Working in the Macroeconomy

A study of the US labor market

Martin F. J. Prachowny

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WORKING IN THE MACROECONOMY

From the *IS-LM* model of the early postwar period onwards, labor markets have received less attention in macroeconomics than goods or money markets, despite the fact that involuntary unemployment remains one of the most pressing policy issues.

This book redresses this imbalance by focusing on the crucial labor-supply and labor-demand relationships in the macroeconomy. The former relies on the reservation-wage model, and the latter includes adjustment and disequilibrium costs that create optimal vacancies and "equilibrium" unemployment. Most importantly, the welfare of various participants in the labor market can be assessed at any existing wage-employment outcome and the possibility of Pareto improvements can be explored. Because the large majority of workers are "secure" in their jobs, they want high wages and are in conflict with "marginal" workers who can only get job offers with lower wages. This conflict over the desirability of "full employment" can be overcome by having the government as employer of last resort at the reservation wage of the marginal worker. Nevertheless, even the best-intentioned and "optimal" intervention becomes a victim of special-interest groups, and the most relevant conclusion is that Pareto improvements are virtually impossible to achieve.

Martin Prachowny is Professor of Economics at Queen's University at Kingston, Ontario where he has taught since 1967. He is the author of a number of journal articles on macroeconomics and six previous books, the most recent of which is *The Goals of Macroeconomic Policy* (1994).

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A Study of the US Labor Market

Martin F.J.Prachowny

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Preface

This book is a sequel to *The Goals of Macroeconomic Policy,* published in 1994, which also dealt with potential conflicts in the labor market. Whereas the former was mainly devoted to an elaboration of stabilization policy issues, the present study is more concerned with raising the profile of the labor market in macroeconomic analysis. Also, some matters which were previously taken for granted are now given a more thorough examination. For instance, in *Goals* I merely asserted that most people work fixed and common hours; here, I present detailed empirical evidence to support this position as well as a theoretical argument for a voluntary choice of common hours even when individuals differ with respect to their tastes for working hours. This makes for a stronger justification of the reservation-wage model of labor supply and of the economic rents that have such a powerful effect on workers' welfare during business cycles. Also, the role of adjustment and disequilibrium costs in the labor market that generated the natural rate of unemployment, *the* crucial variable in the evaluation of stabilization policies in *Goals,* now is subjected to a number of different assumptions to verify their importance. Furthermore, the distinction between "secure" and "marginal" workers played a pivotal role in determining the Pareto efficiency of various policy options in *Goals;* here a whole chapter is devoted to making the distinction explicit and an attempt is made to count secure and marginal workers during a business cycle. Taken together, I hope that *The Goals of Macroeconomic Policy* and *Working in the Macroeconomy* have a harmonious blend of theoretical developments, common-sense observations and bold conclusions.

The first draft of the book was written while I was on sabbatical leave at the University of Washington. The congenial atmosphere in the Department of Economics enabled me to work with just the right combination of discipline and distraction to generate a steady stream of computer printout. I am particularly grateful to my West Coast colleagues, Yoram Barzel and Shelly Lundberg, for sharing with me their accumulated wisdom on labor economics. My Queen's colleague, Chris Ferrall, was kind to extract the data from the Current Population Survey that are presented in Ch. 1. Most importantly, the warm friendship and unstinting hospitality of Janis and Neil Bruce made our stay in Seattle both productive and pleasant. As with previous projects, my wife Marguerite has provided invaluable editorial assistance.

The *IS-LM-AS* model presented in Chs 4 and 5, was previously developed in my earlier book, *Money in the Macroeconomy.* I am grateful to Cambridge University Press for permission to reprint and paraphrase portions of that material.

Introduction

Macroeconomics, despite its reliance on aggregation and generalization, has to keep track of activities in three distinct markets: (1) goods and services, (2) assets, and (3) labor. It is the interaction of these markets that determines the most important variables of economic activity: (1) the unemployment rate, (2) the inflation rate, and (3) the interest rate. Nevertheless, since its beginnings in the throes of the Great Depression of the 1930s, macroeconomic theory has treated analysis of the labor market as a neglected stepchild. The *IS-LM* model of the macroeconomy, developed by J.R.Hicks (1937) and Alvin Hansen (1953) to popularize the Keynesian innovations and still the workhorse of textbooks in the subject area, is of course restricted to the first two markets. Even though unemployment was then and is now the major reason for stabilization policy, a strategic simplification allowed the focus of attention to shift to aggregate demand for goods and services, with the presumption that the underlying production function of the economy would translate output into jobs. Later, when the Phillips curve made its appearance in the postwar period, it led a separate life from the mainstream model and was only intended to accommodate a discussion of sporadic and relatively short bouts of inflation. Only in the 1970s was the Phillips curve converted to an aggregate-supply relation which could be allowed to interact with aggregate demand and created the *IS-LM-AS* model. Even here, the supply and demand decisions in the labor market are suppressed and the goal was to achieve "full-employment output," as opposed to "full employment" itself.

The purpose of this book, as the title suggests, is to redress this imbalance by featuring the important behavioral relationships in the labor market and to incorporate them into a macroeconomic model that also contains the traditional relationships from the other two markets. In fact, instead of the usual procedure, the aim here will be to transfer the events in the goods and money markets to the labor market through their effects on the real wage.

It is tempting to speculate what path macroeconomics would have taken if the labor market had remained the focal point of the analysis and the "imperfections" in that market were addressed directly. How would the subject differ today if Hicks, a noted labor economist in his own right, had drawn a downward sloping labor-demand curve instead of *IS* and an upward sloping labor-supply curve instead of *LM*, had pinpointed the wage and employment situation during the Depression in that diagram, and had advocated Keynesian policies to rectify the situation? For reasons that are somewhat obscure now, major advancements were made in our understanding of consumption theory, investment behavior, and money demand, but not in the supply and demand relationships in the labor market. Labor economics as a discipline emerged from its historical and institutional approach only in the 1960s— too late to make a contribution to macroeconomic analysis, whose practitioners had a vested interest in the existing structure, especially in the debate concerning the effectiveness of stabilization policy that engulfed the profession from the 1970s onward. Even now, the constrained optimization models in labor economics that produce labor-supply and labor-demand decisions are not the basis of aggregate-supply decisions.

There were at least two missed opportunities that would have created a firmer foundation for labor-market analysis in macroeconomics: (1) the reservation-wage model and (2) direct welfare evaluations of various wage-employment outcomes. Reservation prices are applied in situations where indivisibilities lead to high prices and all-or-nothing decisions, but they are also appropriate under conditions where the consumer faces a fixed quantity on offer. As Ch. 1 will demonstrate, there is ample evidence that firms dictate the number of hours that they expect from their employees and that the decision to accept or reject a job offer depends on the person's reservation wage. Not only does this model remove the indeterminacy of the slope of the labor supply curve, as there must be a positive relationship between actual wages and the number of people who have opted to be in the labor force, but variations among individuals in reservation wages lead to differences in economic rents rather than in hours of work. These rents, in turn, create winners and losers during business cycles as the real wage rises or falls. Instead of adopting the reservation-wage model, there is still no agreement on the best model for the labor-supply decision; still worse, the antagonists in the stabilization-policy debate do not seem to recognize that much of the conflict between them is based on whether hours of work are flexible in a business cycle or fixed by a separate optimization process.

Iso-profit and iso-utility curves, originally designed to analyze efficient bargains by McDonald and Solow (1981), are also able to illustrate what combinations of wages and employment lead to welfare changes for both firms and workers and these analytical devices could have played the same pivotal role in macroeconomics as indifference curves in international trade theory. Instead of imposing imperfections such as rigid wages on the labor market by assumption or *ad hoc* reasoning, these iso-profit and iso-utility curves would have graphically indicated that the vast majority of labor-force participants are better off when the labor market operates with excess supply because the wage is higher than in equilibrium. In conjunction with the rents generated by reservation wages, welfare evaluations of various disequilibrium combinations of wages and employment would have indicated that "secure workers," a category that will receive a great deal of attention in this study, have incentives and resources to prevent a competitive determination of wages and they will try to impose institutions that give them a bigger voice in this process.

Another strategic error, in my view, committed by macroeconomists is the unwillingness to accept the lessons learned from the optimal-intervention literature developed by Bhagwati and Ramaswami (1963) for international trade distortions. The point of their argument was that the remedy for a distortion had to be in the same market as the distortion itself and had to reverse the distortion precisely by a subsidy/tax scheme. Thus, if unemployment is the policy problem, the first-best solution was likely to be optimal intervention in the labor market. If, in the end, aggregate-demand management was the only available response, more attention to its second-best characteristics would have improved the quality of the debate over the past two decades. Thus, despite the of ten-repeated emphasis on microeconomic foundations of macroeconomic theory, the best choices about the appropriate apparatus have not always been made: fewer overlapping-generations models or perfect foresight assumptions and more labor-market optimization models would have left the subject in a better state of affairs.

This is not to claim that labor-market analysis has been completely neglected in macroeconomics. There are many articles and books in the literature that treat aggregate labor-market issues, with *The Brookings Papers on Economic Activity* being consistently the most devoted to these topics, but very little of it becomes a permanent feature of macroeconomic models. Even in influential treatises or advanced textbooks such as Blanchard and Fischer (1989), who devote a long chapter to "Some Useful Models" for "analyzing real world issues" (p. 505), only one short section is devoted to a specification of the labor market. They explain: "The next two equations [(21) and (22)] give output supply and labor demand as functions of the real wage and a technological shock. They can be derived from profit maximization under perfect competition" (p. 518). The labor supply equation is merely assumed to be a positive relationship to the real wage, without specifying the optimization procedure involved or without reference to a reservation-wage model with which this equation would be consistent. Then, "Equation (24) specifies the nature of the nominal rigidity: the nominal wage is set to equalize expected labor demand and expected labor supply. Given the nominal wage, employment is determined by labor demand… The wage may be set by bargaining between firms and workers, with the nominal wage set one period in advance. Or the wage may be set by firms, based on efficiency wage considerations, and again set one period in advance." In other words, in equilibrium there can be no unemployment since supply and demand are equal, but later (p. 554), there is "equilibrium unemployment" that arises from another model. Moreover, if the wage rigidity leads to a real wage that creates excess demand, there is nothing in the model to modify the requirement that employment is demand determined; therefore it must be possible to coerce the voluntarily unemployed to work. Finally, the wage-setting process seems to be a matter of indifference to workers as if their bargaining strength had no effect on their welfare.

The authors claim that, "Often the economist will use a simple *ad hoc* model, …one that emphasizes one aspect of reality and ignores others, in order to fit the purpose for which it is being used" (p. 505). While this is an unexceptionable observation, it seems that the unnecessary detail is always in the labor market and that the important aspects of reality deal with asset and goods markets. In this book, I intend to reverse these priorities.

Travelling along this road is not as lonely as might be imagined. Other macroeconomists have become disillusioned with the treatment of unemployment as voluntary and are prepared to acknowledge that the labor market operates in a complicated environment where agents are trying to protect ill-defined property rights to a job. The recent book by Phelps (1994) is an excellent example of such re-evaluations. This is not the place for a detailed comparison between Phelps' and my approach, but it is worth remarking that he is also concerned with the day-to-day employee-employer relationship. His model of the macroeconomy has many more linkages between markets than mine, but perhaps less discussion of welfare effects of macroeconomic events on participants in the labor market. Also, contrary to recent tradition, he is not "silent on policy questions" (p. 359). He argues (Ch. 20) that structuralist policies can and should change the natural rate of unemployment. While policy discussion in this book will concentrate on moving the labor market back to the natural rate rather than reducing the natural rate itself, I suspect that the same inability to find Pareto-improvements identified here will operate in the structural-policy environment as well.

Macroeconomics is—or should be—a policy-oriented discipline, much like international trade and public finance. Involuntary unemployment is the distortion in the labor market that requires our undivided attention; maximizing output for its own sake is not an optimality argument so that we do not always have the right objective function in our macroeconomic models and policy options are not always sharply drawn. Even if the inevitable conclusion is that policy intervention is not warranted, the analytical firepower devoted to models that either assume continuous equilibrium in the labor market or nominal wage rigidities would be better deployed in making welfare comparisons for different groups under various conditions to determine what is a Pareto improvement and what is not.

Overview of the Book

This book sets the labor market at center stage of macroeconomic analysis. As a prologue, data on labor-market activity during business cycles are presented in Ch. 1, with charts and regressions showing how hours per worker, employment, unemployment, vacancies, and wages move during recessions and recoveries. The next two chapters present theoretical models of the labor market, with Ch. 2 devoted to the traditional model and its weaknesses, while Ch. 3 presents a new approach that is better equipped to explain the developments discussed in Ch. 1 because it relies on reservation wages and adjustment costs faced by firms to fill vacancies. Then, Chs 4 and 5 include the labor market in a relatively standard macroeconomic model and explain how shocks or unpredictable events cause output, inflation, interest rates, real wages, and the unemployment rate to respond. Throughout the book there is an important distinction between "secure" and "marginal" workers who have conflicting interests in the labor market. This distinction arises from the fact that adjustments in the labor input are at the extensive margin so that lay-offs create involuntary unemployment for a small minority of workers but no adverse consequences for the vast majority of labor-force participants. In Ch. 6, this distinction between secure and marginal workers and the conflict between them in the labor market is explored; also an attempt is made to measure job security during business cycles. The last two chapters are also connected; they explore the requirements of stabilization policies that are Pareto efficient by improving the welfare of some individuals without making anyone worse off. Traditional fiscal and monetary policies do not fit the bill, but direct labor-market intervention through a program of the government as employer of last resort would provide job opportunities for the unemployed without adversely affecting those who remain employed.

Empirical Applications

Many of the theoretical propositions to be made in this study will be subjected to empirical verification ranging from formal hypothesis testing to anecdotal evidence. This exercise is carried out for only one country, the United States. (This decision is not motivated by chauvinism; I am Canadian.) No attempt is made to provide grand generalizations that apply to diverse settings and therefore conclusions that are drawn for US labor-market conditions may be entirely inappropriate for other countries, although researchers are certainly encouraged to test these ideas in other circumstances. Macroeconomic and labor-market data for the US are most readily available from the CITIBASE data bank (recently renamed DRIBASE) or from the most current *Economic Report of the President.* Data sources provided in the text refer, where applicable, to the name of each variable in CITIBASE.

1
The Operation of the US Labor Market

As it functions on a daily basis, the labor market of the US economy produces outcomes with respect to wages, hours of work, employment, unemployment, productivity, and many other variables of public interest. In this chapter, some of the most important of these labor-market trends and developments will be presented with a view to integrating them with the economic expansions and contractions in postwar business-cycle activity. In particular, the welfare of labor-force participants varies considerably but not uniformly during business cycles. When an economy suffers through a recession, output falls almost by definition, but we need to know how the derived demand for labor services reacts to this shock. Firms rely mainly on reducing the number of employees rather than the hours per worker, even though the former process would be much more egalitarian in its welfare effects. Also, despite elaborate attempts to prove that everyone is making optimal decisions in the labor market, there is extensive evidence of involuntary unemployment and job vacancies existing side by side. Moreover, the data show that those who remain employed during a recession are better off because of higher wages and constant hours. Finally, the popular appeal of Okun's Law derives from the belief that there are wide-spread benefits to a reduction in the unemployment rate through productivity gains, but this obscures the even more compelling law of diminishing returns to a factor. Hence, a downward-sloping and relatively stable labor-demand curve establishes a negative relationship between employment and wages and a positive relationship between unemployment and the welfare of the large majority of those in the labor force who have jobs and are secure in their employment.

The purpose of any theory in economics is to be able to predict events, with reasonable accuracy. In the next chapter, the traditional theory of the labor market will be challenged to predict *ex post* the events that are described here. It will become evident that these analytical tools, while quite serviceable for the purpose of dealing with microeconomic topics, encounter some difficulties with predictions in a macroeconomic environment and that a new approach to the behavior of the labor market in these circumstances is required to account for these events. This new model will be explored in Ch. 3.

1.1
The Limited Choice of Hours in the Labor Market

Workers are not indentured servants and they are presumed to have complete freedom of choice in their labor-market activity. An unfortunate consequence of the individual's right to maximize welfare, subject only to a budget constraint, would be the erroneous prediction of virtual anarchy in the labor market as workers capriciously show up for work at times of their own choosing. Instead, what we find is that there is a regular pattern of hours per day or per week that is essentially established by the firm as a take-it-or-leave-it offer to a prospective worker. Not only that, but firms expect from their workers a set of *common* hours, defined not only as equal hours for all, but also as simultaneous hours. For example, it is not acceptable to report for the night shift when the employer wants the worker on the day shift.

This limited choice is readily observable in the US labor market, where the Current Population Survey (CPS) asks interviewees for their usual hours of work per week. Chart 1–1 shows the response of the departing rotations in the 1982 and 1991 CPS extracts. In both years, the proportion of the respondents who work either zero or forty hours a week is about 75%, leaving each of the other choices between 1 and 99 hours a week only an average of about 0.25% or about 750 respondents. In addition to this evidence, a recent detailed study of workhours in Germany and the US by Hamermesh (1996, p. 20, Table 2.3U) reports that 50.9% of 56,493 US employees in the 1991 CPS worked *exactly* 8 hours a day, 5 days a week. There were only 9.4% who were in the 7 to 9.9 hour range after 8 hours a day is eliminated.

Furthermore, despite reports of the increasing prevalence of part-time work, in 1991 there were almost as many respondents who worked 41–99 hours a week (11.21%) as those who worked 1–39 hours a week (15.42%). It is also to be noted that the results do not differ a great deal between the two years despite many changes in the labor market in that decade, with the exception of the somewhat larger proportion working zero hours in 1982 when the unemployment rate was 9.7%, compared to 6.7% in 1991. Even then, both years are still dominated by those who are voluntarily unemployed.

Finally, the explanation behind those few workers with a very high number of hours per week comes from having two or more jobs, rather than from the ability to work unusually high hours in one job. There are also some high-hours jobs such as interns at hospitals, firefighters, or workers in remote locations, where the employer still dictates the work schedule.

It is not being claimed here that the pattern of distribution of weekly hours of work depicted in Chart 1–1 is universal. Blundell (1995, Fig. 2), for example, shows that married women in the UK had considerable opportunities for part-time work, but he characterizes this sample (p. 8) as unusual even by European standards.

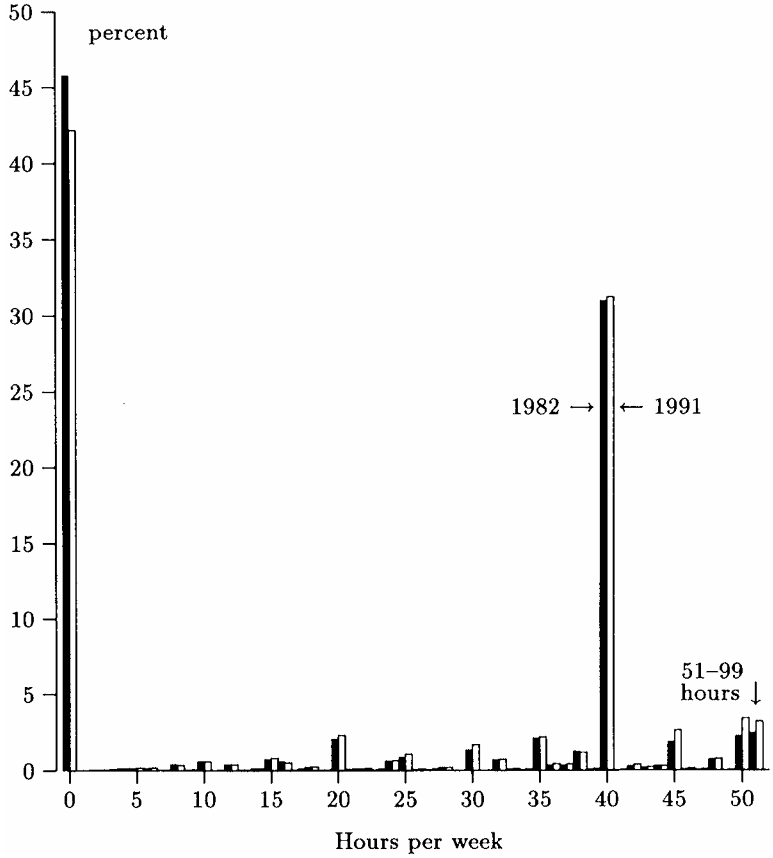

Chart 1–1 Distribution of usual hours per week of the departing rotations from the 1982 and 1991 CPS extracts, "uhours" at position 239–40; total number for 1982=319,421, for 1991=306,308

1.2
The Limited Adjustment of Weekly Hours

When firms change their labor input in response to variations in the demand for their output, most of the adjustment takes place in the number of employees, rather than in hours per employee. This is consistent with evidence shown above that workers do not move from 40 to 41 hours per week as the demand for labor rises or from 40 to 39 hours during a recession. Instead, the bulk of the adjustment takes place in the number of employees at relatively constant hours per week. Although there is evidence that overtime hours in manufacturing industries are procyclical, the mere fact that firms are still prepared to pay hefty overtime premia at the lowest point in the business cycle indicates that hours adjustment is not the major source of changes in the labor input. For instance, in 1982 when

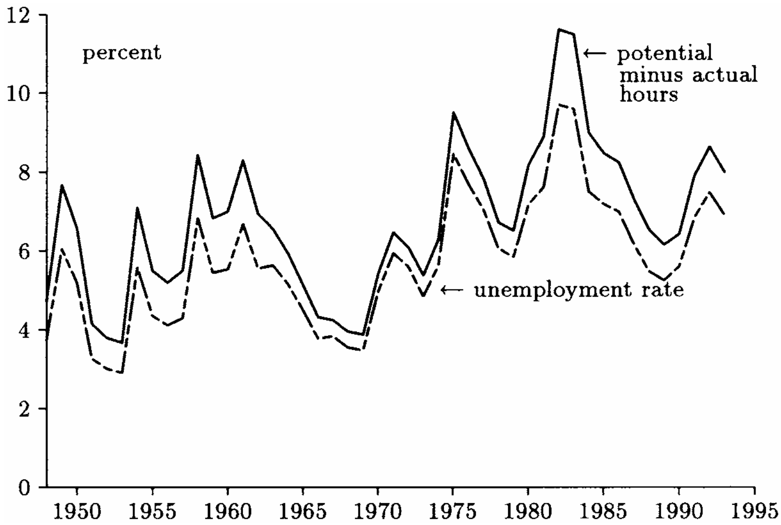

Chart 1–2 Hours gap and the unemployment rate, 1948–93

Source: CITIBASE—LHPOT, LHOURS, LHUR

the unemployment rate was 9.7%, average overtime hours in manufacturing were still 2.3 per week, compared to their previous peak of 3.6 in 1978.

To obtain a broader measure of changes in the extensive margin of employment (i.e., the number of workers, defined as n) as opposed to the intensive margin (i.e., hours per employee, defined as h), data compiled on potential and actual hours of employment in the US economy for 1948–93 are used in Chart 1–2. The former, in natural logs can be written as h^*+n^* (LHPOT),[1] while the latter is $h+n$ (LHOURS). Their difference is composed of two elements: h^*-h and n^*-n. The latter is measured independently by the unemployment rate, which is also shown in Chart 1–2. It is immediately obvious that most of the gap between potential and actual hours is accounted for by the unemployment rate, with only a minor role played by h^*-h. During the entire period of 1948–93, the average gap in total hours was 6.77%, while the unemployment rate was 5.75%. Thus the extensive margin of employment accounted for over 80% of the total adjustment.

Moreover, the cyclical changes in n are much greater than in h. The correlation coefficient between the total hours gap and the unemployment rate over the 46-year period was 0.985. Average weekly hours (LHCH) varied very little after account is taken of the steady downward trend in the postwar period: the

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[1] Unless otherwise noted, data are from CITIBASE and the name of the time series is indicated in parentheses. Data with original frequencies other than annual were converted by taking the mean value of monthly or quarterly observations.

maximum was 43.5 hours in 1947 and the minimum was 38.2 hours in 1984. An alternative measure of the total hours gap is available as a time series in CITIBASE from 1956 onward. It is LHCHL, defined as aggregate hours lost by the unemployed and by those on part-time work for economic reasons as a percentage of potential available labor hours. However, it is not shown in Chart 1–2 since it would virtually coincide with the series reported there. Therefore, we have two independent estimates of h^*-h+n^*-n and they both point to the conclusion that most of the cyclical adjustment in the labor input is through changes at the extensive margin rather than through alterations at the intensive margin. As a consequence, models of the labor market should treat weekly hours as the outcome of a prior optimization and then concentrate on predicting the number of employees as wages change.

1.3 Unemployment in Equilibrium and Disequilibrium

If the evidence in the previous two sections is taken as convincing, then workers face the possibility of being completely and involuntarily unemployed. Unemployment can exist both when the labor market is in equilibrium and when it is in disequilibrium. The former is called the "natural rate of unemployment" and is created by the heterogeneity in the labor market that prevents a vacancy from being converted to a job instantaneously.

The natural rate of unemployment is essentially an unobservable variable because individuals cannot ascertain the cause of their own unemployment, but two estimated time series for the natural rate are shown in Chart 1–3. The data from Gordon (1993) are interpolations from a few positions of assumed equilibrium in the labor market. For that reason, the natural rate as presented by Gordon is almost constant with a slight rise from 5% to 6% over the 46-year period. Adams and Coe (1990, p. 279), on the other hand, estimate their data from demographic factors, changes in unionization, unemployment-insurance benefits and minimum wages. Their time series is much more variable and almost represents a moving average of the actual unemployment rate, except for a lower mean value. The inability to agree on a single estimate of this crucial variable stems from the difficulty in identifying the forces that cause the natural rate to rise or fall over time.

In addition to unemployment in equilibrium, there is also excess-supply or excess-demand unemployment as the labor market continues to make transactions even when the real wage is unable to clear the market. Without speculating about the source of rigid wages at this stage, an unemployment rate above the equilibrium rate implies that the labor market has excess supply of workers, while an unemployment rate below the natural rate is evidence of excess demand.

The systematic movement of the actual rate of unemployment, u, around the natural rate, u^*, in Chart 1–3 mimics the business cycles experienced during the

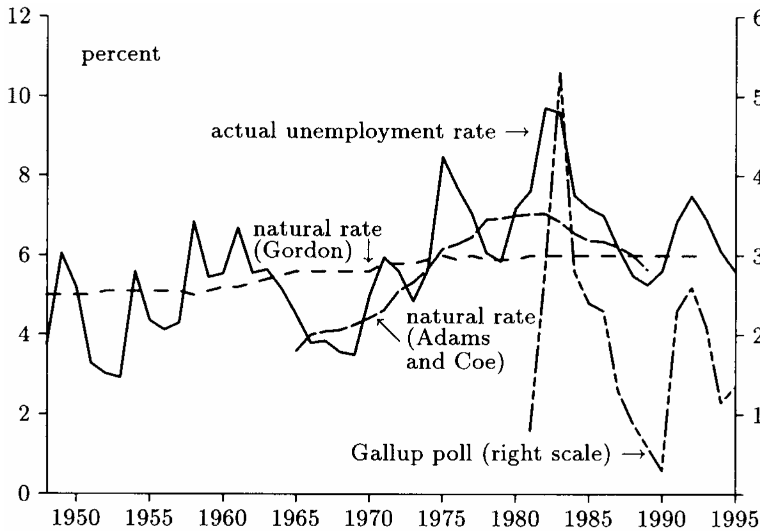

Chart 1–3 Actual and natural unemployment rates, 1948–95; Gallup poll responses who rated unemployment as the most important problem facing the country, 1981–95. Sources: CITIBASE-LHUR, Gordon (1993), Adams and Coe (1990); Gallup poll data, Dornbusch and Fischer (1994, Table 17–1) for 1981–91 and *Gallup Poll Monthly,* Jan. 1993, p. 32, Jan. 1994, p. 43, July 1995, p. 48 for 1992–95

postwar period, with the actual rate above the natural rate during recessions and below the natural rate during a boom. It is worth noting that excess supply can last for an extended time period. For instance, after 1979, the actual rate did not return to the natural rate until 1987. Therefore, labor-market theory must be able to make predictions about employment and unemployment when the market does not clear because transactions continue to take place.

As long as there is a positive natural rate, symmetrical shocks in the labor market should lead to symmetrical outcomes in terms of excess supply and excess demand. However, Chart 1–3 makes it evident that excess demand prevails for shorter time periods than excess supply and that positive differences between the actual and natural rates are, on average, larger than negative differences. For example, in the most recent completed business cycle, the actual rate exceeded Gordon's natural rate by 3.6% in 1983, but in 1989, the actual rate fell below the natural rate by only 0.75%. This evidence suggests that episodes of excess demand are eliminated more expeditiously than periods of excess supply and these asymmetrical dynamics of labor-market operations must also be part of the theoretical model.

The natural rate as reported here is related to but conceptually distinct from Friedman's NAIRU—the unemployment rate associated with nonaccelerating inflation. It would be better to refer to the equilibrium unemployment rate at which the real wage would have to remain constant. This would be consistent with any inflation rate—rising or falling—as long as nominal wages are growing at a rate equal to the inflation rate. In Ch. 3, this notion of equilibrium unemployment will be derived from the co-existence of vacancies and unemployment, in turn dictated by the heterogeneity of the labor market where "square pegs" do not fit into "round holes."

Unemployment is not only descriptive of one's status in the labor market, but also a state of mind about the overall performance of the macroeconomy. Opinion polls measure anxiety rather than anything more substantive, but worried individuals will make different consumption decisions than contented ones as they deflate their perception of permanent income. Furthermore, macroeconomic policy, being a public-choice decision, often responds to these polls and thus aggregate demand will be influenced through proposed changes in government expenditures or taxes to bring about more favorable polls.

Using the right-hand scale, Chart 1–3 also shows the time series for the proportion of respondents who believe that the unemployment rate is the primary economic problem in the nation and who therefore rank inflation and other worries as lower priorities. It is clearly seen that these poll results tend to synchronize with movements in the actual unemployment rate. They also reinforce the view that the labor market operates in disequilibrium for long periods of time. If equilibrium signifies that participants in the market are content with their decisions, then poll results that show a majority of respondents are worried about unemployment, as in 1983, also point to extensive dissatisfaction with the current operation of the market.[2]

Equally noteworthy is the observation that the poll results are much more volatile than the unemployment rate itself. For example in 1983, 53% of the respondents rated unemployment as the chief economic concern, but less than 10% of the population was actually experiencing involuntary unemployment. Then in 1990, the proportion of those worried about unemployment was only about half of the unemployment rate. While it may be possible to argue that people with secure employment are altruistic in their concern and hopes for those who are looking for jobs, it is much more likely that self-interest is at work as the unemployed present a competitive threat for the limited number of jobs that are available. To account for this possibility, the analysis of the labor market must be able to compare welfare positions of the employed and the unemployed and the conflicts between them. High unemployment rates lead to pronounced fear by the employed that their real wages will be eroded by excess-supply pressures in the labor market. On the other hand, low unemployment rates are indications of excess demand and the promise of rising wages. It is through this avenue that unemployment affects the welfare of many more individuals than those who are looking for work.

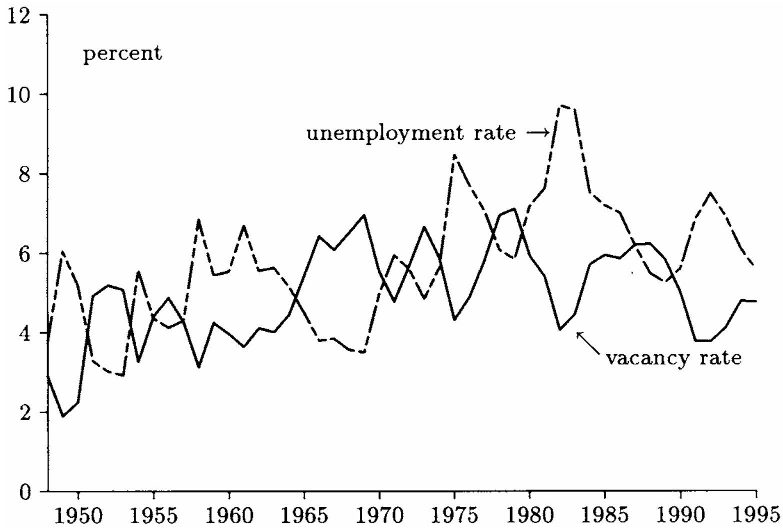

Chart 1–4 Vacancy and unemployment rates, 1948–95. Vacancy rate defined as (LHELX/(LHEM/LHUEM+LHELX)) from CITIBASE, as a percent

1.4
Vacancies

Co-existing with unemployment are vacancies that are not filled by firms at any one time. Data for vacancies are much less reliable than the CPS survey of unemployment and rely mainly on help-wanted advertising, which tends to under-report the full extent of existing vacancies. CITIBASE publishes a time series, LHELX, which is the ratio of help-wanted ads to the number of unemployed. To derive a measured vacancy rate, it is calculated as the ratio of the number of vacancies divided by total demand for labor, which is composed of employment (LHEM) plus vacancies. Blanchard and Diamond (1989) adjust a help-wanted index upward by interpolating the data between periods for which a true vacancy rate is available. They report the number of vacancies in their Fig. 5 for 1968–81 as averaging 2.2 million. For comparison, the number of "vacancies" can be calculated as LHELX times LHUEM, the number of unemployed persons; for the same period, the mean value is much higher at 5.5 million, but the cyclical pattern is very similar.[3]

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[2] The poll asks the question: "What do you think is the most important problem facing the country today?" In the January 1995 *Gallup Poll Monthly* (p. 7), the following categories were listed under economic problems: unemployment/jobs, federal budget deficit, economy in general, taxes, high cost of living/inflation, trade relations/deficit, recession, and other specific economic problems. There was an even longer list of noneconomic problems.

Both the vacancy rate and the unemployment rate are shown in Chart 1–4. In a frictionless and homogeneous labor market, vacancies and unemployment would not exist side by side; those who are unemployed would simply fill the vacancies that firms have. Only in situations of excess demand, where unemployment has ceased, would vacancies appear. Although Chart 1–4 shows that the vacancy and unemployment rates move in opposite directions during business cycles, the relationship is not strong (i.e., $R=-0.177$) and neither the vacancy rate nor the unemployment rate disappears entirely. This indicates that there are always some mismatches in the labor market as firms are looking for workers with certain qualifications in specific geographical areas while the unemployed have other skills or locations. If enough resources were devoted to the process, these mismatches could be eliminated, but firms will typically find that profit maximization dictates that there are optimal vacancies that are not worth filling. This unsatisfied demand for labor in turn means that actual employment will always be less than the demand for labor, not just when excess demand prevails.

According to the Beveridge curve, which is a negatively-sloped relationship between the unemployment rate, u, and the vacancy rate, , when the labor market is in equilibrium one should observe $u=v$, as in 1990, for example. Because has the above-mentioned downward bias, the mean value for is about 1.2% lower than for u, and it may not be possible to determine periods of excess supply or demand from these data.

1.5 The Empirical Wage-Employment Relationship

If equilibrium in the labor market is infrequently observed, we need a mechanism of predicting wage and employment combinations that actually occur. Do we observe the short side of the market, with positions on the labor-demand curve for excess supply and points on the supply curve for excess demand? It is hypothesized that in both sets of circumstances wages and employment levels are found along a labor-demand curve derived from profit maximization subject to the constraint that firms cannot change the amount of capital that they have. Therefore, a negative relationship between wages and employment prevails at all times. To test this hypothesis, a 2SLS regression was estimated with natural logs of annual data for 1956–92. The variables are defined as follows: n= civilian employment in thousands (LHEM), k=constant-cost net stock of fixed reproducible tangible wealth (excluding residential construction and durable goods owned by consumers), in billions of 1987 dollars (*Survey of Current*

[3] Blanchard and Diamond (1989, p. 53) report using the same time series, LHELX, but it is more likely that they used LHEL which is an index of help-wanted advertising in newspapers, 1967=100 and needs a scaling adjustment to obtain the number of vacancies. The adjustment factor is taken from Abraham (1987, p. 243, Table A-1).

Business, Sept. 1993, p. 69, Table 24), and $w-p$=average weekly real earnings in private nonagricultural industries in 1982 dollars (LEW77, data prior to 1964 from *Economic Report of the President,* 1991, Table B-44). The regression results are as follows:

$$n = \underset{(0.27)}{8.30} + \underset{(0.009)}{0.647}\, k - \underset{(0.047)}{0.428}\,(w-p) + \underset{(0.145)}{0.778}\, \epsilon_{-1} - \underset{(0.144)}{0.565}\, \epsilon_{-2}$$

$$\bar{R}^2 = 0.996, \quad F = 2026.1, \quad SSE = 0.014, \quad DW = 2.10,$$

where standard errors are indicated in parentheses. The instruments were: a trend, its square, the growth rate of M1 (FM1, data prior to 1959 from *Economic Report of the President,* 1974, Table C-52), a dummy variable for the oil-price shocks in 1974 and in 1979, the natural rate of unemployment from Gordon (1993) and the natural log of government employment (LPGOV). The residuals follow a second-order autoregressive scheme. An initial average-sized error of 0. 0141 generates a subsequent time series of 0.0109, 0.0006, –0.0058, –0.0048, –0. 0005, and 0.0023 for the next six years.

Although the starting year of 1956 was chosen because of instability in the relationship over an earlier period, a Chow-test for a structural break in 1974 was rejected (F=1.089), when the real wage hit a global peak and therefore the regression is able to cope with the initial 18 years of generally rising wages and the later period of declining real wages. Moreover, an ARCH test (F=0.189) allowed heteroskedasticity of the residuals to be rejected. Finally, of particular importance is the fact that the coefficient for $w-p$ is within a range of previous estimates, 0.15 to 0.5, reported by Hamermesh (1986, p. 453).

As with most time series with a strong upward trend, the regression has difficulty predicting downturns in the year that they occur and the largest errors are evident for these observations. Employment fell in 1958, 1975, 1982, and 1991, but fitted values for n show declines in 1958–59, 1976, 1983 and 1992. However, introducing lags in the independent variables did not improve the performance of the regression. Moreover, although each of the time series in the regression is nonstationary, an Engle-Granger cointegration test indicated that the disturbance term was stationary since the Dickey-Fuller t-statistic was –5.156 against a MacKinnon critical value of –4.730 at the 1% level. The coefficients in the cointegrating vector were 0.643 for k and –0.393 for $w-p$.

If the short side of the market dictated wage-employment combinations during excess demand, this regression would be misspecified and the residuals would not be randomly distributed. Because of the supply constraint during excess demand, n $<n$ and the residuals would tend to be negative. For the years of 1963–74, the only lengthy period of excess demand based on Gordon's natural rate, there were 8 negative residuals and 4 positive ones, but overall, the correlation coefficient between e_t and $u-u^*$ for all 37 observations was only –0. 267. A more direct test of the hypothesis involves the creation of a dummy variable with values of one for $u<u^*$ and zero otherwise and multiplying this variable by $w-p$. Its coefficient will indicate the change in the slope of the

demand curve when there is excess demand in the labor market. This coefficient was significantly positive but very small. The results were as follows: the slope is –0.3227 for excess demand and –0.3266 for excess supply. Thus, there is some evidence to suggest that supply constraints operate in the labor market, but they are relatively weak and the employment-wage relationship remains negative.

Since the real wage uses the CPI deflator while firms are more interested in the producers' real wage, a ratio of the CPI (PUNEW) to the GDP deflator (GDND) was introduced as an additional variable; it was highly colinear with $w - p$ as defined above. As an alternative, a new real wage was formed by using the GDP deflator directly, but it had much less explanatory power than the consumption wage. Nevertheless, the relationship between employment and the real wage remained negative: the elasticity was –0.306, with a standard error of 0.040.

There is a long history to the debate about the real wage being procyclical or countercyclical; the most recent summary is provided by Abraham and Haltiwanger (1995). They report results (p. 1236), based on Granger causality tests, that indicate the real wage as exogenous and employment as endogenous, yet most empirical studies in this area take the real wage as the dependent variable. For the sake of comparison, the employment regression was "inverted" to produce the following:

$$\begin{array}{lllllll} w - p = & 2.43 & - \; 0.924\, k + & 0.977\, n + & 1.448\, \epsilon_{-1} & - & 0.500\, \epsilon_{-2} \\ & (1.97) & (0.225) & (0.159) & (0.170) & & (0.157) \end{array}$$

$$\bar{R}^2 = 0.946, \quad F = 156.3, \quad SSE = 0.015, \quad DW = 1.80.$$

Not only is there now a positive relationship between $w-p$ and n, but this regression also perversely predicts that the real wage will fall when the capital stock increases. As Abraham and Haltiwanger point out (p. 1262), employment has been found to be clearly procyclical, but "the cyclically of real wages is not likely to be stable over time." However, the evidence here is that rising (falling) wages reduce (increase) employment *ceteris paribus,* over the entire 37-year period.

1.6
Okun's Law

One of the most enduring empirical relationships is Okun's Law which specifies that a one-point reduction in the unemployment rate increases output by about 2–3%. Writing a production function in natural logs, with capital and labor as inputs and defining the supply of labor as $n^s = n - u$, produces

$$y = \alpha_1 k + \alpha_2 (n^s - u + h),$$

where $_1$ and $_2$ are output elasticities of the two inputs. For a reduction in u to lead to an increase in y that is two to three times as large would require either that

$_2$ is of the same size or that other factors change *pari passu* with *u*. It was the latter argument that Okun used; he wrote:

> Clearly, the simple addition of 1 percent of a given labor force to the ranks of the employed would increase employment by slightly more than 1 percent…. If the workweek and productivity were unchanged, the increment to output would be only that 1+percent. [Note the assumed constant marginal product of labor, which is inconsistent with most production functions.] The 3 percent result implies that considerable output gains in a period of rising utilization rates stem from some or all the following: induced increases in the size of the labor force; longer average weekly hours; and greater productivity.
>
> (1970, p. 140)

Of these factors, Okun believed that productivity gains were the most important. He was convinced that, "The record clearly shows that manhour productivity is depressed by low levels of utilization, and that periods of movement toward full employment yield considerably above-average productivity gains" (p. 142). Using the year 1990 as an example, I (Prachowny, 1994, p. 12) calculated that residual productivity gains must account for 60% of the $125 billion increase in output if the unemployment rate had been reduced by one percentage point.

Nevertheless, Okun's requirement that labor productivity is procyclical is potentially inconsistent with the evidence in the previous section that wages and employment are negatively related. If workers are paid the value of their marginal product and if employment rises as the unemployment rate is reduced, worker productivity will in fact fall. It is the reduction in wages and not the prospect of improved productivity that induces firms to add workers to their labor force. For productivity to increase without wages adjusting would require the demand curve to shift to the right, allowing more workers to be hired at the given wage. This could occur if the capital stock available to the firm was also procyclical. To obtain the cyclical component of the capital stock, the residual from a regression of *k* against a constant, a trend and its square was obtained. Its correlation with $u-u^*$ was –0.327 indicating that there is some procyclical movement of the capital stock. However, the arithmetic required to produce a 3% increase in output is still suspect. Okun suggested that a one point reduction in the unemployment rate would lead man-hours to increase by 1.8% (p. 142) because of longer hours, *h*, and a greater supply of workers, n^s. Assuming constant returns to scale and giving labor a two-thirds share of output in equation (1.1) means that output increases by 0.667×1.8=1.2%; to reach the 3% figure requires that *k* increase by (3–1.2)/0.333=5.4%. Even if the Okun coefficient is reduced to 2.5, the required increase in *k* is 3.9%, which appears to be unrealistically large, in view of the fact that the largest single annual increase in *k* was 5.1% in 1966 and that the average growth rate was 2.9%.

Okun justified his large estimated coefficient on the basis that other factors, including hours, labor supply and overall productivity, changed systematically along with the unemployment rate and prevented them from having independent effects on output. However, I (Prachowny, 1993) have been able to estimate separate parameters for *k* and *h*, but not n^s, in the production function of equation (1.1), in which case the coefficient for unemployment falls to 0.67. This is more consistent with the interpretation that $_2$ is the share of labor in output and that the marginal product of a factor of production declines with output.

To sum up, the relationship between the unemployment rate and output is complex and probably varies from one business cycle to another. It is therefore not surprising that Adams and Coe (1990, Table 12) found the Okun coefficient to be quite volatile and not as stable or as reliable as its proponents believe.

1.7
The Phillips Curve

Of even longer standing than Okun's Law is the empirical relationship between wage inflation and unemployment known as the Phillips curve. Despite many reports of its demise during the turbulent 1970s, the expectations-augmented version of the Phillips curve still has a great deal of empirical appeal. Estimated for the period 1961–95[4] with 2SLS, the results are the following:

$$\omega = \underset{(0.112)}{0.450}\ \Delta(y-n) + \underset{(0.044)}{0.987}\ \pi_{-1} - \underset{(0.146)}{0.881}\ (u-u^*)$$

$$\bar{R}^2 = 0.743, \quad F = 47.23, \quad SEE = 0.974 \quad DW = 1.20,$$

where is the growth rate of average weekly earnings in private nonagricultural industries, in dollars (LEW), *(y−n)* is the growth rate of labor productivity, measured as the change in the natural log of real GDP, in billions of 1987 dollars (GDPQ) minus the natural log of civilian employment, in thousands (LHEM), is the inflation rate using the GDP deflator, 1987=100 (GDPD), and its lagged value is assumed to be the expected inflation rate. Gordon's time series for the natural rate is used. The same instruments were used as in the labor-demand equation, with the addition of $_{-1}$. An LM-test for serial correlation (with 3 lags) was rejected (F=1.648); an ARCH-test for heteroskedasticity of the residual produced F=1.639 and a Chow-test for a structural break after 1974 generated F=0.783. The hypothesis that the coefficient attached to $_{-1}$ is one could not be rejected (F=0.733). When this constraint was imposed, the slope-coefficient was found to be −1.062 with a standard error of 0.167.

The coefficient of *(y−n)* indicates the "incidence" of productivity growth on real wages and is a measure of the ratio of the demand elasticity divided by the sum of the supply and demand elasticities. Since supply elasticities are considered to be quite low, this coefficient should be much closer to one. To circumvent the need for independently measuring productivity change, it is possible to estimate a *price* Phillips curve. Again estimated for the period 1961–95 with 2SLS, this version of the Phillips curve is as follows:

$$\pi = -\ 0.170 \ + \ 1.102\ \pi_{-1} - \ 0.723\ (u - u^*)$$
$$(0.382) \quad (0.087) \qquad (0.157)$$
$$\bar{R}^2 = 0.830 \quad F = 87.66 \quad SEE = 0.946 \quad \text{Durbin } h = 0.414.$$

Once again the constraint that the coefficient for $_{-1}$ was equal to one could not be rejected. When re-estimated, the slope coefficient became –0.691, with a standard error of 0.138.

Despite the "rational-expectations" criticism of adaptive expectations, the past inflation rate incorporates as much information as is available at the time that decisions have to be made and is a cost-effective means of eliminating as much systematic error from these decisions as is possible. This does not mean that governments could deliberately exploit the relatively flat slope of the Phillips curve to achieve a permanent reduction in the unemployment rate without generating accelerating inflation; the curve would continue to shift upward as long as $u<u^*$. An attempt to keep u below u^* by one percent would raise wage growth by about one percent or the inflation rate by about two-thirds of one percent in the first and every subsequent year.

The price-version of the Phillips curve does not perform very well in predicting the inflation rate during supply shocks such as the oil-price increases in 1974 and in 1979. During these two episodes, the inflation rate increased dramatically without an accompanying reduction in the unemployment rate. In the aftermath, the inflation rate fell speedily without unemployment rising at the same time. Therefore, during the 1970s, there are large positive and then negative residuals at the time of the oil-price shocks. This may be remedied by using a dummy variable for the oil-price shocks in the regression; inflation in 1974 and in 1979 is an extra 1.459% and the slope coefficient is reduced only slightly to –0.677.

In retrospect, the 1970s experience was an anomaly to the normal trade-off between inflation and unemployment during the postwar period and there is no reason to believe that future business cycles will create radically different combinations of these two important macro variables.

1.8
Conclusion

During the postwar period, there have been a number of business cycles. They have not exhibited a regular pattern nor is it likely that the cause is identical for all of these cycles. However, taking deviations of real output from some trend as the basis of these macroeconomic fluctuations, there are a number of related labor-

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[4] National income accounts data prior to 1959 are not available after the major revisions undertaken in 1995.

market variables that also conform to cyclical activity. These can be summarized as follows: during a recession, employment falls and unemployment rises; the real wage also rises because actual inflation is lower than nominal-wage increases; weekly hours, mostly overtime in the manufacturing sector, will be reduced to some extent. Then, during an upturn in economic activity, the movement of these variables is reversed.

This overview of labor-market data as they pertain to the macroeconomy provides the basis for labor-market models that concentrate on business-cycle activity, with an emphasis on aggregated behavior by firms and suppliers of labor services. In the next chapter, the traditional model of the labor market is presented together with an indication of its limitations in predicting the developments presented here. Then, in Ch. 3, a new approach is taken to theoretical analysis of transactions between workers and firms that recognizes the ambiguous and inconclusive allocation of property rights in the labor market.

2
The Traditional Model of the Labor Market

The empirical evidence on the operation of the US labor market in the postwar period from Ch. 1 provides the background against which the theoretical apparatus is developed. This chapter deals with the traditional model of the labor market as it is usually presented in textbooks or literature reviews. The emphasis here is on the macroeconomic aspects of labor-market behavior, so that elements such as investment in human capital, job-market discrimination, minimum-wage legislation, and gender differences in compensation are neglected in an attempt to concentrate on aggregated quantities of homogeneous labor services exchanged in the market at a uniform real wage.

The organizing principle in this review is to identify the major forces behind the supply of labor hours by individuals and the demand for labor services by firms, in both cases derived from optimizing behavior by these groups. Subsequently, these supply and demand decisions will be allowed to interact to determine the wage rate and the amount of labor that is exchanged in the market. The latter is determined not only for equilibrium situations, but also for disequilibrium when the real wage is unable to change instantaneously to clear the market. Although wage rigidity is a controversial issue in macroeconomics, a neutral stance is taken at this stage by noting only the consequences of disequilibrium transactions, not by postulating their likelihood. The review of this mainstream model relies on well-established analytical tools and results and therefore no attempt is made to give specific credit for theoretical developments. However, references to more detailed discussions of particular points will be provided in the bibliography.

It will become evident that the microeconomic foundations of labor supply and labor demand to be presented in this chapter are not adequate for the explanation of macroeconomic observations in the labor market. Unlike the goods or money markets, where individual optimizing behavior is readily translated into serviceable macroeconomic relationships such as the *IS* or *LM* curves, these same analytical tools applied to the labor market need additional *ad hoc* features to generate the aggregate-supply curve of the basic macroeconomic model. For example, while the transactions demand for money based on the inventory model of money holdings is easily converted into an *LM* equation with relatively strict limits on the slope of the curve, describing the equilibrium in the aggregate labor market does not provide a method of distinguishing between hours per worker and the number of workers nor is it consistent with the natural rate of unemployment. These shortcomings of the traditional model will be highlighted in this chapter, setting the stage for a more useful model to be presented in the following chapter.

2.1
The Supply of Hours by an Individual

The basis of an individual's choice concerning optimal hours of work involves a decision to allocate the total time available between the only two possibilities: work or leisure, with the latter incorporating not just "idleness" but also periods of rest and sleep or any activity that is not judged to be work for pay. For most people, leisure is desirable and work is not and in this one-dimensional framework they would always take complete leisure. But work satisfies other wants indirectly by making available resources that can be spent on the consumption of goods and services. In this two-good setting, a typical person will face a meaningful tradeoff between leisure and work. The aim of the analysis is to determine which factors influence this tradeoff and how they translate into different choices about hours of work in specific circumstances. The traditional tool for this purpose is constrained maximization of a utility function by the person who is allocating her time between work and leisure.

