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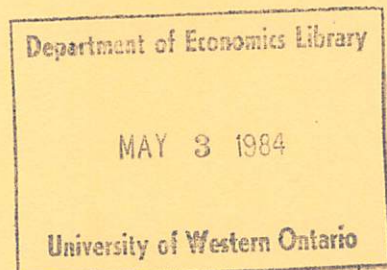
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POLICY, RATIONAL EXPECTATIONS, AND
POSITIVE ECONOMIC ANALYSIS

Herschel I. Grossman



This paper contains preliminary findings from research work still in progress and should not be quoted without prior approval of the author.

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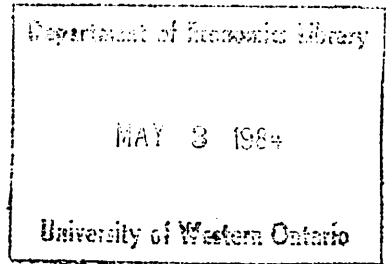
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POLICY, RATIONAL
EXPECTATIONS, AND POSITIVE
ECONOMIC ANALYSIS

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SUMMARY

Policy, Rational Expectations, and Positive Economic Analysis

This paper focuses on the problem of formulating an analysis of economic policy that is consistent with rational expectations. Cooley, LeRoy, and Raymon show that the Lucas and Sargent strategy for econometric policy evaluation is itself vulnerable to the logic of the Lucas critique. The present discussion develops the distinction between counterfactuals and forecasts to clarify the nature of the inconsistencies in the Lucas and Sargent strategy. The paper goes on to propose a research strategy for positive economic analysis that incorporates choice-theoretical modelling of policy. The motivations for this strategy are that it is fully consistent with the logic of rational expectations, that it produces a clear separation between theoretical analysis and the subsequent process of confronting the derived hypotheses with the data, and that it promises to lead to a novel set of revealing and potentially testable hypotheses that relate prices, quantities, and policy variables to each other and to the economy's exogenous variables. This proposed strategy for positive analysis also clarifies the distinction between positive and normative economics and preserves a distinct and meaningful role for normative analysis.

If economic agents in forming the expectations that influence their behavior take account of the processes that actually generate the realizations of these expectational variables, then the parameters of these processes enter into the decision rules that relate individual choice variables to individual information sets. The neglect of this proposition in traditional models of the effects of economic policy produced the famous Lucas (1976) critique of econometric policy evaluation. This proposition also provides the basis for the development of rational-expectations modelling strategies for analyzing and estimating relations between the economy's endogenous and exogenous variables.

Lucas and Sargent--henceforth L&S--describe one such strategy, which they claim provides a correct way to do econometric policy evaluation. See L&S (1981) for a concise description and Sargent (1981) for a fuller discussion. Essential elements in the L&S approach are the explicit specification of relevant information sets and the form of a "policy regime", which relates policy variables to predetermined variables. These specifications permit the derivation of private agents' rational expectations about policy. To implement such a model econometrically, L&S propose simultaneous estimation of the parameters of an historical policy regime and of behavioral parameters of private agents that are independent of the specification of the policy regime. Policy evaluation for L&S involves using these estimated behavioral parameters to simulate the consequences of alternative policy regimes.

In an important criticism of this procedure, Cooley, LeRoy, and Raymon (1982)--henceforth CL&R--show that the L&S strategy, which developed out of the Lucas critique, is itself vulnerable to the logic of the Lucas critique. CL&R point out that, although L&S are interested in the effects of changes in policy regimes, the L&S analysis implicitly assumes that private agents ignore the process that generates policy regimes. In other words, L&S take careful account of the effect of the parameters of the process

that proximately generates policy variables (the policy regime) on the behavior of private agents, but L&S fail to allow for the relation between the parameters that govern regime changes and the behavior of private agents. To exemplify an analytical strategy that is fully consistent with rational expectations, CL&R present a model in which the expectations of private agents are based on knowledge of the possible policy regimes as well as the transition probabilities that govern regime changes.

