The Flawed Foundations of General Equilibrium

Does economic theory rest on solid logical foundations? The influence and prestige afforded to orthodox economics – both as a theory and a source of policy advice – suggests the answer is a resounding "yes."

Economists Frank Ackerman and Alejandro Nadal present a fundamental challenge to this received wisdom. They demonstrate that neither the abstractions of general equilibrium nor their real-world consequences stand up to logical scrutiny. Themes critically analyzed in this book include:

- fundamental flaws in the standard theories of general equilibrium;
- conventional economic assumptions about consumer behavior;
- individual choices and the role of money;
- the application of economic theory to current debates in globalization, trade, and development.

The Flawed Foundations of General Equilibrium shows that there are fatal flaws in the standard theoretical model of a market economy. It will be an enlightening read for economists of all persuasions – and for those in law, social sciences, and public policy arenas where economic theory has become inescapable.

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Routledge
Taylor & Francis Group
LONDON AND NEW YORK

First published 2004
by Routledge
2 Park Square, Milton Park, Abingdon, Oxon, OX14 4RN

Simultaneously published in the USA and Canada
by Routledge
270 Madison Ave, New York NY 10016

Routledge is an imprint of the Taylor & Francis Group

Transferred to Digital Printing 2006

Typeset in Times by Wearset Ltd, Boldon,Tyne and Wear

British Library Cataloguing in Publication Data
A catalogue record for this book is available from the British Library

Library of Congress Cataloging in Publication Data
A catalog record for this book has been requested

ISBN 0-415-70001-9

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Acknowledgments

We would like to thank the Hewlett Foundation, and former Hewlett program officer David Lorey, for their joint support to our two institutions that made this book possible. Frank Ackerman would also like to thank the Bauman Foundation for support for his work on alternatives to market-based environmental policies, including a chapter of this book. Alejandro Nadal would like to thank the MacArthur Foundation for long-term support for his work on this book and his research program on development alternatives for Mexico.

In addition, we thank Francisco Aguayo, Kevin P. Gallagher, Lisa Heinzerling, Rachel Massey, and Tim Wise for helpful comments on individual chapters. At Tufts, Chelsea Feerer, Jordana Fish, and Regina Flores provided much-appreciated assistance in preparing the manuscript for publication. At Routledge, our editor Robert Langham and his assistant Terry Clague enthusiastically supported our efforts from the beginning, and moved the project toward completion with admirable efficiency.

Several of our chapters have previously appeared in economics journals or draw on other previous publications:

Chapter 1, "Still dead after all these years," originally appeared in the *Journal of Economic Methodology* (http://www.tandf.co.uk/journals/routledge/1350178X.html) in 2002, and is reprinted by permission of the publisher.

Chapter 5, "Consumed in theory," originally appeared in the *Journal of Economic Issues* (vol. 31, pp. 651–664) in 1997, and is reprinted here by special permission of the copyright holder, the Association for Evolutionary Economics.

Chapter 6, "Choice of technique revisited," originally appeared in *World Development* (vol. 38, no. 11, pp. 1445–56) in 1990, and is reprinted (with minor updating) with permission of the publisher, Elsevier.

Chapter 7, "Existence values and priceless externalities," is in part excerpted from *Priceless: On Knowing the Price of Everything and the Value of Nothing*, by Frank Ackerman and Lisa Heinzerling (New York: The New Press, 2004), with permission of the publisher.

Chapter 10, "Computable abstraction," is in part based on Luke Ney, Kevin P. Gallagher, and Frank Ackerman, "Economic Analysis in Environmental Reviews of Trade Agreements: Assessing the North American Experience," GDAE Working Paper 02-01 (2002), prepared for the North American Commission on Environmental Cooperation, and available at http://www.ase.tufts.edu/gdae/publications/working_papers/02-01SustAssessments.pdf.

