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Editorial

Daron Acemoglu, Kenneth Rogoff, and Michael Woodford

The twenty-first edition of the *NBER Macroeconomics Annual* continues with its tradition of featuring debates central to current-day macroeconomic issues and analyses of important developments in macro-theory. A number of the papers in the twenty-first edition revisit important debates from earlier editions. These include the debate on the role of structural vector-autoregressions (SVARs) in identifying sources of business cycle fluctuations, the investigation of the trends in firm-level volatility and their implications for aggregate volatility, the debate on the causes of European unemployment, and the question of whether macro policy rules in the U.S. economy have changed over time. In addition, two papers explore new theoretical advances in optimal taxation policy and new approaches to equilibrium yield curves. As has been the tradition in the *NBER Macroeconomics Annual*, each paper is discussed by two experts, who provide contrasting views and elaborations of the themes raised in the papers.

The first paper in this edition is on structural vector-autoregression (SVARs) methodology, which has recently become a popular technique in empirical macroeconomics. SVARs attempt to measure the dynamic responses of a range of macroeconomic variables to structural disturbances (such as technology or preference shocks), while making few *a priori* assumptions about the correct structural relationships. This methodology is potentially useful since there is generally no widespread agreement on the exact structural forms to be imposed on the data to identify the role of various economic disturbances and the mechanisms of propagation. The SVAR approach has been widely used in the context of identifying the relative importance of technology and demand shocks and for uncovering the effects of monetary policy shocks, as well as in a range of other applications, such as studies of the impact of fiscal policy on the economy. Studies using SVAR meth-

odology have had a considerable impact on business cycle research, for example, opening a lively debate on the role of technology shocks and how these propagate through the economy at business cycle frequencies. The *NBER Macroeconomics Annual* has already featured some of the influential work in this genre, starting with the paper by Matthew Shapiro and Mark W. Watson (1988) in volume 3, and more recently with the paper by Jordi Galí and Pau Rabanal (2004) in volume 19. We felt that it would be useful in this volume to have a broader discussion of the appropriate use and interpretation of SVARs.

The debate here may be viewed as an outgrowth of Ellen McGrattan's (2004) comment on Galí and Rabanal (2004) in volume 19 of the *NBER Macroeconomics Annual*, where she argued that the application of the SVAR methodology to uncover the role of technology shocks can be highly misleading. A widely-discussed subsequent paper by V. V. Chari, Patrick J. Kehoe, and Ellen McGrattan (2005) extended this critique to argue that SVAR methodology in general is unreliable, since it depends on econometric specifications that are inevitably violated by dynamic stochastic general-equilibrium models. In "Assessing Structural VARs," Lawrence J. Christiano, Martin Eichenbaum, and Robert Vigfusson assess these criticisms for applied work using SVAR methodology. Their focus is on whether the misspecification involved in assuming a finite-order VAR to describe the joint dynamics of a set of aggregate time series is likely to lead to misleading inferences in practice. They explore this question in the context of two classes of dynamic equilibrium models. Their conclusion is that SVARs are unlikely to lead to misleading conclusions, even when misspecified. In particular, they find that even with misspecified SVARs, confidence intervals for estimated impulse responses would correctly indicate the degree of sampling uncertainty in the estimates, and that the bias in the estimated responses is typically small relative to the width of the confidence interval. They also show that biases in the estimated impulse responses resulting from SVARs with "long run" identifying restrictions (of the kind used by Galí and Rabanal, among others) are small and propose an alternative estimator that can further reduce biases in this case. Their conclusions suggest that when correctly used, SVARs can provide useful insight in the character of aggregate fluctuations.

