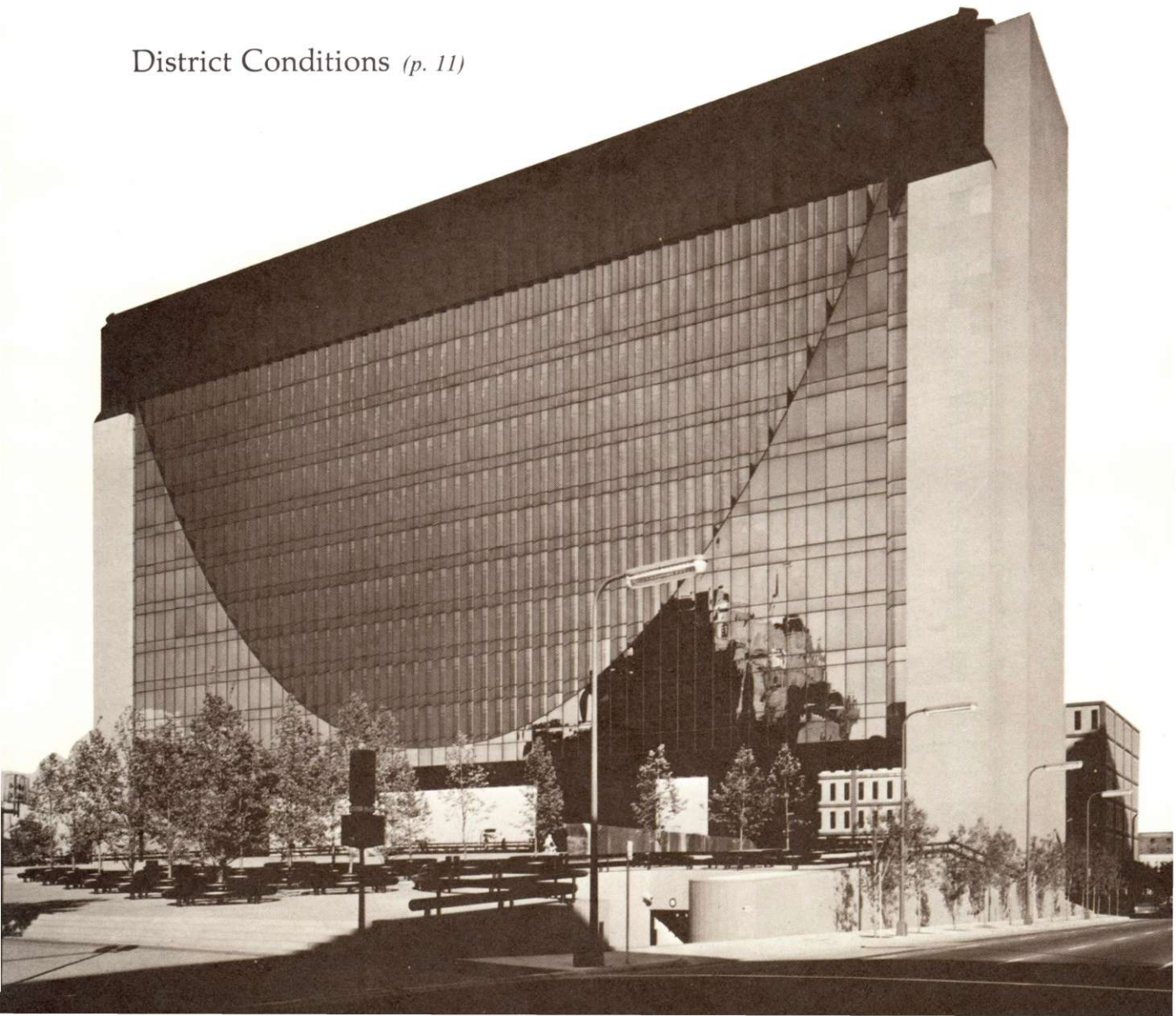
Federal Reserve Bank of Minneapolis Quarterly Review

Fall 1978



Federal Reserve Bank of Minneapolis
Quarterly Review Vol. 2, No. 4

This publication primarily presents economic research aimed at improving policy making by the Federal Reserve System and other governmental authorities.

Produced in the Research Department. Edited by Arthur J. Rolnick, Senior Economist, Kathleen S. Rolfe, Editor/Writer and Visuals Specialist, and Alan Struthers, Jr., Editor/Writer. Graphic design by Phil Swenson and charts drawn by Mary Steffenhagen, Graphic Services Department.

