Chapter 4
Labor Demand Elasticities

While Chapter 3 dealt with the downward sloping nature of labor demand curves, Chapter 4 deals with the *magnitude* of the employment response to a change in the wage rate. We begin the chapter by defining and discussing the own-wage elasticity of demand. In this regard the Hicks-Marshall laws of derived demand are explained, with each of the four laws being related to the substitution and scale effects (concepts that were introduced in Chapters 2 and 3).

After discussing the laws of derived demand in the context of own-wage effects, we move to a discussion of the cross-wage elasticity of demand. Here we stress the concepts of gross substitutability and gross complementarity (as distinguished from substitutes or complements in production). Another section is devoted to a discussion of the empirical evidence on both the own-wage elasticity of demand and cross-wage elasticities.

The chapter concludes with sections that apply the concepts of demand elasticity to analyzing the effects of minimum-wage legislation and technological change.

■ List of Major Concepts

1. The own-wage elasticity of demand is the percentage change in employment of a class of labor induced by a one-percent change in the wages of that class.

2. Cross-wage elasticities of demand are the percentage change in employment of a class of labor induced by wage changes in *another* class; they may be positive or negative.

3. The four Hicks-Marshall laws of derived demand are introduced and related to the substitution and scale effects of a wage change.

4. The concepts of gross substitutability and gross complementarity are defined and distinguished from substitutability or complementarity in production.

5. Empirical evidence concerning the own-wage and cross-wage elasticities of demand, based on both statistical studies and inferential analyses, is presented.

6. Standard labor demand theory predicts that an increase in the minimum wage will result in the loss of employment.

7. Actually measuring the employment effects of minimum-wage increases requires that we distinguish between nominal and real changes in the rate, that other things influencing employment levels be controlled for, and that the presence of uncovered sectors and intersectoral shifts in product demand be built into the design of the study.

8. The results of studies estimating the effects of minimum-wage increases are sensitive to the specification employed, with some studies finding the "conventional" negative effects and some finding none. Even those studies with negative employment effects generally find labor demand elasticities that are much smaller than those summarized earlier in the chapter.

9. Technological change in product markets can change the slope and placement of product demand curves, thereby shifting and/or changing the elasticity of labor demand curves.

10. The labor-demand effects of technological improvements in capital depend on crosselasticities; in attempting to analyze the likely dominance of the substitution or scale effect in this case, the Hicks-Marshall laws applicable to own-wage changes cannot be slavishly applied.

11. Technological change causes total employment to be reallocated, not permanently reduced. Compensation of the losers from technological change is essential for Pareto optimality.

◼ Answers to Even-Numbered Review Questions

2. Union A faces a demand curve in which a wage of $4 per hour leads to demand for 20,000 person hours and a wage of $5 per hour leads to demand for 10,000 person hours. Union B faces a demand curve in which a wage of $6 per hour leads to demand for 30,000 person hours, while a wage of $5 per hour leads to demand for 33,000 person hours.

    a. Which union faces the more elastic demand curve?
    b. Which union will be more successful in increasing the total income (wages times person hours) of its membership?

    Answer: a. As noted in the text, the elasticity of demand for labor is not necessarily a constant along a given demand curve. Indeed, when we speak of changes in wage rates that are not infinitesimal, the actual value of the elasticity depends on the wage rate from which one is starting. Given the data on union A and the formula for the elasticity of demand, $\%\Delta E/\%\Delta W$, union A's elasticity when one increases its wage rate from $4.00 to $5.00 is given by (20,000 − 10,000)/20,000 divided by ($4.00−5.00)/4.00, or (1/2)/(−1/4), which equals −2. In contrast, when one decreases union A's wage from $5.00 to $4.00, its elasticity is given by (10,000 − 20,000)/10,000 divided by (5.00 − 4.00)/5.00 or (−1)/(1/5) or −5. Its elasticity over the interval $4.00 to $5.00 depends on which wage we use as a base.

