A NOTE ON INTERNATIONALLY COORDINATED POLICY PACKAGES
INTENDED TO BE ROBUST UNDER MODEL UNCERTAINTY

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ABSTRACT

Holtham and Hughes Hallett, and a number of other authors,
have suggested that a printout of all 1,000 cases of coordination
considered in Frankel and Rockett (1988) should be made
available. They wish to check whether, if coordination is
restricted to policy packages that they call "strong" bargains,
it would raise welfare a higher percentage of the time. We now
make those results available. The results show that if
coordination is restricted to packages that are robust with
respect to model uncertainty, such as the so-called "strong"
bargains, it does indeed improve the odds in favor of gains from
coordination.

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A Note on Internationally Coordinated Policy Packages
Intended to be Robust Under Model Uncertainty

Empirical work on the international coordination of macroeconomic policy has made a lot of progress over the last eight years. Much of it is quite pessimistic, relative to earlier theoretical arguments that coordination would necessarily improve economic welfare.[1]

Frankel and Rockett (1988) showed two results that apply when national policy-makers do not necessarily know the correct model. (1) They will still in general be able to agree on a package of macroeconomic policy changes that each believes will leave its country better off. But, more importantly, (2) the package could turn out to lower welfare as easily as raise it, when judged in the light of some "true" model that may differ from the two models subscribed to by the two policy-makers. We used ten multi-country econometric models that had participated in simulation exercises under the auspices of the Brookings Institution, to see what would happen if the U.S. policy-makers believed one of the ten models, policy-makers in other OECD countries believed another, and reality was represented by a third. A computer count of the 1,000 (=10x10x10) possible combinations showed that monetary coordination raised U.S. welfare in 63 per cent of the cases where there was a significant effect. For the other countries, coordination raised

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[1] Oudiz and Sachs (1984), for example, found that the gains to coordination, though necessarily positive in their framework, were nevertheless quite small empirically.

welfare in 62 per cent of these cases.[2]

The point that coordination under conditions of model uncertainty could turn out to lower welfare in some circumstances has been readily accepted. But a common reaction has been to argue that the odds in favor of coordination may be better than our calculations suggest, provided policy-makers intelligently take into account their own uncertainty regarding the correct model.

A number of observers have claimed that coordination is in fact unlikely to take place in those cases where a policy-maker's model predicts that the package of policy changes being proposed would make the other country worse off, even though it predicts that his own country will be better off. Currie, Holtham and Hughes Hallett (1989) and Holtham and Hughes Hallett (1987, 1989) have called such cases "weak bargains," and have been cited approvingly by Bryant (1990, p.147) and Kenen (1990, p.83-84). They call cases where both policy-makers expect the package in question to raise welfare for both countries "strong" bargains. They conjecture that if one restricted the test to such "strong condition" bargains, it would show results more favorable to coordination.

There would appear to be little reason why a policy-maker would be altruistic enough to refuse to coordinate, out of concern

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[2] If one believes that there are in fact thousands of possible models and the probability of one of the policy-makers' models being exactly correct is nil, then the computed odds are biased a little in favor of gains from coordination, by including the 190 combinations where reality coincides with one of the policymakers' models. This issue is addressed in the last part of this note.

for his neighbor's welfare, when he believed that the proposed package would be good for himself but would diminish his neighbor's welfare.   The argument of Holtham and Hughes Hallett (HHH) is essentially that such a policy-maker will figure that it is not a good idea to go ahead with a "weak" bargain because the other policy-maker, though he believes now that he will benefit from the proposed package, will be proven wrong next period and will abrogate the deal.   Such an argument would clearly need to be addressed in an intertemporal framework.

Whatever one thinks of the HHH argument as a positive prediction that policy-makers are in fact unlikely to agree on a package unless each thinks that the package will benefit both, a normative argument could be made.   In the presence of uncertainty, policy-makers should check to see if a proposed policy package is robust, i.e., whether it can be expected to prove beneficial under a variety of possible models.   A complete analysis would have a policy-maker assign probability weights to many possible models and then negotiate coordinated packages so as to maximize the expected value of his objective function.[3]   But there is also something to be said for seeing what would happen under simpler checks for robustness of a proposed package.

