Robert E. Lucas Jr.

Introduction to dynamic general equilibrium

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Abstract

This introduces the symposium on dynamic general equilibrium.
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The way aggregate economics is done has changed dramatically over the last four decades: a revolution has occurred. The methods of microeconomics, general equilibrium theory, control theory, dynamic programming, statistical decision theory, and game theory have been adopted by macroeconomists and adapted to address questions that involve market interactions among rational, forward-looking agents, in dynamic settings that experience stochastic shocks. No longer do macroeconomists simply posit aggregate labor supply as a function of the contemporaneous wage and let it go at that. Dynamic general equilibrium models that can be constructed with the new methods have been used to address both traditional macroeconomic questions and a wide array of new problems.

Every aspect of aggregative modeling has been affected by this revolution: investment theory, models of labor supply and labor market frictions, business cycle theory, the way risk and expectations are modeled, models of asset prices, monetary theory, models of fiscal policy, models of

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long run growth, and many others. No area of economics has been untouched. Indeed, the new methods have to a large extent erased the old distinction between micro- and macroeconomics. The approaches in the two areas are common, and economists working in labor economics and other particular areas can easily communicate—and migrate—across the micro–macro boundary.

Many economists participated in the revolution, but Robert Lucas has been the leading figure, and the papers in this volume offer a tribute to his role in the creation of modern macroeconomics. In the beginning there were two key tasks: undermining the old paradigm and offering a one. Lucas did both. His "Critique" [14] of the old methodology played a key role in accomplishing the first, and his 1972 *JET* paper "Expectations and the neutrality of money" [15] accomplished the second. Solidifying the position of the new paradigm then required carrying it forward into other areas of macroeconomics, and Lucas was a key contributor in this part of the revolution as well, developing important ideas and novel models for dealing with many facets of macroeconomics.

The papers in this volume illustrate how the new methods are being used in some of these areas. They fall, roughly, into six groups. The first group looks at investment decisions and their contribution to aggregate fluctuations, and the second, which overlaps with the first, looks at labor market issues. The third deals with expectations and the fourth with fiscal policy. The fifth group deals with risk, in particular with the reflection of risk in asset prices, individual decisions involving risk, and market mechanisms for dealing with risk. The last group of papers deals with long-run economic growth.

1. Investment and aggregate fluctuations

Fluctuations in investment are a large component of aggregate fluctuations, and understanding them is critical for understanding business cycles. Providing microeconomic foundations for investment decisions and the theory of supply, at the industry level and in aggregate, was possible only after methods for dynamic optimization became familiar to economists. Lucas [12] provides an important step in the development of this theory, with a model of investment in a perfectly competitive industry that accommodates the empirical observation that firm sizes vary widely within an industry and growth rates are independent of firm size. The key ingredient in the argument, making the cost of investment a constant returns to scale function that has both the investment rate and the current capital stock as arguments, is a device that is still widely used.

Lucas and Prescott [23] adopted this device and took the modern theory of investment a step further, providing a model in which industry investment is rational and forward looking, with incentives to invest guided by rational expectations about output demand and input prices, given all of the available information. In addition that paper extended the use of recursive methods to the study of dynamic stochastic competitive equilibria, by drawing on the connection between Pareto optima and competitive equilibria. The papers here extend this tradition in two directions.

In his paper "Investment options and the business cycle" in this symposium, Boyan Jovanovic [9] develops a model in which investment has a second input, "ideas," in addition to foregone consumption goods. New ideas arrive each period in proportion to the existing capital stock. These new ideas can be implemented immediately, by investing the requisite output, or they can be stored. Firms find it advantageous to store ideas if the current aggregate productivity shock is low, since in this case investment is relatively costly (since goods are scarce) and the expected return is low (since the shock is persistent). Thus, during recessions firms stockpile ideas. Conversely, during booms investment is attractive, but may eventually be constrained by

the rate at which new ideas arrive. During periods when ideas are in short supply, existing capital goods command a premium: Tobin's q rises. A calibrated version of the model matches some of the main features of the US time series on investment and Tobin's q.

As Edward Green [7] notes in his paper "Heterogeneous producers facing common shocks: An overlapping-generations example" in this symposium, aggregate shocks affect small firms even more than large ones. One hypothesis for why this is so rests on asymmetric information and the consequent requirement that borrowers have collateral. During a downturn the value of the collateral falls, which depresses lending and investment. Since small firms do not have access to the equity and commercial paper markets, they are affected more than large firms by the reduction in bank lending.