Sargent (1984) acknowledges that the L&S strategy contains the "internal contradiction" identified by CL&R. Indeed, Sargent and Wallace (1976) already recognized this problem, and they pointed out that an analysis fully consistent with rational expectations would require the type of extended analytical framework that the model subsequently presented by CL&R exemplifies. Sargent, however, defends the continued use of the L&S strategy on the grounds that these extended models "subvert normative economics". As Sargent and Wallace earlier put it, "If rational agents live in a world in which rules can be and are changed, their behavior should take into account such possibilities and should depend on the process generating the rule changes. But invoking this kind of complete rationality seems to rule out normative economics completely by, in effect, ruling out freedom for the policymaker."

The present paper discusses some issues that relate to the ongoing search for correct and useful strategies for studying economic policy within a rational expectations context. Specifically, Section 1 develops a simple framework that illustrates the distinction between counterfactuals and forecasts and attributes the inadequacy of the L&S analysis to their neglect of this distinction. Section 2 extends this framework to illustrate how to allow correctly for regime changes. Section 3 motivates the idea of modelling policy as a rational process as an extension and improvement on the strategy proposed by CL&R to remedy the inconsistencies in the L&S approach. Section 4 discusses the place of normative economics within a positive

analysis that treats policy as a rational process. Section 5 summarizes.

1. Counterfactuals versus Forecasts

A careful reading of the papers by L&S (1981) and Sargent (1981) indicates that the essential oversight, which leaves them vulnerable to the CL&R criticism, is that these papers do not distinguish between counterfactuals and forecasts. (Sargent (1984, esp. fn. 16) seems to recognize this critical distinction as an afterthought to acknowledging the contradiction identified by CL&R.) The essential point is that, within a rational expectations context, an analytical framework and strategy for determining what would have happened if the policy regime had been different is in general not relevant for determining what will happen if the policy regime changes.

Formalizing this distinction requires a model that specifies both the effects of current and expected future policy as well as the process generating policy. Suppose that the true structural relation between the economic outcome and current and expected future policy variables has the following form:

$$(1) \quad y_t = a_1 E_t x_{t+1} + a_2 x_t + \epsilon_t,$$

where y_t describes an action by private economic agents,

x_t is a policy variable,

$E_t x_{t+1}$ is the mathematical expectation of x_{t+1} conditional on information available in period t ,

ϵ_t is a normally distributed exogenous random variable, with zero mean, uncorrelated serially and uncorrelated with other random variables,

and a_1 and a_2 are constant parameters that are invariant with respect to the process generating x_t .

Economists observe y_t and x_t for $t = 1, \dots, T$, but do not directly observe ϵ_t .

Suppose also that the true process generating x_t is

$$(2) \quad x_t = b + u_t, \quad b \neq 0,$$

where b is a constant parameter and u_t is a normally distributed exogenous random variable with zero mean.

Economists do not directly observe u_t . Generalization of this setup to include systematic effects of predetermined variables on x_t is possible, but is not essential in the present context. The essential elements that the model given by equations (1) and (2) shares with the models considered by L&S are that the actions of private agents depend on their rational expectations of future policy and that the policy regime, described by the constant parameter b and the process governing u_t , is fixed.

(In earlier work, Neftci and Sargent (1978) look for regime breaks to use in testing the hypothesis that certain reduced-form coefficients depend on parameters of the policy regime. Their analysis, nevertheless, uses the framework of equations (1) and (2). Specifically, they assume that rational private agents regard the prevailing regime to be fixed and they treat each historical regime as an independent segment of history. This work, thus, is equally subject to the CL&R criticism.)

As stated by L&S, their objective, in terms of equation (1), is to determine how the behavior of y_t over time depends on the parameters of the process generating x_t . The difficulty, as suggested above, is that this loose statement encompasses two radically different problems. These problems are (1) simulating the effects of hypothetically different past behavior of the policy parameters and (2) forecasting the effects of hypothetical future behavior of the policy parameters.

The first problem, involving counterfactual, is meaningful whatever is the true process generating x_t . Solving this problem correctly generally requires use of the L&S strategy for policy evaluation. The second problem, however, is meaningful only if

the true process generating x_t includes variable parameters. Specifically, this problem is not meaningful if the true model includes equation (2), rather than, for example, an alternative specification of the process generating x_t developed below. Moreover, whatever the true model, the solution of any consistently specified forecasting problem does not require use of the L&S strategy.

