But there is a problem with this analysis. First, at an intuitive level, it does not seem reasonable that increasing the wage would *always* result in an increased supply of labor. If my wage becomes very high, I might well "spend" the extra income in consuming leisure. How can we reconcile this apparently plausible behavior with the economic theory given above?

If the theory gives the wrong answer, it is probably because we've misapplied the theory. And indeed in this case we have. The Slutsky example described earlier gave the change in demand *holding money income constant.* But if the wage rate changes, then money income must change as well. The change in demand resulting from a change in money income is an extra income effect—the endowment income effect. It occurs on top of the ordinary income effect.

If we apply the *appropriate* version of the Slutsky equation given earlier in this chapter, we get the following expression:

$$\underset{(-)}{\frac{\Delta R}{\Delta w}} = \underset{(-)}{\text{substitution effect}} + \underset{(+)}{(\overline{R} - R)} \underset{(+)}{\frac{\Delta R}{\Delta m}}. \tag{9.4}$$

In this expression the substitution effect is definitely negative, as it always is, and $\Delta R/\Delta m$ is positive since we are assuming that leisure is a normal good. But $(\overline{R} - R)$ is positive as well, so the sign of the whole expression is ambiguous. Unlike the usual case of consumer demand, the demand for leisure will have an ambiguous sign, even if leisure is a normal good. As the wage rate increases, people may work more or less.

Why does this ambiguity arise? When the wage rate increases, the substitution effect says work more in order to substitute consumption for leisure. But when the wage rate increases, the value of the endowment goes up as well. This is just like extra income, which may very well be consumed in taking extra leisure. Which is the larger effect is an empirical matter and cannot be decided by theory alone. We have to look at people's actual labor supply decisions to determine which effect dominates.

The case where an increase in the wage rate results in a decrease in the supply of labor is represented by a **backward-bending labor supply curve**. The Slutsky equation tells us that this effect is more likely to occur the larger is $(\overline{R} - R)$, that is, the larger is the supply of labor. When $\overline{R} = R$, the consumer is consuming only leisure, so an increase in the wage will result in a pure substitution effect and thus an increase in the supply of labor. But as the labor supply increases, each increase in the wage gives the consumer additional income for all the hours he is working, so that after some point he may well decide to use this extra income to "purchase" additional leisure—that is, to *reduce* his supply of labor.

A backward-bending labor supply curve is depicted in Figure 9.9. When the wage rate is small, the substitution effect is larger than the income effect, and an increase in the wage will decrease the demand for leisure and hence increase the supply of labor. But for larger wage rates the income

effect may outweigh the substitution effect, and an increase in the wage will *reduce* the supply of labor.

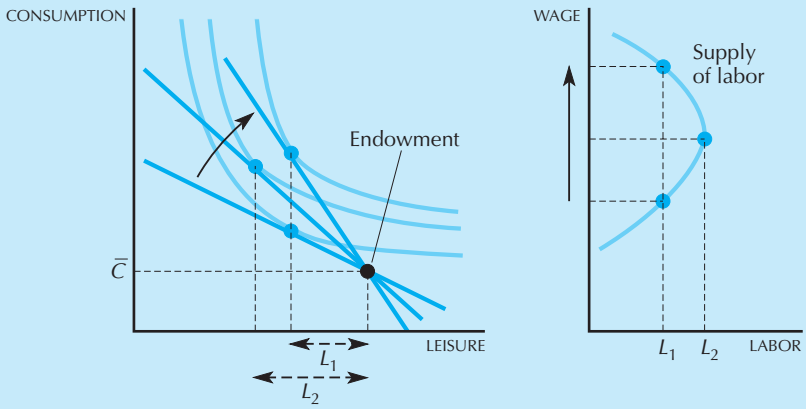

Figure 9.9 **Backward-bending labor supply.** As the wage rate increases, the supply of labor increases from L_1 to L_2. But a further increase in the wage rate reduces the supply of labor back to L_1.

EXAMPLE: Overtime and the Supply of Labor

Consider a worker who has chosen to supply a certain amount of labor $L^* = \overline{R} - R^*$ when faced with the wage rate w as depicted in Figure 9.10. Now suppose that the firm offers him a higher wage, $w' > w$, for extra time that he chooses to work. Such a payment is known as an **overtime wage**.

In terms of Figure 9.10, this means that the slope of the budget line will be steeper for labor supplied in excess of L^*. But then we know that the worker will optimally choose to supply more labor, by the usual sort of revealed preference argument: the choices involving working less than L^* were available before the overtime was offered and were rejected.

Note that we get an unambiguous increase in labor supply with an overtime wage, whereas just offering a higher wage for all hours worked has an ambiguous effect—as discussed above, labor supply may increase or it may decrease. The reason is that the response to an overtime wage is essentially a pure substitution effect—the change in the optimal choice resulting from

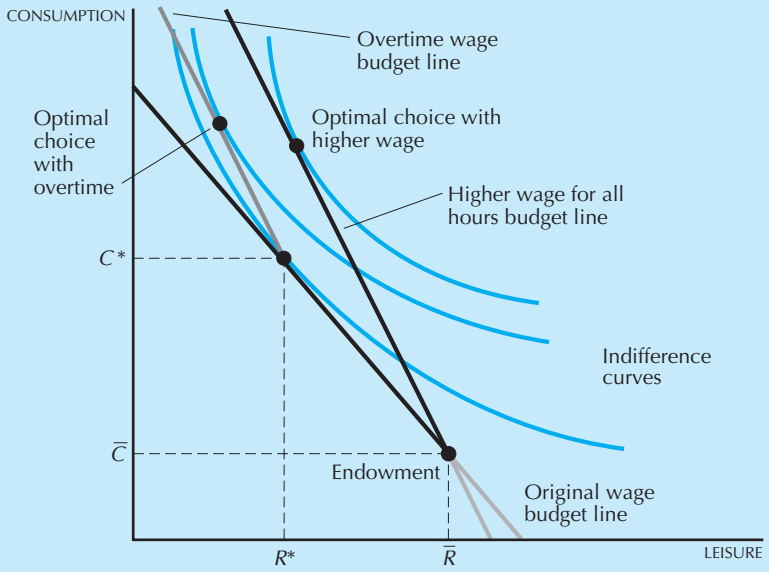

Figure 9.10 **Overtime versus an ordinary wage increase.** An increase in the overtime wage definitely increases the supply of labor, while an increase in the straight wage could decrease the supply of labor.

pivoting the budget line around the chosen point. Overtime gives a higher payment for the *extra* hours worked, whereas a straight increase in the wage gives a higher payment for *all* hours worked. Thus a straight-wage increase involves both a substitution and an income effect while an overtime-wage increase results in a pure substitution effect. An example of this is shown in Figure 9.10. There an increase in the straight wage results in a *decrease* in labor supply, while an increase in the overtime wage results in an increase in labor supply.

Summary

1. Consumers earn income by selling their endowment of goods.

2. The gross demand for a good is the amount that the consumer ends up consuming. The net demand for a good is the amount the consumer buys. Thus the net demand is the difference between the gross demand and the endowment.