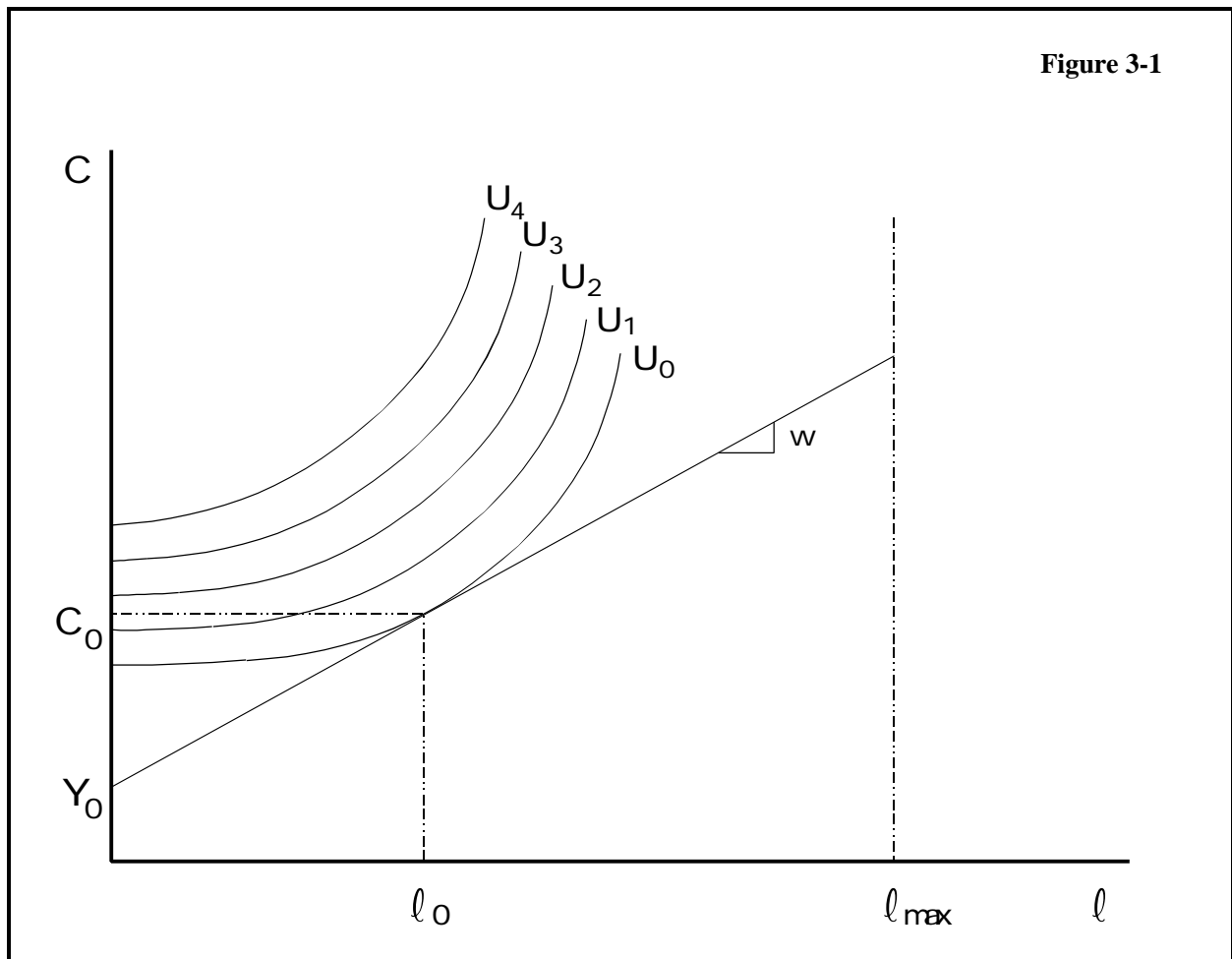


### Notes on Labor Supply, Employment, and Real Wages

This module develops a rudimentary model of the labor-leisure choice that we will use to analyze the behavior of output, employment, and real wages both in the long run and over the business cycle. This model is simply an application of the standard microeconomic analysis of consumer choice.

