Flows, bargaining and unemployment.

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This third model takes as its starting point that the labor market is a decentralized market, with large flows in and out of jobs, and decentralized wage bargaining. The purpose is to characterize the equilibrium level of unemployment and its determinants. The model will serve as a building block for many extensions later.

The presentation of the model is a bit different from the usual one. This is actually to make the model look more like those we have seen before, with a wage equation/labor supply relation, and short- and long-run demand relations, determining the equilibrium. But the model is a close cousin to—and builds on—those developed over time by Diamond (1982), Pissarides (1990), and Pissarides and Mortensen (1997), among others.

1 The general picture

(1) Job creation and destruction.

Jobs are continually created and destroyed. New jobs are productive; if paired with a worker, they produce $y$. Thus, new jobs look for workers. Jobs become

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unproductive with instantaneous probability $s$, and are then closed. Workers in jobs that become unproductive look for new jobs.

(2) Unemployment, vacancies and matching.

Let the number of workers looking for jobs, unemployment, be equal to $u$. Normalize the labor force to be one, so that this is also the unemployment rate. Let the number of workers employed (equivalently the employment rate) be equal to $n = 1 - u$. Let the number of jobs looking for workers, vacancies, be equal to $v$.

The process through which workers and jobs find each other is represented by a matching function. The number of matches, or equivalently, hires is given by:

$$ h = m(u, v); \quad m_u \geq 0, m_v \geq 0 $$

(1.1)

The number of hires is increasing both in the number of workers looking for jobs, and in the number of firms looking for workers. Explicit models of how firms and workers meet suggest that there could be increasing returns (Diamond 1982 JPE). In practice, estimates suggest roughly constant returns: a doubling of the number of unemployed and of the number of vacancies roughly leads to a doubling of hires (Blanchard and Diamond 1989). So I shall assume $m(\ldots)$ to have constant returns to scale.

The dynamics of unemployment are thus given by:

$$ \frac{du}{dt} = s(1-u) - h $$

(1.2)

and in steady state, separations are equal to hires: $s(1-u) = h$.

(3) Free entry

The creation of new jobs is determined by a free entry condition. Forgetting adjustment costs, it costs $k$ to create a new job. You can think of this as a machine which must be bought when the job is created, and becomes useless when the job
becomes unproductive.\footnote{This link between the depreciation of machines and job destruction is too tight. Thinking about how much of the capital stock is sunk in jobs is important. I shall return to it in the next lecture notes.} Thus, there is net creation/destruction of jobs until the value of a new job is equal to the cost. Assume the interest rate, \( r \) to be constant (Note that this model has the same asymmetry between the supply of labor and the supply of capital as model number 2: The total supply of labor is fixed at 1. In the long run, the constant interest rate assumption implies that the supply of capital is fully elastic.)

The equilibrium can be characterized in a very similar way to that in the previous model. The wage set in bargaining is a decreasing function of the unemployment rate: "Labor supply"—recall the semantic discussion from earlier—is upward sloping. At any point in time, employment is fixed: the short run labor demand is fully inelastic. In the long run, zero net profit determines the wage: the long run labor demand is fully elastic.

2 Labor supply. Wage bargaining and wage determination

Suppose that a worker and a job/firm have met. They have the choice of either deciding to produce together, or to search for another match. They clearly have a strong incentive to produce together given that the next match will be no better. What wage will they choose?

(1) Consider the problem of the worker. Assume that he is risk-neutral, and consumes current income (A very useful assumption, but one that will need to be relaxed when we think about saving decisions, and consumption when unemployed). Let \( w \) be the wage paid by the firm and thus consumption when employed. Let \( b \) be the level of consumption when unemployed; assume that leisure
yields no utility, or else is subsumed in $b$. You can think of $b$ as reflecting unemployment benefits. $b$ is also called the reservation wage: no worker will accept a wage less than $b$, as he would better off not working.