A very simple check would be to have the countries go ahead with coordination only in the special case where they share the

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[3] This was done in an extension of the original Frankel and Rockett (1988, p.337-38) analysis, for the simple case of equal weights on all ten models.   Ghosh and Masson (1988) and Hughes Hallett (1989) take this approach further.

same model. The results in Frankel and Rockett (1988, p.330) showed that under such a restriction, the odds in favor of coordination do change, but only a little: to 65 per cent for the United States and 59 per cent for the others. Holtham and Hughes Hallett (1987, p.25) and Hughes Hallett (1989, p.318-322) obtained similar results.[4]

We personally are unsure that each policy-maker would find the other country's model a particularly compelling test for robustness. But Currie, Holtham and Hughes Hallett (1989), Holtham and Hughes Hallett (1987, 1989), Bryant (1990, p.147) and Kenen (1990, p.83-84), have all expressed the belief that it would be an informative exercise to compute the frequency of gains from coordination restricted to "strong" bargains, and have in one way or another lamented the fact that it was not possible to perform this computation from the reported results in Frankel and Rockett (1988).

When we were writing our paper, we did not see any use for the details of the 1,000 individual cases and so we did not have the computer print them out (let alone publish the output in a table). But in light of the interest in these results that has been expressed over the last four years, we have now re-done the entire exercise, and printed out the 1,000 individual cases. The purpose of this note is to present the results. The raw results showing

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[4] Cooper (1989) offers an historical illustration that supports the positive proposition that a prerequisite for governments agreeing on international coordination is that they come to agreement on a model.

the outcomes for each combination of models are available in an accompanying Appendix.[5] A repeat of the Frankel-Rockett count shows that coordination raises U.S. welfare in 60.2 per cent of the cases and rest-of-OECD welfare in 61.9 per cent.[6]

What do the results say about the HHH suggestion to restrict the coordination experiment to "strong" bargains? Under this restriction, coordination will only take place in 410 cases out of 1,000. But within that set, coordination does indeed result in welfare gains more often than it does in the unrestricted set: 78.1 per cent of the time for the United States and 75.9 per cent for the other OECD countries. In other words the HHH conjecture turns out to be right.

If the point of the exercise -- of restricting the set of packages to those that raise a country's welfare according to both models -- is to try out a normative proposal to enhance robustness, then the process can naturally be carried further. Why shouldn't a policy-maker who is concerned about robustness check to see if

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[5] Table 3 in that Appendix shows the changes in monetary policy entailed in the coordination package, and its perceived effects, for all 100 combinations of models. Table 4 shows the true resulting effects on welfare, for all 1000 possible outcomes.

[6] The numbers differ slightly from those in Frankel and Rockett (1988) because the decimal accuracy of the program used this time around divided all cases into gains and losses, whereas the earlier program placed some in the category of no effect to four significant digits. [It is also possible that the difference in algorithm used to find the bargaining solution and in initial conditions might matter in some small way.]

the proposed package would be beneficial according to other models, in addition to the ones that he and the other player favor? We checked the new results to see what happens if coordination is restricted to those cases where the package appears to raise welfare under at least two models: the two that the players believe in or, in the case where they agree on the same model, that one plus some second model. We found that coordination under this restriction would only take place in 390 cases. (In other words, in a few of the cases of model agreement classified as "strong bargains" before, no second model could be found that would imply welfare gains to both countries.). But we also found that coordination would raise U.S. welfare in 80 per cent of those 390 cases, and welfare in other countries in 77.4 per cent. The results are reported in Table 1, under panel 2.

We next strengthened the requirement for a coordination package further, so that it must appear to improve welfare under three models before the countries will proceed, and checked how often those packages would improve welfare; we then proceeded to four models, five, and so on to ten. The results are also reported in Table 1, under panels 3, 4, and so on. As one would expect, the number of cases that survive the criterion dwindles as the requirement is strengthened. But conditional on coordination taking place, the odds in favor of welfare gains from coordination remain high, and in fact rise each time the requirement is strengthened.

