

I. Variable and Fixed factors of production

Let us call factors relatively "*variable*" when the duration of their use does not affect their costs, and those factors relatively "*fixed*" when it does. "Raw" (unskilled) labor is what we had in mind in the previous lectures: workers worked for a piece rate, workers working twice as long cost exactly twice as much.

Since labor's production costs were proportional to its use, the firm would be indifferent to increasing the number of manhours of work either by working the same workers more hours or by hiring more workers and letting everyone work the same number of hours. Which "margin" (hours or workers) the firm varies doesn't make any difference when labor is a purely variable input. However labor is increasingly becoming more skilled, with some fixity of costs associated with employee benefits, and the hiring and training of workers. These "quasi-fixed" costs increases the marginal costs associated with hiring more workers, relative to employing your current workers more hours.

Consider the training of a skilled programmer for Novell. This is a typical programmer, so that in four years he will take her stock options and quit. But until then, she will be uniformly productive after her initial training in the company (which costs the company about \$100,000). Since there is no market in slaves, the only way to recover this investment is to keep the programmer around until she bytes the big one. If she checks out after the first year, then the training costs per year was \$100,000. If she slips her disk after the second year, then training costs were reduced to \$50,000 per year; after the third year, \$33,333. So the cost of training falls with the duration of its use. The longer that you use an input, the greater the chance to "amortize" its cost over many days of use.

Employee benefits offer other examples of fixed costs. Often the cost of these benefits don't increase if the employee works longer hours, but will increase if an additional employee is hired. In Arizona and California, for example, employers pay unemployment insurance tax only the first \$7,000 of the worker's wages in a calendar year (\$18,500 in Utah, higher because of all the unemployed University of Utah alumni). After the UI taxes on the first \$7,000 of wages have been paid, no additional taxes are generated if the worker earns more wage income. However, if another worker is hired, UI taxes again are paid until the wages of that additional worker reaches \$7,000. Hence, as far as UI taxes are concerned, it is cheaper for the firm to work the first employee extra hours (who has already incurred the tax liability) then it is to hire another worker. With the first worker, additional hours allows the firm to amortize the benefits cost.

Under either the skilled training costs or the employee benefit costs scenario, the firm cares about the combinations of "hours per worker" and "number of workers" it employs. Let

w=wage rate

h=hours of work per employee

e=number of employees

F=fixed costs of hiring per employee

C=total labor costs

Cost constraint:

$$C = eF + wh e \text{ rewritten as}$$

$$e = c/(F + wh)$$

Production function (because the firm now distinguishes average hours from number of workers):

$$Y = f(h, e)$$

The firm's constrained optimization problem:

$$\max_{h, e} H = f(h, e) + \lambda (C - eF - wh e)$$

Get the first order conditions

$$f_h = \lambda (w e)$$

$$f_e = \lambda (F + w h)$$

where

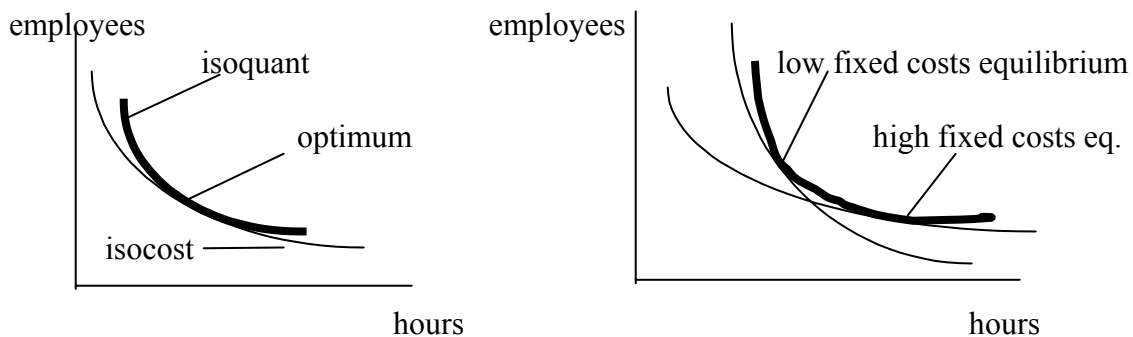
$w e$ = marginal cost of employing current workers one more hour

$F + w h$ = marginal cost of hiring one more worker (to work h hours)

The optimal employment of e, h satisfies the usual marginal conditions

$$\frac{f_h}{f_e} = \frac{w e}{F + w h}$$

The left hand side is the slope of the production function, and the right hand side is the slope of the cost constraint. In e, h -space, the cost constraint is not linear ($e = C/(F+wh)$). So we have an equilibrium pictured as below on the left side.



When fixed costs increase, the isocost curve will flatten as indicated in the right hand side graph immediately above, going from the solid budget line to the dashed budget line. The budget line flattens out because the marginal cost of hiring an additional worker has

increased; the new optimal configuration of e,h employs fewer workers and more hours per worker.

Besides the substitution effect indicated above (holding Y constant), an increase in F will also have a scale effect. An increase in F will increase labor costs, shifting the budget constraint inward, reducing the desired demand for both number of workers and hours of work. The impact on number of workers is unambiguous, both substitution and scale effects reduce the optimal number of workers. The impact on hours of work is ambiguous since the scale and substitution effects work in opposing directions.