Let $V_E$ be the expected present value of consumption if currently employed, $V_U$ be the expected present value if currently unemployed. Both satisfy arbitrage-like equations (If you feel rusty, look at Diamond RESStud 1982, or Pissarides 1990):

\begin{align}
rV_E &= w + s(V_U - V_E) + dV_E/dt \\
rV_U &= b + (h/u)(V_E - V_U) + dV_U/dt
\end{align}

Take the first equation. The right hand side is the “flow” plus the “expected capital gain or loss” from “holding the asset”, with the asset defined as the expected present value of consumption if currently employed. The first term is the wage, $w$. The second term reflects the fact that, with probability $s$, the job is destroyed, and the asset declines in value from $V_E$ to $V_U$. The third denotes the change in the value of being employed, if the job remains productive. The right-hand-side of the equation must be equal to the “opportunity cost of holding the asset,” namely the interest rate times the value of the asset, the left-hand-side of the equation. A similar interpretation applies to the second equation. Note that $(h/u)$, the ratio of hires to unemployment is the probability of finding a job when unemployed; this variable plays a central role in this class of models; it is also called the exit rate from unemployment, or the hazard rate from unemployment.

Taking the difference between the two equations and reorganizing gives the surplus to the worker from becoming employed:

\begin{equation}
V_E - V_U = \frac{1}{r + s + h/u}[(w - b) + (dV_E/dt - dV_U/dt)]
\end{equation}

Not surprisingly, the surplus depends on the difference between the wage and the
reservation wage, \((w - b)\). It also depends on labor market conditions, measured by \((h/u)\). The higher \((h/u)\), the lower the surplus from becoming employed: if it is very easy to find a job, being unemployed is no big deal. If \((h/u)\) is low, if the unemployment pool is stagnant, being unemployed is very different from being employed: the surplus is large.

(2) Consider the problem of the firm. The firm (or, more precisely, its owners) is risk neutral. Let \(V_F\) be the value of a job when matched with a worker, the value of a filled job. Let \(V_V\) be the value of a job when looking for a worker, the value of a vacancy. Following the same logic as before, these two values satisfy the following equations:

\[
\begin{align*}
    rV_F &= (y - w) - sV_F + dV_F/dt \\
    rV_V &= 0 + (h/v)(V_F - V_V) - sV_V + dV_V/dt
\end{align*}
\]  

(2.4)  
(2.5)

Take the first equation. The first term on the right is the flow of profit, the second reflects the probability that the job becomes unproductive, and the third reflects the change in the value of the job if it remains productive. The sum of these terms must be equal to the shadow cost of holding the asset, the left hand side. Take the second equation. When a job is vacant, profit is zero. The probability that it gets filled is \((h/v)\). The third term reflects again the probability that the job becomes unproductive, while vacant. The fourth reflects the change in the value of a filled job, when it remains productive.

Taking the difference between the two and reorganizing gives the surplus to the firm of hiring the worker:

\[
V_F - V_V = \frac{1}{r + s + h/v}[(y - w) + (dV_F/dt - dV_V/dt)]
\]  

(2.6)

Not surprisingly, the surplus depends on profit, \((y - w)\). It also depends on labor market conditions, measured by \((h/v)\): the higher \((h/v)\), the easier it is to fill a
job, and the smaller the difference between a vacant and a filled job.

(3) A plausible assumption is that the wage is chosen so as to split the total surplus in some proportion between the firm and the worker — the generalized Nash bargaining solution. Let \( S = V_E - V_U + V_F - V_V \) be the total surplus. Then, we may assume that \( w \) is chosen so that:

\[
V_E - V_U = \beta S, \quad V_F - V_V = (1 - \beta)S
\]

How should we think of the value of \( \beta \)? One popular way is to think in terms of a Rubinstein game, with \( \beta \) reflecting the order of offers and counteroffers, and the relative impatience of the two sides. In truth, this is a parameter we are a bit uneasy about. For simplicity and following a long tradition, I shall choose \( \beta = 1/2 \). In this case:

\[
V_E - V_U = V_F - V_V = S/2
\]