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Rational Expectations: How Important for Econometric Policy Analysis?*

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Today's econometric models seriously misrepresent the effects of different economic policies because they assume that these policies can systematically fool people. That is the criticism of economists who believe in the theory of *rational expectations.* They believe that people form expectations about economic conditions rationally, by efficiently using all the information available—including information about government policies. Thus, people adjust their behavior to take account of the likely effects of these policies, and any model which assumes people can be repeatedly fooled cannot be trusted.

Some have dismissed this rational expectations criticism because they think it assumes people are "too smart," have more information than most people really do. But the results of our simulation experiment suggest that the criticism should be taken seriously. For according to our experiment, standard models go too far the other way: they implicitly assume people are too dumb. Our results show that in these models people actually take *years* to catch on and react to a more inflationary policy. And only if they can be systematically fooled for such a long time can government policies significantly lower the unemployment rate.

Of course, these results do not imply that the rational expectations theory is right about how people behave. They do, however, illustrate how important assumptions about fooling people are to economic policy making. If the rational expectations theory is right—or simply better than the standard assumption—then the policy assessments being made by today's models are very wrong, and policy makers shouldn't be trusting them to help find the best way to reach economic policy goals.

*Based on "Rational Expectations Forecasts From Nonrational Models," forthcoming in the January 1979 *Journal of Monetary Economics*, and Research Department Staff Report 19, Federal Reserve Bank of Minneapolis, April 1978.

Using Econometric Models

Evaluating the effects of different economic policies with econometric models appears to be a rather straightforward procedure. An econometric model is simply a system of equations, estimated from past experience, which is thought to represent people's behavior. As input, the system requires values for certain economic variables thought to be determined outside the workings of the model, things like international developments and government policies. As output, the system predicts values of certain quantities such as employment and prices under the assumed external (input) conditions.

Such a model can simulate the effects of different government policies on the economy. Then by comparing the outcomes of several simulations of different policy options, government policy makers should be able to choose the best one to accomplish the government's objectives.

Today there are many of these econometric models. Their use in forecasting the economy and predicting the effects of government policy is widely accepted. The models differ considerably in complexity and underlying theories of behavior. Yet regarding the effects of certain kinds of policies, they seem to reach a level of agreement which is surprising (and which, some claim, would be impossible for economists themselves to achieve).

In particular, most, if not all, of the models support the existence of a substantial trade-off between

inflation and unemployment. That is, when the economy is below full employment, government economic stimulus can decrease the unemployment rate dramatically and for quite a long time at the cost of slight or moderate increases in the inflation rate. The association of higher-than-average inflation with lower-than-average unemployment is pretty well established in the historical data from which all of the models were estimated, and simulation experiments almost always imply that the government is able to trade inflation for unemployment by appropriate policy.

The Rational Expectations Criticism

Recently, however, some economists[1] have dissented sharply from the consensus, not only doubting the possibility of inflation-unemployment "trades" but also expressing serious reservations about the general usefulness of existing models and policy simulation techniques. These economists claim that today's models and methods are critically flawed as tools for policy analysis because they don't pay enough attention to people's expectations. To accurately assess the effects of different economic policies, they say, a far more sophisticated modeling of people's expectations must be included in the structure of econometric models. The modeling principle they propose is based on the theory of *rational expectations.*

Most economists agree that expectations are an important influence on the current action of economic agents—consumers, workers, producers, and investors. In the saving and spending decisions of households, the wage demands of workers, and the production and expansion plans of industry, some idea of the future course of prices and other economic conditions helps guide people's actions.

Since the future is so important, the rational expectationists argue, people form expectations about it rationally. To try to do the best they can for themselves, people use all the information they can get to form good forecasts of inflation and other variables which affect their economic decisions today. And because government policy can have such a big effect on the future course of the economy, information about government policy is an important part of the information they pay attention to. When government policy changes, therefore, people adjust their expectations and actions in line with the likely effects of the policy change.

Rational expectationists argue that today's models are, however, ill-equipped to simulate the actual reactions of people to policy changes. This is because most models are built on the assumption that people form their expectations by extrapolating past experience in a mechanical way. Expectations formed in this way are not very sensitive to changes in policy; they change very slowly regardless of policy changes. So simulations using such models implicitly assume that people change their expectations about economic conditions—and thus their behavior—very slowly even when important government policies have obviously changed substantially. In a sense, then, these models assume that people can be fooled for long periods of time into acting against their own best interests.