Green's contribution is to show that this is not the only possible explanation. His paper develops a model without private information, in which small firms are nevertheless particularly sensitive to business cycle shocks. The source of this greater sensitivity is a minimum size (capital input) for any firm. Each firm's productivity is the product of its (permanent) idiosyncratic shock and a stochastic aggregate shock. Thus, firms with low idiosyncratic shocks find it profitable to operate only when the aggregate shock is high enough and the cost of capital low enough. The supply of capital declines after a bad aggregate shock, and with persistent shocks, one bad shock is likely to be followed by another. As a consequence, small firms tend to exit during periods with bad shocks, even in the absence of asymmetric information.

2. Labor markets

Aggregate labor supply is central for both short-run and long-run questions in macroeconomics, and consequently a large body of work, both theoretical and empirical, is directed at the study of labor markets. An important cornerstone for much this work is Lucas and Rapping [24], which represents the first attempt to reconcile micro and macro aspects of labor supply behavior, and to provide solid microeconomic foundations for the aggregate labor supply curve.

A key issue involves the elasticity of labor supply. Labor economists, using microeconomic models of household behavior and looking at panel data, have typically estimated low elasticities of labor supply in response to wage changes. Macroeconomists, using representative household models and looking at aggregate time series, have estimated the wage elasticity to be quite high. A major challenge has been to reconcile these striking differences in individual and aggregate behavior.

In their paper "Micro and macro elasticities in a life cycle model with taxes" in this volume, Richard Rogerson and Johanna Wallenius [30] develop a microeconomic model that does just this. The model has two key features. The first is a fixed (time) cost of working. This cost can be small, but it prevents individual hours from falling below a minimal threshold. The second is a single peaked function relating age and "effective labor" per unit of time supplied. Thus, individuals are most productive in their middle years, and work less efficiently when young and old. The authors explicitly model household decisions about the extensive margin of labor supply, the fraction of lifetime spent working, in addition to the intensive margin, the choice about hours. As a consequence of the hump shape in efficiency, the very young and very old do not work. Individuals enter the workforce when their efficiency reaches a certain optimally chosen threshold, and they exit when their efficiency falls below that threshold. In addition, the hours supplied by an individual who is in the workforce increases with his labor efficiency. Thus, individual labor supply is a single-peaked function of age, but because of the fixed cost hours exceed a minimum level just after entry and just before exit.

Rogerson and Wallenius then use a calibrated version of the model to calculate the labor supply elasticities that it would deliver for various experiments. They show that it can resolve the conflict between micro and macro estimates seen in the data. Specifically, they first show that by varying the convexity of the disutility of work, the model can easily deliver Frisch elasticities in a broad range, including the range found in the empirical literature based on cross section and panel data. The authors then look at the effects of a permanent increase in a tax on labor income. They find that much of the steady state reduction in aggregate hours comes from the extensive margin. Thus, looking at steady state hours per employed worker substantially understates the total effect.

Average hours worked as a function of age show a pronounced hump shape, with individuals working significantly more hours during their middle years. The volatility of hours across age groups is a mirror image, with substantially higher variation at the two ends of the age distribution. These patterns are consistent with models in which there is an age-specific efficiency factor and efficiency has a hump shape as a function of age. But if this efficiency factor is interpreted as human capital, taking it as exogenous is problematic.

In their symposium paper "Business cycle fluctuations and the life cycle: How important is on-the-job skill accumulation?" Gary Hansen and Selahattin Imrohoroglu [8] develop a model in which on-the-job skill acquisition is used to explain the differential response of various age groups to cyclical shocks. Two forms of skill acquisition are considered, learning-by-doing (LBD) and on-the-job-training (OJT). The difference between the two is that LBD is a by-product of production, while OJT requires taking time away from production.

Hansen and Imrohoroglu find that the OJT model produces age profiles for the mean and volatility of hours that are very similar to those in a model with appropriately calibrated exogenous age-efficiency weights, and also very similar to the mean and volatility of hours in the data. Thus, the simulations suggest that a model with OJT can fit the data, and can be well approximated by the simple model with exogenous efficiency weights. The LBD model produces a rather different pattern, however, with excessive volatility for the groups at the ends of the spectrum—those just entering the workforce and those near retirement.

