Educated Preferences:

Explaining Attitudes Toward Immigration In Europe

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Appendix: Open-Economy Models of the Income Effects of Immigration

A. The Heckscher-Ohlin Model

Assume an economy produces two commodities, X_1 and X_2, with constant returns to scale, using two factors of production: high-skilled labor (i.e., human capital), K, and low-skilled labor, L. Factors are perfectly mobile between sectors, markets are perfectly competitive, and the economy is assumed to be small, in the sense that the volume of domestic production of each good has a negligible effect on world prices. Equilibrium is described by full employment of each factor (equations A-1 and A-2) and competitive profits (A-3 and A-4):

$$a_{K1}X_1 + a_{K2}X_2 = K \qquad \text{(A-1)}$$
$$a_{L1}X_1 + a_{L2}X_2 = L \qquad \text{(A-2)}$$
$$a_{K1}w_K + a_{L1}w_L = P_1 \qquad \text{(A-3)}$$
$$a_{K2}w_K + a_{L2}w_L = P_2 \qquad \text{(A-4)}$$

where a_{Ki} and a_{Li} are the quantities of K and L required per unit output of X_i, w_K and w_L are wages for high-skilled labor and low-skilled labor, and P_i are commodity prices. Full employment requires that techniques of production are variable and, since competition ensures that unit costs are minimized, each a_{Ki} and a_{Li} depends upon the ratio of factor prices. After total differentiation of equations (A-3) and (A-4) we can derive the standard solutions that express changes in factor prices as a function of changes in goods prices:

$$\hat{w}_K = \frac{1}{\Delta}\left(\theta_{L2}\hat{P}_1 - \theta_{L1}\hat{P}_2\right) \qquad \text{(A-5)}$$
$$\hat{w}_L = \frac{1}{\Delta}\left(\theta_{K1}\hat{P}_2 - \theta_{K2}\hat{P}_1\right) \qquad \text{(A-6)}$$

where "hats" indicate proportional changes, θ_{Ki} and θ_{Li} are the distributive shares of K and L in the value of output of industry i, and $\Delta = \theta_{K1} - \theta_{K2}$. As long as commodity prices are constant, factor returns will not change. The effect of any changes in the supplies of high- or low-skilled labor (e.g., due to immigration of one type of labor or another) will just be reflected in a change in the output mix. Totally differentiating equations (A-1) and (A-2) and solving yields:

$$\hat{X}_1 = \frac{1}{\Pi}\left(\lambda_{L2}\hat{K} - \lambda_{K2}\hat{L}\right) \qquad \text{(A-7)}$$

$$\hat{X}_2 = \frac{1}{\Pi}\left(\lambda_{K1}\hat{L} - \lambda_{L1}\hat{K}\right) \tag{A-8}$$

where λ_{Li} and λ_{Ki} are the fractions of total low-skilled and high-skilled labor in each sector i, and $\Pi = \lambda_{K1} - \lambda_{L1}$. This is the well-known "factor price insensitivity" result. This result holds for any number of factors (n) used in the production of any number of traded commodities (m), and allowing for production of any number of non-traded commodities, as long as $n \leq m$ (section B below considers cases in which $n > m$). The fixity of the prices of traded goods pins down the prices of the factors and non-traded goods (see Jones and Neary 1984: 20; Ruffin 1984: 261; Komiya 1967).

If we depart from the standard HO assumptions, it is possible to show that this "insensitivity" result does not hold in the large country case, where the change in production in the home economy affects world price levels for traded goods. This is readily apparent from equations (A-5) and (A-6): if production of X_2 is intensive in low-skilled labor, for instance, so that $\theta_{K1} > \theta_{K2}$, any increase in the supply of low-skilled labor due to immigration that generates an increase in the production of X_2 can lead to a decline in P_2 (and an increase in P_1) which also implies lower wages for low-skilled workers (w_L) and higher wages for high-skilled workers (w_K) – in both nominal and real terms. The magnitudes of these effects will be increasing in the country's shares of world markets in the traded goods, but decreasing in the elasticities of substitution between factors in each sector (as can shown by deriving new forms of A-7 and A-8 that allow for changes in the input coefficients, a_{Ki} and a_{Li}).

Factor price insensitivity is also upset if we allow that a country may specialize in producing only a limited set of traded goods and that the inflow of immigrants may be large enough to induce a change in the set of goods produced. With minimal assumptions about the ranges of the input coefficients, a_{Ki} and a_{Li}, associated with production of each separate commodity across a continuum from most to least intensive in low-skilled vs. high-skilled labor, it is straightforward to demonstrate (from alternative forms of A-5 and A-6) that any endogenous shift to a product combination which employs higher ratios of low-skilled to high-skilled labor implies a fall (rise) in the real wages of low (high)-skilled workers.

