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ON THE THEORY OF MACROECONOMIC POLICY

by

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### Jan Tinbergen and the theory of policy.

A great privilege and honor it is for me to speak here today to all of you who are joining me in homage to Jan Tinbergen. I have long regarded Jan Tinbergen as the model economist, the personal example I most hope young economists will follow. He was and is of course a scientist, full of curiosity about how the world works. But his motivation has always been more than curiosity. He wants to know how the world works so that he can make it work better. Knowledge is the foundation of policy. It was natural for Tinbergen to set forth a formal theory of policy nearly fifty years ago. [Tinbergen 1952 and 1956], and it was equally natural for him to relate the theory to practical problems of policy in the Netherlands and elsewhere and to implement it and illustrate it with the help of theoretical and econometric models. Thus Tinbergen was the originator of the subject on which I propose to speak to you today.

For many social scientists public policies are phenomena to be described, analyzed, and understood, just like other aspects of individual and social behavior. Those scholars seek to tell how politics and government work, not to try to make them work better. This is certainly a legitimate standpoint, in economics most prominently represented by James Buchanan and other public choice theorists. They regard do-gooders like Tinbergen and me as naive. We think we have an audience, the general public or legislators or government administrators. We assume that to some degree they identify their personal interest with the public interest, wish to promote social welfare, and respect reason and fact. Certainly that is the spirit in which Tinbergen conceived his theory of policy.

Tinbergen embedded policy in a mathematical economic model. Some variables in the model are identified as policy instruments, some as objectives of policy-makers. Policy instruments are "exogenous" in the sense that policy-makers are free to set their values. There are other exogenous variables, whose values are set by nature or foreigners or other forces external to the model. The model also contains "endogenous" variables; their values depend on the exogenous variables, policy or non-policy. Target

values for some endogenous variables are the objectives of policy. Those objective variables are not the only endogenous variables, but they are the ones that matter.

You can imagine solving such a model so that the solution, or what econometricians call the "reduced form", tells directly how the objectives depend on the policy variables. It is easiest to think of this solution for a set of linear equations. The first truth, simple but illuminating, is that the policy-maker cannot hope to hit targets for more objective variables than the number of instrument variables. The second truth is that the availability of  $N$  instruments does not guarantee that as many as  $N$  objective targets can be hit. There must be  $N$  independent instruments, in the sense that the effects of any one instrument on the objectives are not proportional to those of any other, or of any combination of others. The third truth is that a redundancy of instruments is conceivable, more instruments than needed to hit all the attainable targets, whether or not some other targets are unattainable.

Very frequently some tradeoffs are ineradicable. For example, we probably don't know how to get more equity from the economy without losing efficiency. The array of policy instruments does not include tools that could overcome this familiar tradeoff. For this reason, instruments are insufficient. Yet at the same time, for a given standard of efficiency we might be able to identify numerous combinations of instruments that would yield the same degree of equity. In that sense, instruments are redundant.

#### Applications in macroeconomics.

Rather than pursuing that example, let me turn to my topic of macroeconomics. Tinbergen's framework may seem simple common sense, but it was not obvious beforehand. In the early days of the Keynesian revolution, the idea was to throw everything available at the problem of the moment, depression unemployment or war-generated inflation. Against unemployment, for example, spend more on public works, cut taxes, print more money, and lower interest rates -- all. So indiscriminating and single-minded an attack was perhaps justified during the Great Depression because the target was so remote and so central, and because the constraints on the instruments were so tight that overshooting was not a worry.

After the Second World War, Keynesian economists learned to regard fiscal policy and monetary policy as distinct macroeconomic instruments, substitutes for one another. (It is true that they are not always independent. If printing money is the only way to finance government deficits, then there is no monetary policy independent of fiscal policy. Likewise a small open economy with a fixed foreign exchange rate may not be able to have its own monetary policy.) Fiscal and monetary policies are both instruments of demand management, of short-run or counter-cyclical economic stabilization.

