chapter 33

Earnings II: Sectoral Shocks and Aggregate Disturbances

This chapter represents a significant departure from Chapter 19, which also focused on earnings. Instead of examining how earnings are *distributed* across a given population of workers, we shall now examine how individual and aggregate earnings *evolve* over time. The central thesis that we shall explore is that firms and workers are regularly buffeted by an assortment of random *shocks or disturbances*—both good and bad—that potentially have significant ramifications for their earnings.

Some shocks directly affect workers themselves. For instance, a worker who unexpectedly falls into ill health is one obvious case in point. A less obvious source of shocks is that the outcomes associated with investments in human capital (such as in education, job search, and migration) all have an inherent random—and therefore risky—element.

Other shocks directly affect employers. They can usefully be classified according to their scope. An *idiosyncratic* shock is unique to a particular employer. For instance, an incompetent manager might bungle an important strategic decision, imperiling the firm's survival (lowering the value of labor), or a major new customer might suddenly place a large order for the firm's product (increasing the value of labor). A *sectoral* shock affects the large part of an entire industry or occupational category. For example, an increase in steel tariffs might benefit U.S. steel producers by insulating them from the rigors of foreign competition. Alternatively, the process of *creative destruction*—in which the emergence of new products precipitates the obsolescence of extant ones—stokes the fires of demand for those who possess the skills required by the new ascendent industries of the day, but quells the demand for those who are employed in the industries they eclipse.[1] Finally, *aggregate* shocks simultaneously affect many industries and occupations. For example, a credit crunch—such as that witnessed during the near catastrophic 2008 financial meltdown—could force many firms into bankruptcy and lead to a recession or worse.

LEARNING OBJECTIVES

By reading this chapter, you should be able to:

- Appreciate the myriad shocks that buffet labor-market participants—both workers and employers—over time, and be able to distinguish between idiosyncratic, sectoral, and aggregate shocks.
- Understand why it can be profitable for firms and workers to agree to fixed (real) wage contracts, in which the wage is independent of the state of demand.
- Explain the theoretical conditions that lead to procyclical wages and those that lead to countercyclical wages.
- Recognize some of the econometric obstacles that hinder the attempt to determine the cyclical behavior of the real wage.

33.1 Implicit Risk-Sharing Contracts

The introductory remarks just made point to the myriad shocks that can affect the value of a worker's labor. In this section, we examine the effects of idiosyncratic shocks that affect his employer. By using the methods developed in Appendix D, we show how firms can profit by offering each of their employees a guaranteed fixed wage or salary that is independent of the realizations of these shocks. Intuitively, such a payment arrangement provides workers with *insurance* against undesirable fluctuations in the value of their labor. The theoretical apparatus (which falls under the general rubric of risk-sharing contracts) is one of the most significant developments in modern labor economics.[2]

The Competitive Spot Market Outcome

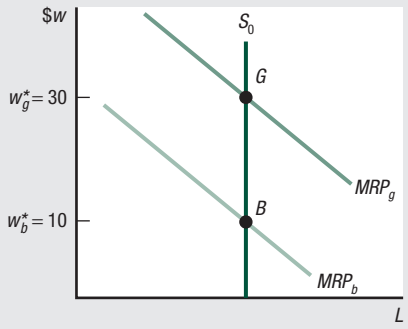
Figure 33.1 depicts the effects of idiosyncratic shocks in a competitive spot labor market, using the case of the steel industry to explain the key points. (A spot market is a competitive labor market in which the demand and supply of labor are equal in each period and the wage equals the *MRP*.[3]) For simplicity, the supply of workers to the industry is assumed to be completely inelastic, which leads to the vertical supply curve, S_0.

Let's assume that, during the course of any given year, each steel producer is subject to an assortment of random shocks (s): some are good, g (a sudden increase in the demand for steel, a reduction in energy or intermediate inputs costs, an increase in domestic tariffs, and so on) and others are bad, b (the converse of the good shocks just listed). At the beginning of each year, let's assume that nobody knows for sure whether the state, s, will ultimately be good, g, or whether it will be bad, b. Nevertheless, experience has taught everyone who participates in the industry that, by year's end, there is a 50% chance that it will be good and a complementary 50% chance that it will be bad.

Because of these shocks, the marginal revenue product of labor (MRP) behaves capriciously over time: during some years it is high (MRP_g), and during others it is low (MRP_b). As shown in Figure 33.1, the equilibrium outcome depends on the realized state s. In the good state, the equilibrium is located at point G, and the hourly wage is $\$w_g = MRP_g = \$30$. In the bad state, it located at point B, and the hourly wage is only $\$w_b = MRP_b = \$10$.

