1. Equilibrium: a situation in which there’s no built-in tendency for things to change
   A. in the labor market, the condition for equilibrium is that the quantity of labor supplied equals the quantity of labor demanded (thus, no unemployment – but see Chapter 12)
   B. efficiency of equilibrium:
      at \(\{w^*, E^*\}\), sum of producers’ + workers’ surplus is maximized
      \(\rightarrow\) at \(E_L\), value of marginal product > reservation wage of the marginal worker, so total surplus would rise if \(E\) rose
      \(\rightarrow\) at \(E_H\), value of marginal product < reservation wage of the marginal worker, so total surplus would rise if \(E\) fell
2. Multiple labor markets and competitive equilibrium
   A. labor markets may be linked by job search and migration (“arbitrage”)
   B. example: workers leave low-wage market for higher wages
      wages rise in the low-wage area, wages fall in the high-wage area; total surplus rises
      (like Adam Smith’s “invisible hand”)

   C. however, no implication that convergence of labor markets will happen “quickly”
      (“conditional convergence”: convergence will be faster if labor markets are
      already fairly similar – e.g., US-Canada vs. US-China)
D. *cobweb model* of market adjustment: original equilibrium at \( \{w_0, E_0\} \); then \( D \) rises very short-run supply is totally inelastic, so with this “shortage,” wage rises to \( w_1 \) …

- attracted by \( w_1 \), quantity supplied eventually rises to \( E_1 \) – creating “oversupply”
- since *short*-run supply is totally inelastic, wage drops to \( w_2 \)
- so *long*-run quantity supplied drops to \( E_2 \) – creating a “shortage” (again)
- so wage rises to \( w_3 \) – etc. etc.
- thus, the process traces out a “cobweb” but eventually converges on \( \{w^*, E^*\} \)
3. Market imperfection: Monopoly (NB: refers to *product/output* market)

A. When output demand curve slopes down, \( MR = [1 + (1/\eta_{Q,P})]P \)
so \( MR < P \), so MR curve lies *below* the output demand curve

**proof:** \( R = PQ = P(Q)Q \)  with \( P'(Q) = dP/dQ < 0 \) (downward-sloping demand curve)

so \( \frac{dR}{dQ} = \frac{dP}{dQ}Q + P \frac{dQ}{dQ} = [(dP/dQ)(Q/P) + 1] P \)

so \( \frac{dR}{dQ} = MR = [1 + (1/\eta_{Q,P})]P \), where \( \eta_{Q,P} = (dQ/dP)/(P/Q) < 0 \)
(elasticity of demand for Q with respect to P)
C. Now consider market equilibrium: where MR = MC
   - We know that MC = w/MPE (in long run, MC must also equal r/MPK)
   - So here, equilibrium implies \[1 + (1/\eta_{Q,P})]P = w/MPE\] and \{[(1 + (1/\eta_{Q,P}))P]\} MPE = w
     (i.e., MR \times MPE = wage, or MRPE = wage)
   - Thus, in equilibrium, [1 + (1/\eta_{Q,P})] MPE = w/P, implying that w/P < MPE
     (“exploitation”)
   - Also, employment is below the level that would prevail under competition

D. text: “Some evidence” that monopolists’ wages are 10% higher than competitive wage (how come???)
4. Market imperfection: Monopsony (NB: refers to input/labor market)
   A. When input supply curve slopes up (as for monopsonist), MCE = \[1 + (1/\varepsilon_{E,w})\]w so that MCE > w, so that MCE curve lies above input supply curve (MCE = marginal cost of employment)

   B. proof: \(C = wE = w(E)E\) with \(w'(E) = dw/dE > 0\)

   \[
   \begin{align*}
   \frac{dC}{dE} &= \frac{dw}{dE}E + w \frac{dE}{dE} = \left(\frac{dw}{dE}\right)\left(\frac{E}{w}\right) + 1\right]w \\
   \end{align*}
   \]

   so MCE = \[1 + (1/\varepsilon_{E,w})\]w, where \(\varepsilon_{E,w} = (dE/dw)(w/E) > 0\) (= elasticity of labor supply with respect to w) since \(\varepsilon_{E,w} > 0\), it follows that \[1 + (1/\varepsilon_{E,w})\] > 1, so MCE > w
C. note that monopsony equilibrium has wage = \( w_M \) (with MCE > \( w_M \) at \( E_M \))