Solving for the wage using (2.3) and (2.6), and rearranging gives:

\[
w - b = \frac{r + s + h/u}{2r + 2s + h/u + h/v} (y - b) + \frac{(1/2)(h/v - h/u)}{2r + 2s + h/u + h/v} \frac{dS}{dt} \tag{2.7}
\]

where the equation of motion for the surplus itself is given by:

\[
S = \frac{1}{r + s + h/u} \left[ 2(w - b) + \frac{dS}{dt} \right]
\]

The wage set in bargaining is a function of the reservation wage \( b \), of the level of output \( y \), of labor market conditions summarized by \( (h/u) \) and \( (h/v) \), and a few other parameters. The expression looks complicated but it is in fact quite simple. I now turn to a discussion of it, and of a number of modifications/extensions.
3 Thinking about wage determination

Simplifications and approximations

(1) Note first that the wage depends not only on current, but also on expected future conditions, through $dS/dt$. To a first approximation, we can however forget this last term. Note that it is multiplied by the difference between the exit rate from vacancies and the exit rate from unemployment, a difference which is ambiguous in sign. Because of this ambiguity, it is not clear a priori whether, for example, an increase in output, $y$, in the future, leads to an increase or a decrease in the wage today. (Can you explain why this is ambiguous?)

(2) Second, note that labor market conditions matter in two ways. A higher $(h/v)$, a higher probability of filling the vacancy if agreement is not reached with the current worker, makes the firm stronger in bargaining. This decreases the wage. Similarly an increase in $(h/u)$, in the probability of finding a job if unemployed, makes the worker stronger in bargaining and leads to an increase in the wage.

Note however that $(h/v)$ and $(h/u)$ are not independent. From the matching function and the assumption of constant returns, we get:

$$ h/v = m(u/v, 1) \quad \text{and} \quad h/u = m(1, v/u) $$

Both depend only on the ratio of vacancies to unemployment. The higher the ratio of vacancies to unemployment, the higher the exit rate from unemployment, the lower the rate at which firms fill vacancies. A convenient case is the Cobb Douglas case with equal exponents on $u$ and $v$ (a case that seems to fit the U.S. data quite well. see Blanchard and Diamond 1989). Let the matching function be given by:

$$ h = m \sqrt{uv} \quad \text{(3.1)} $$

where $m$ is now a parameter. Then the two exit rates are related by the simple
inverse relation:

\[(h/v) = m^2/(h/u)\]  \hspace{1cm} (3.2)

Replacing \((h/v)\) in the wage equation and ignoring the term in \(dS/dt\) gives:

\[w - b = \frac{r + s + h/u}{2r + 2s + h/u + m^2/(h/u)} (y - b)\]  \hspace{1cm} (3.3)

An increase in the exit rate from unemployment leads to an increase in the wage through two channels. As the exit rate increases, it is easier for workers to find a job if unemployed; as workers have less to lose, this leads to an increase in the wage. And it is harder for firms to fill a job; as firms have more to lose, this also leads to an increase in the wage.

As the exit rate goes to zero (the labor market becomes more and more depressed), the wage tends to the reservation wage: \(w \rightarrow b\). As the exit rate goes to infinity (the labor market becomes tighter and tighter), the wage tends to the level of output: \(w \rightarrow y\).