It follows that, according to the simple competitive model, wages jump from \$10 an hour in the bad state to \$30 per hour in the good one. Nevertheless, there is apparently something very rotten in the state of Denmark: the vast majority of workers in the United States are paid on the basis of either an hourly wage or an annual

FIGURE 33.1 Good and Bad Shocks



salary that is determined by a prior contractual agreement. In complete contrast to the predictions of the simple competitive framework, these payments are **not** made contingent on the state of the demand for the firm's product. As a consequence, workers' earnings are more or less completely insulated against subsequent fluctuations in the value of their labor—at least for the duration of the contract.

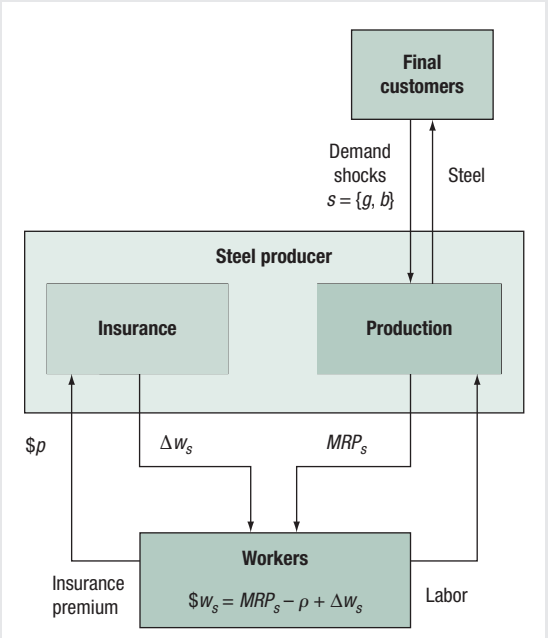
Salaries as a Form of Insurance

At first glance, it would appear to run counter to the firm's profit-maximizing goals for it to agree to pay its employees a wage or a salary that is independent of fluctuations in the demand for its product. Common sense suggests that, for example, a steel producer could surely raise its profits by paying its workers low wages when times are bad. Likewise, universities could reduce their costs by cutting professors' salaries if fewer than expected students sign up for the classes they offer. Yet, as we will shortly argue, this common sense is in point of fact mere folly, and the fixed wages that we observe in practice result from profit-maximizing behavior!

The State Invariant Wage. The argument used to show why state-invariant wage contracts may be profitable is based on an application of the methods developed earlier in Appendix D. More specifically, a risk-neutral firm can profit by insuring its risk-averse employees against fluctuations in the value of their labor.[4] The way it provides the insurance is to pay its employees a constant wage that is independent of the state of demand for its product, and the way it profits is by charging them an insurance premium.

Figure 33.2 depicts the basic principles of how steel producers insure their employees against adverse shocks. As shown, the key theoretical insight is that the firm is envisioned as consisting of two separate departments: *production* and *insurance*. Workers supply their labor to the production department, which it uses to produce the firm's primary product: steel. In return, the production department pays a wage that reflects the workers' actual marginal revenue product of labor, MRP_s, which depends on the realized state s. As shown in Figure 33.2, some years are good ($s = g$), and both the *MRP* and the wage are high; however, other years are bad ($s = b$), and both the *MRP* and the wage are low.

FIGURE 33.2 Implicit Contracts



Workers, however, are risk averse: they dislike these random year-to-year fluctuations in their earnings, and this is where the insurance department comes into play. They can mitigate the unpleasant effects of this riskiness by purchasing an insurance policy from this department by paying the insurance premium $\$\rho$. The way that the policy works is that it pays out an insurance indemnity (i.e., a top-up wage) Δw_s in state s. Obviously, in the good state, the indemnity is zero, $\Delta w_g = 0$, because there is no need to top up the already high wage. In the bad state, however, workers receive positive indemnity payments, $\Delta w_b > 0$, to make up for the earnings loss they suffer because of the shock.

Finally, the firm simplifies the accounting process by cutting a single check, which consolidates the net value of all three payments: the payments by the production (MRP_s) and the insurance departments (Δw_b) *to* workers and the payment by workers to the insurance department ($\$\rho$). As shown in the lowermost box of the figure, each worker's net wage (the one that we all get to see) is then,

$$w_s = MRP_s + \rho + \Delta w_s = \text{a constant} \tag{33.1}$$

Workers are happy with this arrangement, because they are fully insured; the firm is happy too, because it pockets the insurance premium ($\$\rho$).