Introduction

Underneath the flawed foundations

Frank Ackerman and Alejandro Nadal

Few academic theories have achieved as much influence as the economics of competitive markets. Few eighteenth-century metaphors are as well remembered and widely quoted as Adam Smith's invisible hand. Mathematical restatements of that metaphor are endorsed by the great majority of economists, and provide the framework for a large and growing number of decisions about public policy. Prominent economists have described the invisible hand as the most important contribution of economics to social theory (Arrow and Hahn 1971: 4). In the case of economics, the ivory tower casts a long shadow over social and political life.

The image of the invisible hand arises in a parable about the socially desirable outcomes of private competition. The magic of the marketplace coordinates isolated individual decisions, "as if by an invisible hand," to achieve the best possible outcome for society. The individuals are assumed to be selfish (if they were selfless altruists, there would be nothing to prove); and the optimal outcome is not foreseen or planned by anyone. In the opening chapters of his *Wealth of Nations*, Smith made an early, but incomplete, attempt to explain how competitive markets achieved this happy result through the price mechanism. Smith's image of invisible coordination was supported by verbal argument, with stories about bakers and butchers learning by trial and error that they will profit by selling the goods that consumers want to buy. These stories are suggestive, but do not strictly prove that the invisible hand is always in touch with our collective best interests.

Recognizing the incompleteness of the theory, economists continued to struggle with the question of the optimality of market outcomes. Almost two hundred years after Smith, his point about the invisible hand and its desirable results was apparently proved by Kenneth Arrow and Gerard Debreu, in the imposingly abstract mathematics of general equilibrium theory. Imagine an economy of many consumers and producers, selfishly engaged in optimizing satisfaction and profits and satisfying a long list of assumptions (many of which are discussed in this book). Under those assumptions, the model built by Arrow and Debreu shows that there is always a market equilibrium at which supply equals demand for every

commodity. It is a "general" or economy-wide equilibrium since it involves the interaction of all prices with the supply and demand for all commodities, as opposed to partial equilibrium theories, which are concerned with price determination in particular markets.

A general equilibrium is always an optimum outcome for society, using the somewhat odd technical definition of "optimum" that has become standard in economics. (On the political biases of Pareto optimality, see Ackerman and Heinzerling (2004, chap. 2).) The mathematics of general equilibrium seems to show that the private greed of bakers, butchers, and all the rest of us, expressed through the market, leads to a collective result that cannot be improved upon for anyone without worsening the outcome for someone else.

The "proof of existence" of a general equilibrium by Arrow and Debreu in 1954 was hailed as a scientific demonstration of the optimal results attained by competitive markets. Amid the celebration, no critical analysis was undertaken of the economic meaning of the abstract mathematical tools used in their opus. Soon the weight of research shifted to the dynamics of price formation, in order to examine just how market forces could lead to that equilibrium point whose existence had been "proven." Here the results were, to say the least, disappointing. The initial work of Arrow *et al.* (1959) concluded with the conjecture that, in general, the Arrow–Debreu model would converge to an equilibrium position. The conjecture was shown to be false by Scarf (1960), using a simple counterexample. Further research soon led to even more negative conclusions, as Frank Ackerman explains in "Still dead after all these years," Chapter 1 of this book. The discipline soon realized that it was unable to provide a theoretical account of the dynamics of the invisible hand and retreated to the apparent robustness and intimidating abstraction of the static "proof of existence." Ironically, the triumph of free market economic policies during the past two decades has coincided with the recognition by economic theorists that the most general theoretical models of the market economy were leading to discouraging results.

Such doubts are not usually presented in textbooks and classroom lectures, let alone public debate. Most economists do not follow the very theoretical branches of the research literature, and typically continue to assert – and believe – that general equilibrium has been definitively proved to lead to the best of all possible outcomes. This conclusion, the optimality of general equilibrium, does not depend on any information about any real economy. It is an axiomatic deduction from a set of abstract hypotheses, based solely on a mathematical model. Yet it often appears to have very specific and controversial implications for the real world, supporting conservative political arguments against any form of government intervention in markets. If unregulated market competition leads to an ideal result, then public programs, regulations, and initiatives of all types can only make things worse.