Another area central to macroeconomic analysis of business cycle fluctuations is whether and how the volatility of aggregate fluctuations has changed over time. Important work in this area has already been featured in the *NBER Macroeconomics Annual*. James Stock and Mark

W. Watson (2002) in volume 17 have documented the large decline in aggregate volatility in the U.S. economy and investigated its causes, while a number of studies, including the *NBER Macroeconomics Annual* paper by Diego Comin and Thomas Philippon (2005), have documented that, somewhat paradoxically, the level of risk faced by individual firms appears to have increased during the same time span. The paper by Steven J. Davis, John Haltiwanger, Ron Jarmin, and Javier Miranda, "Volatility and Dispersion in Business Growth Rates: Publicly Traded versus Privately Held Firms," reconsiders the question of firm-level volatility using a new database, the Longitudinal Business Database (LBD) developed by the U.S. Department of the Census. The LBD is an ideal dataset for this purpose since it provides annual data on employment at nearly five million firms, covering all sectors of the U.S. economy and all geographic areas. The coverage is thus much wider than that provided by COMPUSTAT, which has previously been used to investigate changes in firm-level volatility, but includes only publicly traded firms (only about 7,000 of the five million firms in the LBD). Davis and co-authors find the trend in firm-level volatility looks quite different when one uses the LBD instead of the COMPUSTAT database because of differences in the behavior of publicly-traded and private firms. There has indeed been a large increase in the volatility faced by publicly-traded firms, but this has been accompanied with an even larger decline in firm-level volatility and cross-sectional dispersion of firm growth rates among private firms. Davis et al. show that this contrast between publicly-traded and private firms is present across different industries. They also document the role of selection in the increased volatility of publicly-traded firms, driven by the fact that recently-listed firms appear to be more volatile than those that have been listed for a longer period. These striking new findings dramatically change our view of the structural changes in the U.S. economy, suggesting that recent advances in productivity have not been associated with as great an increase in risk (and risk-taking) at the firm level as some have argued.

Another topic of lively debate among macroeconomists in recent years has been the source of Western Europe's persistent problem of high unemployment. This topic generated a large literature throughout the 1990s. It has received renewed interest partly because of Edward C. Prescott's (2002) Ely Lecture, where he argued that the difference between hours worked per capita in France and those in the United States could largely be explained by higher tax rates on labor income in France. Prescott based his conclusion on a calibration of a

representative-household model in which tax revenues are used to finance government services that are perfect substitutes for private consumer expenditures. In their paper, "Do Taxes Explain European Employment? Indivisible Labor, Human Capital, Lotteries, and Savings," Lars Ljungqvist and Thomas J. Sargent reconsider Prescott's analysis in a richer model, incorporating both unemployment and potentially incomplete markets. Incomplete markets are important, since they allow Ljungqvist and Sargent to develop a model of indivisible labor without employment lotteries. In this model, unemployed individuals have a negative income shock, and they can only protect themselves against this by "self-insurance", i.e., by borrowing and lending at a risk-free interest rate. Their model also extends Prescott's by allowing for human capital accumulation. They illustrate that the assumption of incomplete markets (and thus no full insurance against employment risk) is important and realistic, and document that full insurance against employment risk (as in Prescott's baseline model) would in fact result in a radical under-prediction of work effort in Europe for the levels of unemployment benefits in effect in most of Western Europe. They also show that their model and Prescott's do not have the same aggregate implications, notably with regard to the predicted effects of changes in the level of unemployment benefits. Ljungqvist and Sargent also suggest that a realistic calibration of their model would indicate that low unemployment is compatible with fairly high tax rates and that Western Europe's more generous welfare policies are more likely to be the primary explanation for higher unemployment than in the United States. Their model therefore not only contributes to the theoretical literature, but also suggests a provocative alternative vision for policy reform in Europe. Their contribution is thus likely to spark both future theoretical work on the modeling of the labor market and unemployment and further debate on possible policy reforms in Western Europe.