While some of the policy implications of today's econometric models may not be heavily dependent on this assumed irrational behavior, the rational expectationists have shown theoretically that the existence of a policy trade-off between inflation and unemployment depends crucially on it. They have designed small, theoretical models of economies in which agents form their expectations rationally. These models generate a historical correlation between unemployment and inflation similar to that in the U.S. economy. However, government policies which decrease unemployment in irrational econometric simulations have no effect on unemployment in these theoretical economies. In a world of rational expectations, that is, there is no inflation-unemployment policy trade-off.

The logic of the rational expectations critique has not been challenged, but its basic assumption of rationality has. Some economists have argued that current models are "good enough" because the real world is more complex, less perfect than the theoretical world of the rational expectations examples. Most people simply are not aware of monetary and fiscal policies, and even if they were, such policies probably wouldn't change behavior much anyway. Therefore, these economists say, there can be a

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[1]The most prominent of this group are Robert E. Lucas, Jr., of the University of Chicago, and Thomas Sargent and Neil Wallace, both of the University of Minnesota and the Research Department of the Federal Reserve Bank of Minneapolis. Some of their papers on the subject are listed at the end of this article.

policy trade-off between inflation and unemployment.

But if people are not rational, how irrational are they? By how much and for how long can they be fooled? And how important is this assumption for policy evaluation?

Evaluating Policies With and Without Rational Expectations: An Experiment

To measure the importance of the rational expectations assumption, we used an econometric model to evaluate the effects of 4 and 8 percent money supply growth on inflation and unemployment in the early 1960s. We simulated the model twice for each money growth alternative—once using the model's standard assumptions about expectations, then adjusting it to reflect rationally formed expectations about inflation.

The econometric model used was developed by researchers at the Federal Reserve Bank of St. Louis. This model is a convenient one to use here for a couple of reasons. It is quite small, and its internal structure is easy to understand. More important, the St. Louis model contains a specific equation which estimates people's expectations of inflation, based on the past. This simplifies the task of assessing the effect of expectations on simulation results and makes it easy to insert alternative assumptions about expectations of inflation without altering the rest of the structure of the model.[2]

The technique we used to produce informed expectations involved a simple change in the model's structure. Instead of expectations generated by the standard equation, the actual price predictions of the model were fed into the equations representing people's behavior. That is, what the model said inflation would be each quarter was made to equal what people expected it would be. Thus, when the effects of different policies were simulated, the model's output would represent the movements of the economy as if people knew what the probable effects of policy would be. People would not have been fooled.

The results of this experiment indicate that the rational expectations theory can have a very large quantitative impact on the predicted effects of different policies. To see this, compare Charts 1 and 2.

The standard policy simulations shown in Chart 1 imply two things. One is that steady monetary expansion can reduce unemployment substantially. In fact, according to these simulations, steady 8 percent money growth in the early 1960s could eventually have driven the unemployment rate below 1 percent. But this would have had to be done at the expense of higher inflation, for the other implication is that a policy trade-off does exist between inflation and unemployment. After two years of steady 4 percent money growth, the standard St. Louis model says, the unemployment rate would have been 4.4 percent and the inflation rate 2.3 percent. If money had grown at 8 percent, the unemployment rate would have fallen to 2 percent but inflation would have been 4.8 percent.

The rational expectations simulations shown in Chart 2 give a very different picture of the effects of monetary expansion. First, it cannot decrease the unemployment rate much. The rational expectations results indicate that 8 percent money growth in the early 1960s could not have driven the unemployment rate below even 4.5 percent, much less the 1 percent rate of the standard simulations. And inflation would have increased much more rapidly than standard simulations predict. This means that, according to the rational expectations simulations, only a very slight policy trade-off between inflation and unemployment exists. And that trade-off is much worse than the standard simulations say. Two years of 4 percent money growth would have resulted in 5.4 percent unemployment and 5.8 percent inflation; an 8 percent policy would only have reduced unemployment to 5 percent at the cost of an 11.8 percent inflation rate. If people are not fooled by government policies, therefore, the cost (measured in terms of inflation) of reducing unemployment by monetary growth appear to be much higher than standard simulations predict.[3]

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[2]Even more than these technical considerations, however, the intellectual background of the St. Louis model makes it the most appropriate vehicle for this rational expectations experiment. The St. Louis model was estimated, in part, to embody the theoretical position commonly called Monetarism. The Monetarists contend, among other things, that there is no policy trade-off between inflation and unemployment. However, conventional simulations of the St. Louis model have implied the existence of a trade-off. In this respect, the model has not been consistent with Monetarist theory. With the inclusion of rational expectations, the St. Louis model produces simulation results more consistent with the Monetarist view.