The two standard objectives of demand management are full employment and price stability, one a numerical target for an unemployment rate variable, the other a numerical target for a price inflation variable. Well, we have two objectives and two instruments. Can't we achieve macroeconomic bliss? At least one popular American macro textbook misread Tinbergen and said so, and some economists who should know better have slipped in to the same mistake. The fallacy is an example of the second truth. With respect to the two targets, fiscal policy and monetary policy are collinear instruments.

That unfortunate fact of life is a consequence of what I call the "common funnel theorem." The theorem says that the consequences of a given volume of aggregate demand, on the one hand, for output and employment and, on the other, for money prices and wages are independent of the sources and composition of that volume of demand. Neither fiscal nor monetary instruments affect the target values directly. Both affect them through the same medium, aggregate demand. The demands generated by fiscal policies and those generated by monetary policies are poured, along with demands from all other sources, into a common funnel. How much goes into prices and how much into output depends on the outflow from the funnel. The output/price or unemployment/inflation tradeoff is inexorable; that is to say, it can't be eliminated or mitigated by altering the fiscal/monetary policy mix.

Another way to put the point is this: A certain volume of aggregate demand will place the economy at a certain point on the aggregate supply (AS) curve relating output to price level or on the short-run Phillips curve relating unemployment to inflation. Whether that volume is supported by an easy fiscal policy combined with a tight monetary policy or by a tight

fiscal policy combined with an easy monetary policy will not shift the AS curve or the Phillips curve and, therefore, will not alter the points reached on those curves.

I guess that many of you are busy thinking of exceptions to my common funnel theorem. I recognize that deviations are easy to imagine, but they are generally unsystematic. For example, the composition of aggregate demand will usually depend on the mix of the two policies. An easy fiscal/tight money mix will be expected to result in relatively more private and public consumption and less investment than the opposite mix. Quite possibly this difference in composition, in any given economy at any particular time, carries with it some difference in price behavior. I just don't see that there is any way for a macro theorist to generalize about that difference or for a macro policy-maker to count on it.

However, there is one systematic exception I will acknowledge. It applies to an open economy in a regime of floating exchange rates with free movement of funds across currencies. An easy fiscal/tight money policy mix means higher interest rates are associated with any given real GNP. They attract internationally mobile funds and appreciate the local currency. The appreciation makes prices of internationally tradable goods lower in local currency. The improvement in overall price indexes and their inflation is probably only temporary, because the price declines are borrowed from other countries and are accompanied by deterioration in the home economy's trade balance and current account. This is not a game every country can play at once. It is a "beggar-thy-neighbor" tactic against inflation in one country, just as policies that lead to exchange depreciation are "beggar-thy-neighbor" tactics against unemployment.

Most economists nowadays think there is no permanent unemployment-inflation tradeoff. That proposition contains both good and bad news. The good news is that the conquest of inflation entails no cost in unemployment. The bad news is that the amount of irreducible -- "natural" -- unemployment may be very high. Anyway the short-run tradeoff is a practical problem in anti-recession or anti-inflation policy-making, and the inability of the two instruments, fiscal and monetary, to overcome the tradeoff is a serious handicap.

Frustrated by the high unemployment rates seemingly necessary for

disinflation or for price stability, many macroeconomists have, at various times, stressed the need for additional independent policy tools. The tie between prices and output or wages and employment due to the common funnel might be broken by price and wage controls or incomes policies. It is interesting that both Keynes and Tinbergen viewed money wage rates as a possible policy instrument. Perhaps direct wage/price instruments could lower the natural or inflation-safe rate of unemployment. Perhaps structural reforms -- which Tinbergen termed "qualitative" policies to distinguish them from quantitative instruments -- could make the short-run tradeoff less painful or even lower the natural unemployment rate.

The two instruments, fiscal and monetary, should be together capable of hitting some pair of targets. One member of the pair would be a real GNP and employment target, with whatever price outcome is conjoined to it. That would be a target for aggregate demand, most likely the natural or inflation-safe unemployment rate. What would be the second target? It might be a variable connected with external balance, the exchange rate or international reserves or the current account.

More fundamentally, the fiscal/monetary policy mix affects the composition of national output as between investment and consumption. As noted above, a tight-fiscal/easy-money policy mix would favor investment, both domestic and foreign. Those who are concerned for the future standard of living of the society relative to the present would naturally favor that policy mix. The opposite combination of policies in the United States in the 1980s has led to a binge in current consumption at the expense of future Americans.

