Answers To Chapter 5

■ Review Questions

1. Answer d. This is the best response since it is the broadest true statement. Answers a and c are too broad since these categories include some costs that are not also quasi-fixed. Answer b gives an example of quasi-fixed costs, but there are others.

2. Answer a. The hourly wage is not a quasi-fixed cost because the total amount paid varies directly with hours worked (and thus with output). Defined benefit plans obligate the firm to make certain payments to retirees. All retirees with a certain number of years of service may receive the same amount, regardless of how many hours they actually worked for the firm, and thus this is likely to be a quasi-fixed cost. Both defined benefit and Social Security programs have elements that are quasi-fixed and elements that do vary with hours worked. Defined contribution plans are usually based on an employee’s total earnings, and hence their cost will be partially a function of how many hours the retiree worked for the firm. Social Security contributions are a percentage of total earnings, provided the earnings are less than some maximum amount.

*3. Answer d. Given the benefits are prorated based on hours worked, these contributions do not qualify as quasi-fixed costs, but rather will vary both as the number of workers changes and as hours change.

4. Answer c. The total cost of training includes the explicit costs of training (3,000) plus the implicit opportunity cost of the trainees time (3,500 – 2,000 = 1,500), for a total cost of 4,500.

5. Answer c. 

\[ ME_H = (\text{wage} + \text{variable benefits per hour}) \times \text{number of workers} = [10 + (50/40)] \\
500 = 5,625. \]

6. Answer b. 

\[ ME_H = [(1 + \text{overtime premium}) \text{wage} + \text{variable benefits per hour}] \times \text{number of workers} = [(1.5)10 + (50/40)]500 = 8,125. \]

7. Answer c. 

\[ ME_M = \text{weekly wages} + \text{weekly employee benefits and quasi-fixed costs} = [10(40) + 200] = 600. \]

8. Answer a.

\[ \frac{ME_M}{MP_M} = \frac{600}{50} = 12 < \frac{ME_H}{MP_H} = \frac{8,125}{625} = 13. \]

The firm should increase M and decrease H to bring about an equality. As M increases, \( MP_M \) will fall, increasing the left side of the equation. As H decreases, \( MP_H \) will rise, decreasing the right side of the equation.
9. **Answer d.** Another possibility is that there will be a decrease in the straight-time wage to the level needed to keep total compensation unchanged.

*10. **Answer d.** Such a law would increase both \( ME_M \) and \( ME_H \). Without knowing the specific \( ME \) and \( MP \) figures, an increase in both \( ME \) values leads to an ambiguous change in the cost-minimization equation.

*11. **Answer a.** Such a law would raise the \( ME \) of part-time workers, causing the firm to substitute full-time workers for part-time workers. Even though part-time workers may still be cheaper than full-time workers, a change in the relative cost of each type of input should bring about a change in the input mix.

12. **Answer a.** This law would increase quasi-fixed costs, thus raising the \( ME_M \) but not the \( ME_H \) associated with part-time workers. The ratio of \( ME \) to \( MP \) for the \( M \) input would rise, forcing the firm to decrease \( M \) and increase \( H \) to restore the cost-minimization equality. There would be fewer part-time workers employed, but those that were still employed would be working longer hours.

13. **Answer a.** While the effects of this law on the employment/hours mix would be different from the version where benefits are prorated, the laws would have very similar effects on the mix of part-time and full-time workers. Again, as in Question 11, the law would increase the \( ME \) of part-time workers, causing the firm to substitute full-time workers for part-time workers.

14. **Answer a.** The present value of the bonus is the 250,000 received in the current period plus the discounted value of the future payments.

\[
250,000 \div 1.06 + \frac{250,000}{(1.06)^2} + \frac{250,000}{(1.06)^3} = 918,253.
\]

15. **Answer b.** As the interest rate falls, dollars received in the future are not discounted as much, hence the gap between the post-training wage and the marginal product does not have to be as large for the firm to recover the full value of its training investment.

