Scratch

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1 Chapter 4: Labor Market Equilibrium

This chapter will study the notion of labor market equilibrium, which is the outcome of the interaction between labor supply, labor demand, and possibly external forces, such as government policies.

Definition D.1: Invisible Hand Theorem

If markets are competitive, and workers and firms are free to enter and leave the market, then the equilibrium allocation of workers and wages will be efficient, in the sense that it maximizes the total gains that workers and firms obtain from trade with each other.

1.1 Equilibrium in a Single Labor Market

Figure 1 illustrates a competitive labor market with an equilibrium at (E^*, w^*).

FIGURE 4-1 **Equilibrium in a Competitive Labor Market**
The labor market is in equilibrium when supply equals demand; E^* workers are employed at a wage of w^*. The triangle P gives the producer surplus; the triangle Q gives the worker surplus. A competitive market maximizes the gains from trade, or the sum $P + Q$.

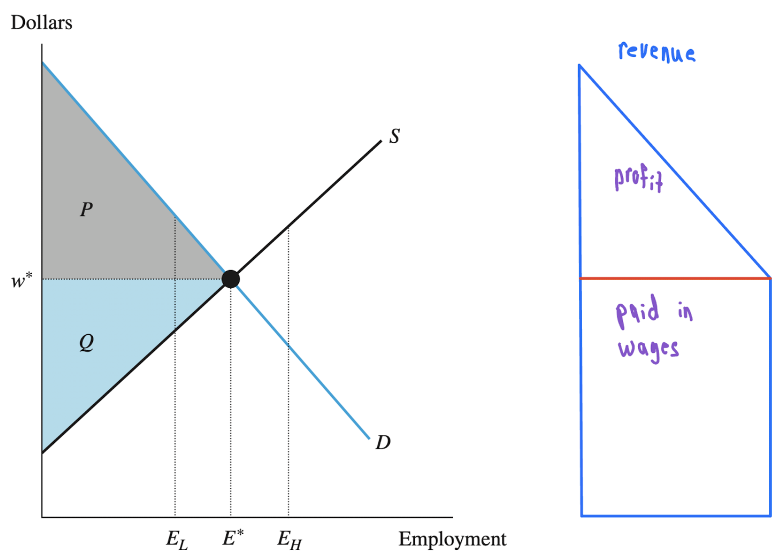


Figure 1: Labor Market Surplus

Since the labor demand curve corresponds to the value of the marginal product, we can see that the area under the labor demand curve up to any given point corresponds to the total revenue a firm receives from hiring that many workers. Thus, since the equilibrium is at (E^*, w^*), the firm's total revenue is given by the area under the demand curve up to

E^*, which is drawn out in blue in Figure 1. Similarly, the area under the supply curve up to E^*, their profit, or producer surplus (denoted P in Figure 1), is given by the triangle above w^* and below the labor demand curve.

Definition D.2: Producer Surplus

Producer surplus is the difference between the revenue a firm receives and the cost it incurs.

Similarly, workers are indifferent between working and not working along the labor supply curve. Thus, workers who are willing to work for less than w^* (which is everyone except the final workers hired) receive a surplus. This surplus is given by the triangle below w^* and above the labor supply curve, denoted Q in Figure 1.

The gains from trade are given by the sum of the producer and worker surplus: $P + Q$. The competitive market equilibrium maximizes the gains from trade. Such an outcome that maximizes gains from trade is said to be "efficient."