Although we commonly speak of monetary and fiscal policies each as univariate, as I have been doing here, we know that under each heading fall numerous specific instruments. The monetary authority can set reserve requirements and impose other restrictions on bank portfolios, can set its own discount and lending policies and rates, and can engage in open market operations in a variety of assets, foreign and domestic, short and long. From a macroeconomic viewpoint, most of these monetary instruments are different ways of doing the same thing, and the central bank chooses among them on quite subsidiary considerations. However there might be some gain in the scope of macroeconomic control from using a variety of open market

interventions, in foreign exchange and in long run securities or even equities, not just in the usual very short-term markets.

The variety of fiscal instruments is even greater. In macroeconomics we look mainly at direct impacts on aggregate spending on goods and services. For government purchases, the impacts are obvious. For taxes and transfers, we emphasize the income effects on spending. Traditional fiscal theory, therefore, treats the items in government budgets as collinear instruments. But attention to incentive and substitution effects enriches the policy menu. Although income tax cuts encourage almost exclusively consumption, an investment tax credit, such as was in effect in the United States from 1962 to 1986, mainly stimulates investment. In that respect, the investment tax credit was a substitute for easy monetary policy as an instrument for moving the composition of current GNP in favor of future growth. With respect to that objective, public investment outlays should of course be differentiated from collective consumption.

#### Uncertainty about the effects of instruments.

The theory of policy so far discussed assumes that the effects of policy instruments on endogenous variables, including policy objectives, are known with certainty, or assumes that expected values are all that matter. Things are quite different when considerations of risk are added in an essential way. My Yale colleague and collaborator William Brainard amended Tinbergen's theory in a classic article. [Brainard 1967] The essential point is to recognize the errors in the regression coefficients in the macroeconomic model, as well as the additive errors in equations.

In the theory so amended, policy instruments are much less likely to be redundant. For hitting the same targets with smaller variance, more instruments are always helpful, provided their coefficient errors have some statistical independence. The argument is just an application of portfolio theory. The policy-maker is the portfolio manager, and the instruments are the assets. But the objectives of the policy-maker are more complex than those of a wealth-owner. The wealth-owner is trying to maximize expected return for a given amount of risk and then to choose her most desirable efficient combination of return and risk. The policy-maker has a number of incommensurable policy-objective variables, not just one, and has to weigh



the expected values and risks of all of them.

Risk aversion imparts some conservatism to policy. In this respect the Brainard theory is probably realistic. With coefficient uncertainty, big doses of policy medicine enlarge the variance of the outcomes, however much they may improve the expected values. A cautious central banker will not, for example, aim for low unemployment even if the expected value of the associated inflation were acceptable if he thought that the probability of a large inflationary deviation from the mean outcome was also high.

What is important, more precisely, is the standard error of the regression (or reduced-form) forecast of a policy-objective variable. That error, we know, is positively related to the distances of the regressors from their mean values in the sample data on which the model was estimated. Policy-makers do not like to move into terra incognita. They do not like to move in big steps. They like to gain observations close to the territory where they are going to operate.

We should, however, not exaggerate the "take-it-easy" moral of this theory. The warning is against big departures from experience, not against big doses of policy instruments per se. Policy instruments often have the same effects on endogenous objectives as some non-policy exogenous variables, and their coefficient errors are likewise highly correlated. Consider, for example, a central bank's increase in the supply of base money and an exogenous decline in the demand for base money, say the public's demand for currency or the banking system's demand for excess reserves. Both the policy move and the non-policy events have the same macroeconomic effects. Thus it would not be conservative to withhold a large increase in base money supply if the authorities knew that it would offset a large autonomous decline in demand for base money. Indeed a compensatory injection of base money, even if large, is the conservative thing to do. The same might apply to fiscal policy, where government outlays and taxes have effects equivalent to some exogenous private demands for goods and services. In the Great Depression it was not conservative of governments to try to keep their budgets balanced.