16. **Answer d.** If workers paid entirely for the training in the initial period (as is the case with general training), the wage during training would have to be much lower, and then there would be no gap between the wage and marginal product in future periods to protect workers from temporary layoffs. The present value of the total compensation package is unaffected, however, by the way in which the training costs are recovered.

17. **Answer d.** If the firm had to pay the entire cost of training during the initial period then they would have a bigger investment to recover in future periods, causing a bigger gap between the wage and the marginal product. If the gap grows so large that the wage slips below the worker’s inherent marginal product, the worker will have an incentive to quit. In either case, however, the firm recovers in present value terms the entire training investment.

18. **Answer c.** Whether the firm can attract workers to its training program and keep them will depend on how the present value of the entire compensation stream compares with what can be earned elsewhere. To recover its training costs, however, the firm must pay the workers less than their marginal product at the firm.
19. **Answer d.** When a firm invests a large sum in its workers, it should be expected to try to recover those investments or take steps to minimize the size of the investment. Thus large investments are consistent with a large gap between the wage and the marginal product, as well as statistical discrimination and internal labor market strategies.

20. **Answer d.** If the firm attributes shorter job tenures to women, it will probably try to pay them less so as to recover the hiring and training investments over the shorter period. If for some reason they must pay the same, the firm will either invest less in its women workers or simply not hire them in the first place.

21. **Answer b.** In a monopsonistic labor market, the firm faces an upward-sloping supply curve for labor because either it is the only firm in the market, or because mobility costs limit the willingness of workers to leave if other firms offer higher wages.

22. **Answer b.** Higher mobility costs mean that workers are less likely to leave. Thus a given percentage change in the wage will lead to a relatively smaller change in the quantity of labor supplied (than if mobility costs were lower), and the supply of labor will be relatively less elastic.

*23. **Answer d.** If a monopsonist faces a market supply of labor $W = a + bL$, then the $ME_l$ will equal $a + 2bL$. The reason the $ME_l$ lies above the wage is that when the firm faces an upward-sloping market supply curve, to attract additional workers it must pay a higher wage, but this higher wage applies to all workers previously hired at the lower wage (assuming it pays a single wage to all workers). This means that the cost of an additional worker to the firm is more than just the wage paid to that worker. The intercept is the same, however, because hiring just one worker does not require any wage changes.

24. **Answer d.** Setting a minimum wage above the monopsony wage creates a horizontal segment to the marginal expense of labor curve. If this segment lies below the point where the original $ME_l$ intersects the $MRP_l$, the optimal employment level will rise. If it intersects the $MRP_l$ above that point, employment will fall. It is also possible for the minimum wage to be set exactly at the level where the original $ME_l$ intersects the $MRP_l$. In that case, there would be no change in employment.

### Problems

25a. The typical worker is employed for 2,000 hours and earns $25,000. The firm must contribute 5% of this, or $1,250, to the fund. For each additional worker hired (with the same hours and wage), the firm’s contribution will go up by $1,250. However, if existing workers were required to work one hour longer per week (50 per year), earnings would rise to $25,625 and hence the firm’s contribution would also rise to $1,281.25. Since the cost varies with the number of workers and with the number of hours worked, it is not a quasi-fixed cost.

25b. Holding hours and the wage base constant, if the typical worker earned $25 per hour then the contribution would be a quasi-fixed cost. Each worker would earn $50,000 and the firm would contribute $2,500 for each employee. However, if the employees worked more hours and increased their earnings, the firm would not have to increase its contribution. On the other hand, given the typical workweek and wage at this firm, a wage base of only $25,000 would also transform this contribution into a quasi-fixed cost.
26a. The cost of checking new hires for legal residency (and the fines levied if a violation is detected) would represent an increase in hiring costs, and hence an increase in quasi-fixed costs. This raises $ME_M$ and will lead the firm to substitute a longer workweek for more workers.