(3) Consider rough values for the parameters and expressions in (3.3). The interest rate is of the order of 0.5% per month. The separation rate from employment in the United States is of the order of 2-3% a month. Both \((h/u)\) and \((h/v)\) are much larger. The probability of exiting unemployment each month in the United States is roughly 30%. The probability of filling a vacancy is even higher: the average duration of a vacancy is less than a month. Thus, the terms in \(r\) and \(s\) are small compared to \((h/u)\) and \((h/v)\), and a good approximation to the equation (2.7) is:

\[\frac{w - b}{y - b} \approx \frac{h/u}{h/u + h/v} = \frac{1}{1 + (u/v)}\]  \hspace{1cm} (3.4)

And under the Cobb Douglas assumption for the matching function:

\[\frac{w - b}{y - b} = \frac{(h/u)^2}{(h/u)^2 + m^2}\]  \hspace{1cm} (3.5)
The U.S. Unemployment Rate and The Exit Rate from Unemployment (Inverse scale), 1968–1986

Exit rate from unemployment (Inverse scale) (percent)

Year


88 87 86 85 84 83
The wage is an increasing function of the exit rate from unemployment—but, note, not of the unemployment rate itself. What matters fundamentally to workers is not how many of them are unemployed, but how likely they are to find a job.

(4) Should we expect a relation between the wage and the unemployment rate itself? This clearly depends on the relation between the exit rate from unemployment and the unemployment rate. Empirically, the (inverse) relation is close in time series. The relation between the two for the U.S. for the period 1968-1986 is drawn in Figure 1. Across countries, the relation is still there, but less close. The theory we are developing will help shed light on why.

Extensions and modifications

(1) No matching problem for firms.

A striking fact about the U.S. labor market is the short average duration of vacancies, less than a month. This suggests exploring what happens if firms have no problem filling a vacancy. Think of the unemployed as waiting at one giant factory gate: firms that need to fill a vacancy just need to open the gate. And given a flow of hires, \( h \), and an unemployment pool \( u \), the exit rate from unemployment is equal to \( h/u \). (The matching function relation (1.1) no longer applies.)

The surplus from being employed for a worker is still given by (2.3). The surplus from having a job filled rather than vacant is still given by (2.6). But it is now equal to zero; if a worker leaves, another can be hired on the spot (take \( h/u = \infty \) in (2.6)). Thus, under the rule that the wage splits the total surplus equally, it must be that \( V_E - V_U = V_F - V_V = S = 0 \), and thus:

\[
\omega = b
\]  

(3.6)

Workers just get their reservation wage. The wage relation has then the usual competitive reverse L shape, flat at \( \omega = b \) until \( u = 0 \), vertical thereafter. The reason is a simple one: because they can replace workers at no cost, firms have all
the bargaining power, and thus can push the wage down to the reservation wage.

(2) No matching problem, but a cost of separation.

Suppose that once the worker and the firm has met, separation implies a cost to the firm. For example, the firm must give initial training to the worker (training lasts one instant) at cost \( c \), the worker cannot or does not want to pay it up front (this is called the "bonding issue" in the literature), and, after the worker has been trained, he can renegotiate. Another possibility that we shall explore at more length later is a state-imposed firing cost: Once the worker has been officially hired, laying him off implies a cost \( c \). Knowing this, the worker renegotiates after being officially hired.

In this case, the cost to the firm of separating and hiring another worker is equal to \( c \) — independent of labor market conditions because of the assumption that firms do not face matching problems. Thus, Nash bargaining implies:

\[
V_E - V_U = c
\]  

(3.7)

This in turn implies \( dV_E/dt - dV_U/dt = 0 \). Solving out for the wage implied by Nash bargaining gives:

\[
w - b = c(r + s + (h/u))
\]  

(3.8)

Note that the wage now does not depend on the level of output. It is a function of the cost \( c \), and of labor market conditions \( h/u \). The higher the exit rate from unemployment, the higher the wage.

If this reminds you of another familiar model, you are right. This is exactly the same expression as that for the wage in the efficiency wage Shapiro-Stiglitz model. There, firms want to pay workers more than their reservation wage to make it costly for them to be fired if they shirk. This shows the close connection between these models.
It also points to other factors than matching frictions in determining the wage. If separating implies a loss to one side (not only because of the need of finding a new match, but because of a sunk cost in the relation), this will translate into more bargaining power for the other side. This is the generic approach taken by Caballero and Hammour, and we shall explore it later.