How can the use of pure mathematics lead to such partisan political conclusions? This paradox suggests that something is wrong with either the theory or its applications. The premise of this book is that there are profound problems both in the theory of general equilibrium and in its common, careless application to reality. A theory built on flawed foundations is unsatisfying for theorists, and has little to say about the economic policy questions that ultimately matter: what changes, what improvements in the status quo, are possible in reality?

Are we beating a dead horse?

A fundamental question needs to be addressed before we go any farther. Is general equilibrium still worth talking about, or is the subject too old and outmoded to bother with? The classic results establishing the existence and optimality of general equilibrium have reached their fiftieth anniversary, and some of the critical findings that we will discuss, concerning the limitations and problems of the theory, are twenty or thirty years old.

When confronted with criticisms of general equilibrium, some economists claim that the discipline has moved on, and that no one still relies on the old Arrow–Debreu framework. Instead, economists are now involved in applications of game theory, chaos or complexity theory, new models of endogenous preferences, the analysis of limited and asymmetric information, and so on. These new approaches lead to varied and intricate results, which, unsurprisingly, fail to exhibit the optimality that general equilibrium so proudly claimed. The old, idealized model of competitive markets is said to be uninteresting, yesterday's news, no longer representative of the leading edge of theory.

We agree that these new approaches can be found in various corners of the economics profession. We wish their advocates well in their efforts to develop new theories. However, they have not yet developed an alternative economic paradigm that rivals or replaces general equilibrium. Perhaps for that reason, the new approaches have not yet had a significant impact on applications of economics to the real world. As Kenneth Arrow (1994: 451) stated not too long ago, "competitive general equilibrium theory is still the only coherent account of the entire economy." This helps explain why both theoretical constructs (see Benetti 1997) and policy recommendations are so often assessed in terms of their deviation from the general equilibrium paradigm.

Game theory is the oldest "new" approach, and has enjoyed decades of mathematically sophisticated applications to economics. Yet its results are unimpressive. With (usually) a small number of participants exploring a small number of choices, with payoffs that depend on the choices made by others, the outcomes of an economic process become indeterminate and need not represent a social optimum. In the prisoner's dilemma, the

ubiquitous introductory example of game theory, the optimum (short sentences if neither prisoner confesses) is unstable, while the worst outcome (long sentences if both confess) is stable. More generally, the "folk theorem" of game theory – a result that was apparently so damning that no one wanted to claim credit for it – shows that essentially anything can happen in an infinitely repeated game. In such a game, multiple equilibria are the norm, while theory in general places very few restrictions on the possible outcomes of the game.

Game theory elegantly clarifies the inherent indeterminacy of oligopoly pricing and other bargaining situations. Its mathematical tools have been applied to a number of abstract economic models. But that is a long way from providing a comprehensive alternative economic theory. Game theory does not provide a new or different framework for a general theory of interdependent markets. Other than stories about oligopolies and bargaining, it is difficult to think of empirical problems that are better explained with game theory than without it.

Chaos theory and complexity theory are two related bodies of analysis that have led to an interesting new perspective on traditional styles of mathematical modeling. (For applications to economics, see, among others, Arthur (1994), Day (1994), Colander (2000), and Ormerod (1998).) In brief, the dynamics of even simple nonlinear systems can be extremely strange, and effectively unpredictable. The smooth movement toward equilibrium, a feature of many traditional economic models, is thus revealed to be dependent on the assumption of linearity – an assumption that is frequently unwarranted. Nonlinear economic systems may exhibit erratic or turbulent patterns of fluctuation ("chaos"), or may develop persistent, disequilibrium structures ("complexity"). Indeed, the dynamic instability of general equilibrium, a topic explored in Chapter 1, rests on similar mathematical insights.