Understanding the Great Depression has been a particular challenge for macroeconomists. In his paper "What—or who—started the Great Depression?" in this volume, Lee Ohanian [29] looks at the role of labor market policies in the early part of the Depression. The early stages of the Depression are particularly difficult to understand, because employment and output declined sharply in late 1929, well before the large decline in the money stock and the increase in bank failures.

Ohanian argues that Hoover's industrial labor policies are central for understanding the early stages of the Depression. Under these policies, which were implemented in late 1929, the federal government provided large firms in the industrial sector with protection from union formation and with the latitude to restrict output and raise prices. In exchange these firms agreed to pay high wages and to shorten the workweek, so that the reduction in total hours was partially accommodated by job sharing. The resulting "sticky wages" in the industrial sector help explain why contractionary monetary policy and deflation had such large and protracted effects during the early 1930s, but had not had similar consequences during earlier periods of significant monetary contraction. Sticky wages also help explain why the contraction in the industrial sector was so much more severe than in the agricultural sector, which was not impacted by Hoover's policies, and in which real wages declined.

Labor markets are not like markets for commodities such as wheat or oil. Because labor is very heterogeneous, it is more difficult and time consuming for suppliers and demanders of labor

to come together. The resulting search frictions are critical for understanding how employment and unemployment fluctuate in response to various types of shocks. The "islands" model of labor market search introduced in Lucas and Prescott [22] is one of the basic models for studying these issues.

In his paper "Island matching" in this symposium, Dale Mortensen [28] uses a variation on that framework to develop a microeconomic foundation for the matching function postulated in Diamond–Mortensen–Pissarides models. In this variation, workers seeking jobs and jobs seeking workers are randomly assigned to an "island" at the beginning of each matching period. Then, on each island potential buyers and sellers are paired with each other, with the number of pairs constrained by the short side of the market. Pairs bargain over the wage and form matches. Unpaired agents return to the pool of the unmatched and go forward to the next period. Because the allocation of vacant jobs and unemployed workers across islands is random, both sides of the market have unpaired agents at the end of the period. The number of pairs formed and the number of unpaired agents of each type depends on the initial ratio of vacancies and job seekers, as does the distribution of wages across pairs at the end of the period.

Mortensen shows that repeating the random allocation process every period generates frictional unemployment. In addition, the resulting (endogenously generated) matching function explains both the Beveridge curve—the empirical downward sloping relationship between the job vacancy rate and the unemployment rate—and the log-linear relationship between the job finding rate and the ratio of vacancies to unemployment.

3. Expectations

The modern revolution in macroeconomics was inspired by the failure of Keynesian models to adequately account for empirical relationships or to provide useful policy prescriptions. Pointing to a fundamental problem in the older generation of models, Lucas' "Critique" [14] was an influential first step in the revolution. The failure of those models to ground their supply and demand curves in the decisions of rational, forward-looking consumers and producers was a fatal flaw. Although they might be successfully parametrized to fit historical data, they would necessarily remain an unreliable guide to the future, especially if significant policy changes were being contemplated.

Lucas [15] took the second step in the revolution, constructing a model that included the major elements that would be needed to create a new paradigm for macroeconomics. The key elements were maximizing agents (consumers and firms), with rational expectations, situated in a dynamic general equilibrium framework. This paper revolutionized the study of macroeconomics. Methodologically, it showed the fundamental role of expectations in determining equilibrium and illustrated how rational expectations could be incorporated. Substantively, it demonstrated, in a way that no one could ignore, the insubstantial basis for policy prescriptions attempting to exploit the Phillips curves. Lucas's follow-up empirical work in [19], based on international evidence from 18 countries, confirmed the conclusion. The point had a major impact on policy makers as well as academics, leading to the gradual realization of central banks all over the world that their main focus should be price stability.

New Keynesian models based on sticky prices have attempted to resuscitate the policy prescriptions of earlier models. Their basic premise is severely compromised by the recent work of Golosov and Lucas [6], who study a menu cost model with idiosyncratic (real) shocks to demand as well as aggregate nominal shocks. In this setting, firms make price adjustments to accommodate both types of shocks. Idiosyncratic real shocks are large, and firms must adjust

prices to accommodate them. Moreover, these adjustments are sufficiently frequent so that, in low-inflation environments, changes in the aggregate nominal price level can be easily absorbed as well. Consequently, in this setting policy makers cannot usefully exploit price stickiness.