Implicit vs. Explicit Contracts. Under the fixed-wage insurance scheme just described, workers are paid less than their *MRP* during good times (they must pay the insurance premium). During bad times, however, their wage exceeds their meager *MRP* because of the indemnity payment. Of course, a potential fly in the ointment with this scheme is that employers might be tempted to renege on the deal by refusing to pay the indemnity (i.e., the top-up wage) in the bad state.

In practice, however, this might be less of a danger than it appears at first glance. For example, the firm and the worker might agree to a formal legally binding explicit contract that specifies the wage level up front (for instance, union contracts are often explicit and extend over 3 years or more).

Alternatively, they might enter into an implicit contractual agreement, in which the firm tacitly agrees to provide its employees with insurance coverage.[5] This kind of arrangement is based on an informal understanding of what constitutes reasonable behavior, and it is enforced via reputational concerns. In this setting, although the firm could (legally) reduce the wage in the bad state it might be disinclined to do so, for this would constitute a breach of the understanding between it and its employees. In response to this type of breach, workers might punish the firm by reducing their work collective effort; moreover, if the firm acquires a reputation for dishonesty, then it might find it very difficult to subsequently recruit new employees. For either or both of these reasons employers might adhere to an implicit insurance agreement, even when, legally speaking, they are not compelled to do so.[6]

33.2 Optimal Risk-Sharing Contracts

In this section, we add some substance to the intuition just presented concerning the ability of wage contracts to provide workers with valuable insurance against adverse fluctuations in the value of their *MRPs*.

The Economic Environment

In the interests of simplicity, let's focus on the contract agreed ex ante between a single firm (called the *incumbent*) and a single worker (Dougal). In the interests of simplicity, let's assume that there are two states: good (g), and bad (b) and that there is a 50–50 chance of either state materializing. For added concreteness, suppose that, as in the previous section, MRP_g = \$30K, and MRP_b = \$10K (in which case, the loss resulting from the occurrence of the bad state is $\$L$ = \$20K).[7]

The Contract. Ex ante, before the impending state of the firm's demand is learned, the worker and the firm agree to the contract $v = (w_b, w_g)$, where $\$w_b$ and $\$w_g$ are the wages the firm is obliged to pay in the bad and the good states, respectively. The ex ante nature of the agreement is the simplest way of capturing the intuitive notion that there is inherent uncertainty concerning a given firm's subsequent fortunes. Some will grow and prosper, while others will wither away. Yet, we must each choose our employer before we learn its ultimate fate.

The Initial Contract. To begin with, suppose that from the beginning of time immemorial, all of the firms in the industry have offered the *spot market* contract $v_0 = (w_g, w_b) = (30K, 10K) = (MRP_g, MRP_b)$—see Figure 33.1. (Recapping, a spot market is simply a competitive labor market in which workers' earnings equal their respective *MRPs* in each period.) This implies that Dougal's **reservation utility**, $\bar{U}_0$, is,

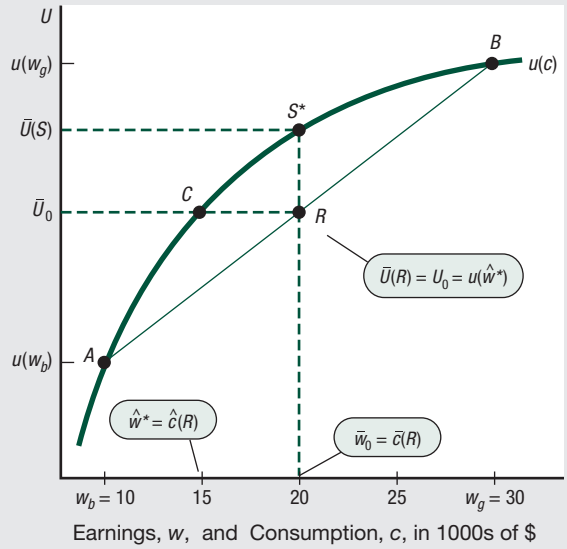
$$\bar{U}_0 = (½) \cdot u(30\text{K}) + (½) \cdot u(10\text{K}) \tag{33.2}$$

since this is the (expected) utility that is offered by every other employer in the industry. Three consequences immediately follow if the incumbent firm also offers the particular contract v_0 to Dougal:

- The contract provides Dougal with just enough expected utility to induce him to accept it, $\bar{U}_0 \equiv 0.5 \cdot u(MRP_g) + 0.5 \cdot u(MRP_b)$.
- Because $MRP_s = w_s$, the incumbent firm's expected profits are zero.
- Dougal's expected earnings are $\bar{w}_0 = (½) \cdot \$30\text{K} + (½) \cdot \$10\text{K} = \$20\text{K}$.