2.1.1
The Time-allocation Utility Function

In consumer theory, a person receives satisfaction from two or more goods or services. For present purposes, it is more instructive to aggregate all goods into one composite "basket of goods" and to specify the alternative source of welfare as leisure. Thus, an individual who offers her hours of work to the labor market is assumed to have a utility function in which the consumption of leisure and of goods provides her with well-being. The utility function is written as

$$U = U(T - H, C), \tag{2.1}$$

where T is the total time, such as 24 hours in a day, to be allocated between work and leisure, H are the hours that the person will want to work, which leaves $T-H$ as leisure hours; C represents the amount of the composite of all goods and services that is consumed in a period. The constraint faced by the individual in the process of optimization involves the expenditures on C:

$$C = \frac{W}{P}H + I, \tag{2.2}$$

where W/P is the real wage that the individual will receive for each hour of work and I is the amount of resources available for goods consumption from sources

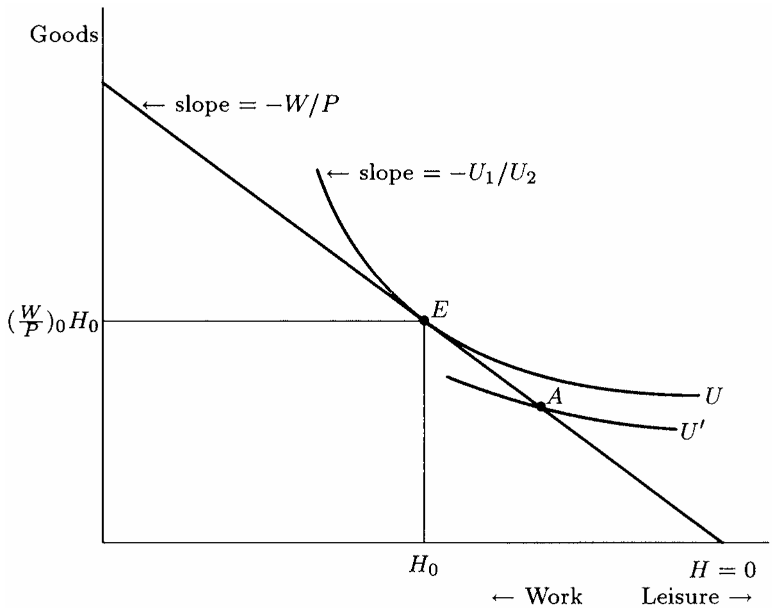

Figure 2–1 The optimal choice of hours of work

other than work (e.g., interest or rental income, allowance from one's parents), which is then added to income from work, *(W/P)H,* giving the total amount available for consumption of goods and services. It is implicitly assumed that the person neither saves nor dissaves, although a decision to save a portion of total income could be incorporated into the budget constraint by subtracting this amount from *(W/P)H+I.* The equilibrium condition is reached by substituting equation (2.2) into equation (2.1), differentiating the resulting utility function with respect to the only variable under the person's control and setting $U/ H=0$. This leads to

$$\frac{U_1}{U_2}=\frac{W}{P}, \tag{2.3}$$

where U_1 is the marginal utility of leisure and U_2 is the marginal utility of goods consumption; their ratio is the marginal rate of substitution between leisure and goods consumption. Both U_1 and U_2 are positive but declining with the amount of leisure or goods, respectively (i.e., U_{11}, $U_{22}<0$); also, each marginal utility would rise if the the amount of the alternative is increased (i.e., U_{12}, $U_{21}>0$). Fig. 2–1 represents this equilibrium. Goods consumption is plotted on the vertical axis, while hours of leisure are shown on the horizontal axis. Since we want to concentrate on hours of work, *H,* they are measured leftward from $H=0$ towards the origin, which incidentally represents $H=T$. The utility function is represented by an indifference curve, *U,* which has the familiar convex shape. Its slope is $-U_1/$

U_2 which rises with H because the marginal utility of leisure increases with hours worked but the marginal utility of goods consumption declines with H. The budget constraint is equation (2.2). Although , the slope of the budget constraint is $-(W/P)$ because H is measured in the opposite direction to leisure hours, $T-H$. The budget constraint is drawn on the assumption that I=0; a positive level of I would shift the budget constraint upward without changing its slope. Whether I is zero or positive, the budget constraint is truncated at H=0; no point to the right is possible since it would imply that the person has chosen more leisure hours than are available.

The optimal choice is made at E in Fig. 2–1, where H_0 hours of work are offered or $T-H_0$ hours of leisure are demanded. At the same time, goods consumption of $(W/P)_0H_0$ is available from the wage income. If the person initially chose H less than H_0, the indifference curve would have been flatter than the budget constraint at their intersection at A, or $W/P>U_1/U_2$. This is not optimal because the person is on a lower indifference curve, U . To remedy the situation, an increased U_1/U_2 is needed, which is accomplished by offering to work more hours or to demand less leisure. This revised decision not only leads directly to a higher value of H, but also to higher goods consumption. Utility also rises until E is reached. A tangency of an indifference curve to the budget line that takes place above and to the left of E would imply that the individual's utility function has stronger preferences for goods consumption and weaker preferences for leisure. Although this tangency can take place almost anywhere on the given budget line, corner solutions are ruled out because they would involve either $U(T,0)$ or $U(0,(W/P)T)$, where the complete absence of either goods consumption or leisure would not meet the minimum requirements for survival. Later, when we give the person some nonwage income, I, it will be possible to contemplate complete idleness, but when I=0, this is not admissible.

2.1.2
The Response of Work Hours to Wage Changes

For the operation of the labor market, it is important to know how individuals react to wage changes in the hours that they want to work. To analyze this issue, Fig. 2–2 replicates the original equilibrium of Fig. 2–1 and then adds a new budget line with a steeper slope resulting from a higher wage rate, $(W/P)_1$. The horizontal intercept of the budget line is still the same at H=0. A tangency to a new indifference curve, U' is drawn at E , showing a leftward movement on the horizontal axis to H_1, which is higher than H_0. Thus a higher wage leads to the prediction that more hours of work will be offered. However, this outcome depends very much on the shape of the indifference map; a new equilibrium could easily be drawn which portrays a smaller number of hours worked. To deal with this ambiguous result, we need to divide the move from E to E into an income effect and a substitution effect. The income effect is shown by the adjustment from E to E because it could be accomplished by giving this person

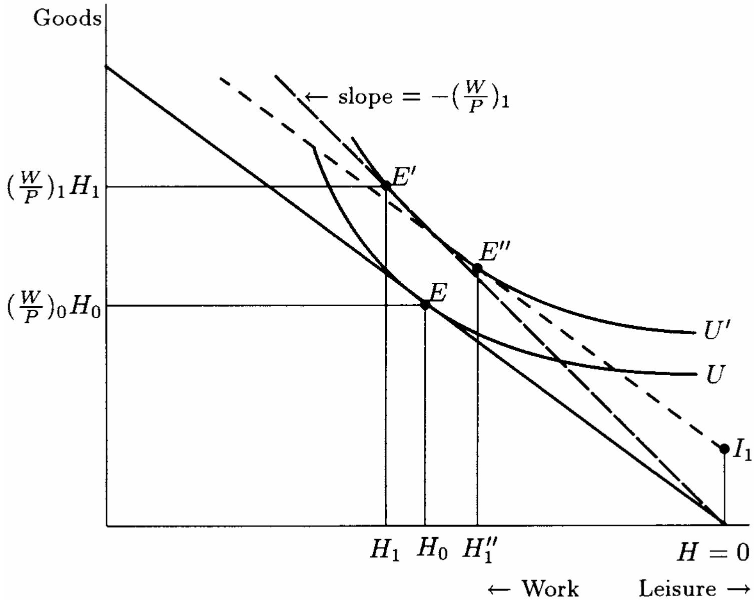

Figure 2–2 The optimal choice of hours of work when the wage rises

I_1 of nonwage income and maintaining the original wage rate, $(W/P)_0$. This person would work less when given extra resources for goods consumption, but a larger amount of work being offered in these circumstances cannot be ruled out. Next, holding the level of utility constant on the new indifference curve, U, we now raise the wage rate from $(W'/P)_0$ to $(W/P)_1$ to see how the person substitutes work for leisure. In this case, he moves from E to E, which always leads to an increase in hours worked from H *1* to H_1, given the convex shape of indifference curves. If the reduction in hours offered from the income effect is smaller than the increase in hours worked from the substitution effect, the net result is an increase in hours supplied when the wage rate rises.

The positively-sloped supply curve for this person is shown in Fig. 2–3(a). However, if the income effect has a large negative impact on hours offered, it will overpower the positive influence of the substitution effect and hours supplied by the individual will fall, as shown by the negative slope of the supply curve in Fig. 2–3(b). It is also quite possible to have a person increase hours of work when the wage is quite low and then reduce hours if the wage rate rises from some high level. This "backward bending" supply curve is shown in Fig. 2–3(c). As a result, we are left with a great deal of uncertainty about the shape and position of an aggregate supply curve of labor, which is the horizontal summation of the individual supply curves in the three parts of Fig. 2–3. For a given increase in the real wage, H_1 rises, H_2 falls and H_3 does both depending on whether the wage increases from a low or high level; their sum could be positive, negative, or even zero, making it impossible to stipulate the slope of the aggregate labor-supply curve unless we know the exact shape of every person's individual supply curve.

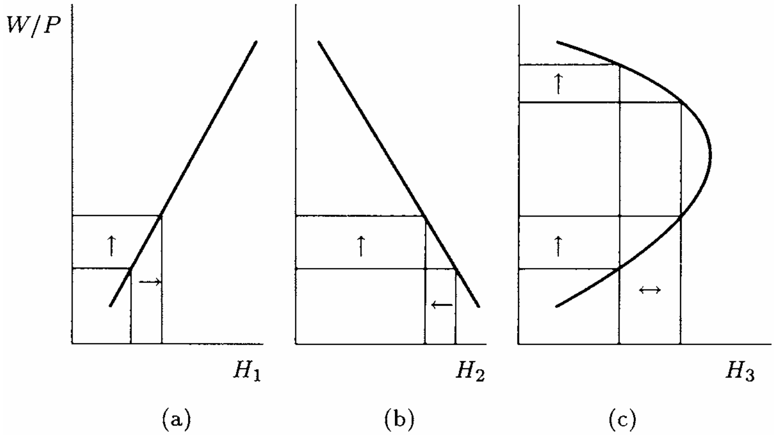

Figure 2–3 Three different labor-supply curves

2.1.3
The Slutsky Equation

To analyze in more detail the source of the ambiguity about individual responses to wage changes, we need to look at a formal apparatus called the Slutsky equation, which distinguishes between and identifies the sources of income and substitution effects that arise from relative price changes.

Budget constraint: where *Y* represents total income available for goods consumption, *C*, and *w W/P* in this section only to reduce notational complexity; later *w* will be defined as the natural log of the *nominal* wage.

Utility function: U(T−H, C).

Supply function: H=h(w, Y). The supply function is derived from maximizing the utility function subject to the budget constraint.

Derivation of the Slutsky equation: The supply equation is differentiated twice with respect to *w,* first without constraint and second holding *U* constant. The former evaluates the total move from *E* to *E* in Fig. 2–2, while the latter measures the substitution effect from *E* to *E* .

$$\frac{\partial H}{\partial w} = \frac{\partial h}{\partial w} + \frac{\partial h}{\partial Y}\frac{\partial Y}{\partial w} = \frac{\partial h}{\partial w} + H\frac{\partial h}{\partial Y}, \quad \text{since} \quad \frac{\partial Y}{\partial w} = H \tag{2.4a}$$

$$\frac{\partial H}{\partial p}\,|_U = \frac{\partial h}{\partial w} + \frac{\partial h}{\partial Y}\frac{\partial Y}{\partial w}\,|_U = \frac{\partial h}{\partial w}, \quad \text{because} \quad \frac{\partial Y}{\partial w}\,|_U = 0 \tag{2.4b}$$

according to the budget constraint, , when it is differentiated with respect to *w,* first allowing *H* to change and then holding *H* constant to maintain a given level of utility.

Eliminating *h/ w* from both expressions by substitution:

$$\frac{\partial H}{\partial w} = \underbrace{\frac{\partial H}{\partial w}\Big|_U}_{\text{substitution effect}} + \underbrace{H\frac{\partial h}{\partial Y}}_{\text{income effect}}. \tag{2.5}$$

The Hicks substitution effect is positive (i.e., an increase in *w* will lead to less leisure but more hours of work) and the income effect may be positive or negative, with the latter more likely since it implies that leisure is a normal good. If *h/ Y*<0, the sign of *H/ w* is ambiguous. Even though *H/ w* may be positive for low hours of work, as *H* increases the negative income effect becomes stronger and may overpower the substitution effect. This is what gives rise to the "backward bending" supply curve in Fig. 2–3(c).

2.1.4
Specific Utility Functions

To continue the exploration of the sources of ambiguity about the slope of the individual labor-supply curve, we will now look at utility functions with specific characteristics. The most useful specification is a Cobb-Douglas utility function that takes the following form:

$$U = (T - H)^{\alpha} C^{\beta}, \tag{2.6}$$

where and are parameters indicating the "importance" of the two arguments in the utility function. To derive a supply equation for hours of work, we need the budget constraint of equation (2.2) and an expression for the equilibrium condition from equation (2.3). The latter is obtained by differentiating equation (2.6) totally to obtain . Substituting the budget constraint for *C* and solving for *H* produces the required supply curve:

$$H = \frac{\beta}{\alpha + \beta}\left(T - \frac{\alpha}{\beta}\frac{I}{W/P}\right). \tag{2.7}$$

On the right-hand side of equation (2.7) are the determinants of the supply of hours of work by an individual who uses a Cobb-Douglas utility function to make this decision. Although this appears to be a complicated expression, it has a relatively straight-forward explanation. For example, if *I*=0, then *H* is a constant proportion, */(+)*, of *T*. If =0.3 and =0.6, then that person will want to work one-third of the total time available. As goods consumption becomes more important, rises in value and the person will want to work longer hours. Now, let *I* become positive and it is evident that hours of work will be reduced. This income effect on hours worked will cause a bigger reduction if is large compared to , or if leisure is more important than goods consumption. However, there is no obvious constraint that prevents *H* from becoming negative. Finally, the most critical relationship in equation (2.7) involves *H* and *W/P*. As *W/P* rises, the amount that is subtracted from *T* gets smaller and therefore *H* rises. This gives us an unambiguously positive slope for the labor-supply curve, except when *I*=0, in which case the supply curve is vertical.

The supply curve becomes more simple if the utility function is homogeneous of degree one so that . Then

$$H = (1 - \alpha)T - \alpha \frac{I}{W/P}. \tag{2.7'}$$

For this case, the supply elasticity with respect to the real wage can be calculated to be *I/(W/P)H.* This is a ratio of nonwage to wage income multiplied by . As a person moves up the supply curve in response to higher wages, the denominator rises and the elasticity falls. The supply elasticity with respect to *I* is exactly the same, except that it is negative.

Another utility function that can be analyzed is called quasi-linear. It is written as follows:

$$U = \alpha(T - H) + \beta \ln C, \tag{2.8}$$

where and are once more parameters of the utility function. Leisure adds to utility linearly, but the amount of goods consumption enters in a log-linear fashion. In other words, the marginal utility of leisure is constant, but the marginal utility of goods consumption falls. Again, equation (2.3) involves the marginal rate of substitution equated to the real wage, which in this case is *C/* =*W/P.* When the budget constraint is substituted, the solution for *H* is

$$H = \frac{\beta}{\alpha} - \frac{I}{W/P}. \tag{2.9}$$

As was the case with the Cobb-Douglas utility function, *H* will be a positive constant when *I*=0, but in this case it has no relation to *T*. In other words, it is possible to have *H* equal 30 hours in a day. Furthermore, as *I* increases *H* falls and as *W/P* rises *H* will fall because the term to be subtracted gets smaller. The supply elasticity with respect to the real wage is now *I/(W/P)H,* which is once more a ratio of nonwage to wage income.

If the utility function is changed to , where *T*−*H* and *C* are interchanged compared to equation (2.9), the supply of hours becomes . In this case, *I* is irrelevant to the decision, but *H* and *W/P* are still positively related. The feature of constant marginal utility of one of the arguments makes it less than ideal in this application. Quasi-linear utility functions are usually employed when the demand function for one small component of consumer expenditures is needed; in that case, holding the marginal utility of the bundle of all other goods constant is sensible.

2.1.5
Other Exogenous Effects on the Supply of Labor

Even if the real wage is constant, other influences can change the number of hours that a person will want to work, the only requirement being that the ratio U_1/U_2 must remain constant as seen from the first-order condition of equation (2.3). Both U_1 and U_2 will depend on the values of the two arguments in the utility function, $T-H$ and C. Differentiating with respect to these two arguments produces

$$dH = -\frac{U_{12} - U_{22}W/P}{U_{11} - U_{21}W/P}dC + dT,$$

where U_{ij} is the derivative of U_i with respect to j. From the previous discussion, $U_{ij}<0$ when $i=j$ and $U_{ij}>0$ when $i \quad j$. Substituting changes in the budget constraint for dC gives the final result:

$$dH = -\frac{1}{\Delta}\left[(U_{12} - U_{22}\frac{W}{P})dI + (U_{11} - U_{21}\frac{W}{P})dT\right], \qquad (2.10)$$

where . Therefore, an increase in I will lead to a reduction in hours worked. The availability of nonwage income eases the budget constraint and allows the individual to have more goods consumption and leisure —assuming that they are both normal goods—and in the process the hours of work are reduced. This is seen in Fig. 2–2 as the movement from E to E where the individual's nonwage income increases from zero to I_1. A decrease in T should be interpreted as the introduction of another activity beside work and leisure. A lower value of T will also reduce hours of work to make room for this activity. Both of these variables and their effect on working hours come into play when a person has to expend resources commuting to and from work.

2.1.6
The Supply of Hours and the Cost of Commuting

Individuals not only earn rewards from employment but they also face costs, most particularly the costs of travelling to and from the workplace. These costs can be divided into two components: (1) the monetary costs involved with public transportation, or the cost of gasoline and parking, wear and tear on an automobile, and (2) the time costs involved in getting to and from work. These enter the budget constraint of equation (2.2) in the following way:

$$C = \frac{W}{P}(H - H_f) + I - F, \qquad (2.2')$$

where H_f represents the time involved in commuting and F stands for the fixed payments for transportation costs attached to employment. The latter has the opposite effect of nonwage income I and reduces the resources available for goods and leisure consumption. From equation (2.10), a decrease in I results in higher hours supplied. Therefore, as monetary costs of commuting increase, the individual will be induced to work longer hours. However, these fixed costs play another role. If they are high enough, a person will not want to work at all. Similar to a firm that must cover its fixed costs or stop operations entirely, a person whose wage income HW/P is less than the fixed costs F will not offer any hours of work if H is already at a maximum and cannot be increased. Thus, some people who face very high transportation costs or very low wages may not want to work at all.

The person now divides the day into three parts: (1) leisure, (2) work hours, and (3) commuting time. Introducing H_f into the analysis has the same effect as lowering T in equation (2.10) which reduces hours of work. In summary, commuting costs shift the budget constraint inward for the individual: the time costs move the H=0 constraint to the left in Fig. 2–2, while the transportation costs move the constraint downward by reducing I. Sometimes these changes are combined. For example, a new transportation system that saves time but charges higher monetary costs will be an unambiguous inducement to increase work hours, because it lowers I and increases T.[1]

2.1.7 Intertemporal Substitution of Hours

One obvious feature of the labor market is that hours of work vary from day to day without much change in the wage rate or other determinants of the work-leisure choice. To accommodate the weekly cycle of work, with the typical two days off on the weekend, we could merely redefine the period over which the optimization takes place from a 24-hour day to a 7-day week. Nor does the consumption of goods and services over several time periods present any new problems for the work-leisure choice. Since people tend to purchase goods when they are not working, goods consumption and working are mutually exclusive activities. To adapt to this situation, the budget constraint should be specified over a long enough period that allows working and goods consumption to take place within the period.

However, there is another intertemporal decision that will affect hours of work in each of two periods: the willingness to substitute leisure in one period for leisure in another period. This is a relevant concern since individuals do not work all their lives. In early adulthood, when the decision to pursue an education eliminates work hours, or in the late stage of life when retirement occurs, choices are made that lead to H=0 for some periods of time and H>0 for others. We can write a utility function that concentrates on this choice:

$$U = U(T - H^0, T - H^1, C), \tag{2.11}$$

where H^0 and H^1 are the hours offered by the individual in each of the two periods and C represents goods consumption over two periods. The budget constraint, in present-value terms, is now:

$$C = C^0 + \frac{C^1}{(1+i)} = Y = (W/P)^0 H^0 + \frac{(W/P)^1}{(1+i)} H^1, \tag{2.12}$$

[1]See Ehrenberg and Smith (1994, pp. 206–11) for more details.

where $(W/P)^0$ and $(W/P)^1$ are the wage rates in each of the two periods. For a given level of C, the optimization involves equating the marginal rate of substitution between current and future leisure to the relative wage rates. Thus,

$$\frac{U^0}{U^1} = \frac{(W/P)^0(1+i)}{(W/P)^1}. \tag{2.13}$$

This equilibrium is shown in Fig. 2–4, where current hours are measured along the horizontal axis and future hours on the vertical axis. In the initial equilibrium at E, it is assumed that the two wage rates are equal in present-value terms. Hence the slope of the budget constraint is −1. This will lead to H^0=H^1 or equal hours in both periods. If the interest rate becomes larger or if $(W/P)^0$ increases, the budget constraint would be steeper and the individual would want less leisure now or higher hours of work, but more leisure in the future. Fig. 2–4 also indicates the location of complete leisure in each of the two periods. In order to predict that either H^0 or H^1 is zero, we would need a "corner solution," but this is not impossible when T is a finite number. To move to a point such as E , as would be the case for a student, the budget constraint must be quite flat. For any given interest rate, the future wage must be quite high compared to the current rate. In other words, the student calculates that the extra education will raise $(W/P)^1$ substantially above $(W/P)^0$ to make it worthwhile to postpone employment. For the prospective retiree, who is at a position such as E where H^1=0, the future wage must be very low compared to the current wage. Alternatively, a person close to retirement will have accumulated a "nest-egg" which gives him access to

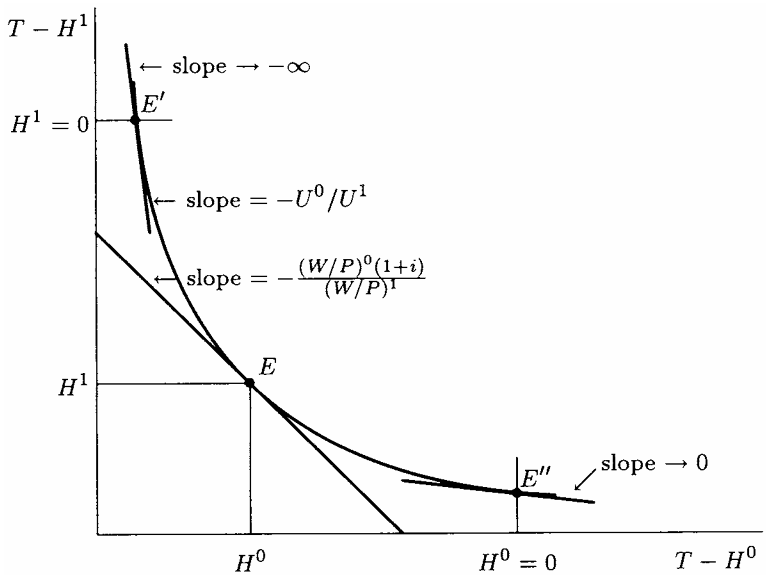

Figure 2–4 Intertemporal substitution of hours of work

nonwage income, *I*, and this increases the marginal utility of leisure. Either of these conditions would allow for a tangency between the indifference curve and the budget constraint that is close to vertical.

Nevertheless, it is difficult to explain abrupt changes in hours from positive to zero or *vice versa* without having large differences in wage rates. In Chart 1–1, it was seen that individuals tended to concentrate on two choices: either H=0 or H=40, per week. In Fig. 2–4, the change in the slope of the indifference curve between H^0 and H^0=0 must be accompanied by an equal change in the relative wage, but it is rarely the case that individuals who must make this choice are offered wildly different wage rates. For example, a person who chooses H=0 may be offered only a dollar less per hour than a person who accepts H=40. What is more, it is difficult to see why the distribution of hours is not more uniform. In Fig. 2–4, there is nothing to prevent a person from choosing to work, say 11 hours a week, but only 0.03% made that choice both in 1982 and in 1991. Finally, there are some individuals who never work and this framework does not explain their decision. In other words, there must be another constraint operating in the labor market that limits the choices made by individuals in the hours that they work.

The utility function of equation (2.11) could be re-interpreted as a household choice of work hours for two individuals who share goods consumption of C. Thus H^0 and H^1 could be the hours supplied by a married couple who face different wages, $(W/P)^0$ and $(W/P)^1$. Although the interest rate would no longer be relevant because this is not an intertemporal decision, Fig. 2–4 could be applied to this choice and corner solutions would imply that one of the two family members is a homemaker.

2.1.8
Overtime Hours

Firms do not pay the same wage for every hour of work that they obtain from their workers. After an arbitrary number of hours per day or per week, firms will pay an overtime premium of "time-and-a-half" or "double-time." The budget constraint now becomes

$$C = \frac{W}{P}\bar{H} + \frac{\widetilde{W}}{P}(H - \bar{H}) + I, \tag{2.2''}$$

where $\bar{H}$ represents the barrier between regular hours and overtime hours and $\widetilde{W}$ is the overtime wage rate.[2] Can workers be persuaded to work extra hours when they are offered such a premium? From the first-order condition of equation (2. 3), if an increase in the wage rate can induce workers to supply more hours, then the overtime premium will be persuasive, but there may be conditions where the adverse income effect may be stronger than the substitution effect of a wage increase and workers will not want overtime hours. Moreover, the value of $\bar{H}$ may not be the optimal choice of hours by each individual and therefore the first-order condition does not hold at $\bar{H}$

Fig. 2–5 depicts the choice of overtime hours. The budget constraint is now kinked at $\widetilde{W}$ at which point it becomes steeper when the overtime wage is paid. For the person who starts with the equilibrium condition at $\bar{H}$, the overtime premium will induce him to offer hours of overtime as he moves from E to E on the higher utility curve. Nevertheless, an alternative individual with the dashed indifference curve marked U_A will be at the initial equilibrium point of E_A. This person cannot be persuaded to work overtime hours because the indifference curve lies above the budget constraint to the left of E_A. One may conclude therefore that overtime hours may not always be a welfare improvement for the worker and that such individuals may refuse the extra hours.

2.1.9
Taxes on Wages

If the government taxes a portion of wage income, the equilibrium condition of equation (2.3) is amended to

$$\frac{U_1}{U_2} = \frac{W}{P}(1 - \tau), \tag{2.3'}$$

2 For a "time-and-a-half" premium,

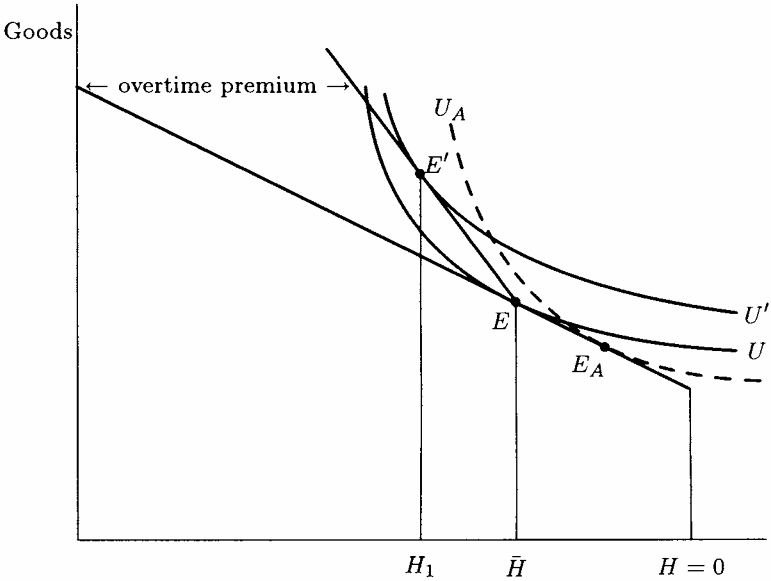

Figure 2–5 Optimal overtime hours

where is the rate of tax imposed by the authorities. The higher is the tax rate, the lower is the return for an hour's work. This has the same effect as a reduction in *W/P* which has the previously derived ambiguous impact on hours of work unless we can be sure that the substitution effect of the tax creates a larger response than the income effect. If the supply curve of hours is positively sloped as in Fig. 2–3(a), then an increase in the tax rate will reduce hours of work.

However, if all income is taxed at the same rate, then after-tax nonwage income becomes *I*(1−) which is smaller than *I*. The effect of this tax is to increase hours supplied by the individual. As a consequence, an all-inclusive income tax has unpredictable effects on labor supply.

2.1.10
Empirical Evidence on Labor Supply by Individuals

Considerable effort has gone into an attempt to find the response of hours of work by individuals to various exogenous events. Most of the emphasis has been on the wage-hours relationship to see which supply curve in Fig. 2–3 is most relevant. This in turn involves estimating the size of the substitution effect and the income effect in equation (2.5). While the reported results differ for a variety of reasons, Ehrenberg and Smith (1994, pp. 188–89) and Blundell (1995) report that male and female responses have historically been dissimilar, but becoming less so in recent times. For men, the income and substitution effects have both been very small so that the supply curve is close to vertical. For women, the response of hours to wage changes has been stronger, with the substitution effect dominating the income effect. Therefore, female labor-supply curves tend to have a positive slope, but over the years the slope has become closer to vertical.

These results do not imply that individuals are making irrational choices in their work-leisure decision. Rather, they have utility functions that cause them to keep their hours constant as wages rise. For any given increase in the wage rate, the substitution effect and the income effect cancel out. For example, with a Cobb-Douglas utility function, H would be independent of W/P in equation (2.7) if I is close to zero, which means that most people have very little access to income from sources other than their work. This may also explain why a married woman, who would treat her husband's income as her I if she is making an independent decision about labor-force participation, may have a greater response to wage change than her husband. The same result is obtained from the quasi-linear utility function that produces the supply curve of equation (2.9).

Another reason for the observed lack of hours response to wage changes is that individuals simply do not have the possibility of working more or fewer hours. Even though people may want to adjust their hours of work when the wage rate or other factors change, they may not have the freedom to do so. Hours per week are severely limited as shown in Chart 1–1; for example, a person working 40 hours a week may want to work 39 or 41 hours, but very few are able to do so. In other words, observed hours of work may not be consistent with desired hours and thus the relationship between hours and wages must take into account the constrained environment in which the choice is made.

2.1.11
Conclusions about Labor Supply

An optimizing individual will consider a number of factors when deciding on the number of hours to work per period of time. The most important of these are: (1) the real wage per hour, (2) the size of nonwage income, (3) taxes, (4) commuting costs, and (5) overtime premia. In many instances, these variables have unpredictable effects on the optimal choice of hours according to the analysis in the previous parts of this section. Moreover, it is difficult if not impossible to predict that a large proportion of the population would not want to work at all. In other words, the equilibrium condition of equation (2.3) or its variants require special conditions to predict H=0. As we saw in Ch. 1, there are very few possibilities with respect to weekly hours, but the theory of optimal hours does not seem to lead to that result. Furthermore, the empirical evidence suggests that workers do not change their desired hours a great deal when the real wage changes so that this model would have difficulty explaining the relatively large number of persons who move from H=0 to H=40 or *vice versa* during a business cycle. What is needed instead is a model that predicts the *participation decision* on the basis of a very limited set of choices. In other words, individuals are presented with an all-or-nothing choice of hours and they must calculate the *reservation wage* that forces them to be indifferent between these choices. This is the model that will be developed in the next chapter.

2.2
The Demand for Labor Services

The hours that are being offered by individual consumer-workers become one of the major inputs into the production process that firms use to generate output, which in turn satisfies the wants of the same consumer-workers that were the subject of the analysis in Section 2.1. To complete the circular flow between goods markets and factor markets, the optimizing process of firms has to be presented in order to understand the factors that determine the demand for labor services.

2.2.1
The Derived Demand for Labor

The firm aims to maximize real profits which are derived from producing output minus the costs of that production. The inputs into the production process are labor and capital, the former depicted by total labor hours, which are composed of H hours from N individuals. The profit function is written as

$$\Pi = Y(HN, K) - \frac{W}{P}HN - \frac{R}{P}K, \tag{2.14}$$

where K is the amount of capital used and R/P is its real user cost. The maximization process generates equilibrium amounts of capital and labor that are used in the production of a given amount of output, Y_0. This is shown in Fig. 2–6.

The equilibrium condition can be written as

$$\frac{Y_{HN}}{Y_K} = \frac{W/P}{R/P}, \tag{2.15}$$

where Y_{HN} and YK are the marginal products of labor and capital, respectively. In most production processes there is diminishing marginal product, therefore . Also, an increase in the co-operating factor will raise the marginal product of the other factor; hence . The equilibrium condition can be simplified to

$$Y_{HN}(HN, K) = \frac{W}{P}, \tag{2.15'}$$

because Y_{HN} will always rise when Y_K falls and *vice versa* so that their ratio moves with Y_{HN} and because the cost of capital is treated as a parameter.

The demand function for labor can be derived from equation (2.15). In natural logs with lower-case letters for their upper-case counterparts in original units, it is written as

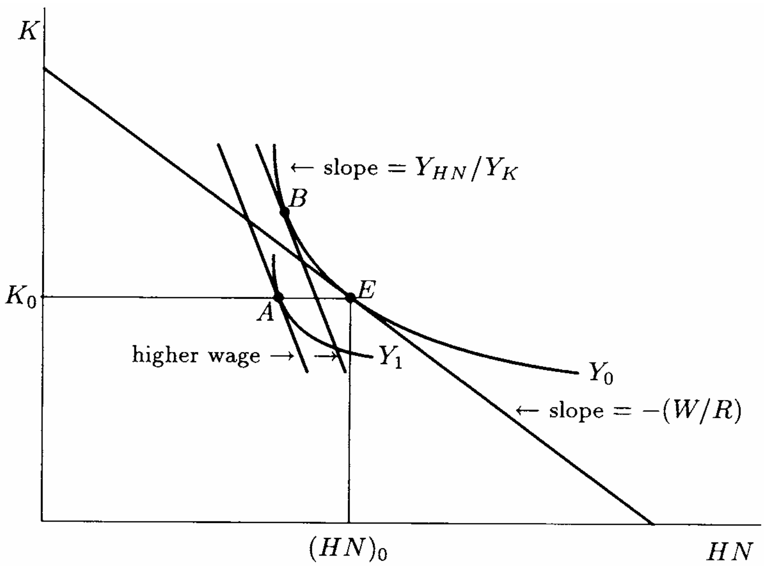

Figure 2–6 Optimal inputs for the firm

$$\delta_1 k - \frac{1}{\delta_2}(h+n) = w - p,$$

where $_1$ is the elasticity of the marginal product of labor with respect to the capital input and 1/ $_2$ is the elasticity with respect to the labor input. The size of these two parameters depends on the specific production process. If substitution between *HN* and *K* is impossible because of fixed proportions, $_1$=0. On the other hand, 1/ $_2$ depends on the strength of the law of diminishing returns to a factor: the more that the marginal product of labor falls with increased hours of the labor input, the greater is 1/ $_2$. When rearranged to a demand function we obtain,

$$h + n = \delta_1\delta_2 k - \delta_2(w-p). \tag{2.16}$$

The estimated coefficients from the US aggregate labor-demand equation in Ch. 1 indicate that $_1$ $_2$=0.647 and $_2$=0.428; therefore, $_1$=1.512 and 1/ $_2$=2.336. [3]

The elasticity of factor substitution is the proportional change in the ratio of *HN* to *K* with respect to a proportional change in relative factor prices. This elasticity can be defined as follows:

$$\sigma = \frac{d(h+n-k)}{d(w-p-r+p)},$$

using natural logs of the variables. If we hold *k* and *r*−*p* constant, assigning them arbitrary values of zero (i.e., unitary values in the original units), then becomes the coefficient attached to *w*−*p* and equals $_2$ in equation (2.16), where it is interpreted as the wage elasticity. Therefore, the larger is the elasticity of factor substitution, the weaker is the law of diminishing productivity of a factor.

Consider now an increase in the real wage which will change relative factor prices and provide a steeper budget constraint in Fig. 2–6. There are two situations in which firms will find themselves: (1) they will want to keep output constant, or (2) they will be unable to change the amount of capital at their disposal. For the former case, firms will be induced to substitute capital for labor, remaining on the original isoquant Y_0, as they move from *E* to *B* in the diagram. Thus, there is a negative relationship between the labor input and its price. In the process, the marginal product of labor rises until it has been equated to the new higher real wage. In the latter case, a new equilibrium must be found along the horizontal line from K_0 to *E,* where an isoquant is tangent to the steeper budget constraint. Such a point is *A,* where output has fallen to Y_1. Again, there is a negative relationship between *H N* and *W/P* as the marginal product of labor rises when the labor input is reduced. Which of these adjustments is more relevant depends on whether *K* is treated as a fixed factor of production in the short run or a variable factor in the long run. In either case, there is an inverse relationship between wages and the labor input, but we do not want to conclude that there is a larger response to a wage change when output is constant than if capital is fixed. In other words, it is not possible to specify that *B* is to the left of *A*. To compare these adjustments requires more information about the production function, to which we now turn.

2.2.2
Specific Production Functions

If the production technology can be summarized by a Cobb-Douglas function, then very precise predictions can be made about the response of the labor input to the wage rate and other variables. The Cobb-Douglas production function is written as

$$Y = (HN)^{\alpha} K^{\beta}. \tag{2.17}$$

The sum + identifies the returns to scale: (a) if + >1, there are increasing returns to scale; (b) if + =1, there are constant returns to scale; and (c) if + <1, there are decreasing returns to scale. Imposing the equilibrium condition from equation (2.15) allows us to solve for *H N.* Written in natural logs, the demand function for labor hours becomes

$$h + n = \frac{1}{1-\alpha}[\ln \alpha + \beta k - (w - p)], \tag{2.18}$$

or

[3]In Ch. 1, the demand curve estimated *n,* not *h*+*n* and used a weekly wage, *w*−*p*+*h,* instead of an hourly wage rate, *w*−*p,* but if *h* is relatively constant, then this has no effect on the wage elasticity and only changes the intercept by ($_2$−1)*h*.

$$h + n = \ln \alpha + y - (w - p). \tag{2.18'}$$

In the latter case, both the output and the price elasticities are equal to one. Also, since <1, the wage elasticity when *k* is fixed is greater than one. As a result, for Cobb-Douglas production functions, *A* in Fig. 2–6 is to the left of *B*. Furthermore, which will be a positive fraction and which will be negative, as can be verified by comparing equations (2.16) and (2.18). From the previously estimated coefficients of the US labor-demand curve, it is possible to calculate =3.336 and =1.512, which are not consistent with constant returns to scale. The Cobb-Douglas representation of the aggregate production function is probably not correct since the elasticity of factor substitution was estimated to be 0.428, instead of the required value of one.

Another possible production function relies on fixed proportions of *HN* and *K*. This would be written as

$$Y = \min\{HN, \alpha K\}, \tag{2.19}$$

so that the one unit of *K* is always combined with *aHN* and produces isoquants with a kink at *HN*= *K*. The parameters $_1$ and 1/ $_2$ are both zero in this case and the demand for labor services is proportional to output; hence

$$h + n = \beta y, \tag{2.20}$$

where the parameter indicates returns to scale. The fixed-proportions production function is obviously not relevant for the aggregated economy as the required elasticity of substitution would have to be zero.

A more general production function has a constant elasticity of substitution that may be greater or less than one. Such a CES function can be written as

$$Y = [\alpha(HN)^{-\beta} + (1 - \alpha)K^{-\beta}]^{-1/\beta}, \tag{2.21}$$

where and are constants.[4] For this situation, the demand for labor is written as

$$h + n = \frac{\beta}{\beta + 1} y + \frac{1}{\beta + 1}(w - p). \tag{2.22}$$

Here, the elasticity of factor substitution is 1/ . The larger is the elasticity of substitution, the larger is the response of the labor input to a change in the real wage. The CES version of the labor-demand function with the capital stock held constant is much more complicated and will not be reported here.

2.2.3
The Effect of Technological Change and Taxes

The improved quality of a factor of production, which is technological progress, can be captured in the production function by letting the marginal product of a factor rise as time passes. Thus, the equilibrium condition in equation (2.15) becomes

$$Y_{HN}(1 + t) = \frac{W}{P}, \tag{2.15''}$$

where *t* measures the passage of time and allows Y_{HN} to increase independently of the amount of the co-operating factor. From the Cobb-Douglas production function, the new demand function merely adds into the bracketed portion in equation (2.18). Although technological change means that less inputs are required for a unit of output, the firm has an incentive to produce more output when the marginal product of labor is above the real wage. Depending on the labor-supply conditions, the real wage will also rise.

Taxes on the labor input will increase the cost of each hour of labor to *(W/P)*(1 +) so that raising these taxes will reduce the demand for labor to the same extent as an increase in the real wage in equation (2.16). However, an increase in taxes on capital will increase the demand for labor in situations where substitution between the two factors is possible.

2.2.4
Imperfectly Competitive Product Markets

A firm that sells in a perfectly competitive product market treats the price of output, *P* in the profit function of equation (2.14), as constant even when it changes its inputs and output. A firm that faces limited competition sells in a market that has a downward-sloping demand curve and thus *P* and *Y* are inversely related. In this case, the response to wage changes in labor demand will be smaller than for perfectly competitive product markets. Instead of equation (2. 15) as the equilibrium condition for labor demand, the relevant equality is given

$$Y_{HN}(HN, K) \times MR = W, \qquad (2.15')$$

where *MR* is marginal revenue, which is related to price as follows: , where is the absolute value of the elasticity of demand. The demand function is now

$$h + n = \delta_2 \ln\left(1 - \frac{1}{\eta}\right) + \delta_1\delta_2 k - \delta_2(w - p). \qquad (2.16')$$

Equation (2.16) is a more general form of equation (2.16). As approaches infinity, the first term becomes zero (i.e., ln 1=0). For less than infinitely elastic demand, the first term becomes negative, when taking the natural log of a fraction, and subtracts from the demand for hours for given *k* and $w-p$. However, contrary to Hicks (1963, pp. 241–46), the elasticity of the demand for labor, ${}_2$, does not depend on the elasticity of demand for the product, . Although the value of ${}_2$ influences the size of the first term, the value of does not help to determine the size of ${}_2$. In other words, a monopolist will use less labor than a competitive firm, but both firms will have the same proportional response to a change in the real wage.[5]

[4]See Henderson and Quandt (1980, p. 111–14).

2.2.5
Unions and Labor Demand

The market for labor services may also be less than perfectly competitive. When unions organize the labor force and act as a single seller, their objectives must be specified in order to determine how wage and employment decisions are altered by their presence. It is usually argued that unions attempt to maximize a utility function that has both wage rates and employment levels as arguments. This is the approach taken by McDonald and Solow (1981). Therefore,

$$U = U\left(\frac{W}{P}, HN\right) \tag{2.23}$$

summarizes this argument and U_1, $U_2>0$ is assumed so that unions face a trade-off between higher wages and more employment. If wages are of utmost importance, U_2 approaches zero. The firm also has the possibility of adjusting wages and employment to leave their profit situation unchanged. This produces an iso-profit curve in the labor-market diagram. By differentiating equations (2. 14) and (2.23) with respect to *W/P* and *HN* and setting the result to zero, we can equate the two trade-offs to obtain:

$$\frac{d(W/P)}{d(HN)} = \frac{Y_{HN} - W/P}{HN} = -\frac{U_2}{U_1}. \tag{2.24}$$

This outcome requires the firm to move along an iso-profit curve, away from its demand curve where $Y_{HN}=W/P$. To the right of the demand curve, real wages must fall to keep profits constant in the face of increased employment, which in turn reduces Y_{HN}. The real wage must also be lower to the left of the demand curve, but now Y_{HN} exceeds the real wage. These various positions are shown in Fig. 2–7, which depicts the downward sloping demand curve HN^d, as well as two of the iso-profit curves described previously. Tangent to $\ _1$ is the indifference curve of the union, U_0, and point *B* is an efficient outcome for the two parties involved in the bargaining. The aim here is to compare this wage and employment level to point *A*, which is the perfectly competitive outcome, where $W/P=Y_{HN}$ at the apex of the iso-profit curve, $\ _0$. Although it is possible that the tangency at *B* gives rise to a lower wage than at *A*, this is unlikely since the union would not have accomplished anything if it cannot raise wages with its monopoly power. Also, despite the fact that employment will be to the right of the demand curve, it is not possible to state that $(HN)_1$ will always be larger than $(HN)_0$. There is a contract curve from *A* through *B* and other tangencies between iso-profit curves for the firm and indifference curves for the union. Moving up along the contract curve improves the welfare of the union, but the firm's profits will fall. Although the contract curve is drawn with a positive slope, a negative slope cannot be ruled out without additional information about the utility

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[5] Hicks' proof is flawed: it assumes constant returns, and uses equation (2.15) instead of (2.15) as the equilibrium condition in situations where is not infinite.

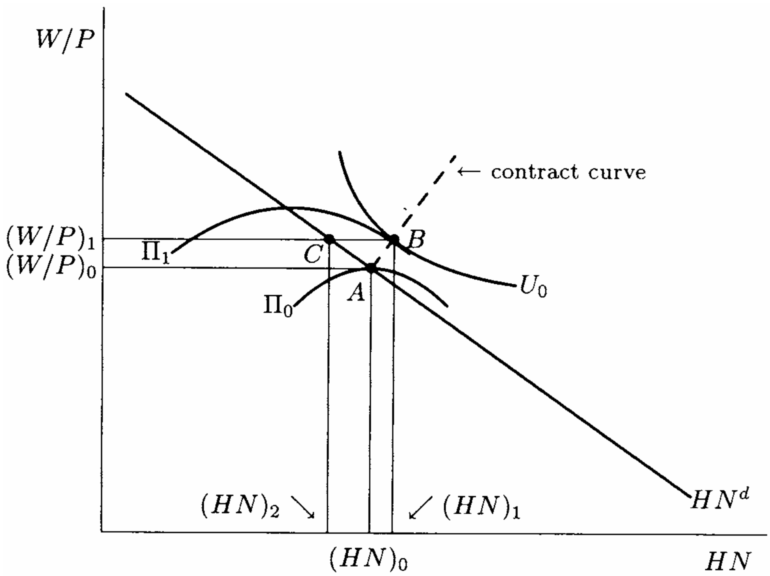

Figure 2–7 Wage and employment effects of a union

function of the union and the profit function of the firm, according to MaCurdy and Pencavel (1986). Moreover, even if $(HN)_1 > (HN)_0$, once the real wage is set at $(W/P)_1$, the firm has strong incentives to move back to the demand curve where profits are higher at *C* than at *B*. To force the firm to keep its employment at $(HN)_1$ would require no-layoff clauses or other staffing-level agreements in union contracts that may be difficult to implement and even more difficult to enforce. Thus, it is dangerous to make categorical statements about the effect of union behavior on wages and employment.

2.2.6
Determination of Hours and Employees

To this point, the focus has been on the determination of the total number of hours as the labor input, with the hours per employee and the number of employees being left indeterminate. If we follow the same optimizing procedure for *H* and *N* separately after *K* has been chosen and then determine the marginal rate of substitution between them, we obtain

$$\frac{dH}{dN} = -\frac{Y_{HN}H}{Y_{HN}N} = -\frac{H}{N}. \tag{2.25}$$

The budget constraint involving only labor costs is $(W/P)HN$. The slope of this constraint is

$$\frac{dH}{dN} = -\frac{H}{N}. \tag{2.26}$$

In other words, both the isoquant and the budget constraint are rectangular hyperbolas which coincide throughout their length and do not allow us to obtain unique values for *H* and *N*. Much of the literature on labor demand either leaves this indeterminacy unresolved by concentrating on the demand for total labor hours, *HN*, or by implicitly assuming that *H* is fixed at $\bar{H}$ by convention or historical accident and then concentrating on the demand for employees who work these fixed hours. The first method implies perfect substitutability between *H* and *N*, while the second assumes that no substitutability is possible. Also, the former seems to give employees complete freedom to determine the hours that they want to work, while the latter allows firms to fix employee hours unilaterally.

The difficulty in separating *H* and *N* derives from the fact that they enter the cost function multiplicatively, instead of additively as with most other factors of production. One potential solution to this problem is to specify additional costs of labor that are linked either to hours or to employees but not to both. For example, firms have costs of hiring and training new workers or other costs that are not geared to the hours that they work. These additional "fixed" costs can be specified as *FN*. By equating the slope of the isoquant from equation (2.26) and the revised slope of the budget constraint, we obtain

$$\frac{H}{N} = \frac{(W/P)H + F}{(W/P)N}. \tag{2.27}$$

The only way that this equality can be satisfied is for *N*=0. In other words, a firm faced with such fixed costs would try to get each employee to work virtually infinite hours in order to minimize *FN*. To obtain a realistic trade-off between *H* and N requires an additional element that is related to *H*, but not to *N*. One candidate is wage-hours combinations such as *W/P*= *H* so that measures the slope of the wage profile. If >0, it is assumed that firms pay an hourly wage that rises with the number of hours worked in a period. Now the equilibrium condition becomes

$$\frac{H}{N} = \frac{\rho H^2 + F}{2\rho H N}. \tag{2.27$'$}$$

This expression is solved for an equilibrium value of *H*, which is

$$H = \sqrt{F/\rho}. \tag{2.28}$$

Now *H* will rise with *F* and fall with the value of , which must be positive to allow its square root to be calculated. Nevertheless, it is difficult to envisage a situation where employees are offered a job that has multiple wage-hours combinations dictated by . Except for overtime hours at a premium, employers do not adjust the wage rate for hours of work. Thus, the wage profile has discontinuities and is not a fixed parameter. In view of these problems, it is best to start with a model that determines hours per employee as the interaction between optimizing individual workers and the profit-maximizing firms that hire them. One element of that model should be the requirement for *common* hours from all workers despite their differences in tastes or other heterogeneity factors. Before embarking on that project in the next chapter, the implications of leaving the division between H and N unresolved or arbitrary need to be explored for predictions about wage and employment outcomes in equilibrium and disequilibrium.

2.2.7
Conclusions about Labor Demand

This section has identified the major forces that determine the amount of labor services that will be demanded by firms under different conditions. The most important of these is the scale of operations, indicated by output or by the amount of the fixed factor, and the real wage rate per hour. The former has a positive influence on labor demand while the latter has a negative effect. However, it then becomes problematic to separate the total amount of labor demanded into hours per individual and the number of workers. As a result, labor-market theory either imposes an *ad hoc* constraint on hours per day or per week and concentrates on the number of employees demanded or it simply leaves the division between H and N unresolved and looks at the demand for HN.

2.3
Equilibrium in the Labor Market

The market for aggregate labor hours involves the interaction of individual suppliers and firms which are aggregated to obtain supply and demand curves. In Fig. 2–8, the aggregate labor-supply curve, N^s, is the horizontal addition of H_1, H_2, …, H_N for N individuals. It is drawn with a positive slope, assuming that the substitution effect overpowers any adverse income effect on hours supplied. The demand curve, N^d, also aggregates the demand for labor hours from M firms, HN_1,HN_2,…, HN_M. The market-clearing wage is $(W/P)_0$ per hour, which will rise if either the demand curve shifts to the right or the supply curve shifts to the left.

A once-and-for-all increase in the productivity of labor will shift the demand curve upward and to the right, which will lead to higher real wages and greater employment. The shift of the demand curve is argued as follows: for a given wage, an increase in the marginal product of labor causes firms to increase their labor demand in order to reduce the marginal product to its previous level. To re-establish equilibrium, firms will be prepared to pay a higher wage for each hour of work and this induces an increase in the desired hours of work by individual suppliers. Because of the extra hours of work, the wage rate does not rise as much as the exogenous increase in productivity. Even though there is a fixed amount of capital, output will increase for two reasons: (1) the increased productivity of labor and (2) the greater use of labor services. As long as the labor-supply curve has a positive slope, increased labor productivity leads to

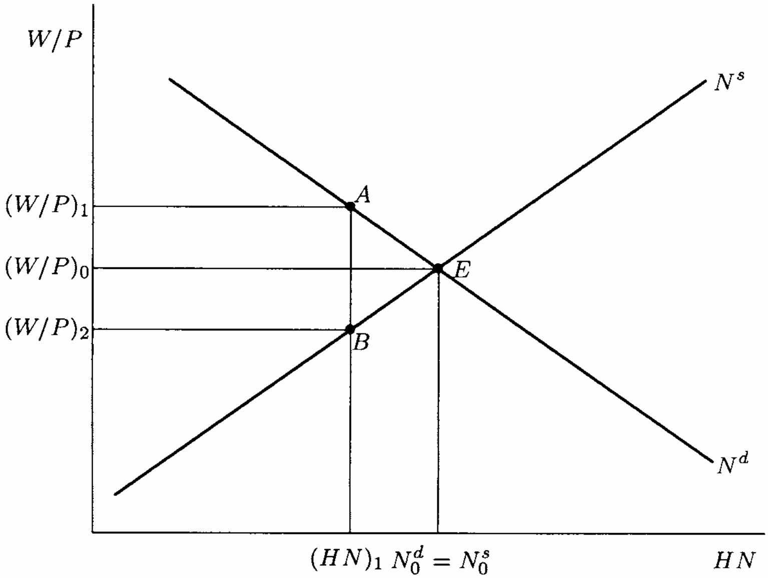

Figure 2–8 The aggregate labor market

greater employment and not reduced labor demand as is often feared when each unit of labor is capable of producing more goods and services.

