5.3.3 The Labor-Power Market

Recall our definition of \( m \):

\[
m = 1 - \frac{w}{n/p}
\]  
(3.12)

If we define \( m' = \frac{1}{1 - m} \), which moves with \( m \), we can state this in terms of rates of growth:

\[
m' = - \frac{w - n + p}{(w + n)}
\]
(by 11)  
(29)

consider the two variables, \( w \) and \( n \) in turn.

Money wages will be determined by a wage-Phillips curve. The Phillips curves for wages and prices will be discussed in chapter 6. However, it can be noted here that the present analysis does not require the existence of a long-term trade-off between money wage inflation and unemployment. Only a medium-term trade-off is necessary. The model does require that there is no large reserve of labor-power that prevents shortages of labor-power from occurring.

\[
\frac{w}{w} = w(U) + \bar{w} \quad (U < 1, w' < 0)
\]  
(30)

where \( \bar{w} \) is the trend rate of growth of money wages, which will be assumed constant in the medium term.

We have introduced two variables that represent productivity in different ways. These are \( \bar{q} \) (trend productivity) and \( 1/n \). How are they related? First, consider \( q \), productivity not corrected for cyclical fluctuations.
\[
q = \frac{Q}{E} \\
= \frac{Q}{(N_0 + N_p)} \\
= \frac{Q}{(q_0^0 + nQ)} \quad \text{(by 3.5, 3.6)}
\]

(31)

Remembering that we assumed that \(\frac{n_0}{n} = s_1\), we get
\[
q = \frac{Q}{(s_1Q^0 + nQ)} \quad \text{(by 3.8)}
= \frac{z}{(s_1 + z)} n^{-1}
\]

(32)

We see that for \(1 > z > 0\), \(dq/dz > 0\), since \(s_1 > 0\). We will assume that \(dq/dz < 0\) when \(z > 1\). When \(z\) is constant, \(n^{-1}\) is proportional to \(q\) since \(s_1\) is constant.

Productivity does not only depend on the rate of capacity utilization but also the rate of unemployment. It depends on the ability of capitalists to extract labor from labor-power, in addition to more purely technical factors. Low levels of unemployment increase the bargaining power of individual workers and unions. Individual workers are able to seek new bosses (or to threaten to do so) and to avoid speed-up. At the same time, replacements and scabs are less available. So \(n^{-1}\) should rise as the unemployment rate falls, holding all else equal. This relationship should be incorporated into the determination of productivity. So, adapting equation 3.14,
\[
\hat{n} = -q + q(U) + x^3
\]

(33)

where \(q' > 0\) (productivity rises as unemployment rises); \(x_3 = 0\) for \(z \leq 1\) and \(x_3 > 0\) for \(z > 1\) (productivity growth is hurt by diminishing returns as we move past full capacity); \(\hat{n} = -q\).
Given (33), equation (32) can be restated as

\[ q^* = -\bar{n} + \left( g_1 / (g_1 + z) \right) \bar{z} \]

\[ = \bar{q} + q(U) + \left( \frac{g_1}{g_1 + z - g_3} \right) \bar{z} \]  \hspace{1cm} (34)

We will assume that \( g_3 = g_1 / (g_1 + 1) \), so that when \( z = 1 \), \( q^* \simeq \bar{q} + q(U) \).

For \( z < 1 \), \( g_1 / (g_1 + z) < g_3 = g_1 / (g_1 + 1) \), so that \( q^* \) is lower.

Now, given (30) and (33), we can restate (29) as

\[ m^*_t = -(w(U) + \bar{w} - \bar{q} - q(U) + g_3 \bar{z}) \]  \hspace{1cm} (35)

We will assume that there is no trend toward profit squeezes, that is, no structural imbalance in the labor-power market. Thus, we will assume that \( \bar{w} = \bar{q} \). This implies that

\[ m^*_t = q(U) - w(U) \quad \text{for} \ z \leq 1 \ \text{or} \ z = \text{constant and} \]

\[ = q(U) - w(U) - g_3 \bar{z} \quad \text{otherwise.} \] \hspace{1cm} (36)

If \( q(U) - w(U) \) is monotonically increasing, there is only one \( U \) such that \( m \) is constant. Thus, there exists a \( U^* \) such that

\[ m^*_t = 0 = q(U^*) - w(U^*) \] \hspace{1cm} (37)

We will assume that \( U^* \) exists at \( z \leq 1 \). This is the medium-term equilibrium rate of unemployment. If \( w(U^*) = q(U^*) = 0 \), we see the situation in diagram 5.9. At \( U = U^* \), \( \bar{q} = \bar{q} = -\bar{n} = \bar{w} = \bar{w} \) and \( m^*_t = 0 \).