The results reported in the Appendix and summarized in Table

1 assume an initial GNP gap of -4.15 % for the United States and -
6.05 % for the rest of the OECD. By way of sensitivity analysis,
we also tried the exercise for an initial GNP gap of -1.26 % for
the U.S. and -4.18 % for the rest of the OECD. When coordination
is restricted to strong bargains as defined by HHH, the odds in
favor of coordination are a little better under the assumption of
these smaller initial GNP gaps: gains occur 81 per cent for the
U.S. and 77 per cent of the time for the rest of the OECD.   But
when the criterion is strengthened to the level where the proposed
package must raise welfare under five or more models, the frequency
of gains becomes slightly worse under the smaller GNP gaps than was
the case in Table 1.[7]

One reason why the odds in favor of coordination rise as the
criterion is strengthened in Table 1 may be spurious. Each model
against which the countries are assumed to check the package's
effects before proceeding to coordinate is included in the list of
ten models by which the success of the coordination is judged,
guaranteeing a favorable outcome in at least those cases.   In
reality there are thousands of models, rather than ten, and no one
model is likely to be precisely right.   An unbiased test would
judge the outcome with a list of models that does not overlap with
the list of models that the countries consult before agreeing on
their package.

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[7] The final results showing the frequency of coordination and
of resulting gains and losses, in analogous form to Table 1, are
reported in Table 1b in the Appendix. The raw results showing the
outcomes for each combination of models are reported in Tables 3a
and 4a, analogous to Tables 3 and 4, also available on request.

The effect of the bias in the test of Table 1 rises with the number of models checked. For example in those few cases where a package raised welfare according to all ten models, whatever model was chosen to represent reality was necessarily one of those that had already been checked, and so success occurred 100 per cent of the time by construction.

A test can be easily constructed that eliminates this bias. Each time a policy package has been found that appears to raise welfare according to the specified number of models k, those k models are excluded from the list of models whereby success is judged. The results are also reported in the Appendix.[8] We necessarily lose observations by this procedure. For example, in the most stringent form of the criterion, where the package must satisfy all ten models, we lose all observations. Nevertheless, we learn that the odds in favor of coordination, for criterion-strengths 1 through 9, are only a little worse than under the first test. They start out, under the HHH "strong" criterion, at a 72.7 per cent success rate for U.S. welfare and 70.0 per cent for the rest of the OECD (and again rise gradually with the strength of the robustness criterion). This still represents a significantly greater success rate than when coordination is undertaken without any checks for robustness under other models.[9]

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[8] Table 2.

[9] By way of sensitivity analysis, we again tried the exercise for an initial GNP gap of -1.26 % for the U.S. and -4.18 % for the rest of the OECD. The frequency counts are available in Table 2b in the Appendix. The odds in favor of coordination are again not much different with these smaller initial GNP gaps. Overall our

In short, restricting coordination to those cases where the proposed policy package meets a criterion of robustness with regard to the assumed model does indeed raise the frequency of actual outcomes under which coordination is estimated to improve economic welfare.

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results do not appear to be very sensitive to the assumed initial conditions.

References

Bryant, Ralph. 1990. Comment on Obstacles to coordination. In International Policy Coordination and Exchange Rate Fluctuation, edited by William Branson, Jacob Frenkel, and Morris Goldstein (Chicago: University of Chicago Press), p.145-153.

Cooper, Richard. 1989. International cooperation in public health as a prologue to macroeconomic cooperation. In Cooper, et al, Can nations agree? Issues in international cooperation, Brookings: Washington, D.C..

Currie, David, Gerald Holtham, and Andrew Hughes Hallett. 1989. The theory and practice on international policy coordination: Does coordination pay? In Ralph Bryant, et al, Macroeconomic Policies in an Interdependent World, Brookings Institution: Washington, D.C.

Frankel, Jeffrey and Katharine Rockett. 1988. International macroeconomic policy coordination when policy-makers do not agree on the true model. American Economic Review 78 (3) June: 318-340.

Ghosh, Atish and Paul Masson. 1988. International policy coordination in a world with model uncertainty. International Monetary Fund Staff Papers 35, 2, June.

Holtham, Gerald, and Andrew Hughes Hallett. 1987, "International Policy Coordination and Model Uncertainty." In R.Bryant and R.Portes, eds., Global macroeconomics: Policy conflict and cooperation, MacMillan: London.

-------------------------------------- 1989. "Policy Coordination Under Uncertainty: The Case for Some Disagreement (A Comment on Frankel and Rockett)," University of Strathclyde, U.K.; revised, March 1991.