From Dougal's vantage point, the contract v_0 translates into a risky prospect of the form $R \equiv (w_g, w_g - L, \pi) = (30\text{K}, 10\text{K}, 0.5)$ shown in Figure 33.3. The figure also depicts his concave utility function, $u(c)$, reflecting his aversion to risk.

FIGURE 33.3 Risk-Sharing Contracts



In the bad state, he earns only \$10K, and his utility is $u(10\text{K})$. In the good state, he earns \$30K, and his utility is $u(30\text{K})$. These two outcomes are depicted at points A and B, respectively. Moreover, since $\pi = 0.5$, his *expected* consumption and utility levels—denoted $\bar{c}(R)$ and $\bar{U}(\text{R})$—are located at the midpoint of the chord AB, at point R. Notice that $\$\bar{w}_0 = \$\bar{c}(R) = \$20\text{K}$, because the average wage payment by the firm equals the average consumption enjoyed by Dougal.

The Optimal Contract

Suppose that the incumbent firm's management has a board meeting that is aimed at increasing its profits. (Under the contract v_0, its profits are zero.) Moreover, assume that everyone agrees that there is little they can do about the demand for the firm's product, as this is determined in international markets. Instead, they focus on attempting to reduce the firm's costs. They agree that their goal is to offer Dougal an alternative labor contract that remains acceptable to him *and* increases the firm's profits.

Full Insurance. Norburt is the first to make a suggestion. Using a PowerPoint presentation, he displays Figure 33.3. Norburt stresses that because Dougal is risk averse, he would strictly prefer the contract $v_1 = (w_g, w_b) = (20\text{K}, 20\text{K})$ because it pays the average wage $\$\bar{w}_0$ for sure in each of the two states.

Norburt explains this contract leads to the safe prospect $S^* = (20\text{K}, 20\text{K}, 0.5)$, located at point S^* in the figure. Everyone attending the meeting agrees that Dougal would strictly prefer the new contract, $\bar{U}(S^*) > U(R)$, because it provides insurance against costly income fluctuations. As for the firm, Norburt observes that its expected profits are unchanged under the new contract:

$$\$\bar{\Pi}(v_1) = (\tfrac{1}{2}) \cdot 30\text{K} + (\tfrac{1}{2}) \cdot 10\text{K} - 20\text{K} = \$\Pi(v_0) = 0 \qquad (33.3)$$

Quite content, Norburt takes his seat again. The contract he proposed, v_1, is indeed preferred by Dougal, and it does not hurt the firm.

Nevertheless, his moment of triumph is short-lived. Betsy questions whether Norburt envisions the firm's future as one in which it becomes an industry leader—that maximizes shareholder value—or one in which it becomes an ineffectual dinosaur that acts as a charity for its employees. She then gives her own PowerPoint presentation, which also happens to display Figure 33.3. She proposes that the firm offer Dougal the following contract: $v^* = (\hat{w}^*, \hat{w}^*)$, where $\hat{w}^* \equiv \$\hat{c}(R)$

is the *certainty equivalent* level of consumption that corresponds to the risky prospect *R*.[8] She notes that this contract is also (just) acceptable to Dougal (see point *C*). What is more, unlike Norburt's scheme, this one actually *raises* the firm's profits, and does so by the amount $\$(\bar{w}_0 - \hat{w}^*) = \$(20 - 15)\text{K} = \$5\text{K}$. (The reader may recognize this as the value of Dougal's risk premium.) Betsy's argument is compelling and wins the day.

The more general message is that, although the value of labor (as measured by the *MRP*) may fluctuate considerably, it is profitable for the firm to offer a contract that calls for a fixed wage that *does not*. The reason is that, by doing so, it provides risk-averse workers with valuable insurance against costly fluctuations in their consumption levels. Moreover, the firm benefits by providing the insurance, as workers are willing to pay for it by accepting lower average wages. Consequently, the theory of risk-sharing contracts explains why it is profitable for the steel industry, universities, automobile producers, and so on and so forth, to pay their employees a wage that is independent of subsequent realized demand shocks.

