

The Specific-Factors Model: Chapter 9

Strictly speaking the HO model refers to movements between long-run equilibrium points. But there are interesting things that happen in the transition between short run and long run. This model really is an extension of HO theory to the short run (with fixed factors) to see if the various HO-related theorems hold.

Specific factors are all around us: types of capital, buildings, land, skills, occupations.

What does it really mean for a factor to move from one type of industry job to another? If he's truly mobile he must be homogeneous with others, which probably means low-skilled. Anyone or anything that is the result of a conscious investment would be heterogeneous and therefore specific in a particular use for a period of time.

Immediate run: all factors fixed in current allocation
Short run: at least one factor is fixed in current allocation
Long run: all factors are mobile and shift between allocations

We usually assume L is mobile and types of K or land are fixed. But obviously labor skills may not be easily mobile (textile workers; opera singers; professors)

Here's our basic short-run result: if you are a specific factor you want to see a rise in the price of the good you produce. You do not want to see a fall in the price of the good you produce. If you're a mobile factor the result is ambiguous.

Consider a 2-good, 3-factor model with mobile L but specific capital types (R in X and S in Y).

$$X = F(L_x, R) \quad Y = G(L_y, S) \quad L_x + L_y = \bar{L} \quad R = \bar{R}; S = \bar{S}$$

We have already seen that the PPFs in this case are concave (chapter 2 and Figure 8.1).

Equilibrium conditions in factor markets:

$$VMPL_x = p_xMPL_x = w \qquad VMPL_y = p_yMPL_y = w$$

$$VMPR_x = p_xMPR_x = r \qquad VMPS_y = p_yMPS_y = s$$

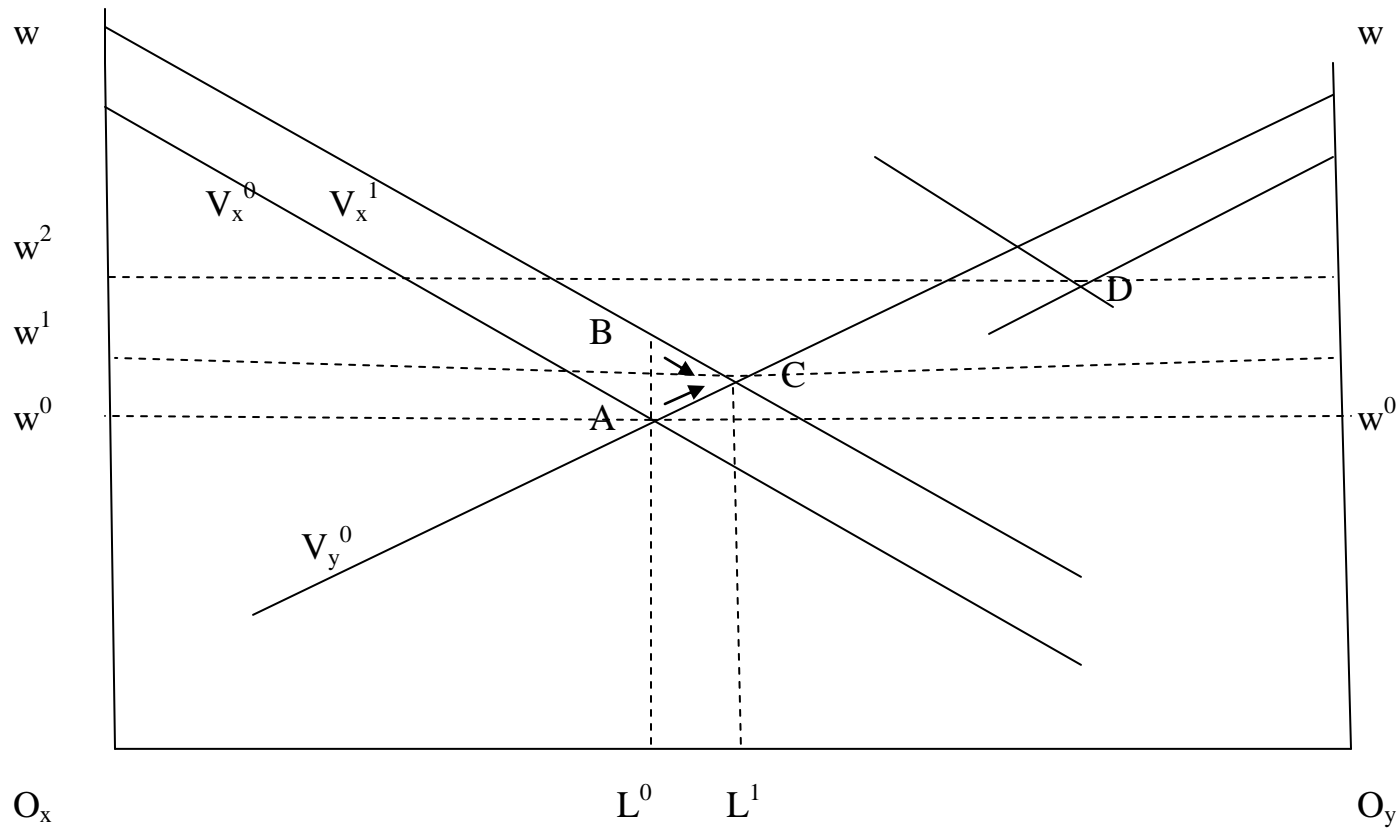
Note there are 3 factor prices and 2 goods prices. Do not expect FPE.