The modern revolution in macroeconomics places expectations on the part of households and firms, about both exogenous shocks and government policy decisions, firmly at center stage. What is still controversial is how those expectations are formed, and how mistaken beliefs and subsequent learning can be incorporated into aggregate models.

The symposium paper "Self-confirming equilibrium and the Lucas critique," by Drew Fudenberg and David Levine [5], examines the possibilities for learning in macroeconomic policy games. In particular, the paper identifies two types of mistakes that policy makers might make. One mistake involves being overly optimistic about the outcome from a policy, the other involves being overly pessimistic. In the former case the policy is adopted, and the policy maker discovers his error. This type of error is related to the Lucas critique, as it can arise from the incorrect use of econometric evidence. Specifically, looking at reduced form relationships that change when policy changes can lead to this type of error.

In the latter case, when the policy maker is overly pessimistic, the policy is avoided, and no learning occurs. Consequently this type of outcome is a self-confirming equilibrium. The paper reviews several macroeconomic applications, including one that involves redistributional tax policy and one that involves inflation. An important conclusion of the learning model is that results depend to a large extent on the discount rate, since patient players are more inclined to invest in learning.

4. Fiscal policy

Tax policy has two main goals, to raise revenue to finance government spending and to provide social insurance against (temporary or permanent) idiosyncratic shocks. Additionally, there is the question of which fiscal instrument(s) should be used to reach each goal, what type(s) of taxes to use. Lucas and Stokey [26] provide a framework for studying optimal policy in a dynamic setting where social insurance issues are absent, so the government's sole objective is to finance a given (possibly stochastic) sequence of spending in a minimally distorting way. The private sector consists of identical households and there is no capital, so distributional issues are absent, as are alternative tax instruments. Atkeson and Lucas [2], on the other hand, look at the problem of providing social insurance against temporary idiosyncratic shocks, in a setting where raising revenue is not an issue. Lucas [20] reviews the tradeoff between capital and labor taxation, in a dynamic setting where both physical and human capital can be accumulated over time.

Complicating matters further, policy decisions in practice are always taken in the presence of substantial uncertainty about the environment, where the latter includes the cross-sectional distribution of preferences and endowments. In their symposium paper "On the robustness of laissez-faire," Narayana Kocherlakota and Christopher Phelan [10] look at the robustness of standard exercises in optimal mechanism/policy design in the presence of this uncertainty.

Specifically, Kocherlakota and Phelan look at the problem of a social planner who would like to reallocate goods across individuals in a way that respects heterogeneity in tastes for different goods and makes transfers to consumers with low endowments. Since neither endowments nor tastes are directly observable, the planner is limited to using incentive-compatible mechanisms to transfer goods. But incentive compatibility implies that net trades can in fact depend only on a summary of the agent's endowment and his tastes. Indeed, agents may have the same set of best responses to any mechanism, even if they have very different endowments.

If low endowments are correlated with tastes for particular goods, then typically mechanisms can be found that improve on laissez-faire. If endowments and tastes are statistically independent, however, then laissez-faire is always optimal. In fact, any mechanism that improves welfare in the correlated environment reduces it in the independent environment with the same marginal distributions. Consequently, if the marginal distributions are known but there is uncertainty about whether needs and tastes are correlated or independent, then under the maximin criterion laissez-faire is optimal.

5. Asset prices, risk aversion

Allocating risk is a central task of any economy, and in modern economies the behavior of asset prices provides a window for assessing how well that task is being accomplished. But interpreting the behavior of asset prices requires a theoretical framework. In [13] Lucas provides a general equilibrium model of asset prices based on rational expectations. Thus, asset prices reflect all available information about future shocks, as well as consumers' attitudes toward risk. The paper provides the first link between general equilibrium theory with risk averse consumers and the concept of "market efficiency" that is standard in the finance literature. It shows how the usual Martingale property that arises in the latter must be modified, and provides the basis for subsequent work using asset price behavior to quantify risk aversion.