At equilibrium there may be *voluntary* unemployment. Given the wage rate and other factors, some individuals will decide to supply no labor and for them H=0. A change in conditions such as expected wages in the future could induce these individuals to want to work now at the current wage and this would shift the labor-supply curve to the right, leading to greater employment and a lower wage.

There is nothing in the equilibrium position to require all workers to provide equal hours without constraining hours per worker to equal $\bar{H}$. If firms treat H and N as perfect substitutes, it does not matter how many hours any individual provides. If, on the other hand, firms dictate $\bar{H}$ hours from each individual, then the supply curve is misspecified because it is predicated on the individual's ability to equate the marginal disutility of work to the real wage at the optimal choice of hours. For such situations, it is more appropriate to rely on a reservation-wage model that will be introduced in the next chapter. Thus, the equilibrium depicted in Fig. 2–8 has one of two intractable problems: (1) it does not allow H and N to be determined, or (2) it uses the wrong labor supply curve.

Moreover, at equilibrium there can be no *involuntary* unemployment as both suppliers and demanders are satisfied with the outcome. The natural rate of unemployment, which is normally defined as the unemployment rate consistent with equilibrium, would have to be zero in this case. Despite our inability to measure the natural rate precisely, it has never been seriously suggested that zero is a reliable estimate of this crucial variable in the labor market.

2.4
The Labor Market in Disequilibrium

When the real wage rate does not clear the market, workers and their employers continue to make exchanges and it is vital that the model of the labor market be able to predict the outcomes in terms of hours and number of employees. In disequilibrium, the short side of the market will prevail if involuntary transactions are not permitted. Thus, if the real wage rises to $(W/P)_1$ in Fig. 2–8, total labor hours will fall to $(HN)_1$ as firms reduce their labor input to raise its marginal product to the higher wage. This same outcome would arise if the real wage fell to $(W/P)_2$ as the level of the labor input is constrained by the reduced supply. Thus, both *A* and *B* in Fig. 2–8 produce identical quantities, but different prices. For that reason, we would not be able to distinguish excess supply from excess demand by knowing only the change in the labor input.

Furthermore, the change in the wage does not indicate the extent to which the adjustment was made in hours per worker and in the number of workers. If hours are assumed to be fixed then the reduction is only in workers. If both *H* and *N* can be adjusted, there would have to be changes in *F* or in equation (2.28) to obtain a new value for desired *H* and the residual adjustment would be in the number of employees. Although the slope of the wage-hours combination is unlikely to change, both the real wage and the real fixed cost of employment will vary in the same proportions when goods prices change unexpectedly. In that event, a higher real wage which reduces employment will lead to most of the adjustment coming in the form of lower hours for the same number of employees. This prediction does not conform to the evidence in Ch. 1 which suggested the contrary result: most of the adjustment is borne by variations in *N*, not *H*.

Finally, as usually measured, the unemployment rate would be zero at both *E* and *B*. Only at *A* would there be a positive unemployment rate and even here there is the possibility that all suppliers of labor are employed, but at reduced hours. Therefore, equilibrium is not consistent with a positive natural rate of unemployment and disequilibrium is not consistent with the actual rate falling below the natural rate during excess demand in the labor market.

If the labor-supply curve is essentially vertical on the grounds that the empirical evidence suggests that income and substitution effects tend to cancel each other, then *E* and *B* in Fig. 2–8 have the same level of employment and both points would have zero unemployment. In this situation, it would be possible to distinguish excess demand from excess supply by observing only the labor input.

2.5 Conclusions

The traditional model of the labor market presented in this chapter, despite its appeal at the microeconomic level, is unable to provide clear analytical answers to a number of important macroeconomic questions. These can be summarized as follows: (1) the ambiguous relationship between the real wage and hours supplied by an individual, (2) the difficulty of predicting changes in the intensive margin (i.e., hours per employee) as opposed to the extensive margin of employment (i.e., number of employees), (3) the inability to justify a positive rate of unemployment in equilibrium, and (4) the problem of analyzing exchanges made during disequilibrium. These shortcomings of the model can be repaired, but instead of overloading the traditional model with additional burdens, it is better to start with a reservation-wage approach to labor supply and to include the possibility that firms have job vacancies in equilibrium because of adjustment costs. These features will be highlighted in the next chapter.

3
A New Approach to Labor-market Transactions

The purpose of this chapter is to devise a model of the operation of the labor market that is more useful for macroeconomic analysis than the framework presented in Ch. 2. First, we will concentrate on deriving the optimal number of hours per worker when they all have common hours. Since the requirement for common hours limits the choice available to any individual, a reservation-wage model of labor-force participation will be developed. Then, the focus shifts to the demand for workers, each one providing a fixed number of hours. Even in a smoothly functioning labor market, it is usually observed that firms are unable to fill all the vacancies that they have. The fact that vacancies and unemployment exist side by side will become the basis for the natural rate of unemployment. Finally, the issue of disequilibrium transactions will be explored. Because only a small minority of participants suffer from disequilibrium, it will become obvious why transactions continue to be made in this state.

3.1
The Market for Common Hours

In addition to the data in Chart 1–1 from the Current Population Surveys of 1982 and 1991 that showed a very limited choice of hours available to most workers, a supplementary CPS survey in May 1985 indicated that approximately 35% of the respondents were dissatisfied with the hours that they worked, with eight out of ten wanting to work more hours at the same wage rate.[1] The implication of this evidence is that about a third of all workers are off their labor-supply curve as derived in Ch. 2. Yet these same workers are not being forced to do something against their will. We therefore need to produce an analytical framework that has both freedom of choice and yet provides very limited choice, without at the same time restricting tastes or other sources of heterogeneity. What we find in the labor market is that there is a regular pattern of hours per day or per week that is essentially established by the firm as a take-it-or-leave-it offer to a prospective

[1]See Dickens and Lundberg (1993, pp. 170–72).

worker. Furthermore, firms expect from their workers a set of common hours, defined not only as equal hours for all, but also as simultaneous hours.[2] Firms are able to "bribe" their workers to work common hours by offering them a higher wage rate, which they can afford to pay because of improved productivity from co-ordinated effort or "team-work." In other words, common hours are a Pareto improvement over anarchical hours.

3.1.1
Workers' Choice of Hours

To begin the analysis, we derive the optimal choice for the individual based only on a generic utility function and the budget constraint. Then, to accommodate the firm's requirement for common hours, workers may be off their labor-supply curve and the welfare consequences of that action must be investigated. Finally, the required inducement from the firm to obtain common hours from these workers can be derived.[3]

Workers have a combined utility function and budget constraint of the following general form:

$$U = U(T - H, \frac{W}{P}H + I), \tag{3.1}$$

where T is the total number of hours available divided between leisure and work, H is the number of hours of work, W/P is the real wage per hour, and I is any amount of nonwage income available to the individual which adds to labor income to pay for total goods consumption. The marginal utility of leisure, U_1, is positive but declines with an increase in leisure; the marginal utility of goods consumption, U_2, has the same properties. From the first-order conditions, the optimal choice for the worker-consumer is $U_1/U_2 = W/P$, so that individuals will adjust H, the only variable under their control until the ratio of marginal utilities equals the common wage. If H is initially too high, it will be observed that $U_1/U_2 > W/P$ because U_1 rises with H and U_2 falls with H. If H is too low, $U_1/U_2 < W/P$. This outcome is the same as in equation (2.3) in Ch. 2, but here it is only the first step in determining the hours worked by an individual.

The first-order condition does not require that all people provide an equal number of hours because U_1 and U_2 depend also on tastes or preferences.[4] Also, variations in nonwage income will lead to variations in hours worked: if there exists declining marginal utility of goods consumption, the greater is I, the smaller is U_2. Moreover, there is nothing in the optimization procedure that

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[2]The term "common hours" was first used by Lewis (1969, p. 12), although he considered this requirement to be a special case.

[3]Hamermesh (1996, p. 12) laments the lack of a theoretical basis for common hours. He proposes but does not formulate "…a complete model…embodying both demand and supply behavior and accounting for externalities in scheduling."

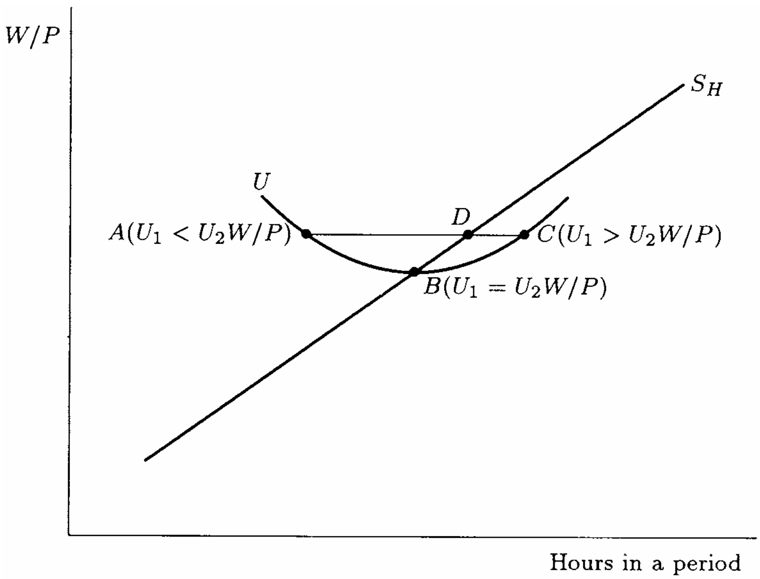

Figure 3–1 Utility and wage-hours combinations

prevents individuals from offering hours that vary by time of day or by day of the week. While we think of the nine-to-five day from Monday to Friday as the quintessential work pattern, the worker's optimization is not constrained to that choice or any other prespecified hours dictated by the firm.

Once it is accepted that workers must be induced to operate away from the supply curve of labor which contains the optimal combination of hours and wages, it is imperative that we have information about their welfare at other combinations of *W/P* and *H*. In Fig. 3–1, a positively-sloped supply curve is shown as S_H. It is therefore assumed that the income effect of a wage increase, although likely to be negative since leisure is usually a normal good, is never large enough to overpower the substitution effect, which is always positive; hence *H* unambiguously increases with *W/P*. By totally differentiating the utility function of equation (3.1) and setting the result equal to zero, we obtain an iso-utility curve that has a slope of .[5] One such iso-utility curve is shown in Fig. 3–1 as the crescent-shaped curve marked *U*. It will have its lowest point on the supply curve, where $W/P = U_1/U_2$. To the right, an individual would require an increase in both *W/P* and *H* to maintain constant utility. The higher goods

[4]Differences in tastes are easily specified in a linear Cobb-Douglas utility function: the person with a "stronger" taste for leisure will have a larger exponent on *T–H* than another person.

[5]This curve is not an indifference curve which would have leisure and goods consumption on the axes, instead of *W/P* and *H*.

consumption available from more hours and greater compensation per hour offsets the loss of leisure and therefore points *C* and *B* are on the same iso-utility curve. In other words, the slope of the iso-utility curve is positive to the right of *B* because $U_1 > U_2 W/P$. At the higher wage at *C*, the individual would want to work fewer hours because that would put her on a higher iso-utility curve at *D,* but firms may insist that this higher wage is only available if the person is prepared to accept *C* as the final position. To the left of *B,* the wage rate must rise but hours must fall to keep utility at the same level as at *B*. At *A,* where $U_1 < U_2 W/P$, the person has been compensated for the undesired leisure by giving her a higher wage for the hours that she works. Again, the person would rather move to *D,* but firms may offer the higher wage only if the individual accepts the shorter hours.

The construction of the iso-utility curve depends on how U_1 and U_2 respond to hours worked. If $U_1/\ H$ is large and $U_2/\ H$ is small, then *U* in Fig. 3–1 will be fairly narrow, while the opposite conditions will lead to a relatively flat iso-utility curve. In the former case, it requires a large increase in the wage rate to induce a person to work an extra hour; in the latter case, it takes a smaller increase to achieve the same result. Also, without more specific information about the person's utility function, we cannot insist that the iso-utility curve is symmetrical around *B*.

The next step in the process of finding a voluntary exchange of common hours between firms and heterogeneous individuals involves taking two persons who would want to work different hours at a common wage and finding the wage premium that would be necessary to induce them to work equal hours. The two individuals are *A* and *B* with the former assumed to want to work fewer hours than the latter at a given wage.

In Fig. 3–2, S_A and S_B are the two supply functions. If the firm has a demand function for labor, $D(H_A, H_B, \ldots)$, where no constraint is imposed on the hours any individual works and if $(W/P)_0$ is the wage rate that clears the market in this situation, then *A* and *B* will choose to work unequal hours with $H_B > H_A$. However, it is possible to obtain $H_A = H_B$ at E, if the firm raises the wage by the vertical distance from $(W/P)_0$ to $(W/P)^*$ and insists that both employees work H^* hours. The narrower are the iso-utility curves, the greater is the wage premium for common hours. Also, the larger the discrepancy between H_A and H_B, the larger is the difference between $(W/P)_0$ and $(W/P)^*$ for any given curvature of U^A and U^B. Moreover, if the firm desired a different level of common hours than H^*, it would have to pay an even larger wage premium. If the firm wanted more hours than H^*, it would move along U^A to the appropriate place with both *W/P* and *H* rising; in the process B's utility would rise above U^B. In the opposite direction, the firm would move along U^B to its preferred position; this time *A*'s welfare rises with higher wages and less hours. Therefore, $(W/P)^*$ is the minimum wage that has to be paid for common hours, with the premium rising for common hours either above or below H^*.

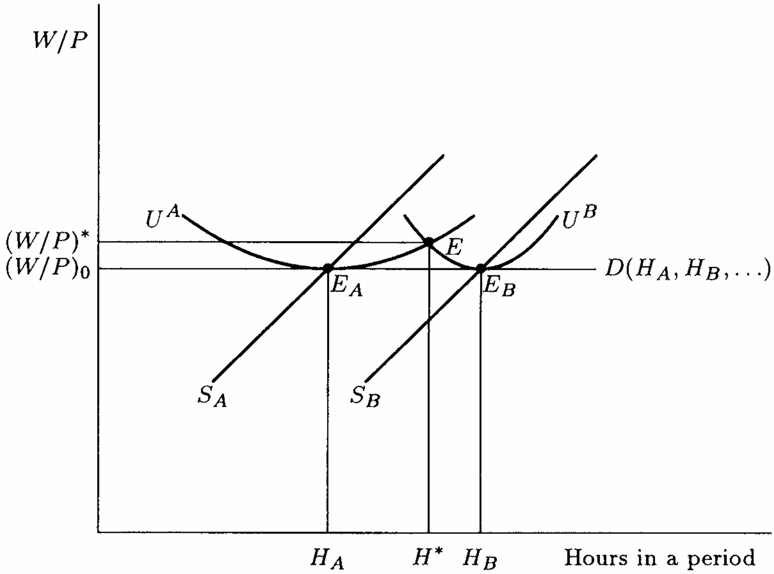

Figure 3–2 Heterogeneous labor supply and wage-hours outcomes

This analysis has only established the required wage premium for equal hours from *A* and *B*. To achieve simultaneous hours involves the same framework as depicted in Fig. 3–2, with *A* and *B* differing in the timing of their equal hours at $(W/P)_0$ (i.e., *A* wants to work early in the period and *B* late). Then, $(W/P)^*$ and H^* shows how they compromise to establish common hours. Combining equal and simultaneous hours to obtain common hours requires two premia: the first one to get *A* and *B* to compromise on the number of hours per period and the second one to arrive at the same timing during the period.

It is now useful to introduce a third individual, *C*, whose desired hours fall between H_A and H_B. This individual's iso-utility curve would be tangent to $(W/P)_0$ between E_A and E_B. This person would play no role in the determination of common hours at *E,* but would gain in welfare from their adoption because *C* would move to a higher iso-utility curve that intersects at *E.* From that perspective, it is most appropriate to choose *A* and *B* as the individuals at the two extremes of the hours decision at a given wage, with *A* being the person who would work the fewest hours and *B* the most hours. Therefore, in an array of a large number of individuals, all with different supply curves of hours, only the two persons at the extreme ends of the array are involved in the determination of common hours and the wage premium that they require; all the others will accept this outcome and have higher welfare to compensate for their passivity. This result is contrary to the traditional analysis which does not impose the constraint of common hours, where any individual's choice of hours is as important as everyone else's for the determination of the wage rate and hours actually worked by that individual.

3.1.2
The Firm's Incentive for Common Hours

If the firm has to pay a wage premium to induce workers to have common hours, we must investigate the firm's ability to pay that premium. As a first step, the role of hours of work in the production process is introduced into the production function. Then, the profit-maximizing wage is obtained for common hours. Finally, the demand for common hours can be integrated with the supply of hours derived in the previous section.

The Production Function

The firm relies on a technology that translates its factor inputs into output, summarized by the following general production function:

$$Y = Y(H_A, H_B, \ldots), \tag{3.2}$$

where Y represents output; there are additional inputs into the production process besides the hours of A and B, such as capital and other workers. One could think of H_A and H_B as being perfect substitutes if the skills and productivity of A and B were identical so that one extra hour from A would exactly compensate for one hour less from B. In that case, the isoquant for H_A and H_B would be linear with a slope of −1. However, if the production process requires A and B to work together and simultaneously, H_A and H_B become perfect complements that have to be used in fixed proportions. For this situation, the isoquant is L-shaped with its kink at H_A=H_B. In the perfect-substitutes case, equal hours play no role in the firm's decision, but in the perfect-complements case they are vital to the efficiency of the production process. In between, there may be a case in which H_A and H_B are gross substitutes. With decreasing marginal productivity of both factors, the isoquant will be convex from below with a slope of , where Y_A, Y_B decrease with H_A, H_B, respectively. It will be assumed that Y_A/Y_B=1 when H_A=H_B so that a single wage, *W/P*, can be paid when equal hours occur.

This convex isoquant is shown in Fig. 3–3 as Y_0. Also, the budget constraint, where Z represents total factor payments, written as

$$Z = (W/P)(H_A + H_B) \tag{3.3}$$

is drawn in the diagram. It must have a slope of −1 and its intercept on either axis will be *Z/(W/P).* If A and B choose different hours of work at a common wage, as in Fig. 3–2 at $(W/P)_0$, this result is replicated in Fig. 3–3 at the point F. Without changing total expenditures, Z, and therefore profits, the firm could pay a higher wage if A and B could be induced to work equal hours. This is shown as the lower budget line that uses *(W/P)*** as the wage rate. The result is now H_A $-H_B$ at E. The greater is the convexity of the isoquant, the greater is the

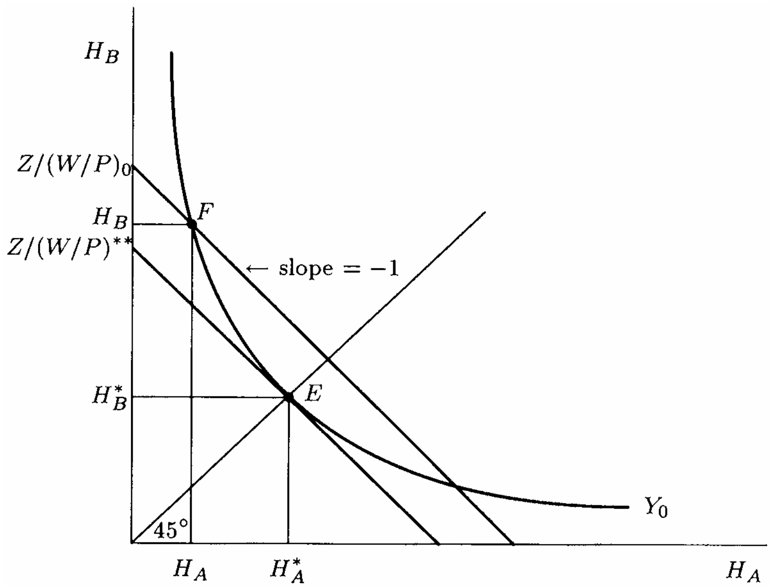

Figure 3–3 The firm's choice of combinations of H_A and H_B

difference between $(W/P)_0$ and $(W/P)^{**}$. In fact, for the case of perfect complements, the isoquant at F would produce less output than at Y_0. At the other extreme, if H_A and H_B are perfect substitutes, the isoquant and budget constraint will coincide throughout their length and there is no optimal choice of hours from the two individuals.

This argument only establishes the equality of H_A and H_B for production processes other than perfect substitutes, but not their simultaneity. However, Y_A and Y_B depend not only on the amount of H_A and H_B, but also on their common presence. If $Yi=0$ when H_A is equal to but not simultaneous with H_B, then this is equivalent to the perfect-complements case discussed above; only if Y_i is independent of any overlapping hours will the case of perfect substitutes be applicable.[6]

Another approach to the requirement for common hours relies on the importance of supervision in the production process. Economies of scale to supervision can be attained because a single person can supervise a number of workers but only if they work common hours. Therefore, common hours reduces the costs of supervision and firms have an incentive to pay workers higher wage rates for this concession in order to save on these managerial costs.

Combining the required wage premium in Fig. 3–2 for common hours with the ability of the firm to pay higher wages when $H_A=H_B$ in Fig. 3–3, the conclusion is that common hours will occur if $(W/P)^{**}$ $(W/P)^*$, that is, if the profitability of common hours is greater than or equal to the incentive needed for A and B to be

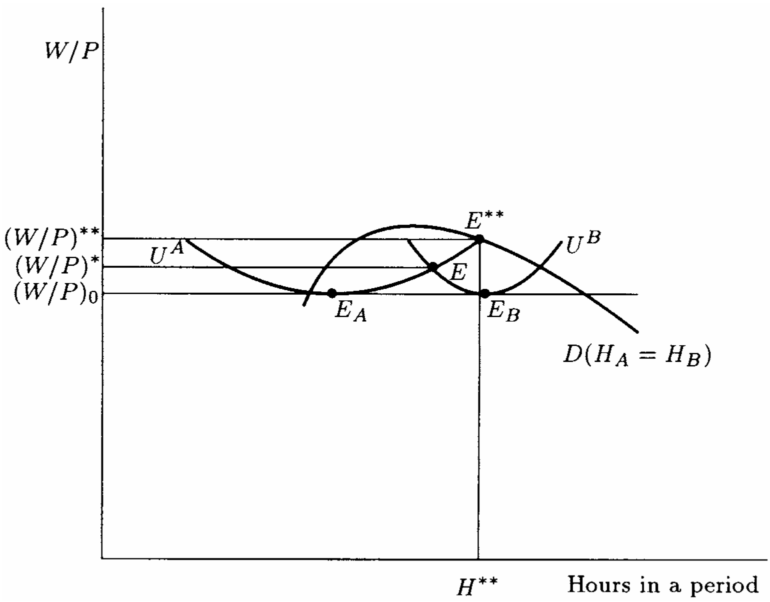

Figure 3–4 Equilibrium in the market for common hours

persuaded to accept common hours despite their different preferences or circumstances.

The Demand for Common Hours

Although we have been able to establish the possibility of workers and firms agreeing to common hours, we have yet to find the optimal choice for these hours. For this, it is necessary to specify the effect on output of increasing H_A and H_B together. This may be called the scale effect. It is likely that output initially increases at an increasing rate as workers get into a rhythm of work, but then at a decreasing rate as boredom or fatigue set in.[7] This pattern will prevail whether we specify hours per day or days per week. The marginal product of both workers together becomes the demand curve for common hours and is shown in Fig. 3–4 as the inverted U-shaped curve. Superimposed on this diagram are

[6]Lewis (1969, p. 13, italics in original) wrote: "I fail to see why…efficient *timing* of performance of functions should commonly have significant consequences with respect to non-timing aspects of the hours of work of team members, either relative to each other or in terms of the absolute average hours worked." Hamermesh (1996, p. 42) makes the contrary argument: "The overwhelming majority of workers put in regular day shifts." See also his Fig. 3.1U (p. 45). I believe that most jobs, except perhaps for self-employment, involve some team-work and co-ordinated effort; it is difficult to enumerate exceptions.

the iso-utility curves of *A* and *B* from Fig. 3–2 to allow for the determination of feasible outcomes. If $D(H_A=H_B)$ were drawn entirely below the point *E,* it would be impossible to find a wage rate that induced workers to supply common hours. From the workers' view point, the final combination of common hours and the wage rate must lie along segments of U^A and U^B on either side of and above *E.*

To determine which point on its demand curve the firm favors, we must determine the profitability of various points on $D(H_A=HB)$. The simplified profit function can be written as

$$\Pi = Y(H)N - \frac{W}{P}HN, \tag{3.4}$$

where *H* now represents the number of common hours from each of *A* and *B,* who together add up to *N.* Differentiating equation (3.4) totally provides us with an evaluation of per capita profits as wages and hours change: *d* $=-Hd(W/P)$ because along the demand curve, Y_H, the marginal product of hours will equal the real wage, *W/P,* and thus rises when the wage falls. The aim of the firm is to be in the lowest possible position on the demand curve. Thus the firm would not choose a point in the positively-sloped portion of the demand curve, nor would it want to maximize the marginal product of common hours. Instead, it will choose *E***, which is its profit-maximizing combination of *H* and *W/P* and is consistent with the incentive needed to have *A* and *B* provide these common hours. In that equilibrium, *A*'s welfare has remained constant, but *B* has been able to move to a higher iso-utility curve. In fact, as it is drawn, Fig. 3–4 shows that *B* has hardly changed the original choice of H_B hours; therefore, *B* receives rents as part of his wage income. As a result, if *B's* supply function shifted for any reason, it would have no effect on the outcome, because only U^A is used in the determination of *E***.

It is, of course, possible that the demand curve lies further to the left and intersects U^B above *E,* but not U^A, in which case, the roles of *A* and *B* are reversed: *A* receives additional welfare and rents and only *B* matters for the determination of equilibrium. Previously, we eliminated all but the two extreme individuals in the determination of the wage premium necessary to obtain common hours from all workers. Now we can eliminate either *A* or *B.* The worker who determines the equilibrium of common hours and the wage rate has the following characteristics: (1) he is the only person who does not increase his welfare from the original individualistic choice of hours, and (2) he makes the largest adjustment in hours because he started at the extreme end of the distribution, either wanting to work the most or the least hours at a given wage.[8]

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[7]This is the same assumption as in Barzel (1973, p. 221).

[8]Lundberg (1985, p. 409) finds empirical support for the proposition that the supply of hours increases with the hourly wage rate. This suggests that *A* is the crucial person in the common hours determination because *B* wants fewer hours at a higher wage.

3.1.3
Influences on the Equilibrium of Common Hours

Once the equilibrium position at E^{**} in Fig. 3–4 is established, it is possible to investigate the influences on that equilibrium. The individual who was identified above as the person at the margin may change her desired working hours. If she is *A* (short hours) and she wants increased hours, this is unlikely to change the equilibrium because she will be replaced at the margin by the next person in the hours distribution. Only if she wants to work less will common hours fall. This feature is likely to explain the slow secular decline in hours of work during the postwar period. From 43.5 hours in 1947, the average weekly hours of all workers in all industries fell to below 40 hours in the 1970s.[9] If the original equilibrium used *B* (long hours) as the decisive person, only increases in desired hours would have an influence on the equilibrium.

On the demand side, a rightward shift of $D(H_A=H_B)$ in Fig. 3–4 due to increased productivity of common hours, will lead to an increase in H^{**} and $(W/P)^{**}$. This could explain the use of overtime hours during an initial expansion in output, when firms would rather have their continuing employees work extra hours at a higher rate of pay than add more workers and absorb the additional hiring and training costs.

The general conclusion is that except for the marginal worker, firms dictate the hours that they expect from their workers. This does not mean that these workers are indentured servants; they adjust willingly because the wage rate is sufficiently higher than it would be if they were allowed to choose their work hours individually.

So far, all firms have been assumed to be identical, but it is possible that there are several demand curves for common hours depending on the production process that is relevant for the firm. For example, some firms may find that full-time work is most profitable while others want part-time workers. In that case, there is a possibility of multiple equilibria and in the extreme case, each worker will be able to find a job that provides the number of hours that allows him or her to remain on the supply curve. However, from the evidence in Chart 1–1, the availability of jobs that provide other than 40 hours a week is quite limited. In particular, despite the presumed smoothness of the production function, only 446 individuals worked either 39 and 41 hours a week in 1991, compared to 95,453 who reported 40 hours. Moreover, Dickens and Lundberg (1993, p. 186) report: "The average man in our sample [of 555 married men from the control group of the Denver Income Maintenance Experiment] receives 2–4 job offers, and is working about 11 hours less than he would like because offers in the most preferred 45–55 hour range are scarce." Therefore, it appears that there is much greater diversity on the supply side than on the demand side and because firms

[9]See LHCH in CITIBASE. Barzel (n.d., p. 10) argues that over a longer time-frame, hours per day fell until 1940, but since then days per year have been reduced.

dictate the hours decision, there will be limited choices for individuals in their hours of work.

3.1.4
Conclusion

Both workers and firms have an incentive to restrict the choice of hours of work in a day or week. The wage rate is correspondingly higher than it would be if there were unco-ordinated hours. Also, except for the person at the margin, all other workers are earning rents at the wage rate that establishes common hours. Therefore, heterogeneity of tastes is reflected in variations in these rents rather than in differences in hours of work. Moreover, while it may not satisfy everyone's sense of fairness, those who make the greatest compromise to achieve common hours receive the smallest rents.

3.2
The Reservation-wage Model

For all potential workers except the person on the margin, there is a willingness to accept a fixed number of hours per period of time, which will be denoted by $\bar{H}$. This is not an *ad hoc* constraint, but instead is an optimum derived from the interaction of the marginal worker and any number of homogeneous firms. It is shown as H^{**} in Fig. 3–4. Therefore, the unconstrained optimizing model of equation (3.1) should be replaced by a reservation-wage model that forces the individual to decide on the wage that creates indifference between not working at all and working $\bar{H}$ hours.

3.2.1
Determination of the Reservation Wage

The equal-utility constraint should be written as

$$U(T,I) = U\left(T-\bar{H}, \left[\frac{W}{P}\right]_r \bar{H}+I\right), \qquad (3.5)$$

where $(W/P)_r$ is the real reservation wage that is the only variable in equation (3.5) under the control of the individual. If the actual wage exceeds the reservation wage, the person will decide to accept the combined wage-hours offer, but if it falls short of the reservation wage, the person will not be in the labor force. In addition to the previous characteristics of the utility function, it is further assumed that an absence of either leisure or goods consumption leads to zero utility, so that $U(0,C)=0$ or $U(T,0)=0$.

Fig. 3–5 shows the process of determining the reservation wage diagrammatically. The two choices for hours are shown as vertical lines from $\bar{H}$ and $H=0$, with the former to the left of the latter because hours of work are

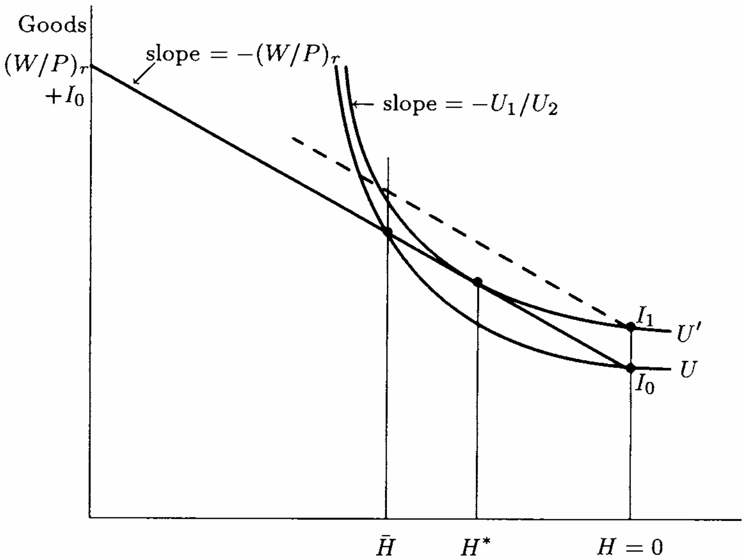

Figure 3–5 Determining the reservation wage

measured from right to left. An initial indifference curve, U, is drawn with its normal convex properties and where it intersects these two lines are the points of indifference between them. Then, a straight line is drawn through these points, the slope of which is the reservation wage. The "height" of the utility curve is established by the amount of nonwage income, I_0, which allows consumption of this amount if the person chooses not to work. In the absence of any nonwage income, the individual will offer to work at any positive wage to avoid the possibility of $U(T, 0)=0$. At the reservation wage, the consumption of goods expands to

It is now evident that any wage rate above the reservation wage will increase utility above U but only if the person works. On the other hand, any wage offer below $(W/P)_r$ will be rejected because it would lower utility. The second-best nature of this result is evident from the fact that at the wage rate $(W/P)_r$ the individual would work H^* hours rather than the two extreme choices that he faces. The difference between U and U indicates the "sacrifice" the person is making to accept common hours. Alternatively, in Fig. 3–1 the person would prefer to be on the supply curve at *D,* where welfare is higher than at *A* or *C.*

As the wage rate rises above the reservation wage, it is not clear whether individuals will be working too little or too much compared to their first-best choice. If the substitution effect of higher wages overpowers the negative income effect, as in Fig. 2–3(a) in Ch. 2, desired hours will rise with the wage rate and at some point $\bar{H}$ will be optimal. Further wage increases beyond that point will mean that individuals will want to work more hours than $\bar{H}$. However, for those

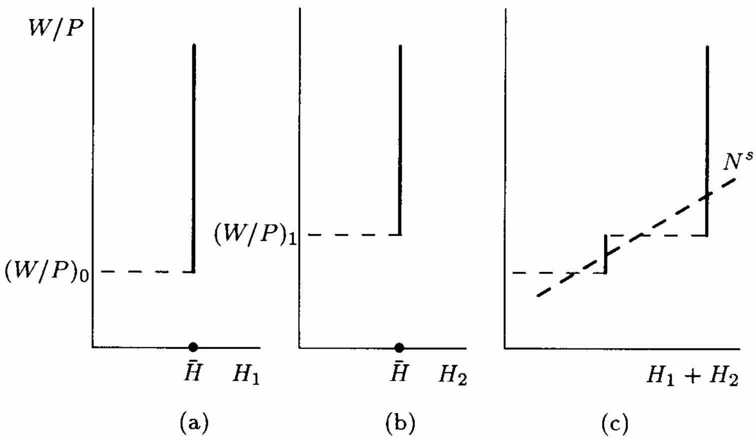

Figure 3–6 Aggregating two individual labor-supply decisions

persons whose utility function dictates a negative relationship between wage rates and hours, the initial distortion will get worse as wages rise. From the survey evidence that shows a large proportion of the respondents wanting to work more hours at the wage rate that they now receive, it appears that H^* increases with the real wage (i.e., H^* moves to the left in Fig. 3–5 as the budget constraint becomes steeper) and that for those individuals.

3.2.2
The Supply of Workers

The supply of labor can be derived from this reservation-wage framework. Since the individual works either zero hours or $\bar{H}$ hours, her supply curve will be a reversed *L*-shape. For the person with a reservation wage of $(W/P)_0$, this supply curve is shown in panel (a) of Fig. 3–6. A second person with a higher reservation wage of $(W/P)_1$ will have a supply curve as shown in Fig. 3–6 (b). Aggregating these two individuals by adding hours horizontally produces the "stair-step" supply curve in panel (c). As we increase the number of individuals, the steps become smaller and the dashed line in panel (c) becomes the supply curve for the entire labor market. It is easily verified that this supply curve must have a positive slope; as the wage rate is increased, someone's reservation wage will be surpassed and that person will add $\bar{H}$ hours to the previous supply. It is, therefore, impossible to have a "backward-bending" labor-supply curve. Only when all reservation wages have been exceeded will the supply curve become vertical. Although the horizontal axes in Fig. 3–6 measure hours, the supply curve can be converted to number of workers because $\bar{H}$ is fixed. The elasticity of supply depends on the response of individuals to a change in the wage rate. If reservation wages are bunched together, the elasticity is high, but if the distribution of reservation wages has some empty segments, the elasticity will be zero in those regions. Thus, if everyone had exactly the same reservation wage, the supply curve would be entirely vertical and the elasticity would be zero.

3.2.3
Factors Influencing the Reservation Wage

By differentiation of equation (3.5), the determinants of the reservation wage can be found:

$$d\left(\frac{W}{P}\right)_r = \frac{1}{U_2\bar{H}}\left[(U_1 - U_2(W/P)_r)d\bar{H} + (U_2^{H=0} - U_2)dI\right], \qquad (3.6)$$

where partial derivatives without identifying superscripts are evaluated at $\bar{H}$. Since $U_1/U_2>(W/P)_r$ at , which $\bar{H}$ exceeds optimal hours at that wage rate, an increase in required hours must lead to a higher reservation wage. As a consequence, part-time work will have a lower reservation wage than full-time work. The co-existence of part-time and full-time work would create some complications for the supply curve in Fig. 3–6. A person who initially accepted part-time work when the reservation wage for this type of job was exceeded may now switch to full-time work if the wage rises even more. In this case, the supply of hours has increased but the number of individuals has remained constant. An increase in $\bar{H}$ should not be confused with a demand that workers put in overtime hours because the latter involves different wage rates for different levels of hours as was shown in Fig. 2–5 on p. 42.

There are also noneconomic costs to employment, such as the popular lament of being “stressed out” on the job. It is not clear how to incorporate such costs into the utility function, but one could argue that it increases the number of hours that a person works and recovers from the effort. In turn, higher $\bar{H}$ hours raise the reservation wage according to equation (3.6). Therefore, noneconomic costs reduce participation rates.

Also from equation (3.6), an increase in nonwage income will have ambiguous effects on the reservation wage, depending on what happens to the marginal utility of goods consumption. In Fig. 3–5, consider an increase in nonwage income from I_0 to I_1. The indifference curve through I_1 intersects the $\bar{H}$ constraint below the dashed line which has the same slope as the original reservation wage; therefore the reservation wage falls. Nevertheless, it would have been possible to draw U' to intersect $\bar{H}$ at a higher point, in which case the reservation wage would be higher. To resolve this ambiguity, we would appeal to the declining marginal utility of goods consumption. A person who works will consume more goods and therefore , which according to equation (3.6) requires that there be a positive relationship between the level of nonwage income and the reservation wage.

3.2.4
Welfare and Rents

The positively-sloped labor-supply curve in Fig. 3–6(c) is predicated on the assumption that individuals differ in their reservation wage because of heterogeneity in tastes or variations in nonwage income. Their experience in the labor market will also lead to differences in welfare. Once a person decides to participate in the labor market, utility will increase with the wage rate as goods consumption rises but leisure remains constant at . Hence a person with a low reservation wage has greater utility from work than a person with a high reservation wage. This is seen in Fig. 3–6 where the person in panel (a), who has the lowest reservation wage, will receive rents equal to when the wage rate is at $(W/P)_1$, while the person in panel (b) will not receive any rents until the wage rises even higher. Even though both persons are paid the same wage rate for the same hours of work, the individual with the lower reservation wage has a larger component in the form of rents than the worker with the higher reservation wage.

The link between reservation wages, utility, and economic rents is derived from the fact that the worker does not change any decision about leisure as the wage rate moves up or down. In Fig. 3–5, if the wage rate rises above $(W/P)_r$, the person will move upward along the $\bar{H}$ constraint to ever-higher indifference curves and the increased consumption available from rising wages is supported by economic rents. These rents cannot be eliminated unless individuals reveal their reservation wages and they have every incentive to keep this information private for fear of being offered a wage that is only slightly above their reservation wage.

3.2.5
Taxes, Commuting Costs and Time-shifting

In Ch. 2, a number of events were postulated and their effects on labor supply were investigated. In the reservation-wage model, these conclusions have to be revised. The introduction of a wage tax reduced the rate of return on work and, depending on the utility function of the individual concerned, created an incentive to adjust hours of work. In the reservation-wage model, this adjustment is not possible. As long as

$$\frac{W}{P}(1-\tau) > \left(\frac{W}{P}\right)_r, \tag{3.7}$$

the individual will make the same decision after the tax, , is applied as before. In fact, a government trying to maximize its revenue from the wage tax could increase the rate until the inequality in equation (3.7) becomes infinitesimally small. However, since tax policy is a public-choice decision rather than a market outcome, it is also obvious that those who are about to lose their rents to the government are likely to spend resources of equal value to prevent the implementation of the tax. Individuals with the lowest reservation wage and thus the highest rents will lobby the most against the tax.

The introduction of commuting costs in equation (2.2) on p. 37, either in time, H_f, or in money, F, will also not affect the participation decision unless they reduce the effective wage rate below the reservation wage. Instead, people will be encouraged to reduce commuting time by moving closer to their jobs. Those whose wage rate is just above their reservation wage will be working more hours than they wish and they have the strongest incentive to increase their leisure hours, , by minimizing H_f. Commuters will also want subsidized transportation costs to maximize their net rents because they are unable to increase their hours of work to spread the fixed money costs of commuting over a longer period of work.

If a person is maximizing a multi-period utility function, there may be good reason for wanting to work more hours this period and fewer hours in subsequent periods or *vice versa.* Once H is fixed, the option of time-shifting of work is no longer possible as long as the wage rate the person expects to receive exceeds the reservation wage. However, the model of equation (3.5) provides a more obvious rationale for choosing H=0 in some periods than does the model presented in Section 2.1.7. Here, a student who has decided to postpone employment and a prospective retiree both have high reservation wages, presumably because their nonwage income is sufficient to enable them to enjoy complete leisure and enough goods consumption. Moreover, unlike the intertemporal model shown in Fig. 2–4 on p. 40, it may not take much of a change in the wage rate offered to either person to make them move from H=0 to $\bar{H}$.

3.2.6
Summary

The reservation-wage model has a number of advantages over the model that predicts the optimal choice of hours: (1) it is not necessary to deal with the ambiguity created by the income effect of a wage increase on the supply of hours, which in turn gives rise to uncertainties about the slope of an individual's labor-supply curve; (2) it makes the explanation for individuals who choose H=0 much easier; (3) it allows for diversity of tastes and other factors and identifies the sources of economic rents in the labor market.

However, there are empirical disadvantages to the reservation-wage approach. It would be irrational for a person to reveal his or her reservation wage and it is virtually impossible to proxy its determinants. The Current Population Survey is the source of much of the data on US labor-market activity and questions about employment status, occupation, wages, hours of work, educational attainment, etc. are asked of the approximately 60,000 participants each month, but none of this information allows us to deduce the minimum wage that the person would accept for the job presently held or being contemplated. In fact, it is quite likely that most employed people could not calculate their reservation wage because it is a complex mental exercise that requires comparisons of two welfare positions, both of which are far removed from their daily experience. It is for this reason that estimates of the elasticity of supply based on the gap between actual and reservation wages are non-existent.[10]

Despite these empirical difficulties, the limited choice of hours in the face of differences in tastes or nonwage income makes the reservation-wage model of labor supply more appropriate and more revealing than the standard approach of hours optimization. There is an extensive literature on reservation-wage models, but it has found acceptability in limited circumstances: for example, when fixed monetary or time costs have to be subtracted from wage income.[11] But the participation decision is the crucial one in a wider set of circumstances because firms and workers find it mutually advantageous to consider only a few possibilities for hours of work.

3.3
The Demand for Workers and Employment

Firms, it is argued, optimize the intensive and extensive margin of employment separately. It is not suggested that substitutability between hours and employees is impossible in the production process, but changing the common hours established in Section 3.1 will not occur frequently because the production function involving common hours is not subject to a lot of technological improvement as co-ordination, interaction, and supervision continue to remain crucial factors. Also, the decisions of the extreme worker (i.e., either A or B in Fig. 3–2) are relatively constant, or if not, that person will be replaced by one with similar tastes and endowments. The fact that those cases of standard-hours adjustment that do occur are highly publicized indicates the rarity of such events. [12] Hence, in the following discussion, a firm takes $\bar{H}$ as parametric and optimizes the number of employees on its payroll.

3.3.1
Factors Influencing the Demand for Workers

The demand for labor is derived from the profit function which is written as follows:

$$\Pi = Y(\bar{H}N, K) - \frac{W}{P}\bar{H}N - \frac{R}{P}K, \tag{3.8}$$

[10]Surveys of the empirical literature by Ehrenberg and Smith (1994, Ch. 6), Mroz (1987) or Pencavel (1986) do not report estimates of the supply elasticity based on reservation wages. Despite the wording of the title, Blau (1991) does not deal with reservation wages as defined here.

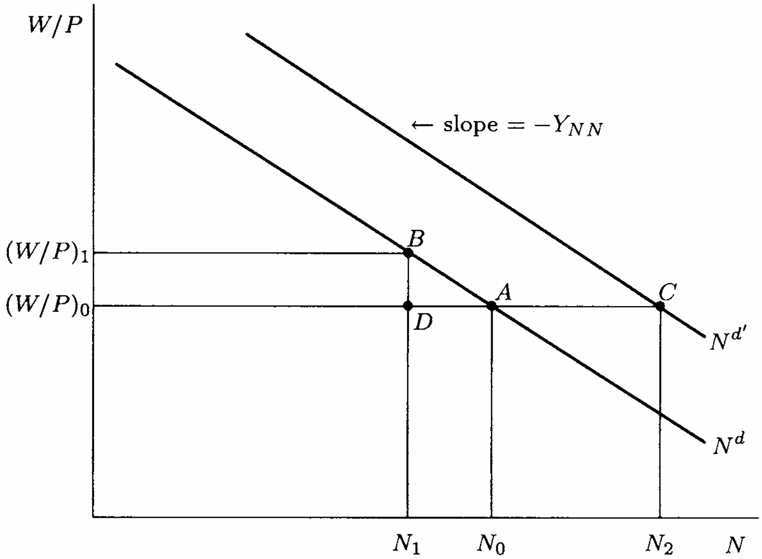

Figure 3–7 The demand for workers

where stands for the total hours worked by the firm's labor force and K represents the capital stock used in the production process. Each person works $\bar{H}$ hours per period for *W/P* per hour or per period. The firm also pays a user cost for its capital equipment equal to *R/P* per unit of time, as if it were leasing its capital from a firm specializing in this function. If the capital stock is fixed for the time-frame of the analysis, the firm will equate the marginal product of employees to the real wage, namely

$$Y_{\bar{H}N} = \frac{W}{P}, \tag{3.9}$$

which allows us to determine desired employment because each level of N has a unique value of when there exists declining marginal productivity of each factor. [13]

Now, we can investigate the effects of exogenous events on the demand for workers. First, consider an increase in the real wage, with both hours and capital held constant. When a firm has to pay its workers a higher wage, it will only do so if the marginal product of each person rises. The method by which the firm can achieve this is to reduce the labor input; hence, *W/P* and N are inversely related and the demand curve for workers is downward sloping, as in Fig. 3–7.

[11]See Ehrenberg and Smith (1994, Appendix 6A).

[12]The negotiations to reduce standard hours in the engineering industries in Germany in the early 1990s were protracted and costly to both sides, in part because of differences over what wage should be maintained: the hourly or the weekly wage.

The extent of the move from N_0 to N_1 in that diagram, in response to the increase in the real wage from *(W/P)*$_0$ to *(W/P)*$_1$, is determined by the slope of the demand curve or the value of Y_{NN}. The greater is the fall in the marginal product of a worker when one more is added, the steeper is the demand curve and the smaller is the reduction in *N* necessary for a given change in the real wage. This feature allows us to translate changes in the labor input into changes in output as well, evaluated at the marginal product of a worker; therefore, output is smaller at *B* than at *A*. This is different from looking at the responsiveness of the demand for labor to wage changes, but holding output constant, as would occur when we rotate a budget line along a given isoquant, as in Fig. 2–6 on p. 46.

Second, allow the firm to have an additional amount of capital. In this event, the firm will hire more workers because their marginal product at the original labor input is now automatically raised and needs to be reduced to the level of the prevailing wage. This is seen as a rightward shift of the demand curve to in Fig. 3–7, allowing firms to hire more workers to N_2 if the real wage is held constant at *(W/P)*$_0$. Output will rise in the move from *A* to *C*, because of the initial increase in the capital stock and through the subsequent hiring of new workers. The demand curve would also shift upward if there were an exogenous increase in the marginal product of each worker through disembodied technical improvements.

3.3.2
Adjustment and Disequilibrium Costs

By definition, total demand for labor equals actual employment plus vacancies, which may be defined as "unemployed jobs" to make them symmetrical with unemployed persons.[14] These vacancies are created by the existence of additional costs other than the direct payments to factors of production. The additional costs are:

$$J = \alpha_1(N - N_{-1} + Q)^2 + \alpha_2(N^d - N)^2. \tag{3.10}$$

The term attached to $_1$ reflects adjustment costs of moving the labor input from its immediate past value to its optimal value and the term with $_2$ represents disequilibrium cost of being away from the optimal amount of *N*. These costs are quadratic so that they are symmetrical around N=N_{-1} and N=N_d and rise faster than the extent of the adjustment or disequilibrium. The adjustment costs are incurred whenever a new employee is added to the workforce or an existing employee is laid off or fired. They include hiring and training costs when N>N_{-1}

[13]In the subsequent discussion, to simplify notation, it will be assumed that by an appropriate adjustment in *W/P*.

[14]Jackman, Layard, and Pissarides (1989, p. 377) defined a vacancy as "a job which is currently vacant, available immediately and for which the firm has taken some specific recruiting action…"

as well as any termination costs that may have to be paid if an employee is fired or laid off when $N_{-1}>N$. In the absence of quits, Q, which are voluntary departures from the employer, N would reach the desired level and would remain constant until a new development in the profit function dictated an alternative number of employees. In this case, $J=0$ in equation (3.10). However, quits are a periodic event and prevent adjustment costs from being eliminated over time. The disequilibrium costs, on the other hand, are incurred because the firm will have optimal vacancies and can be quantified by the extra costs that have to be paid when a firm is not at the equilibrium condition given by $Y_N=W/P$. The rationale for quadratic cost functions will be taken up in more detail at the end of this section.

Optimal Vacancies

Since a firm is attempting to minimize the *sum* of adjustment and disequilibrium costs, it will not be able to eliminate either one and thus there will be optimal vacancies in equilibrium.[15] In other words, there is now a distinction between the demand for employees, which is given by equation (3.9) and determines N^d in equation (3.10), and the *use* of employees which is obtained from minimizing J in equation (3.10). Thus, optimal labor use is given by

$$N^* = \frac{\alpha_1 N_{-1} - \alpha_1 Q + \alpha_2 N^d}{\alpha_1 + \alpha_2}. \tag{3.11}$$

Then, since $V=N^d-N$,

$$V^* = \frac{\alpha_1 (N^d - N_{-1} + Q)}{\alpha_1 + \alpha_2}. \tag{3.12}$$

The process by which N^* and V^* are determined is shown in Fig. 3–8. Starting at a position of N_{-1} with the aim of moving to N^d, a firm will minimize the sum of these two costs that it faces and hire additional workers that move it to N. Here adjustment costs are equal to A and disequilibrium costs are B, which sum to the vertical distance to C. Any attempt to move immediately to N^d would involve larger costs at D, where total and adjustment costs coincide since disequilibrium costs have been eliminated. Therefore, the distance between N and N^d equals the number of vacancies that the firm has accepted as optimal. During the period, the firm also experiences quits, which will move it back towards N_{-1} at the start of the next period and the process repeats itself until the firm finds itself in a steady position on a treadmill because new hires, which push it ahead, just equal quits that pull it back and the adjustment-cost curve does not move over time.

[15]It may appear sensible to put the additional costs in equation (3.10) directly into the profit function of equation (3.8) and to re-optimize the number of workers, N, but this would not let us determine vacancies.