As a first step in analyzing the model given by equations (1) and (2), observe that equation (2) implies

$$(3) \quad E_t x_{t+1} = b,$$

and that substituting equation (3) into equation (1) gives

$$(4) \quad y_t = A + a_2 x_t + \varepsilon_t, \quad \text{where} \quad A = a_1 b.$$

Equation (4) says that y_t depends on the parameter b of the process generating x_t , through the rational expectation of the future realization, x_{t+1} , as well as on the current realization, x_t .

Given that equations (1) and (2) are the true model, the problem of forecasting the effects of policy consists only of predicting the future time path of y_t conditional on hypothetical future realizations of u_t . To solve this problem, observe that equation (2) implies an estimate \hat{b} , which is simply the mean value of $\{x_t\}_{t=1}^T$, and that, from equation (4), a regression of y_t on x_t yields estimates \hat{A} and \hat{a}_2 . Combining equations (2) and (4) gives the forecasting equation

$$(5) \quad y_t = A + a_2 b + a_2 u_t + \varepsilon_t.$$

To forecast using equation (5), set A , a_2 , and b equal to their estimated values, set ε_t equal to its zero mean, and simulate

$\{y_t\}_{t=T+1}^{\infty}$ for any hypothetical realization of $\{u_t\}_{t=T+1}^{\infty}$.

This forecasting exercise does not require use of the L&S strategy for policy evaluation, but, because it concerns realizations within a given policy regime, it is also not an example of the type of problem that L&S have in mind. As suggested above, however, within the context of equations (1) and (2) as the true model, the only admissible questions about the effects of different policy regimes involve counterfact. For example, how would the historical pattern of y_t have differed had the constant parameter b of the process generating x_t been different? Answering this question requires using the L&S strategy.

The econometric part of the L&S strategy involves implementing equations (2) and (4) together, which, in the present context, means simply performing the additional step of dividing \hat{A} by \hat{b} to obtain the estimate \hat{a}_1 . Notice also that $\hat{u}_t = x_t - \hat{b}$ and that $\hat{\varepsilon}_t = y_t - \hat{A} - \hat{a}_2 x_t$. Thus, to determine the hypothetical differences in the history of y_t associated with hypothetical differences in the policy regime, rewrite equation (5) as

$$(6) \quad y_t = (a_1 + a_2)b + a_2 u_t + \varepsilon_t,$$

set $a_1, a_2, \{u_t\}_{t=1}^T$ and $\{\varepsilon_t\}_{t=1}^T$ equal to their estimated values, and simulate $\{y_t\}_{t=1}^T$ for counterfactuals involving constant values of b other than \hat{b} . Notice that the estimate of a_1 , the additional statistic that the L&S strategy provides, is an essential element in this exercise.

2. Regime Changes

Because private agents rationally treat b as a constant, the model given by equations (1) and (2) implies that, if b had been one unit larger, then, for all $t = 1, \dots, T$, x_t and $E_t x_{t+1}$ each would have been one unit larger, and, as equation (6) indicates, y_t would have been $a_1 + a_2$ units larger. The mistake made by L&S is to propose using this result to forecast

mistake made by L&S is to propose using this result to forecast the effects of changes in the parameter b governing the process generating x_t , a parameter that is a constant in the model assumed to be true. If the parameter b of the process generating x_t is truly a variable rather than a constant, then equation (2) is not part of the true model. In this case, pretending, as L&S implicitly do, that equations (1) and (2) are the true model generally produces wrong forecasts. Specifically, if b is truly variable, using the relation between y_t and b given by equation (6) to forecast the effects of changes in b is not consistent with rational expectations.

To illustrate these points, assume that equation (2) is false, and that the true model includes instead

$$(2') \quad x_t = b_t + u_t \quad \text{with} \quad b_t = \beta + \delta_t, \quad \beta \neq 0,$$

where β is a constant parameter,

b_t is now a variable parameter,

and δ_t , like u_t , is a normally distributed random variable, with zero mean, uncorrelated serially and uncorrelated with other random variables.

Economists do not observe either u_t , b_t , or δ_t .