D. now consider market equilibrium: where MR from labor = MC of labor
\( MR = \) value of the marginal product of labor, i.e., \( MR = P \times MPE \)
\( MC = [1 + (1/\varepsilon_{E,w})]w \)

so here, equilibrium implies \( P \times MPE = [1 + (1/\varepsilon_{E,w})]w \), or \( MRPE = [1 + (1/\varepsilon_{E,w})]w \)
so that, in equilibrium, \( MPE / [1 + (1/\varepsilon_{E,w})] = w/P \)
implies that, in equilibrium, \( w/P < MPE \) (“exploitation”)

note also that employment \( E_M \) is below the level \( E_C \) that would prevail in competition

E. above result refers to nondiscriminating monopsonist (everyone gets the same wage)
a discriminating monopsonist pays each worker his/her reservation wage and
encapsulates all surplus (workers get none) – average wage will be below the
competitive level \( w^* \), but employment will equal the competitive level \( E^* \)
F. Minimum wage revisited
1. minimum wage prohibits workers from selling their labor for less than \( w_{\text{Min}} \)
2. so introducing a minimum wage *changes the marginal cost of labor curve*, from \( abc \) (in absence of the minimum) to \( defbc \) (in presence of the minimum)
3. thus, *after* introducing \( w_{\text{Min}} \), equilibrium employment will be at \( E_{\text{min}} \), which will be *greater* than \( E_{\text{Mon}} \) (*provided* isn’t set too high)
5. Payroll taxes: a tax $T$ per worker imposed on employers
   A. this generates two labor demand curves:
      • $D_0$ shows the maximum total amount that employers are willing to pay for labor
        (the tax doesn’t change this)
      • $D_1$ shows the maximum that employers are willing to pay workers
        (this was previously the same as $D_0$, but now is lower by the amount of the tax $T$)
      • Amount of tax = $T = \text{vertical distance between } D_0 \text{ and } D_1$
B. in **pre-tax** equilibrium, wage = $w_0$, employment = $E_0$
   in **post-tax** equilibrium, employment = $E_1$
   worker is paid $w_{1w}$
   employer’s total cost of labor = $w_{1E}$
   worker’s wage has **fallen** from $w_0$ to $w_{1w}$
   employer’s cost of labor has **risen** from $w_0$ to $w_{1E}$
   thus, some of the tax imposed on employers has been shifted to workers!

C. ceteris paribus, the tax will have the same effects if imposed on **workers**!
   this tax will generates **two** labor supply curves:
   - $S_0$ shows the minimum *total* amount that workers would accept in order to work
     (the tax doesn’t change this)
   - $S_1$ shows the minimum that workers will require *employers* to pay them
     (this was previously the same as $S_0$, but now is higher by the amount of the tax $T$)
   - Amount of tax = $T =$ vertical distance between $S_0$ and $S_1

\[ [\text{Compare outcomes if we shift D curve down by as much, T, as S curve was shifted up!}] \]
D. net impact of the tax:
- Workers and employers end up sharing the cost of the tax (employers shift some of the tax onto workers, or vice-versa, depending on who initially pays the tax)
- Employment drops
- Tax generates a deadweight loss (sum of employers’ + workers’ surplus decreases)
5. Payroll subsidies ("negative taxes"): a subsidy $Z$ per worker paid to employers

A. this generates **two** labor demand curves:
   - $D_0$ shows the value of labor’s marginal product (the subsidy doesn’t change this)
   - $D_1$ shows the maximum that employers are willing to pay *workers* (this was previously the same as $D_0$, but now is higher by the amount of the subsidy $Z$)
   - Amount of subsidy $= Z = $ vertical distance between $D_0$ and $D_1$

B. in **pre**-subsidy equilibrium, wage $= w_0$, employment $= E_0$
   in **post**-subsidy equilibrium, wage $= w_1$, employment $= E_1$
   note that firms and workers share the subsidy, just as they would “share” a tax!
C. net effect of subsidy would be the same if paid to workers instead of employers!