Questions

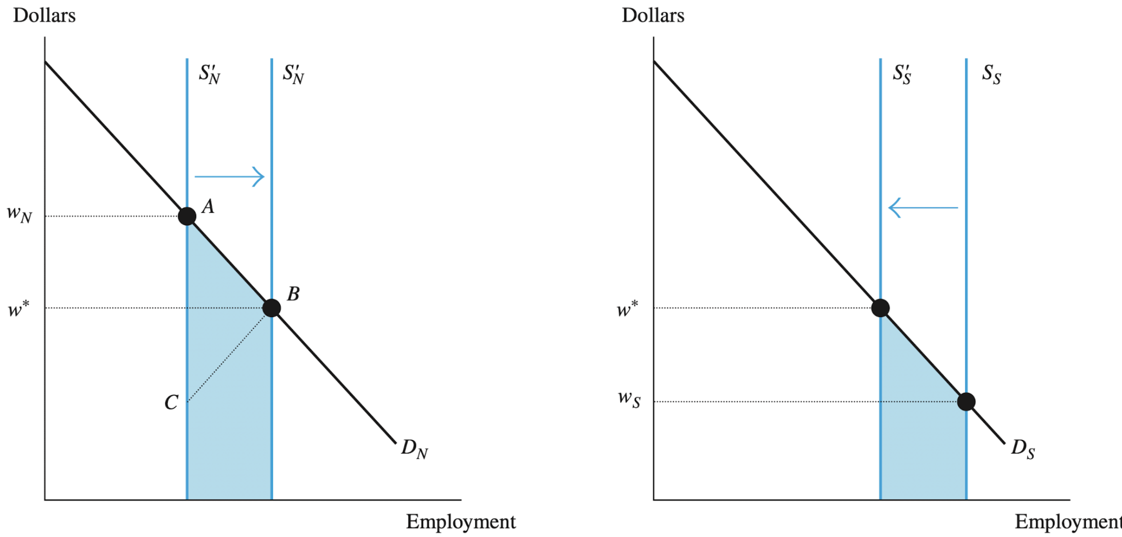
It's somewhat challenging for me to think about how I should think about the connection between surplus and wellbeing. I understood surplus as a clear quantitative measure, but it seems like we would only care about it insofar as it connects to something more like the wellbeing of the parties involved. However, it's super unclear to me if we're trying to connect it back to that in any way.

1.2 Equilibrium across Labor Markets

So far, we have focused on a single labor market. Now, we turn to the case of multiple labor markets linked by migration. In Figure 2, we see two labor markets, N (north) and S (south). We start with the wages (w_n) in the north being higher than the wages (w_s) in the south. If workers are able to move freely, then workers from the South will move to the North, which will decrease supply in the South and increase supply in the North up to the point that wages are equalized across the two markets, at w^*. Note that this analysis relies on the idea that workers in each region are perfect substitutes for each other.

We find that this movement increases the total output across the markets. Specifically, the North market's output is originally the area under the demand curve up to A and after the move extends to B – the increase is characterized by the blue trapezoid. For the South, output reduces by the amount characterized by the blue trapezoid in its market. However, the increase in the North is larger than the decrease in the South. In particular, the growth in the North is large by the size of the triangle ABC.

FIGURE 4-2 **Competitive Equilibrium in Two Labor Markets Linked by Migration**
The wage in the northern region (w_N) exceeds the wage in the southern region (w_S). Southern workers want to move north, shifting the southern supply curve to the left and the northern supply curve to the right. In the end, wages are equated across regions (at w^*). The migration reduces the value of output in the South by the size of the shaded trapezoid in the southern labor market and increases the value in the North by the size of the larger shaded trapezoid in the northern labor market. Migration increases the value of aggregate output by the triangle *ABC*.



(*a*) The Northern Labor Market (*b*) The Southern Labor Market

Figure 2: Equilibrium across Labor Markets

1.3 Policy Application: Payroll Taxes and Subsidies

1.3.1 Payroll Taxes Imposed on the Firm

The payroll tax is a tax imposed on the firm that is some fraction τ of the wage paid to the worker.

Figure 3 illustrates the effect of a payroll tax. Here, we suppose there is a payroll tax of \$1 per hour. The initial equilibrium is at (E_0, w_0), at point A. The payroll tax placed on the firm decreases the labor demand uniformly by the amount of the tax. Thus, the new equilibrium is at point B, where the employment level is now E_1, the wage received by the worker is w_1, and the effective wage paid by the firm is $w_1 + 1$.

FIGURE 4-4 **A Payroll Tax Imposed on Firms**
A payroll tax of \$1 imposed on employers shifts down the demand curve (from D_0 to D_1). The tax cuts the wage that workers receive from w_0 to w_1 and increases the cost of hiring a worker from w_0 to $w_1 + 1$.