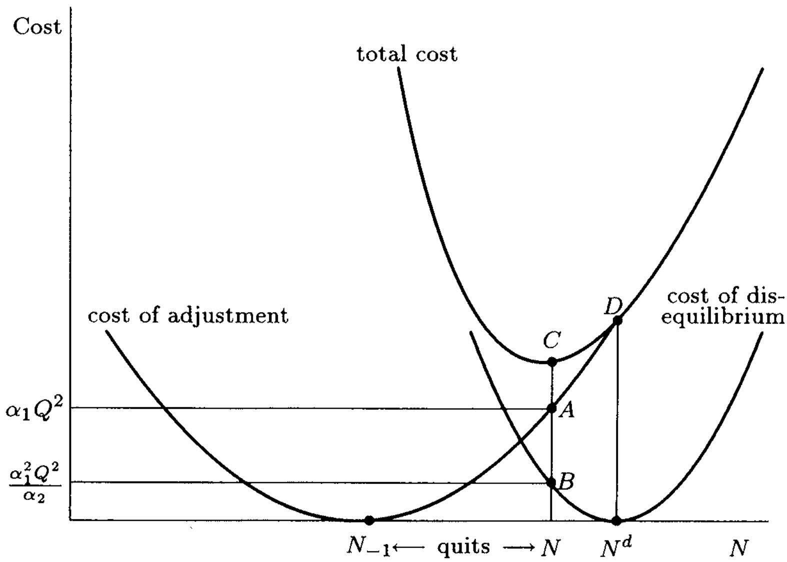

Figure 3–8 Adjustment and disequilibrium costs in the labor market

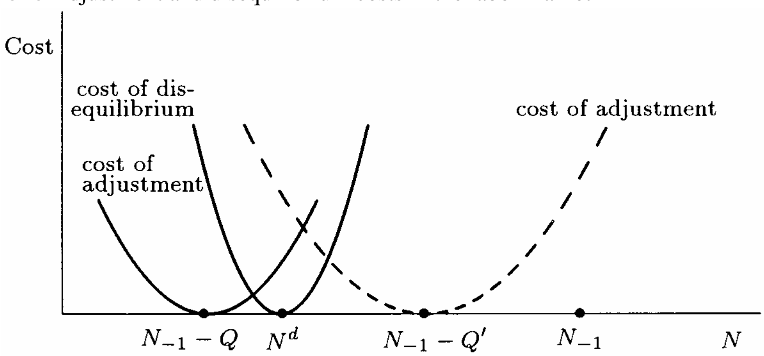

Figure 3–9 Adjustment and disequilibrium costs when $N_{-1}>N^d$

Fig. 3–8 has been drawn on the assumption that $N^d > N_{-1}$ and that employment should increase. However, adjustment and disequilibrium costs operate symmetrically in a situation where $N_{-1}>N^d$ and firms want to reduce their labor input. This is shown in Fig. 3–9. In this case, the existence of quits actually helps the firm to make adjustments because people who leave jobs voluntarily are assumed not to involve termination costs. If quits are relatively large compared to the lay-offs that firms are contemplating, then and firms will actually have to hire new workers to move back to N^d. The optimal level of N is somewhere between and N^d and involves total cost minimization (not shown) essentially the same way as in Fig. 3–8. However, if quits are small (i.e., Q) then and firms will have to shed additional workers to minimize total costs. In that case, actual employment will exceed the demand for labor and according to equation (3.12), $V^{*}<0$. Although such a situation may be interpreted as labor hoarding when firms have more workers than they "need" it would be more revealing to characterize such outcomes as temporary and involuntary overemployment. In any event, the empirical evidence, according to Ehrenberg and Smith (1994, Fig. 10.1), is that quits are large relative to lay-offs; they show a ratio of the monthly quit and layoff rates that exceeds one in every year from 1959 to 1981. As a consequence, firms are likely to want to hire more workers in most circumstances and they will end up with $N<N^d$ and positive vacancies.

In equilibrium, $N=N_{-1}$ over time and the vacancy rate becomes

$$v \equiv \frac{V}{N^d} = \frac{\alpha_1}{\alpha_2} q, \qquad (3.13)$$

where q Q/N^d is the quit rate.[16] The larger is $_1$, the more important are adjustment costs and the vacancy rate will increase; the opposite happens when $_2$ rises. The vacancy rate could become negative if $_1q>$ $_2$.

Once employment is steady, the values of and $V=($ $_1/$ $_2)Q$ can be substituted into equation (3.10) to obtain the minimum total cost, , with the first term representing adjustment costs and the second term disequilibrium costs, both of which will rise with Q^2.

The Details of Adjustment and Disequilibrium Costs

The quadratic cost functions in equation (3.10) are convenient for subsequent analysis, but do they fit other requirements to be convincing? First consider disequilibrium costs since they are more obvious than adjustment costs. In the case of a linear labor demand equation (see below), these costs are

$$J_D = \frac{1}{2}\left(Y_N(N) - \frac{W}{P}\right)(N^d - N), \qquad (3.10a)$$

which will always be positive, except for $N^d=N$ on the demand curve, where $J_D=0$. If employment is too low (i.e, $N^d>N$), the marginal product will exceed the real wage and the firm loses the area under the demand curve in total product but refrains from paying wages to the "missing workers," the difference being a triangle with the horizontal dimension of N^d-N and the vertical distance of Y_N-W/P. An example would be the area ABD in Fig. 3–7. If the firm has too many workers (i.e., $N^d<N$), it pays more in wages than it receives in extra revenue and the net loss is again a triangle with the same dimensions, both of which are now negative. Comparing equations (3.10) and (3.10a), we see that disequilibrium costs are the same if In other words, the parameter $_2$ should be chosen to be half the slope of the labor-demand curve.

[16]It would be more conventional to define q Q/N, but this would require that , which is more cumbersome than is necessary.

Next, consider adjustment costs, which are a group of fixed costs incurred by the firm only when it changes its complement of workers. They should be symmetrical with the firm facing "firing costs" such as severance pay whenever quits are not large enough to prevent lay-offs or dismissals and "hiring costs" for situations when employment is increasing. These adjustment costs can be specified as

$$J_A = F(N - N_{-1} + Q). \quad (3.10b)$$

If *F,* the per capita cost, is positively related to the size of the adjustment, the parameter . Thus, there would have to be increasing hiring costs or firing costs, which are captured by the size of $_1$. There does not appear to be much empirical evidence on the behavior of these adjustment costs in relation to the size of adjustment. Ehrenberg and Smith (1994, Table 5.1) report that firms devoted an average of 161 hours to hiring and training of new employees during the first three months on the job. Some of the categories listed such as recruiting, extra supervision and informal training would surely be subject to increasing costs. Data on firing costs seem not to be readily available, but if severance pay is linked to seniority, the greater is the extent of required downsizing, the more senior workers will have to be dismissed and the per capita cost will rise. Lazear (1990) also argues that termination costs will reduce employment by increasing hiring costs.

3.3.3
Employment and the Demand for Labor

In the labor-market diagram, there must now be a distinction between the labor-demand curve and the labor-use curve, the horizontal distance between them being dictated by vacancies. The former is shown as N^d in Fig. 3–10, while the latter is *N.* Also drawn in the same figure is an upward-sloping labor-supply curve, based on the reservation-wage model in the previous section. The new *N* curve is steeper than N^d because at high wages demand is low and so are vacancies, whereas at low wages both demand and vacancies are higher. The vertical distance between N^d and *N* measures the extra fixed costs of acquiring new workers. When the firm has N_0 workers, it pays them $(W/P)_0$ per hour, but it must also spend the vertical distance between *A* and *E* per worker for these extra costs. These costs are determined optimally in Figs. 3–8 and 3–9. The firm will pay $_1Q^2$ in adjustment costs and in disequilibrium costs in each period for a given level of quits. The higher are these costs, the greater is the vertical distance between N^d and *N,* but also the greater is the horizontal displacement of the labor-use curve away from the labor-demand curve. Thus anything that increases optimal vacancies, , also increases the costs that the firm pays for filling those vacancies.

While it may appear that the extra costs faced by the firm in the employment process act just like a linear tax which shifts the demand curve downward from

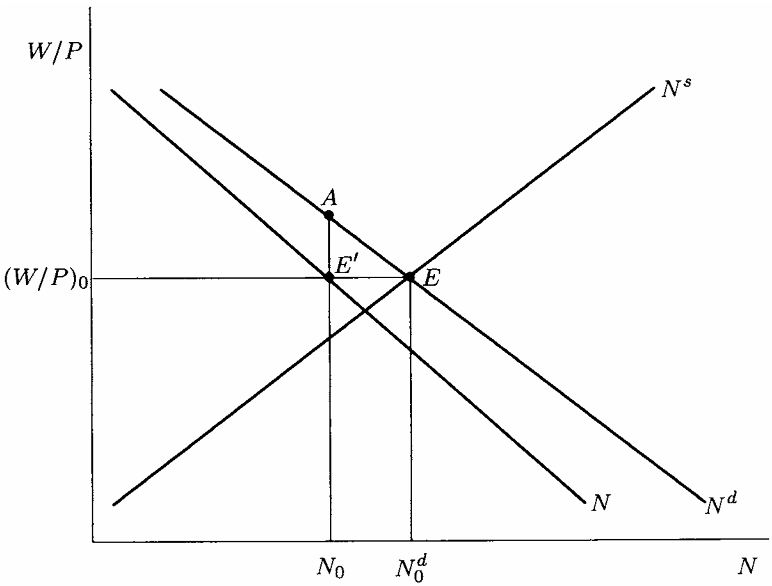

Figure 3–10 Equilibrium in the labor market

N^d to *N,* this is not an appropriate analogy in the present case. The reason is that the firm actually faces two "taxes" with opposing effects: adjustment costs are a tax on employment and therefore induce vacancies, but disequilibrium costs are a tax on vacancies and encourage optimal employment. If vacancies were eliminated, as at *D* in Fig. 3–8, *V* is transferred from disequilibrium costs to adjustment costs and total costs are , which is larger than at *C.* Therefore, the distance *EE* in Fig. 3–10 measures desired vacancies in equilibrium because it minimizes the effect of the two taxes.

Since vacancies are a stock while quits are a flow per unit of time, it may be possible to reduce overall costs by anticipating future quits. This would involve increasing current hires by one worker and reducing present vacancies below the one-period optimum. Current-period costs are now and next-period costs are . In the first period, the one extra hire would increase costs by , because $V=(\ _1/\ _2)Q$. In the second period, the additional costs are $-2\ _1Q+\ 2$ Over the two periods, the difference in costs between intertemporal minimization and single-period minimization is , in present-value terms. The larger are disequilibrium costs or the lower are quits, the more costly is the intertemporal strategy. Moreover, firms may be reluctant to anticipate future developments and incur costs that would otherwise not be necessary. For example, labor demand may fall in the next period, which means that less vacancies have to be filled.

So far, it has been assumed that firms pay the costs indicated in equation (3. 10), but this does not establish the incidence of these costs. It is possible that unemployed persons looking for jobs would be willing to pay the adjustment costs, but not the disequilibrium costs in equation (3.10). However, the requirement to absorb these costs depends more on the elasticities of supply and demand than on the institutional setting for the payment of hiring costs. Setting $_2$=0 for this purpose, adjustment costs would shift the N^d curve to N in Fig. 3–10 and lower the real wage received by workers, while increasing total costs for the firm. Alternatively, if workers pay for their hiring costs, the labor-supply curve would shift leftward as some individuals would now have a higher reservation wage, but this is just another way of creating the gap between labor costs faced by firms and the wage received by workers. If the supply of workers is quite elastic, workers absorb very little of these costs, but if all persons in the economy have exceeded their reservation wage and the supply curve is vertical, their wages will be reduced by the size of the hiring costs. Similarly, if the demand for workers is elastic, firms can shift the adjustment cost to workers, but not if demand is quite inelastic.

Job-search theory, which made its appearance in the 1970s, imposed the costs of finding a job on those who supply labor services, but in that framework the search was for a better-paying job due to a distribution of wage offers that required costly search to find the best one. In that theory, all workers are the same but they could receive different wages depending on the fruitfulness of their search; in this chapter there is heterogeneity in skills or location, while wages are all the same.[17]

3.3.4
Equations for Labor Demand and Labor Use

First, the *notional* labor-demand curve is based on the total cost of an employee, *W/P+J/N,* which must equal the marginal product of each worker, Y_N; therefore, a linear relationship is given by

$$N^d = \beta_0 - \beta_1 \left(\frac{W}{P} + \frac{J}{N} \right). \tag{3.14}$$

Since ,

$$N = \beta_0 (1 - \frac{\alpha_1}{\alpha_2} q) - \beta_1 (1 - \frac{\alpha_1}{\alpha_2} q) \frac{W}{P} - \beta_1 (1 - \frac{\alpha_1}{\alpha_2} q) \frac{J}{N}. \tag{3.15}$$

From previous calculations,

$$\frac{J}{N} = \alpha_1 q^2 N \left(1 + \frac{\alpha_1}{\alpha_2} \right), \tag{3.16}$$

which can be substituted into equation (3.15) and solved for N as a function of *W/ P* to obtain the labor-use equation:

$$N = \frac{\beta_0 (1 - \alpha_1 q/\alpha_2)}{1 + \beta_1 (1 - \alpha_1 q/\alpha_2)(\alpha_1 q^2 [1 + \alpha_1/\alpha_2])} - \frac{\beta_1 (1 - \alpha_1 q/\alpha_2)}{1 + \beta_1 (1 - \alpha_1 q/\alpha_2)(\alpha_1 q^2 [1 + \alpha_1/\alpha_2])} \frac{W}{P}. \tag{3.15'}$$

Equations (3.14) and (3.15) are the same except for the expression

$$\frac{1-\alpha_1 q/\alpha_2}{1+\beta_1(1-\alpha_1 q/\alpha_2)(\alpha_1 q^2[1+\alpha_1/\alpha_2])}$$

which appears multiplicatively in both the constant and slope coefficient of equation (3.15) and makes N steeper than N^d, but with the same vertical intercept. Any factor that raises $_1$ or q will increase the horizontal distance between N^d and N, but an increase in $_2$ will have the opposite result. In the event that $_1$=0, q=0 or $_2$, N^d and N have the same equation.

To this point, the quit rate, q, has been taken as a fixed fraction of employment. However, the evidence is that the quit rate is likely to be procyclical. If q and N are positively related, the N-curve in Fig. 3–10 will become even more steep relative to the demand curve as vacancies (i.e., the horizontal distance between N^d and N) increase when quits rise at high levels of employment.

The vertical distance between N and N^d in Fig. 3–10 measures the costs per worker that the firm incurs for adjustment and disequilibrium. Equation (3.16) indicates that these costs, on a per capita basis, are related to the level of employment. Any factor that increases the vacancy rate also increases the value of J/N. For example, an increase in $_1$ raises vacancies according to equation (3. 13) and also raises J/N according to equation (3.16). Furthermore, because $N<N^d$, $W/P<Y_N$ in Fig. 3–10.

It must be reiterated that equations (3.14) and (3.15) serve two purposes: (1) the horizontal difference between N^d and N measures the number of vacancies that the firm tolerates and indirectly the costs that it avoids with these vacancies; (2) the vertical difference measures those extra costs that the firm actually decides to pay.

3.3.5
The Demand for Overtime Hours

Although the "standard" hours in a period will be held fixed at $\bar{H}$, it is useful to determine how firms decide on their demand for overtime hours, if they have to pay a higher wage, $\widetilde{W}$ for each hour above $\bar{H}$. Unless there are hiring and training costs in addition to the hourly wage paid to a new employee, the firm would *never* use overtime hours because the new worker is always a cheaper source of extra hours. Moreover, such additional costs, discussed above, give rise to vacancies, that could be "filled" with overtime hours. However, if the firm decides to rely on overtime and avoid the fixed costs, J in equation (3.10), it would lose employees at the rate of Q per period and would have to increase its reliance on overtime even if output and the total labor input remain constant. Therefore, vacancies cannot be eliminated and costs lowered by the use of overtime hours.

[17]For a review of job-search theory, see Smith (1994, Ch. 7).

Nevertheless, over shorter periods, when the firm is contemplating an increase in employment, it should consider overtime hours as a substitute. The adjustment costs that it faces are $_1(N-N_{-1})^2$, which may be prorated for each hour that any new employee is expected to remain with the firm. From that perspective, it is easy to see that in situations where the extra hours are not expected to become a permanent feature of the production process, the firm would rather use overtime hours than incur these fixed costs, but if the expansion is likely to last for some time, they will hire new workers instead. Thus the higher is the expected value of "life-time hours" and the smaller is $_1$, the less is the reliance on overtime hours.

In the initial stages of an economic upturn, it is not unusual to find that overtime hours increase more than new workers; later, as the expansion becomes more "permanent" the number of employees will rise and overtime will stabilize or even fall. In a recession, overtime will decline first, especially if there are fixed "firing costs" attached to lay-offs. It is for this reason that overtime hours are considered a leading indicator of macroeconomic activity.

3.4
Equilibrium in the Market for Labor

It is now possible to combine the reservation-wage model for the supply of workers with the vacancy model of the demand for workers to obtain an equilibrium that determines the number of jobs available in the economy as well as the real wage rate at which these transactions are to be made. This equilibrium is shown in Fig. 3–10. The most important element of that equilibrium is the existence of unemployment.

3.4.1
The Natural Rate of Unemployment

At the equilibrium point, *E* in Fig. 3–10, while the demand for labor is equal to units, the satisfied demand or actual employment is only N_0, with the remaining representing the number of vacancies that firms have. At the wage rate, $(W/P)_0$, they are able to hire new workers that just equal those lost through quits. Also, these vacancies equal the number of labor-market participants who are unemployed. The point *E* is to the left of the supply curve, suggesting that some individuals who have exceeded their reservation wage at $(W/P)_0$ are unable to find jobs at that wage rate. They are involuntarily unemployed. Milton Friedman has labelled this as the natural rate of unemployment. It is the unemployment rate consistent with equilibrium in the labor market. It would be observed at the point where the number of vacancies equals the number of unemployed. This is a "square-pegs-round-holes" problem, with the unemployed being the square pegs that do not fit into an equal number of round-hole vacancies. If the labor market were completely homogeneous, the problem would disappear as all pegs would become round or all holes would become square. In that sense, geographic immobility or mismatched skills are the cause of heterogeneity in the labor market and the more serious they are, the larger is the natural rate of unemployment and the larger is the distance between the N^d and N curves in Fig. 3–10.

Not surprisingly, a small compact country like New Zealand has a low natural rate of unemployment, perhaps 1%, while geographically large and diverse countries such as Canada and the United States have much higher natural rates, perhaps in the 5% to 9% range. Furthermore, the natural rate is not fixed for all time. In Chart 1–3, there are two reported estimates of the US natural rate. It is argued that the natural rate rose during the 1960s and 1970s as women and young people, who have a difficult time finding an initial job, became more prominent in the labor force and raised the natural rate. Also, increased benefits in unemployment insurance caused some individuals to pretend that they were in the labor force in order to obtain these benefits. This also raised the natural rate during that time period in the sense that firms faced higher costs of finding workers that met their requirements and individuals increased their propensity to quit an existing job when unemployment benefits were readily available. Since the 1970s, these trends have reversed themselves and the natural rate has fallen, as is evident from the Adams and Coe (1990) data.

It is often useful to characterize the source of unemployment, but the natural rate is both structural and frictional unemployment so that the distinction between them is not important here. Structural unemployment arises because of heterogeneity and the resulting mismatches that occur between supply and demand, which in turn create costs for firms and lead to optimal vacancies. On the other hand, frictional unemployment takes place when individuals do not move immediately from one job to another and are unemployed in the process of searching. These frictions also create costs for firms and encourage firms to have vacancies.[18]

It is tempting to re-interpret equilibrium in the labor market as the intersection of the N^s and N curves in Fig. 3–10 because at the wage rate $(W/P)_0$ not all workers are employed and those that are unemployed would bid down the wage; hence $(W/P)_0$ cannot be sustained. While the existence of unemployment surely puts downward pressure on real wages, it must be remembered that existing vacancies put upward pressure on wages. At *E,* where vacancies and unemployed workers are equal, these pressures cancel each other and leave the real wage constant, a requirement for equilibrium in a market.

Moreover, since $N=N^s(1-u)$ defines the unemployment rate, *u,* the natural rate of unemployment is determined by the vacancy rate, .[19] Anything that increases vacancies also raises the natural rate of unemployment. For example, a higher quit rate will force firms to absorb higher adjustment costs but they will also avoid some of these costs by filling fewer job vacancies. Thus, unemployment in equilibrium increases whenever it becomes more costly to overcome mismatches in the labor market. On the other hand, assuming away adjustment and disequilibrium costs would lead to $N=N^d=N^s$ and to a natural rate of zero percent.

In job-search theory, there was also unemployment in equilibrium but it was entirely voluntary because at some point a person would quit an existing job to engage in full-time search for a better job. This is essentially frictional unemployment due to uncertainty about what constitutes the best paying job. The natural rate developed here, on the other hand, relies on the costs of filling vacancies due to the heterogeneity of the labor force and is involuntary to the extent that the unemployed are unable to overcome the mismatches that are part of labor-market operations. The major criticism of search theory is that it does not allow people to look for other jobs while still employed. If on-the-job search is more likely, there would be no unemployment in equilibrium and the natural rate would still have to be related to the factors that cause vacancies.

Finally, without the distinction between the labor-demand curve and the labor-use curve in Fig. 3–10, it would not be evident that some individuals are unemployed in an equilibrium situation. The labor demand curve is based on total labor costs, including not only direct wage payments but also hiring and training costs, while the labor-use curve takes into account only the former; therefore, the vertical distance between them measures the latter as *AE*.

3.4.2
Comparative Statics

At this stage, it is instructive to subject the equilibrium in Fig. 3–10 to some exogenous changes to determine what happens to employment, unemployment, and the real wage. First, an increase in the supply of workers through a reduction in the reservation wage will shift N^s to the right and employment will increase while the wage rate will fall; the unemployment rate remains the same if q, $_1$, and $_2$ have remained constant. It is worth noting that only a specific group of individuals will be stimulated to enter the labor force: those whose reservation wage was previously above the going wage but is now below it. Two groups will not be affected: (1) those people who had a reservation wage below $(W/P)_0$ and had previously decided to participate in the labor market and (2) those whose reservation wage was previously and is still too high to encourage them to work.

Second, an increase in the productivity of labor will shift both the N^d and N curves upward as firms are willing to pay more to each existing worker. In both

[18]As long ago as 1958, Dow and Dicks-Mireaux defined "mismatch unemployment" but it never seemed to be connected to the natural rate of unemployment. They wrote: "The fact that unfilled vacancies for some sorts of labour coexist with the unemployment of other sorts implies that the kinds of labour demanded differ from those on offer" (p. 3).

[19]From $N=N^d - V$, which defines vacancies, it is obvious that $N=N^d(1- \;)$ and $u=\;$ when $N^d=N^s$.

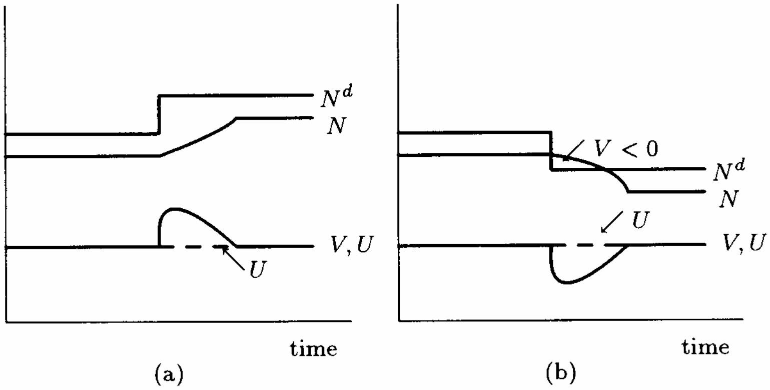

Figure 3–11 N^d, N, V, and U for a rise and fall in N^d

equations (3.14) and (3.15), the increase in the labor productivity would be captured by an increase in the parameter $_0$. The wage rate will rise, but not by as much as the increase in productivity when the supply curve is positively sloped; also employment will increase. However, the unemployment rate will not change, although the number of persons who are unemployed will rise as long as the N curve is steeper than the N^d curve.

The transition from one equilibrium to the next one is interesting in its own right when the N^d curve shifts. As shown in Figs. 3–8 and 3–9, N moves over time to a new position as firms have to absorb adjustment costs to hire new workers or lay off existing ones. For an increase in demand, the movement of N, V, and U (for the number of persons who are unemployed) is shown in Fig. 3–11 (a). The fact that $V>U$ during the transition indicates that there is excess demand in the labor market. Perhaps more interesting is the case of a reduction in labor demand shown in part (b) of Fig. 3–11. Since actual employment falls more slowly than demand, there is a period of time when the former exceeds the latter and vacancies essentially become negative—although anything lower than V=0 is difficult to imagine—with unemployment remaining virtually constant. When firms have too many employees they are thought to be hoarding labor, but they really do not follow this pattern willingly; they cannot reduce the labor input fast enough, especially if quits are small relative to the “downsizing” that is necessary. When a new equilibrium is reached, vacancies will again be positive and equal to the number of unemployed persons, but during a transition to lower demand, the N^d curve could be to the left of the N curve.

Finally, an increase in the quit rate will cause the N curve to move leftward, but leave the N^d curve in place as q appears in equation (3.15), but not in equation (3.14). The number of workers will fall, but the wage rate remains constant. Furthermore, the unemployment rate will rise as will the costs incurred by the firm to fill its vacancies. The same results would prevail if adjustment costs increased with a higher value of $_1$ or if disequilibrium costs decreased as

$_2$ falls. These three factors explain differences in natural rates of unemployment among countries or through time.

3.5
Disequilibrium Employment and Unemployment

Having dealt with the characteristics of equilibrium, we can now move on to situations in which the labor market is in disequilibrium. What is the nature of transactions in disequilibrium and are they voluntary exchanges? It will be argued that employment will be determined by the labor-use curve for both excess supply and excess demand, while unemployment will be dictated by the distance between N^s and N. Therefore, the unemployment rate will exceed the natural rate when there is excess supply and *vice versa* for excess demand. This outcome requires that the firm be able to decide on the number of employees unilaterally. Although workers and their unions have an obvious interest in this decision, it will become obvious that firms cannot be compelled to move away from the labor-use curve once the real wage is determined.

Consider an initial situation where N_0 is the employment level at *A* on the *N* curve in Fig. 3–12. Then, the real wage rises to $(W/P)_1$ and this combination of wage rate and employment would move the firm to point *B* above and to the right of the *N* curve. An iso-profit curve, $_1$, would pass through this point, but its apex would be on the *N* curve.[20] If the firm is unable to change the real wage, it has a strong incentive to reduce employment and reach a point such as *C*. Here, another iso-profit curve (not drawn) would have its highest point. Since iso-profit curves lower on the *N* curve have higher profits, *C* is better for the firm than *B* and it will avoid arrangements and agreements that bind it to specific levels of employment in conjunction with fixed wages for some period into the future.

In this setting, actual employment will always be on the N curve because that is what firms will choose to do once they know the real wage rate. Consider a real wage of $(W/P)_0$ in Fig. 3–13, which is too high for equilibrium and would move the firm to *A* on the *N* curve. Actual employment above N_0 would mean that the marginal product of workers is below the real wage and firms could generate more profits if they reduce the number of workers, with those that remain having a higher marginal product. Symmetrically, a labor input of less than N_0 means that the marginal product should be lowered by having more workers. Only on the *N* curve does the firm have the profit-maximizing number of workers. Next, consider a lower real wage, $(W/P)_1$, which is now below the equilibrium real wage. The firm will want actual employment to be N_1 at *B* on the *N* curve. But since the labor market is now experiencing excess demand, with $N^s<N^d$, can firms always obtain the number of workers they want without relying

[20] Isoprofit curves were developed in Section 2.2.5.

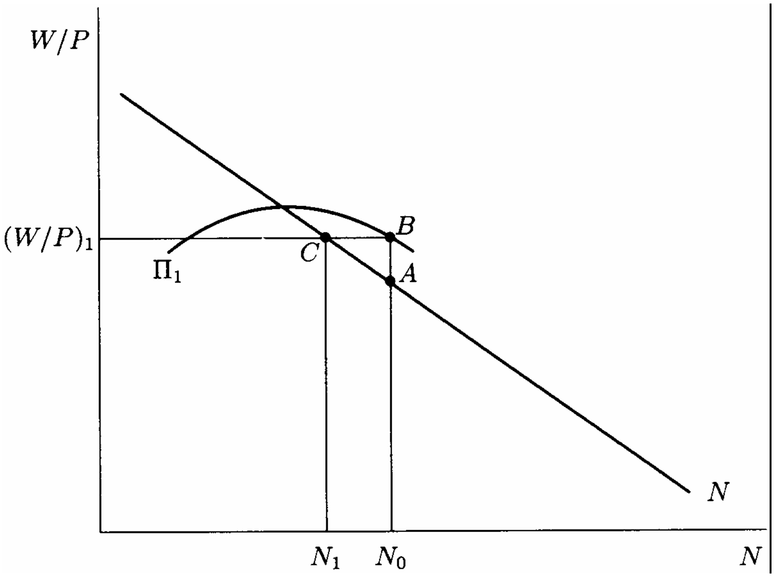

Figure 3–12 Firm's incentive to be on the labor-use curve

on involuntary exchanges? The answer is yes as long as the wage rate does not fall below the intersection of the *N* and N^s curves. Because actual employment is still less than the number willing to work at $(W/P)_1$, firms will be able to dictate their complement of workers.

The assertion that firms are always on the labor-use curve in Fig. 3–13 leaves out of account their inability to change the labor input instantaneously in the face of adjustment costs. For example, if the wage rises to $(W/P)_1$, the firm will have N_e of the labor input and it takes time to move to N_0. Therefore, the firm will move along the arrows above *N* as it adjusts from *E* to *A*. In the opposite direction, the firm will be temporarily below the *N* curve as it moves from *E* to *B*. While this suggests that employment will adjust sluggishly to wage changes, long lags are not supported by the evidence from annual data used in the empirical labor-use equation estimated in Ch. 1. Hence, on a year-to-year basis, firms are indeed observed to be on the labor-use curve, although for shorter periods they are forced to be off the curve.

From this discussion, we can conclude that excess-supply situations which prevail at $(W/P)_0$ give rise to the number of workers who are unemployed exceeding the number of vacancies; hence the actual rate of unemployment is higher than the natural rate of unemployment. In Fig. 3–13, the former is equal to while the latter is equal to . The difference, , can be called disequilibrium unemployment. Returning to the "square-pegs-round-holes" analogy, in equilibrium the number of square pegs is equal to the number of round holes, but in excess-supply situations such as *A*, there are a number of round pegs that are not positioned in an equal number of round holes. Excess demand prevails at *B*

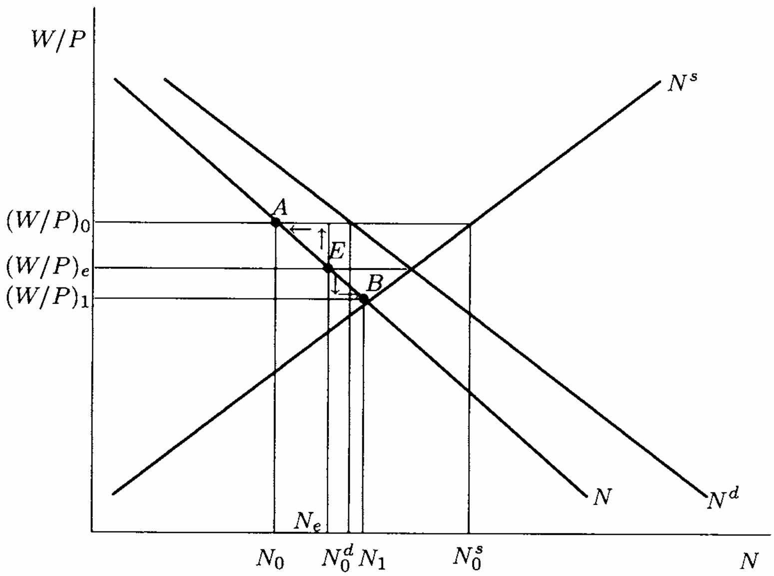

Figure 3–13 Employment at disequilibrium wages

and vacancies are now greater than the number of workers who are unemployed; by the same token, the actual unemployment rate is now less than the natural rate, but still positive. In these situations, square pegs have been forced into some round holes with the resulting mismatch reducing the marginal product of workers, but at the lower wage rate firms can tolerate this outcome.

The twin conclusions from this discussion are: (1) employment will (almost) always be on a negatively sloped labor-use curve, and (2) the actual rate of unemployment will be above the natural rate when there is excess supply in the labor market and *vice versa* for excess demand. The evidence from Ch. 1 very much supports these conclusions. By contrast, the labor-market model of Ch. 2 did not fit very well with this evidence.

3.6
Conclusions

Comparing predictions about labor-market behavior from Chs 2 and 3, there are a number of "facts" that are more easily explained by the model presented here. Some crucial strategies in developing this new approach are:

1. Optimizing procedures should be applied separately to the intensive margin of employment (i.e., hours per worker) and to the extensive margin (i.e., the number of employees). There is much less variation in the former as seen in Charts 1–1 and 1–2 and the limited choice of hours is consistent with

differences in tastes or endowments. Individuals can be bribed to work common hours by offering them a wage rate that is higher than firms could pay if workers came to work at times of their own choosing and in turn firms are able to pay these higher wages because common hours are more productive. Thus, common hours are a Pareto improvement over anarchic hours in many production environments.

2. When individual workers are self-limited in the hours that they work, the reservation-wage model is more appropriate than the optimal-hours model, although they both depend on a utility function than has goods and leisure consumption as arguments. Furthermore, there are no ambiguities about the slope of the labor-supply curve since income and substitution effects are not relevant. Instead, individuals will reveal their differences in endowments not as variations in hours, but as differences in rent.
3. In the aggregate labor market, there is likely to be heterogeneity in skills and location and this fact creates extra costs for the firm. Since firms will have an incentive to avoid some of these costs, the resulting vacancies give rise to involuntary unemployment in equilibrium, which can be associated with the natural rate that has been part of macroeconomic models for decades, but has not been derived from optimizing behavior in the labor market.
4. When the real wage is unable to clear the labor market, transactions continue to take place, as millions of employees voluntarily report to work every day. Predicting these transactions becomes the task of the labor-use curve, which is a negative relationship between employment and real wages. When the real wage is high and there is excess supply, employment falls and the unemployment rate rises above the natural rate. The opposite occurs when there is excess demand.

These features of the labor market can now be incorporated into the aggregate-supply curve of the full model of the macroeconomy to see how it interacts with activities in the goods and money markets. This task will be undertaken in the next chapter.

4
A Model of the Macroeconomy

The labor market does not operate in isolation; it interacts with goods markets and asset markets to determine three important macroeconomic variables: (1) the inflation rate, (2) the interest rate, and (3) the unemployment rate. The macroeconomic model to be presented in this chapter is not complicated and is to be found in almost any textbook in macroeconomics. In fact, it is based on the well-known *IS-LM-AS* relationships, with the only claimed novelty being the emphasis on the micro-foundations of labor-market transactions developed in the previous chapter. From the goods market, we derive the *IS* curve which shows combinations of income and the interest rate that keep unintended inventories from appearing. In the money market, equilibrium is maintained along the *LM* curve which is again a locus of points in income-interest-rate space. Finally, the labor market provides us with the aggregate-supply curve *via* a production function and the labor-use equation. The *AS* curve is a relationship between output or income and the rate of inflation. The economy is assumed to be closed to international transactions to maintain simplicity, but an open-economy version of the model could be developed by introducing these transactions in the goods or asset markets.[1]

4.1
The Building Blocks of the Model

Because there are a number of variables such as the inflation rate that are expressed as "rates of change," it is more convenient to work with natural logs than with the original units of account. In fact, they make it much easier to deal with inflation as a continuing phenomenon.

[1]The *IS* equation determines the exchange rate in a flexible-rate economy or the *LM* equation determines the endogenous money supply in a fixed-rate regime. See Prachowny (1985, Ch. 9).

4.1.1
The IS Curve

Equilibrium aggregate demand in the goods market is attained when unintended inventory accumulation or decumulation is absent. This requires that planned saving equals intended investment or, in a more complicated version of the economy, when *ex ante* saving plus taxes equal *ex ante* investment plus government expenditures. Saving and taxes are positively related to the level of income, investment expenditures are determined partly by income and partly by the real interest rate, while government expenditures are treated as being exogenous to the model (i.e., they are presumed to be determined by the legislative process). Therefore, defining S as the natural log (from now on written as In) of saving plus taxes, I as In of investment plus government expenditures, y as In of income, and $i-\ {}^e$ as the real interest rate, all per unit of time, we obtain two relationships as follows:

$$S = b_0 + b_1 y, \tag{4.1}$$

$$I = b_2 + b_3 y - b_4(i - \pi^e). \tag{4.2}$$

The constant b_1 is the elasticity of saving plus taxes with respect to income and should not be interpreted as the sum of the marginal propensities to save and to tax. Therefore, b_1 need not be less than one. The use of natural logs gives rise to elasticities since the change in S required by a change in y involves proportional changes, not absolute changes. The elasticity b_1 is equal to the *marginal propensity* to save and to tax divided by the *average propensity* to save and to tax, both of which must be less than one. This makes it possible for the elasticity to exceed unity when the marginal propensity is larger than the average propensity. Similarly, b_3 is the income elasticity of investment expenditures. Also, b_2 contains the exogenous government expenditures, while b_0 represents any autonomously determined taxes and saving. Other exogenous effects on S and I are also contained in b_0 and b_2 respectively. Finally, b_4 is the interest elasticity of investment expenditures. Since investment and the interest rate are negatively related, there is a minus sign in front of b_4 which itself is positive, as are all other constants in equations (4.1) and (4.2).

The Nominal vs. the Real Interest Rate

Investment expenditures are related to the real interest rate, not to the nominal interest rate. The real interest rate is expressed as the nominal interest rate, i, minus the expected inflation rate, ^{e}. Since the pay-off on current investment expenditures lies in the future, the real cost of repaying borrowed funds depends on both the nominal interest payments and the expected change in the price level between now and the time that income is generated by the investment goods, concurrently with the time that repayment of the loan must be made. To put the matter more concretely, consider a loan of one dollar that requires a repayment of \$(1+*i*) at the end of one year. The purchasing power of this amount will deteriorate over time if inflation is present. This reduction in purchasing power is measured by the price level at the beginning of the year divided by the future price level, or , where p_{-1} is the In of the price level at the start of the year and p^e is the In of the price level *expected* to prevail at the end of the year. Notice that with p^e, we are dealing with a variable that is not known at the present time and therefore must be estimated on the basis of whatever information is known at the time that expectations are formed; for that reason a superscript *"e"* identifies a variable for which an expected value is required. From this discussion, we can see that the real cost (expressed in natural logs) of borrowing one dollar is . This expression can then be rewritten as $i-\ ^{e}$ since ln(1+*i*) is approximately equal to *i*, when it is written as a fraction and by definition, .

After the fact, the real interest rate may or may not indicate the true cost of borrowing funds for investment expenditures, depending on whether the forecast for inflation was correct or not. While the investor knows the nominal interest cost at the beginning of the period, she does not know the rate of inflation that will prevail and there may be a difference between expected and realized inflation. The *ex post* real interest rate would be $i-$, where is the rate of inflation actually experienced, but since it cannot be observed at the time that the decision is made, it is not a very useful piece of information.

Consumer Demand and Wages

While equation (4.1) incorporates the Keynesian version of the consumption function, it does *not* rely on another Keynesian notion that consumption expenditures would be depressed if real wages fell. Although disposable income is to a large extent wage income, there are a number of reasons why consumption and the real wage rate are not closely related. First, wage earners are not the only ones making consumption decisions; retired persons and other *rentiers* are also important categories. In 1992, personal income (GMPY in CITIBASE), which is the constraint on consumption expenditures after taxes are subtracted, was only a little more than half (56.7%) in the form of wage income (GMW); transfer payments to persons (GMPT) was 16.3%; and personal interest income (GMPINT) was 12.6%. Second, a lower real wage does not necessarily reduce wage income; it depends on the elasticity of the demand for labor, with an elasticity exceeding one resulting in higher wage income.[2] Third, even if wage income falls, there may be only a redistribution of total disposable income and other sources of income such as transfers may in fact rise. Thus, consumption is determined by the amount of income produced in the economy, but not by its functional distribution.

Determination of Aggregate Demand

Savings and taxes remove spending power from the stream of aggregate demand while government expenditures and investment add to it. When they exactly offset each other, aggregate demand for goods and services is consistent with income. Therefore, *S*=*I* is an equilibrium condition from which we derive the *IS* curve. Setting equations (4.1) and (4.2) equal to each other allows us to find those values of *y* and $i-\ {}_e$ that satisfy this equilibrium condition:

$$y = a_0 - a_1(i - \pi^e), \qquad (4.3)$$

where and . Equation (4.3) is the *IS* curve of the model. In the denominator of both a_0 and a_1 there appears (b_1-b_3), the difference between two positive numbers. In order to have the *IS* curve as a negatively-sloped line in Fig. 4–1, this difference must be unambiguously positive. This in turn implies that the income elasticity of saving plus taxes must exceed the income elasticity of investment. In the simple Keynesian model of income determination this same requirement was put forward as the savings function being steeper than the investment function to guarantee a stable equilibrium, or put another way, it is necessary that the marginal propensity to save exceeds the marginal propensity to invest. This is essentially the same requirement as $b_1>b_3$ since both b_1 and b_3 are ratios of marginal propensities to average propensities and the average propensities to save and to invest will be equal when *S*=*I*. The numerator of a_0 also contains the difference between two positive numbers, b_2 and b_0, which represent the autonomous components of investment, government expenditures, saving, and taxes. For the *IS* curve to be in the first quadrant with only positive values for *y* and *i*, we must restrict a_0 to be positive, which in turn means that $b_2>b_0$.

Since an increase in government expenditures is treated as an exogenous event, it is captured by a rise in b_2 which is then translated into an increase in a_0. The change in a_0 is related to the change in b_2 by $1/(b_1-b_3)$ which is the Keynesian multiplier. On the other hand, an increase in lump-sum taxes involves a higher b_0 and through a similar multiplier process reduces a_0. For these reasons, a_0 will be identified with fiscal policy; an increase in a_0 represents expansionary fiscal policy through a reduction in taxes or an increase in government purchases or both while a reduction in a0 is associated with contractionary fiscal policy. Also, any other factors that change the consumption or investment decision would cause a_0 to rise or fall.

Fig. 4–1 shows the *IS* curve with *y* measured on the horizontal axis and i, not $i -\ {}^e$, on the vertical axis. Therefore, points on the *IS* curve represent constant aggregate demand only for a given rate of expected inflation. Its horizontal intercept is , its vertical intercept is , and its slope is $-1/a_1$. An increase in a_0 shifts the *IS* curve upwards and to the right. An increase in ^{e} has the same effect

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[2]In Ch. 1, an elasticity in the neighborhood of 0.4 was estimated.

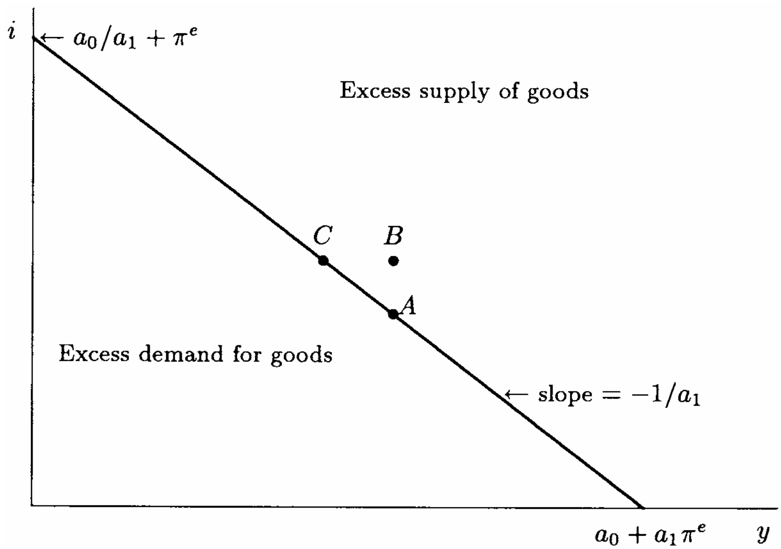

Figure 4–1 The *IS* curve

and it should be noted carefully for later reference that the vertical displacement of the *IS* curve is exactly equal to the increase in ^{e}.

If points on the *IS* curve represent equilibrium in the market for goods and services, what can we say about points to the left or to the right of the *IS* curve? Consider a point such as *B* in Fig. 4–1 and compare it to point *A* which is on the *IS* curve. The point *B* has a higher interest rate than point *A* but the same income. Thus at *B,* saving and taxes are higher than investment plus government expenditures and therefore demand for the existing output is deficient. For this reason, all points to the right of the *IS* curve are designated as excess-supply points, requiring a fall in output to re-establish equilibrium at *C.* Excess supply is identified with involuntary inventory accumulation as output produced exceeds output demanded. Similarly, points to the left of the *IS* curve indicate excess demand since *I*>*S*. Excess demand is indicated by inventory reductions. From this argument it can be seen that the interest rate and income must move in opposite directions to keep involuntary inventory changes from appearing.

4.1.2
The LM Curve

Whereas the *IS* curve deals with the market for goods and services as flows per period of time, the *LM* curve deals with asset markets as stocks at a point in time, but this is not an inconsistency in the model because flow equilibrium characterizes the former and stock equilibrium is essential to the latter. The *LM* curve is concerned with equilibrium in the money market, but there are many other assets available to the individual. Does equilibrium in one market automatically imply equilibrium in all the other asset markets? The answer is yes if there is only one other asset. Individuals who are satisfied with their holdings of money, must also be satisfied with their holdings of the residual asset, given their total wealth. If, however, there are three or more assets in total, achieving desired money balances does not guarantee that the other two assets are held in optimal proportions to total wealth.

For the development of the macro model in this chapter, only two assets will be made available to wealth-holders: money and bonds. The chief distinction between the two is that money has a constant nominal value—even though it may have declining purchasing power over goods—and pays no interest, while bonds have a variable market value and have interest coupons attached to them. This simplification belies the ingenuity of financial institutions in making available a wide variety of competing assets and blurring the distinction between money and bonds. Equilibrium in the money market is then achieved when the demand for money is equal to its supply. Automatically, this condition also ensures equilibrium in the bond market.

The Demand for Money

In an inflationary environment, the first important distinction to make is between nominal money balances and real money balances. The latter are obtained by dividing the former by a price index to capture the purchasing power of money holdings. The demand for money is a demand for real money balances and behavioral predictions are made for this variable. If all prices doubled but nothing else changed, demand for real money balances will remain unaltered; all that happens is that people will want to hold twice as much in nominal balances.

In the Keynesian view there are three separate "demands" for money: (1) the transactions demand, (2) precautionary demand, and (3) speculative demand. However, only the transactions demand for money has a sound theoretical basis, [3] but that is sufficient to allow us to conclude that the demand for money depends positively on income and negatively on the interest rate so that

$$m - p = a_2 y - a_3 i, \tag{4.4}$$

where *m* is the natural log of the stock of nominal money. Therefore, $m-p$ represents the demand for real money balances. The two constants in equation (4.4) are both positive.

The parameter a_2 is the income elasticity of the demand for money and a_3 is the interest semi-elasticity since the interest rate is not expressed in natural logs. Although the "square-root" inventory rule specifies the demand for money as a function of the In of *i,* the *IS* curve uses the interest rate in its original units. To avoid introducing nonlinearities into the model if both *i* and ln *i* are variables,

[3] See Prachowny (1985), Ch. 5.

only the former will be used in both *IS* and *LM* equations. An increase in real income will lead to higher real money balances being demanded, basically for transactions purposes. If "shoe-leather costs" of converting other assets into money change, the demand-for-money function will also be affected. An increase in these costs makes $m-p$ larger for given levels of y and i and would be captured by an increased constant term in equation (4.4), but this is not shown here to eliminate extra notation. An increase in the nominal interest rate will lower the demand for real money balances according to equation (4.4). Here, we have a connection between a nominal variable and a real variable. Why is real money demand not a function of the real interest rate in an inflationary environment? The answer is that neither money nor bonds, the only two assets in which wealth can be held, provide any protection against inflation. They are denominated in dollars and the purchasing power of both falls equally for any given rate of inflation. Therefore, the opportunity cost of holding money is the interest income foregone by not holding bonds, namely the nominal interest rate.

The Supply of Money

Equation (4.4) represents the demand for money, but it can be converted into an equilibrium condition for the money market if the left-hand side is redefined as the supply of real money. The supply of money is associated with the activities of the central bank and the commercial banks. Because of the importance of the role of the central bank in the money-supply process, monetary policy is one of the two major stabilization instruments. However, the central bank has a direct influence only on the nominal money supply so that as a first approximation m can be treated as an exogenous variable while p will be an endogenous variable. To make matters more complicated, when inflation prevails, the central bank does not concern itself as much with the level of the money supply as with its growth rate. In many countries, monetary policy targets are stated in terms of an acceptable range for the growth rates of various definitions of the money supply because central banks know that a given stock of money will become inadequate for transactions purposes with the mere passage of time as rising prices erode its purchasing power. To incorporate the requirement that monetary policy controls the growth rate of the nominal money supply, we can link levels and changes in levels from one period to the next by

$$\mu - \pi = m - p - (m - p)_{-1}, \tag{4.5}$$

where μ is the exogenously determined growth rate of the money supply and is the inflation rate during a specific period. The change in the real money supply from the last period (indicated by the subscript −1) to the present period ($m-p$ without a time subscript) is measured by the growth rate of real money balances, $\mu-$. If $\mu>$, real money balances are growing over time as the central bank is "pumping" money into the economy faster than it is being "drained" by the loss

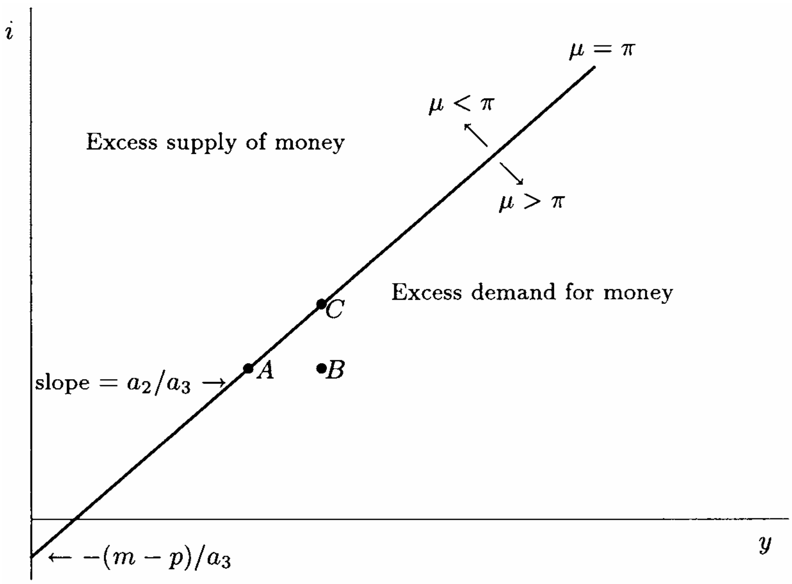

Figure 4–2 The *LM* curve

of purchasing power. If $\mu=$, nominal money balances are rising with time but real money balances are constant.

We are now ready to formulate the equation for the *LM* curve where supply and demand in the money market are equal. The equation is derived by substituting equation (4.5) into (4.4) to arrive at

$$\mu - \pi = a_2 y - a_3 i - (m - p)_{-1}. \tag{4.6}$$

The *LM* curve is drawn in Fig. 4–2. However, it will not remain in place unless $\mu=$. If that condition is satisfied we return to equation (4.4) which is consistent with any rate of inflation as long as real money balances remain constant. The slope of the *LM* curve is a_2/a_3 which is positive; its intercept on the horizontal axis is $(m-p)/a_2$ and its vertical intercept is $-(m-p)/a_3$ which is always negative. Starting from this $\mu=$, if μ increases and therefore becomes larger than , $m-p$ will be increasing through time and the *LM* curve will move steadily down and to the right. This is a continuous movement and does not produce the same result as a once-and-for-all increase in the real money supply without the passage of time.

Points on either side of the *LM* curve imply something about the nature of disequilibrium in the money market. Starting from a point such as *A* on the *LM* curve, an increase in income would move the economy to *B*. Here, there is excess demand for money since transactions requirements are higher. Existing real money balances can only be consistent with this higher income if the interest rate rises to a point such as *C*. Conversely, any point to the left of *LM* signifies excess supply of real money balances.

The Bond Market

As indicated earlier, the demand and supply conditions in the bond market do not provide any additional information about asset-market equilibrium given that money and bonds are the only two assets available. Total real wealth is the sum of real money balances and real bond holdings. Given equation (4.4) and the amount of total wealth, it is easy to calculate bond holdings as a residual. In essence, income and the interest rate determine the composition of wealth. An increase in income requires more transactions balances and forces a shift out of bonds and into money while an increase in the interest rate raises the opportunity cost of money and creates an incentive to shift out of money and into bonds. An increase in total wealth, however, will allow more money and more bonds to be held.

