0005
VAR				
Model representing reality:				
MCM	−0.3816	44.3387	−4.9812	−1.3162
VAR	−103.4766	−0.2434	−23.5026	−49.5836
OECD	−0.9549	0.6821	0.6499	0.7499
LINK	−1.1892	6.4375	0.3904	0.0935
OECD				
Model representing reality:				
MCM	−0.0369	−3.9371	−1.0554	0.0275
VAR	−15.5198	−0.0822	0.8745	−5.7063
OECD	−0.4217	−1.4097	0.0195	0.0041
LINK	−0.2856	−1.1406	−0.0282	0.0049
LINK				
Model representing reality:				
MCM	−0.0355	−7.3674	−0.7440	0.1852
VAR	−9.1634	−0.1755	2.7751	−2.7714
OECD	−0.3176	−1.8212	0.0019	−0.0069
LINK	−0.2547	−1.7867	−0.0266	0.0006

revealed. For this reason, the "perceived gain" reported in the last two lines of each cell in Table 9 is sometimes negative, even though the perceived gain from coordination with no change in information must necessarily be positive.

The actual effect of coordination depends on which is the true model, as usual. Table 10 reports the change in welfare for the United States and for the non-U.S. OECD under each of the four alternative candidates for the true model. If we include all ten models, coordination under averaging improves U.S. welfare in 600 cases out of the total of 1,000 combinations, and it improves non-U.S. OECD welfare in 643 cases. As Table 6 shows, these odds are a little better than when each knows the other's model with certainty (line 3 compared with line 1).

In the second extension, we relax the assumption that each player acts as if it were certain about the correct model. We assume rather that it assigns weight to each of the possible models. To preserve some disagreement about models, we could assume that each puts primary weight on its favorite model but is reasonable enough to put some weight also on the other models (perhaps with larger weight on the favorite model of the other player, on the theory that the latter must have access to some independent information). Instead, we consider the simple case of uniform weights, so that each will be playing by the same "compromise" model.

Such a compromise might also be interpreted as a type of cooperation through exchange of information. The conjecture is that ministers in Group of 7 and Summit meetings might do better to discuss their beliefs directly rather than tell the others how to adjust their policies. Kenen (forthcoming, pp. 8-9) argues that the gains from consultation, defined as swapping information (as opposed to coordination, defined in the first paragraph of this study), have not been sufficiently emphasized by academic economists. Similarly, Bryant (1987, p. 8) suggests that "we economists underplay the importance of the 'mere' exchange of information that occurs in consultation."

When policymakers maximize expected welfare by averaging the multipliers in the ten equilibrium models to estimate a compromise model, the Nash noncooperative equilibrium implies a 2.1 percent U.S. monetary expansion relative to the baseline and a 60.6 percent monetary contraction in the other country. The welfare effects of averaging models, compared with the same Nash noncooperative equilibrium when each policymaker acts upon a single model held with certainty, are reported for both U.S. and non-U.S. OECD welfare in Table 11. The four possibilities shown in each case for both the "model subscribed to by the U.S." and the "model subscribed to by non-U.S. OECD" are those the respective policymakers give up if they move to the compromise model. The move raises welfare a majority of the time. When all ten models are used, averaging raises U.S. welfare in 568 cases and non-U.S. OECD welfare in 513.

TABLE 9

EFFECT OF COORDINATION WHILE AVERAGING TO ESTIMATE OPPONENT'S MODEL

(in squared percentage points of GNP)