Yet this provocative new body of mathematics has another feature that sharply limits its value in economic modeling. Chaotic and complex systems are sensitively dependent on initial conditions. A trivially small change in data inputs can lead to large qualitative changes in outcomes; since this problem was first noticed in an atmospheric model, it is often referred to as the "butterfly effect." Due to the nonlinear dynamics of atmospheric models, a butterfly flapping its wings could in theory cause a large-scale change in the weather on the other side of the earth. For economic modeling, the butterfly effect means that small errors in data, or even decisions about rounding off data, could utterly change the predicted results. Under these conditions quantitative forecasting and conventional approaches to model estimation become impossible. Thus, we are typically unable to prove the existence of well-defined nonlinear equations that describe the evolution of the system (Ruelle 1988: 197); all that can be proved about nonlinear economic dynamics in general is that almost anything can happen.

Chaotic and complex models can provide qualitative illustrations of the broad range of possible economic dynamics, creating colorful numerical images of potential instability. But thanks to the butterfly effect, they can often do no more. They can be thought of as a null hypothesis for the entire project of quantitative modeling, a mathematical demonstration of the limits of mathematics. The null hypothesis can be rejected only when there are grounds for believing that an economic process is linear or otherwise well behaved. This is an important critique that deserves to be taken seriously; it might imply a greater role for older, verbal styles of historical and political analysis of economic problems. It does not, however, suggest that we are about to achieve a useful quantitative understanding of the economy as a chaotic or complex system. A vigorous recent claim that complexity theory is already influencing policy analysis points to few specifics other than the growing use of the (valuable) notion of path-dependency (Colander 2000).

Another new approach picks up an old theme, criticizing the unrealistic traditional model of consumer preferences (a point that is also discussed in our essay on consumer theory). Standard economics, as embodied in general equilibrium theory, assumes that individual preferences are formed outside the economic system (exogenously) and are not influenced by economic interactions. A modest body of recent literature rejects this assumption and instead explores the more reasonable hypothesis that preferences are in part endogenous, shaped within the economic system. Proponents of this perspective (Bowles 1998; Bowles and Gintis 2000) rightly point out that it is subversive of the traditional general equilibrium model.

However, the new literature on endogenous preferences cannot yet be considered part of an alternative paradigm, for three reasons. First, it has attracted relatively few adherents, and is therefore only in the early stages of development. (On the more widely discussed, but less theoretically ambitious, "prospect theory" of Kahneman and Tversky, see p. 6.) Second, it is often formulated in the narrowly mathematical style of conventional theory, as if seeking to show that new results can be achieved with as few theoretical innovations as possible. This strategy works against the creation of a comprehensive alternative; it proposes minor amendments rather than new constitutions. The more sweeping critiques by Thorstein Veblen and John Kenneth Galbraith, economists who addressed endogenous preferences in the past, were more persuasive and more realistic.

Finally, when the new analyses of endogenous preferences achieve precise mathematical formulations, in this respect surpassing Veblen and Galbraith, they create the kind of nonlinearities that allow chaos and complexity, as discussed above. When people are prone to follow the opinions of others, it is possible for fads and speculative bubbles to arise – species of nonlinear complexity that are unpredictable in any detail. (For our own modest contribution to the massive literature on the subject, see

Ackerman and Gallagher (2002) on the evidence for speculative bubbles in prices of recycled materials.) It is no surprise that some of the researchers examining endogenous preferences are also active in exploring complex economic systems – with all the problems we have described.

There are more innovations that offer other amendments to existing theory, many of them less important than endogenous preferences. One route to status in the mainstream of the economics profession is to explore what happens when a single assumption of the standard theory is relaxed. Yet these isolated innovations are never cumulative; the individual amendments never add up to a whole new draft. The game begins again, from the same starting point, when the next economist proposes to relax a different assumption.

For example, one set of empirical patterns in consumer behavior, described in the so-called prospect theory of Daniel Kahneman and Amos Tversky, has gained widespread attention among economists. Kahneman shared the Nobel Prize for economics in 2002 (Tversky had died a few years earlier) for proving that the standard model of consumer choice is inconsistent with psychological reality in several respects. The Kahneman–Tversky results are often mentioned by economists as an interesting puzzle, but rarely combined with other innovations in the pursuit of a new paradigm; instead, other innovations typically assume the standard model of the consumer, for the sake of mathematical convenience and familiarity.