If \( \bar{w} \neq \bar{q} \), the medium-term equilibrium will not be such that \( U = U^* \). If \( \bar{w} > \bar{q} \), more unemployment is needed to cancel out the effects of this trend on \( m \). Similarly, if \( \bar{w} < \bar{q} \) then \( U < U^* \) so that \( m \) does not rise in the trend. These cases will not be considered here.
Diagram 5.9: The Determination of $m^*$. 

The diagram illustrates the relationship between $\hat{n}$ and $U$, showing the determination of $m^*$.
Equation (37) tells us that \( m \) is constant at \( U^* \). Equation (36) tells us that \( m \) will rise if \( U > U^* \) (since \( q(U) - w(U) > 0 \)) and fall if \( U < U^* \). This is suggested by the FEPS theory.

So what determines the rate of unemployment? Consider the effects of changes in the short-term equilibrium rate of growth. Recall that labor-power demand is \( E = N_o + N_p \) while labor-power supply is \( N \).

The rate of unemployment equals

\[
U = \frac{N_u}{N} = \frac{(N - E)}{N} = 1 - \frac{E}{N}
\]

(38)

Thus,

\[
dU/(1 - U) = \frac{\dot{N} - \dot{E}}{N}
\]

(39)

Labor-power demand grows with output demand \( \dot{E} = G_e \) since \( p = \) constant adjusted for productivity \( q = Q/E \) growth:

\[
\dot{E} = G_e - q
\]

\[
= G_e - \dot{q} - g(U) + (g_3 - g_1/(g_1 + z)) Z
\]

(40)

The second step is from (34).

From the definition of \( Z \), we know that \( Z = Q^* - Q^p \), where \( Q^p \) is potential output. Since \( p = \) constant, \( Q^* = G_e \). Potential output will be defined as that level of output that could be produced at full capacity \( (z = 1 = \) constant) and ignoring the effects of unemployment on productivity (or in the hypothetical situation where \( z = 1 \) and \( q(U) = 0 \)). That is,

\[
Q^p = q + \bar{N} = G
\]

(41)
So,
\[ \dot{z} = G_e - G \]  
(42)

Thus, (40) becomes
\[ \ddot{z} = G_e - G - q(U) + \left[ g_3 - \frac{g_3}{g_1 + z}\right](G_e - G) \]  
(43)

Simultaneously, labor-power supply will be assumed to grow as follows:
\[ \ddot{N} = \dot{N} + N(U) \quad (N' < 0) \]  
(44)

This is because unemployment dampens the growth rate of the labor force due to the discouraged-worker effect.

So, combining equations (39), (43), and (44), we get
\[ \frac{dU}{1 - U} = - \left[ 1 + g_3 - \frac{g_3}{g_1 + z}\right](G_e - G) + N(U) + q(U) \]  
(45)

Since \( g_3 = 0 \) for \( z \leq 1 \), the quantity in the square brackets is positive and less than unity. Thus, if \( G_e \) exceeds \( G \), the rate of unemployment falls, while if \( G_e < G \), the rate of unemployment rises. However, this movement is discouraged at high levels of unemployment (and encouraged at low levels of unemployment) because unemployment has a positive effect on productivity. This damping effect is countered by the discouraged-worker effect which means that high levels of unemployment will slow (and low levels of unemployment will quicken) the rate of growth of the labor force.

Assume that \( N(U^*) + g(U^*) = 0 \). Thus, when \( G = G_e \) and \( U = U^* \), \( dU = 0 \).

This assumption is necessary for our definition of medium-term equilibrium because if \( U \) were changing at \( U^* \) and \( G_e = G \), \( \dot{N}' \) would be changing (according to equation 36). Note that since we assumed that \( q(U^*) + w(U^*) \)
(equation 37), we are assuming by implication that \( N(U^*) + w(U^*) = 0 \). For simplicity, assume that (as shown in diagram 5.9),

\[
N(U^*) = q(U^*) = w(U^*) = 0
\] (46)

so that at \( U = U^* \) (and \( z < 1 \) or \( z = \) constant), \( \hat{w} = \hat{w}_1 = \hat{u} = \frac{\hat{a}}{\hat{q}} = \hat{q}_1 \), and \( \hat{z} = \hat{z} \). For \( U > U^* \), \( w < \hat{w}_1, q > \hat{q}_1 \), and \( z < \hat{z} \), while for \( U < U^* \), \( w > \hat{w}_1, q < \hat{q}_1 \), \( \hat{u} < \hat{u}_1 \), and \( \hat{z} > \hat{z} \).