Model subscribed to by U.S.	Model Subscribed to by Non-U.S. OECD			
	MCM	VAR	OECD	LINK
MCM				
Bargaining change in policy:				
Non-U.S. money supply	−2.755	8.075	3.594	−0.215
U.S. money supply	−0.021	−0.510	0.443	0.334
Perceived change in targets:				
Non-U.S.: Y	−1.029	1.362	0.752	−0.051
CA	−0.027	0.903	−0.025	0.003
U.S.: Y	−0.008	−0.191	0.166	0.125
CA	0.000	0.017	−0.005	−0.005
Perceived gain for:				
Non-U.S.	0.0125	0.0872	0.0033	0.0009
U.S.	0.0001	0.0026	0.0013	0.0001
VAR				
Bargaining change in policy:				
Non-U.S. money supply	−46.791	3.411	−5.647	−15.201
U.S. money supply	−66.265	37.151	−22.917	−37.952
Perceived change in targets:				
Non-U.S.: Y	−5.950	4.312	−2.849	−2.091
CA	0.173	4.751	−0.352	−0.198
U.S.: Y	−63.735	28.887	−18.881	−33.024
CA	0.902	0.931	−0.360	−0.221
Perceived gain for:				
Non-U.S.	0.3905	0.5650	−0.4098	−0.0844
U.S.	39.2270	11.8864	10.3586	16.7692
OECD				
Bargaining change in policy:				
Non-U.S. money supply	−6.416	20.379	7.848	0.271
U.S. money supply	−5.527	−5.847	−0.990	−1.706
Perceived change in targets:				
Non-U.S.: Y	−1.438	2.981	1.495	0.097
CA	−0.010	1.746	−0.089	−0.017
U.S.: Y	−2.371	−1.829	−0.200	−0.676
CA	0.196	0.607	0.163	0.090
Perceived gain for:				
Non-U.S.	0.0361	0.2435	−0.0123	−0.0041
U.S.	0.0228	0.2009	0.0553	0.0162
LINK				
Bargaining change in policy:				
Non-U.S. money supply	−5.089	44.038	8.474	1.861
U.S. money supply	−2.217	−28.237	4.207	3.565
Perceived change in targets:				
Non-U.S.: Y	−1.520	4.882	2.010	0.284
CA	−0.028	1.948	−0.004	0.014
U.S.: Y	−0.682	−5.958	1.263	0.938
CA	−0.032	2.062	0.029	−0.096
Perceived gain for:				
Non-U.S.	0.0357	0.7861	0.0138	0.0033
U.S.	−0.0184	0.6110	0.0576	0.0006

TABLE 10

EFFECT OF COORDINATION COMPARED WITH NONCOOPERATIVE SOLUTION WITH AVERAGING: TRUE GAINS FROM COORDINATION

(in squared percentage points of GNP)

Model Subscribed to by U.S.	Model Subscribed to by Non-U.S. OECD			
	MCM	VAR	OECD	LINK
Gains for the United States				
MCM				
Model representing reality:				
MCM	0.0001	0.0026	0.0013	0.0001
VAR	1.7426	0.7576	−2.0435	−0.1914
OECD	−0.0081	0.1229	0.0078	−0.0108
LINK	−0.0094	0.2345	0.0287	−0.0047
VAR				
Model representing reality:				
MCM	−10.9240	0.6002	−2.3508	−4.7125
VAR	39.2270	11.8864	10.3586	16.7692
OECD	−12.2776	0.8405	−2.4845	−5.1682
LINK	−5.2851	0.2468	−1.0846	−2.2542
OECD				
Model representing reality:				
MCM	−0.0941	−0.0923	−0.0073	−0.0184
VAR	9.5277	0.8061	−2.8193	1.2366
OECD	0.0228	0.2009	0.0553	0.0162
LINK	−0.0283	0.5544	0.0720	0.0042
LINK				
Model representing reality:				
MCM	−0.0320	−1.4327	0.0237	0.0226
VAR	5.3773	−3.9521	−7.2862	−3.8789
OECD	0.0070	−1.0465	−0.0229	−0.0500
LINK	−0.0184	0.6110	0.0576	0.0006
Gain for Non-U.S. OECD				
MCM				
Model representing reality:				
MCM	0.0125	7.3801	0.6581	−0.0630
VAR	3.8204	0.0872	−4.2978	−0.1175
OECD	0.1584	1.5901	0.0033	0.0029
LINK	0.1347	1.6933	0.0296	0.0009
VAR				
Model representing reality:				
MCM	0.3905	−12.5586	0.8582	0.3970
VAR	114.7240	0.5650	24.7853	46.5345
OECD	0.8155	3.3431	−0.4098	−0.6620
LINK	1.2612	−0.3424	−0.0650	−0.0844
OECD				
Model representing reality:				
MCM	0.0361	19.9676	1.5301	0.1717
VAR	15.6662	0.2435	−7.3530	1.4815
OECD	0.4063	3.6273	−0.0123	−0.0095
LINK	0.2629	4.2805	0.0461	−0.0041
LINK				
Model representing reality:				
MCM	0.0357	46.6779	1.1965	0.0218
VAR	9.7144	0.7861	−13.3783	−5.8397
OECD	0.3041	6.4888	0.0138	−0.0040
LINK	0.2291	9.1414	0.0533	0.0033