The last of the new approaches that we will discuss is in some ways the most impressive. The Arrow–Debreu model assumes that all market participants have perfect information about all commodities, employment and investment opportunities, etc., imposing immense and implausible information requirements. Rejecting this assumption, Joseph Stiglitz and his co-workers have explored the economic implications of limited and asymmetric information (see Stiglitz (2000) and numerous sources cited there). Market participants are clearly at a disadvantage when they lack information that others possess, and thus cannot necessarily find the choice that maximizes their welfare. In a limited information context, the unregulated market equilibrium may be far from optimal, and there are frequent justifications for government intervention.

Stiglitz is well known in the economics profession, and shared the Nobel Prize in economics in 2001. His work on the economics of limited information has achieved the widest recognition of any of the "post–general equilibrium" alternatives we have examined (aside from the uneventful assimilation of game theory into the most abstract formulations of economics). Yet here, too, interesting new theoretical developments have failed to dislodge the older dreams of optimality. The economics of limited information has not led to a new synthesis or a comprehensive new method of modeling and prediction. Rather, it justifies intervention to improve on market outcomes on an *ad hoc*, case-by-case basis. It was, in this sense, the ideal theory for the modest and eclectic liberalism of the

Clinton administration, in which Stiglitz initially served as chairman of the Council of Economic Advisors.

We are happy to note that we are not alone in seeing a need for reexamining the foundations of general equilibrium theory. In a work with interesting parallels to our own, Michael Mandler (1999) has explored a set of "foundational" problems in contemporary microeconomic theory. He largely addresses a different set of questions than we do: he explores the indeterminacy of factor prices in modern theories of production, the logical problems introduced by the switch from cardinal to ordinal utility, the contradictions of reliance on Pareto optimality, and the surprising difficulty in proving that equilibrium rates of interest are positive. (The first of these has some overlap with Nadal's "Choice of technique revisited," Chapter 6 of this book.) In Mandler's view, the formalization and mathematization of neoclassical economics that occurred from the 1930s to the 1950s solved some problems with earlier theories, but introduced a number of unintended new problems that economic theory has not yet resolved. Thus, the flaws in the foundations of general equilibrium theory extend well beyond the ones examined in this volume.

Economic theory in practice

Turn from theory to practice, and the intriguing new developments in economic theory are nowhere to be seen. Economic arguments are of ever-increasing importance in public life, transforming environmental and social policy, reorganizing international relations, and pressing toward privatization and cutbacks in the public sector, to mention just a few of the leading impacts. In all of these arenas, it is the old, simple theory of the invisible hand, the belief in the optimality of unregulated market outcomes, that drives the economic analysis and the policy recipes. The neoliberal paradigm is founded on this act of faith, as reflected in many areas of contemporary policy and political debate:

- The common practice, in applied economic analyses, of referring to all taxes and tariffs as "distortions" assumes that only a hypothetical pure laissez-faire economy could be undistorted.
- Cost–benefit analyses are becoming the standard for evaluation of environmental, health, and other policies in the United States, testing whether these policies maximize the same benefits as the market would – and, in the process, often clashing with essential, noneconomic policy goals.
- Applied policy analyses frequently rely on "computable general equilibrium" (CGE) models, inspired by the abstract theory of general equilibrium; in many cases, unrealistic assumptions derived directly from the theory (e.g., all markets clear, so involuntary unemployment is impossible) are embedded in CGE models.

- The World Bank and the IMF routinely advise and pressure developing countries to reduce the role of the public sector, to cut tariffs, subsidies, and public spending – in short, to rely only on the market.
- Free trade and investment are increasingly presented as the most effective routes to prosperity and the most urgent policy goals, justifying international agreements that can overturn national laws and regulations if they interfere with global free markets.