D. net impact of subsidy:
- workers and employers end up *sharing* the subsidy (workers get a higher wage, firms pay a lower wage)
- employment rises
- subsidy generates a deadweight loss (sum of employers’ + workers’ surplus falls) – intuitively, this is because labor is now paid more than the value of its marginal product (VMPL): $w_{1w} > w_{1E} = \text{VMPL}$
\[ k \text{ subsidy} = Z \text{ per worker} \times E_1 \text{ workers} = \text{area of } (A + B + D + E + F + G) \]

<table>
<thead>
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<th>surplus</th>
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<th>after</th>
<th>change</th>
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<td>worker</td>
<td>B+C</td>
<td>A+B+C+D</td>
<td>A+D</td>
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<tr>
<td>employer</td>
<td>A</td>
<td>A+B+E+F</td>
<td>B+E+F</td>
</tr>
<tr>
<td>*government</td>
<td>0</td>
<td>-(A+B+D+E+F+G)</td>
<td>-(A+B+D+E+F+G)</td>
</tr>
</tbody>
</table>

deadweight loss

\[ -G \]
6. Application: Payroll taxes vs. mandated benefits (health insurance, etc.)

A. mandated (required) benefit is like a payroll tax – imposes added cost on employer

B. key question: is the benefit’s *cost to the employer* greater/less than its value *perceived by the worker*?

C. if cost of benefit to employer > perceived value to worker,
   D curve shifts down by more than S curve so wage falls, employment falls (see below, left)

D. if cost of benefit to employer < perceived value to worker,
   D curve shifts down by less than S curve so wage falls, employment rises (see below, right)
7. Application: Immigration

A. impact on wages of natives: negative if immigrants are substitutes for native labor, positive if complements with native labor

![Diagram showing wage effects of immigration]

B. empirical evidence: slight negative impact of immigration on native wages (but hard to keep ceteris paribus)
C. difference-in-difference analyses:

*change* in outcome for “experimentals” – *change* in outcome for “controls”

**Card’s study of Mariel boatlift:**
- wages, employment of natives in Miami changed very little after Mariel boatlift relative to changes in “control” cities w/no boatlift:
  - diff-in-diff estimate for Miami (relative to “control cities”) implies black unemployment actually *fell* (but not statistically significantly so) after Mariel
- the Mariel boatlift that never happened (1994: Cuban refugees *returned to Gitmo*):
  - here, diff-in-diff estimate implies that black unemployment rate in Miami rose by a statistically significant amount!

D. so, problem for simple theory: why don’t huge supply shifts due to immigrants have an effect on wages?

E. possible answer: when immigrants move in, some natives move out or don’t arrive; this drives natives’ wages down elsewhere, and defeats the diff-in-diff method: the other cities aren’t valid control groups – e.g., the Miami/Pittsburgh example (consider flu shots: even the outcome for “controls” who didn’t get the vaccine may be affected by the outcome for the “experimentals”)

➔ see graphs, next page
Influx of immigrants shifts supply curve from $S_0$ to $S_1$. Natives leave, so supply shifts back to $S_2$. On balance, wage falls to $w^*$.

Natives who left Miami arrive in Pittsburgh. Supply curve shifts to $S_1$, wage falls to $w^*$. 
example: California (Figure 4-15)
total population in CA has grown continuously,
but population of natives in CA tapered off after 1970
(but beware of “post hoc” fallacy!)

thus,
• Some of the effect of immigration may be felt in cities with few immigrants
• Diff-in-diff methodology may be invalid for studying immigration’s effect on wages
• Across-city comparisons may not tell us anything useful about impact of immigration,
  because immigration can affect wages in all cities, not just those in which the
  immigrants happen to be located (e.g., the “flu-shot” example)

an alternative: looking at national data
Borjas (Figure 4-16) finds that occupations with greater change in immigrant share
of employment have slower wage growth