In fact the VMPL curves are the demands for the various factors. They state that each sector hires labor (or specific factor) up to where the additional revenue generated equals the factor price. Note the demand for labor in X would shift upward if price of X goes up; it would also increase if there is an exogenous rise in MPL_x . That would happen if the specific factor in X increases or there is an improvement in technology in X. Similar comments for labor demand in Y and for both specific-factor demands.

Let's first look at impact of goods prices on factor prices and real incomes.

Suppose that in any long-run equilibrium good X is labor-intensive and Y is capital-intensive. To make the analysis easier, let's set $p_y = 1$. Then $p = \frac{p_x}{p_y} = p_x$.

How do we depict equilibrium for the mobile factor labor? With this labor allocation box (next page). We draw the VMPL schedules (labeled by V) for labor in X from the left axis and for Y from the right axis. Their intersection determines the initial (nominal) wage rate and also how much labor is employed in X versus Y. (These lines are not necessarily linear.)



Initial long-run equilibrium at A. Now suppose R and S are specific and can't move. And suppose there is a rise in the price of X (perhaps because this country moves from autarky to free trade and exports X or perhaps because it imports X and imposes a tariff on imports). The initial impact is to shift up the demand for labor in X as shown. In fact because $V = pMPL$ it follows that $\% \Delta V = \% \Delta p$ since MPL does not change initially. So the distance BA/L^0A is actually the proportionate rise in both price and the V schedule in X.

Immediate Run: All factors are stuck. Wage in X would rise to B (same percentage rise as price) with no change in wage in Y.

Short Run: Labor is mobile. With the increase in price of X that sector will try to produce more in the short run. It can only get labor to move from Y to X and to make that happen the wage rises to w^1 . There is more labor in X and less in Y so output of X rises and output of Y falls in the short run.

Impacts on real wages, etc. As X sector adjusts from B to C it has more labor coming in to work with a given R. That implies a lower MPL in X (move down demand curve) and a higher MPR in X. So real wage falls in terms of good X but real price of R rises in terms of good X. As Y adjusts from A to C there is labor flowing out so less labor to work with a given S. That implies a higher MPL in Y and a lower MPS in Y. So real wage rises in terms of Y and real price of S falls in terms of Y.

We could state this in terms of ratios:

$\frac{R}{L_x}$ falls so MPL_x falls and $\frac{w}{p_x}$ falls

$\frac{S}{L_y}$ rises so MPL_y rises and $\frac{w}{p_y}$ rises

This means that in the short run whether a worker gains or loses from the price change depends on her consumption preferences. (Try to show this with a budget constraint, using real wages as intercepts.)