The Evidence

The basic prediction of the theory of insurance-based wage contracts is that wages are insulated from temporary fluctuations in the demand for labor. This stands in sharp contrast to the predictions of the simple competitive framework in which wages *do* respond to such shocks.

Numerous empirical studies have been conducted to test whether wages are better explained by insurance-based contract theory or by the simple competitive approach. In a seminal study, Beaudry and DiNardo (1991) find compelling support for the presence of implicit contractual agreements between firms and workers.[9] Grant (2003) reexamines the hypothesis proposed by Beaudry and DiNardo (1991), using a much more extensive data set that extends over three decades. He finds compelling support for the implicit contracting framework. Ham and Reilly (2002), also provide a comprehensive analysis of wage determination. Again their findings offer strong support for the risk-sharing hypothesis.

33.3 Aggregate Disturbances

In the United States, as in most other industrialized economies, certain key economic variables—such as employment, the gross domestic product (GDP), incomes, and consumption levels—are characterized by an apparent cyclical pattern.[10] Thus, over time, GDP undergoes protracted periods of growth that culminate in peaks of economic activity that are then followed (usually) by marked declines, which terminate in a trough or a recession:

> A recession is a significant decline in activity spread across the economy lasting more than a few months visible in industrial production, employment. . . .

> A recession begins just after the peak of economic activity and ends just as the economy reaches a trough.[11]

Figure 33.4 depicts the behavior of two key economic indicators: the quarterly percentage change in the gross domestic product, and the quarterly change in (non-farm) employment. According to this definition, the U.S. economy has experienced three recessions between 1980 and 2005. As indicated by the vertical bands, they began in July 1981, July 1990, and March 2001.

As might be expected, during a recession the level of employment declines and the level of unemployment rises. Hence employment is *procyclical*, whereas unemployment is *countercyclical*.

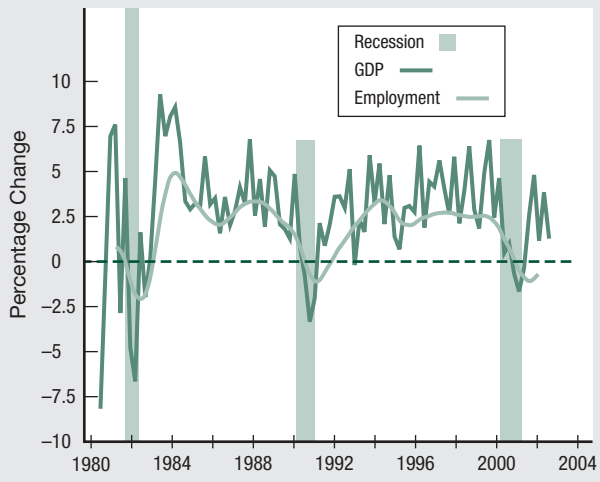
Procyclical or Countercyclical Real Wages: Theory

A question of great interest to economists—on both theoretical and policy grounds—is whether the real wage is procyclical, countercyclical, or (more or less) independent of the business cycle. On this score, it would be fair to say that there was, until relatively recently, a general theoretical presumption the behavior of the real wage is *countercyclical*.

As Keynes (1936) remarked, over 70 years ago, in his *General Theory*:

> [A]n increase in employment can only occur through the accompaniment of a decline in real wages. Thus, I am not disputing this vital fact which the classical economists have (rightly) asserted as indefeasible.[12]