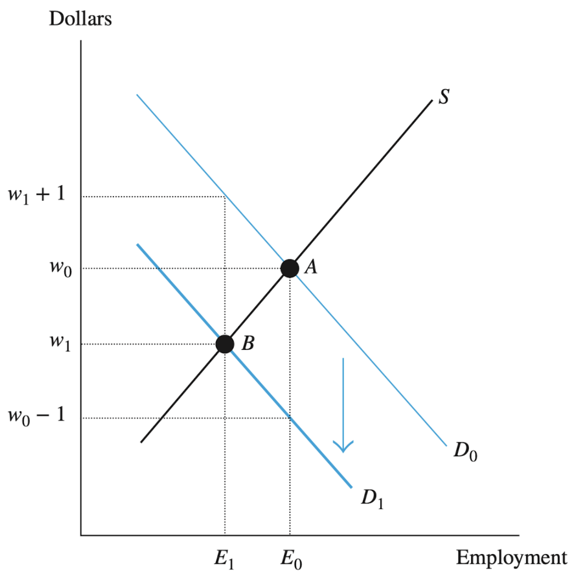


Figure 3: Payroll Tax

1.3.2 Payroll Taxes Imposed on the Worker

Figure 4 illustrates the effect of a payroll tax if it were imposed on the worker instead of the firm. Here, the effect is essentially the reverse in which the labor supply curve shifts up by the amount of the tax. Now, the equilibrium is at point B, where the employment level is E_1, the wage received by the worker is w_1, but the worker now pays a tax such that the effective wage received by the worker becomes $w_1 - 1$.

Whether the tax is imposed on the firm or the worker, the outcome is the same.

FIGURE 4-5 **A Payroll Tax Imposed on Workers**

A payroll tax imposed on workers shifts the supply curve to the left (from S_0 to S_1). The payroll tax has the same impact on the equilibrium wage and employment regardless of who it is imposed on.

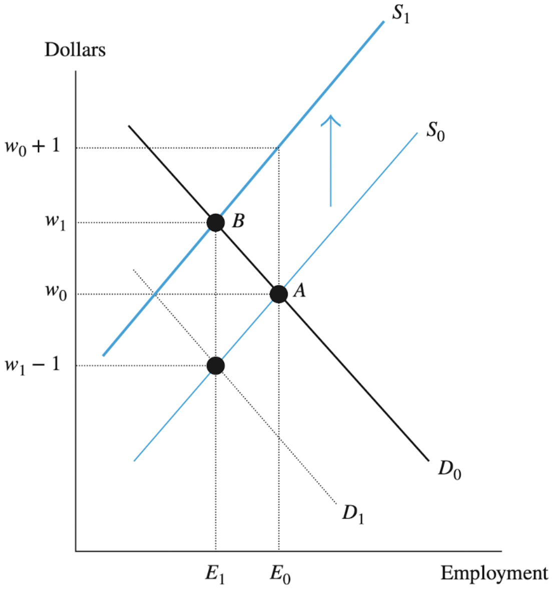


Figure 4: Payroll Tax Imposed on Workers

1.3.3 When Will the Payroll Tax Be Shifted Completely to Workers?

When the labor supply is perfectly inelastic, the entire burden of the payroll tax is shifted to the worker, as illustrated in Figure 5.

FIGURE 4-6 Inelastic Supply and a Payroll Tax Imposed on Firms
A payroll tax imposed on the firm is shifted completely to workers when the labor supply curve is perfectly inelastic. The wage is initially w_0. The \$1 payroll tax shifts the demand curve to D_1, and the wage falls to $w_0 - 1$.