#### A. Optimal Consumption and Work Effort

*Opportunity Set.* Consider an individual named Wolfgang who has nonlabor income of  $Y_0$  and who



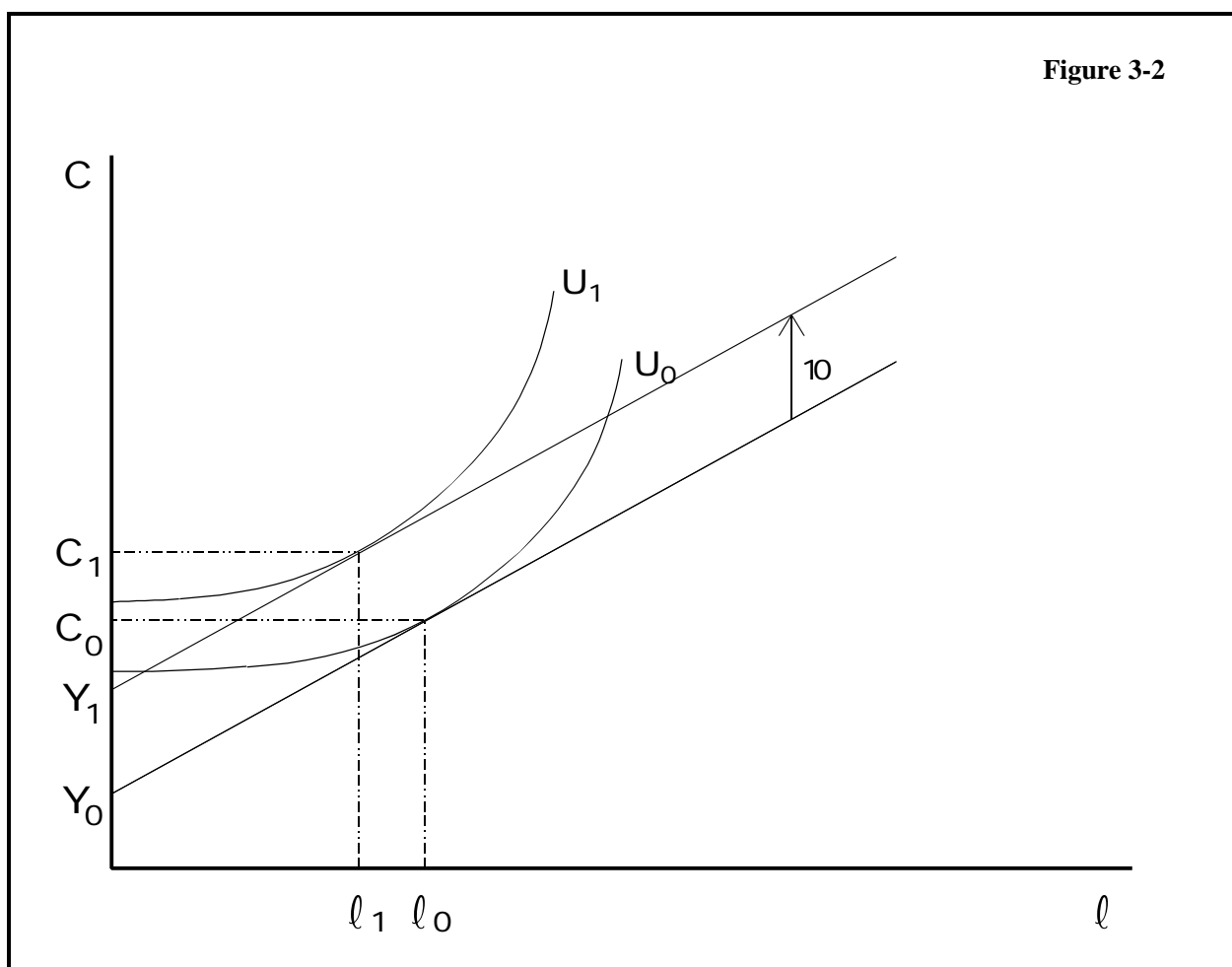
can earn labor income by working at a real wage rate of  $w$ . To keep things simple, assume that Wolfgang cannot borrow or save, so that he spends all of his income on consumption in each period of life. (Later, we will expand the model to include borrowing and saving.) Wolfgang's budget constraint is

$$C = Y_0 + w\ell, \quad (1)$$

where  $C$  denotes consumption. This budget line is depicted in Figure 3-1, where  $\ell_{\max}$  is the maximum amount of time available. The budget line indicates that Wolfgang can obtain more consumption goods by working more, so that he faces a tradeoff between consumption and leisure. His opportunity set consists of all points on or below his budget line.