Subsequent work has extended the "Lucas tree" model in many directions and used it as the basis for empirical investigations of asset price behavior. Nevertheless, many empirical questions remain, the equity premium puzzle being perhaps the most famous. Briefly, that "puzzle" involves the fact that the covariance of consumption and asset prices is low, while the excess return on equity compared with safer assets is high. With standard models for consumer preferences, these two facts can be reconciled only by attributing to consumers a very high degree of risk aversion, values that are inconsistent with other are sources of evidence on attitudes toward risk. In his Presidential Address to the American Economic Association, Lucas [17] notes that while the equity premium is still a puzzle, "we need to look beyond high estimates of risk aversion" to resolve it.

In "Doubts or variability," in this volume, Francisco Barillas, Lars Hansen, and Thomas Sargent [3] propose a resolution to the puzzle using a framework in which agents are concerned about model misspecification. The authors make two main points. First, they show that model uncertainty produces equilibrium behavior—allocations and prices—similar to those produced by risk aversion. However, the interpretation of asset prices is quite different in the two settings. In the presence of model uncertainty asset prices are uninformative about risk aversion.

In addition, the presence of model uncertainty creates an additional benefit from reducing short-run fluctuations. Doing so would allow agents to estimate more precisely the model ingredient about which they are uncertain, the long run growth rate of consumption. With a low discount rate, agents care a lot about that growth rate, and with ambiguity-averse preferences, the gains from improved information are large.

Housing transactions typically entail substantial adjustment costs, and consequently individuals adjust their consumption of housing services infrequently. Between moves and at the time of a transaction, the consumer also makes decisions about nondurable consumption and her portfolio of financial assets. In her symposium paper "Moving costs, nondurable consumption, and portfolio choice," Nancy Stokey [31] uses a calibrated theoretical model to assess the impact of adjustment costs on those decisions. The impact on portfolios is found to be significant, with the portfolio share in risky assets taking a significant jump at the time of a housing transaction.

Stokey also looks at the model's potential for explaining the equity premium puzzle. While it is usually labeled as a puzzle about the excessively high return on equity, it can as well be viewed as a puzzle about the excessive smoothness of consumption. Thus, a transaction cost for housing offers a potential explanation for smooth consumption. Housing consumption is constant over long intervals, and if the elasticity of substitution between housing and nondurables is less than unity, nondurable consumption is also smoother. The magnitude of the error from estimating risk aversion from the (misspecified) frictionless model using data from an economy with an adjustment cost can be calculated, and the adjustment cost works in the right direction. The effect is small, however: adjustment costs do not seem to explain the equity premium puzzle.

In standard models of insurance, firms are assumed to have the power to enforce exclusivity of contracts. That is, an individual who enters a contract with one insurer cannot purchase additional coverage from other firms. In her symposium paper "Anonymity and individual risk," Pamela Labadie [11] studies the consequences of dropping this assumption. In particular, the paper looks at the properties of an anonymous mechanism, a market environment in which the same price vector (insurance rate) is offered to all agents, and any agent is free to choose any quantity. That is, contracts are not exclusive.

The potential advantage of this system is that it involves transfers across different types of agents, and these transfers can be welfare enhancing compared with a separating equilibrium in the environment with exclusive contracts. In addition, the resulting allocation is robust against re-contracting. In the parametric model Labadie studies, anonymous equilibria always exist, although they may not be unique. Moreover, even though the anonymous equilibrium is not incentive efficient, it may Pareto dominate the standard equilibrium with exclusive contracts.

6. Long run growth

The differences in both income levels and growth rates across countries are enormous. As Lucas observed in [18] after commenting on these facts and asking about their source, "The consequences for human welfare involved in questions like these are simply staggering: Once one starts to think about them, it is hard to think about anything else." In that paper Lucas goes on to develop a model of endogenous growth based on investments in physical and human capital, where the latter is interpreted broadly, including technology as well as education, health and other components. That model has become a workhorse of the growth literature, extended to study theoretical questions about tax policy, empirical questions about the role of schooling, and a host of others.

The broad interpretation of human capital is critical for fitting the data, however. Investments in physical capital and education—the factors that are easily measured—are clearly not the whole story. Growth accounting exercises looking at time series for single economies and development accounting exercises looking at cross-section data across countries have concluded that total factor productivity (TFP) is the single most important factor for explaining both income growth rates and differences in income levels.

The enormous differences in TFP levels across countries are especially difficult to explain. Nevertheless, as Lucas notes in [16], occasional growth "miracles" provide some evidence about the factors that have allowed a few countries to catch up with the world's TFP leaders. In that paper Lucas develops a first model of how miracles can occur. In subsequent work Alvarez and Lucas [1] pursue the connection between technology and trade, and Lucas [21] argues that openness to foreign trade and inflows of foreign capital are important in stimulating catch-up growth.