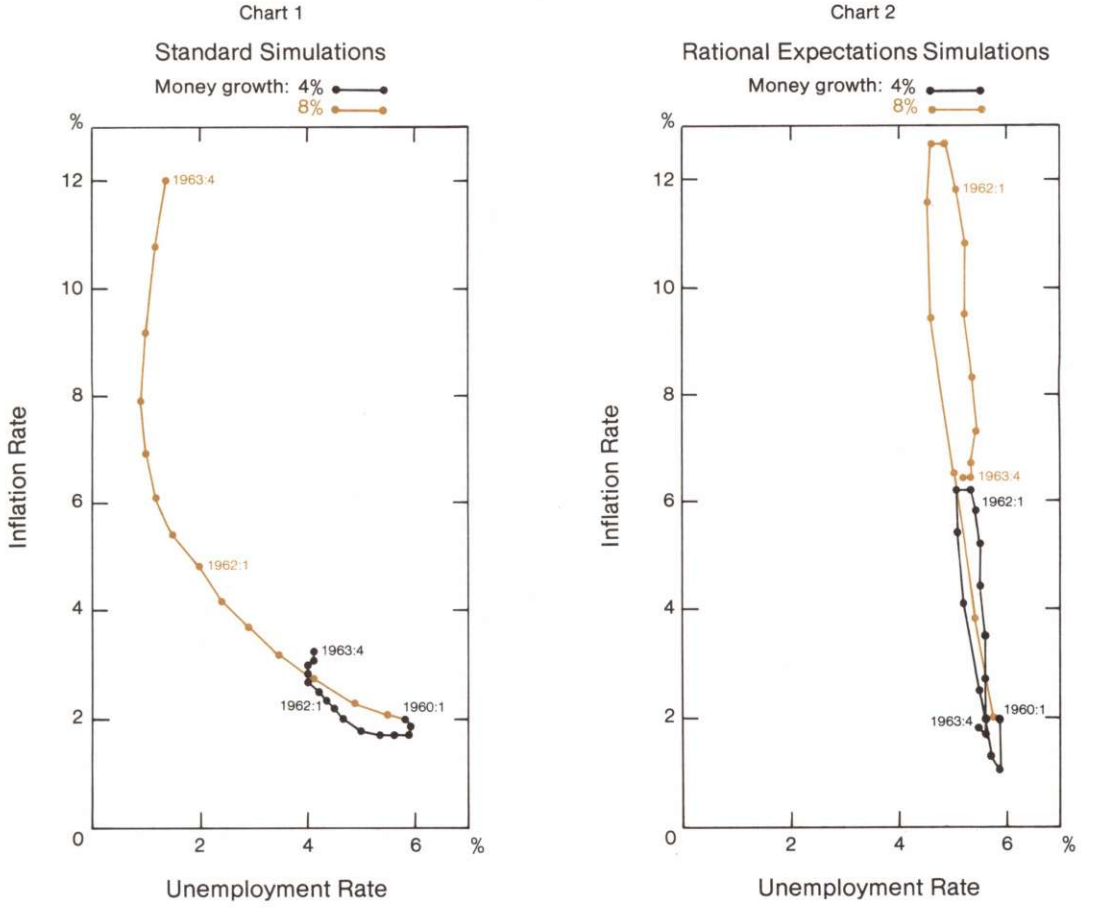
[3]Using the large Federal Reserve-MIT-Penn econometric model in this experiment produces similar results. See "Rational Expectations Forecasts From Nonrational Models," *Journal of Monetary Economics*, forthcoming January 1979, or Research Department Staff Report 19, Federal Reserve Bank of Minneapolis, April 1978.

In fact, the policy trade-offs demonstrated by the two versions of the St. Louis model are so different that in 1960 policy makers might have chosen differently between the two policies depending on which set of simulations they relied on. If they cared about both inflation and unemployment but considered unemployment a more pressing problem, on the basis of the standard simulations they would most likely have preferred 8 percent money growth. But if they chose on the basis of the rational expectations results, they might have preferred the slower 4 percent growth, thinking it not worthwhile to generate so much inflation just to reduce unemployment by a small amount.

Charts 1 and 2

The inflation/unemployment trade-off practically disappears when rational expectations are assumed.