Equation (45) shows that at high rates of unemployment \( U > U^* \) and when \( z \) is low, the positive \( q(U) \) may dominate the other terms, so that we may see the "perverse" case where the rate of unemployment rises even though \( G_e < G \). This case is made less likely because \( N(U) \) is negative for \( U > U^* \). We might also see a perverse case where this negative term \( N(U > U^*) \) dominates so that the unemployment rate falls even though \( G_e < G \). This case is made less likely because \( q(U) \) is positive. Because the two perverse cases require contradictory assumptions \( q(U) + N(U) > 0 \) for the former, \( q(U) + N(U) < 0 \) for the latter they will not coexist. For a high rate of capacity utilization, it is less likely that we'd see perverse cases since as \( z \) rises, the quantity in brackets rises (especially after \( z > 1 \)), so that the \( G_e - G \) term dominates.

For simplicity, we will assume away the perverse cases. We can assume that the effects of \( U \) on \( q \) and \( N \) by and large cancel out or, more stringently, that \( N(U) + q(U) = 0 \), so that

\[
dU/(1 - U) = -[1 + g_3 - g_1/(g_1 + z)](G_e - G) \tag{45'}
\]

From (45') we see that \( U \) falls as \( z \) rises (and vice-versa). Thus, we can posit the existence of a \( z^* \) that corresponds to \( U^* \). We have assumed that \( z^* \leq 1 \) and will continue to make this assumption. Note
that it is only coincidence that $U^*$ corresponds to "full employment" or that $z^* = 1$.

The above analysis could be interpreted as assuming that the labor-power market works in a symmetrical way. The usual Phillips curve suggests the contrary: money wages will become more responsive to $U$ as it falls. This can be represented by the following type of function.

$$s = \left( \frac{U}{U^0} - \frac{U}{U^0} \right) + \bar{w}$$

(30')

where $\bar{w}$ is a constant. This does not change our general results. We can modify this formulation further to include lagged values of $U$. This means that if the unemployment rate is constant at a certain level, it will lead to accelerating wage inflation (if $U < U^*$) or decelerating wage inflation (if $U > U^*$). Thus, with a constant price level, $m$ will fall for $U < U^*$ and rise for $U > U^*$. This behavior captures the notion of increasing (or decreasing) imbalances as the economy stays at high (or low) levels of employment.

From (45') and (35') (or 35''), we can conclude that (1) the unemployment rate falls if $G_e > G$ and rises if $G_e < G$; (2) the rate of capacity utilization rises if $G_e > G$ and falls if $G_e < G$; and (3) if $U > U^*$ ($z < z^*$), $m$ will rise while if $U < U^*$, $m$ will fall—unless $z > 1$ and $G_e < -\left( \frac{1}{\beta_3} w(U) + G \right)$. This latter case is that of a recession where the rate of growth is negative and the economy moves out of the region of diminishing returns. Note that we cannot come to a conclusion about the changes in $G_e$ in all of these various situations: if $G_e > G$ and $U < U^*$, then we see a rise of $z$ and a fall in $m$ at the same time. These have contradictory effects on $G_e$. These cases will be examined in section 5.3.6 below.
5.3.4 The Raw Material Market

Unemployment in labor-power markets plays the role of a disciplining force in the labor-process, while raw materials markets work more along the lines of the "law" of supply and demand. However, we assume that these two markets move together.

Given our definition of the terms of trade as \( p/p_m \) and the no-inflation assumption:

\[
\hat{P} = -\hat{P}_m \tag{47}
\]

Now \( \hat{p}_m \) depends on the tightness of the raw materials markets, that is, the excess demand for raw materials at the trend price (\( \hat{p}_m \)). This tightness is represented by the variable \( T \). If \( p_m = \hat{p}_m \), \( T = 0 \).\n
\[
\hat{p}_m = \hat{p}_m(T) + \hat{p}_m \tag{48}
\]

where \( p_m(0) = 0 \), \( p'_m > 0 \), and \( \hat{p}_m \) is the trend rate of growth of raw material prices. Since we earlier assumed that raw material usage per unit output was constant in the trend (i.e., \( \hat{z}_2 = 0 \)), if \( \hat{p}_m \neq 0 \), we will have an upward or downward trend in \( z_2/p \). Therefore, assume that \( \hat{p}_m = 0 \) so that \( \hat{p}_m = -\hat{P} = \hat{p}_m(T) \)

\[
\hat{p}_m = 0 \text{ so that } \hat{p}_m = -\hat{P} = \hat{p}_m(T) \tag{49}
\]

If we wish to introduce a trend in \( z_2 \), all we need to do is to assume that \( \hat{z}_2 = \hat{p}_m \) to have similar results. (If \( \hat{z}_2 < \hat{p}_m \), capitalists suffer from a serious structural imbalance.)