*Preferences.* We assume that Wolfgang likes both consumption and leisure (i.e., he dislikes working). We can represent these preferences with a standard, two-dimensional indifference curve diagram (also shown in Figure 3-1). The indifference curves slope upward since work effort is a bad rather than a good. Indifference curves further to the northwest represent more highly valued combinations of work effort and consumption than indifference curves to the southeast.

*Choice of Consumption and Work Effort.* From among all combinations of consumption and work effort in his opportunity set, Wolfgang chooses the one that yields the most utility (i.e., the one he prefers most).



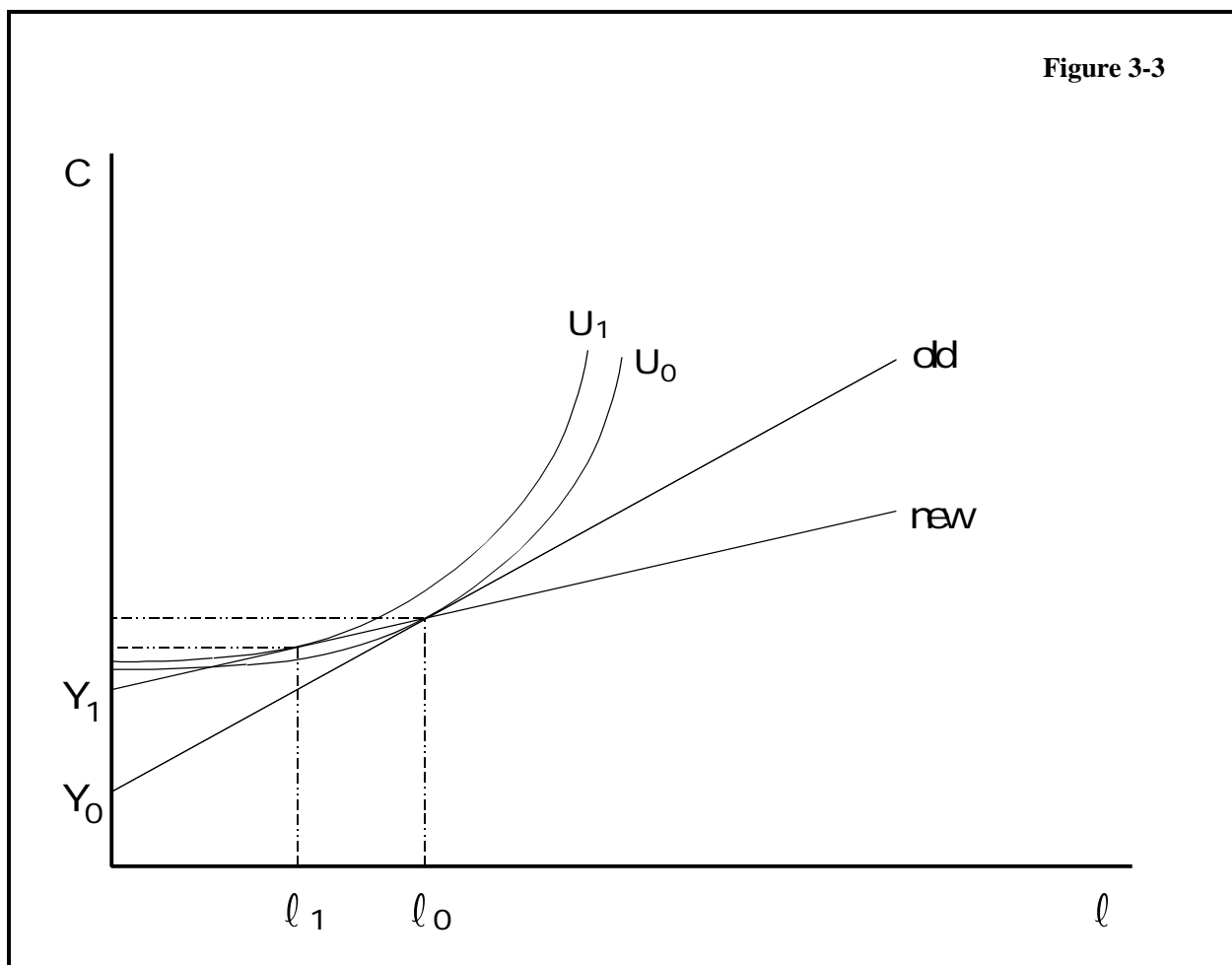
He will never choose a point below his budget line, because some other point on the budget line gives more consumption, less work effort, or both. The most highly valued of the feasible combinations occurs where the budget line is tangent to the highest attainable indifference curve. This is the point Wolfgang chooses, and it results in consumption of  $C_0$  and work effort of  $\ell_0$ .