4 Labor demand.

The value of a new job, productive but vacant, is equal to $V_V$. Ignoring costs of adjustment, the cost of creating a new job is $k$. Thus, in steady state, the free entry condition implies:

$$V_V = k$$

(4.1)

Using equation (2.5) and (2.6), together with the fact that in steady state, $dV_F/dt = dV_V/dt = 0$, gives:

$$\frac{1}{s + r} \frac{h/v}{r + s + h/v} (y - w) = k$$

Rewriting gives us the wage consistent with free entry:

$$w = y - \left(\frac{r + s}{h/v} + 1\right)(r + s)k$$

Assume first that firms do not face matching problems, so that $(h/v) = \infty$ and the term in brackets is equal to one. The wage consistent with zero net profit is then equal to $w = y - (r + s)k$: the wage must be equal to output minus the user cost of capital, itself equal to $r$ plus $s$ —which in this expression reflects depreciation.

Now return to the term in brackets. It reflects the fact that jobs are initially created vacant, and thus do not produce until the firm has hired a worker. The lower $(h/v)$, the longer it takes on average to hire a worker, the lower the feasible wage.

Assuming the matching function to be Cobb Douglas and symmetric in unem-
employment and vacancies gives:

\[ w = y - \left( \frac{(r + s)(h/u)}{m^2} + 1 \right)(r + s)k \]

This relation is the long-run demand relation in our model. The wage is a decreasing function of the exit rate from unemployment. We just saw the reason why: a higher exit rate for workers means a longer time for firms to fill a vacancy, and thus a lower wage to maintain the same level of profit. But it is important to realize that this effect is small: recall that the average duration of a vacancy is a few weeks, that of a match many years.

What happens in the short run depends on the dynamic costs of entry and/or of adjustment of capital. An assumption often made in the literature is that there is no cost of adjustment, so that the free entry condition holds all the time (for example Mortensen and Pissarides (1997)); this is a convenient but unappealing assumption, especially when the focus is on business cycle fluctuations. If, instead, costs of adjustment prevent discrete changes in capital (an infinite rate of change is infinitely costly), the short run labor demand is vertical. This comes from the Leontief nature of the technology: one unit of output requires \( k \) units of capital, and one worker.

5 Equilibrium and the determinants of unemployment

With an explicit specification of costs of adjustment for capital, one could characterize the dynamics of unemployment. I shall focus here just on the steady state.

We have two relations between the wage and the exit rate from unemployment. The first is the wage—or labor supply—equation. From above, in steady state, and under the assumption that the matching function is Cobb-Douglas:

\[ w - b = \frac{r + s + h/u}{2r + 2s + h/u + m^2/(h/u)} \left( y - b \right) \]

(5.1)
Figure 2. Equilibrium wage and exit rate.
This relation is drawn as the upward sloping curve in Figure 2. The wage is on the vertical axis. The exit rate from unemployment is on the horizontal axis. The wage relation starts at \( b \) and increases with \( (h/u) \) to asymptote \( y \).

The second relation is the free entry — or long run demand, equation. From above, and again under the assumption that the matching function is Cobb Douglas:

\[
    w = y - \left[ \frac{(r + s)(h/u)}{m^2} + 1 \right](r + s)k
\]

This relation is drawn as the downward sloping line in Figure 2. Recall that the effect of labor market conditions is small, so that the long run labor demand is nearly flat. It is drawn as such in Figure 2.

Together, the two relations determine the wage, \( w^* \), and the exit rate from unemployment, \( (h/u)^* \). Note that, in steady state, the inverse of the exit rate is equal to the average duration of unemployment, so that duration is given by \( 1/(h/u)^* \).