TABLE 11

EFFECT OF AVERAGING TO ESTIMATE OWN MODEL WHILE UNDER NONCOOPERATIVE SOLUTION: TRUE GAINS

(in squared percentage points of GNP)

Model Subscribed to by U.S.	Model Subscribed to by Non-U.S. OECD			
	MCM	VAR	OECD	LINK
Gains for the United States				
MCM				
Model representing reality:				
MCM	−0.1405	−0.0614	−0.1235	−0.1260
VAR	83.1202	1.5495	45.6511	50.3466
OECD	−1.8933	1.0077	−1.6010	−1.6549
LINK	−3.1293	1.9124	−2.6906	−2.7768
VAR				
Model representing reality:				
MCM	9.4959	1.2475	9.0786	7.0351
VAR	22.4318	0.1611	21.5290	17.0695
OECD	8.1975	2.9908	7.7790	5.7568
LINK	1.3311	3.5149	1.1711	0.4338
OECD				
Model representing reality:				
MCM	−0.0458	−0.0613	−0.0653	−0.0636
VAR	72.3810	1.5264	41.6093	44.5739
OECD	−1.9992	1.0102	−1.6856	−1.7275
LINK	−3.1290	1.9180	−2.7234	−2.7834
LINK				
Model representing reality:				
MCM	−0.1001	−0.0500	−0.0913	−0.0924
VAR	76.0063	1.9489	42.6057	46.0620
OECD	−1.9896	0.9818	−1.6778	−1.7235
LINK	−3.1400	1.8297	−2.7206	−2.7878
Gains for Non-U.S. OECD				
MCM				
Model representing reality:				
MCM	−77.2052	60.1925	−70.5512	−72.3227
VAR	203.9442	−9.8339	120.2067	130.9411
OECD	−10.1212	12.2112	−12.0524	−12.0128
LINK	−11.4224	13.2347	−12.7891	−12.8286
VAR				
Model representing reality:				
MCM	−77.3318	99.8204	−77.2838	−75.5238
VAR	73.8551	−8.9516	71.1615	57.7137
OECD	−11.1399	15.8816	−11.1755	−11.1096
LINK	−12.2419	20.2481	−12.3686	−12.6859
OECD				
Model representing reality:				
MCM	−77.2195	60.4137	−71.5020	−72.6865
VAR	188.5202	−9.8289	115.8803	123.0370
OECD	−10.4069	12.2321	−12.0093	−11.9889
LINK	−11.5336	13.2740	−12.7991	−12.8182
LINK				
Model representing reality:				
MCM	−77.2146	56.6418	−71.2662	−72.5907
VAR	193.8318	−9.9146	116.9776	125.1267
OECD	−10.3120	11.8780	−12.0207	−11.9965
LINK	−11.4956	12.6047	−12.7972	−12.8211

TABLE 12

EFFECT OF AVERAGING TO ESTIMATE OWN MODEL WHILE UNDER COOPERATIVE SOLUTION: TRUE GAINS

(in squared percentage points of GNP)

Model Subscribed to by U.S.	Model Subscribed to by Non-U.S. OECD			
	MCM	VAR	OECD	LINK
Gains for the United States				
MCM				
Model representing reality:				
MCM	−0.2635	−0.1845	−0.2465	−0.2485
VAR	83.0252	1.3312	46.5952	50.8122
OECD	−2.0064	0.8716	−1.7084	−1.7604
LINK	−3.1460	1.8390	−2.7160	−2.7950
VAR				
Model representing reality:				
MCM	11.5125	0.0565	2.9545	5.3135
VAR	22.0022	−0.3848	18.2152	16.5622
OECD	10.6106	1.2346	1.2996	3.8836
LINK	2.3730	2.1500	−1.3410	−0.2870
OECD				
Model representing reality:				
MCM	−0.1555	−0.0775	−0.2245	−0.2165
VAR	71.9862	2.0782	45.0462	46.8982
OECD	−2.1084	0.8126	−1.8064	−1.8414
LINK	−3.1430	1.5130	−2.7730	−2.8180
LINK				
Model representing reality:				
MCM	−0.2095	1.2705	−0.2475	−0.2495
VAR	75.2732	7.0692	48.9012	51.3582
OECD	−2.1064	2.0706	−1.7364	−1.7844
LINK	−3.1550	1.4570	−2.7600	−2.8160
Gains for Non-U.S. OECD				
MCM				
Model representing reality:				
MCM	−75.1135	60.3275	−68.7305	−70.3275
VAR	205.0822	−8.8588	123.2742	132.9862
OECD	−10.1807	11.7683	−12.1257	−12.0797
LINK	−11.1671	13.0489	−12.5591	−12.5871
VAR				
Model representing reality:				
MCM	−75.2495	70.1315	−71.0695	−72.5135
VAR	63.5892	−8.2918	70.8602	61.7442
OECD	−11.0727	11.7843	−11.4877	−11.2697
LINK	−12.0721	14.3949	−12.4521	−12.4531
OECD				
Model representing reality:				
MCM	−75.1275	46.4765	−69.8855	−70.7945
VAR	189.3552	−9.0088	123.3402	128.2432
OECD	−10.4637	9.9423	−12.0887	−12.0557
LINK	−11.2691	10.3759	−12.5751	−12.5771
LINK				
Model representing reality:				
MCM	−75.1235	19.4225	−69.6275	−70.7065
VAR	194.2622	−9.5438	128.5622	134.7192
OECD	−10.3707	7.1383	−12.1087	−12.0577
LINK	−11.2281	5.4919	−12.5821	−12.5831