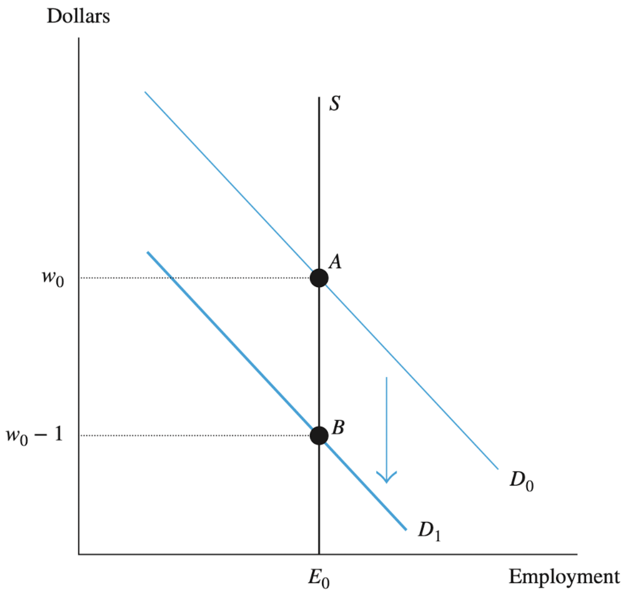


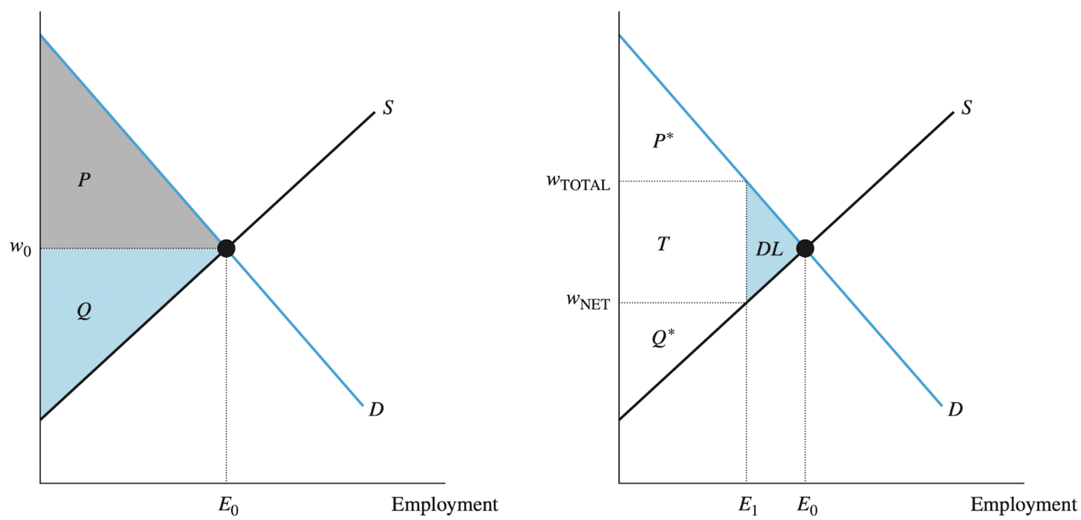
Figure 5: When Payroll Tax is Shifted Completely to Workers

1.3.4 Deadweight Loss

Figure 6 displays the reduction in the total surplus – aka the deadweight loss – that results from the imposition of a payroll tax. Recall that the initial equilibrium is at (E_0, w_0), and the new equilibrium after the tax is at (E_1, w_{NET}), where the firm pays w_{TOTAL} and the worker receives w_{NET}. Now, the total surplus has been reduced by the DL triangle. The consumer surplus now becomes Q^*, rather than Q; the producer surplus now becomes P^*, rather than P; and the government collects tax revenue equal to the rectangle T.

If you look back at Figure 5, you can see that when the labor supply is perfectly inelastic, there is no deadweight loss from the imposition of the tax, and the producer surplus remains the same. All that changes is a transfer of consumer surplus to the government in the form of tax revenue. Specifically, the rectangle characterized by $w_0AB(w_0 - 1)$ is transferred from consumer surplus to government revenue.

FIGURE 4-7 **Deadweight Loss of a Payroll Tax**
(*a*) In a competitive equilibrium, E_0 workers are hired at a wage of w_0. The triangle P gives the producer surplus and Q gives the worker surplus. The total gains from trade equal $P + Q$. (*b*) The payroll tax reduces employment to E_1; raises the cost of hiring to w_{TOTAL}; and reduces the worker's take-home pay to w_{NET}. The triangle P^* gives the producer surplus; the triangle Q^* gives the worker surplus; and the rectangle T gives the tax revenues. The net loss to society, or deadweight loss, is given by the triangle DL.



(*a*) No-Tax Equilibrium

(*b*) Payroll Tax Equilibrium

TABLE 4-1
Welfare Implications of a Payroll Tax

	No-Tax Equilibrium	Payroll Tax Equilibrium
Producer surplus	P	P^*
Worker surplus	Q	Q^*
Tax revenues	—	T
Total gain from trade	$P + Q$	$P^* + Q^* + T$
Deadweight loss	—	DL

Figure 6: Deadweight Loss

1.3.5 Employment Subsidies

Figure 7 illustrates the effect of an employment subsidy of \$1. Effectively, this does the opposite of the payroll tax in terms of its effect on the demand curve; that is, the demand curve uniformly moves up by the size of the subsidy.

Under this setup, the equilibrium moves from A to B, where at B, the worker receives a wage of w_1, while the firm only has to pay $w_1 - 1$.