An important question in empirical macroeconomic modeling is whether government policy is appropriately modeled by uniform, time-invariant systematic rules, perturbed by additive random errors, or whether the response coefficients that describe government policy should be modeled as varying over time as well. Proponents of the view that systematic policy has changed to an important extent over time often deal with this problem by splitting their sample, but estimate rational-expectations equilibria (REE) under the assumption of a uniform policy rule that is expected to last forever for each sub-period. Troy Davig and Eric M. Leeper, in "Fluctuating Macro Policies and

the Fiscal Theory," propose an alternative approach: estimation of a regime-switching model in which the response coefficients of the government policy rules switch at random intervals among a finite number of recurrent possibilities, under the assumption that agents correctly understand the probability of these switches and their consequences for equilibrium dynamics. The estimated regime-switching model has different implications than a simple assumption of a REE for each interval over which the policy rules remain constant, for the anticipation of possible switching to another regime affects equilibrium dynamics under each of the individual regimes. First, the conditions for stability and determinacy of equilibrium are changed: even though, according to the authors' estimates, the U.S. economy has spent some parts of the postwar period under monetary/fiscal regimes that would imply either explosive dynamics or the existence of stationary sunspot equilibria if the regime in question were expected to persist indefinitely, the estimated switching model is one with a determinate REE. Consequently they support the conclusion of Richard Clarida, Jordi Galí, and Mark Gertler (2000) that U.S. monetary policy switched from "passive" to "active" at the beginning of the 1980s. Nevertheless, their model does not confirm the conclusion of the earlier authors that the U.S. economy was for that reason subject to instability due to self-fulfilling expectations in the 1970s. And second, they find that even in periods in which fiscal policy is "passive" (or Ricardian), fiscal disturbances affect both inflation and real activity (contrary to the principle of Ricardian equivalence), owing to the fact that the U.S. periodically reverts to an "active" fiscal policy regime under which taxes do not increase in response to increased public debt. This means that even clear evidence that tax rates respond to public debt in at least some periods in the way required to ensure intertemporal solvency does not mean that the fiscal theory of the price level is empirically unimportant; in the model of these authors, the mechanism emphasized in that literature affects equilibrium dynamics (though to differing extents) both when fiscal policy is "passive" and when it is not.

One of the important developments in theoretical public finance in recent years has been a revival of interest in the optimal policy approach pioneered by James Mirrlees (1971). Mirrlees' seminal paper showed how incentive and information problems can be the critical constraint on the structure of tax systems, and thus offered an attractive alternative to the existing approach, pioneered by Frank Ramsey, which arbitrarily assumed a given set of tax instruments (say, only proportional

taxes on various categories of income). The Ramsey theory of optimal taxation was extended to dynamic settings starting in the late 1970s and has since become the basis for macroeconomists' recommendations on optimal tax smoothing over the business cycle or on the desirability of taxing capital income. The renewed interest in Mirrleesian theory has prompted economists to reassess these macroeconomic questions using models in which constraints on the structure of taxes come from information and incentive compatibility constraints. This literature has already made important advances, but many of the contributions are theoretical and are cast in the context of relatively abstract models. In "New Dynamic Public Finance: A User's Guide," Mikhail Golosov, Aleh Tsyvinski, and Iván Werning survey this new literature and emphasize its implications for macroeconomics. They develop the major insights of the dynamic Mirrlees approach in the context of a two-period economy. They give particular attention to the question of how capital and labor "wedges"—discrepancies between marginal rates of substitution and technological rates of transformation that might (but need not be) created by the presence of a distorting tax—should vary in response to aggregate shocks in a constrained-optimal allocation of resources. In addition to showing that a Mirrleesian approach to such questions may be possible (and insightful), the analysis highlights some notable differences between the Mirrleesian results and those derived in the Ramsey theory. For example, a celebrated result of the representative-agent Ramsey theory is that tax rates on labor income should be smoothed, both across time and across states of the world; thus they should not vary in response to different levels of government purchases. The authors show that a similar result (with regard to the labor "wedge") obtains under the Mirrleesian theory when uncertainty regarding individual agents' skills is fully resolved in the first period. However, when uncertainty about skills remains even in the second period, optimal labor "wedges" can vary with the realized shock to the level of government purchases. These results make it clear that a careful analysis of the constraints on tax policy that pays attention to the relevant kinds of heterogeneity in the population is necessary to draw reliable conclusions about the nature of optimal policy.