## B. Reaction to Shifts in the Opportunity Set

Now that we have described how Wolfgang chooses a combination of work effort and consumption, we examine how his work effort and consumption change when his opportunity set changes. Wolfgang's opportunity set changes if his budget line shifts, and there are several ways in which this might happen.

*Parallel Shifts.* Suppose that a rich aunt leaves Wolfgang an inheritance sufficient to purchase 10 units of consumption goods, so that his nonlabor income is now  $Y_1 = Y_0 + 10$ . Receipt of this windfall causes a parallel upward shift of the budget line (Figure 3-2).

How will Wolfgang respond to his good fortune? Because the slope of his budget line (i.e., the wage rate) is unchanged, the terms on which he can trade leisure for goods are unchanged. However, because he can consume more food at any given level of work effort, the windfall exerts an income (or wealth) effect. If

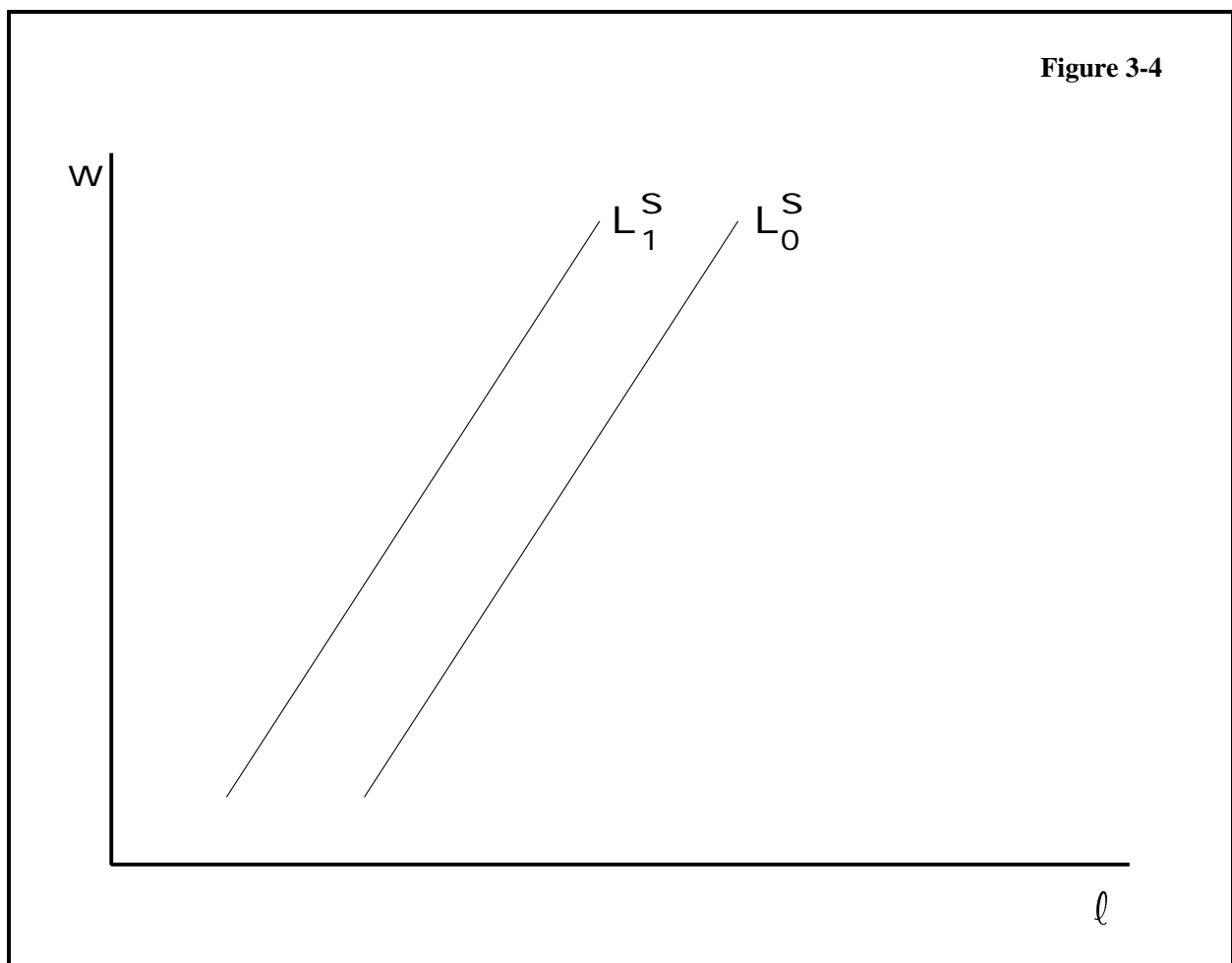


consumption and leisure are both normal goods, Wolfgang will respond to his windfall by consuming more of both goods and leisure. Alternatively stated, he will work less. As shown in Figure 3-2, consumption increases from  $C_0$  to  $C_1$  and work effort drops from  $\ell_0$  to  $\ell_1$ .

*Nonparallel Shifts.* Now suppose that instead of receiving an inheritance, Wolfgang faces a change in his compensation package. To be specific, suppose that his employer gives him lump-sum fringe benefits equal to 10 units of consumption goods regardless of how much he works, but reduces his wage rate so that his total compensation will remain unchanged if he continues to work  $\ell_0$  hours (Figure 3-3). Will Wolfgang in fact continue to work  $\ell_0$  hours?