Inflation and unemployment rate simulations of the St. Louis model
Quarterly 1960:1-1963:4

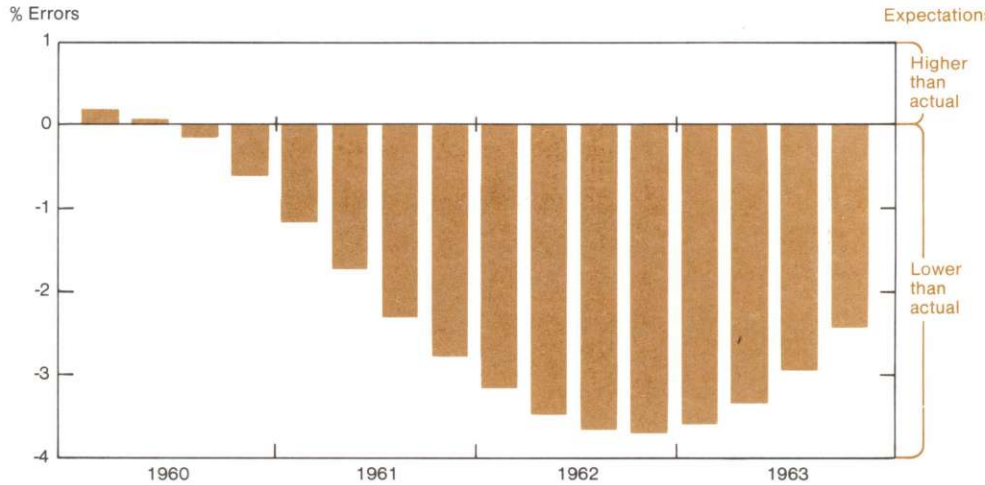


Source: FRB Minneapolis

Chart 3

According to this model, people don't learn from experience.

Errors in expectations of inflation in standard simulation of the St. Louis model with 8% money growth
Quarterly, 1960-1963, at annual rates



Source: FRB Minneapolis

Fooling People

Since the rational expectations simulations come from a model adjusted to assume people know the probable effects of government policies, the large difference between the standard and rational expectations simulations is the result of the unadjusted St. Louis model assuming people will be fooled about the course of inflation. And because this model calculates an anticipated inflation rate, we can measure just how badly it thinks they will be fooled.

The forecast errors made by agents in the model's 8 percent money growth simulation are shown in Chart 3. These errors are the differences between the expectations of inflation computed from the expectation equation in the model and the actual rates of inflation predicted by the model.

The most striking feature of these errors is the persistence of underprediction. Obviously the St. Louis model assumes people learn very slowly. For the last three and a half years of the period shown people would expect less inflation than actually occurred. Even though their forecasts were never even approximately vindicated by experience, they would continue to forecast in the same way. For example, at the beginning of 1963, after four quarters of seeing actual inflation galloping at a rate more than 3 percentage points faster than expected, people would be expecting 4.6 percent inflation and would be surprised when actual inflation of 7.9 percent resulted. That is, the model assumes they would be fooled by over 3 percentage points for the fifth quarter in a row.[4]

Conclusion

Implausible as that may sound, so far there is little empirical evidence to determine whether people

[4]The large and persistent errors in Chart 3 are not because the expectation equation of the St. Louis model fits historical data poorly. In fact, a simulation analyzing the effects of a money growth rate of 2 percent (the actual average for the period) shows that the equation makes only very small errors in predicting inflation. The errors in that simulation were all less than 0.4 percent.

The problem is that when simulating the effects of a policy which is much different from experience, economists must choose. They can assume (as standard simulation techniques do) that people will stick to the same forecast rules as before and thus accept high, persistent forecast errors. Or they can assume (as the rational expectations technique does) that people's forecast errors will remain roughly the same as before and they will adjust whatever forecast rules they use in a roughly correct way.

really can be fooled this long (though the little evidence there is suggests they can't). As the results of our experiment illustrate, however, whether they can or not is very important for the use of econometric models in policy making. For if the rational expectations theory is right and people cannot be systematically fooled, policy makers using current models are being seriously misled about the effects of at least some of the government policies they're considering. The conclusions of these models must be approached cautiously, therefore, until we know more about how people form and change expectations.

The importance of the rational expectations theory goes beyond that, though. For even if it is wrong, and government policies can systematically fool people, should they? Rational expectations thus poses a fresh challenge for economists: to design policies which are effective without having to fool people.

Some Papers on Rational Expectations

Lucas, Robert E., Jr. "Econometric Policy Evaluation: A Critique," in *The Phillips Curve and Labor Markets*, ed. Karl Brunner and Allan Meltzer. Amsterdam: North-Holland Publishing Co., 1976.

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