generation of dynamic stochastic general equilibrium (DSGE) models that feature financial frictions also fall short of making a material difference in implied business-cycle dynamics.

In many applications, practitioners are interested in exploiting the information content of binary-event indicators in the context of statistical models. For example, one may be interested in the association between interest rates and economic activity over different phases of the business cycle. Harding and Pagan show that ignoring dynamic properties of binary indicators may lead to incorrect statistical inference in such applications. They prescribe methods to remedy such inference problems in the context of both linear regression models and probability models such as probit.

Anticipating business-cycle turning points is essentially the holy grail of empirical business-cycle analysis. Perhaps not surprisingly, Harding and Pagan show that such efforts prove largely unsuccessful: over sufficiently long histories, linear and nonlinear models that use past growth rates or incorporate additional predictors fail to systematically predict peaks in economic activity in advance. They argue that the occasional success in the literature was either short lived or primarily a result of the artifact of the redefinition of the event being predicted. The recommendation is settling for more modest aims, such as trying to recognize a turning point soon after it occurs, as argued by Hamilton (2011). The illustration of why recession prediction is extremely difficult in the context of a DSGE model puts what is seemingly obvious in a rigorous context: to successfully predict recessions, one needs to identify indicators that are correlated with future innovations to the dynamic economic system.

The book forcefully hammers out its central message with illustrative examples and provides invaluable guidance to practitioners, but it falls short of expectations in a few important aspects. First, illustrations and discussions that relate to recurrent events in financial markets are limited, compared to what one would expect from a study like this. Second, if the authors had provided a bit more detail on implementation of the procedures used in the book and made all data and programs available in a central location, that would have significantly increased its pedagogical value. Finally, the book's coverage of nonlinear models appears somewhat one-sided, as it largely focuses on shortcomings of such models, although they are extensively used by academics and practitioners to make probabilistic inference about unknown states of the economy or financial markets. Nonetheless, the book is a great read and excellent reference for students of recurrent event analysis in economics and finance.

REFERENCES

Burns, Arthur F., and Wesley C. Mitchell. 1946. *Measuring Business Cycles*. New York: National Bureau of Economic Research.

Chauvet, Marcelle, Zeynep Senyuz, and Emre Yoldas. 2015. "What Does Financial Volatility Tell Us about Macroeconomic Fluctuations?" *Journal of Economic Dynamics and Control* 52: 340–60.

Hamilton, James D. 2011. "Calling Recessions in Real Time." *International Journal of Forecasting* 27 (4): 1006–26.

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D Microeconomics

The Oxford Handbook of the Economics of Networks. Edited by Yann Bramoullé, Andrea Galeotti, and Brian Rogers. Oxford and New York: Oxford University Press, 2016. Pp. xi, 841. $175.00. ISBN 978–0–19–994827–7, cloth.

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Individuals learn about new products from friends, neighbors, and colleagues. Countries trade goods and services differentially with other countries. Firms receive spillovers from research and development by nearby or related firms. Financial institutions trade assets bilaterally in over-the-counter markets. In these examples, an agent (be it an individual, country, firm, or financial institution) interacts with or imposes particular externalities on a subset of other agents. Each of those "other agents" then interacts with or imposes externalities on a (possibly) different subset of agents. These local relationships coalesce into a global, interconnected structure: a network. *The Oxford Handbook of the Economics of Networks* seeks to review and summarize the literature to date on such interaction structures in economics.

Following an introduction by the editors (part 1), part 2 consists of three chapters (by Alan Kirman, Sanjeev Goyal, and Matthew O. Jackson, respectively) that provide thought-provoking perspectives on the current literature. These chapters describe the introduction in the 1990s, and subsequent evolution, of work on networks in economics. As suggested by the examples above, interaction in the very small (a single agent or two agents interacting) and in the very large (say, an anonymous market setting) is not always sufficient. Networks were introduced into economics to understand strategic behavior when agents interact in more complex ways. For example, in chapter 3, Goyal discusses early work on networks in social learning where learning occurs through contacts and is not adequately captured by single-agent or public learning.

Early work on networks in economics tended to be theoretical. Economists modeled and continue to ask and model, questions both about how agents' behavior depends on the network of interactions and how agents form interactions strategically. Take the example above of a financial institution. Financial institutions exchange assets within trading relationships. We might model the network of relationships between institutions and examine how this determines prices. However, financial institutions are also able to choose those relationships. In this case, we need a model where financial institutions choose with whom they develop trading relationships.

Part 3 of the handbook is a well-curated set of chapters covering theoretical models of strategic behavior on fixed networks (chapters by Yann Bramoullé and Rachel Kranton; Francesco Nava; and Yves Zenou) and models of strategic network formation (chapters by Paolo Pin and Brian W. Rodgers; Ana Mauleon and Vincent Vannetelbosch; Fernando Vega-Redondo; Marcin Dziubiński, Sanjeev Goyal, and Adrien Vigier), with some overlap between the two. The development of tools to tackle networks within economic frameworks has been, and continues to be, an important part of the economics literature. Chapters in this handbook do an excellent job of covering not only the workings of these tools, but also explaining any related difficulties, as well as conceptual and tractability reasons for modeling choices.