FIGURE 4-8 **The Impact of an Employment Subsidy**
An employment subsidy of \$1 per worker hired shifts the demand curve from D_0 to D_1, increasing employment. The wage that workers receive rises from w_0 to w_1. The cost of hiring falls from w_0 to $w_1 - 1$.

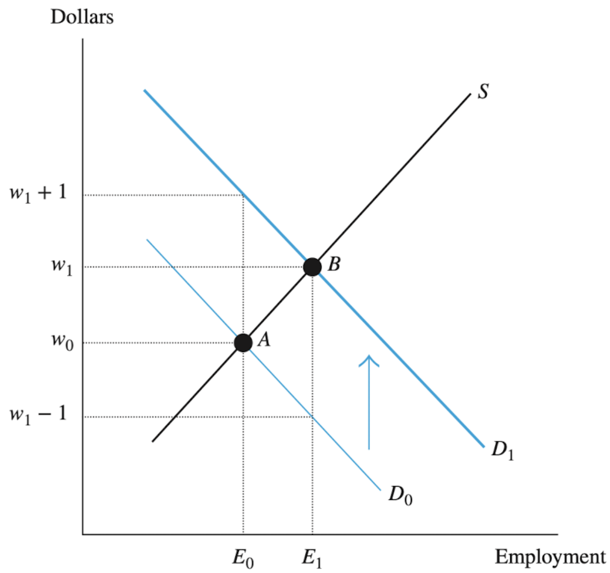


Figure 7: Employment Subsidy

The effect of the subsidy on employment will depend both on the labor supply elasticity and the labor demand elasticity. How it depends on the labor supply elasticity may be intuitive; if workers are very responsive to an increase in the wage, then more employment will be generated by the subsidy, and vice versa.

Figure 8 is a very quick demonstration that I draw of how the demand elasticity also impacts the effect on employment. For example, in the first panel, if demand is perfectly inelastic, then the subsidy naturally has no effect on employment. In the second panel, if demand is reasonably elastic, then the subsidy may have a more notable impact. The third panel shows the smaller effect when demand is reasonably inelastic but not perfectly inelastic.

1.4 Policy Application: Mandated Benefits

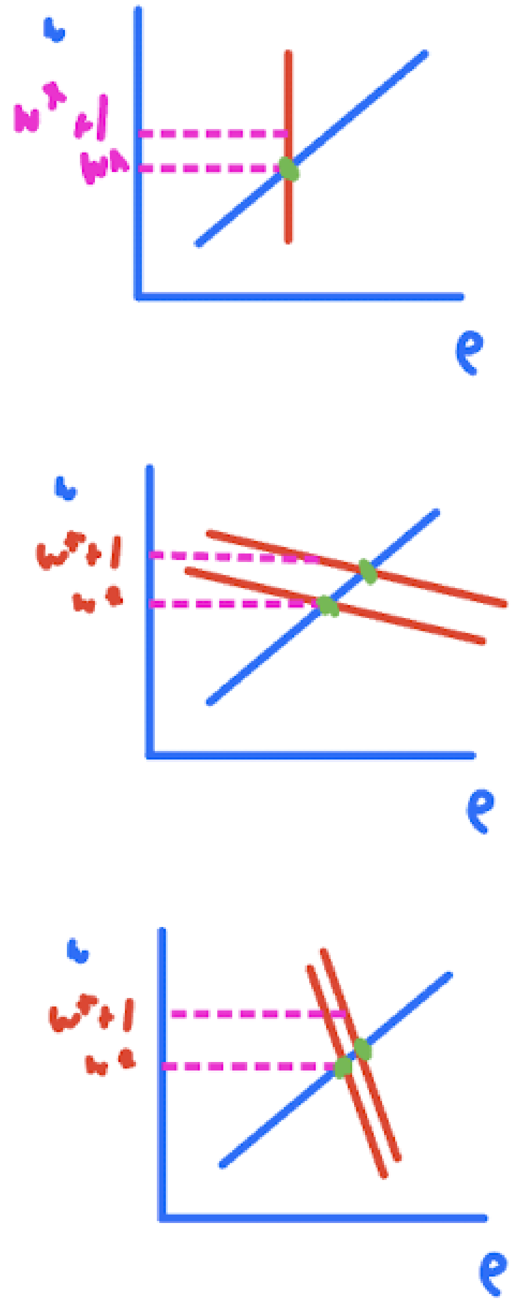


Figure 8: Impact of Demand Elasticity on Employment