Changes in the tightness of the market depend on demand and supply.

If we define \( T \) as \( (\hat{q}_m - \hat{q}_m)/(\hat{q}_m - \hat{q}_m) \), then

\[
dT = (T + 1)(\hat{q}_m - \hat{q}_m) \tag{50}
\]
where $q^d_m$ is the demand, and $q^s_m$ the supply, for raw materials at the trend price of raw materials ($\bar{G}_m$, which has been assumed constant).

Given equation (3.15),

$$q^s_m = \bar{S}_2 z^4$$  \hspace{1cm} \text{where} \hspace{1cm} \bar{S}_4 = 0 \text{ for } z \leq 1 \hspace{1cm} \bar{S}_4 > 0 \text{ for } z > 1 \hspace{1cm} (3.15)$$

we can define $q^d_m$ in terms of the rate of growth of output ($G_e$) and the rate of growth of raw material usage per unit output:

$$q^d_m = G_e + \bar{S}_2$$

$$= G_e + \bar{S}_2 + \bar{S}_4 z$$

$$= G_e + \bar{S}_2 + \bar{S}_4 (G_e - G) \hspace{1cm} (31)$$

Note that we are ignoring substitution effects (changes in demand due to changes in prices) because $q^d_m$ is defined for a given price. Supply is defined in a similar way; in addition, it will be assumed that $\bar{q}^d_m = \bar{q}^s_m$.

Thus,

$$dT = (T + 1)(1 + \bar{S}_4)(G_e - G) \hspace{1cm} (32)$$

from equations (30) and (31).

Just as in the labor-power market, we should expect asymmetry in the raw materials market. The rise of raw materials prices is not the same as their fall. First, the existence of producer cartels gives a downward stickiness to prices. Second, there should be a minimum price for raw materials because of the cost of production. If the price falls to a level close to the cost of production, producers will cut back production. Thus, the supply curve will be more elastic for $T < 0$. This will be represented by the assumption that $p_m(T)$ is of smaller magnitude for $T < 0$ than for $T > 0$.  

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We complete the model by assuming that raw material markets are in equilibrium when \( z = z^* \) (and \( U = U^* \)). Thus, raw material and labor-power markets are assumed to be in equilibrium simultaneously.

Thus, we have the situation where if \( T > 0 \) (\( U < U^* \), \( z > z^* \)), \( p_m > 0 \) and the terms of trade are falling; if \( T < 0 \) (\( U > U^* \), \( z < z^* \)), \( p_m < 0 \) and the terms of trade are rising; if \( G_e > G \), then \( dT > 0 \) and \( p_m \) will rise; and, if \( G_e < G \), \( dT < 0 \) and \( p_m \) will fall.
5.3.5 Changes in the Capacity-Capital Ratio

The capacity-capital ratio is defined as

\[ h = p \frac{\dot{Q}}{K} \]  

(3.11)

Thus,

\[ \dot{h} = \dot{p} + \frac{\ddot{Q}}{K} - \frac{\dot{K}}{K} \]  

(54)

\[ = G - G_e \]  

(54')

since \( \dot{p} = 0, \frac{\ddot{Q}}{K} = G, \) and \( \frac{\dot{K}}{K} = G_1 = G_e \). Thus, as \( G_e > G \) and the economy is growing faster than the "natural" rate, \( h \) is falling and as \( G_e < G \), \( h \) is rising.

Let us investigate the fall of \( h \) for \( G_e > G \) further. We defined potential output as \( \frac{Q}{N} \) so that

\[ \frac{\ddot{Q}}{Q} = \frac{\dot{Q}}{Q} + \frac{\dot{N}}{N} = G \]  

(41)

For simplicity, we can assume that the means of production are homogeneous in the sense that they all have the same production process and price, so that \( K = p_1 M \) (where neither \( p_1 \) nor \( M \) are vectors) so that

\[ \dot{K} = \dot{p}_1 + \dot{M} \]  

(55)

Thus, from (41) and (55), equation (54) becomes

\[ \dot{h} = (\dot{p} - \dot{p}_1) + (\dot{G} + \dot{N} - \dot{M}) \]  

(56)

This equation has two parts. In the first set of parentheses, we see the "price effect" while in the second set, we see the "real effect."