More recently, research in networks has intensified within a number of fields. Finance and development are two good examples of this. In development, local relationships can play a large role in economic transactions—for example, a lack of access to insurance markets means that this economic role is often played by person-to-person risk sharing. Indeed, work on networks in development is discussed throughout the handbook (see chapters by Emily Breza; Markus Mobius and Tanya Rosenblat; Kaivan Munshi; and Lori Beaman). In particular, the expansion of networks research in development has added a valuable collection of detailed empirical studies of networks and participant behaviors to the growing networks literature.

The breadth and depth of the literature over the past two decades makes this handbook a particularly valuable endeavor, and the editors of this book provide us with a first-rate service. The editors make sensible choices in organizing a new literature that has grown fast—in terms of methodology and questions asked—and has spread into many fields of economics. Parts 1 and 2 provide an introduction to networks and part 3 provides a review of theoretical methodology with applications. Part 4 provides a review of empirical and experimental methodologies. The second half of the handbook is centered around three important topics in economics where networks play a central role: diffusion and learning in networks (part 5), the role of community in facilitating economic transactions (part 6), and the structure of organizations and markets (part 7). Handbooks are typically used as a reference to explore new topics. In keeping with this, the authors of the thirty-one chapters do careful work, furnishing detail appropriate to a handbook and pointing to further research, as well as highlighting key progress, challenges, and areas ripe for future study.

While I can recommend reading each part of the handbook, in the short space left in this review I am going to concentrate the discussion around one topic. Focusing on diffusion, I will try to highlight a small portion of the exciting themes, questions, and challenges running throughout the handbook.

The diffusion of technologies, ideas, behaviors, and knowledge is central to growth and

development. Diffusion is frequently a social process. Ideas and information pass between neighbors and colleagues. The benefit to adopting a new technology can depend on friends and family also having adopted that technology. Learning about new products can come from observing neighbors using those products. Thus, networks can be a critical element in understanding both the spread of "things" and when these "things" might fail to spread. Part 5 of the handbook focuses on this work. Related discussion is found throughout the handbook.

In part 5, P.J. Lamberson (chapter 18) explains that diffusion models are typically composed of two main features: a network describing relationships and an interaction rule about how technology, information, or behavior diffuses from one individual to another. Chapter 18 focuses on the role of connectivity—how many contacts each individual has—and whether more connected societies are more effective at diffusion. Chapter 19, by Benjamin Golub and Evan Sadler, considers social learning in networks, and examines in which networks consensus occurs and when that consensus is correct. Chapter 20, by Antonio Cabrales, Douglas Gale, and Piero Gottardi, discusses and models financial contagion to determine when a shock in revenue to one firm can lead to large-scale default. Chapter 21, by Daron Acemoglu, Asuman Ozdaglar, and Alireza Tahbaz-Salehi, examines how shocks to agents propagate through a network and how network structure influences the global impact of those shocks. They illustrate a third key feature of diffusion: an aggregation rule that determines how individual agents' outcomes aggregate to a global outcome.

One of the central messages of part 5 is that the nature of interaction between agents and the way agents' behaviors aggregate are crucial to the results. Changes in interaction or aggregation rules can even reverse the role of a particular network feature; for example, greater connectivity may propel diffusion under one rule but hinder diffusion under another. These chapters show how rules translate into which network features matter for diffusion and make clear the necessity of understanding exactly what rules of interaction or aggregation underlie the relevant diffusion. Understanding the microfoundations of these rules is then an important area for future research.

A recurrent theme of the handbook is the tension between the complexity of the network and the desire to understand how general features of the network matter. Understanding the role of networks requires capturing some of the complexity that defines a network but, at the same time, breaking down this complexity to pull out general features of the network structure that play a part in a given problem and outcome. Many of the chapters highlight progress that has been made in this area. One strand of research on diffusion (see chapter 18) takes an elegant approach to this tension using a "degree-based mean field approach." This approach models degree distribution (the number of contacts each individual has), abstracting away from other features of networks, and provides us with general and in-depth understanding of the role of connectivity in diffusion. This tension between complexity and abstraction also exists in another form, highlighted by Golub and Sadler: not only does the researcher have to deal with the complexity of networks, but so does the "subject." In chapter 19, Golub and Sadler illustrate a model of social learning in which, each period, individuals update their estimates by averaging the estimates of their contacts. Again, this approach is tractable and allows for general and informative results on how beliefs spread and converge. They discuss averaging of beliefs as a heuristic and point to the question of how individuals deal with the intricacies of the complex network in which they reside as an active and exciting area of research.

This first handbook on the economics of networks is a timely and excellent reference. I would highly recommend it to researchers looking into a particular topic, as well as for those already working in this area.

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