The reason averaging usually raises welfare is probably the simple statistical principle that, on average, the average of ten numbers is closer to the individual numbers than the individual numbers are to each other. The principle does not apply directly, because the fact that each policymaker has a better estimate of the "true" parameters does not necessarily imply that the Nash equilibrium will be better. But it seems to work here.

The next step is the move from the noncooperative equilibrium to the cooperative equilibrium while maintaining the assumption that each policymaker averages multiplier estimates. Based on the compromise model, a move to the Nash bargaining point consists of a 4.4 percent reduction in the U.S. money supply and a 1.1 percent increase in the non-U.S. OECD money supply. The consequence, according to most of the models, is to lower U.S. output and to raise non-U.S. OECD output (with more divergence among models regarding the current accounts, as noted earlier). According to the compromise model, the policy change lowers U.S. output by 1.17 percent, raises the U.S. current account by 0.08 percent of GNP, raises non-U.S. OECD output by 0.14 percent, and raises the non-U.S. OECD current account by 0.11 percent of GNP.[3] The key question is whether this coordinated policy change improves welfare under various candidates for the true model. If either the OECD or LINK model is correct, coordination does improve welfare for both players. But some models give negative results. Out of the 10 models, 2 show increases and 8 show losses for U.S. welfare. For non-U.S. OECD welfare, 6 show increases and 4 show losses.[4] This represents no better a case for coordination than prevailed when each player had its own model, as can be seen in Table 6.[5]

Ghosh (1987) and Ghosh and Masson (1988) claim that model uncertainty—far from rendering coordination unattractive, as in my results—actually furnishes an argument in favor of coordination, provided policymakers recognize that they do not know the true model. Essentially, their argument is that if the policymaker has rational expectations, the weights he assigns to the models (one-tenth to each of ten in our experiment) will correspond to the best weights available. If this is so, the policymaker must raise expected welfare by coordination: if the proposed policy package did not raise expected welfare, he would not agree to it. This argument would

[3] One could attempt to rationalize the compromise model's prediction that both the U.S. and non-U.S. OECD current accounts improve by positing a decline in prices of imports of oil and other commodities from less developed countries. But the magnitudes of the current-account effects are, in any case, very small.

[4] Note that when the policymakers have the same compromise model, there are only 10 possible outcomes rather than 10^3.

[5] Holtham and Hughes Hallett (1987, p. 158) find that "there is no advantage in using a synthetic model, which averages the properties of competing models; they generate nearly as many losses as the worst of the 'names' models."

be correct if one believed that governments do assign the best weights to the conflicting models. Among other things, the policymakers of all governments would have to have identical perceptions even though the model builders did not. It is the premise of this study that policymakers do not share a common, correct set of perceptions, so that policymakers do not necessarily use the best weights. Thus to argue that policymakers maximize expected welfare by coordinating is to say that what matters is the perception of the happy policymaker that he has made the best decision—even if he is actually ruining the economy.