26b. An increase in quasi-fixed costs raises $ME_M$ and hence the relative cost of employing additional workers. This induces a substitution of hours for workers. However, it will also raise the marginal cost of production, which in turn should lead the firm to choose a lower output level. This lower output level triggers a scale effect in which the firm will have an incentive to cut back on its use of both workers and hours. Therefore, whether the workweek actually increases depends on whether the substitution effect dominates the scale effect (whether hours and employment are gross substitutes).

27. The inequality suggests that if the firm produced one less unit of output by using fewer workers, its total cost of production would go down by 2. If the firm then proceeded to produce that same unit of output using a longer workweek, its total cost of production would only rise by 1.5. In other words, the firm could produce the same total output at a lower cost by changing its mix of employment and hours. If the firm can produce the same output at a lower cost with a different input mix, it could not have been at the optimal mix of workers and hours.

28a. The post-training wage will be set at 240.

\[
(MP_0 - W_0) + (MP_1 - W_1) + \ldots + (MP_{15} - W_{15}) = Z.
\]

Assuming for simplicity $W_1 = \ldots = W_{15} = W$, then

\[
200 - 150 + 15(250 - W) = 200 \implies 15W = 3600 \implies W = 240.
\]

Under this plan, workers pay for 50 of the 200 in training initially, and then the firm recovers 10 per month over the next 15 months. Workers will find this position attractive since the total payment stream over the entire length of employment is greater than what they could have earned elsewhere based on their inherent marginal product.

\[
150 + 15(240) = 3750 > 16(225) = 3600.
\]

28b. The firm would have to recover its full 200 in training expenses over the 15 post-training periods. This implies a wage of 236.67. While this is still above the worker’s inherent marginal product, the protection the firm has against quits has shrunk. The more the workers pay for their training in the initial period, the more protection the firm has against quits.

28c. There would be no gap between the post-training wage and the marginal product. Workers want the firm to bear some of the initial cost so that there is a gap, and hence some protection from temporary layoffs.

28d. This would reduce the post-training wage to 235 and increase the gap between the wage and the marginal product to 15.

28e. The firm can recover its costs over 5 periods if

\[
MP_0 - W_0 + MP_1 - W_1 + \ldots + MP_5 - W_5 \geq Z.
\]

Given the constraint $W_0 = \ldots = W_5 = 225$, then

\[
200 - 225 + 5(250 - 225) = 100 < Z = 200.
\]
Therefore, the firm could not recover its training costs. The shortest time of recovery \((n)\) can be determined by solving the equation
\[
200 - 225 + n (250 - 225) = 200,
\]
which implies \(n = 9\) months (after training).

28f. The inherent \(MP\) sets a lower bound for the wage in the post-training periods. To find the highest this boundary could be, solve the equation
\[
200 - 150 + 15(250 - MP) = 200,
\]
which implies the maximum \(MP^*\) equals 240.

29a. The post-training wage will be set at 402.5.

\[
MP_0 - W_0 + \frac{MP_1 - W_1}{1 + r} = Z \Rightarrow 400 - 375 + \frac{535 - W_1}{1.06} = 150
\]
\[
\Rightarrow 535 - W_1 = 132.5 \Rightarrow W_1 = 402.5.
\]

29b. Although the inherent \(MP\) is not given in the problem, the lowest it could be is 400, the marginal product during training. Using this value as a lower bound, the firm’s training program is not attractive since the present value of the total compensation stream is less than what can be earned elsewhere.

\[
375 + \frac{402.5}{1.06} = 754.72 < 400 + \frac{400}{1.06} = 777.36.
\]

30a. The firm more than recovers its training investment on a present value basis.

\[
1800 - 1600 + \frac{2500 - 2200}{1.06} + \frac{2800 - 2600}{(1.06)^2} = 661 > Z = 500.
\]

30b. This training program is not likely to persist since other firms could offer the workers the same kinds of specific training opportunities at higher wages and still make a profit.