No comparable impacts can be detected for any of the sophisticated new departures in economic theory. The mystique of the market, the urgency of rolling back regulation, the verbal equation of freedom and democracy with market competition – the politics that George Soros has called "market fundamentalism" – all these are political reflections of the continuing power of old-fashioned economic theory, as codified in general equilibrium. Some economists may claim to have moved on and started a new life elsewhere, but there is an issue of paternity at stake: market fundamentalism is not a child of the chemistry department, or of classical literature.

In the rush to endorse market-oriented policies, economists have forgotten one of the key theoretical results of past decades. Leave aside, for the moment, the crucial questions about whether the competitive market ideal is a desirable goal, and whether the theory describing it is logically consistent. (This book will argue strongly for negative answers to those questions.) Even if it were desirable, it would clearly be impossible to remove all of the "market imperfections" from the real-world economy, and to make reality conform to the textbook model of perfect competition, perfect information, and all the rest. How do we know, then, that incremental movement toward an unattainable ideal is worthwhile?

The "theory of the second best" (Lipsey and Lancaster 1956) tells us that since the theoretical optimum identified by general equilibrium is not attainable, it may not even be a goal worth striving for. By way of analogy, suppose that you are trying to climb to the highest attainable point in a national park, but the path to the peak of the highest mountain is impassable. Depending on the height of the obstacle, your best strategy might be to abandon the highest mountain and climb the second-highest peak at the other end of the park. Even granting, for the sake of the argument, the debatable proposition that a perfectly competitive general equilibrium represents the highest peak of consumer satisfaction, the real-world obstacles that make that peak unattainable might well make it preferable to pursue a very different economic goal.

Unfortunately, the original idea of the second best has been forgotten even as the words have passed into the jargon of economics – now often contrasted with the awkwardly redundant "first best." In many policy-oriented articles, analyses, the "first best" label is awarded to the option most rigorously deduced from abstract free market theories, while "second

best" has come to mean merely "not as good as the first best under idealized, perfectly competitive market conditions." With nothing but the same old theories and some new mathematics in their knapsacks, policy analysts set out to climb what they see as the highest mountain – heedless of the many obstacles that will prevent them from getting anywhere near the top, and uninterested in the rest of the economic terrain.

An overview of the book

The eleven chapters in this book fall into three groups, plus a concluding contribution. The first four deal with the mathematical logic of general equilibrium theory itself. The next three take on particular assumptions of the theory that collide with reality. The following three chapters address issues in the recent discussion of globalization, trade and development, an area where market fundamentalism has become particularly important. The final chapter returns to the "big picture" with a look at the political and philosophical meaning of Adam Smith's invisible hand.

All of the first four chapters address problems that arise within the mathematics of general equilibrium, or in the attempt to make economic sense of the mathematics. In Chapter 1, "Still dead after all these years," Frank Ackerman discusses the troubling finding of dynamic instability in general equilibrium. Imagine that all the assumptions of the model were granted, and that the equilibrium existed, as a static optimum. What would happen if it were perturbed by small random events? What would happen if underlying conditions changed and the economy had to find its way to a new equilibrium point? By the 1970s, analysis of this question had reached a decisively negative outcome: there is no hope of demonstrating the stability of general equilibrium, or even setting any limits on its dynamics. Essentially any dynamic pattern, no matter how unstable and chaotic, could arise in a general equilibrium model. Ackerman explores the implications of this finding for economic theory, seeks to provide an intuitive understanding of the dynamic failure of the model, and suggests new theoretical directions that are needed to overcome the problem.

The next three chapters are the most mathematically demanding of the volume; in these, unlike our others, the reader will necessarily encounter some of the formal mathematical structure of the model. In "Behind the building blocks" (Chapter 2), Alejandro Nadal challenges two of the theory's crucial assumptions that are usually accepted without comment. First, the proof of the existence of general equilibrium requires the assumption that quantities and prices can take on any real number values, which defies common sense and ordinary experience. Most commodities are naturally measured in integers; some bulk commodities might be measured in rational numbers. There is simply no economic meaning, however, to irrational numbers for quantities or prices.