Another important growth area in macroeconomics in recent years has been the use of macroeconomic models to understand asset pricing; "macro finance" models of the term structure of interest rates have attracted particular interest. In "Equilibrium Yield Curves," Monika Piazzesi and Martin Schneider consider the extent to which variations

over time in the yield curve for U.S. bond prices are consistent with a representative-household model, and the extent to which these movements can be explained by the evolution of aggregate time series. Their theoretical model predicts the evolution of the prices of bonds of all maturities, given stochastic processes for inflation and for aggregate consumption expenditure. A theoretical forecasting model (a VAR) is estimated for the joint dynamics of the latter two macro variables, and the authors then ask to what extent the yield-curve dynamics that would be implied by the theoretical bond-pricing model are similar to those actually observed over the sample period. Previous exercises of this kind have often failed even to correctly explain the average slope of the yield curve, finding a “bond premium puzzle” according to which the theoretical model implies that the average yields on longer-maturity bonds should be lower than average short rates of interest, whereas historically they have been higher. Piazzesi and Schneider solve this problem by proposing an alternative form of preferences (Epstein-Zin preferences), and documenting a dynamic relationship between inflation and consumption growth of a kind that can generate a positive average term premium in the case of these preferences. Their model also successfully accounts for other important features of observed bond prices, such as the degree of serial correlation of both short and long yields. They then consider a more complex version of their model, in which agents must estimate the joint dynamics and inflation and the aggregate consumption process, rather than being assumed to correctly understand the data-generating process estimated by the authors (i.e., assumed to have rational expectations). The model with learning helps to explain shifts in the average shape of yield curves over time; for example, differences in the yield curve after 1980 are attributed to an increased subjective estimate of the degree of persistence of fluctuations in inflation after observing large and persistent swings in inflation in the 1970s. These suggestive results are encouraging, both for the prospect of an eventual unified explanation of aggregate fluctuations and the evolution of asset prices, and for our ability to understand the role of expectation formation in macroeconomic dynamics.

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Abstracts

1 Assessing Structural VARs

Lawrence J. Christiano, Martin Eichenbaum, and Robert Vigfusson

This paper analyzes the quality of VAR-based procedures for estimating the response of the economy to a shock. We focus on two key issues. First, do VAR-based confidence intervals accurately reflect the actual degree of sampling uncertainty associated with impulse response functions? Second, what is the size of bias relative to confidence intervals, and how do coverage rates of confidence intervals compare with their nominal size? We address these questions using data generated from a series of estimated dynamic, stochastic general equilibrium models. We organize most of our analysis around a particular question that has attracted a great deal of attention in the literature: How do hours worked respond to an identified shock? In all of our examples, as long as the variance in hours worked due to a given shock is above the remarkably low number of 1 percent, structural VARs perform well. This finding is true regardless of whether identification is based on short-run or long-run restrictions. Confidence intervals are wider in the case of long-run restrictions. Even so, long-run identified VARs can be useful for discriminating among competing economic models.