4.1.3
The IS-LM Framework

Until recently the *IS* and *LM* curves would have been sufficient to deal with the determination of the main economic variables in the macroeconomy, y and i. Now, inflation is just as important as income and the interest rate and the *IS-LM* model is no longer considered complete without the addition of an aggregate-supply relationship. However, the *IS* and *LM* curves remain an important part of the augmented model since they describe fully the aggregate-demand side of the economy and the place of stabilization policy in that model. Repeating the equations for the equilibrium conditions for the goods markets and asset markets:

$$y = a_0 - a_1(i - \pi^e), \qquad (4.3)$$

$$\mu - \pi = a_2 y - a_3 i - (m - p)_{-1}, \qquad (4.6)$$

we can see that they jointly determine y and i if $\;^e$ is exogenous in (4.3) and if $\mu=$ in (4.6). Therefore, the inflation rate and its expectation are not yet endogenous variables. Given these assumptions, the *IS* and *LM* curves are drawn in Fig. 4–3. In fact, two *IS* curves are drawn in the diagram, an artificial *IS* curve for $\;^e$=0 and the other for the current value of $\;^e$, the vertical distance between them being $\;^e$. This procedure allows us to read both the nominal and real interest rates on the vertical axis. Equilibrium in the goods and asset markets is achieved simultaneously when *IS*(^{e}) and *LM* intersect because y_0 and i_0 satisfy both markets at the same time. Subtracting $\;^e$ from i_0 at *E* moves us to *E* where the vertical distance is $i-\;^e$. In the absence of inflationary expectations, there would be only the *IS*(^{e}=0) curve but equilibrium would still be at *E* and not at *A*, which would have a lower level of income. Instead, the *LM* curve would shift down to intersect at *E* when $\mu=\;=0$. Here, the nominal interest rate and real interest rate would coincide.

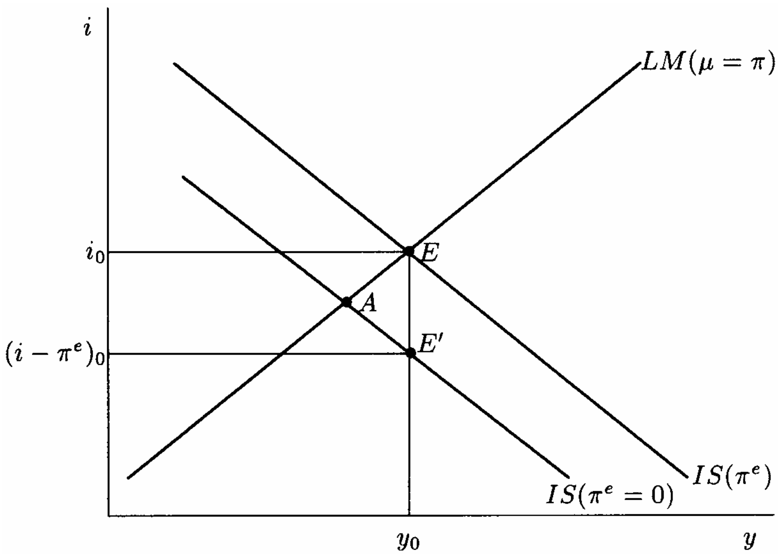

Figure 4–3 Equilibrium in the *IS-LM* framework

The diagram also indirectly shows other variables of interest. Once y and i are determined, and given ^{e}, S, and I can be calculated. Also given real wealth and real money balances, $m-p$, bond holdings can be determined residually. Furthermore, given m, y, and i, the price level, p, can also be calculated.

Dynamics in the *IS-LM* Model

The economy does not move instantaneously from one equilibrium to another when a change is required. In fact, it is the economy's inability to adapt to exogenous shocks without friction that is cited as the basis for stabilization policy initiatives. But before we can deal with such issues, we need to understand the path taken by the economy when it is disturbed from its initial equilibrium. For this we need to look at the dynamics of adjustment, that is, the evolution of y and i during the adjustment from one equilibrium to another. In many circumstances, we are only interested in comparative-statics results where we compare initial and final values of y and i after an exogenous change in the economy, but at other times the intervening period of disequilibrium is important as well and we want more detailed information, namely the path that y and i take as the economy proceeds from one equilibrium to another.

If the *IS* curve shifts upward, E in Fig. 4–3 is no longer the equilibrium combination of y and i and they must adjust to the new circumstances. Similarly, after a shift of the *LM* curve, y will rise and i will fall as the economy moves to a new position. The path taken in either case depends on a number of other assumptions about the adjustment process. The first two deal with allocating adjustment variables to specific markets.

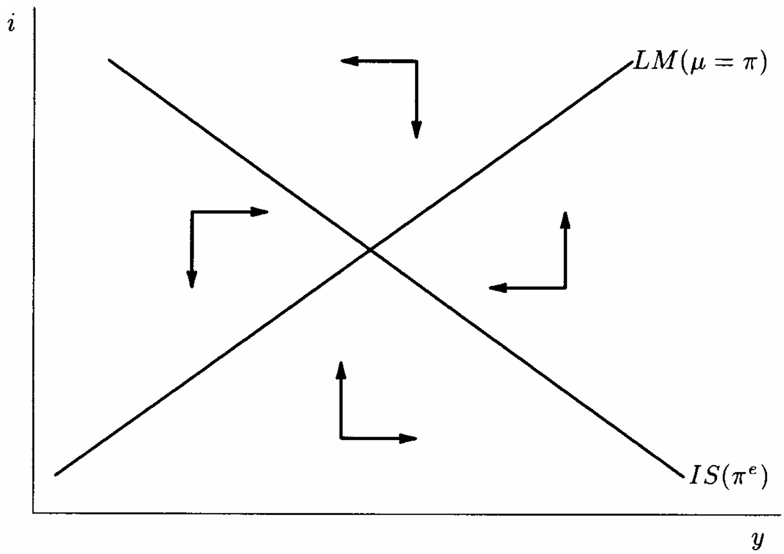

Figure 4–4 Dynamics in the *IS-LM* framework

1. Income and output rise when there is excess demand for goods and services. The signal to increase output comes from involuntary inventory decumulation when demand for current production exceeds its availability. Conversely, output is reduced when firms find their inventories climbing unintentionally. The horizontal arrows in Fig. 4–4 depict this adjustment, moving to the right from any position to the left of the *IS* curve and moving to the left from any position to the right of *IS*.
2. The interest rate rises when there is excess demand in the money market. Since the interest rate is considered to be the relative price between money and bonds, it responds to eliminate disequilibrium in these markets simultaneously. If there is excess demand in the money market, as there would be at any point below the *LM* curve, the interest rate rises, while excess supply in the money market is represented by points above the *LM* curve and requires a fall in the interest rate. The vertical arrows in Fig. 4–4 show these movements. Alternatively, the price of bonds falls when there is excess supply in the bond market. Since the interest rate and the price of bonds move in opposite directions and since excess supply of bonds goes along with excess demand for money, both approaches give the same result.

Reversing this allocation would not make much sense. It would be difficult to argue that the interest rate, an asset-market relative price, should adjust to cope with disequilibrium in the goods market or to find reasons for output adjustment when only asset markets are out of equilibrium. But we have not yet established whether horizontal movements dominate vertical movements or *vice versa* at any stage of the adjustment. We therefore need to make one more assumption about the relative speeds of adjustment of income and the interest rate.

3. The adjustment of the interest rate is much faster than the adjustment of income and output. From differences in the nature of the markets and the signals that operate in them, it is clear that bond prices and interest rates can change very quickly in response to new developments, while the output response may take weeks or even months because of lags in inventory information. In fact, if the adjustment in the money market becomes close to instantaneous, we would never observe any combination of y and i that was off the *LM* curve. The important implication of this process is that the initial adjustment of the interest rate is too large to be consistent with the new equilibrium. The "overshooting" of the final target must then be corrected by a partial reversal in the movement of the interest rate. This volatility of the interest rate in response to policy or other exogenous changes is a feature of the rapid adjustment in the asset market and causes it to bear a disproportionate share of the total adjustment that must take place.

One dimension of the adjustment process has not been discussed, namely the time that it takes for the economy to reach a new equilibrium. The length of adjustment is a hotly debated issue between neoclassical economists who tend to believe in a fast, self-equilibrating mechanism and Keynesians who advocate policy intervention because the economy can be trapped for long periods of time in disequilibrium. But it is disequilibrium and speed of adjustment in the labor market that are at issue in this debate, not whether there are long lags in the adjustment to equilibrium in the goods market. In these circumstances, the argument made in Ch. 3 that millions of workers are happy to report to work every day, regardless of the state of the labor market, indicates that disequilibrium in that market may prevail for many years.

4.1.4
The Aggregate-demand Curve

The *IS-LM* framework determines the interest rate and income, but only if the inflation rate is taken as exogenous. Moreover, the level of income is not yet related to capacity constraints which come from the aggregate-supply relationship. But, the *IS* and *LM* curves together provide us with the aggregate-demand curve. From them, we can derive an important demand-side relationship between the inflation rate and output or income. Similar to any other demand curve, quantity demanded decreases as price increases; the only differences are that we are dealing not with any specific commodity but with commodities in general and instead of a price level, we have an inflation rate determining demand.

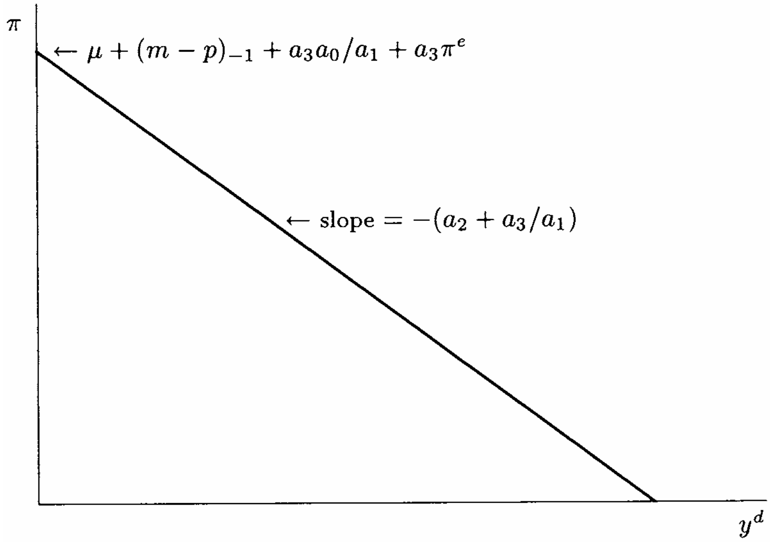

Figure 4–5 The aggregate-demand curve

To derive the *AD* curve, we substitute the *IS* equation into the *LM* equation, eliminating the variable *i* in the process:

$$\pi = \mu + (m - p)_{-1} - \left(a_2 + \frac{a_3}{a_1}\right) y^d + \frac{a_3 a_0}{a_1} + a_3\pi^e, \tag{4.7}$$

where the superscript *"d"* is added to *y* to enable us to treat it as the In of output demanded and to distinguish it from $y^{s,}$ which later refers to aggregate supply. The *AD* curve is drawn in Fig. 4–5, where the inflation rate is on the vertical axis and income is on the horizontal axis. The vertical intercept is and the slope of the *AD* curve is which is negative. Thus the *AD* curve represents an inverse relationship between y^d and . Why does the demand for goods and services decline after an increase in ? By looking at equation (4.6), we can see that an increase in reduces the real quantity of money in the economy creating excess demand in the money market. In turn, this causes the nominal interest rate to rise. With ^{e} held constant, the real interest rate also rises, chocking off some investment expenditures and thereby reducing aggregate demand. Therefore, as we move upward along the *AD* curve, the real interest rate must be rising.

The steeper is the *AD* curve, the greater is the required change in the inflation rate to bring about a given change in aggregate demand. To reduce the absolute size of the slope of the *AD* curve requires that a_2 or a_3 fall in value or that a1 rises. As investment expenditures become more sensitive to the real interest rate or as money demand responds less to income or interest-rate changes, it will require a larger increase in real money balances to stimulate a given amount of aggregate demand and this in turn requires a larger decrease in the inflation rate.

There are two other important characteristics of the *AD* curve: (1) the effects of policy changes on its position and (2) the continuing adjustment arising from the presence of $(m-p)-1$ in the vertical intercept. In our earlier discussion, we saw that a0 was associated with fiscal policy and μ. was the monetary policy instrument. An increase in either variable will shift the *AD* curve upward, in the former case by a_3/a_1 and in the latter case on a one-for-one basis. These are, however, the first-round effects only. Since $(m-p)-1$ also determines the intercept of the *AD* curve, subsequent changes in the real money supply must also be taken into account. As long as μ and are not equal, $(m-p)-1$ will continue to adjust and force the *AD* curve to move upwards or downwards in the following period.

For purposes of comparison, a once-and-for-all change in a_0 has somewhat different results. Again the *AD* curve shifts upward initially, the inflation rate rises, but since μ has not been changed, $(m-p)_{-1}$ will now be smaller and *AD* starts shifting back down again until its previous position is re-established, where $\mu=$ and $m-p$ is constant.

So far, expected inflation has been treated as exogenously determined. An increase in ^{e}, from whatever source, will also force the *AD* curve to shift upwards by the amount a_3 which represents the interest elasticity of the demand for money. Why does this parameter appear here since ^{e} is in the *IS* equation, not in the *LM* equation? Higher inflationary expectations increase the nominal interest rate to the same extent, according to equation (4.3) if y and a0 are given. This reduces the demand for real money balances by a_3; given μ, the only way that this can be achieved is through an increase in .

An increase in ^{e} will shift the *AD* curve upward by a_3 times the change in $^{e.}$ At any given level of income this would also increase by as. In that way, expected inflation pushes actual inflation but there must be some constraint on this self-fulfilling prophecy; otherwise and ^{e} would chase each other upwards or downwards without reference to μ and the real money supply would either disappear or reach infinity. If $0<a_3<1$, the process is self-limiting and the inventory rule to transactions balances dictates that a_3 should be in the vicinity of 0.5.

4.1.5
The Aggregate-supply Curve

The *AD* curve by itself cannot determine output and the inflation rate. To complete the model, we also need the aggregate-supply curve. Although emphasis on the aggregate-supply relationship is relatively new, the older Keynesian model did not neglect it entirely; it merely contained an assumption that minimized its role. In the 1950s and 1960s, when the price level was virtually constant but output fluctuated through a number of business cycles, it was taken for granted that until the economy reached "full" employment there would be no pressure on prices as demand determined output and income through the *IS-LM* framework. This assumption became unrealistic in the 1970s and 1980s and since then the *AS* curve has become more complicated. However, its derivation is relatively straightforward and its usefulness is quite general, allowing us to incorporate a number of competing assumptions about behavior in the labor market, which is the crucial market for the *AS* curve, with the Keynesian and neoclassical predictions treated as polar cases.

The derivation of the *AS* curve, which shows combinations of y and   that satisfy the requirements of the labor market, has two steps: (1) the production function for the economy relates total output to factor inputs; and (2) factor-market supply and demand relationships connect factor inputs to the inflation rate.

The Production Function

Treating all output as a homogeneous entity, we can use a single production function for the entire economy which determines total output on the basis of the various factor inputs, the principal ones being labor and capital. The production function can be written as

$$y^s = b_5 + b_6 n + b_7 k, \tag{4.8}$$

where y^s is now interpreted as the natural log of total output supplied to the economy, n is the In of total labor services and k is the In of capital services in the production process. The bs are all positive parameters: b_5 represents a productivity factor and indicates how y could increase even if n and k were constant; b_s is the elasticity of output with respect to the labor input; and b_7 is the elasticity of output with respect to the capital input. Restrictions could be imposed on this production function. For example, it may be argued that empirical evidence suggests that a doubling of both inputs always doubles output, in which case $b_6+b_7=1$.

There is an important time dimension that must be assigned to the production function. A macro model that deals with policy issues has a fairly short time horizon. For such purposes, it is useful to distinguish between fixed and variable factors of production as Alfred Marshall suggested. Of the two factors in equation (4.8), k will be treated as the fixed factor which remains constant throughout the analysis and n is the variable factor which firms can hire or fire as demand for their output rises or falls. Of course, this distinction is too sharp to be completely relevant to every-day experience. A significant element of the labor force in any firm, such as management personnel, can really be treated as a fixed factor. On the other hand, investment expenditures above those required for depreciation add to the capital stock existing at the beginning of any period and therefore k is not really a constant. The important question is: how long does it take to translate an investment decision into additional productive capital services? The answer depends very much on the specific characteristics of the capital equipment involved, but for many capital goods this time horizon is longer than the typical period for which stabilization policy is relevant.

Nevertheless, the reader should remember that this assumption accounts for many of the results that follow and if indeed the capital stock is endogenously determined by the model, the outcome for the economy would be substantially different. Returning to equation (4.8), since k is constant, the production function can be simplified to

$$y^s = b_8 + b_6 n, \tag{4.8'}$$

where $b_8 = b_5 + b_7 k$. Also, any technological improvement would be encompassed by a larger value of *b8.*

The Labor Input

The next step involves the determination of the labor input. For this, we need to summarize the conclusions that were reached in Ch. 3: (1) workers and firms have agreed to hours per period that are essentially fixed; (2) firms are allowed to make profit-maximizing decisions about the number of workers that they wish to use as long as there are some unemployed workers available; and (3) actual employment is less than the number of workers demanded by the firm, the difference representing optimal vacancies.

The number of workers demanded by a firm depends negatively on the real wage and if actual employment is a constant proportion of quantity demanded, then

$$n = b_9 - b_{10}(w - p), \tag{4.9}$$

where n is the In of the number of workers actually employed by the firm, $w-p$ is the natural log of the real wage, obtained by subtracting p from w, the natural log of the nominal wage. The parameter b_9 is a positive constant and b_{10} is the elasticity of labor demand with respect to the real wage. It is also positive since there is a minus sign in front of it. Equation (4.9) is visually represented by the N curve in Fig. 3–10 on p. 87, except that here it is expressed in natural logs. With vacancies a constant proportion of labor demand according to equation (3.13) on p. 85, $n^d = n + v$, so that the demand curve has the same slope as the labor-use curve, but a larger vertical intercept. For later reference, since $u = 1 - N/N^s$, this is rewritten in natural logs as $n^s = n + u$. When the labor market is in equilibrium, $v = u = u_e$, indicating that the vacancy rate determines the natural rate of unemployment.

In an environment where wages and prices are always rising but not necessarily in the same proportion, we want to write the demand relationship in terms of inflation rates. Generating first differences of equation (4.9), we obtain

$$n = n_{-1} - b_{10}(\omega - \pi), \tag{4.9'}$$

where is the rate of change of nominal wages. From this perspective, the number of workers rises if < since the real wage would be falling over time. Only if = is the real wage constant and $n = n_{-1}$.

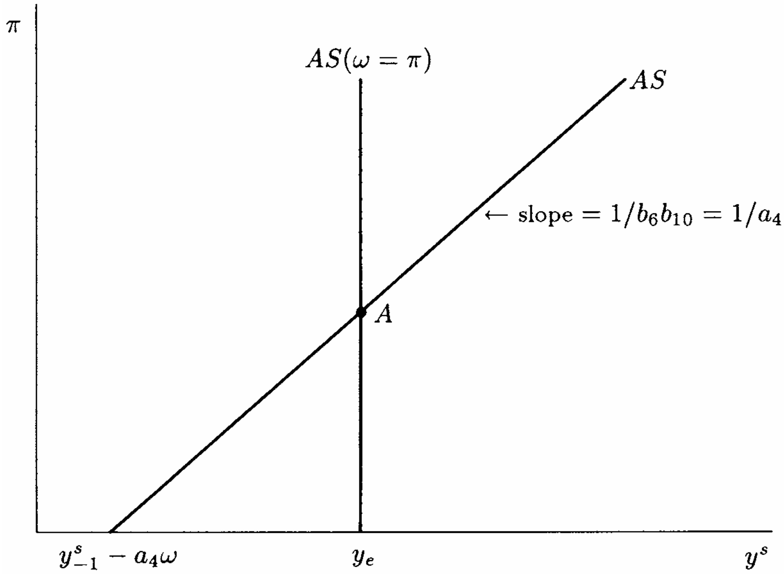

Figure 4–6 The aggregate-supply curve

The General *AS* Curve

By taking first differences of the production function in equation (4.8), we obtain

$$y^s = y^s_{-1} + b_6(n - n_{-1}), \qquad (4.8'')$$

into which is substituted equation (4.9) to produce a relationship between output and the inflation rate:

$$y^s = y^s_{-1} - b_6 b_{10}(\omega - \pi). \qquad (4.10)$$

According to this equation, an increase in the inflation rate, with given, would start to reduce the real wage and increase the number of workers that firms want to employ. The extent of that adjustment is given by the parameter b_{10}. Then the extra workers will produce more output, as measured by the parameter b_6, allowing y^s to exceed . Hence, there is a positive relationship between y^s and and the *AS* curve is upward sloping.

On the other hand, if the labor market is in equilibrium, there is only one level of output that is consistent with that situation. From the production function, we can define equilibrium output as

$$y_e = b_8 + b_6 n_e, \qquad (4.11)$$

where n_e is the labor input, in natural logs of the number of workers when the labor supply equals the labor demand. In Fig. 3–10 on p. 87, it is the quantity *N0*. Thus, in equation (4.11), any combination of and is consistent with y_e and n_e as long as = . For that reason, if the labor market is in equilibrium, the associated *AS* curve is vertical with a horizontal intercept at y_e. Both the general *AS* curve and the long-run, equilibrium AS curve are drawn in Fig. 4–6.

The Supply of Labor

From the reservation-wage model of Ch. 3, there is a positive relationship between the number of individuals willing to work $\bar{H}$ hours and the real wage. In natural logs, the equation is

$$n^s = b_{11} + b_{12}(w - p). \tag{4.12}$$

Although the supply of labor is a crucial ingredient in the determination of equilibrium in the labor market, it plays no role in the aggregate-supply equation (4.10). Within limits to be established shortly, the number of workers in the economy is dictated by firms moving along their profit-maximizing labor-use curve of equation (4.9). Even in situations of excess demand in the labor market, n^s exceeds n and therefore firms will be able to find willing workers. The equilibrium wage is determined by $n^{s=}n^d$ $n+v$. Thus,

$$w - p = \frac{b_9 - b_{11} + v}{b_{10} + b_{12}}. \tag{4.13}$$

The lowest wage possible is reached when v=0 in equation (4.13) or where $n=n^s$. If the wage actually fell below this value, employment would be restricted by the labor-supply equation, but this would also imply that the unemployment rate had fallen to below zero. Since there is no evidence of this in Chart 1–3, the restriction on wage movements along the labor-use curve is of no consequence.

The equilibrium levels of employment, n_e, and of output, y_e, on the other hand, do depend on the supply of labor. Solving for n_e in equation (4.11) by substituting the wage rate from equation (4.13) into the labor-use equation (4.9) produces:

$$n_e = \frac{b_9 b_{12} + b_{10} b_{11} - b_{10} v}{b_{10} + b_{12}}. \tag{4.14}$$

It is obvious that changes in b_{11} or b_{12} in the supply equation will influence the value of n_e and through the production function, y_e. For example, a lowering of reservation wages will increase b_{11} in equation (4.12) and will lower the real wage while raising equilibrium employment as well as equilibrium output. On the other hand, any factor that raises v will reduce employment and output in the long run because of higher costs of filling vacancies. Finally, substituting equation (4.12) for n^s and equation (4.9) for n into $u=n^s - n$ produces,

$$u = b_{11} - b_9 + (b_{10} + b_{12})(w - p), \tag{4.15}$$

which shows a positive relationship between the unemployment rate and the real wage rate. If we were to substitute the equilibrium real wage from equation (4.13) into equation (4.15), the unemployment rate, when the labor market is in equilibrium, would be $u_{e=}v$. When the labor market has excess supply, the real wage is too high and $u>u_{e;}$ excess demand creates $u_e>u>0$.

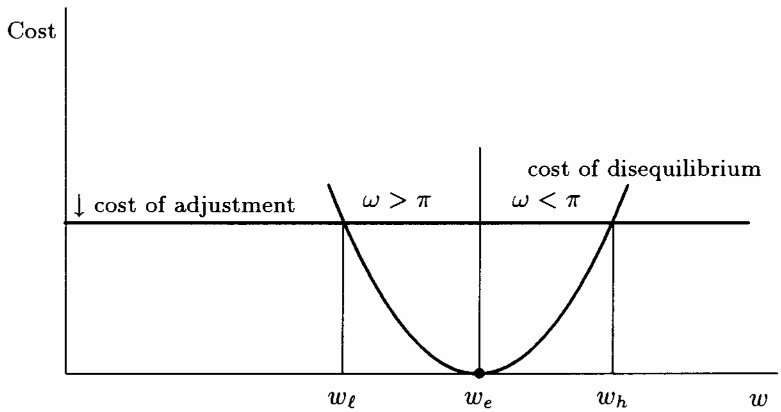

Figure 4–7 Adjustment and disequilibrium costs to wage changes

Nominal Wage Determination

The last step in the process of deriving the *AS* curve involves the determination of , the rate of change of nominal wages. Again a special characteristic of the labor market is involved. The labor market is distinguished from "spot" markets, where purchases and sales are made for current use. Employment involves a longer-term commitment, whether or not a union contract exists. This commitment is not absolutely binding on either the firm or the worker, but a tacit agreement is in force that sets the nominal wage for some time into the future. If a spot market were the rule in labor transactions, it would mean that workers and management would be renegotiating the wage every day or even every hour as new developments occurred in the labor market. The costs of this process are sufficiently high and the uncertainty is sufficiently annoying to both parties that a "fixed" wage for some period of time is accepted by both groups. This does not mean that the length of time for which wages are constant is institutionally rigid, but one- to three-year contracts are still the norm.

The previously introduced device of adjustment and disequilibrium costs can be applied to see why wages are fixed in some circumstances. Both workers and firms will have to absorb costs when the wage rate is away from its equilibrium value. These costs are shown as quadratic in Fig. 4–7, rising steeply in both directions as we move from the nominal wage consistent with equilibrium, w_e. To the right of w_e, nominal wage increases should be less than the inflation rate to bring down the real wage; to the left of w_e, the opposite relationship between and holds. Contrary to previous applications of adjustment costs, in the wage-negotiations case they are likely to be fixed, in the sense that they involve information and negotiation costs that do not vary with the difference between the real wage in the market and the equilibrium wage. In these circumstances, minimizing total costs involves choosing the lower of the two costs. Therefore, between *we* and w_h, adjustment costs are higher than disequilibrium costs and labor-market participants will tolerate the disequilibrium that they experience. On the other hand, if the actual real wage is higher than w_h or lower than w_e, they will incur the adjustment costs and move back to w_e.

In most markets, adjustment costs are very low and therefore equilibrium prices prevail almost all the time, but in the labor market, because of the ambiguous sharing of property rights, these costs are likely to be higher; hence, they provide a rationale for less-than-continuous changes in   to keep the real wage at w_e. However, since adjustment costs are incurred once while disequilibrium costs are paid as long w w_e, adjustment costs fall over time or disequilibrium costs rise over time. It is for that reason that wages are negotiated periodically, more frequently if adjustment costs fall relative to disequilibrium costs. During periods in which inflation is low and labor-market activity is fairly predictable, wages may be negotiated only every year, but in periods of variable inflation or other turmoil, wages may be subject to change much more frequently.

The general proposition is that the nominal wage, or its rate of change in an inflationary setting, will be set so as to maintain equilibrium in the labor market, although its welfare consequences for a heterogeneous labor force will cause us to challenge this requirement in the next chapter. A constant real wage can be guaranteed by setting   equal to , but since   is set for a future period   cannot yet be observed and ^{e}, the expected inflation rate, will have to be used instead. This requirement can be written as

$$\omega = \pi^e. \tag{4.16}$$

The determination of wages is a complex process where emotional issues are just as important as economic ones and in specific circumstances equation (4.16) is wide of the mark, but for now we will accept it as a first approximation. However, there are two general sets of circumstances where equation (4.16) would not hold: (1) when the marginal product of workers is increasing over time so that the real wage should also rise and this requires that   > ^{e}; and (2) if bargaining is taking place at a time when the labor market is not in equilibrium and   will diverge from ^{e} to allow the real wage to rise or fall to re-establish equilibrium. For the present, in order to keep the analysis as uncomplicated as possible, the absence of both of these circumstances will be assumed. In that case, equation (4.16) can be substituted into the *AS* curve of equation (4.10), but also y_e can be substituted for $y^s{}_{-1}$ when the economy starts from equilibrium. Thus the final version of the *AS* curve is

$$y^s = y_e - a_4(\pi^e - \pi), \tag{4.17}$$

where a_4=b_6b_{10}. Hence, an increase in the importance of labor in the production function or a flatter labor-use curve will raise the value of a_4.

Equation (4.17) captures both the long-run and short-run properties of the *AS* curve. If the long run is identified with equilibrium, the vertical *AS* curve of Fig. 4–6 is obtained if ^{e}=   or, in other words, if inflationary expectations are fulfilled. On the other hand, if   does not coincide with ^{e}, as could occur in the short run, then the last term in (4.17) is either positive or negative and y^s exceeds or falls short of y_e. Equation (4.17) is now the positively-sloped line in Fig. 4–6, with the horizontal intercept of $y_{e-}a_4$ ^{e}.

The Phillips Curve

The Phillips curve is essentially a generalization of the wage adjustment process stated in equation (4.16), which holds only if the labor market is in equilibrium. To allow for excess demand and excess supply, the Phillips-curve equation can be written as

$$\omega = \pi^e - \lambda(u - u_e), \tag{4.18}$$

where $u - u_e > 0$ signifies excess supply in the labor market, which puts downward pressure on the real wage and requires that $<$ ^{e}. The opposite pressure applies for excess demand, when $u - u_e < 0$. The parameter A translates the extent of disequilibrium in the labor market into real-wage changes per unit of time. The lower is the value of , the flatter is the Phillips curve. In Ch. 1, the value of was estimated to be in the vicinity of 0.6 to 0.7.

This completes the discussion of the various building blocks of the macroeconomic model and we are now ready to take a look at its structure.

4.2 The Complete System

The macroeconomic model consists of the *IS*, *LM*, and *AS* equations, which are repeated here as

$$y = a_0 - a_1(i - \pi^e), \tag{4.3}$$

$$\mu - \pi = a_2 y - a_3 i - (m - p)_{-1}, \tag{4.6}$$

$$y^s = y_e - a_4(\pi^e - \pi). \tag{4.17}$$

The only additional information that we need to close the system is that output demanded as determined by the *IS-LM* equations equals output supplied as derived from the *AS* curve. This requirement can be written as

$$y = y^d = y^s, \tag{4.19}$$

where y^d is the relevant variable in the *AD* curve which was obtained previously by collapsing the *IS-LM* equations into equation (4.7). This system is very flexible. If we want to determine all three important macroeconomic variables, *y, i,* and , we use equations (4.3), (4.6), and (4.17) together with our information about μ, $(m-p)_{-1}$, ^{e}, and y_e, the parameters a_0 through a_4 and the equilibrium condition of equation (4.19). If, on the other hand, we are content to calculate y and , we need only use equations (4.7) and (4.17) together with (4.19). Nevertheless, these two ways of looking at the economy do not present different views; they are fundamentally the same, with the former having somewhat more detail than the latter, remembering that the *AD* curve is just another way of writing the combined *IS-LM* curves.

The complete system is depicted in Fig. 4–8. In the upper portion is the *IS-LM* framework which is similar to Fig. 4–3. The lower portion combines the *AD* and *AS* curves of Fig. 4–5 and Fig. 4–6. Because of the connection between the *IS-LM* curves and the *AD* curve, the equilibrium level of income in the upper portion of the diagram cannot differ from that in the lower portion.

The intersection of *IS*(^{e}) and *LM* determines *y* and *i* and from *IS*(^{e}=0), we can read *i*− ^{e}. Then, from the intersection of *AD* and *AS,* we can derive the equilibrium values of and *y*. More importantly, we can determine the changes in *y*, *i*, and that occur if policy changes or exogenous events shift one or more of the *IS-LM-AS* curves.

4.3 Long-run Equilibrium

If left to its own resources for a period of time, the economy would settle down at a particular combination of *y, i,* and and would replicate itself year after year. We do not observe such a situation very often, if at all, since there are always new events occurring that start a fresh round of adjustment before the previous one is completed. Nevertheless, this concept of long-run equilibrium is useful for analyzing the path that *y, i,* and would take if sufficient time were to elapse. How long does it take to reach long-run equilibrium? No precise answer can be given in terms of months or years, especially since there is much dispute about what contributes to the speed of adjustment in the economy when presented with an exogenous event. Keynesians feel that the adjustment process is slow and that long-run equilibrium is a distant goal while neoclassical economists believe that the economy has the ability to adjust quickly and that the long run is easily reached. Both sides believe in equilibrium but their notion of what it constitutes differs. To accommodate both positions in the macroeconomic model, we can introduce another version of equilibrium, namely short-run equilibrium or more aptly called *temporary equilibrium* in that the economy can be observed to be in this position for some short period of time before it continues its adjustment process to the long run.

We can define these concepts of equilibrium more precisely in terms of certain characteristics of the model. Short-run equilibrium requires only the previously stated mechanism of closing the system, namely

$$y = y^d = y^s, \qquad (4.19)$$

while long-run equilibrium requires, in addition, that

$$\pi = \pi^e \quad \text{or} \quad y = y_e. \qquad (4.20)$$

From these requirements, we can see that the goods market is in a position of rest under both concepts of equilibrium. If output demanded did not conform to output supplied, there would be involuntary inventory adjustments and further changes in output and income would occur. This process is assumed to be completed every time we observe an economy in short-run equilibrium. Equation

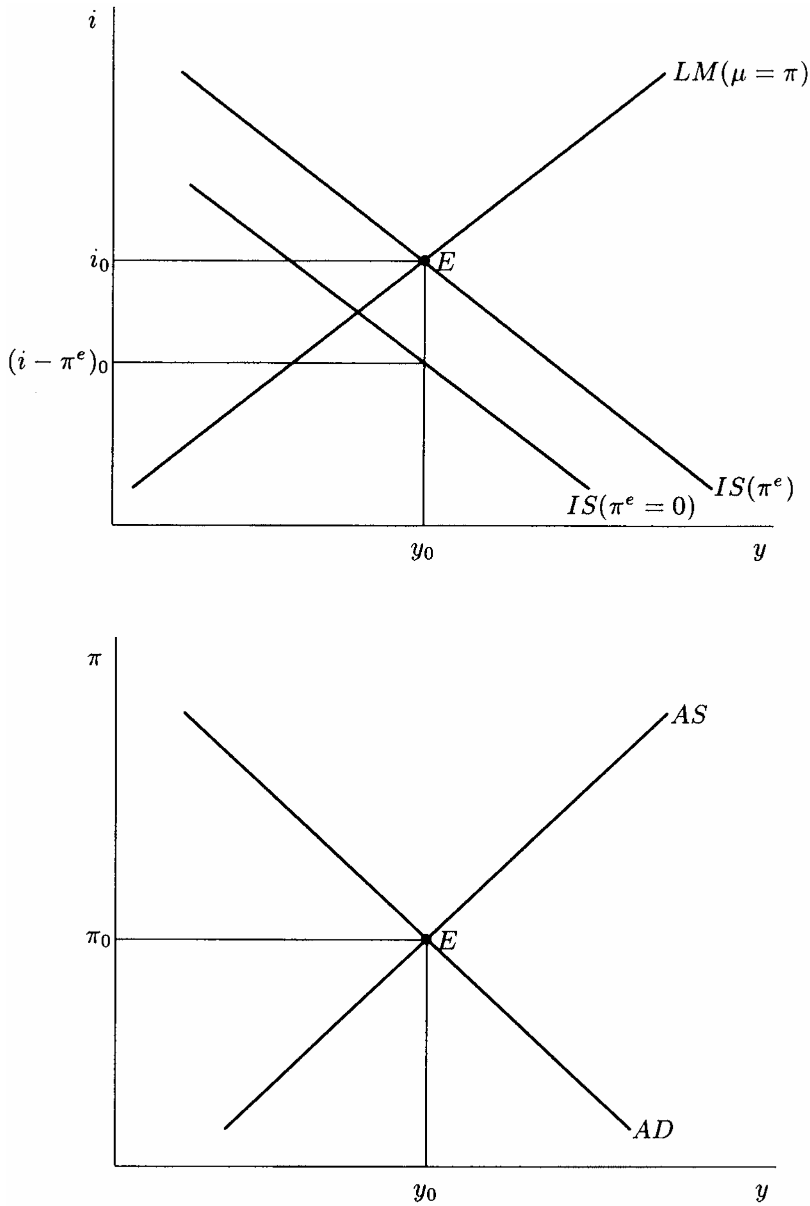

Figure 4–8 The complete system

(4.19) also indirectly requires the asset markets to be in equilibrium at all times since the position of the *AD* curve would not remain constant if μ or $(m-p)_{-1}$ were changing over time. However, the labor market may not be in equilibrium in the short run, although it must be in the long run. Only if equation (4.20) is satisfied is the real wage constant at the level required to set supply equal to demand in the labor market. When expectations about inflation are fulfilled, there is no incentive to make further adjustments and the economy can settle down to a stationary state. If and ^{e} do not coincide, this will not be known until the end of the current period during which no adjustment takes place, but after which a new estimate of ^{e} will be made.

Expectations about the future rate of inflation play a vital role in the macroeconomy but ^{e} cannot be observed directly; therefore, we can never be sure how it is determined or how it adjusts to new circumstances. It is this unobservability of ^{e} that makes macroeconomics both frustrating and exciting. All the other variables in our macroeconomic model can be measured—some more accurately than others—but ^{e} remains elusive. We could take a poll, asking a random selection of people for their estimate of $^{e.}$ But opinion polls are fragile things to interpret and since expected inflation is a more important variable for some economic decisions than for others, it is not clear how one can get a meaningful index of ^{e} . Alternatively, we might perhaps infer ^{e} from current wage settlements. But as we saw earlier, there are times when and ^{e} need not coincide and unless we can pinpoint the change in labor productivity, the extent by which can diverge from ^{e} cannot be calculated.

Despite the fact that ^{e} remains a state of mind, we can insist that long-run equilibrium is only achieved when $= {}^{e.}$ A situation where is not equal to ^{e} is a message to alert individuals that they made a mistake in the past and that ^{e} needs correction. When equation (4.20) is satisfied however, individuals are happy with their previous decisions and are ready to repeat them unless new events come along that break the existing pattern.

The last major task in this chapter is to explore the characteristics of long-run equilibrium, leaving for subsequent chapters a discussion of the series of short runs as the economy evolves to a new long-run equilibrium. If $= {}^{e}$, the macroeconomic model of equations (4.3), (4.6), and (4.17) is simplified. First, the *AS* curve becomes $y=y_e$ and is drawn as the vertical line in Fig. 4– 9. Because it is vertical, the *AS* curve determines income and output without reference to the *AD* curve. Second, given *y,* the *IS* curve can be rewritten as . Next, for the *LM* curve to remain in place requires that $\mu=$, which suggests that equation (4.4) becomes relevant and that $\mu= \; = {}^{e}$. Then substituting in the *LM* curve, allows us to solve for the real money supply. Finally, the real interest rate is determined by

There are a number of important implications of this long-run structure of the economy. First, the solutions for *y*, , and *i* are determined sequentially, not simultaneously. Output and income are determined only by the *AS* curve, the inflation rate is equal to the given growth rate of the money supply and the interest rate is determined by the location of the *IS* curve. In the lower portion of Fig. 4–9, the *AD* curve plays a limited role; it intersects with the *AS* curve at a vertical distance of $\mu=$. To summarize, the long-run values of *y,* , and *i* are given by:

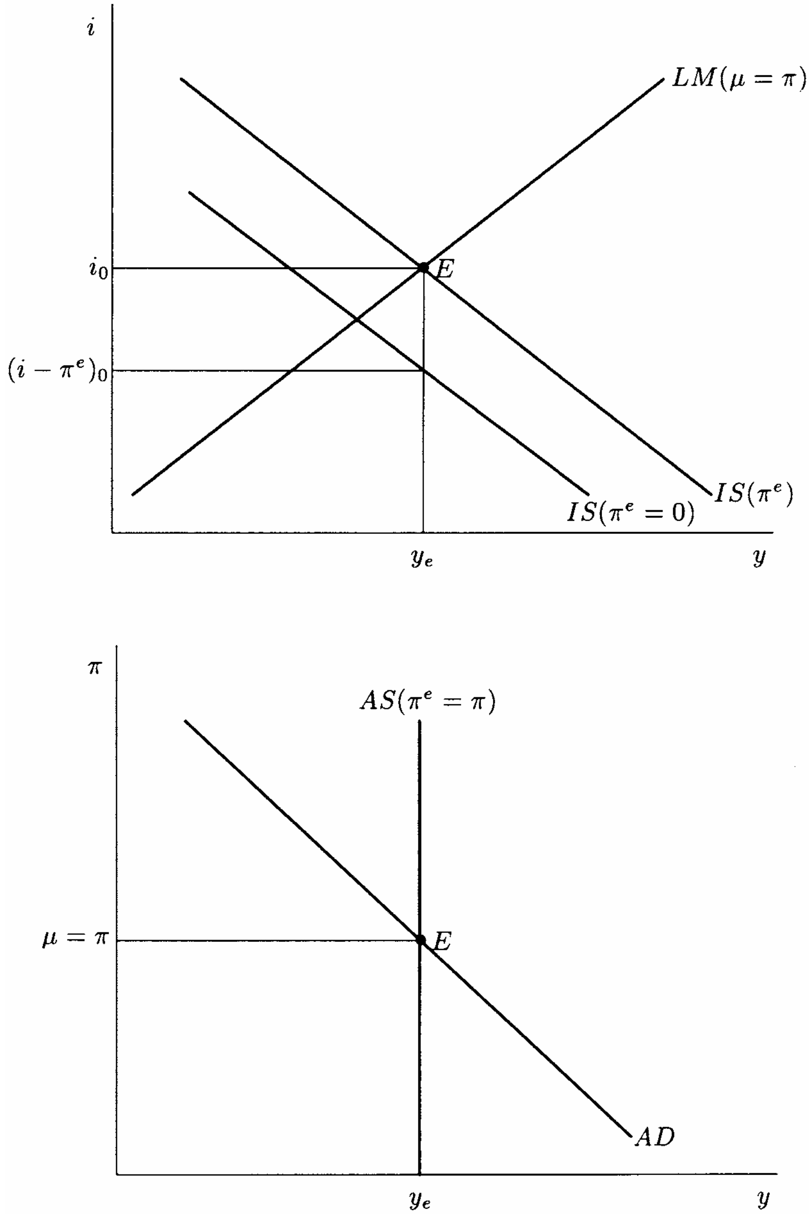

Figure 4–9 Long-run equilibrium

$$y = y^d = y^s = y_e, \tag{4.21}$$

$$\pi = \mu = \pi^e, \tag{4.22}$$

$$i = \frac{a_0 - y_e}{a_1} + \mu. \tag{4.23}$$

All the variables on the right-hand side of these equations are exogenous and they uniquely determine the three variables of greatest interest to any discussion of macroeconomic performance.

Second, this structure must be interpreted in a way that may be unfamiliar. As a case in point, aggregate-demand policies in the form of fiscal or monetary policy, although they affect the location of the *IS* or *LM* curves, do not influence the level of income. No matter what happens in the upper portion of Fig. 4–9, output remains at y_e as dictated by the *AS* curve. Since the real wage remains constant in the long run, the labor input into the production process remains unaltered and together with a fixed capital stock, y_e is the only possible output from the production function. Demand for that output will automatically materialize. As we shall see later, from a long-run perspective, policy influences on output and income have to come through the *AS* curve, hence the term "supply-side policies."

4.4 The Long-run Effects of a Supply Event

To understand better the long-run characteristics of the macro model, it is useful to postulate some exogenous shock to the system that has lasting real and nominal repercussions. From the previous discussion of aggregate-demand policies, it is obvious that this can only be accomplished by some event that affects the location of the long-run *AS* curve. In the long run, the horizontal intercept of the *AS* curve is determined by equilibrium employment in equation (4.14). Consider a decrease in the supply of labor at every wage rate, as might occur after an increase in nonwage income; now the reservation wage would be higher and make work less attractive. This lowers the value of b11 in equation (4. 12). In panel (b) of Fig. 4–10, the decreased labor input is translated into lower equilibrium output by a shift to the left of the vertical *AS* curve and *y* decreases to $y_{e1.}$ If the *AD* curve did not shift, the inflation rate would rise to $_1$. However, since μ has not changed, must remain as before and *AD* will shift to the left to intersect *AS* at *E* . The *LM* curve in panel (a) is also affected by this exogenous event; $m-p$ must fall to satisfy the lower transactions demand. This is accomplished by having temporarily above μ for some time during the adjustment process. The new *LM* curve, *LM* , intersects *IS* at *E* where y_{e1} prevails; here, both *i* and $i-\ ^e$ are higher. Finally, the increased real interest rate will choke off some aggregate demand (i.e., investment expenditures) in the face of lower equilibrium output.

This is a convenient place to stop. The full model has been elaborated and its long-run implications have been explored. The next step, in Ch. 5, is to introduce macroeconomic shocks that give rise to recessions and booms and to transfer

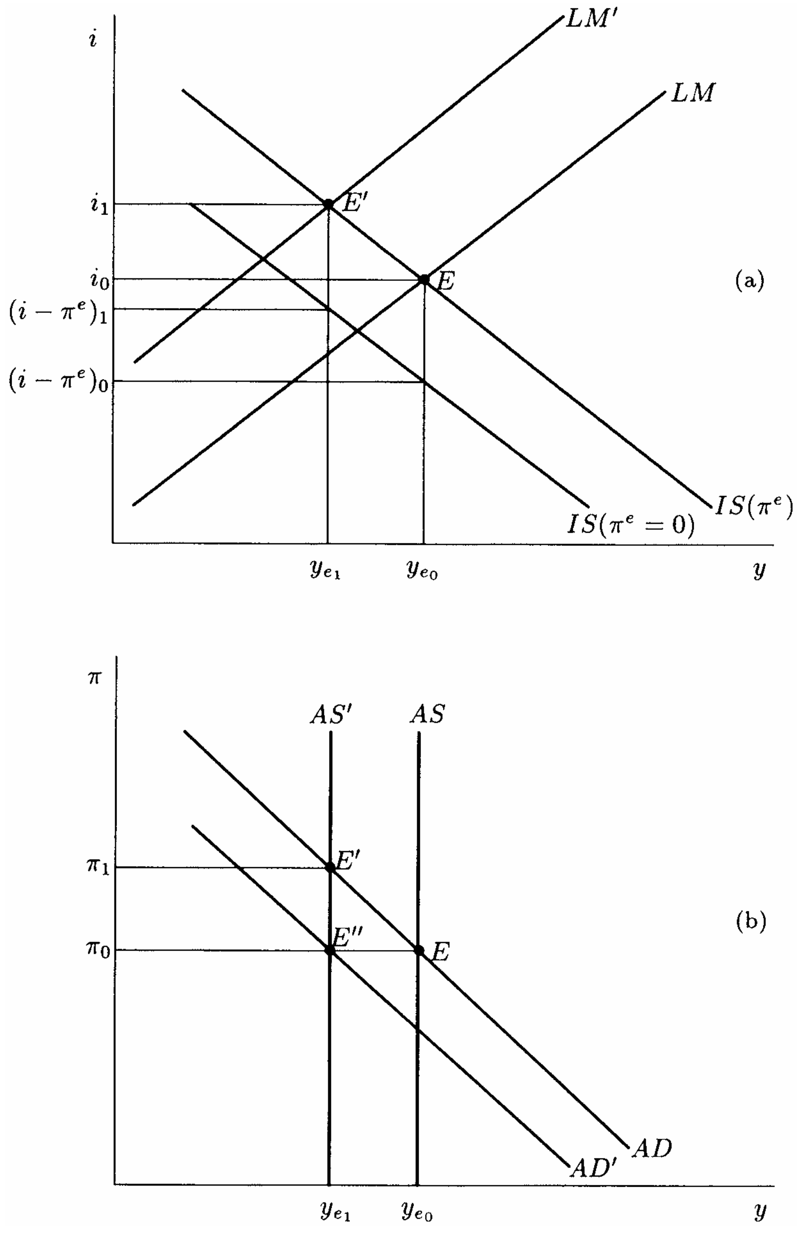

Figure 4–10 The long-run effects of a supply event

these events to the labor market to determine how employment, the real wage, and unemployment react.

4.5
Summary

This chapter has developed and analyzed a simple but comprehensive model of macroeconomic behavior. It has some important characteristics that are worth enumerating:

1. It attempts to explain the most significant variables in the economy: income, the interest rate, and the inflation rate.
2. It incorporates the most important markets: goods, assets, and labor.
3. It uses the now familiar *IS-LM-AS* framework.
4. It distinguishes between short-run equilibrium, where only aggregate demand equals aggregate supply and the long run, where in addition, inflationary expectations are fulfilled.
5. It distinguishes between nominal and real economic magnitudes and the effect that exogenous changes can have on these two categories of variables.
6. It incorporates, in a very general way, both fiscal and monetary policy instruments.
7. It has dynamic features, allowing for continuing adjustment in the economy following a one-time change in an exogenous variable.
8. Its most important feature is that it does not take sides in the debate between Keynesians and neoclassical macroeconomists.

5
The Labor Market in the Business Cycle

This chapter continues the analysis of the macroeconomy, with a special emphasis on the role played by the labor market. First, random shocks will be introduced that have the capability of moving the economy away from long-run equilibrium as defined in Ch. 4. This feature will allow us to differentiate between predictable events that can be incorporated into expected inflation and unpredictable shocks that create a discrepancy between predicted and actual inflation. Second, the effects of the shocks on the real wage, employment, and unemployment will be investigated. Third, in the aftermath of the shocks, the real wage must adjust to re-establish equilibrium in the labor market, but the welfare repercussions of this process indicate a conflict between "secure" and "marginal" workers. The resolution of this conflict is not easily predicted and wage determination may have "democratic" forces as much as competitive forces.

5.1
Introducing Uncertainty in the Economy

Business cycles involve departures of income from potential output or the unemployment rate from the natural rate as well as errors in the prediction of inflation. Although the macroeconomic model developed in Ch. 4 is capable of predicting changes in output or inflation rates in response to various exogenous events, we need to differentiate between events that leave the labor market in equilibrium and those that create excess demand or supply for some time period. In the former case, no governmental intervention is required, but in the latter case, stabilization policies may be needed to overcome the labor-market disequilibrium.

To determine this difference requires identifying the distinction between predictable and unpredictable events. For instance, assume that at the beginning of a period, it is established that consumer expenditures will be lower than previously by a known amount. This event would shift the *IS* curve downward, but before we can calculate the effects of this change, we must be aware that there are other adjustments as well. Since the event is known beforehand, its effect on the inflation rate can be predicted precisely and incorporated into the expected rate of inflation. This leaves the equality between expected and actual inflation undisturbed and, dictated by the aggregate-supply curve, output remains at the equilibrium level. There will be a lower real interest rate which allows investment expenditures to replace the reduced consumption expenditures in the total demand for goods and services.

The complications for macroeconomic policy arise from uncertainty about the future. If, in the previous example, the consumers' intentions were not known economy-wide until after they were observed, a reduction in their expenditures would not be offset by increased investment purchases since the expected rate of inflation would not fall. Because of this shock to the system, output deviates from its equilibrium level and the labor market operates in a situation of excess supply.

When these shocks occur, the goods and money markets will still be observed in equilibrium. Adjustments to new information are virtually instantaneous and continuous in asset markets and thus a disequilibrium interest rate seems highly unlikely. In the goods market, on the other hand, unexpected inventory accumulation or decumulation can take place for some time before firms realize what is happening, but it will be assumed that annual observations in the national income accounts are sufficiently infrequent that inventories will have adjusted to the desired level. Therefore, only the labor market is subject to disequilibrium transactions in the following analysis.

5.1.1
Stochastic Variables

The version of the macroeconomic model developed in Ch. 4 does not contain elements of uncertainty and is therefore lacking an important ingredient for a coherent discussion of labor-market disequilibrium. However, this situation can be remedied. Uncertainty is everywhere and its existence will be introduced into all three markets in the macroeconomy: goods and services, assets, and labor. This is done by adding a stochastic variable to each of the *IS*, *LM*, and *AS* equations. A stochastic variable represents a random draw from a probability distribution that is known beforehand. For instance, consumption expenditures are largely predictable on the basis of known income, but some randomness continues to exist. This does not mean that consumers are making capricious decisions about their expenditures, but rather, that it is impossible to capture all the factors that determine everyone's consumption expenditures. All we can do is hope that these missing factors are random and relatively unimportant.