#### Pitfalls in policy exploitations of empirical regularities.

The estimation of policy effects is of course very tricky. Years ago we

thought of policy instruments as completely autonomous, exogenous to the economy we were modeling, uninfluenced by the endogenous variables of that economy, insulated from the random disturbances in their values. But if policy-makers themselves were following some rules, even roughly, then their settings of instruments were not exogenous. Observed correlations of instrumental and objective variables may reflect the behavior of the makers of policy, not the behavior of the economy. Those correlations are misleading if they are interpreted as telling how the economy would respond if policy-makers acted differently from the rules they followed in the sample period of observation. "Goodhart's law" says that in economics any observed regularity will vanish if policy-makers attempt to exploit it.

There are numerous examples in macroeconomics. Before central bankers fell under the sway of monetarism, they followed accommodative, at least partially accommodative, policies. When expansion of the economy increased the demand for bank credit and for deposits and currency, the central bank allowed the supplies to expand as well. In recessions, they allowed money and credit aggregates to shrink along with the economy. Milton Friedman and other monetarists cited the time series correlations of money stocks and nominal national incomes as evidence of the sovereign power of monetary policy, and alleged that stabilizing money supply would stabilize the economy. But when central bankers took the criticisms of the monetarists seriously and ceased to be so accommodative, the correlations became much weaker.

Fiscal policy provides another example of how misleading a guide to policy simple correlations can be. Government deficits have generally been negatively correlated with economic activity, seemingly contradicting the Keynesian view that deficit spending would be expansionary. Of course, the paradox is only superficial. There are two explanations for it. One is the endogenous variation of government finances in response to fluctuations in economic activity. Tax codes and expenditure laws are such that revenues automatically -- that is, without new policy decisions or legislation -- move procyclically and expenditures countercyclically. Because of this endogeneity, it is a mistake to regard the deficit as an instrument. Tax and expenditure laws and formulas are instruments; given them, budget outcomes are endogenous. The "full employment budget" and numerous variants of it are

an attempt to eliminate these endogenous cyclical effects and to provide a rational quantitative measure of fiscal policy.

A variant of this confusion occurred in the 1980s in the United States. Standard macroeconomic models, both theoretical and econometric, say that deficit spending policies will raise real interest rates. Apologists for the Reagan deficits appealed to the absence of positive simple correlations between deficits and interest rates. The absence of such correlations reflects the fact that the same fluctuations of economic activity that move deficits countercyclically move interest rates procyclically. They don't tell what happens when deficits are massively increased by policy rather than moved endogenously. We found out in the 1980s, when both real interest rates and federal deficits were much higher than in any previous post-1945 recovery.

The second explanation of negative correlations between deficits and economic activity is that governments often reinforce the "built-in stabilizers" with endogenous changes in fiscal policy: tax cuts, generous transfers, and public works to combat recession, tax increases and expenditure economies and postponements to fight inflation.

Of course the whole purpose of econometrics, as Tinbergen and the other giants of the 1930s, 1940s, and 1950s developed it, was to solve exactly this problem of sorting out causes and effects. The idea was to specify equations that would stand up in the face of changes in policies and policy rules -- and in the face of non-policy shocks as well. Yet if observed data record little variation in policies or policy rules, or in non-policy variables equivalent to them, the most sophisticated techniques will be unable to forecast the effects of policy innovations.

The celebrated "Lucas critique" [Lucas 1976] goes still further, asserting that the structural or behavioral equations of macro-econometric models would not be stable under changes in policy rules, or policy regimes, because private economic agents adapt their own behavior to that of the government. Applied to monetary policy, the argument is that since changes in purely nominal magnitudes cannot make any real difference to rational agents, changed settings of monetary instruments are effective only when they are unexpected or misperceived. Applied to fiscal policy by Robert Barro [1974], the argument is that changes in taxes and transfers can have

no macroeconomic effects, specifically no effects on economy-wide spending and saving, because rational agents will know that reverse changes of equivalent present value will occur in the future.