2 Volatility and Dispersion in Business Growth Rates: Publicly Traded versus Privately Held Firms

Steven J. Davis, John Haltiwanger, Ron Jarmin, and Javier Miranda

We study the variability of business growth rates in the U.S. private sector from 1976 onwards. To carry out our study, we exploit the recently developed Longitudinal Business Database (LBD), which contains annual observations on employment and payroll for all U.S.

businesses. Our central finding is a large secular decline in the cross sectional dispersion of firm growth rates and in the average magnitude of firm level volatility. Measured the same way as in other recent research, the employment-weighted mean volatility of firm growth rates has declined by more than 40 percent since 1982. This result stands in sharp contrast to previous findings of rising volatility for publicly traded firms in COMPUSTAT data. We confirm the rise in volatility among publicly traded firms using the LBD, but we show that its impact is overwhelmed by declining volatility among privately held firms. This pattern holds in every major industry group. Employment shifts toward older businesses account for 27 percent or more of the volatility decline among privately held firms. Simple cohort effects that capture higher volatility among more recently listed firms account for most of the volatility rise among publicly traded firms.

3 Do Taxes Explain European Employment? Indivisible Labor, Human Capital, Lotteries, and Savings

Lars Ljungqvist and Thomas J. Sargent

Adding generous government supplied benefits to Prescott's (2002) model with employment lotteries and private consumption insurance causes employment to implode and prevents the model from matching outcomes observed in Europe. To understand the role of a "not-so-well-known aggregation theory" that Prescott uses to rationalize the high labor supply elasticity that underlies his finding that higher taxes on labor have depressed Europe relative to the United States, this paper compares aggregate outcomes for economies with two arrangements for coping with indivisible labor: (1) employment lotteries plus complete consumption insurance, and (2) individual consumption smoothing via borrowing and lending at a risk-free interest rate. The two arrangements support equivalent outcomes when human capital is not present; when it is present, allocations differ because households' reliance on personal savings in the incomplete markets model constrains the "career choices" that are implicit in their human capital acquisition plans relative to those that can be supported by lotteries and consumption insurance in the complete markets model. Nevertheless, the responses of *aggregate* outcomes to *changes* in tax rates are quantitatively similar across the two market structures. Thus, under both aggregation theories, the high disutility that Prescott assigns to labor is an impedi-

ment to explaining European nonemployment and benefits levels. Moreover, while the identities of the nonemployed under Prescott's tax hypothesis differ between the two aggregation theories, they all seem counterfactual.

4 Fluctuating Macro Policies and The Fiscal Theory

Troy Davig and Eric M. Leeper

This paper estimates regime-switching rules for monetary policy and tax policy over the post-war period in the United States and imposes the estimated policy process on a calibrated dynamic stochastic general equilibrium model with nominal rigidities. Decision rules are locally unique and produce a rational expectations equilibrium in which (lump-sum) tax shocks always affect output and inflation. Tax non-neutralities in the model arise solely through the mechanism articulated by the fiscal theory of the price level. The paper quantifies that mechanism and finds it to be important in U.S. data, reconciling a popular class of monetary models with the evidence that tax shocks have substantial impacts. Because long-run policy behavior determines the qualitative nature of equilibrium, in a regime-switching environment more accurate qualitative inferences can be gleaned from full-sample information than by conditioning on policy regime.

5 New Dynamic Public Finance: A User's Guide

Mikhail Golosov, Aleh Tsyvinski, and Iván Werning

This paper reviews recent advances in the theory of optimal policy in a dynamic Mirrlees setting, and contrasts this approach to the one based on the representative-agent Ramsey framework. We revisit three classical issues and focus on insights and results that contrast with those from the Ramsey approach. In particular, we illustrate, using a simple two period economy, the implications for capital taxation, tax smoothing, and time inconsistency.

6 Equilibrium Yield Curves

Monika Piazzesi and Martin Schneider

This paper considers how the role of inflation as a leading business-cycle indicator affects the pricing of nominal bonds. We examine a

representative agent asset pricing model with recursive utility preferences and exogenous consumption growth and inflation. We solve for yields under various assumptions on the evolution of investor beliefs. If inflation is bad news for consumption growth, the nominal yield curve slopes up. Moreover, the level of nominal interest rates and term spreads are high in times when inflation news is harder to interpret. This is relevant for periods such as the early 1980s, when the joint dynamics of inflation and growth was not well understood.