Equation (2') explicitly treats the parameter b_t of the policy regime as a variable and includes in the model a specification of the process generating b_t . The model developed by CL&R is a variant on the analytical framework of equations (1) and (2'). As a first step in analyzing this model, observe that equation (2') implies

$$(3') \quad E_t x_{t+1} = E_t b_{t+1} = \beta,$$

and that substituting equation (3') into equation (1) gives

$$(4') \quad y_t = B + a_2 x_t + \epsilon_t, \quad \text{where} \quad B = a_1 \beta.$$

Given that equations (1) and (2') are the true model, the problem of forecasting the effects of policy now involves consideration of regime changes. Specifically, the future time path of y_t depends on the future time path of b_t --or, equivalently, on future realizations of δ_t --as well as future realizations of u_t . To obtain forecasts of y_t conditional on the evolution of the policy regime, observe that, from equation (4'), a regression of y_t on x_t yields estimates \hat{B} and \hat{a}_2 . Combining equations (2') and (4') gives the forecasting equation

$$(5') \quad y_t = B + a_2 b_t + a_2 u_t + \epsilon_t.$$

To forecast using equation (5'), set B and a_2 equal to their estimated values, set ϵ_t and u_t equal to their zero means, and simulate $\{y_t\}_{t=T+1}^{\infty}$ for any hypothetical realization of $\{b_t\}_{t=T+1}^{\infty}$.

Because, in this case private agents rationally treat divergences between b_t and β as transitory disturbances, the model given by equations (1) and (2') implies that, when b_t increases by one unit, x_t increases by one unit, but $E_t x_{t+1}$ is unchanged, and the expected value of y_t increases by only a_2 units. The important general point is that, except in the special case in which b_t evolves as a random walk, the change in the expected value of y_t in response to a one unit change in b_t does not equal $a_1 + a_2$ units, which is the effect suggested by the pretense that b_t is constant.

Another potential problem, which, because equation (4') has the same form as equation (4), does not arise in the present example, is that the pretense that b_t is constant also would lead, in the econometric part of the analysis, to biased estimates of the relation between y_t and x_t . For example, if b_t truly evolves as a random walk--in which case the implied forecasting equation has the same form as equation (6)--the model generates an equation that looks superficially like equation (4), but in which

the error term is correlated with x_t . The main lesson is that correct forecasts of the effects of changes in parameters of the policy require specification, estimation, and simulation of a model that incorporates the true process generating these changes.

Another important lesson is that forecasting, whether it involves the effects of realizations within a given policy regime or the effects of changes in the parameter of the policy regime, does not involve using the L&S strategy for policy evaluation. Specifically, in the model given by equations (1) and (2'), forecasts of the effects on y_t of changes in b_t do not require an estimate of the underlying parameter a_1 . Of course, reliable forecasting of y_t is subject to standard pitfalls. For example, without independent knowledge of the global form of equation (4'), we may doubt the reliability of the estimates of the linear coefficients, B and a_2 , for calculating the effects of realizations of b_t outside the range of historical experience. (See Sims (1982) for a further discussion of this issue and related points.)

It is also possible, in the context of the model given by equations (1) and (2'), to consider questions about the effects of different policy regimes involving counterfact. Analysis of counterfactuals concerning different past values of the constant β , like the analysis of counterfactuals involving b in the model given by equations (1) and (2), requires using the L&S strategy to obtain an estimate of the parameter a_1 .

3. Modelling Policy as a Rational Process

The model developed by CL&R has the same form but substantially more structure than the model given by equations (1) and (2'). Analysis of the CL&R model involves solving the private agents' problem in two steps. First, using the known transition probabilities of regimes changes and the observed past and current realizations of the policy variable, form probability distributions for future realizations of the policy regime. Second, using these probability distributions and the

probabilities of policy actions within each regime, form probability distributions for future realizations of the policy variable.

Flood and Garber (1983) also analyze a model of this type. Their setup is simpler than CL&R in that agents know which regime currently obtains, but is more complex in that the transition probabilities vary over time depending proximately on realizations of certain endogenous variables, which depend in turn on realizations of exogenous variables and the fixed parameters that govern private behavior.

These models, like the simpler models developed in the preceding section, fully specify both the process that generates policy actions as well as the economic structure that determines the effects of current and expected future policy actions. Thus, all of these models provide a framework for the consistent application of rational expectations in analyzing how endogenous variables, including policy variables, depend on the processes that generate the economy's exogenous variables and on the realization of these processes. Nevertheless, these models offer only limited scope for analyzing the interaction between policy and the behavior of private agents and formulating testable hypotheses about policy and its effects.