Note that we let price of X rise and price of Y held constant. So from this we can see that the wage must rise less than price of X but surely rises more than the price of Y:

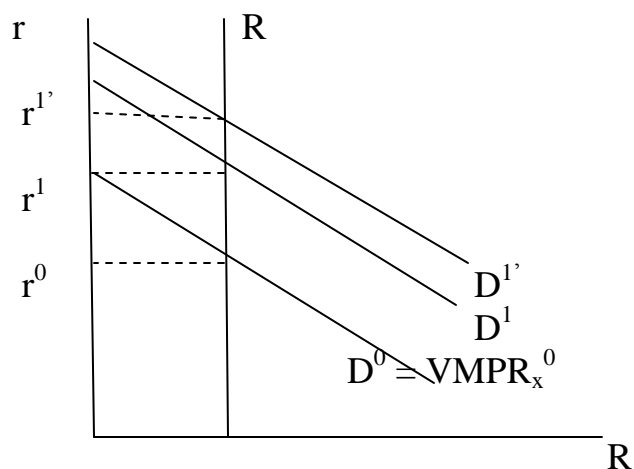
$$\% \Delta p_x > \% \Delta w > \% \Delta p_y$$

This is a general statement and is why there is an ambiguous effect on real labor wages.

We can also see that MPR_x rises so r/p_x rises. But we held price of Y fixed $\Rightarrow r/p_y$ rises also. Owners of the specific factor in the sector with the higher price are made better off in terms of both goods. You can think of this as an increase in scarcity rents; sector X wants to expand but can't get more R so its price rises a lot.

And it's easy to see that MPS_y must fall since labor leaves Y and S is specific, so both real returns to the S factor go down in the short run. Owners of the specific factor in the sector with the price that did not change (and so went down in relative terms) are made worse off in terms of both goods. Think of this as a reduction in scarcity rents; sector Y contracts but can't get rid of S so its price falls a lot.

Can see this difference with simple demand-supply curves for each specific factor in the short run:



For factor R there is a vertical supply curve in short run. Initial factor price is r^0 . The rise in demand to D^1 simply reflects the price increase in good X as in the labor diagram above. In immediate run $\% \Delta r = \% \Delta p_x$. But in the short run labor moves into good X and that makes R more productive, shifting its demand curve up and making its price higher. So in the short r rises more than price of X.

You should show the corresponding analysis for factor S, where demand falls.

SUMMARY

In short run the impacts of a price change in the economy are:

Output of good with higher price rises, other output falls.

Specific factor gains (loses) in expanding (contracting) sector.

Real wage of mobile factor falls (rises) in terms of buying expanding (contracting) sector good. So its welfare overall is ambiguous.

NOTE! This ambiguity depends only on mobility and the elasticities of labor demand (in labor diagram above the steepness of V_y matters for the wage). It does NOT depend on factor intensities.

Now what happens when we move to the long run? Now the Stolper-Samuelson theorem takes over:

We assumed above that X is labor-intensive in any long-run equilibrium. So we must get higher real wages of labor and lower real prices of the (now mobile) other factor.

$$\% \Delta w > \% \Delta p_x > \% \Delta p_y > \% \Delta r = \% \Delta s$$

Here the price of Y doesn't change so r and s actually fall from their initial level.

Going back to the labor diagram the final long-run equilibrium is at a point like D where there is a higher real wage and capital moved from Y to X, thereby shifting the demand curves.