The reduction in the wage rate reduces the amount of consumption that Wolfgang can obtain for each additional hour of work, thus making labor less attractive than before. Alternatively stated, the wage reduction exerts a substitution effect toward less work effort. By assumption, however, there is no income effect, since the change in the compensation package allows Wolfgang to earn the same income as before if he chooses not to change his work effort. Because there is only a substitution effect but no income effect, Wolfgang reduces his work effort from  $\ell_0$  to  $\ell_1$ . Notice that the reduction in work effort also results in less consumption.

Figure 3-3 illustrates an important result: holding real income constant, labor supply is positively related to the real wage rate. This relation is known as the labor supply curve, and it is shown in Figure 3-4. A



movement along the labor supply curve is due to the substitution effect of a wage change. The larger is the substitution effect, the flatter is the labor supply curve. We can also use Figure 3-4 to represent the effects of a change in real income. As we saw above, an increase in real income (like Wolfgang's inheritance) reduces work effort at any given wage rate, thus shifting the labor supply curve leftward from  $L_0^s$  to  $L_1^s$ . The larger is this income effect, the more the curve shifts.

How would Wolfgang react if his employer raised his wage rate with no offsetting change in fringe benefits? At a given real income, the higher wage rate tends to make Wolfgang to work more. However, the wage increase also raises Wolfgang's real income, shifting his labor supply curve to the left. The net effect on his work effort is unclear. With a large substitution effect (a flat labor supply curve) and a small income effect (a small leftward shift of the curve), work effort increases. This case is shown in Figure 3-5, where the wage rate increases from  $w_0$  to  $w_1$ , the labor supply curve shifts from  $L_0^s$  to  $L_1^s$ , and work effort increases from  $\ell_0$