Second, the theory "naturally" leads to the problem of unbounded

consumption and production possibility sets for individuals, yet the mathematical apparatus of the model requires that these sets be bounded. Production possibilities are unbounded if a profitable producer faces truly constant returns to scale; consumption possibilities are unbounded if a household is, or owns a share of, one of these producers. Nadal demonstrates that the device used to demonstrate boundedness of the relevant sets is truly a *deus ex machina*, devoid of economic sense.

In Chapter 3, "Money and prices," our colleague Carlo Benetti brings up the remarkable fact that general equilibrium describes an economy without money. Reviving past lines of analysis that were too quickly abandoned, Benetti shows that pairwise barter cannot always reach an equilibrium, even when aggregate demand equals supply for every commodity. Money is needed, but none of the theoretical devices proposed to explain the existence of money withstand rigorous scrutiny. The existence of money is crucial to, but also external to, the market; it cannot be created by a market process alone. This theoretical finding coexists with the political irony of free market advocates relying on central banks, such as the Federal Reserve in the United States, to provide continual, active, short-term management of the money supply in pursuit of macroeconomic stability. In practice, free market capitalism requires a strictly regulated market in capital. Yet ideologues continue to promote the deregulation of financial markets on the grounds that it will, in theory, bring about a better allocation of resources.

Benetti, Nadal, and a third colleague, Carlos Salas, examine the epitome of the abstract model of general equilibrium in our fourth, and mathematically most difficult, chapter, "The law of supply and demand in the proof of existence of general competitive equilibrium." The standard proof of the existence of equilibrium involves a demonstration that there is a fixed point in the mapping used to represent market processes. Mathematically, the mapping transforms old price vectors into new ones, based on excess demand. Economically, it is supposed to represent (at a high level of abstraction, to be sure) the effects on prices of the market forces of supply and demand. A fixed point in this mapping is a point at which prices are no longer changing; hence it represents an equilibrium. However, as Benetti, Nadal, and Salas demonstrate, the mappings do not make economic sense. Designed for mathematical convenience, they fail to correspond to any plausible economic description of the effects of excess demand on prices. This is, as far as we know, a new and unique critique of the general equilibrium model.

The next group of three chapters moves to a less abstract level, addressing three major assumptions of standard economic theory. (These are not the only such assumptions; they are simply ones we have worked on. Two of the three are published journal articles, and the third is largely derived from a recently published book co-authored by Ackerman. The treatment of labor economics, and of race, gender, and inequality, among many other topics, are deserving of similar treatment.)

In "Consumed in theory" (Chapter 5), Ackerman revisits the stunning unreality of the standard model of the consumer. *Homo economicus*, greedy, insatiable, and antisocial, may not be entirely unknown in real life, but he hardly describes human nature and economic behavior as a whole. Studies of consumer behavior in other social sciences have produced much more interesting and realistic accounts. Critiques of key aspects of the standard economic theory are well known, in some cases dating back as far as Veblen's writings at the turn of the last century. Yet greater realism would undermine the mathematically convenient model of maximizing behavior that is embedded in general equilibrium.

In "Choice of technique revisited" (Chapter 6), Nadal discusses the assumed influence of factor prices on the choice of techniques. Do producers frequently make well-informed choices among different technologies, unconstrained by sunk costs, on the basis of changing relative prices? Neoclassical theory seems to require an affirmative answer, contrary to common sense and ordinary observation. Economic analysis of the choice of technique was debated for a while following Sraffa's critique of marginal productivity theory, but even Sraffa's approach does not provide the basis for a satisfactory theory of technology choice. In view of the importance of technological change for economic growth and development, the creation of a more adequate theory of choice of techniques remains an important goal.