Let's put all this together in the following table: **Effect of a price rise in p_x/p_y**
(where X is labor-intensive in the long run)

Immediate Run: Both L in X and R get higher real incomes in consuming Y, no change in X
Both L in Y and S get lower real incomes in consuming X, no change in Y

Short Run: All labor gains in terms of consuming Y, loses in terms of consuming X
Owners of R get higher real incomes in terms of both goods
Owners of S get lower real incomes in terms of both goods

Long Run: All labor gains real wages in terms of both goods.
All "capital" (now one factor) lose real incomes in terms of both goods

INTERESTING RESULTS:

1. Consumption patterns matter for welfare in the short run.
2. Stolper-Samuelson does not hold in the short run.
3. There is always at least one factor whose short run and long run interests are different. Here, labor might naturally oppose free trade despite its long-run gains if it prefers to consume X and takes a short-run view (myopic view of trade policy, which means heavily discounting future gains).
4. Specific factors in the short run would strongly oppose free trade if they are in sector that would decline; would favor it if in sector that would expand.
5. Stolper-Samuelson (long run) says that factors should lobby for or against free trade on *factor* lines. Specific factors model (short run) says lobbying should be done on an *industry* basis rather than a factor basis. Labor unions may well agree with management in opposing free trade in textiles, steel, etc. Much depends on time horizons of workers, capital owners, industries, and policy makers.

And note that if we bring in another country we can say FPE does not hold in short run. Here's an easy proof.

Suppose that country f is capital-abundant and h is labor-abundant. In autarky (initial long-run equilibrium) f would have higher real wages and h would have lower real wages; f would have lower real capital prices and h would have higher real capital prices.

Now let them go to free trade. If X is labor-intensive we would expect h to export it and its price would rise in h while price of X would fall in f. Going through analysis above we would find

Short-run results:

Foreign: w^f falls; $\frac{w^f}{p_x}$ rises; $\frac{w^f}{p_y}$ falls This happens because in f the X sector would contract and labor would move to Y (go through this analysis).

s^f rises; $\frac{s^f}{p_x}$ and $\frac{s^f}{p_y}$ both rise; r^f falls; $\frac{r^f}{p_x}$ and $\frac{r^f}{p_y}$ both fall. This happens because labor moves from X to Y making S more productive and R less productive in foreign.

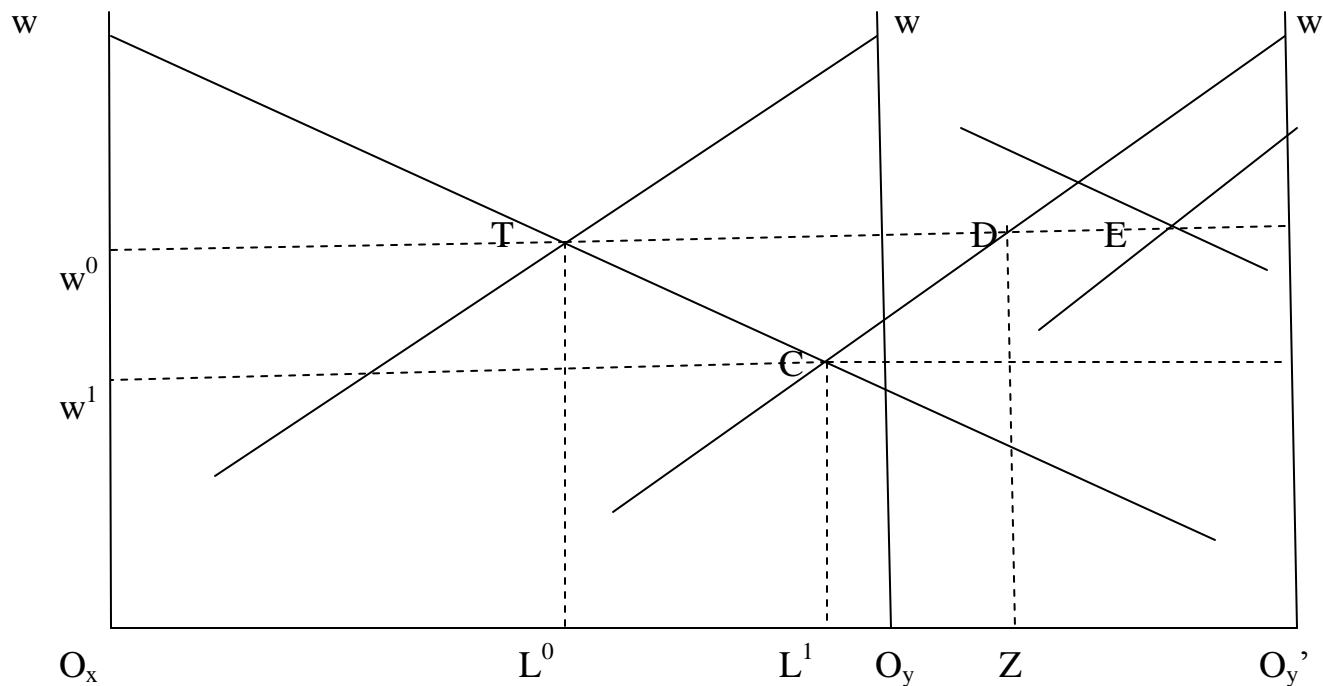
Home: show that real wage is higher in Y and lower in X; both real prices of R are higher; both real prices of S are lower.