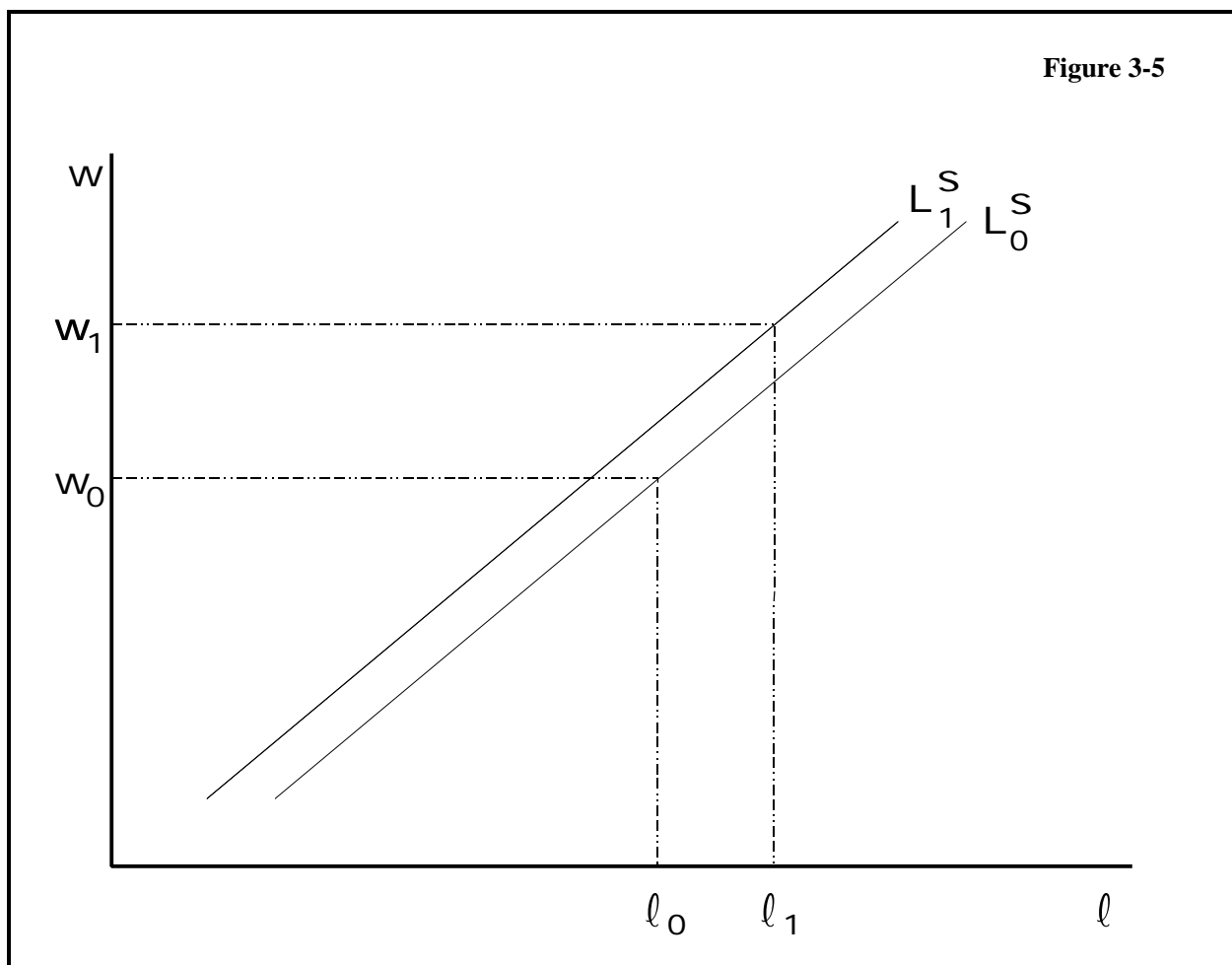