Chapter 7, "Existence values and priceless externalities," is adapted from Ackerman's recent book, co-authored with Lisa Heinzerling, on the limitations of cost–benefit analysis and the market-based paradigm of environmental valuation (Ackerman and Heinzerling 2004). Microeconomic theory assumes, usually with only the briefest of comments, that all externalities must be priced and internalized in order for optimal outcomes to be achieved. In practice, it is clear that many externalities cannot be priced, let alone internalized. Analyses of externalities and attempts at empirical valuation have led to a distinction between use values and nonuse (such as existence) values. The former are often, at least in principle, monetizable; the latter normally are not. Existence values are very important; it is impossible to evaluate the passion surrounding environmental issues without them. Hence the dilemma: monetization of use values alone leads to underestimation of the true social significance of externalities, while monetization of use and nonuse values leads to logically unsound numerical estimates. As Ackerman explains, nonuse values are real, but they are not really numbers.

The next three chapters address three closely related topics in the recent economic analysis of globalization, trade, and development. In Chapter 8, "The Contradictions of the Open Economy Model," Nadal examines the widely accepted Mundell–Fleming model of an open economy – a macroeconomic framework that rests on the microeconomic foundations of general equilibrium – and the collision of that theory with

economic reality in Mexico. The problem is not just that Mexico has suffered from stagnation and unimpressive macroeconomic performance in recent years. Nadal demonstrates that the model is inherently contradictory, as applied to Mexico. The goals of macroeconomic stability and growth, and the needs and demands of foreign capital, place incompatible demands on exchange rates, interest rates, anti-inflation policy, and other measures. Neoliberal advice to shrink the role of the state clashes with the evident need for major public-sector initiatives. The problems of countries such as Mexico will not be solved by advice from a model plagued by internal contradictions.

In "An offer you can't refuse" (Chapter 9), Ackerman reviews trade theory and the search for alternatives. The "science" of neoclassical economics seems to lead straight to policy prescriptions favoring free trade; the numerous critics and opponents of free trade have often failed to articulate their differences in the realm of economic theory. Ackerman suggests that static comparative advantage is to trade and development as gravity is to airplane design: a factor that cannot be overlooked, but far from the whole, or even the most interesting and complex, part of the story. There are good reasons in theory to doubt the simple prescriptions of free trade, and ample historical evidence that successful development has almost never occurred in a free trade environment. Demands from international agencies and treaties for developing countries to adopt free trade today amount to kicking away the ladder that developed countries have climbed in the past.

Ackerman and our colleague Kevin P. Gallagher take up the question of "computable general equilibrium" (CGE) models, as applied to the environmental assessment of trade agreements, in "Computable abstraction" (Chapter 10). On the basis of the name alone, CGE models often inherit the prestige and the aura of well-established science that attaches to general equilibrium theory. But as Ackerman and Gallagher demonstrate, CGE models have extremely high information costs, are lacking in transparency, and frequently resort to questionable or arbitrary assumptions for the sake of completeness and computational convenience. It is hardly surprising that they have a spotty record of prediction in practice. Retrospective analysis finds that CGE models fail to provide accurate descriptions of the effects of major trade agreements. Ackerman and Gallagher end with a call for simpler, more transparent approaches to modeling, to overcome the evident weaknesses of the CGE approach.

Finally, in Chapter 11, "Freedom and submission," Nadal returns to the larger questions about the foundational metaphor of general equilibrium, Adam Smith's invisible hand. Some analysts have suggested that the invisible hand process makes individuals into degraded and unattractive agents, such as the narrow and greedy caricatures discussed in "Consumed in theory." Nadal argues that the invisible hand process – a social system that provides unexpected, unplanned coordination of individual decisions for

the common good – is more general, and can be more attractive, than the usual vision derived from Smith's *Wealth of Nations*.

The market system proposed in *Wealth of Nations* has, as this book shows, led to fundamental and unresolved problems. However, Smith offered an earlier version of invisible hand processes in his *Theory of Moral Sentiments*; in this account, the invisible hand is crucial to the evolution of public morality and social justice. While the details of Smith's theory are entangled in the issues and vocabulary of eighteenth-century philosophy, the general point is a hopeful one: under the right circumstances, unplanned coordination of individuals may emerge from a variety of social systems. Could this apply to democratic political processes, and perhaps even the evolution of better economic systems? In any case, the need for better economic theories is clear, as the chapters of this book establish that the dominant school of economics is built on flawed foundations.