Consider the latter first. The real component shows that the capacity-
capital ratio falls because productivity and the labor-force are growing at a constant rate while the stock of means of production is growing at a faster rate. This implies that the use of equipment has no effect on productivity growth. This does not imply that this is a long-term truth; rather, it is a medium-term phenomenon. In the long term, \( q \) is determined by investment growth according to a "technical progress function" (see below, section 5.4). But in the medium term, investment affects productivity only marginally and with a lag. Existing equipment still exists and is not immediately upgraded. This study is a first approximation of a "vintage" model of the accumulation of equipment.

This story can be amplified in three ways. If we redefine potential output as that output that could be produced at full capacity at the existing level of unemployment (rather than \( U^* \)), potential output growth will slow at low levels of unemployment since productivity growth will slow (since labor discipline is hurt). Similarly, marginal labor-power and raw materials may be used when the economy is growing quickly so that output per machine may fall at full capacity. Second, in an unplanned, chaotic process of economic expansion, horizontal maladjustments may develop: the usefulness of machinery in industry A may depend on production in a complementary industry B. But industry A may be developed beyond the ability of industry B to supply the necessary inputs. So on average, aggregate output per machine will be depressed at full capacity.

Third, because some investment is wasteful (e.g., advertising and speculation), that component of investment will have no effect on \( q \) in either the long or medium term. These three effects suggest that \( h \) will be lower in the economic expansion than indicated in equation (56).
For the price effect, we might see $p_1^* > p = 0$ if the production of machinery is more labor-intensive (i.e., a greater percentage of costs is for labor-power) or if more raw-material intensive and if wages and raw-material prices rise as happens in this model if $z > z^*$. (Recall that for stability, neoclassical two-sector growth models require that machinery production be more labor-intensive.) Prices of machinery may also rise if the machinery industry is pushed into the region of diminishing returns. (However, just as output prices are kept down by foreign competition, $p_1$ might be kept down. This seems a minor problem for the U.S. economy where by and large means of production are produced domestically. It seems likely, however, that foreign competition will become more important in the future.) This problem of diminishing returns can be represented as follows:

$$p_1^* - p = g_s(G_e - \bar{G}) + \text{wage or } p_m \text{ induced effects} \quad (57)$$

where $\bar{G}$ is the rate of growth when the machine-producing industry is operating at full capacity. We will assume that $\bar{G} > G$ and that $g_s = 0$ while $G_e \leq \bar{G}$ and that $g_s > 0$ for $G_e > \bar{G}$.

What determines $\bar{G}$? There are two factors, the capacity-capital ratio for the machine-producing sector ($h_1$) and the share of total $K$ devoted to production in that sector ($K_1/K$). If full capacity production of sector 1 ($p_1^*K_1$) is equal to the highest level of aggregate investment possible before diminishing returns set in ($I^*$), then

$$\frac{I^*}{K} = p_1^* \frac{K_1}{K} = (p_1^* \frac{\phi_1}{K_1}K_1/K) = h_1 \frac{K_1}{K} = \bar{G} \quad (58)$$

Both $h_1$ and $K_1/K$ are determined in ways not described in the present analysis.
Given this elaboration of the price and real effects that determine \( \hat{h} \), we can no longer assert that \( \hat{h} = G - G_e \) because it may be true that \( \hat{h} < G \). Nevertheless, there should be a positive relationship between \( \hat{h} \) and \( G - G_e \) and if \( G = G_e \), \( \hat{h} = 0 \).

Note that a rise of \( p_1 \) relative to \( p \) represents only a shift in the distribution of surplus among capitalists and not a decrease in the size of the surplus. But this price change does discourage investment since it is more expensive to buy machinery when \( p_1 \) rises.

Quantity effects are more permanent than price effects because they are built into equipment. Prices \( (p_1) \) will fall as soon as the growth rate of the economy falls. But over-investment, horizontal misadjustment, and waste persist longer. These problems have to be purged from the system through a process of bankruptcies and plant closures. There are also limits to the rate at which these imbalances are purged, since gross investment cannot be negative and net investment is seldom so.

There are also institutional limits: while in a competitive market, firms with inefficient plant and equipment have no choice but to go broke or restructure, monopolists have the ability to protect their investments. The inefficient competitor in an oligopolistic market can settle for a rate of profit less than that of the dominant firm. Thus, the greater the degree of monopolization of an economy (and the smaller the degree of foreign competition) the longer will imbalances built into a low value of \( h \) persist.