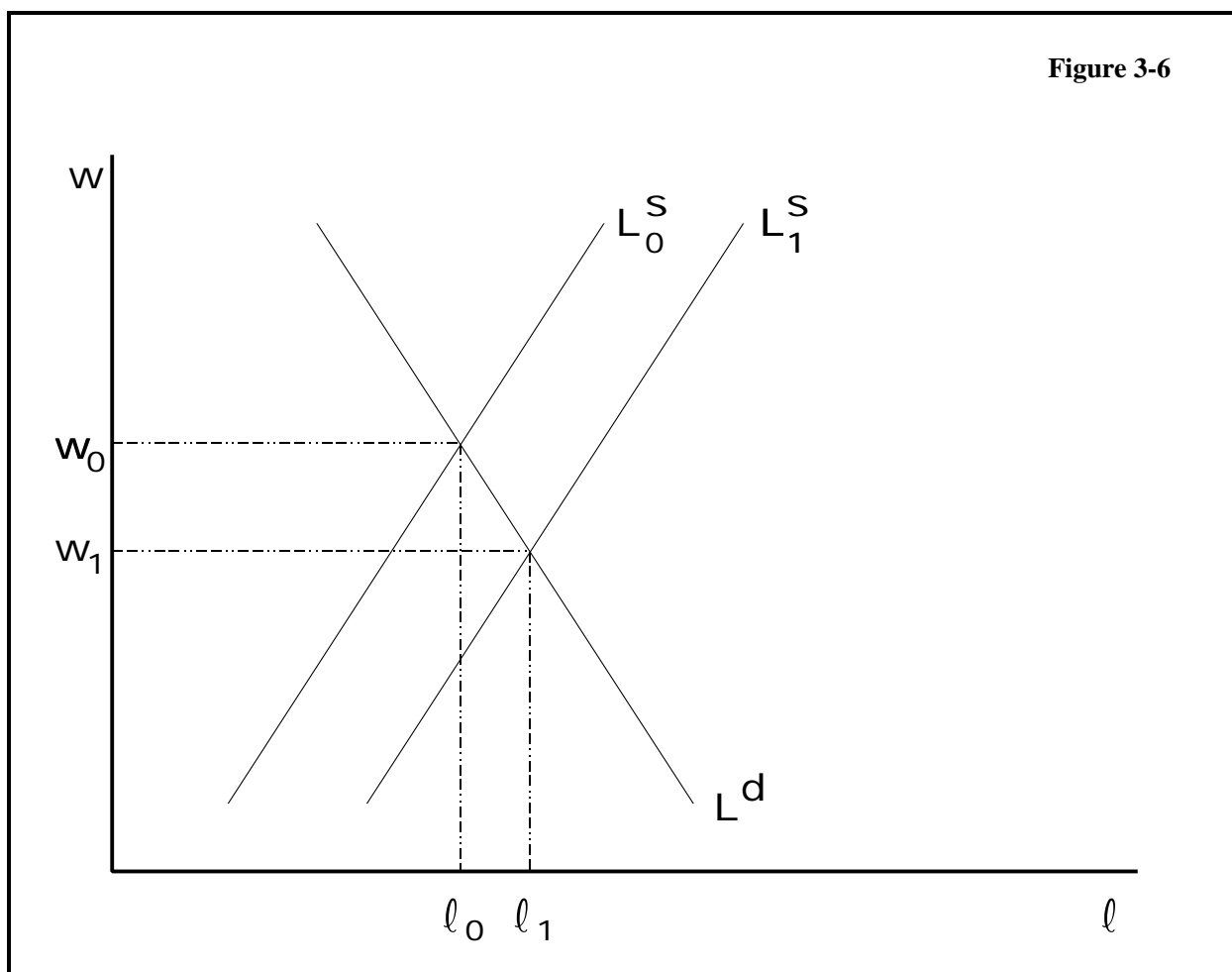