In their symposium paper "Openness, technology capital and development," Ellen McGrattan and Edward Prescott [27] extend the neoclassical growth model to include (proprietary) technology capital at the firm level that can be used to produce both at home and abroad. In their model countries differ in population, local TFP, and degree of "openness." The degree of openness determines the extent to which foreign firms can exploit their own technologies when operating within that country's borders. If a country is less than fully open, the TFP of any foreign firm is reduced, and if a country is completely closed the TFP of any (potential) foreign firm falls to zero. Each plant has decreasing returns to scale in tangible inputs, and crucial to the theory is that the maximum number of plants any firm can operate in any given country is limited by that country's population size.

The model is used to study the role of openness in fostering economic development. Firms can invest in technology capital, and their incentives for doing so depend on the set of countries where it is profitable for them to operate, and on the profits generated by plants in those countries. Thus, openness has two effects. In the short run an open country enjoys the benefits of higher wages and returns to capital, as (more productive) foreign firms employ those resources. In the longer run, investments in technology capital are stimulated by the ability of the investing firms to reap profits abroad as well as at home.

Their model has no increasing returns in the technical sense, and there is no role for trade in goods, except for intertemporal trade in the composite final good. Nevertheless, in this setting both source and recipient countries enjoy large gains from economic integration, for two reasons. First, more rapid diffusion of technologies enhances TFP in recipient countries. In addition, the enhanced incentives to invest in technology capital benefit both recipient and source countries. McGrattan and Prescott find large gains from opening unilaterally, and even larger gains from multilateral integration.

Changes in employment patterns across time and space reflect, among other things, the creation and diffusion of new technologies. Thus, the time series patterns for employment across various geographic regions provide a useful source of information about technical change. In their symposium paper "Spatial growth and industry age," Klaus Desmet and Esteban Rossi-Hansberg [4] provide evidence showing that changes in geographic employment patterns are quite different for manufacturing and services. In particular, the relationship between employment level and employment growth differs across industries. They argue that the observed patterns can be rationalized by a model in which the usefulness of geographic concentration changes over an industry's life cycle. Concentration is useful during periods of rapid innovation, because of knowledge spillovers—agglomeration externalities—of the type studied in Lucas and Rossi-Hansberg [25]. As the technology matures and diffuses through space, knowledge spillovers become less important, and producers can reduce costs by moving to less densely concentrated areas, resulting in geographic dispersion.

The authors develop a model with two sectors, manufacturing and services, and multiple geographic locations. Both sectors enjoy knowledge spillovers and goods are tradeable, thus allowing locations to specialize. The model is used to study the dynamic response of the economy to a major innovation affecting a particular industry. The immediate effect of such an innovation is to increase the reward to geographic concentration, to take advantage of knowledge spillovers as the innovation is refined. As the refinement process slows down and the technology diffuses spatially, a period of geographic dispersion begins. Thus, the model is consistent with the observed fact that young industries, in terms of the technology they use, tend to become more geographically concentrated, whereas older ones become more dispersed. To further illustrate this point, the authors show that the spatial growth pattern of manufacturing at the beginning

of the 20th century, when it was experiencing the effect of electrification, was virtually identical to that of the service sector in recent decades, when it was experiencing the effects of rapid innovation in information and telecommunications technologies.

7. Conclusion

The revolution in macroeconomics of the last few decades has changed the way economists think about every question involving aggregates: positive questions about the consequences of various aggregate shocks on investment behavior or labor supply and about the sources of asset price fluctuations, normative questions about the extent to which society can insure its citizens against idiosyncratic taste or endowment shocks, and policy questions that involve both, including classic questions about the consequences of various monetary and fiscal policies. The revolution has been methodological as well, erasing the distinction between the tools and methods used in micro- and macroeconomic modeling. Some of the techniques used in this body of work are drawn together and systematized in Stokey and Lucas [32], a book that has helped train a younger generation of macroeconomists.

It is remarkable that the same person who gave us the Lucas span of control, the Lucas supply curve, the Lucas critique, and Lucas trees, has made fundamental contributions to so many other areas as well. Indeed, in terms of training the next generation of economists, one could do quite well by simply teaching a course in "Lucasian" economics.

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