31a. Since this is general training, the firm will offer a wage of \(W_0 = MP_0 - Z = 5.50 - 3 = 2.50\) during training. In the post-training periods the wage will equal the marginal product of 9.

31b. Although it would appear a post-training wage of 7.5 would enable the firm to recover its general training investment, such a wage could not be sustained since the typical worker’s marginal product of 9 will be observed by all firms. Other firms would be willing to bid up to 9 for these workers.

31c. Since the training period wage could not fall to 2.50, the firm would have to cut back the amount of training it offers to only 1.50. If this is not possible, then either no training will be offered, or the workers will not be hired.
32a. The optimal employment level ($L^*$) occurs where $W/P = MPL$ ($P$ represents the price of the firm’s output). Substituting the given information yields

$$\frac{40}{2} = 50 - 2L^* \Rightarrow 2L^* = 30 \Rightarrow L^* = 15.$$  

32b. Employing the $W/P = MPL$ rule again yields

$$\frac{40}{1} = 50 - 2L^* \Rightarrow 2L^* = 10 \Rightarrow L^* = 5.$$  

Assuming no training investment, the firm cuts employment from 15 to 5 when the product price falls.

32c. At $L = 15$, $MPL = 20$. If the firm sets $W$ at only 20 and the product price is 2, then at that employment level the $MP$ exceeds the real wage ($MP_L = 20 > 10 = W/P$). If the product price now falls to 1 (say, because the demand for the product falls), the gap will be eliminated, but $W/P$ will now be exactly equal to the $MP_L$ and there will be no need to change the employment level. The gap that existed between the wage and the marginal product insulated the workers from the reductions in employment that usually accompany reductions in $P$.

### Applications

33a. Robin would be offered a post-training wage of 15,122.

\[
MP_0 - W_0 + \frac{MP_1 - W_1}{1+r} + \frac{MP_2 - W_2}{(1+r)^2} = Z, \\
\Rightarrow 11,000 - 10,500 + \frac{16,000 - W_1}{1.06} + \frac{17,000 - W_2}{(1.06)^2} = 3,000.
\]

Assuming for simplicity $W_1 = W_2 = W$, then

\[
\frac{(1.06)(16,000 - W)}{(1.06)^2} + \frac{(17,000 - W)}{1.06} = 2,500 \Rightarrow \frac{16,690 - 1.06W + 17,000 - W}{1.1236} = 2,500, \\
\Rightarrow 33,960 - 2.06W = 2,809 \Rightarrow 2.06W = 31,151, \\
\Rightarrow W = W_1 = W_2 = 15,122.
\]

33b. The program is attractive since the present value of the total compensation stream exceeds that associated with the alternative offers.

\[
10,500 + \frac{15,122}{1.06} + \frac{15,122}{(1.06)^2} = 38,225
\]

is greater than

\[
11,500 + \frac{11,500}{1.06} + \frac{11,500}{(1.06)^2} = 32,584.
\]
33c. Ann would be offered a lower post-training wage of 13,350.

\[ 11,000 - 10,500 + \frac{16,000 - W}{1.06} = 3,000 \Rightarrow 16,000 - W = 2,650 \Rightarrow W = 13,350. \]

33d. The firm’s training program should be attractive since the present value of the total compensation stream is more than what can be earned elsewhere.

\[ 10,500 + \frac{13,350}{1.06} = 23,094 \]

is greater than

\[ 11,500 + \frac{11,500}{1.06} = 22,349. \]

33e. Assuming the firm must pay Ann the higher wage, then they would not be able to recover the 3,000 training investment over her shorter job tenure. As a result, either Ann would not be hired or the firm would not invest as much in her training.