    To prevent this type of result, economists often define the *average elasticity* over the wage interval W_1 to W_2 as

    $$[(E_2 - E_1)/0.5(E_1 + E_2)]/[(W_2 - W_1)/0.5(W_1 + W_2)].$$

    Note that this elasticity estimate does not vary with the end of the wage interval (high or low) at which one starts. In the present question the average elasticities for Union A and Union B are given by

    Elas. (A): $[(20,000 - 10,000)/15,000]/[(4.00 - 5.00)/4.50] = (2/3)/(-2/9) = -3$

    Elas. (B): $[(33,000 - 30,000)/31,500]/[(5.00 - 6.00)/5.50] = -0.524$

    Given the above data, Union A faces the more elastic demand curve.

b. One cannot say which union will be more successful in increasing its members' total earnings. This depends upon a number of factors, including the bargaining power of the two unions and the firms with which they deal. It is true, however, that the union with the more elastic demand curve will suffer a larger percentage employment loss for any given percentage increase in wages, and this is likely to reduce its incentive to push for large wage gains. Thus, one's inclination is to say that the union facing the less elastic demand curve is likely to be more successful in raising its members' wages.

(This answer assumes that wage/employment contracts under collective bargaining lie on the demand-for-labor curve. As shown in the appendix to Chapter 12, this need not always be the case.)

4. The public utilities commission in a state lifts price controls on the sale of natural gas to manufacturing plants and allows utilities to charge market prices (which are 30% higher). What conditions would minimize the extent of manufacturing job loss associated with this price increase?

Answer: This question involves the cross-elasticity of demand. A higher price of natural gas will have a *substitution* effect that could favor increased employment, and a *scale* effect that tends to reduce employment. Factors that minimize the extent of job loss are those that make for a robust substitution effect and a small scale effect. A large substitution effect will tend to occur if labor is easily substituted for natural gas in the production process, and if the supply of labor is relatively elastic. A small scale effect would be created if natural gas is a small part of the overall cost of production, and if the demand for the products made using natural gas is relatively inelastic.

6. In 1942 the government promulgated regulations that prohibited the manufacture of many types of garments by workers who did the sewing, stitching, and knitting in their homes. If these prohibitions are repealed, so that clothing items may now be made either by workers in factories or by independent contractors doing work in their homes, what effect will repealing the prohibitions have on the labor demand curve for *factory workers* in the garment industry?

Answer: Repealing the prohibitions enables garment manufacturers to substitute home workers for factory workers. Assuming that the 1942 regulations were constraining, one can presume that there will be at least some substitution of home workers for factory workers; this substitution will tend to shift the labor demand curve for factory workers to the left. However, there may be a favorable scale effect for certain factory workers performing tasks (such as packaging and shipping) complementary with home production.

Besides the shift to the left of the labor demand curve, the new substitution possibilities opened up by repealing the 1942 regulations should serve to make the labor demand curve for factory workers more elastic. Just as the greater ability to substitute capital for labor will tend to make the labor demand curve more elastic, so too will the ability to substitute home labor for factory workers.

■ Answers to Even-Numbered Problems

2. Professor Pessimist argues before Congress that reducing the size of the military will have grave consequences for the typical American worker. He argues that if one million individuals were released from the military and were instead employed in the civilian labor market, average wages in the civilian labor market would fall dramatically. Assume that the demand curve for civilian labor does not shift when workers are released from the military. First, draw a simple diagram depicting the effect of this influx of workers from the military. Next, using your knowledge of (i) the definition of the own-wage elasticity of labor demand, (ii) the magnitude of this elasticity for the economy as a whole, and

(iii) the size of civilian employment in comparison to this flood from the military, graph these events and estimate the magnitude of the reduction in wages for civilian workers as a whole. Do you concur with Professor Pessimist?

Answer: Because you were asked about the effects on civilian wages as a whole, you will probably *not* concur with Professor Pessimist. Own-wage elasticity of demand for labor = %Δ(quantity demanded)/%Δ(wage) = $(\Delta Ld/Ld)/(\Delta W/W)$. In this case $\Delta Ld = 1$ million, Ld = about 147 million employed workers, and the own-wage elasticity of demand for labor is approximately −1. Thus, $−1 = (1$ million$/147$ million$)/(\Delta W/W)$, so $\Delta W/W$ will be very small–about −1/147 (or −0.0068). This implies that wages will fall by 0.68%.