Hughes Hallett, Andrew. 1989. What are the risks in coordinating economic policy internationally? In R.MacDonald and M.Taylor, eds., Exchange Rates and Open Economy Macroeconomics, Blackwell and Co.: Oxford and New York.

Kenen, Peter. 1990. The coordination of macroeconomic policies. In International Policy Coordination and Exchange Rate Fluctuation, edited by William Branson, Jacob Frenkel, and Morris Goldstein (Chicago: University of Chicago Press).

Oudiz, Gilles, and Jeffrey Sachs. 1984. Macroeconomic policy coordination among industrial economies. Brookings Papers on Economic Activity 1: 1-75.

Table 1

MORE STRINGENT CONSENSUS VARIANTS
CASE OF INITIAL U.S. GNP GAP OF -4.15% AND NON-U.S. OECD GAP OF -6.0

This table summarizes cases for which coordination of U.S. and Non-U.S. OECD money supplies according to the Nash Bargaining Solution allows for welfare improvements when the decision to coordinate is subject to a more stringent requirement than just each of the players perceiving they will be better off solely according to the model each player believes in.

In each of the cases below, the countries proceed with coordination on the condition both countries obtain positive gains when the true model is either one

1. of the models which the players believe in

	Number	Percentage
positive U.S. gains	320	78.1
negative U.S. gains	90	21.9
TOTAL CASES	410	100

positive Non-U.S. OECD gains	311	75.9
negative Non-U.S. OECD gains	99	24.1
TOTAL CASES	410	100

2. of two models or more

	Number	Percentage
positive U.S. gains	312	80
negative U.S. gains	78	20
TOTAL CASES	390	100

positive Non-U.S. OECD gains	302	77.4
negative Non-U.S. OECD gains	88	22.6
TOTAL CASES	390	100

3. of three models or more

	Number	Percentage
positive U.S. gains	298	82.8
negative U.S. gains	62	17.2
TOTAL CASES	360	100

positive Non-U.S. OECD gains	288	80
negative Non-U.S. OECD gains	72	20
TOTAL CASES	360	100

4. of four models or more

	Number	Percentage
positive U.S. gains	279	87.2
negative U.S. gains	41	12.8
TOTAL CASES	320	100

positive Non-U.S. OECD gains	263	82.2
negative Non-U.S. OECD gains	57	17.8
TOTAL CASES	320	100

5. of five models or more

	Number	Percentage
positive U.S. gains	247	91.5
negative U.S. gains	23	8.5
TOTAL CASES	270	100

positive Non-U.S. OECD gains	233	86.3
negative Non-U.S. OECD gains	37	13.7
TOTAL CASES	270	100

6. of six models or more

	Number	Percentage
positive U.S. gains	213	92.6
negative U.S. gains	17	7.4
TOTAL CASES	230	100

positive Non-U.S. OECD gains	210	91.3
negative Non-U.S. OECD gains	20	8.7
TOTAL CASES	230	100

7. of seven models or more

	Number	Percentage

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                              negative Non-U.S. OECD gains    0              0
                              ==================================================
positive U.S. gains    178      93.7    TOTAL CASES                   100            100
negative U.S. gains     12       6.3
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TOTAL CASES            190      100     *  all gains, positive and negative, are greater than 0.0001
                                        in absolute value.

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positive Non-U.S. OECD gains   182    95.8
negative Non-U.S. OECD gains     8     4.2
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TOTAL CASES            190      100
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8. of eight models or more

	Number	Percentage
positive U.S. gains	137	97.9
negative U.S. gains	3	2.1

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| TOTAL CASES | 140 | 100 |

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| positive Non-U.S. OECD gains | 138 | 98.5 |
| negative Non-U.S. OECD gains | 2 | 1.5 |

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| TOTAL CASES | 140 | 100 |

9. of nine models or more

	Number	Percentage
positive U.S. gains	128	98.5
negative U.S. gains	2	1.5

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| TOTAL CASES | 130 | 100 |

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| positive Non-U.S. OECD gains | 129 | 99.2 |
| negative Non-U.S. OECD gains | 1 | 0.8 |

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| TOTAL CASES | 130 | 100 |

10. of ten models or more

	Number	Percentage
positive U.S. gains	100	100
negative U.S. gains	0	0

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| TOTAL CASES | 100 | 100 |

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| positive Non-U.S. OECD gains | 100 | 100 |