Lucas, Barro, and other exponents of the New Classical Macroeconomics are guilty of the fallacy of misplaced concreteness. They apply to the hurly-burly of short-run adjustments and fluctuations theorems that might under ideal conditions apply to long runs and long horizons. The logical consequence is the "real business cycle theory" of Kydland and Prescott [1982] and others. This approach is premised on the idea that both individuals and society at large adapt rationally and optimally to all unavoidable natural, technological, and external shocks to which the economy is subject. The observed fluctuations in business activity which we call cycles are, in this view, simply the history of those adaptations. Money matters not at all, and Barro-type intertemporal substitutions nullify fiscal policies -- although of course public claims on real resources do make a difference. There is no business cycle problem, in the sense of Keynes, Tinbergen, and the builders and estimators of macro models.

Recent history has not been kind to these approaches. Relative to them, the old-fashioned macro-econometric models have been doing well. Jan Tinbergen is a modest man, and he never thought that econometric equations, his or others', would last forever. I am sure he is now, and was fifty years ago, prepared to believe that clear changes of policy regime, like other changes in the environment of economic activity, alter structural equations and their coefficients. Lucas and company have made us more sensitive to such possibilities, properly so.

#### Relations between qualitative and quantitative policies.

Tinbergen distinguished quantitative policies -- setting and changing the values of instrument variables -- from qualitative policies -- alterations in structure by regulation, deregulation, and institutional innovation. In important respects these are substitutes for each other. The more numerous are effective built-in fiscal stabilizers, the less necessary are discretionary changes of fiscal instruments. If one thinks of policy rules as equations of the system, then if other structural equations are

altered, whether by deliberate qualitative policies or spontaneously, the policy equations will need to be changed too.

One way to look at policy rules and other structural equations is to regard the model as a whole as a mechanism converting exogenous shocks into fluctuations of endogenous variables, including those which are policy objectives. For example, in a classic article William Poole [1970] showed that, although the same expected value of real national product could in principle be obtained either by setting the money stock or by setting interest rates, the variance of that policy objective around its target mean would depend on the instrument used. This insight can be generalized to policy rules and to the variance-covariance matrix of several objective variables.

In the Poole model the policy rule in question is the central bank's supply of money in response to a short term interest rate. The central bank does not know whether an observed increase in the interest rate is the result of strength in the goods market (upward IS shift) or of an increased demand for money (inward LM shift). Accommodation is desirable in the latter case but not in the former. The coefficient of the interest rate in the central bank's supply curve can be chosen so as to minimize the variance of national output.

To pursue and generalize the Poole example, now suppose that, as actually has been happening, the government relaxes legal ceilings on the rates banks can pay depositors. This deregulation sharply reduces the built-in accommodation of the monetary system, because a general rise in interest rates no longer induces private agents to economize money holdings. As a result, a more accommodative money-supply rule is now optimal, [Tobin 1983]

#### What can economists say about policy objectives?

In his classic 1953 book Tinbergen begins with a brief mention of "a collective ophelimity function" as the object to be maximized. This function -- sometimes called social utility or social welfare -- would make commensurable the numerous economic outcomes that matter. It would be something like a weighted average of their values. But after the first page Tinbergen deals only with vectors of quantitative objective outcomes, without trying to rank the vectors, much less summarize them in scalar

scores. I have taken the same standpoint throughout this lecture so far.

Yet the pervasiveness of intractable tradeoffs, the lack of sufficient independent instruments to hit several important goals simultaneously, makes ranking and scoring of vectors of policy goals very important. We can wash our hands of the task by assigning both the burden and the privilege to the political process, to public opinion and government policy-makers. After all, we economists have no business imposing our own social values. But economics cannot and should not, I think, dodge these issues completely. Our discipline can at least contribute to clarity and sophistication of thought about social choices. Many practical objectives of policy are not ultimate values but measurable variables somewhere between those values and actual tools of policy. In this sense they are intermediate instruments.

For example, in macroeconomics the two traditional short-run objectives, low unemployment and price stability, are not ends in themselves. Even real national product is not a goal per se. We economists are disposed to consider consumption (including leisure, public goods, and other non-market commodities) as the activity that generates utility or ophelimity. We usually score outcomes for individual consumers by the utility attaching to their prospective streams of consumption over time, and over contingent "states of nature" as well.