An alternative interpretation of the results on averaging was mentioned above: the two players retain their belief in one model or another but in the interest of improving on the noncooperative equilibrium they agree to an alternative kind of cooperation. They bargain directly over an official compromise model rather than just over policy settings, and then they maximize joint welfare gains as in the Nash bargaining solution but using the compromise model. Line 6 in Table 6 reports the count for welfare gains from this kind of cooperation: 563 for U.S. welfare and 511 for non-U.S. OECD welfare.[6] As the results in Tables 11 and 12—or the overall counts in lines 4 or 7 of Table 6—show, virtually all these gains can be reaped by averaging to get better model estimates alone, without a simultaneous move from the noncooperative to the cooperative solution.

[6] Recall that in the experiment in which each policymaker believes in a model with certainty, the statistics included the one-eighth cases in which the policymaker turned out to have had the correct model, so that the odds were biased in favor of coordination's improving welfare. That is not the case here. When the models are averaged, as in each of the last three experiments in Table 6, none of the gains represent cases in which policymaking is based on exactly the correct model, under our method of counting the possible outcomes.

6 THE GAINS FROM BETTER INFORMATION ON THE MODEL

We have already established the perils of cooperative policymaking when using the wrong model. One might wonder about similar perils of policymaking even without cooperation. If policymakers are wrong about the initial position, or about the welfare weights, or about the multipliers, they will not necessarily be able to attain the optimum Nash noncooperative equilibrium. How much could they improve welfare simply by discovering the true model?

The last two tables show the effects, staying within the Nash noncooperative equilibrium, if one policymaker who may previously have had the incorrect model discovers the correct model. Table 13 shows the effects of a model switch on U.S. welfare and on non-U.S. OECD welfare for four possible true models when the two countries are free to vary their money supply but not their levels of government expenditure. If the two countries already have the correct model, the gains of course are zero. In occasional cases, the U.S. gains from switching to the correct model are negative because there is a loss of bargaining power and the other country moves in an undesirable direction. But the gains are usually positive and are sometimes larger than 1 percent of GNP.

One sense in which the gains from unilateral moves can be seen to be "large" is to compare them with the potential gains from coordination. In Chapters 4 and 5, we saw that the effect of a move from the Nash noncooperative equilibrium to the cooperative equilibrium can easily have a negative effect on welfare if the policymakers are using the wrong models. But we now give coordination the benefit of the doubt. We report in the first column of Table 13, for each of the models, the effect on U.S. and on non-U.S. OECD welfare from coordination under the assumption that both countries know the true model. These four numbers are thus a sort of upper bound on the gains from coordination. In two cases (the OECD and LINK models), the potential gain for the United States is about 0.013, worth only 0.1 percent of GNP. The gain is even more negligible in the case of the MCM and is substantial only in the case of the VAR model. In a slight majority of cases, the gains from discovering the correct model and unilaterally adjusting monetary policy are greater than the further gains from coordination.

Table 14 reports the same statistics, U.S. and non-U.S. OECD welfare effects, when the countries are free to vary their level of government expenditure as well as their money supplies. It remains true that the gains

TABLE 13

GAINS FROM UNILATERAL SWITCH TO TRUE MODEL UNDER NONCOOPERATIVE SOLUTION, USING MONETARY POLICY ONLY

(in squared percentage points of GNP)