The basic problem is that these models do not go far enough in departing from standard practice. Specifically, they still treat policy regimes and their evolution as exogenous processes, like natural phenomena, and they provide no criteria for modelling the policy process beyond an appeal to historical experience. The natural next step in the development of positive models that endogenize policy, and that have testable implications about the evolution of policy actions as well as other endogenous variables, would seem to be to explicit economic theory to specify the behavior of the policymaker more fully.

A proven strategy for deriving useful hypotheses about the effects of policy is to apply the calculus of rational choice to the behavior of private agents. An analogous application of

economic theory would treat the behavior of the policymaker as a choice-theoretic problem. This modelling strategy involves the presumption, at least as a working hypothesis, that policymakers, like private agents, behave as if they have fixed preferences over the outcomes that they can influence. Accordingly, this modelling strategy treats the evolution of policy actions, whether classified as occurring within a policy regime or as involving changes in the policy regime, as the rational and, hence, predictable response to shifts in the constraints that the policymaker faces.

Within a choice-theoretic formulation of policymaking, rational expectations mean that private agents act as if they understand the choice problem that the policymaker faces. Specifically, private agents base their expectations on their knowledge of policymaker preferences and constraints, derived perhaps from familiarity with patterns of policy outcomes. This revised view of expectation formation implies, for example, that people are more aware and responsive to the apparent preference of the Swiss monetary authority for price stability than they are to the way in which the authority manipulates policy instruments to achieve this objective.

The application of the calculus of rational choice to the policymaker directs attention beyond the usual problem of analyzing the reaction of private agents to policy. It focuses theoretical analysis instead on the interplay between policy and private behavior, and it alters the appropriate framework for testing hypotheses about preferences and the structure of the economy. Specifically, allowing the possibility of rational policymaking suggests that the chosen policy regime depends on the potential effects of policy actions.

In this event, it is inappropriate to take policy regimes as exogenous in testing hypotheses about the effects of policy. Thus, the idea of rational policymaking directs econometric implementation to the estimation of fixed parameters that reflect the preferences of policymakers and private agents and the

structure of the economy and that are invariant with respect to realizations of the underlying processes that generate the variables that are exogenous to the economy. Knowledge of these parameters also permits forecasting of the evolution of the economy's endogenous variables conditional on hypothetical realizations of the economy's exogenous variables.

None of these motivations for modelling policy as a rational process make it self evident that this research strategy can provide a realistic framework for positive economic analysis. Indeed, according to Grossman (1980), "experience suggests that the political process has limited ability to specify consistent goals, establish priorities, and choose between competing objectives about economic matters, especially when these decisions require comprehension of complex technical issues and constant processing of complex information." A possible inference from this observation is that a view of "the political process as operating as would a rational being facing a maximization problem that is well defined and has a consistent solution ... does not provide a good basis for understanding the government's ... policies."

The present discussion suggests that the idea of rational expectations leads to a research program that incorporates just such a view of policy. The objective of this research is the derivation of statistical hypotheses that relate the behavior of private agents and the behavior of policymakers to each other and to the economy's exogenous variables. This success of this program, however, does not require that the model's portrayal of either private agents or policymakers corresponds literally to their actual conscious behavior. The as-if rationale for choice-theoretic modelling is an essential feature of positive neoclassical economic analysis. An evaluation of this research strategy depends on the results of the confrontation of the derived hypotheses about the relations between observed variables with the data.

4. The Place of Normative Economics

As mentioned above, Sargent (1984), following the earlier argument of Sargent and Wallace (1976), contends that models that include a specification of the evolution of policy for all time leave no place for normative analysis. Sargent and Wallace made this point in the context of a framework that, like the CL&R model, treats the evolution of policy regimes as an exogenous process. In reiterating this position, however, Sargent explicitly refers to a framework that views policy as resulting from a rational choice process.

This section discusses a view of the distinction between descriptive and prescriptive analysis that derives from modelling policy as a rational process and that, in contrast to Sargent's view, preserves a distinct and meaningful role for normative economics in a rational-expectations context. Note, however, that even if we were to accept Sargent's interpretation of normative economics, his desire to prescribe policy would not justify his employing the logically inconsistent L&S analytical framework.

To define terms precisely, descriptive, i.e., positive, economic analysis attempts to model the interactions of economic agents with nature and with other agents and to deduce the actual consequences of these interactions. As just emphasized, the behavioral modelling in neoclassical positive economics usually seeks descriptive accuracy only in an as-if sense.