FIGURE 33.4 U.S. Economic Activity

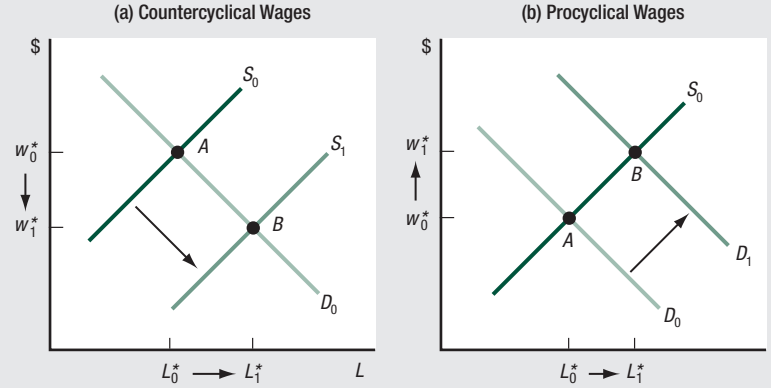


Source: U.S. Bureau of Labor Statistics

The predicted countercyclical behavior of the real wage is nothing more than the aggregate manifestation of the law of diminishing marginal returns to labor. Figure 33.5*a* depicts the basic idea. The labor market is initially in equilibrium at point A: the level of employment is L_0^*, and the real wage is $w_0^* \equiv W_0/P_0$, where W_0 is the nominal wage and P_0 the price level. Figure 33.5*a* also depicts an outward shift in the labor-supply schedule from S_0 to S_1. What is predicted to happen next depends on whether one happens to be looking at the world through **new-Keynesian** or **new-classical** spectacles.[13]

According to the new-Keynesian approach, (initially) nothing happens at all because the nominal wage, $\$W_0$, is arthritic in general and downwardly inflexible in particular. Hence the level of employment is

FIGURE 33.5 The Behavior of the Real Wage over the Business Cycle



initially stuck at point L_0^*. If, however, the government increases spending or lowers taxes, then the concomitant increase in aggregate demand causes the price level to increase from P_0 to P_1. As a result, the real wage falls from its initial level w_0^* to $w_1^* = W_0/P_1$. The outcome is that the equilibrium shifts from point *A* to point *B*: the real wage declines, and both the level of employment and output increase, implying the real wage is countercyclical.

In contrast, according to the new-classical approach, prices and wages are both fully flexible. The snag is that workers are poorly informed about the true price level $\$P$—which they need to know to determine the value of the real wage, $w \equiv W/P$. In this setting, a surprise increase in the price level (to P_1) can temporarily fool them into believing that their real *wage* has increased—even though it has not.

This latter observation explains why, in Figure 33.5*a*, the labor-supply curve shifts from S_0 to S_1: workers believe the real wage has increased and they supply more labor accordingly. Again, the outcome of the real wage is countercyclical: the equilibrium shifts from point *A* to point *B*, output and employment increase, but the real wage declines.

Despite the long intellectual pedigree of the argument that the behavior of the real wage is countercyclical, it is possible to construct simple models that predict exactly the opposite result: a procyclical real wage. According to a new branch of macroeconomics, called **real business cycle** (RBC) theory, the economy is constantly subject to a variety of shocks which result in a procyclical real wage. Figure 33.5*b* depicts the idea. The labor market is initially in equilibrium at point *A*. As shown, a technology shock shifts the labor-demand schedule outward from D_0 to D_1 *along a stable labor-supply schedule*. Notice that once the new equilibrium is established at point *B*, the real wage, employment, and output have all increased: the real wage is *procyclical*.

Procyclical or Countercyclical Real Wages: The Evidence. Before the development of the RBC framework, the consensus view among economists was that the real wage *is* countercyclical. From this perspective, the empirical findings of two early studies caused no end of headaches for the profession: evidence adduced by Dunlop (1938) and by Tarshis (1939) suggested that, if anything, the real wage is *procyclical* rather than countercyclical. The early head-on collision between received theory, on the one hand, and the evidence, on the other, generated a spate of research activity.

Much of the subsequent empirical work used the following estimation framework:

$$(W_t/P_t) = \alpha + \beta \cdot CYC_t + \varepsilon_t \tag{33.4}$$

where α and β are parameters to be estimated, ε_t is an error term, W_t/P_t is the real wage, and CYC_t are an assortment of cyclical variables (which are measured at date t).[14] According to Equation 33.4 the real wage is procyclical if $\beta > 0$ (as it depends *positively* on the cyclical variables); it is countercyclical if $\beta < 0$, and it is neither procyclical nor countercyclical if $\beta = 0$.

Early work by Bodkin (1969) attracted considerable attention because his evidence suggested that $\beta = 0$, indicating that the real wage and business cycle activity are unrelated. Many economists viewed this as a step in the right direction for it helped reconcile the *evidence with the accepted theory*! Subsequent work by Neftci (1978) and Sargent (1978) then indicated that movements in the real wage are countercyclical after all. The main innovation of their work was recognizing that the business cycle is a complicated dynamic process. One consequence of this is that changes in cyclical variables at date t may also affect the real wage at later dates $t + 1$, $t + 2$, and so on. If so, then these variables *must* be included in the regression to avoid the problem of omitted variable bias, which would result in unreliable statistical estimates.[15]