However, the military recruits in a very narrow segment of the labor market—mostly high school grads who do not attend college, and who are between ages 17–21. Thus, downsizing would have the greatest effect on this segment of the market. If there were only 13.5 million, say, in this age group, a labor demand elasticity of −1 would yield a wage effect of the military downsizing of closer to −7.4% on this group of the population.

4. The following table gives the demand for labor at Homer's Hideaway, a motel in a small town.

Number of Hours	Wage
2	$10
3	8
4	6
5	4
6	2

a. Draw the demand for labor curve.
b. Calculate the wage elasticity of demand along the demand curve. Indicate whether the elasticity is elastic, inelastic, or unitary elastic.
c. As you slide down along the demand curve, does the demand curve become more or less elastic?

Answer: a. Simple plot of tabular data.

b.

Number of Hours	Wage	Elasticity
2	$10	—
3	8	$[(3 − 2)/2]/[(8 − 10)/10] = [1/2]/[−2/10] = −2.5$
4	6	$[(4 − 3)/3]/[(6 − 8)/8]\ \ = [1/3]/[−2/8]\ \ = −1.32$
5	4	$[(5 − 4)/4]/[(4 − 6)/6]\ \ = [1/4]/[−2/6]\ \ = −0.76$
6	2	$[(6 − 5)/5]/[(2 − 4)/4]\ \ = [1/5]/[−2/4]\ \ = −0.40$

The demand curve is elastic at its upper end and inelastic at its lower end.

c. The demand curve becomes less elastic (or more inelastic) as you slide down along the curve.

6. Calculate the own-wage elasticity of demand for Occupations *a*, *b*, and *c* below. E_D and W are the original employment and wage. E'_D and W' are the new employment and wage. State whether the demand is elastic, inelastic, or unitary elastic.

    a. $\%\Delta E_D = 5, \%\Delta W = -10$

    b. $E_D = 50, \; W = 7$
         $E'_D = 40, \; W' = 8$

    c. $E_D = 80, \quad W = 8$
         $E'_D = 100, \; W' = 6$

    Answer: a. $\eta_D = \%\Delta E_D/\%\Delta W = 5/(-10) = -1/2$ [inelastic]

    　　　　　　 b. $[(40 - 50)/50]/[(8-7)/7] = (-0.20)/0.14 = -1.43$ [elastic]

    　　　　　　 c. $[(100 - 80)/80]/[(6 - 8)/8] = (20/80)/(-2/8) = -1$ [unitary elastic].

■ Suggested Essay Questions

1. The United States is considering placing a tax on producers based on the amount of carbon dioxide emitted during the production process (carbon dioxide is a byproduct emitted from the burning of fossil fuels). If such a tax were imposed, analyze the conditions under which the demand for labor in a particular industry would be *most negatively affected.*

    Answer: This tax is essentially a tax on capital, and as such it will have a scale effect that tends to reduce the demand for labor and a substitution effect that tends to increase the demand for labor. Thus, the demand for labor will be most negatively affected if the scale effect is large and the substitution effect is small. The scale effect will be larger when the capital that emits carbon dioxide is a larger fraction of overall costs and when the product demand curve is more elastic. The substitution effect will be smaller when it is more difficult to substitute labor for capital and when the labor supply curve is less elastic.

2. Suppose that State X passes a new piece of legislation that requires all employers to offer paid family leave to workers who have children or parents who need their care for an extended period. Under this new law, businesses are required to hold a job for a worker who goes on paid leave for up to six weeks. When on leave, workers receive 55% of their normal (non-overtime) pay. What are the likely labor market responses from the demand (employer) side of the market? Include in your analysis a consideration of factors that would affect the *size* of these responses.

    Answer: This requirement clearly increases the cost of hiring labor, and will have a scale effect and a substitution effect that both serve to reduce the demand for labor. The drop in the demand for labor will be larger when labor is a larger share of overall cost, the product demand curve is more elastic, capital is more easily substituted for labor, and the supply curve of capital is more elastic. (The requirement will also cause firms to want to substitute more hours per worker—an issue that is addressed in Chapter 5.)