These random elements are literally added to the existing model, which can now be written as follows:

$$y = a_0 - a_1(i - \pi^e) + x_g, \tag{5.1}$$

$$\mu - \pi + x_m = a_2 y - a_3 i - (m - p)_{-1}, \tag{5.2}$$

$$y = y_e - a_4(\pi^e - \pi - x_s) + x_s. \tag{5.3}$$

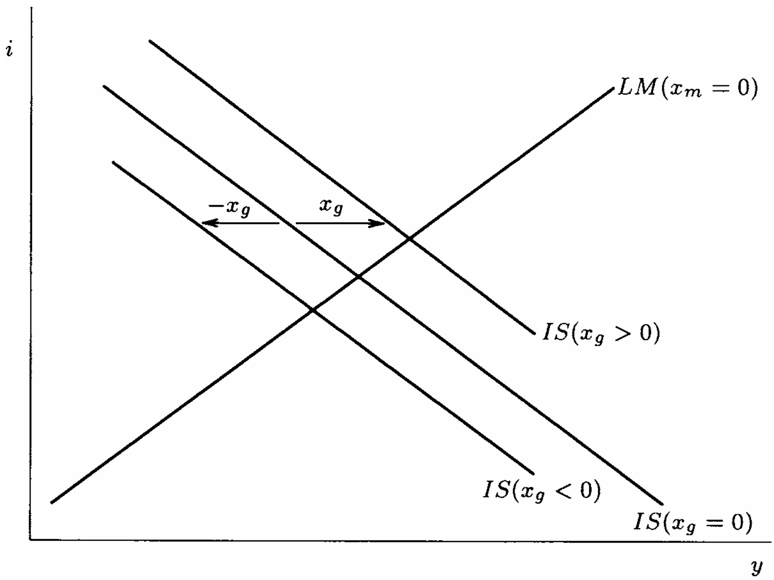

Figure 5–1 The stochastic *IS* curve

Previously defined variables are: y=income or output, i=interest rate, ^{e}=expected inflation, μ=growth rate of the money supply, =inflation rate, $(m-p)_{-1}$=real money supply at the end of the previous period, and y_e=equilibrium output. The variables y, y_e, and $(m-p)_{-1}$ are defined as the natural logs of their actual values. The as are positive parameters and can be interpreted as elasticities with respect to the variable to which they are attached. The growth rate of nominal wages, , is a contractual variable determined before shocks have revealed themselves and it is set equal to the expected inflation rate in equation (5.3).

The stochastic variables are x_g, x_m, and x_s, one to each equation. They are associated with unexpected "shocks" to the economy. They are also expressed as natural logs. When the economy is in full equilibrium, shocks must be absent by definition and each x is equal to zero. This means that the antilog of each x is 1 leaving the *IS*, *LM*, or *AS* equations influenced only by the deterministic elements of the model. Thus, the expected value of each x is zero. But we know from past experience that *xs* have been positive or negative. For instance, if x_g is positive, it can be interpreted as a "shock" that causes an unexpected increase in aggregate demand and shifts the *IS* curve upward and to the right as shown in Fig. 5–1. The value of x_g adds to the horizontal intercept of the deterministic *IS* curve for which x_g=0. Alternatively, a negative x_g subtracts from the existing demand and shifts the *IS* curve to the left. Although we do not know the direction and extent of the shift in the *IS* curve for the current period, we do know all the past

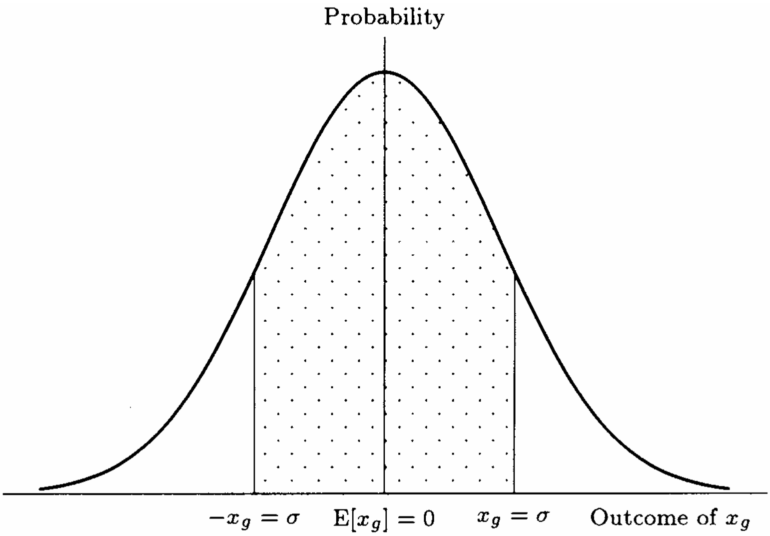

Figure 5–2 Probability distribution of x_g

shocks that have occurred. This information can be summarized by the standard deviation. It is calculated from

$$\sigma = \sqrt{\frac{\sum x_{g_i}^2}{n}}, \tag{5.4}$$

where $x_{gi}=x_{g1}\ldots x_{gn}$ represents all n of the previously observed shocks to the *IS* curve.

With our information about E[x_g] and , we can draw its probability distribution in Fig. 5–2. In this illustration, the larger the absolute value of x_g, the less likely its occurrence. The distribution is also drawn symmetrical about E[x_g] =0. Furthermore, for a "normal" distribution, two-thirds of all outcomes lie within one standard deviation of the mean (the shaded area in the diagram), 95% lie within two s and three s exhaust all but three out of a thousand possibilities, virtually the entire area under the bell-shaped curve. In the diagram, the shock is assumed to equal one standard deviation in size; two-thirds of the time it will be smaller and one-third of the time it will be larger.

Having identified x_g with demand shocks in the *IS* curve, we need to make comparable economic interpretations of x_m and x_s. In equilibrium, x_m=0, but an unexpected increase in the growth rate of the money supply means that x_m>0. This would tend to increase $m-p$ over time and have the effect of shifting the *LM* curve to the right, period after period, until catches up. A deviation of x_m from zero is labelled a "monetary shock." Finally, x_s is associated with a "supply shock." If x_s>0, output can expand beyond y_e even if and ^{e} remain equal to each other. This may arise from an unexpected increase in labor productivity.

Unlike the other shocks, x_s appears twice in equation (5.3). The reason is that x_s has two separate effects on y: (1) the existing labor force becomes more productive and adds x_s to output; and (2) the marginal product of labor increases, as measured by − $-x_s$. This causes firms to add workers to their labor force by the value of b_{10}, the parameter in the demand equation (4.9) on p. 120, who in turn produce more output by the value of b_6 in the production function of equation (4.8); a_4 is then defined as b_6b_{10} so that output expands a further a_4x_s for a total of $(1+a_4)x_s$. The stochastic version of the *AD* curve is derived by substituting the *IS* curve of equation (5.1) into the *LM* curve of equation (5.2) and is written as

$$\pi = \mu + (m-p)_{-1} - \left(a_2 + \frac{a_3}{a_1}\right) y^d + \frac{a_3 a_0}{a_1} + a_3\pi^e + x_m + \left(\frac{a_3}{a_1}\right) x_g. \tag{5.5}$$

This is the same as equation (4.7) on p. 115 except for the addition of the last two terms that capture aggregate-demand shocks.

5.1.2
Information Extraction

The values for x_g, x_m, and x_s are not directly observable, even after the fact, because our data do not distinguish between anticipated and unexpected events. For instance, if the growth rate of the money supply for a given year is measured at 10%, it is unlikely that the central bank would be able to indicate that 8% was expected and 2% was unintended. However, we can extract information about the xs by observing y, , and i. The *IS-LM-AS* curves of equations (5.1), (5.2), and (5.3) are drawn in Fig. 5–3, initially with all xs equal to zero. Now, each x will be allowed to take on a positive value which will change , y, and i, but the combination of these changes will be unique for each x. Start with $x_g>0$. This shifts the *IS* curve up to *IS*' and also the *AD* curve to *AD'*. The new short-run equilibrium is observed at *E'* with y_1, ${}_1$, and i_1. Now consider a positive x_m. For this event, the *LM* curve shifts to *LM'* and the *AD* curve again moves to *AD* . At *E* , we observe y_1, ${}_1$, but i_2. Thus a goods-market shock can be differentiated from a money-market shock by what happens to the interest rate. Finally, assume that $x_s>0$. This shock shifts the *AS* curve down and to the right leading to *E* where y_1, ${}_2$, and i_2 prevail. Now, x_s and x_m can be distinguished by the reaction of the inflation rate. It should be noted that the *LM* curve will have to shift to *LM* because $<\mu$ for some period of time. These effects are summarized by the sign matrix below, where each of the columns has a unique combination of signs:

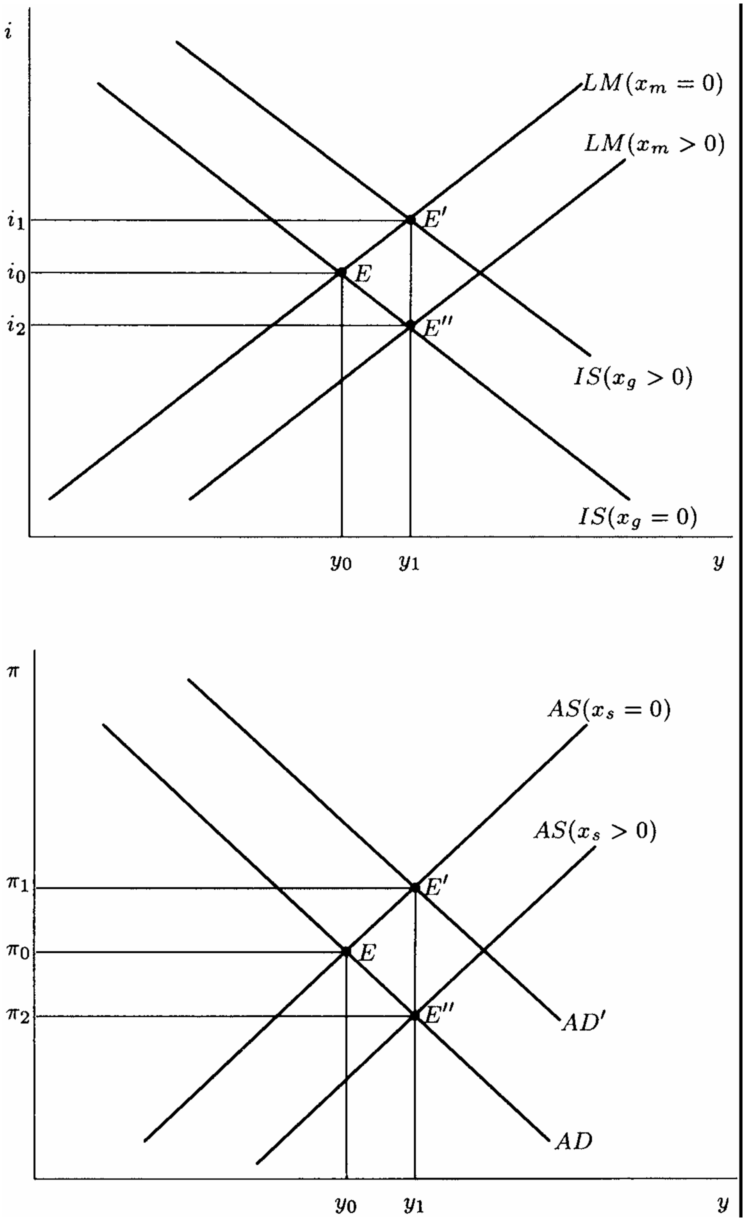

Figure 5–3 Information extraction from different shocks

$$
\begin{array}{c} \\ y \\ \pi \\ i \end{array}
\begin{array}{c} x_g > 0 \quad x_m > 0 \quad x_s > 0 \\ \left(\begin{array}{ccc} + & + & + \\ + & + & - \\ + & - & - \end{array} \right) \end{array}
$$

In all cases, *y* rose to y_1, but negative shocks would lead to a reduction in income and all signs would be reversed. There is, of course, the possibility that more than one *x* is nonzero in any one period in which case, information extraction becomes more complicated but not impossible. We know that in general *y*, , and *i* depend on all the *xs* and solving equations (5.1), (5.2), and (5.3) for the *xs* with *y*, , and *i* treated as exogenous variables would show how the observed changes in *y*, , and *i* give rise to certain values for the *x*s. However, in order to do this, we would have to have accurate estimates for all the as as well as the other variables in the system.

5.2
Forming Expectations about Inflation

In the previous discussion about the effects of a reduction in consumption expenditures, the distinction between a predicted change and an unexpected event was paramount. In the former case, the effect of lower consumption expenditures could be incorporated into ^{e}, but in the latter case this could not be done. With predictable events, ^{e}= and $y=y_e$, but if the event occurs without warning, ^{e} need not equal and *y* need not coincide with y_e, so that the economy may now diverge from its equilibrium position. This suggests an important role for ^{e} and the process by which it is determined in the performance of the macroeconomy.

How are expectations about inflation formed? Since we cannot observe *expected* variables, we are forced to theorize about this process without being able to verify it explicitly. However, individuals can be expected to be economically rational about this process, which means that they should make optimal forecasts of inflation based on their knowledge of the macroeconomic model and conditioned on the efficient use of all available information. Hence, this process is called rational expectations.

If forming expectations is merely information processing, what information do individuals have and how do they use it? First, they know the *IS-LM-AS* model and the role of the inflation rate in it. For instance, individuals can be presumed to know that a decrease in consumption expenditures will cause a temporary decline in the inflation rate and that an increase in μ will cause a permanent increase in the inflation rate. If they observe either event they would want to incorporate its effect into their prediction of the inflation rate for the next period. Second, they have certain information about the current performance of the economy and policies in force at the moment which they would use in forecasting inflation. This procedure can be formalized in the following way. First, we need to solve the *IS-LM-AS* model to obtain the determinants of the inflation rate. This involves finding the solutions for *y*, , and *i,* in equations (5. 1), (5.2), and (5.3) in terms of all the exogenous variables in the system. The solution for   is

$$\pi = \left(\frac{1}{a_1 + a_3 a_4 + a_1 a_2 a_4}\right) \Big(a_1[\mu + (m-p)_{-1} + x_m] + a_3(a_0 + x_g) - (a_1 a_2 + a_3)[y_e + (1 + a_4)x_s] + (a_1 a_3 + a_3 a_4 + a_1 a_2 a_4)\pi^e\Big). \tag{5.6}$$

Each individual now knows what causes inflation and to what extent. For instance, a decrease in consumption expenditures is captured by a fall in a_0; multiplying by the known value of $a_3/(a_1+ a_3a_4+a_1a_2a_4)$ allows us to calculate the effect on . Similarly, an *exogenous increase* in ^{e} increases by $(a_1a_3+a_3a_4 +a_1a_2a_4)/(a_1+ a_3a_4+a_1a_2a_4)$. To ensure that does not rise more than ^{e}, we can impose a limit of $0<a_3<1$ on the parameter a_3; otherwise, we would end up with an explosive cycle of inflation merely through the expectations process without an accompanying increase in μ.

But even more important is the fact that ^{e} should not be treated as an *exogenous* variable. If a0 changes and responds, why would ^{e} remain at its previous level? If it did, we may not be using all the information we have at hand. To get out of this vicious cycle of determining ^{e} and *vice versa,* we need to preserve the structure of equation (5.6) but to eliminate ^{e} from it. Without ^{e} in equation (5.6), the parameters attached to the other variables in the equation would no longer be the same, since the underlying model now treats ^{e} as an endogenous variable, rather than as an exogenous variable as before. To cope with this vexing problem, we "invent" an equation similar to (5.6), but without ^{e} in it, which means that and the other exogenous variables are connected by what are known as "undetermined coefficients." This equation is written as

$$\pi = c_0\mu + c_1(m-p)_{-1} + c_2 x_m + c_3 a_0 + c_4 x_g + c_5 y_e + c_6 x_s, \tag{5.7}$$

where the *c*s are not yet identified. Nevertheless, equation (5.7) also represents a way of determining inflation.

Second, ^{e} is the mathematical expectation of from this equation. Therefore,

$$\pi^e = \mathrm{E}[\pi] = c_0\mu + c_1(m-p)_{-1} + c_3 a_0 + c_5 y_e. \tag{5.8}$$

The terms c_2x_m, c_4x_g, and c_6x_s have been eliminated since the expected value of the *x*s is zero and therefore these variables cannot influence expected inflation, although the subsequent occurrence of non-zero *x*s will affect actual inflation.

Now equation (5.8) includes all the factors that can influence expected inflation and it can be substituted back into equation (5.6) to eliminate ^{e} from the list of exogenous variables. This produces

$$\begin{aligned}\pi = \left(\frac{1}{a_1 + a_3a_4 + a_1a_2a_4}\right)\Big([&a_1 + c_0(a_1a_3 + a_3a_4 + a_1a_2a_4)]\mu \\ &+ [a_1 + c_1(a_1a_3 + a_3a_4 + a_1a_2a_4)](m - p)_{-1} + a_1x_m \\ &+ [a_3 + c_3(a_1a_3 + a_3a_4 + a_1a_2a_4)]a_0 + a_3x_g \\ &+ [c_5(a_1a_3 + a_3a_4 + a_1a_2a_4) - (a_1a_2 + a_3)]y_e \\ &- [(a_1a_2 + a_3)(1 + a_4)]x_s\Big).\end{aligned} \tag{5.9}$$

Third, by a careful comparison, it can be seen that equation (5.9) has exactly the same variables on the right-hand side as equation (5.7), the one that each individual invents who forms expectations about ^{e}. Since they both come from the very same *IS-LM-AS* model of equations (5.1), (5.2), and (5.3), the coefficients attached to each variable must be the same. With this information we can now solve for the undetermined coefficients, the cs in equation (5.7), by setting them equal to the corresponding coefficient in (5.9). Thus

$$c_0 = \frac{a_1 + c_0(a_1a_3 + a_3a_4 + a_1a_2a_4)}{a_1 + a_3a_4 + a_1a_2a_4}$$

which simplifies to

$$c_0 = \frac{1}{1 - a_3}.$$

This parameter is positive because it was shown earlier that $a_3<1$. Next,

$$c_1 = \frac{a_1 + c_1(a_1a_3 + a_3a_4 + a_1a_2a_4)}{a_1 + a_3a_4 + a_1a_2a_4},$$

which again simplifies to

$$c_2 = \frac{a_1}{a_1 + a_3a_4 + a_1a_2a_4} > 0.$$

Then

$$c_1 = \frac{1}{1 - a_3} > 0.$$

In a similar fashion, the other coefficients are determined to be

$$c_3 = \frac{a_3}{a_1(1 - a_3)} > 0,$$

$$c_4 = \frac{a_3}{a_1 + a_3a_4 + a_1a_2a_4} > 0,$$

$$c_5 = -\frac{a_1a_2 + a_3}{a_1(1 - a_3)} < 0,$$

$$c_6 = -\frac{(a_1a_2 + a_3)(1 + a_4)}{a_1 + a_3a_4 + a_1a_2a_4} < 0.$$

We have now come full circle. The undetermined coefficients are determined and we can get rid of the *c*s in equation (5.7) which now represents the structural relationship for the inflation rate, including the role of expected inflation, but without having ^{e} as a variable on the right-hand side. By substituting for the cs in equation (5.7), we arrive at

$$\begin{aligned}\pi = {} & \frac{1}{1-a_3}[\mu + (m-p)_{-1}] + \frac{a_1}{a_1 + a_3 a_4 + a_1 a_2 a_4} x_m \\ & + \frac{a_3}{a_1(1-a_3)} a_0 + \frac{a_3}{a_1 + a_3 a_4 + a_1 a_2 a_4} x_g \\ & - \frac{a_1 a_2 + a_3}{a_1(1-a_3)} y_e - \frac{(a_1 a_2 + a_3)(1+a_4)}{a_1 + a_3 a_4 + a_1 a_2 a_4} x_s.\end{aligned} \tag{5.10}$$

The last step in completing the model involves forming expectations about inflation from equation (5.10). Thus

$$\pi^e = \frac{1}{1-a_3}[\mu + (m-p)_{-1}] + \frac{a_3}{a_1(1-a_3)} a_0 - \frac{a_1 a_2 + a_3}{a_1(1-a_3)} y_e. \tag{5.11}$$

Equation (5.11) only differs from (5.10) since $E[x_m]=E[x_g]= E[x_s]=0$. This completes the process by which expectations about inflation are formed by rational individuals who use all the information available to them in order to minimize the undesirable effects of errors in ^{e}.

5.3
The Effect of Shocks on the Labor Market

So far, the effects of the shocks have appeared in the goods and money markets, but it is also possible to see how the labor market reacts when any of the three types of unpredictable events occurs. Thus, the impact of the various xs on the real wage, employment, and unemployment can now be investigated. The real wage changes from one period to the next according to

$$w - p = (w-p)_{-1} + \omega - \pi. \tag{5.12}$$

If the economy starts in full equilibrium, will be set equal to ^{e} and therefore, the real wage changes by the difference between ^{e} and from equations (5.10) and (5.11). When substituted into the wage equation, we obtain

$$\begin{aligned} w - p = {} & (w-p)_{-1} - \frac{a_1}{a_1 + a_3 a_4 + a_1 a_2 a_4} x_m \\ & - \frac{a_3}{a_1 + a_3 a_4 + a_1 a_2 a_4} x_g + \frac{(a_1 a_2 + a_3)(1+a_4)}{a_1 + a_3 a_4 + a_1 a_2 a_4} x_s.\end{aligned} \tag{5.12$'$}$$

The two "demand shocks," x_{m} and x_g, will force the real wage to move in the opposite direction. For example, a positive monetary shock will leave the expected rate of inflation unchanged, but will raise the actual inflation rate by less than the size of the shock itself. On the other hand, a positive productivity shock, $x_s>0$, will lower the actual inflation rate and will increase the real wage by more than the size of the shock if $a_1a_2+a_3>a_1$.

Whatever happens to the real wage, it will stimulate firms to adjust their employment level to get back to the profit-maximizing labor-use curve, written as

$$n = b_9 - b_{10}(w - p - x_s), \tag{5.13}$$

which is the same as equation (4.9) in Ch. 4, except for the addition of the productivity shock in the brackets where it has the same effect on the demand for labor as an equal proportional decline in the real wage. By substituting the wage change from equation (5.12), the effect on employment can be calculated:

$$\begin{aligned} n = n_{-1} + b_{10}x_s + \frac{b_{10}a_1}{a_1 + a_3a_4 + a_1a_2a_4}x_m \\ + \frac{b_{10}a_3}{a_1 + a_3a_4 + a_1a_2a_4}x_g - \frac{b_{10}(a_1a_2 + a_3)(1 + a_4)}{a_1 + a_3a_4 + a_1a_2a_4}x_s. \end{aligned} \tag{5.13′}$$

In addition to changes in employment from real-wage adjustments after any of the shocks, there is the direct positive effect of higher productivity on the demand for labor. If the real wage were constant, firms would have an incentive to hire more workers when their productivity rises, to reduce the marginal product to the previous level and this is captured by $b_{10}x_s$. The total effect of x_s on n is ambiguous unless we have more detailed information about the parameters of the underlying equations. Again, the crucial comparison is between $a_1a_2+a_3$ and a_1. If a_2 and a_3 are large, while a_1 is small, the real-wage increase will overpower the direct effect on employment.

The impact of the various shocks on the unemployment rate depends not only on how employment changes but also on how the supply of workers is affected. The labor-supply equation is written as

$$n^s = b_{11} + b_{12}(w - p) - x_r, \tag{5.14}$$

which introduces a new shock, x_r, that shifts the labor-supply curve leftward when the reservation wage rises, but has no effects on output, inflation, and other macroeconomic variables. This “labor-supply shock” must not be confused with the “labor-demand shock”, x_s, which is called a “supply shock” for its impact on the supply of output. The unemployment rate is defined as

$$u = n^s - n. \tag{5.15}$$

By substituting equations (5.13) and (5.14) into this definition and assuming that the natural rate of unemployment prevailed in the previous period (i.e., $u_e=u_{-1}$), we obtain

$$\begin{aligned} u = u_e - x_r - b_{10}x_s - (b_{10} + b_{12})\Bigg(\frac{a_1}{a_1 + a_3a_4 + a_1a_2a_4}x_m \\ + \frac{a_3}{a_1 + a_3a_4 + a_1a_2a_4}x_g - \frac{(a_1a_2 + a_3)(1 + a_4)}{a_1 + a_3a_4 + a_1a_2a_4}x_s\Bigg). \end{aligned} \tag{5.15′}$$

Positive aggregate-demand shocks will reduce the unemployment rate below the natural rate because they lower the real wage, increase employment, and reduce labor-force participation. A productivity shock will have the same ambiguous effects on unemployment as it does on employment in equation (5.13). Finally, an unexpected increase in the reservation wage will reduce the supply of labor as well as the unemployment rate.

What *should* happen to the real wage to keep the labor market in equilibrium in the face of macroeconomic shocks? The wage rate that clears the labor market is determined by equating $n^{d}=n+v$ and n^s:

$$w - p = (w - p)_{-1} + \frac{b_{10}x_s + x_r}{b_{10} + b_{12}}, \tag{5.16}$$

which can be compared directly to the actual change in the real wage in equation (5.12). Both labor-market shocks require a change in the real wage, but only x_s triggers a change in $w-p$ and the extent of the actual change does not match the required change. For goods-market or monetary shocks, the real wage should remain constant but is unable to do so. The lack of concordance between (5.12) and (5.16) is an indication that labor-market equilibrium cannot be preserved in this stochastic environment.

These results can also be shown diagrammatically in Fig. 5–4, which duplicates the labor-market diagram of Fig. 3–10, but now allows unpredictable events to create disequilibrium in the labor market. A negative aggregate-demand shock, either $-x_m$ or $-x_g$, will decrease the inflation rate below what was previously anticipated and used for wage determination at the beginning of a period. In either case, the real wage rises from $(W/P)_0$ to $(W/P)_1$ in Fig. 5–4. Firms will react by laying off workers until they reach A on the labor-use curve with N_1N_0 fewer workers. A positive aggregate-demand shock would increase inflation, reduce the real wage, and increase employment, as long as the wage did not fall below the intersection of N and N^s. Therefore, employment moves in the same direction as output for aggregate-demand shocks.

A stochastic reduction in the reservation wage (i.e., x_r<0) will shift N^s to N^s and since the real wage does not change, employment remains at E; unemployment will rise from $E\,E$ to $E\,G$ in this case.

A negative productivity shock will affect the demand for labor and cause both N and N^d in Fig. 5–4 to shift down; only the former is shown by a dashed line N , parallel to N, with the vertical distance between them equal to $-x_s$. At a constant real wage, firms would move from E to F on the new labor-use curve and employment would fall again. However, a negative supply shock will also raise the inflation rate through directly reduced output and this will in turn lower the real wage, which means that firms will also move downward on the new N curve to a position such as B. This point cannot be ascertained until we know what happens to the inflation rate, since the demand for labor depends on $-\ \ -x_s$. If increases more than the value of $-x_s$, the firm will in fact want more workers than in the original equilibrium. Since the relative size of x_s as well as the inflation that it causes are ambiguous, we must, at this stage, admit that it is not possible to prove that employment falls after a negative supply shock.

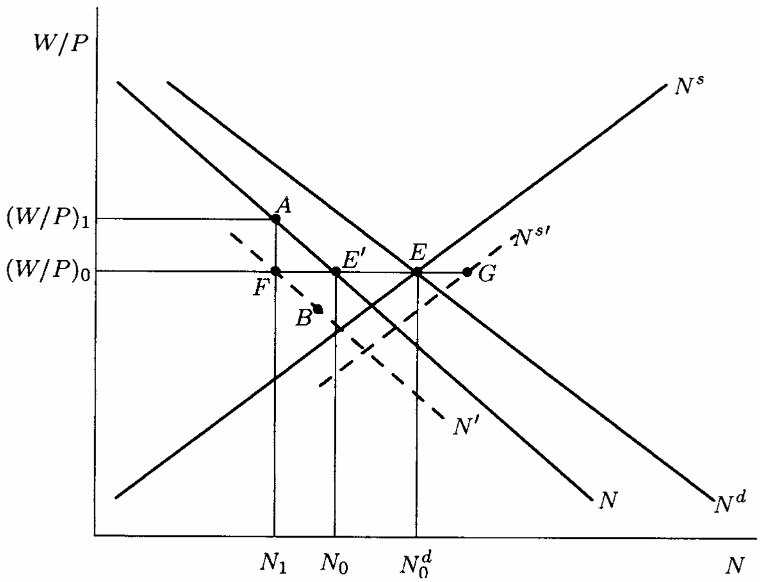

Figure 5–4 Shocks in the labor market

5.4
The Aftermath of Shocks

In the period after any of the shocks has occurred, there is no reason to believe that they will continue. In that case, for the coming period E[x]=0, but real variables in the macroeconomy do not return automatically to their previous equilibrium values. In particular, the real wage may not move easily to its market-clearing value, even if contracts have expired and all information is freely available to the participants in new wage negotiations.

To re-establish $(w-p)_{-1}$ in equation (5.12) or $(W/P)_0$ in Fig. 5–4 would require that nominal wage growth be dictated by

$$\omega = \pi^e + \frac{a_1}{a_1 + a_3 a_4 + a_1 a_2 a_4} x_{m_{-1}} + \frac{a_3}{a_1 + a_3 a_4 + a_1 a_2 a_4} x_{g_{-1}} - \frac{(a_1 a_2 + a_3)(1 + a_4)}{a_1 + a_3 a_4 + a_1 a_2 a_4} x_{s_{-1}}, \tag{5.17}$$

where the shocks are now one period old. Because of the lower inflation rate during the period of negative demand shocks, wages must grow more slowly than the expected inflation rate to allow the real wage to fall. In the aftermath of a negative productivity shock, the labor-use curve in Fig. 5–4 will have shifted back to its previous position, but the real wage will have to rise as well in order to re-establish equilibrium. It should be noted that the *labor-supply* shock, x_{r-1} does not appear in equation (5.17); once N^s shifts back to its original position, the labor market is again in equilibrium and the real wage does not need to adjust.

Although there should not be a discrepancy between actual and predicted inflation in the period after a shock, ^{e} in equation (5.17) is not constant. It will continue to respond to changes in $(m-p)_{-1}$ as seen in equation (5.11). If real money balances rose through $<\mu$ previously, then ^{e} will change by $1/(1-a_3)$. Subsequently, real money balances will fall again when the inflation rate rises once more. Hence ^{e} will cycle with decreasing amplitude, but in the absence of new shocks it will predict accurately.[1]

Whether nominal wages adjust by the amount determined in equation (5.17) depends on the resolution of a conflict between those who are still employed and those who are involuntarily unemployed. If the real wage is at $(W/P)_1$ and employment is at N_1 in Fig. 5–4 after a negative demand shock, those who still have jobs are better off than with a real wage of $(W/P)_0$ in equilibrium as they enjoy more goods consumption, but have the same amount of leisure. Therefore, they are receiving extra economic rents at the higher wage during excess-supply situations. On the other hand, those who are laid off or fired when firms reduce employment from N_0 to N_1 are worse off since they now have too much enforced leisure and reduced goods consumption. It is therefore in the interest of those whose employment is secure to maintain the real wage at $(W/P)_1$, by insisting on nominal wage adjustments that are higher than those stipulated in equation (5. 17). Since expected inflation cannot be observed or even calculated, secure workers have an incentive to introduce an upward bias in ^{e}. In any event, secure workers want to limit the competitive forces in the labor market. They have a strong incentive to make it difficult, if not impossible, for an unemployed person to offer to do the job of an existing employee at a lower wage and such behavior is almost completely absent from labor-market search. In other words, secure workers want to replace a competitive market with a wage-determination process that gives them a voice and a vote since they typically outnumber "insecure" or "marginal" workers by a large number. They are prepared to spend some of their rents to influence the wage-determination process to their advantage and eliminate the competitive forces that give leverage over real wages to marginal workers. Therefore, a combination of the reservation-wage model which creates rents and a nonrandom allocation of employment that creates secure and marginal workers produces a conflict between these two groups and it is not clear that it is resolved in a predictable manner as suggested by equation (5.17).

When the real wage is below its equilibrium value after a positive demand shock, the incentive for wage adjustment is reversed. Now, secure workers want wages to rise to increase their welfare. Only "marginal" workers who are in danger of losing their jobs will resist these wage increases, but again they are outnumbered by a large margin. Thus, there is likely to be asymmetry in the speed with which real wages adjust to disequilibrium, with slower adjustment during excess supply than during excess demand. As a consequence, there is also

[1]The dynamics of this process are described in Prachowny (1985, Ch. 3).

likely to be asymmetry in the business cycle, with $u>u_e$ for longer and by more during excess supply than $u<u_e$ during excess demand. The evidence from Chart 1–3 supports this proposition, especially in the latter part of the 1948– 95 period, and dictates against the notion that the natural rate is merely a moving average of the actual rate.

5.5 Conclusions

Participants in the labor market continue to make transactions when the labor market is out of equilibrium; for most of them these transactions are welfare-superior to waiting until the wage returns to its market-clearing value. In fact, those workers who continue employment during excess supply are better off than in equilibrium. In these circumstances, it is vital that the macroeconomic model that we use be able to predict how employment, unemployment, and real wages move in response to various shocks to the system. This chapter has taken the previous *IS-LM-AS* model and added the distinction between predictable and unpredictable events in the goods, money, and labor markets. The latter create a discrepancy between actual and expected inflation, which in turn pushes the labor market out of equilibrium. The resulting effects on real wages and employment generate a conflict between secure and marginal workers over real-wage adjustments in the aftermath of the shocks. Therefore, disequilibrium may continue, not due to lack of complete information or through contractual obligations, but because it is in the interests of a large group of workers. Put another way, "sticky" wages are not the result of inherent imperfections in the labor market, but instead are produced by self-interested participants who have every reason to stifle competitive behavior.

6
The Distinction between Secure and Marginal Workers

Heterogeneous agents are an uncomfortable fact of life in any macroeconomy, but in most markets differences in tastes or resource availability are expressed only as variations in quantities bought and sold. However, in the labor market, once we take account of the reservation wage, these differences lead to variations in economic rent while everyone works essentially the same number of hours. Moreover, firms adjust their labor input at the extensive margin rather than at the intensive margin, in a way that is largely predictable by those who are affected. Thus, labor-force participants face another source of heterogeneity: differences in the degree of security of employment or, in other words, variations in the risk of complete involuntary unemployment. Individual perceptions of job security, in turn, will lead to a potential conflict over wage demands between those with high security and those with little or no security. This conflict is the focus of this chapter.

6.1
Identifying Secure and Marginal Workers

The reservation-wage model of labor supply in Ch. 3 introduced a source of heterogeneity in the labor force: individuals differed in their reservation wage and in the economic rents that they collected for working fixed and pre-specified hours. However, there is another dimension to heterogeneity, namely the security of employment and the certainty of the rents. The welfare of a labor-force participant depends on goods consumption and on leisure, but once hours of work are fixed, utility depends only on the wage rate and on the probability of employment. Thus the *ex ante* utility function is written as

$$\mathrm{E}[U] = \gamma U(W/P) + (1-\gamma)U(I), \tag{6.1}$$

where measures the probability of employment and therefore of receiving the going real wage, *W/P*. In the absence of employment, which has a probability of 1− , the person enjoys complete leisure but is reduced to goods consumption available from nonwage income of *I*. Individuals who are in the labor force have exceeded their reservation wage by definition and thus utility of employment must be higher than utility of unemployment, or *U(W/P)>U(I)*.[1] Expected utility is at its maximum at the wage rate that puts the person at the margin of employment, but individuals are unable to manipulate this maximization process because the wage rate is uniform for all workers, while the margin of employment varies for each person. The value of is subjectively determined and will differ for each individual depending on personal characteristics and experience, but it is not independent of the real wage. Given the negative slope of the labor-use curve developed in Ch. 3, an increase in *W/P* will reduce employment and will lower the value of for some individuals, presumably those who will lose their jobs.

If total employment is constant and certain, there are two possible ways of allocating jobs: (1) predictably or (2) randomly. In the former case, everyone will know who is employed and who is unemployed, as with a strict seniority system. Here, a secure worker has =1 while an unemployed person will assign a value of zero to . In this instance, there are no marginal workers. Therefore, the proportion of the labor force equal to $1-u$ will assign the value of one to and the proportion u who are unemployed will have at zero, with no one having an intermediate value of . This distribution is shown as the solid rectangle in Fig. 6–1, which plots the value of on the vertical axis and the cumulative proportion of the labor force on the horizontal axis, with those having the highest s on the left.

On the other hand, if employment is a random draw in every period, then everyone has an equal chance at employment and all labor-force participants will have a maximum value of $=1-u$. This distribution is also shown in Fig. 6–1 with dashed lines. Since both distributions have the same area, it is not possible to suggest that one system of allocating jobs is better than the other, especially if one uses a Benthamite welfare function that aims for "the greatest good for the greatest number."

These two distributions can be altered to allow for both uncertainty in the unemployment rate and for some unpredictability in job allocation. Either of these conditions will create a group of workers who assign 1< <0 to their chances of employment. These are marginal workers who might either lose their jobs if the unemployment rate rises or who might gain employment if the unemployment rate falls. This new "hybrid" distribution is shown in Fig. 6–1, coinciding with the first distribution marked "certain u —predictable n as far as A and again from B to 1. In between, marginal workers are ranked by their s[2] The size of this group, that is, the horizontal distance between A and B depends on many factors, but includes macroeconomic conditions. During a recession, when the unemployment rate is high or when seniority rights may not protect jobs,

[1]See Prachowny (1994, Fig. 4–2) for a visual depiction of welfare related to the real wage.

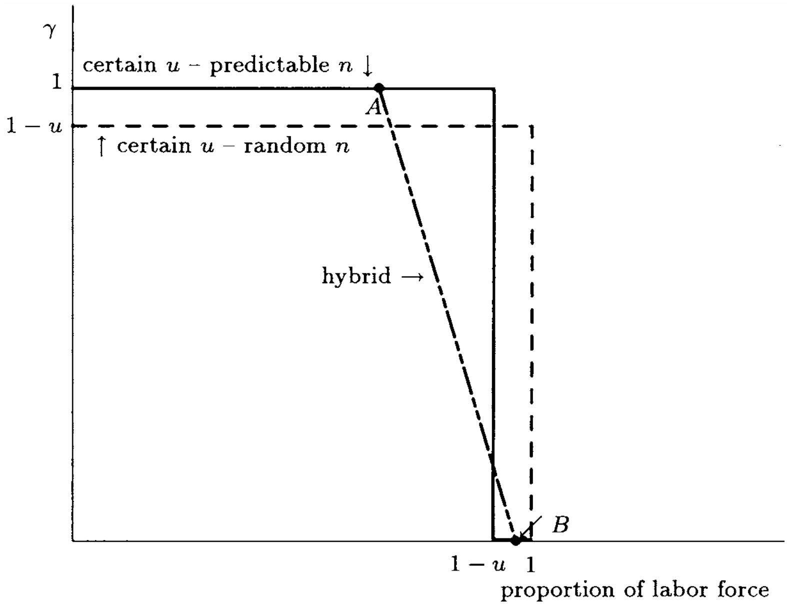

Figure 6–1 Determination of secure and marginal workers

the group of marginal workers will be larger than in a boom period. In Fig. 6–1, this would be seen as a shift of the point *A* to the left and/or point *B* to the right during an economic downturn and the reverse when the economy is in an upturn.

In the previous chapter, there was a conflict between secure and marginal workers over adjustments to the real wage. The utility function of equation (6.1) helps to understand the source of the friction between these two groups. Secure workers who have =1 want the highest possible wage, but marginal workers recognize that an increase in *W/P* will reduce and could lower welfare. How this conflict gets resolved in the wage-determination process is extremely difficult to predict. What is clear is that secure workers have an incentive and resources to prevent a competitive outcome where only marginal workers matter. Secure workers want a voice in wage determination and an appeal to "democratic rights" may be difficult to resist. In other words, secure workers want to establish institutions and conditions that reinforce and preserve their "power" in the labor market. These forces are virtually impossible to measure or quantify, but it would be hard to believe that secure workers are not a majority in the labor force and that they are not a formidable force in determining wages.

It is not argued that secure and marginal workers are easily or permanently identified by personal characteristics or by labor-market experience. After all,

[2]This segment of the distribution can have other shapes besides a straight line.

like expected inflation, job security is a state of mind and cannot be measured by direct means. The Gallup poll time series, cited in Chart 1–3, gives some indication of how people respond to changing macroeconomic conditions in their assessment of job security. Despite the inability to measure expected inflation, macroeconomic theory has made great strides by incorporating this concept into the analysis; I hope that the distinction between secure and marginal workers will also help us better understand the operation of the labor market during business cycles.

6.2
What Do Secure and Marginal Workers Want?

As long as self-identification by secure and marginal workers is possible, this distinction between them plays a useful role in analyzing how they want the labor market to operate. In general, labor-force participants want secure employment and the highest possible real wage. Of course, they know that higher real wages are likely to lead to lay-offs, given the negative slope of the labor-demand curve, so they are aware that there is a trade-off between security and wages. But to the extent that workers can manipulate the environment in which they work, either through collective bargaining or through political lobbying, they will try to make the trade-off as painless as possible. Do secure and marginal workers have the same interests in this respect or do their views conflict with one another?

Since marginal workers want security, they want to increase job opportunities in the economy. The employment regression in Ch. 1 allows us to calculate the number of people who gain or lose jobs. The "labor-use" equation was estimated to be the following:

$$n = 8.30 + 0.647k - 0.428(w - p), \tag{6.2}$$

where n, k, and $w-p$ are number of employees, capital stock, and real wages, respectively, all in natural logs. A reduction in the wage rate will increase the number of jobs; for those who receive them this will be an improvement in welfare as long as the wage still exceeds the reservation wage. Also, the more elastic is the demand for labor, the greater is the increase in employment for a given wage reduction. On the other hand, a wage increase leads to fewer lay-offs if demand is less elastic. Hence, marginal workers want a "kinked" demand curve. Even better would be an increase in the capital stock since this would not only raise employment security, but would also increase the real wage. For example, a 1% increase in k would raise the real wage by 1.48% and employment by 0.015%, if the labor-supply elasticity is assumed to be 0.1. Therefore, unemployed workers or those at the margin of employment want policies that will shift the labor-use curve outward or make it flatter. Failing that, they want expansionary stabilization policies that will reduce the real wage and increase employment along a given labor-use curve.

Those with secure employment, on the other hand, want to maximize the real wage subject to retaining job security; therefore, the labor-use equation is inverted to show how the real wage is affected:

$$w - p = 19.39 + 1.505k - 2.336n. \quad (6.2')$$

This group of workers is quite content to let employment fall and to let unemployment rise in order to obtain higher wages. The limit to this process is that as wages rise those with secure employment will decline. Also, secure workers want the wage elasticity to be as small as possible to obtain large wage increases when employment falls, but in a situation where employment is likely to increase, they want elastic demand to keep the resulting wage reduction as small as possible. Hence, the ideal labor-demand curve will be kinked at the present combination of n and $w-p$, but unlike the kinked demand curve for marginal workers, secure workers want a steeper segment at high wages. The welfare of secure workers also improves with an increase in the capital stock because it raises the real wage, as shown above. In terms of macroeconomic policies, secure workers want a contractionary stance, even if there is a recession and excess supply in the labor market.

Comparing these two "wish lists," marginal and secure workers would agree that expansionary labor-market policies are desirable to the extent that they shift the labor-demand curve outward. On the other hand, they are unlikely to agree on pure aggregate-demand policies, with secure workers wanting contractionary policies in all phases of the business cycle and marginal workers demanding expansionary policies. In that light, to the extent that expansionary policies have the support of the electorate, they must be perceived as measures that increase the productivity of labor and not directly aimed at raising the inflation rate.

Moreover, these two groups will be at odds concerning policies that affect the wage elasticity, especially when employment is likely to fall. According to Hicks' (1963, p. 242) list of the Marshallian "rules" for the derived demand for labor, secure workers want to eliminate substitutes for themselves, but marginal workers want to be those substitutes; also, secure workers are better off if they can persuade everyone that labor costs are a small fraction of total costs, but marginal workers have the opposite incentive; finally, secure workers want the supply of capital to be inelastic, but marginal workers want an elastic supply of cooperating factors. However, as shown in Ch. 2, changing the elasticity of demand for the final product does not affect the wage elasticity and thus the two groups are not likely to argue about the extent of monopoly power in product markets.

6.3
Secure Workers and Unionization

The conflict between secure and marginal workers is most acute in a union setting where the median voter is particularly important in determining wages and employment. A utility function for a union might be written as

$$U = U(w - p, n), \tag{6.3}$$

with $U_{w-p}, U_n > 0$. According to this argument, a union would choose a particular combination of $w-p$ and n that maximizes the joint welfare of its members. This involves a tangency between an indifference curve and an iso-profit curve as shown in Fig. 2–7 on p. 52. Alternatively, if combinations of the real wage and employment cannot be to the right of the labor-use curve because firms are not compelled to operate at such points, the tangency will be between a union indifference curve and the labor-use curve itself. This latter dictates the trade-off between real wages and employment that the union must accept and equation (6. 2) indicates that a 1% reduction in employment will allow for a 2.34% increase in real wages.

Secure workers will be tempted to raise U_{w-p} and to lower U_n in the preference structure of the union, but marginal workers will want the opposite change in union goals. Presumably, secure workers are in a majority and the median voter will express the preferences of secure workers. However, since the ratio U_{w-p}/U_n is fixed by the slope of the labor-use curve, the point of tangency will move to a higher $w-p$ and a lower n. That is, as $w-p$ rises U_{w-p} will be reduced if declining marginal utility prevails; this is reinforced by U_n increasing in the face of the reduction in n. Thus, the change in preferences has not changed the extent of the trade-off between $w-p$ and n, but it has changed the two variables themselves.

However, a union based on the preferences of secure workers carries the seeds of its own destruction. If voting is limited to those who have jobs, then the median voter will always be a secure worker who has an incentive to raise the wage at the expense of employment. This will lead to higher wages and lower employment than would be consistent with a competitive equilibrium. Since secure workers are likely to survive through their seniority rights, their majority position will give them economic power through a union that would otherwise belong to marginal workers in a competitive labor market. Of course, owners of firms are unlikely to be passive in the conflict between secure and marginal workers; they will resist wage increases since a movement upward along a labor-use curve reduces profits. However, unless marginal workers are given extraordinary voting powers in a union or an alliance between marginal workers and firm management can bring about countervailing power, the self interest of secure workers will lead inevitably to the demise of the union and their security of employment. Therefore, it takes a far-sighted union executive to accentuate job creation and to check wage demands in order to protect the long-term interests of secure workers.[3]

The empirical evidence, according to Lewis (1986, Ch. 9), is that unions raise wages above the competitive level by 10–20%. If the estimated labor-use curve for the economy as a whole applies to the unionized sector, the union wage advantage creates job losses in the order of 5–10%, but since the wage elasticity is likely to be lower in the union sector than in the rest of the economy, this estimate of job losses is biased upward. Moreover, Lewis indicates that the union-wage advantage is higher during recessions than during boom periods. This would be consistent with secure workers being able to protect their position at the expense of marginal workers when wage concessions would have protected existing jobs. Perhaps these wage premiums in the unionized sector can explain the decline in union membership in the past two or three decades, but there are other factors at work: demographic changes, deregulation of various industries, and increased foreign competition.

6.4
Counting Secure and Marginal Workers

Many of the previous predictions relied on the existence of a majority of secure workers in the labor force and on the economic power that such numerical superiority provides. This makes it imperative that we be able to count secure and marginal workers with some confidence. An alternative to self-identification of job security as expressed in the Gallup-poll data, is an examination of historical data from the labor market as it moves through a number of business cycles. There are two approaches to this task: (1) the rational-expectations view of employment changes and (2) the "experience" with unemployment of the population during a given year.

6.4.1
Employment Changes in the Business Cycle

Participants in the labor market are presumed to know what factors determine the demand for labor and how previous shocks have altered the quantity of workers demanded by firms. Of course, they will not know the nature, timing, and size of future shocks, but they rely on their information of the historical record to predict their future in the labor market, especially the probability that they will have a job when that next shock occurs. The employment regression in Ch. 1, repeated as equation (6.2) above, allows us to calculate how recessions or booms triggered by various macroeconomic shocks will change the number of people who gain or lose jobs. According to the discussion of macroeconomic shocks in

[3] See Mark Twain's *Life on the Mississippi* (1883, Ch. 15) for an account of the Pilots' Benevolent Association who controlled membership and demand for their services until they raised wages so high that "vulgar little tugboats" put them out of business.

the previous chapter (equations (5.12) and (5.13)), negative demand shocks (i.e., either $x_m<0$ for a monetary shock or $x_g<0$ for a goods-market shock) will increase the real wage and thus reduce employment. On the other hand, a negative productivity shock ($x_s<0$) will reduce $w-p$, but will have an ambiguous effect on n since it also reduces k or the intercept in equation (6.2).

Therefore, a demand-induced recession that increases the real wage by 1% will reduce employment contemporaneously by 0.4% which in 1990 would have affected 471 thousand workers. In the opposite direction, a 1% reduction in the real wage if actual inflation exceeds wage increases by that amount, would add the same number of individuals to the workforce. Alternatively, a negative supply shock that happened to reduce k by 1% but also decreased the real wage by, say, 1.5%, would lower employment by 0.026%, which in 1990 would have meant 31 thousand workers. Thus, supply shocks have less effect on employment than demand shocks unless they happen to be larger.

During the period 1956–92 for which the employment equation is estimated, the largest annual reduction in employment occurred in 1958 when 1.6% or slightly more than one million workers lost their jobs. In the 1982 recession, the reduction in n was only 0.87% or 872 thousand. Whatever the size and nature of shocks that transpired in this 37-year period, changes in employment were not large or abrupt and should leave workers with previously secure employment in the same state of mind. Therefore, an objective assessment of one's chances of losing a job in a recession, leaves the vast majority of workers secure in their employment.

6.4.2
Unemployment Experience

However, fear of unemployment may not be related to observed changes in *average* employment from one year to the next, but instead may be related to the incidence of *any* unemployment during the year. The US Bureau of Labor Statistics (1990, p. 1), which publishes data on "work experience" from the March supplement of the Current Population Survey, notes the following distinction: "Because the reference period is a full year, the number of persons with some employment and/or unemployment greatly exceeds the average monthly employment and unemployment levels, which are based on a 1-week reference period. For example, while 131.9 million persons worked at some time during 1989, the average monthly employment level was 117.3 million. The total number of persons who were unemployed for at least one week in 1989, at 17.3 million, was 2–1/2 times the average unemployment level of 6.5 million." Not only are figures published in terms of employment and unemployment experience, but the BLS provides data for the number of job seekers who did not work at all, and for those who had two, and three or more independent spells of unemployment. In 1989, of the 17.3 million who experienced some unemployment, 1.6 million did not find any work, while 2.5 million had 2 spells of unemployment and 2.6 million had three or more spells during the year. According to Akerlof and Main (1980, p. 888), those with one spell of unemployment were out of work for 11.5 weeks in a year on average during 1965–77. The second spell was 7.8 weeks in length and the third or subsequent spell was 5.2 weeks. The BLS data, which are reproduced in Table 6–1 for the years 1959–93, allow us to measure job security on the basis of actual employment and unemployment experience.