Our standard paradigm says that tastes, together with technologies and resource endowments, are the deep fundamental data of an economy, from which all economic behaviors and outcomes are derived. The paradigm is vulnerable to several difficulties, which we occasionally acknowledge but commonly sweep under the rug. Even at an individual level, utility is not clearly and unambiguously formulated; people are often ambivalent or schizophrenic. Tastes are not wholly exogenous and stable. They are transient and inchoate. They are much influenced by changing social and cultural trends, by information and disinformation, by habits and traditions, by advertising and other sales promotion efforts. Utility is a weak reed on which to hang intertemporal choices, especially those involving uncertainty. Although contemporary theory places heavier and heavier weight on utility, it is hard to believe the concept can bear the burden.

Moreover, we know there is no way to aggregate individual preferences into social rankings, let alone to combine individual utilities into a

collective ophelimity index. As if this were not obvious, Kenneth Arrow proved it rigorously years ago. The impossibility applies to aggregations across contemporaneous cohorts, a fortiori across generations living and unborn. No wonder so many of today's macro theorists purchase mathematical rigor by assuming that society can be represented by a single consumer, if not immortal at least identical in endowments and tastes generation after generation.

A common diagnosis of the current United States economic problem is that my country, in both private and public sectors, is saving too little. The implicit value judgment is that currently living generations are mistreating future generations; we are consuming at their expense. One symptom and vehicle of this misbehavior is the United States current account deficit. (Its counterpart in Japanese and European, mainly German, surpluses might similarly represent excessive saving.) The policy moral is to tighten fiscal policy in the United States (and ease it in the surplus countries.)

The contrasting laissez faire view is that these payments imbalances, and the differences in saving behavior underlying them, reflect rational personal and national choices. They require and invite no policy moves. Americans want to consume more now and less later; Japanese and Germans want to do the reverse. International and intertemporal markets permit both sides to do what they want. There is no problem.

The laissez faire view is mistaken, I think. The current U.S. generation does not realize what it is doing, what the future consequences and costs will be. As voters and consumers, they have been deliberately misinformed -- by politicians whose priority was to cripple the civilian public sector of the nation by demagogically exploiting the public's natural distaste for taxes. In this situation, I think Jan Tinbergen would agree in principle, it is the duty of the economist to help the public make informed and rational choices, not to acquiesce in the mindless faith that everything is always for the best.

The big issues of stabilization policy in the last thirty years have, as I already noted, frequently involved the unemployment-inflation nexus. Macro-economists have not helped the public understand and assess the costs of inflation. Are there indeed costs of inflation per se? Or are they costs of any price changes, whether up or down, or of deviations either way of

prices from previous expectations? At a more primitive level, the general public and politicians confuse absolute price levels and relative prices, or general across-the-board inflation and changes in specific prices. They also confuse continuing inflationary trends with one-shot changes in prices.

Even economists often charge to inflation the inevitable social costs of phenomena of which inflation is a symptom (like wars and OPECs). The true policy issue presented by an unavoidable adverse shock requires comparing its costs under alternative policy responses, some of which might entail more inflation than others. Policy responses in Europe, North America, and Japan to the oil price shocks of 1973-74 and 1978-79 aimed at disinflation and generated severe recessions in the process. Were these the least-cost responses to those shocks? I do not answer the question. I just say that it is the correct question.

"Time inconsistency" is a popular recent topic in the theory of policy. Typically the government is assumed to have, for some unexplained reason, social objectives different from those of the society it is governing. (This sounds like Buchanan's public choice theory, but here it is not a question of elected officials and bureaucrats who are manipulating the political system in their own interests.) The government deceives the public in order to make the economy come out the government's preferred way. The usual application is to the inflation-unemployment tradeoff, assumed to be absent in the long run. The government makes private agents think that prices will be stable and behave accordingly. Then the government exploits those expectations and behaviors by an inflationary policy, which produces a bulge of employment and output. The people don't really want so much employment and output, so the bulge recedes after they catch on to the government's true strategy. Does this make sense? If the government is rational it knows that the strategy cannot work repeatedly. If the government is benign it doesn't wish a non-optimal outcome anyway.

A common analogy is to the classroom teacher who wants the students to study but does not care to inflict a test on them and on herself. The teacher announces the test but then cancels it at the last minute. But maybe the students really want both the study and the test, and anyway a teacher cannot credibly threaten tests that never take place.