B. The Specific Factors Model

Now consider a simple version of the two-commodity, three-factor model examined by Jones (1971). Each commodity, X_i, is produced using high-skilled labor (human capital) specific to it, K_i and low-skilled labor, L, that is shared with the other sector and mobile between sectors. In cases such as these, where (due to specificity) the number of factors exceeds the number of traded goods, factor returns are not determined solely by commodity prices, they also depend on factor supplies. Equilibrium is again described by full employment of each factor and competitive profits:

$$a_{K1}X_1 = K_1 \tag{B-1}$$

$$a_{K2}X_2 = K_2 \tag{B-2}$$

$$a_{L1}X_1 + a_{L2}X_2 = L \tag{B-3}$$

$$a_{K1}w_{K1} + a_{L1}w_L = P_1 \tag{B-4}$$

$$a_{K2}w_{K2} + a_{L2}w_L = P_2 \tag{B-5}$$

where a_{Ki} and a_{Li} are the quantities of K_i and L required per unit output of X_i, w_{Ki} and w_L are wages for high-skilled labor in each industry and low-skilled labor, and P_i are commodity prices. After some manipulation, totally differentiating yields the classic Jones's solutions:

$$\hat{w}_{K1} = \frac{1}{\Phi}\left\{\left[\lambda_{L!}\frac{\sigma_1}{\theta_{K1}} + \frac{1}{\theta_{K1}}\lambda_{L2}\frac{\sigma_2}{\theta_{K2}}\right]\hat{P}_1 \;-\; \frac{\theta_{L1}}{\theta_{K1}}\lambda_{L2}\frac{\sigma_2}{\theta_{K2}}\hat{P}_2 \;+\; \frac{\theta_{L1}}{\theta_{K1}}\left(\hat{L} - \lambda_{L1}\hat{K}_1 - \lambda_{L2}\hat{K}_2\right)\right\} \tag{B-6}$$

$$\hat{w}_{K2} = \frac{1}{\Phi}\left\{\left[\lambda_{L2}\frac{\sigma_2}{\theta_{K2}} + \frac{1}{\theta_{K2}}\lambda_{L1}\frac{\sigma_1}{\theta_{K1}}\right]\hat{P}_2 \;-\; \frac{\theta_{L2}}{\theta_{K2}}\lambda_{L1}\frac{\sigma_1}{\theta_{K1}}\hat{P}_1 \;+\; \frac{\theta_{L2}}{\theta_{K2}}\left(\hat{L} - \lambda_{L2}\hat{K}_2 - \lambda_{L1}\hat{K}_1\right)\right\} \tag{B-7}$$

$$\hat{w}_L = \frac{1}{\Phi}\left\{\lambda_{L!}\frac{\sigma_1}{\theta_{K1}}\hat{P}_1 \;+\; \lambda_{L2}\frac{\sigma_2}{\theta_{K2}}\hat{P}_2 \;+\; \left(\lambda_{L1}\hat{K}_1 + \lambda_{L2}\hat{K}_2 - \hat{L}\right)\right\} \tag{B-8}$$

where $\Phi = \lambda_{L!}\dfrac{\sigma_1}{\theta_{K1}} + \lambda_{L2}\dfrac{\sigma_2}{\theta_{K2}} > 0$,

and Φ_i is the elasticity of substitution between low-skilled and high-skilled labor in sector i. It is clear that any increase in the supply of low-skilled labor ($\hat{L} > 0$), at fixed commodity prices, will lower real wages for low-skilled workers while raising real wages for high-skilled workers of *all* types – the latter gains are largest (smallest) for those in sectors that use low-skilled labor more (less) intensively. Inflows of any type of high-skilled labor ($\hat{K}_1 > 0, \hat{K}_2 > 0$) will raise real wages of low-skilled workers while reducing real wages of *all* high-skilled workers.

Unlike the basic "insensitivity" results from the HO model, however, these distributional effects are compromised by the inclusion of non-traded goods in the model. If X_2 is a non-traded commodity (e.g., medical care), any inflows of workers with skills specific to its production (K_2) that generates an increase in the production of X_2 can lead to a decline in P_2 – this can occur when consumption tastes among individuals are such that the expansion in the output of X_2 is not matched by the increase in aggregate consumer demand for X_2 (if, say, immigrants have tastes biased strongly in favor of traded goods). If this is the case, as is clear from (B-6) above, high-skilled workers in the traded sector may actually benefit, in real terms, from immigration of high-skilled workers who have training specific to the non-traded sector. Perhaps even more telling, if production in the non-traded sector is highly intensive in low-skilled labor, the same kind of analysis leads to the conclusion that inflows of low-skilled immigrants may lead to a subsequent decline in P_2 and the real wage effects for native low-skilled workers then become ambiguous. This is clear from (B-8): since we cannot be sure that nominal wages for low-skilled workers fall more quickly than does P_2, native workers may actually benefit in real terms if their consumption tastes are biased strongly in favor of the non-traded good.

More ambiguity enters when we consider the large country case. Assume again that both commodities are traded, but now allow that (world) prices may change in response to the total amount of each good produced in the economy. If production of X_2 is relatively intensive in low-skilled labor, inflows of low-skilled labor due to immigration will increase output of X_2 and can lead to a decline in P_2 (and an increase in P_1). Now the effects of these immigration flows on the real wages of *all* high-skilled and low-skilled workers become ambiguous, and depend in part upon consumption tastes.

References:

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