It is argued that those who did not experience any unemployment will think of their jobs as being entirely secure, that is, they assign a value of one to in equation (6.1). At the other extreme, those who looked for work during the year but found none would have no job security and would evaluate at zero. In between, those who had one or more spells of unemployment would be marginal workers, whose would fall as the number of spells

Table 6–1 Data for Work and Unemployment Experience and Measures of Job Security, 1959–93

Year	*L*	*UN*	*DNW*	*um*	*um*	*UNl*	*S*(0.1)	*S*(0.25)
1959	79494	12195	1332	2415	1813	6635	0.961	0.928
1960	82204	14151	1586	2568	2034	7963	0.957	0.921
1961	81963	15096	1676	2664	2299	8457	0.954	0.915
1962	83944	15256	1887	2695	2524	8150	0.952	0.914
1963	85038	14211	1811	2389	2246	7765	0.956	0.922
1964	86837	14052	1713	2413	2342	7584	0.958	0.924
1965	87591	12334	1405	2177	1765	6987	0.964	0.935
1966	87540	11387	1274	1946	1465	6702	0.968	0.941
1967	89432	11564	1253	1854	1503	6954	0.969	0.943
1968	91480	11332	1250	1651	1471	6960	0.970	0.946
1969	93640	11744	1163	1814	1603	7164	0.971	0.945
1970	95576	14615	1725	2229	2096	8565	0.962	0.931
1971	97652	15950	2171	2261	2220	9298	0.957	0.925
1972	99730	15436	2076	2231	2122	9007	0.959	0.929
1973	102747	14697	1635	2196	2047	8819	0.965	0.937
1974	104769	18785	2161	2872	3116	10636	0.955	0.919
1975	105843	21402	3240	2653	3038	12471	0.944	0.907
1976	108783	20795	2973	2815	3024	11983	0.948	0.912
1977	111531	19910	2618	2672	2975	11645	0.954	0.919
1978	114464	18185	2129	2490	2735	10831	0.961	0.929
1979	116983	18468	1990	2510	2804	11164	0.962	0.931
1980	118348	21410	2597	2810	3159	12844	0.955	0.920
1981	119658	23382	2863	3237	3750	13532	0.950	0.912
1982	120235	26493	3958	3719	3854	14962	0.939	0.897

Year	*L*	*UN*	*DNW*	*um*	*um*	*UNl*	*S*(0.1)	*S*(0.25)
1983	121503	23762	3928	3123	3305	13406	0.943	0.907
1984	124117	21535	2969	3147	3000	12419	0.954	0.920
1985	125890	20984	2424	2995	2960	12605	0.959	0.926
1986	128143	20703	2380	2903	2975	12445	0.960	0.929
1987	130036	18535	2081	2715	2482	11257	0.965	0.937
1988	132185	17096	1735	2676	2460	10225	0.969	0.943
1989	133444	17257	1577	2612	2460	10608	0.971	0.944
1990	134436	19786	1874	2952	2854	12106	0.966	0.936
1991	134985	21256	2414	3124	2732	12986	0.962	0.931
1992	135822	21441	2739	3036	2698	12968	0.960	0.929
1993	138895	20516	3430	2766	2570	11750	0.957	0.930

See Data Appendix at the end of this chapter for definitions and sources.

increased. Therefore, in 1989, the point *A* in Fig. 6–1 would be 87.1% along the horizontal axis, while point *B* would be 1.18% to the left of unity. The other 11. 7% of those with work experience but with one or more spells of unemployment would be marginal workers. In 1992, a year of greater excess supply in the labor market than 1989, the proportion of the labor force with complete job security is estimated to be only 84.2%, while those with zero job security increased to 2%. Since the former fell more than the latter increased, the proportion that are marginal workers rose to 13.8%.

Whether we look at average employment changes along a labor-use curve or analyze the data for work experience from the BLS, we are left with the strong impression that a large majority of those in the labor market have not recently experienced unemployment and are secure in their jobs. The next step is to determine the influence of variations in job security over the business cycle on wage determination.

6.4.3
Job Security and Labor-market Behavior

In order to gauge the influence of job security on labor-market behavior, we can calculate a time series composed of index numbers which in turn are a weighted average of the proportions of labor-force participants with varying spells of unemployment. This index has the following formula:

$$S = \gamma_0 U(0) + \gamma_1 U(1) + \gamma_2 U(2) + \gamma_3 U(3), \tag{6.4}$$

where *U(i), i*=0,…, 3 represents the proportion of the total with zero, one, two, or three or more spells of unemployment and ${}_{i}$ is the relevant weight attached to each group. We have already decided that ${}_{0}$=1 for the group that did not experience any unemployment during the year, namely *U*/(0), and that =0 for the group that found no work during the year, which excludes them from equation (6.4). However, there is no easy way to decide on the appropriate values of the remaining 75, other than to restrict them to fractions that decline as the subscript increases.

Initially two choices were made: (1) the weights fall from 1.0 by 0.1, so that 3=0.7, and (2) the weights fall by 0.25. These two data series are shown as the last two columns in Table 6–1. The mean value of *S*(0.1) was 0.959 for 1959–93 with a standard deviation of 0.0079, and for *S*(0.25) the mean was 0.927 with a standard deviation of 0.0120. Both of these index number series were highly correlated with the unemployment rate as it is traditionally calculated. Therefore, although many more people in the labor force experience some unemployment during the year than are unemployed during the reference period, these two measures tend to move together and it is difficult to find the independent effect of the index of job security on labor-market behavior. For instance, when the price Phillips curve of Ch. 1 (p. 25) was re-estimated for 1961–93 with either *S*(0. 1) or *S*(0.25) as an additional independent variable, they did not add a significant contribution to the explanation of the inflation rate. However, when they replaced the unemployment gap, $u-u^*$, they were significant explanatory variables. This outcome suggests that non-nested techniques should be employed to determine which has a stronger claim to predicting wage or price inflation. The procedure involves estimating two linear regressions that have the following generic form: $Y = \; + \; Xi$ where X_1 is represented by the vector $u-u*$ and X_2 is represented by the index numbers from *S*(0.1), which provided superior results to *S*(0.25) in the previous stage. Then, two further regressions are estimated: (1) and (2) , where and are the fitted values from the first and second models, respectively. The test is H_0: $_i$=0. If the null hypothesis cannot be rejected for $_1$, but can be rejected for $_2$, then model 1 is preferable to model 2 and *vice versa.* When these tests were applied, the *t*-value of $_1$ was −0.17, while the *t*-value of $_2$ was 2.74. Hence, we are forced to reject the explanation of the Phillips curve based on the job-security index in favor of the traditional one which relies on the unemployment gap.

This leaves us with two choices: (1) we reject the notion that secure workers use their power to influence the wage outcome for the labor market as a whole; or (2) we conclude that our measurement of variations in job security over postwar business cycles has not been accurate enough to allow it to have an independent effect on the Phillips curve.

6.4.4
Secure Workers and Externalities

If secure workers operate on the basis of their self interest, but do not exploit their power to the fullest, they must recognize that their attempt to do so triggers externalities that would leave them in a inferior position to that available from moderation. Therefore, secure workers do not push the real wage above its equilibrium value because they are afraid that such action would erode their security. But what is the basis of that fear? It might be argued that the unemployed will offer to do the jobs of secure workers for less pay and this likelihood increases with the wage paid to secure workers, but as will be shown in the next chapter, secure workers are protected from such competition by the adjustment costs that were introduced in Ch. 3.

It may also be posited that unemployment insurance schemes require secure workers to finance the unemployed and that this reduces the after-tax wage enough to make higher wage demands unattractive. However, given the fact that about 95% of the labor force would, at worst, have to finance the unemployment insurance benefits of 5% of the labor force, this is not a significant wage tax. For example, if the replacement ratio of unemployment benefits is 0.5, the tax is = [(0.05×0.5)/0.95]100=2.63%. Now, if a wage increase reduced employment to 90% and increased unemployment to 10%, the tax rate would rise to =[(0.1×0.5)/0.9]100= 5.5%. However, from the labor-use curve, we can calculate that the 5% reduction in employment would lead to an 11.7% increase in the real wage, which would leave secure workers better off even after they paid the higher tax, because the after-tax wage rises by [1.117(1–0.055)/(1–0.0263)—1]100=8.4%. Although workers with jobs have to pay some of the costs of unemployment, they are too small to create the kind of externalities that would moderate their behavior.

Furthermore, the existence of unemployment creates an environment of arbitrary discrimination and that may lead to revolutionary change in the labor market which may threaten the privileged existence of the secure workers. This fear in turn reduces the wage demands of secure workers in order to preserve the *status quo*. In other words, they are optimizing their position over the long run and sacrificing short-term gains that may lead to permanent losses. Such a situation may have existed in the Great Depression (see Ch. 7 for further discussion), but during postwar recessions there does not appear to have been any political movement of the unemployed that advocated repeal of seniority rules or the abolition of institutions that protect secure workers.

Finally, it may be argued that the analysis of the role of secure workers fails to take account of the full distributional and general-equilibrium implications of restricting labor supply. If we take the capital stock as given, the losers are not only marginal workers but also the owners of capital, which would lead them to reduce investment at the first opportunity. The induced reduction in the capital stock will in turn lower secure workers' marginal product and their real wage. From equation (6.2), we know that a 1% reduction in the capital stock will lead to a 1.505% decline in the real wage. Nevertheless, long-run considerations would lead to the opposite effect. If capital is not a fixed factor of production, firms will substitute capital for labor, if wages are raised artificially by secure workers. Those that remain, will have higher marginal product and wages as firms become more capital intensive. As a consequence, this externality works in favor of secure workers. However, related to the reduced profitability of higher wages is the possibility that firms will go out of business and eliminate their entire workforce, leaving no one secure in their employment.

6.5
Conclusion

Individuals who choose to participate in the labor market differ among themselves not only in their reservation wage, but also in their susceptibility to unemployment, once it becomes evident that most of the variation in the labor input is at the extensive margin of employment. This means that business cycles have very uneven welfare effects on workers, with those who remain secure in their employment being better off than those who have marginal employment, even if the wage rate is the same for both groups. In this chapter, the major focus has been on identifying and counting secure and marginal workers, as well as predicting differences in their behavior in the labor market. Since the distinction between them relies on a state of mind, it is perhaps not surprising that some of these predictions are difficult to verify.

Data Appendix

Table 6–1 provides data that allow for the calculation of an index of job security based on unemployment experience during a whole year. Two versions of this index are provided.

Definitions:

L=total who worked or looked for work, thousands,
UN=total with unemployment, thousands,
DNW=did not work but looked for work, thousands,
*UN*3=with 3 or more spells of unemployment, thousands,
*UN*2=with 2 spells of unemployment, thousands,
*UN*1=with one spell of unemployment, thousands, calculated as residual from *UN,*
S(0.1) and *S*(0.25), see text.
Sources: US Bureau of Labor Statistics:

1959–87, *Handbook of Labor Statistics,* Bulletin 2340, 1989, Table 50,
1988–89, *Seven Out of Ten Persons in the Working-age Population Had Some Employment During 1989,* USDL 90–447, 1990, Table 3,
1990–91, *Work Experience of the Population, 1991,* USDL 92–644, 1992, Table 3,
1992–93, *Work Experience of the Population, 1993,* USDL 94–559, 1994, Table 3.

7
Pareto Improvements in the Labor Market: Part I

Most of the debate in macroeconomics during the past several decades has concerned itself with the *ability* of stabilization policy to change the unemployment rate and very little with the *desirability* of such action. Neoclassical macroeconomists argue against interventionism on the basis that governments are unable to influence the unemployment rate. They seem to take for granted that equilibrium is Pareto efficient and that everyone has an interest to eliminate unemployment. This view leaves out of account the fact that most labor-force participants are not threatened by unemployment and have no direct interest in providing job opportunities for the small minority that may from time to time experience involuntary unemployment. Keynesians, on the other hand, are convinced that a reduction in the unemployment rate would be a Pareto improvement; those who become employed gain, while those with prior employment do not lose. In fact, Okun's Law, which showed that a one-percentage point reduction in the unemployment rate increased output by two to three percent, provided a dividend to everyone through greater productivity. These Keynesian welfare evaluations are inconsistent with the requirement that a reduction in the unemployment rate must be accompanied by a lower real wage and with the finding reported in Ch. 1 that Okun's coefficient is too low to generate the necessary productivity dividend. Thus, both macroeconomic ideologies have an inadequate welfare basis for their policy conclusions. The purpose of this chapter is to remedy this deficiency and to determine whether there are any Pareto improvements in the traditional stabilization-policy framework that concentrates on adjusting aggregate demand for goods and services to achieve full employment. The next chapter will continue the search for welfare-improving policies that operate directly in the labor market.

7.1
Welfare Comparisons in the Labor Market

Following any of the shocks enumerated in Ch. 5, the labor market will be thrown into disequilibrium. At that stage, individuals and firms will assess their welfare to determine whether a return to equilibrium is superior to the *status* *quo*. The answer depends very much on which model of the labor market is relevant. The traditional approach to labor-market transactions elaborated in Ch. 2, which allows workers and firms to adjust hours, leads to the optimality of equilibrium while the reservation-wage model presented in Ch. 3, with hours for each individual relatively fixed, creates a conflict between "secure" and "marginal" workers. These two views can now be analyzed in terms of welfare comparisons between equilibrium and disequilibrium created by unpredictable events.

7.1.1
Welfare Changes with Adjustable Hours

Since the discussion is restricted to Pareto improvements in the labor market, we will concentrate on the interactions between labor-force participants and the firms that employ them to see how each group fares when real wages or hours of employment change. Therefore, we need the utility function of the typical individual based on goods consumption and leisure and the profit function of a firm with that typical employee as its labor input. In addition, Fig. 7–1, which replicates the hours-supply decision from Fig. 2–3(a) and uses a downward-sloping hours-demand curve for each worker, will allow us to visualize changes in hours and wages and their welfare effects.

During a business cycle, a worker is subjected to changes in the real wage paid per hour when random shocks hit the labor market and possibly also to changes in hours worked. Both of these have an effect on the welfare of the labor-force participant. By differentiating the utility function with respect to hours of work, *H,* and the real wage, *W/P,* we obtain

$$dU = \left(U_2 \frac{W}{P} - U_1\right) dH + U_2 H d\frac{W}{P}, \tag{7.1}$$

where U_1, U_2 are the marginal utilities of leisure and goods consumption, respectively. These changes in wages and hours do not necesarily keep the worker on the labor supply curve, where $U_2/U_1=W/P$ and would eliminate the expression in brackets. It is possible that an individual works less than desired hours, in which case $U_2(W/P)>U_1$ as the marginal utility of goods consumption rises and the marginal utility of leisure falls when income and hours of work are reduced. It is not possible, in the absence of indentured service, to have the opposite inequality which would put workers to the right of their supply curve. Finally, the change in utility depends on whether *H* and *W/P* move in the same direction, as they would along the supply curve, or in opposite directions in other circumstances.

The firm, in making an optimal decision about hours of work from each employee, calculates the effects on profits according to the following formula:

$$d\Pi = \left(Y_H - \frac{W}{P}\right) dH - Hd\frac{W}{P}, \tag{7.2}$$

where Y_H is the marginal product of an hour's labor from each worker, which is equal to *W/P* on the demand curve, but greater than the real wage to the left of D^H in Fig. 7–1 below. The opposite inequality is impossible since being to the right of the demand curve involves involuntary exchange. Along the demand curve in Fig. 7–1, *dH* and *d(W/P)* move in opposite directions; from equation (7. 2), a decrease in *W/P* will increase profits as output expands but per-unit labor costs fall.

These welfare effects are shown in Fig. 7–1 as iso-utility curves for workers and iso-profit curves for firms. In the former case, setting dU=0 in equation (7.1) generates a locus which is *U*-shaped with its lowest point on the supply curve; iso-utility curves that have higher wages and hours represent a welfare improvement; thus, U_1 in Fig. 7–1 is better than U_0. Iso-profit curves are derived from equation (7.2) with $d\Pi$=0 and have an inverted (*U*-shape, with the apex on the demand curve. Profits increase as firms move down the demand curve and Π_1 is preferred by firms to Π_0. With this apparatus, it is possible to make comparisons of any two combinations of *H* and *W/P* in terms of their welfare implications and to predict whether workers or firms will favor changes in these variables. The reason that combinations other than those that prevail in equilibrium (i.e., H_e and $(W/P)_e$ in Fig. 7–1) must be considered is that shocks to the macroeconomy will create disequilibrium in the labor market, but transactions may continue to take place in this environment.

Consider first a shock to the economy that raises the wage rate from its equilibrium value to $(W/P)_1$ in Fig. 7–1. This higher wage is the result of an unpredictable reduction in the inflation rate in the wake of a negative demand shock, either $-x_g$ or $-x_m$, as indicated in equation (5.12) on p. 146. In response to the higher wage, firms will reduce their labor input to *A* in Fig. 7–1. Also, at this wage the supply of labor is at *A′* which is interpreted as individuals wanting to work more hours per period of time than they are offered or that they worked in equilibrium.[1] This extra supply will put downward pressure on the real wage until it reaches $(W/P)_e$. Some welfare comparisons for labor-force participants can be made between *E, A,* and *A* . While workers would be better off at *A* than at *E*, they would have to accept *A* instead of *A* since firms cannot be induced to use more labor input at this wage. Moving from *A* to *E,* utility would change according to equation (7.1) with dH>0, $d(W/P)$<0, and $U_2(W/P)_1 > U_1$ because the person is to the left of the labor-supply curve at *A*. Therefore, the change in utility is ambiguous, with the first term being positive and the second term negative. If the iso-utility curve through *E* has steep sides (i.e., U_1/ *H* is large or U_2/ *H* is small), then *A* is better than *E* because dU<0 in equation (7.1); alternatively, if the iso-utility curve is relatively flat, *E* is preferred to *A*.

While workers may be ambivalent about lowering the real wage to its equilibrium value depending on their own utility function, firms have a clear

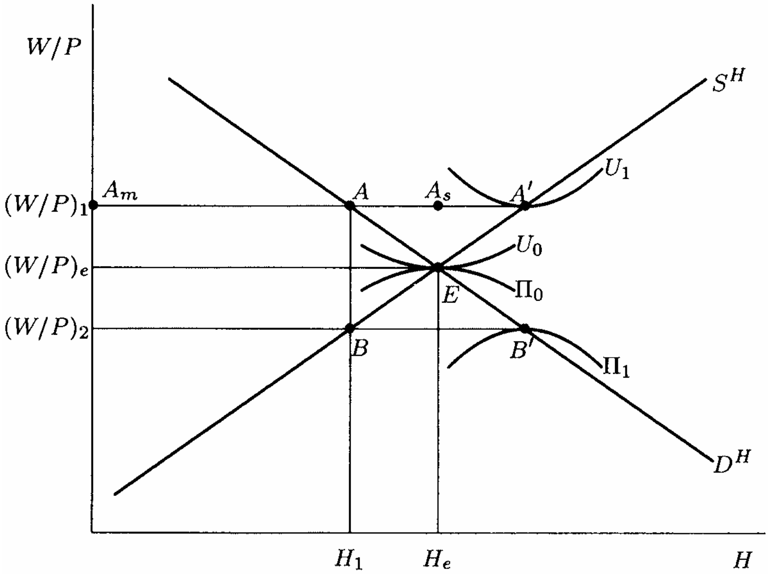

Figure 7–1 Welfare evaluations in the labor market

preference for *E* over *A* since the former generates more profits than the latter. Is it possible to predict the outcome in these circumstances? As long as there are *some* workers for whom $dU>0$ in equation (7.1), they will offer to work more hours for a lower wage and firms will have strong incentives to accept these offers. The displaced workers, who presumably faced $dU<0$ in the move from *A* to *E* will now have $H=0$ at A_m, which must be a welfare loss since it has the same goods consumption as *voluntary* unemployment but excess leisure. Hence, they too will find it advantageous to accept the equilibrium wage. Therefore, firms and workers all agree that wages should fall, in which case nominal wage adjustments are likely to follow the pattern established by equation (5.16) on p. 148.

To continue the analysis, the same welfare evaluations can be made for a real wage that is temporarily too low to clear the market. The wage rate $(W/P)_2$ in Fig. 7–1 would be the result of a positive shock to the inflation rate, with nominal wage growth dictated by the expected inflation rate which does not change. The short side of the market would stipulate that the employment level is at *B* on the S^H curve, while firms would want a labor input of *B′* on the demand curve. Workers are worse off at *B* than at *E* and they want the competitive forces emanating from excess demand to raise the wage back to $(W/P)_e$ as quickly as

[1]If the labor-supply curve is vertical or even backward-bending, the subsequent analysis would not change appreciably, unless it introduced instability in the market.

possible. The only counterforce to raising wages comes from firms that may find their profits reduced. However, since they have had to accept a suboptimal situation at *B,* profits may in fact rise. This depends on whether the iso-profit curve Π_0 passes above or below *B* in Fig. 7–1. If the iso-profit curve has steep sides, firms would rather accept the higher wage than face a supply constraint at B. In other words, although $d(W/P)>0$ and $dH>0$ in the movement from *B* to *E,* it is possible that $d\Pi>0$ in equation (7.2) if the discrepancy between the wage and the marginal product is large enough. As long as there are *some* firms that find it profitable to raise the wage back to its equilibrium value, other firms will have to follow suit for fear of losing all their workers, which generates losses equal to fixed costs.

In summary, in a labor market with flexible hours, all workers and firms have strong incentives to rid themselves of excess-supply or excess-demand conditions. They would not want to commit themselves to long-term contracts that would prevent fast adjustment nor would they need policy intervention since they are able to find the necessary welfare-improving changes better than the government. Because equilibrium is a Pareto improvement over disequilibrium, it is in everyone's interest to have a market-clearing wage as quickly as possible and we would observe hours adjustment by all workers to reach this optimal position.

7.1.2
Welfare Changes with Common Hours

As an alternative, in adjusting to *A* from *E* in Fig. 7–1 initially after the shock, firms may have eliminated some workers entirely and kept hours constant for the remaining employees, when they find that common hours are more profitable than anarchical hours, as shown in Ch. 3. For this situation, firms will find it advantageous to reduce the labor input at the extensive instead of the intensive margin. In the wake of the shock, "marginal" workers, as characterized in the previous chapter, lost all their hours of work while "secure" workers were better off at the higher wage at $(W/P)_1$. Since secure workers continue to have $\bar{H}$, their utility depends only on what happens to the real wage. Equation (7.1) is therefore amended to

$$dU_s = U_2 \bar{H} d\frac{W}{P}, \tag{7.1'}$$

which increases unambiguously as the wage rises. For marginal workers, utility changes are discontinuous; if they move from employment to unemployment during a recession, their utility falls from to what it would be at the reservation wage, *U(T,I)*, where *I* is the amount of nonwage income available to support goods consumption.

At $(W/P)_1$, secure workers would be at A_s, directly above *E,* while those who have been laid off are positioned at A_m. Clearly, welfare at A_s is higher than at *E* because of the greater goods consumption that is possible at the higher wage without any change in leisure. Although it is possible to draw the iso-utility curve U_0 to pass below A_m, this would imply that involuntary unemployment is to be preferred to voluntary unemployment; it is therefore taken for granted that marginal workers will accept the lower equilibrium wage in order to maintain their previous employment. Consequently, there is a conflict between secure workers who want the wage to remain at $(W/P)_1$ and marginal workers who want it to return to $(W/P)_e$. In this situation, it is not obvious how the conflict between secure workers and marginal workers is resolved, but in the next section, the lack of competition among workers will be analyzed. In the meantime, secure workers may have the power to slow down the equilibrating process, prolonging excess-supply conditions and maintaining unemployment that is both complete and involuntary for a small minority of the labor force.

There is also an asymmetry in the incentives for a return to equilibrium when the shock reduces the real wage to $(W/P)_2$ in Fig. 7–1. Here, secure workers are worse off as their ability to enjoy goods consumption has been reduced without an offsetting increase in leisure, according to equation (7.1). Those marginal workers who have been hired at this lower wage prefer this situation to involuntary unemployment. Now, secure workers prefer a return to equilibrium, but marginal workers want the excess demand to prevail for as long as possible.

7.1.3
Implications for Policy Intervention

Flexible and fixed hours of work generate contradictory incentives for workers and firms and opposite predictions concerning the optimality of equilibrium when it is subjected to a sudden shock. This observation, although not often explicitly stated, leads to diametrically opposed views about the benefits of macroeconomic fine-tuning held by the two major schools of thought: the "classical" and the Keynesian dogmas. To a classical macroeconomist, the principal guiding light is equilibrium. This state is in everyone's interest and therefore each of us will try to achieve it. Underlying this belief is the perception that all markets are organized as auction markets, clearing at almost every instant in time, and that prices determined in these markets provide the participants with the signals that allow them to respond to changing conditions in ways that maximize their individual benefits as well as those of society as a whole. In such a world, other institutional arrangements are not valid, since they cannot improve on the results available from a complete set of auction markets. There is no room in the analysis for the influence of such institutions as labor unions and contracts. If unions do not disrupt equilibrium they are tolerated but irrelevant; if they cause disequilibrium or prevent instantaneous adjustment in the labor market, they will be eliminated by a new institutional arrangement for setting wages that does not produce this undesirable result. In the labor market, the universal appeal of equilibrium is the result of assuming strong competitive forces that lead individuals to adjust their hours in response to unpredictable events.

By contrast, Keynesian macroeconomists recognize implicitly the distinction between secure and marginal workers and that stabilization policies are needed to help the latter group. Interventionist models posit the rigidity of wages and the existence of unemployment by relying on the common-hours, reservation-wage analysis of the labor market developed in Ch. 3. The evidence from Ch. 1, in my view, clearly supports the claim of lasting disequilibrium and the lack of hours adjustment by individuals. Nevertheless, this conclusion does not win the argument in favor of interventionism since a Pareto improvement cannot be guaranteed. In fact, a conflict environment is now the rule unless the Okun coefficient can be raised to a value of two or three through substantial productivity increases when the unemployment rate is reduced. Only if expansionary policies that increase employment also raise the ability of firms to pay higher wages to all of their employees, will such intervention receive support from the majority of labor-force participants. Again, the evidence of the negative relationship between employment and wages and of a small Okun coefficient eliminates the possibility of bribing existing workers with a "full-employment dividend" and of organizing a political coalition between secure and marginal workers to push for interventionism. In any event, except for Okun himself, Keynesian macroeconomists seem not to have used the size of the Okun coefficient to buttress their argument for activist policies. Standard stabilization policies, although they can be effective in dealing with unemployment, also hurt the vast majority of labor-force participants who will, in a democracy, place obstacles in the way of "optimal" macroeconomic policies. In that context, it is necessary to investigate new ideas about Pareto-improving strategies that involve direct intervention in the labor market. Before proceeding with this task in Ch. 8, it is necessary to return to the issue of competitive forces in the labor market. If unfettered competition among workers is allowed to take place, the sharp distinction and unresolved conflict between secure and marginal workers that has been drawn so far is irrelevant.

7.2 Competition for Jobs

When some workers experience a welfare improvement during excess-supply conditions in the labor market while others are reduced to involuntary unemployment, one would expect that the latter will compete with the former in the job market and thereby eliminate the distinction between them.

A specific indication of the absence of cut-throat competition in the labor market is the observation that unemployed persons do not offer to do the job of a currently employed worker for a lower wage. Solow (1990) has analyzed in some detail the possible reasons for this self-imposed limit on competitive behavior. He writes:

> When there are a lot of unemployed workers, you might expect employers actively to solicit competitive wage cutting on their part. It rarely happens. The cases when it does happen, usually in deep recessions or when there is a serious threat from imported substitutes for the firm's product, are striking enough to call attention to the fact that it does not happen in run-of-the-mill recessions, although the unemployment rate might rise by two or three percentage points and even in average times there appears to be some excess supply of labor.
>
> (p. 37)

Solow is aware that this self-imposed constraint on behavior by unemployed workers may not be optimal from their perspective. He states:

> An injunction not to engage in wage cutting puts a major strain on unemployed workers…At most times and in most places, the margin of advantage of employment over unemployment remains substantial…But then the belief that there is a stable and effective social norm against wage competition for jobs needs some reinforcement of a kind that might come from showing that obeying such a norm is individually rational, besides performing a social function.
>
> (pp. 39–40)

What Solow essentially argues is that "the margin of advantage of employment," while possibly large at a moment in time, is eliminated over a lifetime of labor-force participation. The crucial assumptions in the Solow model are: (1) "All workers in the firm's labor pool are alike." This applies to their reservation wage and to their discount factor (p. 53); and (2) "Jobs are allocated to workers at random, independently in each period" (p. 54). Although the calendar time for a period is not specified, a rational unemployed worker may see no reason to rock the boat by offering to work for less, when in a short while he has a 90–95% chance of getting a job with the higher wage. However, if workers differ significantly in these attributes, it is very likely that a person with an unusually low reservation wage will compete for an existing job even though a person with a reservation wage just below the going wage would resist this temptation. Also, one would expect that a person who has been unemployed for many periods to be more eager for a job than a person who has experienced very little unemployment in the past. Despite these potential conflicts in the labor market, Solow's model leads to the conclusion that *ex ante* all workers will have practically the same job-market experience, being involuntarily unemployed about 5–10% of the time and getting the same rewards for their sacrifice of leisure when they do work. For such a homogeneous group, it is much easier to make a convincing case that "social norms" govern their activities than for a heterogeneous group that faces divisive issues in the work place.

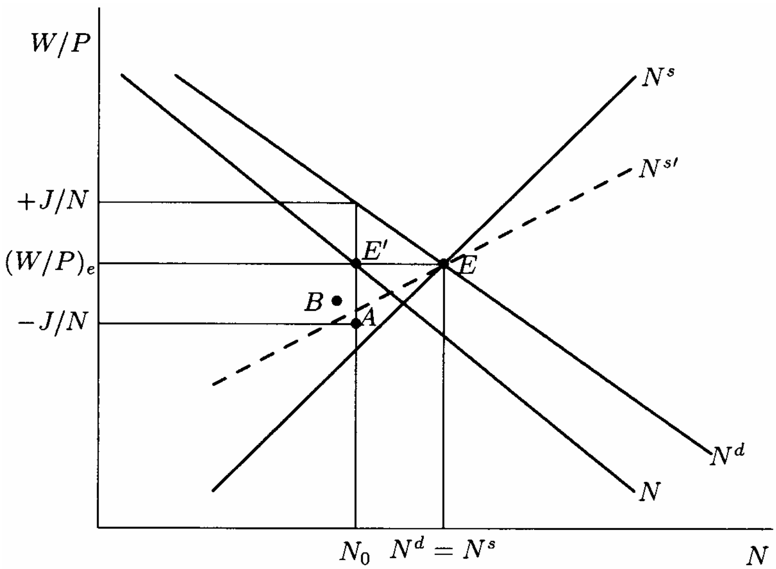

Figure 7–2 Adjustment costs and competition for jobs

If job allocation is more predictable than random, the distinction between secure and marginal workers becomes paramount and in this setting, we must find another rationale for restrictions to competition that make it difficult for unemployed workers to find jobs: relatively large fixed costs of adjusting the workforce.

7.2.1
Competing for Existing Jobs

The stage is now set for an examination of the difficulties faced by unemployed workers competing for existing jobs by undercutting the existing wage. The analysis will take place at equilibrium in the labor market, but later that requirement will be relaxed. Fig. 7–2 is based on Fig. 3–10 as a depiction of equilibrium in the labor market, where supply is determined by the reservation-wage model and labor use is less than labor demand because of optimal vacancies determined by adjustment and disequilibrium costs, J/N, from equation (3.16). At $(W/P)_e$, there are involuntarily unemployed persons equal to $E\,E$ who would offer their services at that wage. However, firms cannot costlessly exchange current workers for new ones even if the wage is lowered to some extent. In fact, firms would require that the wage fall to $(W/P)_e - J/N$ before they would be interested in such a swap. Essentially, they would force the new workers to absorb the adjustment costs. Would there be any workers who would offer their services at that wage rate? The answer depends on the slope of the labor-supply curve. If the relatively steep curve depicted by N^s is used, there are still persons who would want to work at that wage rate, but if N^{s}' is relevant, $(W/P)_e - J/N$ is below the reservation wage of all unemployed workers and the wage offer would be refused. In other words, the adjustment and disequilibrium costs perform the function of a buffer protecting existing workers, for whom these costs have been paid, against outsiders.[2] The size of *J/N* plays a critical role in protecting existing workers. In industries where hiring and training costs are low, the protection may appear to be low, but these industries also tend to have a high quit rate which then raises *J/N.*

The adjustment costs that create a wedge between current and potential workers may be argued to work against the interests of the former group. In the presence of such costs, employers may be tempted to cut wages of existing employees, knowing full well that they would have difficulty finding jobs elsewhere because potential employers would have to pay the hiring and training costs for them. However, secure workers would not be intimidated by this threat since they also know that firms would have to pay adjustment costs in order to replace them. In such a game, the employees have the "property rights to the status quo" and they are in a position to exploit this advantage by resisting wage cuts.

The existence of quits in the labor market presents both a barrier to unemployed workers in raising the semi-fixed costs of employment and an opportunity for a job in the near future.[3] However, during conditions of excess supply, the unemployed have greater opportunities to compete for jobs. If the wage rate rises above its equilibrium value, absorbing the adjustment costs becomes easier. For example, in Fig. 7–2, the higher wage minus adjustment costs is shown as point *B,* which is now above even the flatter labor-supply curve and would mean that there are more people prepared to compete for jobs than in equilibrium. The opposite conclusion holds when there is excess demand.

To determine the extent of the obstacles faced by marginal workers, data are needed for the labor-supply elasticity and for the size of adjustment costs, neither of which are readily available. Hiring, training, and other fixed costs of additional employees will vary from firm to firm, from one type of worker to another, and over time, making it extremely difficult to generate a time series for the entire economy that measures *J/N.* Although evidence on the supply of hours indicates a steep if not vertical labor-supply curve, elasticities derived from reservation-wage models are notably unavailable. In the absence of reliable estimates of

[2] It is these costs that create the distinction between "insiders" and "outsiders" made popular by Lindbeck and Snower (1986).

[3] Ehrenberg and Smith (1994, Fig. 10.1) report a quit rate of 1–3% per month, but according to Akerlof, Rose and Yellen (1988), about 40% of quits lead directly to another job, which in the aggregate labor market does not provide an opportunity for an unemployed person to secure a job.

reservation wages, such elasticities will remain elusive. Moreover, even if we believe that we have workable proxies for reservation wages, it may still be impossible to predict the participation decision because the aggregate data are dominated by the strong upward trend of women entering the labor force since the middle 1960s, despite generally falling wages from the 1970s onward. However, as a sensible alternative to obtaining regression coefficients, it may be worth arguing that the reservation wage lies between the amount of unemployment benefits available to eligible participants and the wage rate paid in industries or occupations that have the greatest difficulty in attracting workers, which suggests the retail-trade sector as the best candidate for this role.

In Fig. 7–2, the inverse of the slope of N^s measures the labor-supply elasticity. Taking 1987 as an example, when the labor market was approximately in equilibrium, the amount *E E* divided by the vertical distance from E' to either of the supply curves, both in natural logs, will provide an indication of the elasticity. In that year, the average weekly wage (LEW), which measures $(W/P)_e$ in Fig. 7–2, was $312.41 while weekly unemployment insurance benefits (*Economic Report of the President,* 1996, Table B-41) were $140.55. The unemployment rate was 6.18% and this measures *E E.* Thus, the lower bound on the labor-supply elasticity is 0.0618/(ln 312.41−In 140.55)=0.0774. The average hourly wage in the retail-trade industries (LEHTR) when multiplied by the average weekly hours in the sector (LWTR) generates a weekly wage of $6. 11×29.23=$178.59. Using this figure instead of the unemployment benefits produces an upper bound to the elasticity equal to 0.109. These estimates suggest that the supply curve is steep and that any reasonable amount of adjustment costs will eliminate most candidates for the wage offer of $(W/P)_e - J/N$.

The wage rate in the retail-trade industries may also be an indirect indication of the size of adjustment costs. This sector seems to come close to being able to find new workers without search, hiring, or training costs, and therefore weekly earnings of their employees represents total employment costs as well. There are, of course, differences in skills, in weekly hours and in many other factors between the retail industries and all other sectors of the labor market, but the gap between $312.41 and $178.59, equal to about 75%, may be the upper limit on the potential size of adjustment costs, *J/N.* In other words, a person who was in the labor force but unemployed in 1987, may have expected a weekly wage just below $312.41 while job hunting and competing with existing workers, but instead was offered something slightly above $178.59 which was not sufficient for the individual to accept. Thus, existing workers are protected in the security of their jobs by low reservation wages and/or high adjustment costs, but these calculations are only a preliminary indication of this situation and I do not want to place too large a burden of proof on this evidence.

7.2.2
Conclusions

The conclusion to be reached from this analysis is that unemployed workers *may not* have self-discipline imposed on them by a rational social norm; instead they *may* be shut out of existing jobs by the cost of fitting them into the workplace, a cost already paid by current workers who are then protected from the competitive ravages of market discipline. The evidence on these costs is circumstantial and does not provide overwhelming support for this proposition, but it is suggestive of important differences between those who have jobs and those who are involuntarily unemployed.

The analysis of competitive forces in the labor market is not new; however, most of the previous studies have looked at unions as the source of monopsony power. Here, all workers are atomistic, equally able, individual competitors, but they differ in two important respects: reservation wages and security of employment. Both of these factors play a role in the difficulty that involuntarily unemployed persons have in finding jobs. Workers gain security just by having cleared the hurdle of the firm's cost of hiring them; unemployed persons may not be willing to absorb these costs if the resulting wage is below their reservation wage. Hence, the larger are the fixed costs of employment, the greater is the security of workers with jobs and the lower is the reservation wage of unemployed persons still seeking work. In this context, the current emphasis in labor-market models on repetitive lotteries for a limited number of jobs at the beginning of each period, with everyone having the same chance of winning, is seriously misplaced.

7.3
Conflict over Traditional Stabilization Policies

The debate over macroeconomic policy has concerned itself with the need for intervention to achieve full employment, but the welfare benefits of such action have not been debated in the proper context because noninterventionists have argued that stabilization policy is both useless and harmless and interventionists have taken the position that reducing unemployment could not hurt those who are already employed. At this stage of the analysis, it is worthwhile to look at the role that traditional stabilization policies play in the macroeconomy and how they affect various participants in the labor market.

7.3.1
Stabilization Policy and the Labor Market

The interventionist position is staked on the ability of the government to influence aggregate demand in the economy through monetary or fiscal policies, with the consequences for the labor market usually left unexplained. However, if firms are to be stimulated to hire more workers in a recession, the extra aggregate demand that comes from enlarged government expenditures or from lower interest rates must be translated into a lower real wage and this in turn can only be achieved by raising the inflation rate.

Standard Phillips-curve analysis can help us to understand the effects of stabilization policies on the important variables in the labor market. Consider a starting point of u_0 as the unemployment rate in Fig. 7–3 below. The associated inflation rate is $_0$. If the government decides to pursue expansionary policy at this point, it will either increase government expenditures or raise the growth rate of the money supply. If it is able to hide this policy change from the public, it becomes an unpredictable event as defined in Ch. 5, but if labor-market participants are able to incorporate this information into their expected-inflation calculations, it is treated as a predictable event. If we concentrate on monetary policy, the former enters the model as $x_m>0$, while the latter is $d\mu>0$. From equation (5.10) on p. 145,

$$\pi_1 = \pi_0 + \frac{1}{1-a_3}(\mu_1 - \mu_0) + \frac{a_1}{a_1 + a_3a_4 + a_1a_2a_4}x_m \tag{7.3a}$$

and from equation (5.15) on p. 148

$$u_1 = u_0 - \frac{(b_{10}+b_{12})a_1}{a_1 + a_3a_4 + a_1a_2a_4}x_m = u_0 - (b_{10}+b_{12})(\pi_1 - \pi_0), \tag{7.3b}$$

which provides us with an equation for a Phillips curve. The slope of the Phillips curve in Fig. 7–3 is $1/(b_{10}+b_{12})$, which is the sum of the slopes of the labor-use and labor-supply curves. Expansionary monetary policy that is unpredictable will move the labor market from *A* to *B* in Fig. 7–3, raise the inflation rate to $_1$, and lower the unemployment rate to u_1. If the policy change is announced beforehand, the Phillips curve shifts upward through a higher expected inflation rate; the move is from *A* to *C* and the inflation rate rate rises more to but the unemployment rate remains at u_0. In the former case, the higher unanticipated inflation will reduce the real wage by the difference between $_1$ and $_0$ since wage contracts failed to incorporate the policy change. In turn, employment rises as firms take advantage of the lower cost of labor and the unemployment rate falls, both because of the increased labor use and because labor supply will fall when some previous participants find their reservation wage in excess of the current real wage.

7.3.2
Labor Demand and the Phillips Curve

By concentrating on full-employment output as the goal instead of full employment itself, Keynesian macroeconomics is able to side-step the link between the labor market and aggregate demand that the Phillips curve makes possible. It is often taken for granted by Keynesians that any increase in the demand for goods and services will lead to extra output and employment without

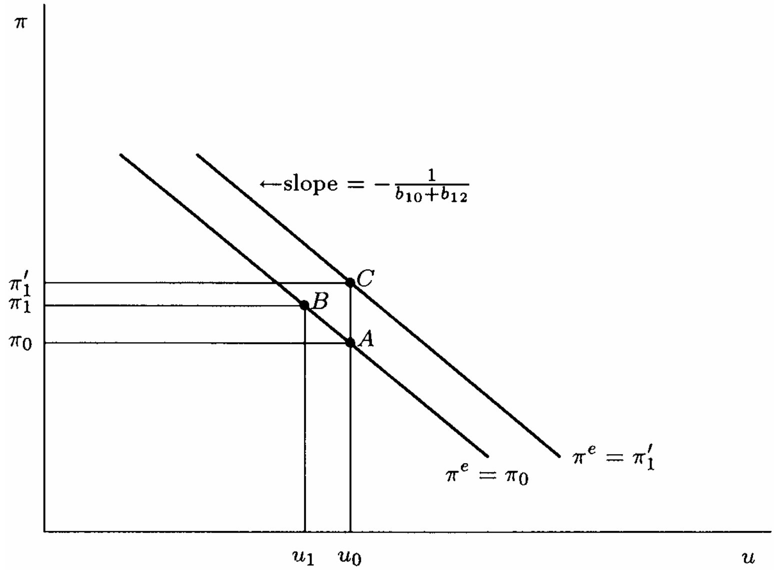

Figure 7–3 Phillips curves and stabilization policies

a change in the real wage, but this requires special conditions which conflict with other aspects of the model. From the profit-maximizing position of the firm, given by

$$Y_N = \frac{W}{P}, \tag{7.4}$$

where Y_N is the marginal product of an additional worker, it is evident that greater employment with a constant real wage requires that there is a fixed marginal product of labor. This is often the treatment found in textbooks, for example, in Dornbusch and Fischer (1994, p. 224), who write the production function as $Y=aN$. However, this assumption is inconsistent with a stable negatively-sloped Phillips curve, which requires higher inflation and therefore a deteriorating real wage when the unemployment rate is reduced. It is also inconsistent with a negatively-sloped labor-demand curve, for which there is ample supporting evidence in Ch. 1.

If the manipulation of aggregate demand affects the inflation rate and if nominal wages are "sticky," the real wage will move countercyclically and this implies that the welfare of secure workers is higher in a recession than in a boom period. For that reason, workers with job security are not anxious to see the implementation of expansionary policies, especially if they come as a surprise and cannot be included in calculations of expected inflation. According to the welfare evaluation in equation (7.1), secure workers are worse off at *B* in Fig. 7–3 than at *A*, although they are indifferent between *A* and *C*. The steeper is the Phillips curve the greater is the loss of welfare for secure workers. This bias against countercyclical stabilization policy conflicts with the interests of the unemployed who need this policy intervention to obtain job offers. In turn, those who gain jobs when the unemployment rate falls from u_0 to u_1 have increased their welfare since the wage that they will receive is by definition higher than their reservation wage.

The empirical Phillips curve estimated in Ch. 1 provides us with some evidence of the extent of the welfare loss for secure workers when unemployment is reduced. From the estimated coefficient of the slope of the Phillips curve in the vicinity of −0.7, we can calculate the wage reduction needed to decrease unemployment. In 1982, when the unemployment rate was 9.7%, it would have taken extra unanticipated inflation of 3.7×0.7=2.59% to reduce unemployment to the natural rate of 6%. This would have meant a reduction in the weekly wage from $267.51 to $260.34. Whether the average worker is prepared to accept such a sacrifice in order to make jobs available to those who are unemployed is a matter for serious debate, but it cannot be argued that stabilization policies are a Pareto improvement. The only way to increase employment with a constant wage is to increase the marginal product of labor at the same rate. From the equation estimated in Ch. 1, an increase in the capital stock by 1% will raise employment by 0.647%, with the real wage unchanged. Although expansionary monetary policy could be used to exploit this possibility, probably with lags, expansionary fiscal policy will have perverse effects.

Alternatively, the interventionist argument could be based on the perceived weakness of marginal workers in the wage-determination process. In this context, the role of government is to protect the interests of marginal workers and to accept welfare losses for secure workers. However, such a position would lead to a bias against any contractionary action because there is always the threat that some marginal workers would be laid off. In any case, I am not aware of any Keynesian argument that is based on a social-welfare function that assigns a high priority to a small group of disadvantaged labor-force participants. Moreover, because such policy intervention would have to be a public-choice decision, it also gives warning that secure workers, who would be the losers from full-employment policies, will not tolerate such a system. Despite a formal commitment to full employment since 1946, renewed and strengthened in 1978 by the Full Employment and Balanced Growth Act, neither Democratic nor Republican administrations have given effective and whole-hearted support to this goal, as documented in Prachowny (1994, Ch. 2).

7.4
The Benefits of Wage Indexation

One of the legacies of the inflationary experience of the 1970s is the great difficulty of predicting with any accuracy the rate of inflation for even a short time horizon. It did not take long for workers and firms to realize that instead of trying to achieve a certain real wage *ex ante,* it would be better to do it *ex post* As a result, cost-of-living adjustment (COLA) clauses appeared in more and more labor contracts. This institutional adaptation in the labor market has an important effect on the macroeconomy when it is subjected to different kinds of shocks. Gray (1976) concluded that full wage indexation helps to preserve the economy's equilibrium when it is faced with demand shocks, but that supply-side shocks are made worse by COLA clauses that prevent any adjustment of the real wage. In the context of the potential conflict between secure and marginal workers, indexation may have another advantage; by pre-specifying the wage-adjustment process, it might prevent the power struggle over wages that could prevent a rapid return to equilibrium. First, we will analyze the macroeconomic effects of indexation and second, the incentives for its implementation.

7.4.1
The Macroeconomic Effects of Indexation

In Ch. 5, the wage-determination process was forward-looking in the sense that , the growth rate of nominal wages was geared to ^{e}, the expected inflation rate; with COLA clauses, wage determination becomes backward-looking because is set to whatever happens to be. A contract with a COLA clause will not specify a timetable for specific nominal wages, but instead, will contain a formula providing for wage adjustments at specific times in relation to changes in a price index, usually the Consumer Price Index (CPI). There are various formulae that are used: some have a maximum amount to be paid in COLA, others provide a threshold value for inflation before COLA clauses come into effect, some are stated as "cents per point of the CPI," others are written in proportional terms. For our purposes, to pinpoint the effects of wage indexation, COLA clauses with proportional features will be used. The rate of change of nominal wages now becomes

$$\omega = f\pi + (1 - f)\pi^e, \qquad (7.5)$$

where f is the indexation factor which can take any value between zero and one. Equation (7.5) stipulates that is a weighted average of and ^{e}. If $f=1$, there is full indexation, $f=0$ means that indexation is absent, while $0<f<1$ indicates partial indexation.

Since it is the labor market that is affected by the choice of indexation, it is the slope of the *AS* curve that will be influenced. If labor agreements are negotiated before shocks make themselves evident, unions and firms will have to make a choice about COLA clauses. If they choose not to use a COLA clause, is predetermined by all the factors that are known at the time, but it cannot be changed afterwards if shocks intervene; then the *AS* curve is as it was before. But if any degree of indexation is incorporated into labor contracts, equation (7.5) is substituted into the *AS* curve of equation (4.17) on p. 125, which is now

$$y = y_e - a_4(1 - f)(\pi^e - \pi). \qquad (7.6)$$

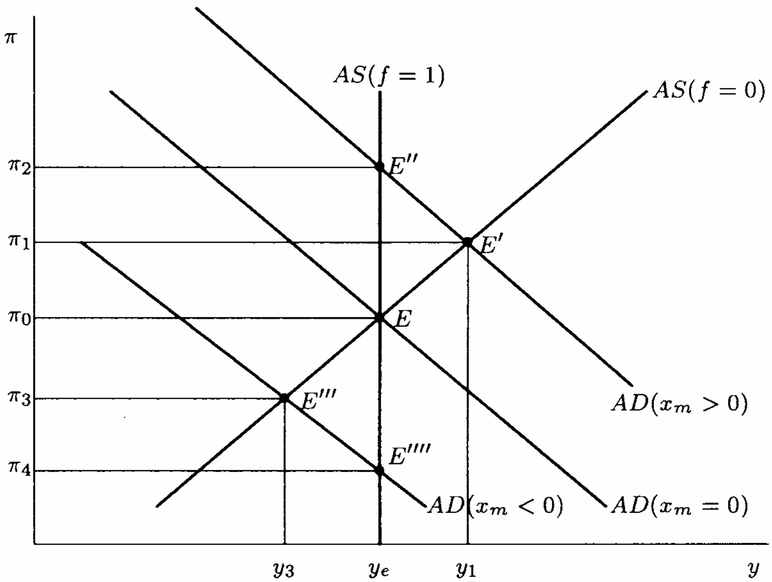

Figure 7–4 A monetary shock, with and without indexation

The slope is now $1/[a_4(1-f)]$. If f=1, the *AS* curve becomes vertical and the distinction between and ^{e} is unimportant. With 0<f<1, the *AS* curve has a slope between $1/a_4$ and infinity.

We can now subject the economy to various shocks to see how it reacts with and without indexation. Let us consider demand shocks as contained in the *AD* curve, such as x_m or x_g. Suppose that x_m becomes either positive or negative after a period in which all *x*s were zero. From an inspection of equation (5.5) on p. 140, a positive x_m causes the *AD* curve to shift upwards, while a negative x_m moves *AD* in the opposite direction. Both are shown in Fig. 7–4. We also have two *AS* curves, *AS*(f=0) for zero indexation and *AS*(f=1) for full indexation, both of which intersect at *E*, the initial equilibrium before the shock appears.

With a positive shock and no indexation, the economy will move to *E* with both higher inflation and higher output, $_1$ and y_1. With full indexation, the inflation rate rises more, to $_2$, but output remains insulated at y_e. If y_e is an optimal point for the economy then full indexation is the preferred way of setting wages. The same result applies if there is a negative shock since *E* ″ is inferior to *E*″″.

Why does indexation have an advantage in this context? In a world buffeted by shocks, it is impossible to maintain labor-market equilibrium because of the difficulty in changing the nominal wage continuously. But contracts, rather than auctions, can provide the necessary flexibility of the nominal wage if these contracts incorporate COLA clauses. By making the nominal wage more flexible, it gives the real wage greater stability. Therefore, in a stochastic environment, what is needed is a contingent contract which stipulates certain outcomes

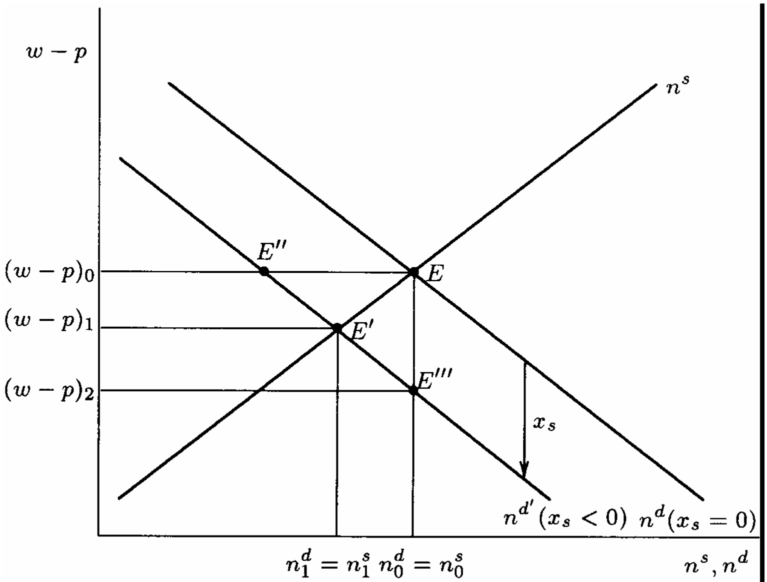

Figure 7–5 A supply shock, with and without indexation

depending on a list of events that may transpire. COLA clauses are an example of such contingent contracts. They are easily defined and enforced; all that is needed is a price index that is acceptable to both sides. Since individual unions and firms cannot influence the CPI to any extent, it is the one used most often in COLA clauses.

In summary, we can have both long-term contracts and equilibrium if full indexation is included in such contracts when the economy faces unknown influences on the location of the *AD* curve. This advantage of COLA clauses is, unfortunately, not universal. When the economy is subjected to labor-market shocks, the optimum is only partial indexation.

In this instance, it is no longer possible to identify the preshock output with equilibrium in the labor market and for that reason, it is necessary to see how shocks affect that market directly. In Fig. 7–5, the supply and demand curves for labor are drawn, but unlike Fig. 7–2, here they are in natural logs. Initially x_s=0. A negative value for *x*s shifts the n^d curve down by the value of x_s because it represents an unexpected deterioration in the marginal product of labor.[4] To move to a new short-run equilibrium at *E'*, the real wage should fall to $(w-p)_1$, but unless there is just the right degree of indexation this will not happen. With full indexation, $(w-p)_0$ remains, leading to employment less than the desired nd1 at *E'''*. Without any indexation, will rise by as shown by equation (5.10) on p. 145, where all the determinants of are indicated in a rational-expectations framework. If a_2=1 and a_3=0, as Gray assumes in order to simplify the analysis, then $w-p$ will fall exactly by the value of x_s, leading to $(w—p)_2$ which is now too low for the new equilibrium at E' and the labor market moves to E''' on the new demand curve. Thus $(w-p)_1$, the optimal real wage, requires partial indexation with the optimal size of f depending on the slopes of the n^d and n^s curves. This can be verified by reference to equation (5.16) on p. 148, which indicates that should fall below in the face of a negative supply shock by the value of $b_{10}/(b_{10}+b_{12})$, an expression that must lie between zero and one.