Prescriptive, i.e., normative, economic analysis, in contrast, attempts to determine how economic agents should behave. The specific normative problem that usually concerns economists who advise economic agents, and which motivates the L&S strategy for policy evaluation, is the prescription of appropriate actions to achieve given goals. Another, more subjective, normative problem, usually taken to be outside the professional expertise of economists, is the prescription of the goals themselves.

CL&R respond to the argument of Sargent and Wallace by denoting the exercise of forecasting endogenous variables conditional on realizations of the exogenous stochastic variables that influence the policy process to be normative economics. The problem with this response is that, as CL&R recognize, the assumption that policy evolves according to the fixed process specified in their model leaves no independent role for these forecasts in influencing policy. In other words, given the assumptions of the CL&R model, policy advice based on what CL&R denote as normative analysis seems pointless.

Viewing policy as a rational process, however, allows for a quite different conception of the scope for normative economics, one that neither Sargent nor CL&R consider. Given choice-theoretic model of policy, we can view normative analysis as concerned with formulating and solving the actual choice problems faced by policymakers, while viewing positive analysis as concerned with modelling the consequences of these choices in probabilistic terms. From this perspective, the normative economist is part of the action, whereas the positive economist is part of the audience. In other words, the policy economist advising government officials and the electorate, like other economists who play a prescriptive role--for example, the business economist advising firms or the home economist advising households--is a component, at least implicitly, of the interaction between policy and private behavior that the positive analysis attempts to model. In this context, if a fully specified descriptive model is true, even in a probabilistic sense, the actual activities of all of these normative economists are helping to confirm the predictions that the positive economist derives from the model.

Nevertheless, from the standpoint of the decision making economic agent or its advisor, the normative problem remains meaningful, even if positive analysis is successful in predicting its outcome on average. The essential point is that the formulation of positive models of the choice processes of private

agents and policymakers that fit the data, and thus seem to be true at least in an as-if sense, do not vitiate these choice processes. In particular, the development of a positive model that includes a choice-theoretic analysis of policymaking does not supercede policy advice. Rather, this development clarifies the distinction between the positive economist as a spectator and the normative economist as a player, and it points to the importance of keeping straight these different activities in which an economist can engage.

5. Summary

This discussion has focused on the problem of formulating an analysis of economic policy that is consistent with rational expectations. After developing the distinction between counterfactuals and forecasts to clarify why the L&S strategy for econometric policy evaluation is vulnerable to the CL&R criticism, the discussion goes on to propose a research strategy for positive economic analysis that incorporates choice-theoretic modelling of policy. The distinguishing feature of this research strategy is that it treats policy as an endogenous variable that results from the interaction between the preferences of the policymaker and the behavior of private agents. The main attractions of this strategy are the following:

First, in contrast to the L&S strategy for econometric policy evaluation, it models a process that generates both policy regimes and policy actions, and, thus, it is fully consistent with the logic of rational expectations. Second, in contrast to the usual ways of empirically implementing rational-expectations models of policy, it produces a clear separation between the theoretical analysis and the subsequent process of confronting the derived hypotheses with the data. For example, it avoids treating the policy regime as an exogenous empirical artifact when attempting to estimate the effects of policy. Third, and most important, it promises to lead to a novel set of revealing and potentially testable hypotheses that relate prices, quantities, and policy

variables to each other and to the economy's exogenous variables. Recent work by Barro and Gordon (July 1983, August 1983) and by Green (1983) illustrates the possible fruitfulness of this research strategy for understanding such puzzling phenomena as the evolution of monetary policy, inflation, and aggregate economic activity.

Although it preserves a distinct role for normative economics, the program of positive economic analysis advocated in the present discussion does not directly address the problem of how to give good policy advice, or of how to do normative economics in general. This program also does not address the related positive problem, which traditionally lies in the domains of behavioral psychology and political science, of literally describing the conscious behavioral processes of private agents and policymakers. Both of these problems involve further considerations such as understanding the technologies available for decision making and analyzing how decision makers use and should use the results of positive economic analysis. These considerations, however, are not necessarily directly relevant to the objective of deriving testable hypotheses that describe the relation between prices, quantities, policy variables, and the economy's exogenous variables.

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