II. Quasi-fixed costs #1: Employee Benefits

Table : Social Insurance and Employee Benefit Programs

type of benefit:	Social Insurance Programs	Employer Provided Benefits
Health Care Benefits: **paid time off	Workers' Compensation Social Security Disability Insurance Temporary Disability Insurance	Short Term Disability Long Term Disability Sick Leave
**medical expense	Workers' Compensation Medicare	group medical expense group dental coverage
Retirement and Life/Survivor Insurance	Social Security--Old Age and Survivor Insurance	pension plans profit sharing plans group life insurance
Other Programs	Unemployment Insurance Family and Medical Leave Act	vacation, day care moving expense educational expense wellness programs counseling services

(Source: *The Economics of Social Insurance and Employee Benefits*, Butler)

Employer Provided Benefits in the far right hand column are those employer-provided insurance benefits which the firm voluntarily offers to their employees. By contrast, social insurance programs (offered through social security, unemployment insurance, temporary disability insurance, or workers' compensation) specify both a level of benefits that a firm must offer and an administrative process to see that the firm is complying in providing those benefits.

How Social Insurance Differs from Employer Provided Benefits

1. The level of weekly benefits are mandated in social insurance programs, but are not in employee benefits. Maximum and minimum benefits for workers compensation, as well as the waiting period, is determined on a state by state basis, but it is the same for each employee in the state covered by those programs. The same is true of unemployment insurance. Social Security benefits are not only the same for workers with the same labor market experience within a state, Social Security benefits are the same across all states. Hence, there is no inter-firm variation in the expected benefits for

workers with equivalent wages. There is a lot of variation between firms, however, in the level of benefits that employers offer in their health benefits plans, retirement and life insurance plans. Moreover, even within a firm the employee is frequently given options as to the type of medical expense coverage they have, the percent of their wages that they contribute to a retirement fund, etc.

2. Because these benefits are mandated by the state, there is a formal, well-defined outside review process for appealing benefit reductions in workers' compensation, unemployment insurance, and Social Security. Very few states have an administrative review process for employee benefits. Interestingly, despite the formality of the appeals process, or perhaps because of it (or the mandated nature of social insurance), there are a lot more lawyers litigating workers' compensation benefits' disputes than there are lawyers litigating employer-provided disability (and medical/health) benefits disputes.

3. Workers do not directly contribute to workers' compensation or unemployment insurance benefits, but they often do contribute directly to certain employee benefits. In particular, workers often pay a part of medical plan premiums and contribute to 401K plans with some employers matching all or part of the workers' 401K contribution.

This difference is more apparent than real, however. Even for workers' compensation and unemployment insurance, there is evidence that workers indirectly pay for some of their benefits through lower (compensating) wages.

4. There is an emphasis on adequacy of benefits in social insurance, through the establishment of minimum levels of benefits. There is less concern about minimum benefits in employee benefit programs. For example, while there are minimum benefits provided to those receiving retirement benefits in social security, there is no minimum retirement benefit for those in a defined benefit contribution plan.

5. In terms of quasi-fixed costs, the social insurance are important because they all depend on a covered wage base that determines when additional pay results in no more additional taxes. Unemployment Insurance and Workers' Compensation Insurance covered. Recent covered wage base limits (by state) are available on the class website. The employee benefits are also generally important because the employers contribution to many of these programs depends mostly on the number of employees rather than whether or not they work extra hours (overtime pay, for example, does not generally affect the costs of any of these benefits). The growth of these programs is indicated in Table 2 below.

Table 2: Employee Benefits Paid by the Firm as a Percent of the Payroll

year	'51	'61	'71	'81	'91	'96
Type of Benefit						
TOTAL EMPLOYEE BENEFITS	18.7	24.9	30.8	37.3	39.2	41.3
SOCIAL INSURANCE	3.5	5.1	6.3	9.0	8.9	8.8
Social Security	1.4	2.7	4.5	6.3	7.1	7.0
Unemployment Compensation	1.4	1.5	.7	1.2	.5	.7
Workers' Compensation	.6	.8	1.0	1.4	1.3	1.1
PENSION and INSURANCE BENEFITS (not Profit sharing)	5.4	7.9	10	12.7	15.6	15.7
Pension Plans	3.6	4.2	4.9	4.2	4.7	6.3

Insurance Premiums: Medical Expense, Life	1.4	2.7	4.5	6.0	9.3	8.4
Salary Continuation, STD, LTD	.0	.0	.0	.6	.5	.7
PROFIT SHARING	.7	.8	1.0	1.1	.9	.6
PAID REST and TRAVEL TIME	1.9	2.6	3.4	3.4	2.2	3.7
PAYMENTS—time not worked	6.0	7.6	9.2	10.0	10.4	10.2
Paid vacations	3.2	4.2	4.8	5.0	5.6	5.3
Paid Holidays	2.0	2.5	3.0	3.4	3.2	3.1
Paid Sick Leave	.6	.7	1.0	1.3	1.2	1.2

Source: U.S. Chamber of Commerce, [Employee Benefits Historical Data](#) (US Chamber of Commerce, Washington, DC: 1981), and U.S. Chamber of Commerce, [Employee Benefits](#), various issues. These data represent the employer's share of employee benefit costs only (not any worker contributions).

(Source: *The Economics of Social Insurance and Employee Benefits*, Butler)