Figure 3-6



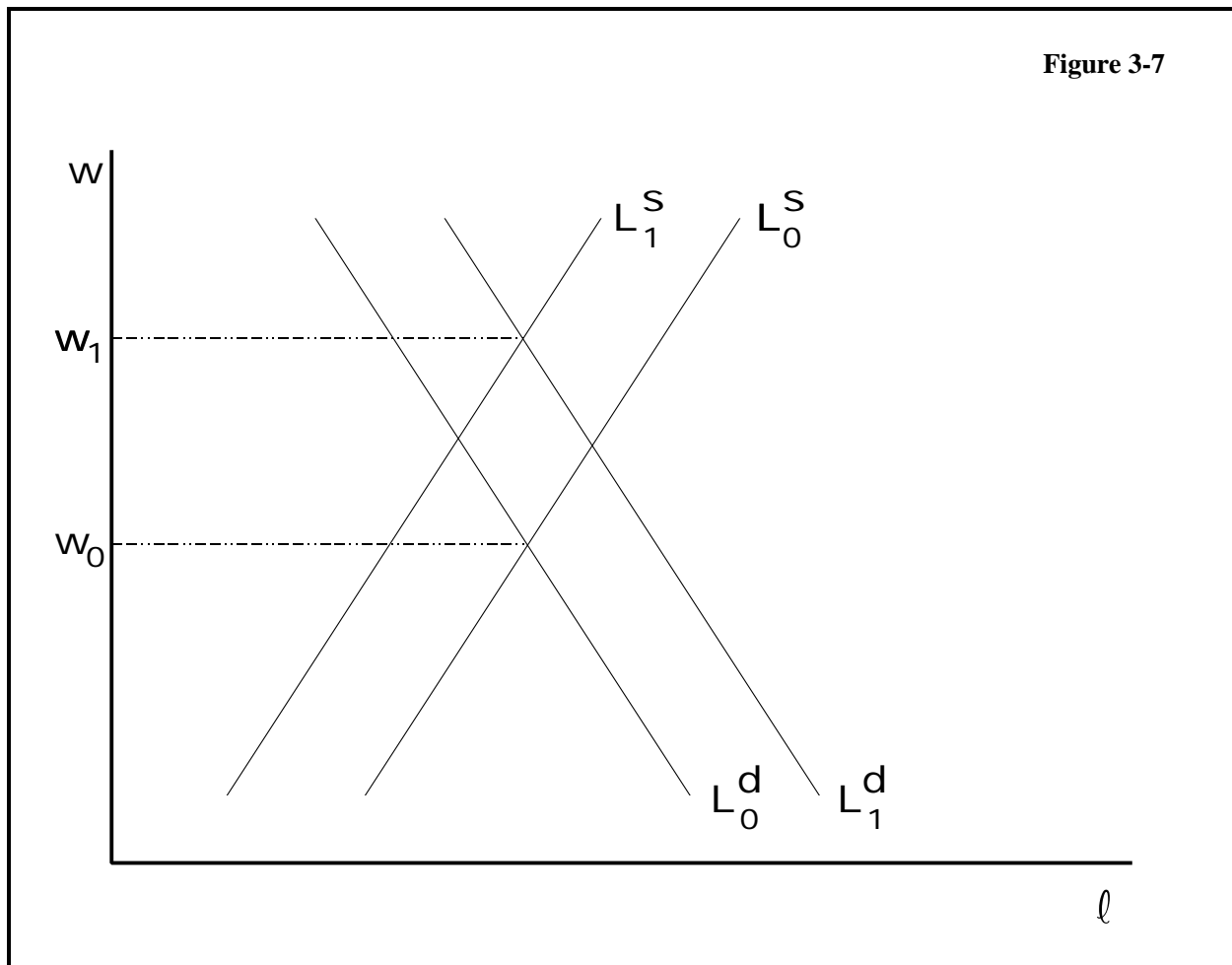
to  $l_1$ . If the relative strength of the income and substitution effects were reversed, work effort would decrease.

### C. Clearing of the Labor Market

What determines the real wages and aggregate work effort that we observe in the economy? Suppose that the economy is populated by a large number of workers like Wolfgang and a large number of price-taking firms. We saw in Module 2 ("Production and Distribution") that the marginal product of labor (MPL) is negatively related to the amount of labor a firm employs and that each firm hires labor up to the point where the MPL equals the wage rate. Thus, the MPL curve constitutes the firm's demand curve for labor. Aggregating across all firms, we obtain a downward-sloping market demand curve for labor. Likewise, we can aggregate the labor supply behavior of all workers to obtain an upward-sloping market supply curve of labor. If the real wage can adjust freely, the market clears at the intersection of these two curves (Figure 3-6).

We can use these simple labor demand and supply curves to examine the effects of various economic shocks. First, let's see what would happen if technology and the capital stock remained fixed but population increased. In this case, the labor demand curve remains unchanged while the labor supply curve shifts to the right, implying higher work effort and lower real wages (Figure 3-6 again). This is just the Malthusian no-

Figure 3-7



growth prediction which, as we have seen, was invalidated by a combination of technical progress and capital accumulation. Even in this pessimistic case, the increase in population does not lead to an excess supply of labor (commonly called unemployment). As long as real wages are free to adjust, they do so, and the labor market clears.

Now let's see what happens to work effort and real wages over the long term as a result of technical progress and capital accumulation. Each of these forces raises the MPL, increasing the demand for labor. They also raise the real incomes of workers, reducing labor supply (Figure 3-7). Real wages clearly increase, but the effect on aggregate work effort is ambiguous.