It was soon recognized, however, that one obvious explanation for the contradictory evidence is that perhaps *both* procyclical and countercyclical forces are at work, but that they operate with differing strengths at different points in time. Hence those studies that uncovered an insignificant relationship may have done so because they failed to adequately separate the underlying *cause* of the cyclical disturbance into its procyclical and countercyclical components (and hence jumbled together these two conflicting effects). In this light, Sumner and Silver (1989) is particularly illuminating. They conclude:

> We found that real wages were either pro-cyclical or counter-cyclical depending on the sample period chosen. Employment changes generated by aggregate-supply shocks were associated with pro-cyclical real-wage movements, while during years dominated by shifts in aggregate demand, real wages were highly counter-cyclical.[16]

Problems with Aggregate Time-Series Data. More recently, several authors have advanced a very different interpretation of the evidence just presented concerning the behavior of the real wage. Specifically they have espoused the view that much of what we see is in fact spurious: reflecting both deep-seated econometric and data problems that inhere in the use of *aggregate* time-series data.[17] For instance, Blundell, Reed, and Stoker (2003) succinctly summarize one of the main problems:

> [I]f the overall distribution of skills in the workforce remains unchanged, aggregate wages will increase when relatively low-wage individuals leave employment, but it is hard to argue that "well-being" has been improved in any meaningful way.[18]

In other words, even if everyone's real wages were constant, the *observed aggregate* real wage could appear to fluctuate because of changes in the employment experiences of different worker groups.

It is possible to delineate two main classes of statistical pitfalls that arise in using an aggregate wage equation—such as Equation 33.4—to estimate the cyclical properties of the real wage: (a) **selectivity bias** and (b) **composition bias**.[19] *Selectivity bias* reflects the fact that we can (usually) just measure the wages of those who are employed and not the potential would-be wages of those who are not. Hence the average wage may change over the business cycle simply because a disproportionate number of (say) low-skilled low-wage workers lose their jobs. *Composition bias* refers to changes in the measured average wage that results from the business cycle having a differential impact on alternative sectors of the economy (such as between the high-paying manufacturing and the low-paying service sectors).[20]

The thrust of much of the most recent research in this area has attempted to remedy these problems by using (longitudinal) data that include wage observations on individual workers.[21] After the statistical pitfalls are addressed, the general consensus in the literature is that the real wage is *procyclical*. However, there is still controversy regarding the magnitude of this effect.

Thus Solon, Barsky, and Parker (1994) remark,

> [T]he main conclusion of our paper is that the apparent weakness of real wage cyclicality in the United States has been substantially exaggerated by a statistical illusion . . . since the 1960s, real wages have been highly pro-cyclical in that period even though aggregate real wage data for the same period have not been nearly so pro-cyclical.[22]

In contrast, Keane, Moffitt, and Runkle (1988) observe, "[o]ur results show that the true effect of the cycle on the wage is still pro-cyclical but much smaller in magnitude than previous estimates using micro data have suggested."[23]

SUMMARY

- Employers can profit from offering their risk-averse employees insurance against adverse shocks to their productivities. They do this by agreeing to pay a fixed salary or a fixed hourly wage that is independent of the shock.
- A procyclical real wage is one that rises during booms and declines during recessions. A countercyclical real wage has the opposite characteristics.
- Problems of selectivity and composition bias create difficulties in determining whether the aggregate real wage is pro- or countercyclical.
- Selectivity bias reflects the fact that we can just measure the wages of the employed and not the would-be-wages of those who are not. Therefore, the observed real wage may vary over the course of the business cycle because of changes in the employment rate of (say) low-wage workers.
- Composition bias arises if the business cycle has a differential impact on alternative sectors. For example, during a downturn, large numbers of high-wage manufacturing workers may lose their jobs.

PROBLEMS

P1. Outline why it can be profitable for a firm to offer its employees a fixed salary that is independent of shocks that affect the value of labor.

P2. What is the primary distinction between an implicit and an explicit contract? Are there circumstances under which a firm might abrogate the terms of an implicit agreement?

P3. A firm is employing a risk-averse worker, whose utility is $u(c) = \sqrt{c}$. There are two states: good and bad, and each occurs with a probability of one half. The worker's marginal revenue product of labor in the good state is \$10K; it is only \$100 in the bad one. (a) Suppose that the firm is currently paying $\$w_g$ = \$10K and $\$w_b$ = \$100. What are its profits and average wage payments? What is the worker's expected utility? (b) Now suppose that the firm offers the worker the same wage in both the good and the bad states. What is the lowest wage it can offer that will still be acceptable to the worker? What happens to its expected profits if it offers this wage?