Model Subscribed to by U.S.	Model Subscribed to by Non-U.S. OECD			
	MCM	VAR	OECD	LINK
Gains for the United States				
MCM				
Model representing reality:				
MCM (0.0000) [a]	0.0000	0.0000	0.0000	0.0000
VAR (0.4323)	0.6069	0.0139	0.2412	0.3328
OECD (0.0128)	0.0011	−0.0000	0.0008	0.0007
LINK (0.0141)	0.0001	0.0008	0.0003	0.0001
VAR				
Model representing reality:				
MCM (0.0000)	0.0964	0.0131	0.0920	0.0716
VAR (0.4323)	0.0000	0.0000	0.0000	0.0000
OECD (0.0128)	0.1019	0.0198	0.0946	0.0748
LINK (0.0141)	0.0447	0.0169	0.0389	0.0322
OECD				
Model representing reality:				
MCM (0.0000)	0.0009	0.0000	0.0006	0.0006
VAR (0.4323)	0.4995	0.0137	0.2008	0.2750
OECD (0.0128)	0.0000	0.0000	0.0000	0.0000
LINK (0.0141)	0.0001	0.0009	−0.0000	0.0000
LINK				
Model representing reality:				
MCM (0.0000)	0.0004	0.0001	0.0003	0.0003
VAR (0.4323)	0.5358	0.0179	0.2107	0.2899
OECD (0.0128)	0.0001	−0.0003	0.0001	0.0000
LINK (0.0141)	0.0000	0.0000	0.0000	0.0000
Gains for Non-U.S. OECD				
MCM				
Model representing reality:				
MCM (0.0001) [b]	0.0000	1.3740	0.0665	0.0488
VAR (0.3216)	2.1378	0.0000	1.3004	1.4078
OECD (0.0078)	0.0193	0.2426	0.0000	0.0004
LINK (0.0038)	0.0141	0.2606	0.0004	0.0000
VAR				
Model representing reality:				
MCM (0.0001)	0.0000	1.7716	0.0005	0.0181
VAR (0.3216)	0.8281	0.0000	0.8012	0.6667
OECD (0.0078)	0.0004	0.2706	0.0000	0.0007
LINK (0.0038)	0.0044	0.3293	0.0032	0.0000
OECD				
Model representing reality:				
MCM (0.0001)	0.0000	1.3764	0.0572	0.0453
VAR (0.3216)	1.9835	0.0000	1.2571	1.3287
OECD (0.0078)	0.0160	0.2424	0.0000	0.0002
LINK (0.0038)	0.0128	0.2609	0.0002	0.0000
LINK				
Model representing reality:				
MCM (0.0001)	0.0000	1.3386	0.0595	0.0462
VAR (0.3216)	2.0375	0.0000	1.2690	1.3505
OECD (0.0078)	0.0171	0.2390	0.0000	0.0002
LINK (0.0038)	0.0133	0.2543	0.0002	0.0000

[a] Gains from coordination for the United States, assuming that all countries believe the same, correct model.

[b] Gains from coordination for non-U.S. OECD, assuming that all countries believe the same, correct model.

TABLE 14

GAINS FROM UNILATERAL SWITCH TO TRUE MODEL UNDER NONCOOPERATIVE SOLUTION, USING MONETARY AND FISCAL POLICY

(in squared percentage points of GNP)

Model Subscribed to by U.S.		Model Subscribed to by Non-U.S. OECD			
		MCM	VAR	OECD	LINK
Gains for the United States					
MCM					
Model representing reality:					
MCM	(0.0002) [a]	0.0000	0.0000	0.0000	0.0000
VAR	(0.0001)	6.4695	0.7747	8.0802	3.8767
OECD	(0.0001)	0.2162	−0.1875	0.3561	0.1741
LINK	(0.0001)	0.2815	0.4161	0.6199	0.1809
VAR					
Model representing reality:					
MCM	(0.0002)	0.8851	6.2040	4.2811	5.7775
VAR	(0.0001)	0.0000	0.0000	0.0000	0.0000
OECD	(0.0000)	0.7313	4.1867	3.7902	5.1662
LINK	(0.0001)	0.3563	1.0594	1.4970	1.7908
OECD					
Model representing reality:					
MCM	(0.0002)	0.1316	0.9128	0.3480	0.0808
VAR	(0.0001)	0.3059	1.4629	7.6123	2.8207
OECD	(0.0000)	0.0000	0.0000	0.0000	0.0000
LINK	(0.0001)	0.0263	0.0369	0.0156	0.0014
LINK					
Model representing reality:					
MCM	(0.0002)	0.0924	3.2834	0.6249	0.0642
VAR	(0.0001)	1.1194	2.3370	9.3277	2.8708
OECD	(0.0000)	0.0436	−1.2085	0.0734	0.0017
LINK	(0.0001)	0.0000	0.0000	0.0000	0.0000
Gains for Non-U.S. OECD					
MCM					
Model representing reality:					
MCM	(0.0001) [b]	0.0000	0.2232	0.4319	0.1740
VAR	(0.0002)	11.3928	0.0000	12.2560	7.5393
OECD	(0.0002)	0.2275	0.5724	0.0000	0.0377
LINK	(0.0002)	0.3441	7.2746	0.5592	0.0000
VAR					
Model representing reality:					
MCM	(0.0001)	0.0000	0.3528	5.1936	0.1402
VAR	(0.0002)	2.1916	0.0000	2.5054	4.9072
OECD	(0.0002)	0.5662	15.1193	0.0000	0.2213
LINK	(0.0002)	2.7143	24.4791	17.5131	0.0000
OECD					
Model representing reality:					
MCM	(0.0001)	0.0000	1.8177	1.9351	0.3683
VAR	(0.0002)	2.2479	0.0000	10.5056	5.9473
OECD	(0.0002)	1.5557	4.4157	0.0000	0.1027
LINK	(0.0002)	2.9010	17.1275	1.5826	0.0000
LINK					
Model representing reality:					
MCM	(0.0001)	0.0000	3.0139	3.0754	0.2975
VAR	(0.0002)	3.4954	0.0000	13.6618	6.0407
OECD	(0.0002)	1.2941	13.2203	0.0000	0.1191
LINK	(0.0002)	1.6091	27.7992	3.2490	0.0000