The unemployment rate itself is determined by the condition that the flow in be equal to the flow out:

\[
    u(h/u) = s(1 - u)
\]

or equivalently:

\[
    u^* = \frac{s}{s + (h/u)^*}
\]

(5.2)

If \( s \) is small relative to \( (h/u)^* \) — as it is empirically — then the unemployment rate is approximately equal to the separation rate divided by the exit rate, or equivalently to the separation rate times duration.

Two remarks before we look at the equilibrium more closely.

(1) If we assume instead that firms face no matching problems, but a fixed cost of separation, the characterization of the equilibrium is even simpler. It is recursive. The long run labor demand is flat, and determines the wage. The wage equation, (3.8) determines the exit rate required to make workers accept that wage. Equa-
tion (5.2) then determines the unemployment rate.

(2) The equilibrium can be characterized instead in the unemployment-vacancies space (for example Pissarides 1990).

The condition that new hires equal separations gives a first relation between unemployment and vacancies:

\[ m(u, v) = s(1 - u) \]

This gives an inverse relation between unemployment and vacancies.

The condition that the wage set in bargaining be consistent with the wage implied by free entry gives a second relation:

\[ b + \frac{r + s + h/u}{2r + 2s + h/u + h/v} (y - b) = y - \left[ \frac{r + s}{h/v} + 1 \right] (r + s) k \]

where \( h = m(u, v) \). Note that both \( (h/u) \) and \( (h/v) \) are functions only of \( (u/v) \), so that this relation is satisfied for a given ratio \( (u/v) \). This second condition thus gives us a line from the origin with slope depending on the parameters of the model.

I shall let you work out the equilibrium in that space. I have chosen a representation in terms of wages and exit rates to make the comparison with traditional labor supply labor demand models easier. But the alternative representation is often useful. Indeed looking at the co-movements in unemployment and vacancies can tell us something about the nature of the shifts behind changes in unemployment; these comovements are known as the Beveridge relation, or Beveridge curve. For how to use the Beveridge curve as a diagnostic tool, see for example Blanchard and Diamond 1989. (When we look at different shifts below, make sure that you characterize what happens in the unemployment-vacancy space as well.)

**Determinants of unemployment**
Let's now return to our discussion of the determinants of unemployment in the light of this model. (In each case, draw the shifts in the two relations drawn in Figure 2, and characterize the equilibrium graphically.)

(1) Changes in the degree of reallocation, measured by changes in the separation rate, affects the unemployment rate more than one for one. Other things equal, stagnant economies are thus likely to have a lower unemployment rate, dynamic economies a higher one.

To see why, consider the effects of the separation rate first on the exit rate, and then on the unemployment rate.

Take the wage equation: an increase in $s$ affects the wage, but the sign of the effect is ambiguous, and the effect is likely to be small in size. The source of the ambiguity is that an increase in $s$ decreases the horizon of the match and, as this affects both sides, the effect on the current wage is ambiguous (check that it depends on the sign of $(h/u - h/v)$.)

Take the free entry condition. Because we have assumed that the machine dies with the job, an increase in $s$ is like an increase in the depreciation rate. This requires a decrease in the wage to allow firms to break even, and the labor demand relation shifts down. This decreases the exit rate, equivalently increases duration: such an increase in duration is needed to force workers to accept the lower wage. How important is this effect? It may be less important than our model suggests: the link between job destruction and machine destruction is likely to be less strong than we have formalized.

If we assume that the second effect dominates, an increase in $s$ leads to a lower feasible wage, and thus an increase in unemployment duration. Together with the direct effect of $s$ on $u$ from equation (5.2), this implies that the unemployment rate moves more than one for one with $s$. A doubling of the flow into unemployment, at unchanged duration, leads to a more than doubling of the unemployment rate.
(2) The efficiency of the matching process, or the role of unemployment in matching, also has a strong effect on unemployment. The more efficient the matching, the lower the unemployment rate.

Consider, say, a doubling of $m$, the efficiency of matching in the Cobb Douglas matching function. The main effect here is through the wage equation. (Recall that the effect of labor market conditions, and by implication of $m$, on the feasible wage in the free entry equation is small, and can, again to a first approximation, be ignored). Ask what must happen to the exit rate from unemployment to maintain the same wage. The answer is: to a first approximation, the exit rate must double.