7.4.2
The Incentives for Indexation

Optimality of indexation has been judged on the basis of whether it can preserve equilibrium in the labor market, but that is not necessarily the incentive that participants in that market have for adopting COLA clauses. Secure workers have an interest in raising their real wage while maintaining their jobs; marginal workers want to keep the real wage low enough to attract job offers. Since COLA clauses are part of a contractual agreement that covers all members of the group, it is not possible to rely on competitive forces to determine their implementation; instead, the decision must satisfy the median voter, who is most likely to be a secure worker. Thus, there will be a large group favoring implementation of full indexation at a time of high unexpected inflation that erodes real wages, but COLA clauses will be eliminated from contracts if there is any danger of deflation where they would automatically reduce nominal wages.

It is interesting to note that the greatest penetration of COLA clauses in US union contracts took place during the 1970s when the two oil-price increases, interpreted as supply shocks, suggested that full indexation was not optimal. Since then, the incidence of COLA clauses has receded even though business cycles have been dominated by demand shocks. During the 1970s, the only period of "double-digit inflation" in the postwar period, secure workers urged the adoption of COLA clauses when their real wages were threatened by the very size of the inflation rate; during the 1990s, on the other hand, as inflation was barely above zero, secure workers have no interest in promoting indexation. Card (1986) shows that about 20% of collective bargaining agreements in 1966 had COLA clauses; by the early 1980s this proportion had risen to 60%, but it has fallen again since then. He writes (p. S161, fn. 31): "As an empirical matter, most of the changes over time in the proportion of indexed contracts seem to be correlated with aggregate price uncertainty."[5]

Therefore, wage indexation does not solve the problem of conflicting views between secure and marginal workers. In fact, the competitive power of marginal workers is eroded further by the requirement that all participants be subject to the same COLA clauses and democratic forces will make the median voter a secure

[4] To maintain clarity in the diagram, n^d and n, the labor-use curve, are considered to be the same.

worker. The incentives for secure workers to adopt wage indexation depend on the size of inflation, while equilibrium in the labor market requires optimal degrees of indexation that depend on the source of the shock.

7.5
Conclusion

This chapter has concerned itself with welfare evaluations of macroeconomic events in the labor market and their consequences for disequilibrium transactions. If all workers are the same and if they adjust to shocks by raising or lowering the hours that they all work, there is a strong incentive to move back to equilibrium. If, on the other hand, hours of work are pre-determined by a prior optimization procedure, firms will adjust their labor input at the extensive margin, leaving most workers unscathed, while a small minority have large changes in their welfare. The distinction between secure and marginal workers becomes the source of a powerful conflict over the benefits of returning to equilibrium. Although interventionist and noninterventionist schools of thought in macroeconomics have long debated the need for stabilization policy, there is precious little attention given to the welfare effects of the policies that are being contemplated. Although Keynesians have won the day by insisting that disequilibrium in the labor market is protracted, they have failed to make the case that traditional stabilization policies or other "optimal" systems such as wage indexation, are in fact Pareto improvements. In the next chapter, some new possibilities for direct labor-market intervention will be explored to determine whether they offer the opportunity for helping the unemployed without hurting those who have secure jobs.

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[5]For earlier evidence, see Douty (1975, p. 12, Table 1) and Davis (1983).

8
Pareto Improvements in the Labor Market: Part II

This chapter continues the search for policy measures that "improve" the performance of the labor market during a business cycle. Standard stabilization policies that rely on moving aggregate demand for goods and services to the point where full-employment output is achieved were found not to meet the requirements of Pareto efficiency. Therefore, we will investigate policies that operate directly in the labor market. First, the general notion of "job-creation programs" that stimulate employment through subsidies, tax relief, or direct government hiring will be explored. Second, the possibility of the government as employer of last resort at a prespecified wage rate will be analyzed. Third, the difficulty of obtaining any optimality in policy choices in the face of a conflict over property rights and economic rents will be discussed.

8.1
The Popular Appeal of Job-creation Programs

Perhaps the most important function for government today is to "create" jobs. Despite reports that such programs are often prohibitively expensive, legislators and voters tend to favor initiatives that provide job subsidies to private firms or that involve direct public employment. In one recent example, reported by *The Economist* (March 19, 1994, p. 31), the state of Virginia enthusiastically approved subsidies of $163 million to Walt Disney for a theme park that would employ 19,000 mostly low-wage workers.[1] Alternatively, governments pursue public-works projects, whose main purpose is to find work for the unemployed. An example from the recent past is the Emergency Employment Act of 1971, which involved the cumulative participation of about 300,000 persons at an estimated cost of approximately $1 billion.[2] This emphasis on direct involvement in the labor market seems to have replaced the more traditional countercyclical stabilization policies of the 1950s and 1960s, which worked through the goods or

[1]Subsequently, Disney pulled out of the project, not after a tax revolt, but because of massive protests from environmentalists and authenticists.

money markets. It is especially paradoxical that governments rely on subsidized job creation when expansionary monetary policy during a recession could generate these jobs without any cost to the treasury.

The purpose here is to determine whether direct government participation in the labor market through subsidized private employment or putting people directly on government payrolls has the strength of public acceptance that politicians often claim.[3] There must be a sizeable portion of the electorate that finds this method of job creation better than the alternatives that it faces and the aim is to identify this group. It appears that current workers may find it cheaper to finance job-creation programs than to take wage cuts that would allow the unemployed to find jobs. The simple arithmetic is that 90 to 95% of the labor force who are employed will find it cheaper to "bribe" the 5 to 10% who are unemployed to find other jobs than to let them compete for their jobs by bidding down the wage rate.[4]

Perhaps the most remarkable episode that constitutes evidence in favor of this assertion concerns the short history of the Civil Works Administration (CWA) during the early New Deal of the Roosevelt administration. Between November 1933 and July 1934, the CWA spent $$3 million and employed 4 million persons in 180,000 projects, ranging from 40,000 schools built to 3,000 artists and writers applying their skills. President Roosevelt is quoted by Sherwood (1950, pp. 54–5) as stating: "It is my considered opinion that [CWA] has averted one of the most serious crises in our history. Revolution is an ugly word to use, but I think we were dangerously close at least to the threat of it." The program reduced the unemployment rate, according to Darby (1976, Table 3), by about six percentage points in 1934. Then abruptly, Roosevelt canceled the program partly because of strong opposition from Republicans and Southern Democrats in Congress, partly because of accusations of waste, but mostly because of fears that CWA workers would not have an incentive to find self-sustaining work in the private sector (Sherwood, p. 56). After the November 1934 election which was interpreted as a resounding approval of New Deal initiatives such as public-works projects in place of direct unemployment relief, Roosevelt's enthusiasm was rekindled and the WPA and PWA, which had even larger resources than the CWA, were established in 1935. In his new program, Roosevelt announced: "Work must be found for able-bodied but destitute workers…" Despite the fact that the voting public did not fully understand the sources and nature of the

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[2]See Levitan and Taggart (1974) and Wiseman (1976) for a description and evaluation. Vernez and Vaughan (1978) discuss a wide range of public-works and public-service programs to reduce cyclical unemployment.

[3]It is important to realize that the benefits from these "make-work projects" come from the employment itself, not from the productivity of the jobs created. In the army, idle bodies are put to work digging dinosaur latrines.

[4]Recent workfare programs have not received universal approval; these programs increase the supply of labor instead of the demand for workers.

Great Depression and despite a 20% unemployment rate, a large majority of voters — including those who still had jobs—favored job-creation programs such as the CWA and its successors.

From this viewpoint, the focus of analysis must be the labor market itself. First, a comparison will be made between the costs of accepting a wage reduction and providing resources to hire the unemployed when the labor market exhibits excess supply. Second, because the analytical results are subject to ambiguities, an attempt is made to provide empirical estimates of these two costs for the US labor market during the period 1954–95.

The crucial feature of the operation of the labor market, developed in Ch. 3, is that individual welfare depends on two factors: (1) the actual wage relative to the reservation wage and (2) the prospects for employment at a particular wage. As a result, most persons in the labor force who continue to have a job are better off when the unemployment rate rises, because the real wage is higher when there is excess supply, as represented by the situation at point *A* in Fig. 3–13 on p. 97; these secure workers receive rents equal to the difference between the actual wage and the reservation wage. However, those who lose their jobs in the process are worse off because the extra leisure does not compensate for the loss of wage income. As a consequence, there are winners and losers as the labor market moves between excess demand and excess supply during a business cycle. The aim is to identify the winners and losers and to ascertain the extent of support for countercyclical job-creation policies.

8.1.1
The Cost-effectiveness of Job Creation

To understand why job-creation programs have popular appeal, we need to show that alternative measures to find jobs for the unemployed have greater costs. This will be done by a particular mental experiment that involves an initial situation of excess supply in the labor market such as position *A* in Fig. 8–1. This excess supply is measured by involuntary unemployment, above the natural rate, equal to the distance BC'. In the course of time, the excess of unemployment over vacancies will drive down the real wage from $(W/P)_0$ to $(W/P)_e$ and employment will rise from *A* to *E* along the labor-use curve. Those who were employed previously will suffer a loss of welfare from the wage reduction, while continuing to work the same number of hours. These secure workers are, of course, not inclined to view this equilibrating move with enthusiasm, but they are unlikely to be able to prevent the competitive forces from operating over time. However, if they can persuade governments to provide subsidies to firms to create new jobs or to hire the unemployed directly, then the wage rate $(W/P)_0$ could be converted into an equilibrium by shifting N^d and N to the right until the former intersects N^s at *C*. Would this be a worthwhile proposition even if secure workers had to finance this entire job-creation program out of their resources? If the answer is yes, then a jobs program that is partly financed from other tax

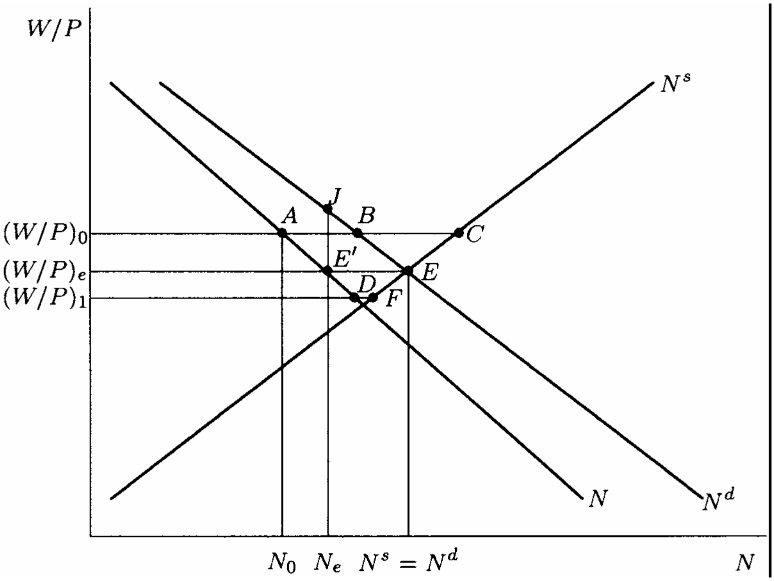

Figure 8–1 Comparing the cost of wage reductions and job-creation programs

revenues or from budget deficits would have even greater appeal to current workers, who would then become partial "free riders."

From Fig. 8–1, it is possible to compare the costs to secure workers at *A* of returning to equilibrium and of providing enough resources for job creation to convert $(W/P)_0$ into an equilibrium wage. The cost of returning to equilibrium employment at N_e is simply the vertical distance $(W/P)_0-(W/P)_e$ times the number of employees, N_0. On the other hand, the cost of the job-creation program is $(W/P)_0$ times the distance *BC*. It is assumed that these jobs pay the going wage, $(W/P)_0$; otherwise, there would be continuing competition for existing jobs. However, it may be possible to pay only $(W/P)_0$ minus the distance JE' in Fig. 8–1 because fixed costs of employment prevent unemployed persons from replacing existing workers, as shown in Section 7.2. Also, the subsidy per new job may be less to the extent that the output is saleable. Thus, we want to compare which represents the wage reduction and which measures the subsidy:

$$\phi = \left[\left(\frac{W}{P}\right)_0 - \left(\frac{W}{P}\right)_e\right] N_0, \tag{8.1}$$

and

$$\psi = \left(\frac{W}{P}\right)_0 (N^s - N^d). \tag{8.2}$$

The difference between and is difficult to evaluate without more information, especially the slope of N^s and N^d. From Fig. 3–6(c) on p. 74, the labor-supply curve can be written as

$$N^s = \lambda_0 + \lambda_1 \frac{W}{P}, \tag{8.3}$$

and the labor-demand curve was given by equation (3.14):

$$N^d = \beta_0 - \beta_1 \left(\frac{W}{P} + \frac{J}{N} \right). \tag{8.4}$$

As noted above, a positive value of J/N reduces the wage rate that has to be paid to those involved in the job-creation program. To make the cost of this program as large as possible, it will be assumed that J/N=0. The quantity $(W/P)_0$—$(W/P)_e$ in equation (8.1) can now be rewritten as $(N^s-N^d)/(+ {}_1)$. Hence, equation (8.1) becomes

$$\phi = \frac{N^s - N^d}{\lambda_1 + \beta_1} N_0. \tag{8.1'}$$

Comparing equations (8.1) and (8.2), > if $N_0>(W/P)_0({}_1+ {}_1)$; in other words, the smaller the supply and demand elasticities or the larger the number of current workers, the lower is the cost of job creation compared to wage reductions.

The job-creation program is limited to those who are involuntarily unemployed due to excess supply in the labor market. Secure workers would not be interested in providing resources to find jobs for the structurally unemployed. That is, the appropriate number for job assistance is *BC* and not *AC* in Fig. 8–1. If the labor market were in equilibrium at *E,* there would be a number of unemployed persons, *E E,* putting downward pressure on wages, but an equal number of vacancies putting upward pressure on wages. Therefore, the structurally unemployed do not provide a threat to secure workers. Nevertheless, a job-creation program may not be able to make the distinction between excess-supply and structural unemployment. Thus, the cost of financing a plan to provide jobs for all unemployed persons would be

$$\psi' = \left(\frac{W}{P} \right)_0 [N^s - N] = \psi + \left(\frac{W}{P} \right)_0 V, \tag{8.5}$$

which will, of course, be larger than in equation (8.2) since *N* is always to the left of N^d and there will always be a positive number of vacancies, *V.*

In principle, an equal amount of resources could be used to finance unemployment insurance. In other words, secure workers are not concerned with the method of compensating unemployed persons, only with their withdrawal from seeking jobs. However, the mere existence of such a scheme will lead to altered behavior. If the unemployment insurance compensation is at $(W/P)_0$ per hour for *H* hours, then welfare of the unemployed is now higher than for the employed because they have extra leisure and their "nonwage income" is equal to wage income of those who work. There is now an incentive for those currently employed to stop working. In addition, those who are voluntarily unemployed will pretend that they are in the labor force in order to receive unemployment insurance benefits which would finance extra goods consumption. It is for these reasons that unemployment insurance programs have replacement ratios that are less than one and minimum work histories for eligibility. Even if employment is better than receiving unemployment insurance, those who continue to work would not be willing to fund an insurance scheme that avoided moral-hazard problems because it does not remove those who are unemployed from competition for jobs and does not eliminate downward pressure on the real wage.

Moreover, unlike the unemployment insurance scheme, job-creation programs will not induce the voluntarily unemployed to participate since they have to work H hours in order to receive these benefits and their enjoyment of leisure is too great to make this a welfare improvement. Therefore, there is a reasonable limit to the number of people who qualify for eligibility.

To determine whether such job-creation programs have symmetrical incentives, we must look at the operation of the labor market during excess demand, when the wage rate $(W/P)_1$ in Fig. 8–1 prevails. Now, there is unemployment equal to *DF,* which is less than the natural rate. Those who are currently employed have strong motives to see the wage rate rise back to equilibrium as quickly as possible. In that case, they would not want to reverse previously established programs that financed jobs for the unemployed. Any action that eliminates workers on the public payroll would also reduce the extent of the excess demand or even create excess supply in the labor market, either of which eases the upward pressure on wages. This creates a lack of symmetry in the incentives for job-creation programs: current workers want more in recessions but not less in boom periods.

The decision to initiate or expand job-creation programs becomes a public-choice situation in which the currently employed labor force will have an important role, merely because of their numbers relative to the total population. Although voters consist of workers, nonworkers, and nonparticipants in the labor force, many of the last group will not have a direct interest in this choice and will vote on other issues. However, workers with secure jobs have a large stake in this decision and their welfare calculations are likely to be crucial to the outcome. In the face of ambiguities about the relative size of and , we need to rely on empirical data to indicate the likely choice.

8.1.2
Costs of Job Creation in the US Labor Market

In this section, we will attempt to measure the alternative costs faced by current workers which were identified in the previous section. To the extent that assumptions are necessary, they will be chosen to maximize the cost of job creation, so that the decision will be biased against this choice. For example, it will be assumed that current workers must pay the whole amount needed for job-creation programs and that the wage to be paid to these new workers is the same as that received by current workers. However, to provide a range of estimates, both and will be calculated.

To estimate we need, first of all, the slope of the labor-use curve between *A* and *E′* and the slope of the labor-supply curve between *C* and *E* to determine the distance $(W/P)_0-(W/P)_e$. The demand elasticity of 0.428 was reported on p. 20 and the supply elasticity of 0.1 derived on p. 181 will be increased to 0.25 as the basis of conservative slope calculations.

The recession year 1982 is chosen as an example for the calculation of . Actual employment (LHEM) was 99,526 thousand, while the labor supply (LHC) was 110,204 thousand. Adjusting the former by Gordon's (1993) estimate of the natural rate of unemployment equal to 6%, leaves excess-supply unemployment equal to (110,204–99,526–0.06×110,204)=4,065.76 thousand. To convert the demand elasticity to the value of the slope of the line involves multiplying 0.428 by the ratio of *N* to $(W/P)_0$, which in 1982 was $267.51 per week, measured in 1982 dollars. Thus $_1$=159.24. A similar conversion for the supply curve yields =0.25×110,204/267.51=102.99. Then =99,526×52×4,065. 76/267.51 which produces an annual "loss" of wages of $78.66 billion. For the period 1954–95, these calculations are shown in Chart 8–1, with the assumption

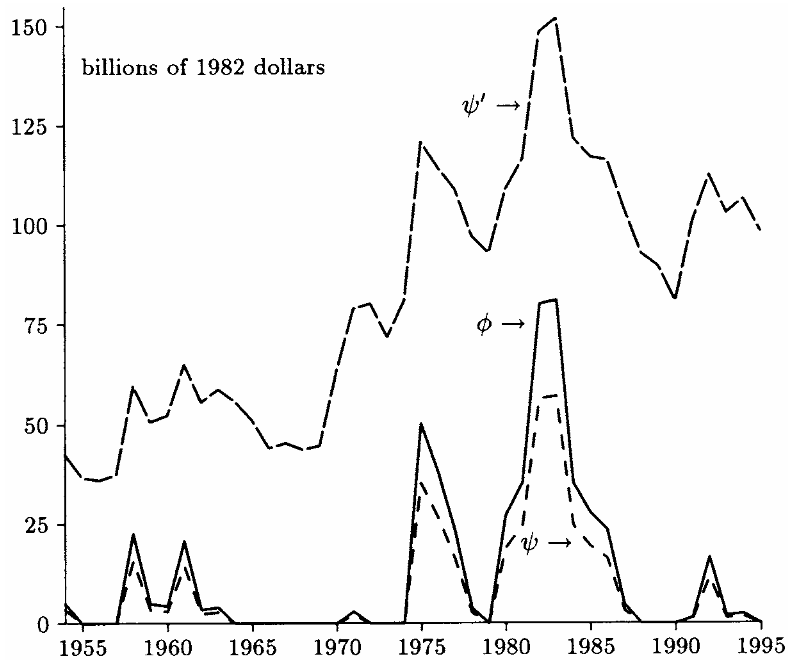

Chart 8–1 Comparing the costs of wage reductions and job creation, 1954–95. is the cost of wage reductions, is the cost of a limited job-creation program, and is the cost of an unlimited program. See text for specific definitions

that =0 for excess demand in the labor market; that is, when the natural rate is below the actual rate of unemployment.

The calculation of is more straightforward, once it is accepted that those who take part in the job-creation program will be paid the current real wage, $(W/P)_0$. In 1982, as found above, the excess-supply unemployed equal 4,065.76 thousand. They will each be paid $267.51 a week in 1982 dollars, for a total cost of $1.087 billion per week or $56.55 billion annually. Therefore, for 1982, exceeds by about 50%. Because of the difficulty of differentiating the causes of unemployment, we will also make estimates of in equation (8.5). The total number of unemployed in 1982 was 110,204–99,526=10,678 thousand. When multiplied by the weekly wage, the total annual cost of the expanded program becomes $148.7 billion which is about 70% greater than the cost of wage reduction. Both and are also shown in Chart 8–1 for the years 1954–95. Although is not allowed to become negative when there is excess demand in the labor market, is always positive since the unemployment rate never becomes negative.

The ranking of the three outcomes is the same in all the years in which there is excess supply in the labor market: > > . Because of these results, it is not possible to make a categorical statement about the preferences of secure workers for job-creation programs, unless it is known beforehand that structurally unemployed persons would be excluded. Nevertheless, as will become evident in the next section, to the extent that a wage rate less than *(W/P)0* needs to be paid to the participants in the program, both and will fall and both could be less than . Since has a mean value of $82.4 billion for 1954–95, while 0=$12.4 billion, it would take a reduction in *(W/P)0* of about four-fifths to achieve > > . On the other hand, a lower labor-supply elasticity would also raise . For example, if the supply elasticity is zero, =20.3 and the necessary reduction in $(W/P)_0$ falls to about 60%. Finally, it should be kept in mind that the mean value of is large because this program was designed to be "generous" and is not eliminated when there is excess demand in the labor market.

Although the calculations of and have allowed for different values of the supply elasticity and the number of persons eligible for job-creation programs, they may also be sensitive to the choice of the natural rate of unemployment. Instead of Gordon's (1993) data, we can also use the Adams and Coe (1990) estimates for 1965–89, which are somewhat more variable than the Gordon data. [5] For this limited period, the mean value of changed from $17.8 billion for the Gordon natural rate to $13.7 billion for the Adams-Coe rate, while the mean value of changed from $12.2 billion to $9.6 billion. Although both the wage reduction and the cost of job creation are lower to some extent, the ranking remains: > .

8.1.3
Conclusion

This chapter opened with the question whether "secure workers" would find it in their self interest to propose and even finance job-creation programs that would eliminate the competition for existing jobs by currently unemployed workers. Despite a deliberate attempt to "stack the deck" against such programs by choosing assumptions that accentuate their costs, it was found that wage reductions are often larger than payments for such subsidized jobs. It is not argued that secure workers would volunteer to pay this subsidy or that the electorate as a whole does not criticize make-work projects as "boondoggles," but if it were possible to limit the choice between allowing excess supply to bring down the real wage or eliminating the excess supply through tax-financed job-creation programs, the latter would often win.

[5]They had the same mean (i.e., 5.8%), but the standard deviation was ten times higher for the Adams-Coe data (i.e., 1.13 vs. 0.16).

8.2
Public Service Jobs as Stabilization Policy

The job-creation programs discussed above do not pretend to be first-best solutions in any sense of the word. They cannot replicate the results of continuous equilibrium in the labor market and they are not Pareto efficient as unemployed people are made better off at the expense of secure workers who must be taxed to finance these programs. However, they *are* a welfare improvement for all concerned compared to what would happen if competitive forces were allowed to operate: secure workers maintain the *status quo ante* and unemployed people get jobs. Instead of an optimal means to overcome the effects of business cycles on the labor market, the previous section was an exercise in counting votes for and against a specific government action that would require democratic approval. At this point, it is optimal intervention in the labor market that becomes the focus of attention.

In addition to the lack of Pareto efficiency of traditional aggregate-demand policies discussed above, monetary and fiscal policy initiatives do not meet the requirements of optimal intervention to remove a market distortion because they do not operate in the market where the distortion (i.e., involuntary unemployment) exists. Also, compared to unemployment or welfare payments, public-service jobs maintain labor-market attachment, which is now considered an important tool in preventing long-term unemployment. Operationally, if the ultimate goal is "natural-rate employment," there may be other advantages to direct government hiring of the involuntarily unemployed over the more traditional but indirect approach of influencing aggregate demand for goods and allowing the production function for the economy to take care of employment. One of these advantages involves the elimination of employment lags. For example, after the 1990–91 recession, US output reached its previous peak in 1992:1, but employment did not recover until 1993:2. Since 1947, the fifteen peaks and troughs in real output (GDPQ) preceded the highs and lows in the number of employees (LHEM) by an average of 0.93 quarters. These lags in the employment decision create the possibility that aggregate-demand policies could become procyclical instead of stabilizing the unemployment rate.

The government as an employer of last resort is not a novel idea. The previous account of the Civil Works Administration (CWA) reveals the possibilities of this approach. By contrast, the Public Employment Program (PEP) of the early 1970s, despite our greater understanding of the operation of the labor market and the need for stabilization policies, was smaller in scale, less effective in reducing unemployment and a bureaucratic nightmare. The role of public-service jobs in stabilization policy has received previous analytical scrutiny, but there are at least two issues that have not been addressed previously: (1) the optimal implementation of such entitlement programs in which the government is prepared to be the employer of last resort, and (2) the public-choice aspects of the decision to have government involvement in the labor market when it

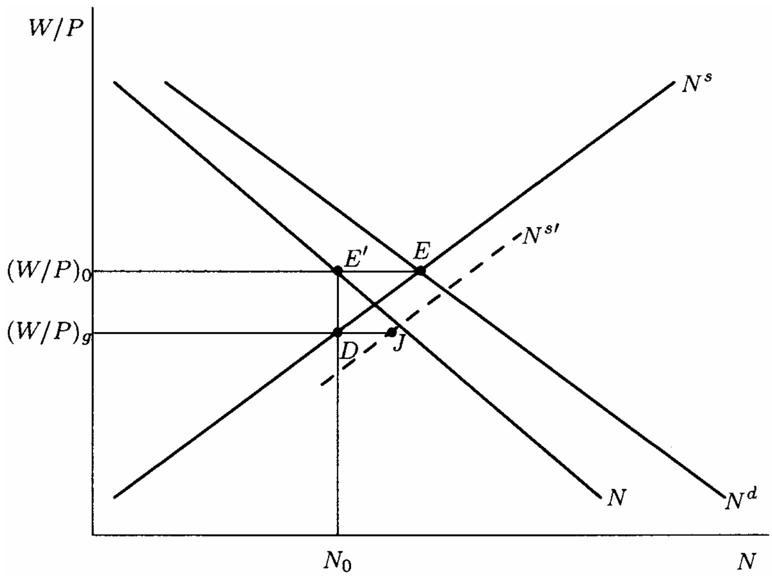

Figure 8–2 Optimal intervention in the labor market

becomes obvious that not everyone gains and some lose from this intervention. This section will concentrate on these two issues in an attempt to rekindle interest in a policy choice that has been plagued by impressions of ineffectiveness, fraud, and corruption.

8.2.1
Optimal Intervention

As long as the labor market remains in equilibrium there is no rationale for government intervention. There are, however, various shocks to the macroeconomy that will force the labor market to operate in disequilibrium until contracts expire or "hand-shake" agreements are renegotiated. Three types of shocks can be incorporated into the operation of the labor market: (1) aggregate-demand shocks, labelled x_g and x_m, (2) productivity shocks identified as x_s, and (3) labor-supply shocks, depicted by x_r. In each case, the aim is to find the level of employment and the rate of unemployment that will prevail in the labor market after the shock.

An aggregate-demand shock involves an unpredictable event in either the goods market or the money market that alters the inflation rate from what was previously anticipated and used for wage determination at the beginning of a period. Examples of a negative shock would be an unanticipated decrease in money creation or an unexpected decline in consumer expenditures. In either case, the inflation rate falls and the real wage moves in the opposite direction as nominal wages are unable to adjust. A positive shock that creates excess demand in the labor market is also possible and the labor-use curve would still dictate the level of employment; in such cases, the unemployment rate would be positive but below the natural rate. The only limit is that the wage rate should not fall below the intersection of N^s and N in Fig. 8–2. A negative productivity shock, x_s<0, is captured by a downward shift of both N and N^d as if some capital were suddenly destroyed. Finally, an unpredictable event in the leisure-work decision could shift the labor-supply curve. For example, a decrease in nonwage income could lower the reservation wage and cause more people to enter the labor force. This would shift the N^s curve to the right because x_r>0. If the opposite event shifted the labor-supply curve inward, there is at least the possibility that fewer than N_0 workers would be available and employment would be supply constrained, with firms no longer maintaining their position on the labor-use curve, but since unemployment would vanish, this is an unlikely event.

If wages could adjust instantaneously in the face of such shocks, the labor market would re-equilibrate and unemployment would remain at the natural rate. But the labor market is characterized by formal and informal contracts and not by spot transactions. Moreover, as was made evident previously, some groups are better off in disequilibrium than in equilibrium and they have every reason to continue to make transactions in this state.

The results of the shocks on the unemployment rate were derived in Ch. 5 and equation (5.15) is repeated here:

$$u = u_e - x_r - b_{10}x_s - (b_{10} + b_{12})\left(\frac{a_1}{a_1 + a_3a_4 + a_1a_2a_4}x_m + \frac{a_3}{a_1 + a_3a_4 + a_1a_2a_4}x_g - \frac{(a_1a_2 + a_3)(1 + a_4)}{a_1 + a_3a_4 + a_1a_2a_4}x_s\right), \tag{8.6}$$

where u_e represents the natural rate of unemployment or the vacancy rate, so that $u>u_e$ can be interpreted as excess-supply unemployment or $u<u_e$ as excess-demand "overemployment."

There are three groups of participants in the labor market whose welfare will be affected by various unpredictable events: (1) workers who continue to be employed after the shock, (2) workers whose employment status changes from employment to unemployment or *vice versa,* and (3) the owners of firms who hire workers. The first group are "secure workers" whose welfare depends only on the wage rate, with higher wages providing greater utility. The second group, which is at the margin of employment, is not only concerned about the wage rate, but also whether employment is available at that wage. If the wage rate falls, new workers are hired and they are better off than previously when they had offered their services, but had no work. If the wage rate rises and some workers are laid off, they are worse off as the extra leisure does not compensate them for the loss of income. The third group, the owners

Table 8–1 Summary of Effects of Shocks on the Labor Market

Shock	*W/P*	*N*	$u - u_e$	*U(W/P)*	*U(N)*	*U*(II)	N_g
x_m<0	+	−	+	+	−*	−	+
x_m>0	−	+	−	−	+	+	0
x_g<0	+	−	+	+	−*	−	+
x_g>0	−	+	−	−	+	+	0
x_s<0	−	?	?	−	?*	+	?
x_s>0	+	?	?	+	?*	−	?
x_r>0	0	0	+	0	−*	0	0
x_r<0	0	0	−	0	+	0	+

of firms, is interested only in profits. If the wage rate falls, profits will rise as output increases more than costs.[6]

In summary, secure workers improve their welfare if the real wage rises; marginal workers look at *U(N)* for their assessment of welfare changes; and firms evaluate *U*(II), but this is related inversely to *U(W/P)* when it is realized that profits and real wages move in opposite directions. These welfare effects are summarized in Table 8–1, indicating the direction of change for each variable after the shocks enumerated above. The "?" for productivity shocks arises from the ambiguity of the effect of x_s>0 on u in equation (8.6). Its direct effect is negative as employment rises, but its indirect effect on the inflation rate and real wages is positive. The columns marked *U(W/P), U(N),* and *U*(II) indicate welfare changes for secure workers, marginal workers, and owners of firms, respectively. The challenge to policy makers is to intervene to prevent a loss of utility to the marginal workers in situations identified by an asterisk (*) for the five cases in the column labelled *U(N).* In the other three cases, *U(N)* has increased and no action is needed.

Since governments are unable to react to the shocks until after their realization, it appears impossible to keep $u=u_e$ by any kind of optimal intervention. For example, in the wake of a negative monetary shock (i.e., x_m<0), the unemployment rate will rise as real wages are increased by the temporary lower inflation. Only later, would the authorities be able to reverse the inflationary trend and restore equilibrium in the labor market. Nevertheless, governments are able to implement an employer-of-last-resort policy to keep the unemployment rate constant in the face of shocks.

The aim of stabilization policy that uses public-service jobs as its instrument is to find Pareto improvements that restore the welfare position of any group that has been adversely affected by a shock, without disturbing those groups that have improved their situation as a result of the shock. We shall see that reliance on public-service jobs will be able to achieve this aim better than traditional

[6]These welfare effects were derived in Section 7.1.

policies that operate in the goods or money markets, because they can pinpoint the distortion and eliminate it.

The rule for government hiring is the following: *For every type of shock, the government should stand ready to offer employment at a wage rate* $(W/P)_g$ *which is found by the intersection of the labor-supply curve and the level of equilibrium employment, shown as D (or J) in Fig. 8–2.*

This rule makes the demand for labor infinitely elastic at the chosen wage, and by maintaining a single wage in the face of all shocks to the system, the number of labor-market participants is fixed, except for x_r 0. These changes in the labor market force employment to be supply determined instead of demand determined and cause u to equal u_e in circumstances where $u>u_e$ would otherwise prevail; they still allow $u<u_e$, where the rule stated above would be ineffective. The results of the policy are shown in the last column in Table 8–1 under N_g, which indicates with a "+" the situations for which public-service jobs are needed. For $x_m, x_g<0$, the government hires workers who have been laid off by private employers when the real wage rose, but for x_m, $x_g>0$ the government has no takers for its offer to employ anyone at $(W/P)_g$. For $x_r>0$, the labor supply has fallen, but private employment remains constant, while for $x_r<0$, government hires the new entrants to the labor force. It is not clear what happens to government hiring when x_s 0 unless we know the direction of change for u, but if either case reduces private employment, the government's job offer will be accepted by those who became unemployed. This policy has a number of features that are worth enumerating:

1. Implementation of such an entitlement program is much easier than tailoring a particular response for every type of unpredictable event, a puzzle that often cannot be deciphered until it is too late to take action.
2. In every case, those groups who benefited from the shock are left in their improved position, while those whose welfare deteriorated are made better off. Such a policy of public-service jobs is therefore a Pareto improvement.
3. Although the government offers to employ anyone at the wage rate $(W/P)_g$, this policy will attract the right number of workers, namely those who were made worse off by the shock due to involuntary unemployment. Therefore, this policy does not have moral-hazard or adverse-selection problems since it does not cause individuals to alter their behavior nor does it attract people for whom the program was not intended.
4. This policy cannot restore the utility of those groups who have suffered a loss but are still employed, such as during a positive aggregate-demand shock that lowers real wages for those who previously worked at the equilibrium wage. In other words, this is not an income-maintenance program nor is it a first-best solution because it cannot replicate equilibrium in all respects.
5. The policy of choosing a wage rate on the labor-supply curve that creates the optimal level of employment would still prevail even if adjustment costs

were assumed away and the N and N^d curves coincided in Fig 8–2. Their inclusion here is dictated by the need to have structural unemployment in equilibrium, which increases the difficulty of excluding ineligible participants. On the other hand, the reservation-wage model of labor supply is a crucial ingredient; without it there would not be the possibility of finding the appropriate wage for public-service jobs that attracts the desired number of individuals.

8.2.2
Some Practical Problems

Although the proposal to offer public-service jobs at a particular wage rate avoids many bureaucratic difficulties of establishing entitlements, there are other practical problems that must be addressed. In order to calculate the public-service wage, $(W/P)_g$, we need quantitative information about the elasticity of supply of workers. This evidence does not appear to be available for the reservation-wage model, but an estimate of its size in Ch. 7 indicated an elasticity in the neighborhood of 0.1. Using 0.12 for illustrative purposes, we can write: $\ln N^s = 0.12 \ \ln(W/P)$. Starting at equilibrium, E in Fig. 8–2, the number of labor-market participants must be reduced to D by the natural rate of unemployment, which Gordon (1993) suggests has been 6% for the period 1981–91. Therefore, the reduction in the wage rate below its equilibrium value is 0.06/0.12=50%. At that wage rate, there would be no applicants for public-sector jobs, as everyone would prefer to work in the private sector which has just enough jobs for them. If however, there occurred a negative aggregate-demand shock that raised the real private wage and resulted in lay-offs, these marginal workers would now accept the public-service jobs. It is also important that the replacement ratio of any available unemployment benefits be smaller than the ratio of the two wages; otherwise being on the dole would be a welfare improvement on public-service jobs.[7]

As long as the supply of workers is not highly elastic, it is obvious that public-service workers will have to accept wages that are substantially below those in the private sector. This would be contrary to current US practice where the federal government is required by legislation to pay wages of “comparable” private workers.[8] Such legislation is often championed by unions as an indication of worker solidarity. However, if high public-sector wages prevent the government from using public-service jobs as countercyclical policy, private-sector workers would be better off allowing a two-wage system to prevail. As shown in the first part of this chapter, secure workers have an incentive to prevent the unemployed from competing for their jobs; therefore, any action that provides new jobs for the unemployed reduces the excess-supply pressure on wages. It also benefits the marginal workers who would have greater continuity of employment, even if it is at the lower public-service wage rate. Therefore, the unified wage system is only of benefit to the permanent government employees whose welfare rises with the wage rate.

8.2.3
Comparisons with Traditional Stabilization Policies

Set against this proposal for direct government hiring at a prespecified wage, we must analyze monetary and fiscal policies that operate in the money or goods markets and then transmit their effects to the labor market. Such policies will change the real wage prevailing in the labor market by altering the inflation rate. Expansionary policy will increase the inflation rate, while contractionary policy will have the opposite effect. If such policy changes are implemented when nominal wages are growing at a predetermined rate, the real wage will fall with expansionary policy and employment will rise. This can help the labor market move back to equilibrium in the face of a prolonged recession, but it is not a Pareto improvement because workers who have retained their jobs —some 90 to 95 percent of the labor force—will be made worse off. The advantage of public-service jobs lies in the two-tier wage system which has differential effects on various participants in the labor market, whereas aggregate-demand policies impose the same wage on everyone. In other words, government as employer of last resort is optimal intervention, but monetary and fiscal policies are not.

Moreover, total government expenditures per job created will be less with direct government hiring than with traditional fiscal policy. Assuming that the final products that the government purchases are the same in the two systems of procurement and that the production functions are the same in the private and public sectors, the only difference is in the cost of labor which favors the government if it can pay a wage rate that may be only about half of the private-sector wage. Therefore, fiscal policy designed to reach full employment would be more effective if government hired its own workers rather than buying products from the private sector. However, it must be taken into account that owners of firms will lobby for traditional fiscal expenditures since greater demand for private goods increases the profits of the firms that sell to the government.

Finally, it may be argued that traditional stabilization policies are better suited to dealing with the short-run trade-off between unemployment and inflation, but that is not really the case. With aggregate-demand policy, the economy moves along a short-run negatively-sloped Phillips curve to a "desired" location, while government hiring moves the economy along the labor-use curve in Fig. 8–2 to the full-employment level. Both have the same implications for inflation and unemployment. However, neither policy can maintain this trade-off in the face of

[7]In 1990, average unemployment benefits were $161.56 a week, while the private nonagricultural wage was $345.35, which makes the replacement ratio about 47%.

[8]See Smith (1977) for details.

"supply" shocks that cause inflation and unemployment to move together (i.e., stagflation). No matter which market had been used to sustain employment levels in the face of the oil-price increases in the 1970s, inflation was bound to increase, either because the Phillips curve shifted upward or because the labor-use curve shifted to the left.

8.2.4
Conclusion

Stabilization policy has always been evaluated by its ability to reach or maintain full employment, without looking at the welfare effects on other groups besides those who are unemployed. It seems to have been taken for granted that everyone else is unaffected by these actions. In that light, macroeconomic policies that operated in the money or goods markets were viewed as being equivalent to those that operated in the labor market. Once it is shown that there are conflicts in the labor market concerning the optimal wage and level of employment, it is evident that such conflicts cannot be resolved by influencing aggregate demand for goods and services. Instead, what is needed to achieve a Pareto improvement is a well-chosen wage rate at which the government is prepared to hire any applicants. This wage rate is the supply-constrained reservation wage for the person at the margin of employment when the desired number of individuals have jobs and this wage is the same for all types of shocks that buffet the economy from time to time. Despite this sanguine conclusion about the ability to design Pareto-improving policies, we know that in their implementation much of the improved efficiency of the labor market will be lost and replaced by attempts to redistribute economic rents. In the last two sections of this chapter it is time for such cynicism to re-assert itself.

8.3
Exploiting Optimal Policies

Taxes and subsidies are supposed to be implemented in order to change behavior toward a social optimum in the face of some market failure, but they evolve into a conflict over property rights and rents. For example, a tax on tobacco products may be designed to reduce smoking because of its hazardous externalities (e.g., second-hand smoke, extra medical expenses, etc.), but for those who did not smoke in the first place nor are subjected to its externalities, it merely reduces taxes on other activities and therefore increases their rents.[9] If, in addition, the tax does not affect smoking behavior, especially if tobacco companies retaliate by price reductions or more intensive advertising, it also reduces rents for smokers and/or tobacco companies. Therefore, the political decision to initiate a tax on cigarettes is at least as much a matter of transferring resources from smokers and tobacco companies to nonsmokers as it is concerned with the health benefits of a smoke-free environment. The perpetual conflict over expropriated and appropriated rents remains even if the market failure disappears. If for some reason it can now be claimed that smoking is no longer a health problem, the tax should be removed, but nonsmokers would have strong incentives to oppose this move because other taxes would have to be increased to compensate for the revenue loss. Since it can never be "proven" that smoking created health risks in the first place, there is an interminable and inconclusive debate about the veracity of conflicting claims and politicians ultimately have to make the decision on the basis of the political strength of the two groups, which in turn is based on the rents that are at stake.

Even if the tax on smoking affects the behavior of smokers and if nonsmokers are afflicted in large numbers by second-hand smoke, there is still a conflict over property rights and the resulting rents that they create. Consider two types of people: *A* who obtains satisfaction from smoking and *B* who prefers clean air or who suffers negative externalities from *A*'s smoking. Their utility functions would have the following format: $UA(C, S)$ and $UB(C, -S)$ where *C* is their consumption of all other goods and *S* is the amount of smoke that they both consume. Given the characteristics of *B,* the less smoke the greater is the level of utility. Their budget constraint is identical but depends on the starting point; they have endowments of *I* if clean air is the *status quo ante;* alternatively, if smoking is a "right", they both have $I+S_0$ which includes some arbitrary positive amount of smoke. Their endowments finance purchases of *C* which has a price of one and *S* with a price of *p.* These individuals could trade with each other until they reach an equilibrium where their marginal rates of substitution are equalized (i.e., $U_2/U_1=p$).[10] If *A* had the right to smoke, then *B* would have to "bribe" him in order to reduce the air pollution to "optimal" levels. If, on the other hand, *B* had the right to clean air, she would have to be bribed to allow *A* to smoke. In the process, there would be a transfer of p^*S^*, where S^* is the optimally chosen amount of smoke and p^* is the optimal price of smoking. If clean air is the property right, *B* has $I+p^*S^*$ to spend on *C* and *A* has $I-p^*S^*$ for the same purpose. However, if the property rights are allocated to the smoker, the transfer is reversed and *A* now has more to spend on *C* than does *B.* If preferences are quasilinear, the same amount of smoke will be generated,[11] no matter who has the property rights and this is hailed as a major achievement by welfare economists because the Pareto efficient allocation does not depend on an assumption about property rights. Nevertheless, *A* and *B* are not indifferent to the allocation of these rights; the owners are better off because they receive the economic rents. In fact, it is quite possible for nonsmokers to have an improvement in welfare from an increase in smoke pollution through a sub-optimal exchange, when they are also "given" the property rights to clean air. In

[9]A November, 1991 Gallup poll found that 53% of the respondents were not concerned about second-hand smoke. See *Gallup Poll Monthly,* December 1991, p. 10.

other words, there must be some values of $S>S^*$ and $p<p^*$ that makes for the nonsmoker.

The tax on cigarettes implies that there are pre-existing property rights to clean air. The government is essentially the transfer agent in the process described above. It collects revenues from smokers who are persuaded to reduce their smoking to levels acceptable to nonsmokers and then it passes on these revenues to the latter group. If smokers had the property rights, they would have to be subsidized to reduce their smoking with revenues collected from nonsmokers. Such a subsidy scheme, however, is not enforceable because of moral hazard in the answer to the question: "How many cigarettes have you given up?" Perhaps for this reason alone, nonsmokers have been allocated the property rights once it was recognized that smoking created externalities.

Governments are not really needed in cases where property rights are clearly defined and contracts are enforceable as the two groups have strong incentives to bargain with each other for Pareto improvements. As long as there is a market for smoke, the participants have every opportunity to reach a Pareto efficient outcome and a competitive equilibrium. The role of government arises when property rights are ill-defined. If A believes he has the right to smoke without hindrance and if B believes that she has the inalienable right to clean air, an external authority is required to arbitrate between them and the political allocation of these rights may be more important to the two parties than the optimal tax on smoking.

Property rights are not handed down by some *deus ex machina;* instead, they are claimed and fought over endlessly in the political arena. This conflict will itself use up resources and it is quite possible that both sides will dissipate all the rents generated from property rights to justify their claim. For example, both smokers and nonsmokers may have only $I-pS$ available for goods consumption and still no clear allocation of the property rights. In that context, is an optimal tax really a Pareto improvement when it inevitably leads to the squandering of resources on rent-seeking activities?

It is even more difficult to assign property rights in the labor market than in the case of tobacco smoke, but this does not prevent anyone from making a claim to these rights. If property rights to jobs were clearly and perpetually allocated, there would be no involuntary unemployment and no need for stabilization policies. If all members of the labor force had the right to a job, but without a guaranteed number of hours nor with a contractually fixed wage, they would have strong incentives to share the available hours of work, as was shown in Ch. 7. Instead, only "secure" workers have property rights in the labor market, but they are enhanced rights that include not only a job, but also pre-specified hours and wages. These additional rights are available to secure workers because

[10]See Varian (1996, pp. 558–63) for a useful discussion and diagrams of this situation.

[11]The contract curve is a horizontal line when S is on the vertical axis.

there are no markets for hours allocation and for the frequency of wage adjustments. There is no intrinsic reason why these markets are unavailable, but since they would work to the detriment of the large majority of labor-force participants, they are prevented from appearing by the unassailable demand that institutional or constitutional change requires a democratic process, not a competitive one. Secure workers are prepared to sacrifice some of the rents that they earn from their privileged position to finance job-creation programs for marginal workers as shown earlier in this chapter. They do this in order to prevent competitive forces from reducing the real wage available when excess supply prevails in the labor market.

The job-creation program presented in Section 8.1 does not convert all labor-force participants into secure workers. Those who are "structurally" unemployed are not a threat to secure workers and bribing them is not an attractive option. If government administrators of such programs are unable to make the distinction between the two kinds of unemployment or are too generous and give everyone the same property rights in the job market, the financing costs are too large to obtain public approval, as was shown in Chart 8–1. The employer-of-last-resort program in Section 8.2, on the other hand, allows for universal eligibility, but at a "punitive" wage, which may be only about 50% of the market wage. If equity considerations dictate that the government pay the same wage as the private sector, the program will again become too expensive, especially since it attracts too many people. Therefore, the two labor-market interventions described in this chapter, while they are Pareto improvements compared to disequilibrium unemployment, require a discipline in their administration to maintain their effectiveness and their popular appeal: either eligibility or the wage rate must be controlled.

However, administrators of government programs have incentives to be generous because their own rents are at stake. If, for example, during a recession a public-service job program were instituted in accordance with the optimal intervention discussed above, it would automatically be terminated when the recession ends as the private sector once again provides enough jobs at the market wage; in other words, no labor-force participant would accept $(W/P)_g$ in Fig. 8–2 in the absence of a shock to the labor market that would otherwise create excess supply. Hence, the funds allocated for the program are no longer needed and taxes should be cut. But the administrator of the job program has property rights to his job and thus has the ability to keep it going. To ensure demand for the services of this program when the labor market returns to equilibrium, he can raise the wage from $(W/P)_g$ to $(W/P)_0$ and there will now be additional eligible labor-force participants: those who are "naturally" unemployed between E and E . It will be impossible to dismantle the program in these circumstances even though it is no longer optimal. Since the determination of $(W/P)_g$ is difficult to make in the first place, given the absence of information about reservation wages, it is not possible to prove that the job program is too generous or that the administrator has a personal stake in the wage decision.

There is no independent way of judging the merits of a case; it will always be a confrontational search for truth that uses up resources without a guarantee that the outcome is anywhere close to optimal.

In fact, there is a presumption that policies that are no longer optimal will be allowed to continue; that is, there is a property right to the *status quo.* The benefits of terminating a government program are measured by the tax revenues that no longer have to be collected and these represent a small gain for a large number of people. However, the costs of closing the program are concentrated among those who administer the program or receive its benefits. In a democracy, where each voter has the same voice no matter what the size of the welfare costs or benefits, the Pareto-improving tax cut and elimination of the program should receive the required majority of votes. Nevertheless, there is an indirect weighting of votes by the size of the gains or losses at stake through the voluntary disfranchisement of those for whom the costs of an informed vote are too large compared to the benefits. In these political decisions, there are more winners than losers, the total gains are larger than the total losses, but these very facts lead to the gains being dispersed while the losses are concentrated. In other words, democratic government, despite its appeal to mass participation in our daily lives, is badly designed to make decisions about economic efficiency and resource allocation.

The current attempt at military-base closings is a painful and powerful lesson in the difficulty of obtaining Pareto improvements in the political market place. Congressmen and Senators who have made strong and passionate statements about the evils of budget deficits also have no difficulty in justifying the continuation of bases in their district or state. At a time of reduced world tensions, it may be optimal to reduce defense expenditures and to eliminate surplus military installations. But military and naval bases are not uniformly distributed across the country and not everyone derives a livelihood from these bases. While an air base in a remote part of the country may be able to “protect” the entire nation from a surprise attack, its economic impact is limited to a small area and when defense is no longer important, economics takes its place. Political representatives for the affected area will see that the benefits of closing the base are much smaller than the costs and they are prepared to expend as much political capital as necessary to make that view prevail. To prevent these special-interest arguments from making it impossible to close any base, a politically-independent, eight-member Defense Base Closure and Realignment Commission is instructed to make the choices, which Congress and the President can reject, but only the entire list.

The implication of relying on this procedure is that political decisions cannot be trusted to improve economic efficiency because the debate is always about rents and not optimal policies.[12] In that light, one has to take a very long-term view of economic policy advice. It is best not to institute a new program, despite its optimality at the time since, sooner or later, it will no longer meet those requirements but will not be dismantled because a few “stakeholders” are more powerful than the majority of citizens. Cumulatively, the government introduces more inefficiencies in the economy than it was mandated to overcome. The most pronounced and important evolution in our understanding of optimal policy intervention has not been in designing Pareto improvements, but in our ability to convert socially-optimal policies into special-interest benefits.

8.4
An Epitaph for Macroeconomic Policy

Despite the best efforts of economists to devise optimal taxes, optimal tariffs, or optimal intervention, economic decisions by governments do not involve Pareto-improving policies, but instead are only elaborate redistributions from one group to another. Politicians in their campaign rhetoric make promises that they will "make things better" than before or than their opponents. However, they can, at best, do so only for a limited clientele and for a limited time and only by imposing costs on other groups. In a world of rational expectations, efficient information processing, and repeated disappointments, the continuing and widening gap between promise and performance—for example on the federal budget deficit—remains puzzling and troublesome. Even more unfathomable is the observation that voters rely on campaign promises to determine their choice; in the process they encourage even more political hyperbole meant to sway the electorate. One would predict, on the basis of Darwinian law and the passage of time, that the governmental institutions designed to implement stabilization policies would wither away as the public became more and more skeptical of the ability to achieve their stated aims. However, it is obvious that private institutions will not replace governments in the provision of what is essentially a public good called "full employment" and there are no market pressures to generate optimal money balances or to eliminate unnecessary budget deficits. The voting public is therefore trapped by its own greed and gullibility; it refuses to give up any of its entitlements to government services and benefits but insists on a lower tax burden. All that a voter can do is hope that the next political rent lottery will make him a winner, even if most everyone else is a loser.

[12]Senator Feinstein of California urged the President to reject the 1995 base-closure list outright, despite predictions of $6 billion in annual savings. "There are simply too many jobs at stake in California," she is quoted as saying (*New York Times,* July 4, 1995, p. 9).

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