P4. What are the primary obstacles that hinder determining whether the real wage is procyclical or countercyclical?

P5. Use a figure like Figure 33.5 to show that shifts in the demand and supply of labor might lead to an acyclical real wage.

P6. Suppose that real wages are independent of fluctuations in the business cycle. Low-skilled workers earn \$10 per hour and high-skilled workers earn \$100. Why might this result in an apparently procyclical real wage?

NOTES

1. See Schumpeter (1943). Aghion (2002) provides an excellent review of the labor-market consequences of creative destruction.
2. The theoretical foundations of the risk-sharing contracts approach were laid down by Azariadis (1975), Baily (1974), Gordon (1974), and

Akerlof and Miyazaki (1980). Rosen (1985) provides a superb survey.

3. The reader will recall that the *MRP* measures the value to the firm of hiring an additional worker (or worker hour). Under competitive conditions, the *MRP* schedule *is* the firm's labor-demand schedule.
4. The assumption that workers are risk averse accords well with the observation that most people purchase insurance of one kind or another. The assumption that firms (more specifically their owners) are risk neutral is often viewed as an excellent first approximation. The reason is that owners are the firm's shareholders who typically hold large diversified portfolios. This diversification largely eliminates any idiosyncratic risk: if some stocks perform poorly, then, chances are, others will perform well.
5. Implicit contracts are termed *self-enforcing* if neither party finds it in his or her interests to breach the agreement. Bull (1987) was the first to examine this issue. See also the seminal paper by MacLeod and Malcomson (1989). In a recent interesting study, Hogan (2001) argues that one of the primary roles of trade unions is policing implicit contracts.
6. Nevertheless, in an interesting recent study, Bertrand (2004) shows that the financial pressures brought on firms by increased import competition might induce them to breach their implicit agreements with workers.
7. So there is no doubt, "MRP_g = \$30K," says that, over the course of the year, the worker produces goods (or services) valued at \$30K in the good state. Analogous remarks apply to MRP_b.
8. Certainty equivalence was defined on page 7. Recapping, an individual is indifferent, on the one hand, between the risky prospect R and, on the other, obtaining $\hat{c}(R)$ for sure: $\bar{U}(R) \equiv u(\hat{c}(R))$.
9. See also Beaudry and DiNardo (1995) and McDonald and Worswick (1999).
10. This section draws from the comprehensive survey of the area by Abraham and Haltiwanger (1995).
11. Defined in the NBER's *Recession Dating Procedure*, NBER report, April 10, 2003.
12. Keynes (1936), p. 17.
13. The new-Keynesian approach is an attempt to place many of the informal arguments proposed by J. M. Keynes, in his *General Theory*, on a rigorous microeconomic footing. The development of the new classical approach was spearheaded by Milton Friedman.
14. This corresponds to Abraham and Haltiwanger (1995), equation 2.
15. In an important study, Geary and Kennan (1982) modified Neftci's (1978) framework by considering a different time period and using a different but more appropriate price index to calculate the real wage. Their findings, once again, pointed to an *insignificant* statistical relationship between the real wage and the business cycle.
16. Sumner and Silver (1989), p. 706.
17. See, for example, Bils (1985); Keane, Moffitt, and Runkle (1988); and Solon, Barsky, and Parker (1994). More recently, Blundell, Reed, and Stoker (2003) examine the issue using UK data.
18. Blundell, Reed, and Stoker (2003), p. 1114.
19. The possibility of composition bias was first proposed by Stockman (1983).
20. Keane, Moffitt, and Runkle (1988) control for selectivity bias by using powerful econometric methods first developed by James Heckman (1974). The basic idea behind the estimation procedure (called a self-selection correction technique) is to impute an implicit wage for the unemployed. Armed with a wage (explicit and implicit) for every worker in *every state* (employed or unemployed), there is no selectivity bias because everyone is accounted for!
21. Bils (1985) and Keane, Moffitt, and Runkle (1988) use National Longitudinal Survey of Young Men (NLSYM) data and Solon, Barsky, and Parker (1994) use data from the PSID (Panel Study of Income Dynamics).
22. Solon, Barsky, and Parker (1994), p. 3.
23. Keane, Moffitt, and Runkle (1988), p. 1232.

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