The point is that in the short run real wages move in opposite direction in h and f. Further s and r move apart in the two countries. There is no short-run FPE.

Let's finish this model by considering whether the Rybczynski theorem holds. These are hard problems to analyze if we permit prices to change also so to simplify let's consider a small open economy facing fixed prices for X and Y.

There are two kinds of factor to change and see what happens.

Case 1: an increase in the mobile factor supply. (For example, immigration into an economy: what happens in the short run?)



Let this be h and start at T , in free trade. Now consider labor force growth in h as shown by the rightward shift in good Y origin. Note that the labor demand curve in Y shifts to the right by the same amount. The short-run result is a lower wage at point C . Labor employed in X rises to L^1 . But the distance $ZO_{y'}$ is the same as the distance L^0O_y and so there is more labor in Y also. Keep in mind that R and S are fixed in the short run.

Results:

1. Lower wage, same prices, so all laborers are worse off in the short run.
2. Because there is more labor in both goods but S and R are fixed the MP's of S and R go up and they get higher real incomes in terms of both goods. Both specific factors gain from an immigration of the mobile factor.
3. Both outputs rise in the short run, though by how much depends on elasticities of labor demand. (So Rybczynski Theorem does not hold.)
4. It is possible (not likely) that output of Y could rise so much that the labor-abundant country h would export capital-intensive Y in the short run, so HO may not hold either.

To figure out the long-run equilibrium we can use the Rybczynski Theorem. With constant goods prices we ultimately have to get back to the same factor prices so we return to the initial wage rate. However, Ryb theorem says output of labor-intensive X has to rise and output of Y has to fall. So we end up at a point like E.

Note an implication: in the short run the return to R (specific in X) must be higher than return to S (specific in Y) to make "capital" move as it becomes mobile.

Case 2: A rise in one specific factor. Figure 9.3 in the text considers a rise in the specific factor used in good 1 (X). Let's reason through what we get if there is a fall in S (used in Y). Again, hold goods prices constant.

- a. This would reduce demand for labor in Y (V_y would shift down) \Rightarrow lower wage. With constant goods prices, we see that all labor loses real wages in the short run.
- b. Labor would move from Y to X \Rightarrow R/L ratio would fall in X \Rightarrow higher r and the factor specific in X clearly gains real income in both goods (again, scarcity rents).
- c. Impact on S real incomes is a bit tricky since both S and L_y go down. But we already saw the wage falls for a given output price so s (return to S) must actually rise since there cannot be any profits made. So the specific factor gains in Y also. This means that a change in a specific-factor endowment causes the price of both specific factors to move in the same direction and opposite to the mobile factor. *Both specific factors would like to see less of the other in the short run.*
- d. Output of X rises and output of Y falls in the short run due to lower S supply. This sounds like Rybczynski since we assumed that Y is capital-intensive in the long run. But this is just one case: if R had fallen in

supply then we would get output of X goes down and output of Y goes up. So output responses depended on sector of the factor, not intensity, in the short run.

In the long run we would return to initial wage with less Y produced, more X produced and so additional “capital” would move to X as S became mobile.

What all of this means is that there are radically different impacts in a short-run model in the linkages between endowments, outputs, and goods and factor prices. Life just isn't so easy for policymakers.