34a. The subminimum wage should increase the likelihood that teens would receive on-the-job training of all types, but especially general training. In the training investment model discussed in this chapter, the minimum wage serves as a floor beneath which the wage cannot fall, but in so doing, it sometimes results in a gap between the wage and the marginal product that is too small for the firm to recover its training investment. (Recall Problem 25e.) This situation is most likely to arise in the case of general training because general training must be recovered during the training period, and so often necessitates a large gap between the wage and the marginal product. This in turn may necessitate a wage so low that it is below the minimum wage.

34b. Using the example given in the Summary section of this chapter, suppose instead the training is general and there is a minimum wage of 425. The firm would like to set a wage of 400 during period zero, but would be prohibited from doing so. The firm would be unable to recover its training investment, and as result, the worker would not be hired or less training would be offered. A subminimum wage of, say 390, would allow the firm to hire the worker and offer the full amount of training.

35a. Using the cost-minimization framework, subsidizing training costs should lead to a reduction in the \( ME_M \) term, setting off adjustments that would increase the number of workers demanded. (It would also result in a different mix of workers, with a higher percentage of workers from disadvantaged groups being hired.) Holding output constant, as the number of workers demanded increases, the number of hours worked by existing employees will probably go down unless other inputs like capital are adjusted downward instead. This reduction in hours would be called a substitution effect, and it takes place because workers are now relatively cheaper than they were before. A complete analysis should also allow for the possibility of output changing. An increase in output is to be expected here since a decrease in \( ME_M \) will drive down the \( MC \) of production and lead to an increase in output. As output increases, typically both employment and hours rise. This increase in the demand for both inputs would be called a scale effect. If the scale effect dominates the substitution effect, hours could actually increase. In such a situation, hours and workers would be called gross complements in the production process.
35b. Since the program is targeting employer expenditures on training, assume that the training being offered is firm-specific. (Recall that with general training the worker typically pays for the training in the initial period.) As mentioned in the answer to 31a, the program should result in an increase in the number of workers from disadvantaged backgrounds being hired. For those disadvantaged workers who would have been hired and trained anyway, protection against temporary layoffs is reduced since there is now likely to be a smaller gap between the post-training wage and the workers’ marginal product. The wage should exceed the workers’ inherent marginal product by more than before, however, providing the firm more of a buffer against quits. For those workers who would not have been hired and trained except for the program, job stability is clearly increased since they now have a job where the post-training wage will be set such that $MP' < W < MP$.

*36a. $MRP_L = MR \times MPL$.

\[ K = 3 \Rightarrow Q = 3L \Rightarrow MPL = 3. \]
\[ MR = 64 - 2Q = 64 - 2(3L) = 64 - 6L. \]
\[ MRP_L = (64 - 6L) 3 = 192 - 18L. \]

*36b. In this problem, the marginal product of labor is constant; it does not diminish as $L$ increases. This assumption is made to make the algebra of the problem simpler.

*36c. If $W = a + bL$, then $ME_L = a + 2bL$

\[ \Rightarrow ME_L = 6L. \]

36d. Profit maximization occurs where $MRP_L = ME_L$.

\[ 192 - 18L = 6L \Rightarrow L^* = 8. \]

36e. $W^* = 3(8) = $24, $Q^* = 3(8) = 24, P^* = 64 - 24 = $40, Profit = PQ - WL - CK = 40(24) - 24(8) - 5(3) = $753.$

36f. $W_{\text{min}} = 30 \Rightarrow ME_L = 30$ (provided $L < 10$) $\Rightarrow$ profit maximization occurs where

\[ 192 - 18L = 30 \Rightarrow L^* = 9. \]

In this case, the minimum wage leads to an increase in employment opportunities.

$W_{\text{min}} = 66 \Rightarrow ME_L = 66$ (provided $L < 22$) $\Rightarrow$ profit maximization occurs where

\[ 192 - 18L = 66 \Rightarrow L^* = 7. \]

In this case, raising the minimum wage too high leads to a decrease in employment opportunities.