The time inconsistency story is another example of the treatment of the



economy as a whole as a single individual. Likewise in the 1970s several macro theorists held forth the prospect of painless disinflation accomplished by credible threat of resolutely restrictive monetary policy. The threat would be that, regardless how severe the recession, how great the unemployment, how widespread the bankruptcies, the government and central bank would persevere until inflation dropped to zero. Workers and unions could not count on macro-policies to save their jobs; they would have to lower their money wage rates. Business managers could not count on macro-policies to save their markets and their solvencies; they would have to lower their prices. According to the theory, under this threat the inflation would melt so fast that the threatened hardships would not occur.

Events under Mrs. Thatcher and Paul Volcker did not confirm the theory. Was Volcker guilty of "time inconsistency" in declaring premature victory?

The trouble is, I think, that the actual game does not involve just the two players government and private economy. It is an  $n+1$ -person game, one government (maybe more actually) and  $n$  private sectors, who are playing against each other as well as against the government. Here is a manifestation of the problem of coordination, the central problem of macroeconomics. The typical private player has no incentive to act constructively in response to the government's threat unless he thinks many other players will do likewise. No one can see the spectacle in the theater or stadium if everyone stands, but who has the incentive to obey a general admonition to sit down? When the teacher tells her grade school class there will be no picnic unless all gum-chewing ceases, would any rational child who shares the general liking of gum stop? Threats against everybody in general addressed to nobody in particular rarely work.

In the theory of policy under uncertainty, one objective is a low variance of outcomes. If we had scalar opheimity, it would be a low variance of that index. What we actually mean by "low variance" deserves thought. Is fluctuation over time bad in itself? We don't care much about diurnal, weekly, seasonal, or in some cases even year-to-year fluctuations.

Policy plans involve re-settings of the various instruments in order to achieve desirable future paths of the objective variables. The re-settings would not in general be decided in advance, only the rules that relate them to experience. The variances of concern are ex ante estimates of measures of

deviations of actual realizations from expected paths. Those measures are related to the variances over time of the processes determining the objective variables, but they are not the same thing.

Concluding remarks.

I have spoken of policy "rules," but I close by warning against taking the concept too literally. In monetary policy in particular there has been a long debate on rules versus discretion. This debate overlaps the argument about blind versus feedback rules. "Discretion" means "feedback" in practice because policy-makers take account of information, rather than setting instruments independently of observations. "Leaning against the wind" was a Federal Reserve rule throughout the 1950s and much of the 1960s. It means partial but not complete accommodation, but it allows lots of room for discretion, i.e. for consideration of circumstances not foreseen or even foreseeable in any formula.

Rules are bound to be pretty simple. It's not possible to formulate rules for policy-makers that cover all contingencies, any more than it is possible to write Arrow-Debreu contracts. In the United State we are fortunate that the Federal Reserve abandoned monetarist rules in 1982. Thanks to some skillful pragmatic fine-tuning by Paul Volcker and now Alan Greenspan, America, unlike Europe, has enjoyed a long and successful recovery. For one thing, the recovery has reduced unemployment by at least one more percentage point than anyone would have thought inflation-safe ten years ago. The Federal Reserve has been willing to learn by experience how far it was possible to go.

Even in the 1950s Jan Tinbergen was acutely aware of the problem of international coordination of national macroeconomic policies. That is a much bigger problem today, because of the massive size, fluidity, and extraordinary technical efficiency of global financial markets. We used to say that it is not possible for every sovereign nation to achieve its goals regardless of events elsewhere. Now, clearly, it is not possible for any nation to do so. By the same token, the policies of each country spill over into outcomes elsewhere. For example, although every government and central bank may aim for price stability within its jurisdiction, it is not feasible to accomplish adjustments to international imbalances in payments without

changes in national price levels relative to each other. This is true whether the international monetary regime involves fixed or floating exchange rates.

The Group of Seven creates the shadow of coordination but not the substance. True international coordination is the biggest challenge to the theory and practice of macroeconomic policy for the next decade. It is a political challenge, of course, but also an intellectual one worthy of a Jan Tinbergen.

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