To see why, recall the approximation to the wage equation when we take into account that $r$ and $s$ are small relative to both $(h/u)$ and $(h/v)$:

$$\frac{w - b}{y - b} \approx \frac{h/u}{h/u + h/v}$$

And recall, from the specification of the matching function, that:

$$(h/v)(h/u) = m^2$$

Now check that if both $(h/v)$ and $(h/u)$ double when $m$ doubles, both equations are still satisfied. If the exit rate from unemployment roughly doubles, then equation (5.2) then implies that the unemployment rate roughly halves.

If we think of matching as depending more generally on the degree of match between the skills of workers relative to the requirements of jobs, this points to a second factor in the determination of unemployment, what some labor economists have called mismatch. The higher the degree of mismatch, the higher the unemployment rate. Times of high reallocation may thus increase unemployment both directly, as we saw earlier, and indirectly through a larger mismatch between workers and jobs.
(3) The reservation wage affects unemployment duration and the unemployment rate. In particular, the more generous unemployment insurance, the longer the duration of unemployment and the higher the unemployment rate.

In this model, the reason has nothing to do with search, but with the effect of the reservation wage on wage determination. The higher the reservation wage, the higher the wage for given labor market conditions. To reconcile the wage set in bargaining with the unchanged wage consistent with zero net profit, unemployment must be more painful: the exit rate must decrease, duration must increase. And, in turn, from equation (5.2), the longer the duration of unemployment, the higher the unemployment rate.

(4) An increase in productivity not fully matched by a proportional increase in the reservation wage, leads to a decrease in unemployment duration, and thus a decrease in unemployment.

A useful exercise here is to derive the set of conditions needed for an increase in $y$ to be consistent with an unchanged exit rate and thus an unchanged unemployment rate. Suppose that $y$ increases by a factor $\lambda > 1$. And suppose, to avoid effects through the capital-output ratio, that a job now requires $\lambda k$ units of capital. In that case, the wage consistent with free entry also increases with a factor $\lambda$. We can then ask: What has to happen to $b$ for the exit rate in the wage equation (5.1) to be consistent with this higher wage and higher output? Inspection shows that $b$ must also increase by a factor $\lambda$: in that case, $(w - b)/(y - b)$ is unaffected and so is the exit rate from unemployment. If $b$ increases however by less than $\lambda$, the exit rate increases, unemployment decreases.

(5) An increase in the interest rate is likely to decrease the equilibrium exit rate, increase duration, and increase unemployment.

The interest rate appears both in the wage and the free entry relations. But, for reasons we already discussed when looking at changes in $s$, the effect of the inter-
Est rate on the bargained wage is ambiguous and likely to be small: the increase in the interest rate shortens the effective horizon, affecting both sides roughly in the same way. The main effect is on the wage consistent with free entry: a higher interest rate means a larger proportion of output going to capital, and thus a lower feasible wage. Just as in our previous model, an increase in the interest rate shifts the long run labor demand down, leading to a lower exit rate, and, from equation (5.2), a higher equilibrium unemployment rate.

6 Conclusions

Time to summarize. I have sketched a model based on viewing the labor market as a decentralized market, with job creation and destruction, flows of workers, and decentralized wage bargaining. This view allows us to think about the potential factors behind the labor supply and demand shifts we took as primitives in the previous model. This model shows how factors such as changes in reallocation intensity, in the efficiency of matching, in unemployment benefits, in productivity, or in the interest rate can all lead to shifts in labor supply or/and labor demand. It also shows how some of these factors affect both supply and demand, although in most cases, the effect is mainly on one of the two relations. It also tells us whether to look for changes in flows, or in duration, or in both. In short, it gives us a more powerful tool for both looking at specific questions, and for looking at data.