[a] Gains from coordination for the United States, assuming that all countries believe the same, correct model.

[b] Gains from coordination for non-U.S. OECD, assuming that all countries believe the same, correct model.

from unilaterally switching to the correct model are usually positive. Sometimes they are large. For example, when the United States believes the VAR but the true model is the OECD model, the gain from switching is 3.79 (assuming that the other country is playing by the OECD model). Translated from the terms of quadratic welfare function, this is worth 1.9 percent (the square root of 3.79) of GNP. Similarly, when the United States believes the OECD model but the true model is the VAR, the gain from switching is 1.2 percent of GNP. By contrast, the potential gains from coordination are always very small. Now the gains from correcting policies unilaterally are almost always greater than the gains from coordination.

It is not a new finding that the potential quantitative gains from coordination are small, even under the conventional assumption that they are necessarily positive because the true model is known. Oudiz and Sachs (1984), among others, found the same result and attributed it primarily to the small trade multipliers that in practice link the United States with the rest of the OECD, let alone with individual countries. Carlozzi and Taylor (1985), Oudiz (1985), and Canzoneri and Minford (1986) also find that the quantitative gains are small. But it is interesting to see the small size of these gains compared side-by-side with the gains from unilateral improvements in policymaking.

In the context of U.S. policy in the 1980s, a commonly proposed policy-coordination package is a reduction in the U.S. budget deficit, accommodated by a monetary policy of allowing interest rates to drop so as to maintain nominal GNP growth, and accompanied by expansion in Europe and Japan. Some economists have argued that most, if not all, the gains from this policy package could be accomplished if the U.S. policymakers did their part unilaterally. In 1983 and 1984, it seemed to some that the obstacle was precisely the one on which we have focused here: the U.S. Treasury was operating with the wrong model. There may be other reasons why the U.S. administration has so far failed to propose measures that would reduce the structural budget deficit substantially. One possibility is a misperception of the initial conditions, as described in Chapter 2; official forecasts of the rate of growth have been too high, and official forecasts of the trade and budget deficits have been too low. Another possibility is the assignment of incorrect weights in the objective function; for example, many businessmen think the administration has put insufficient weight on the trade deficit. (The spirit of this paper is that it could alternatively be true that the objective function, forecast, and model used by the administration are correct and those of its critics incorrect.)

A more sympathetic interpretation is that political constraints prevent the administration from convincing the Congress or the Federal Reserve to adopt the right policies. Indeed, as suggested in an earlier footnote, the real

purpose behind Secretary Baker's efforts in international meetings to set in motion worldwide interest-rate cuts may have been to overcome political obstacles at home to a switch in the monetary/fiscal policy mix. Another example of this phenomenon would be the efforts of finance ministers of other countries, meeting at the OECD and elsewhere in the late 1970s, to "psyche themselves up" to return home and push through measures to reduce their countries' budget deficits.

While the results reported here appear to argue against "coordination" as precisely defined at the outset of this study, from another perspective they provide support for "cooperation" as defined more broadly to include the exchange of information. First, there are sometimes gains simply from countries' telling each other what model they are playing by, compared with the noncooperative equilibrium in which each must guess the other's model (Tables 7 and 8). Second, there are often gains from countries' pooling estimates as to the correct models, whether coordinating to maximize joint perceived welfare gains (Table 12) or not (Table 11). Third, if cooperative research efforts could produce better estimates of the true model, the gains might be very large (Tables 13 and 14). Finally, if discussions in international fora allow finance ministers to build political momentum behind measures that they already know to be desirable, the gains could again be large. Thus the scope for useful international cooperation remains wide, provided it is defined broadly rather than in the precise academic sense.

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