Wage Gaps and International Trade

The wage gap between more educated, more highly skilled workers and relatively less skilled workers in the United States widened over the 1980s. At the same time, trade with developing countries became a much bigger part of overall U.S. imports. Is greater international competition a possible culprit behind widening wage disparities? A possible link between these two trends is suggested by a result from international trade theory known as the **Stolper-Samuelson effect.**[4]

We consider a simple example of a trade model where there are two factors of production in a country, skilled labor (S) and unskilled labor (U). This country produces two goods, textiles (T) and computers (C). Production is described by the *technical coefficients* a_{ij}, each of which represents the amount of input i (either S or U)

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[4] The original reference is Wolfgang Stolper and Paul Samuelson, "Protection and real wages," *Review of Economic Studies* 9 (1941): 58–73.

required to produce good j (either T or C). That is,

$$a_{UT} = \frac{U_T}{T} = \frac{\text{unskilled labor in textiles}}{\text{output of textiles}}$$

$$a_{ST} = \frac{S_T}{T} = \frac{\text{skilled labor in textiles}}{\text{output of textiles}}$$

$$a_{UC} = \frac{U_C}{C} = \frac{\text{unskilled labor in computers}}{\text{output of computers}}$$

$$a_{SC} = \frac{S_C}{C} = \frac{\text{skilled labor in computers}}{\text{output of computers}},$$

where U_C and S_C are the number of unskilled and skilled workers, respectively, in the computer industry and U_T and S_T are the number of unskilled and skilled workers in the textile industry. In this application we assume that these coefficients are constant, although the results of the analysis are the same when the coefficients can vary by assuming a more flexible production technology.

We assume perfect competition, which implies zero profits. Thus the total wage bill equals total revenues. Denoting the wage to unskilled labor w and the salary to skilled labor as s, the zero-profit condition for the two industries is

$$U_C w + S_C s = p_C C \quad \text{and} \quad U_T w + S_T s = p_T T,$$

where P_C and P_T represent the price of computers and textiles, respectively.

The zero-profit conditions can be divided by total output in each industry (either C or T) to obtain

$$\frac{U_C}{C} w + \frac{S_C}{C} s = p_C \quad \text{and} \quad \frac{U_T}{T} w + \frac{S_T}{T} s = p_T.$$

Note that these fractions equal the technical coefficients. This system can be expressed as $Aw = p$, where A is the matrix of technical coefficients, w is the vector of payments to labor (that is, wages and salaries), and p is the vector of prices, as shown by

$$\begin{bmatrix} a_{UT} & a_{ST} \\ a_{UC} & a_{SC} \end{bmatrix} \cdot \begin{bmatrix} w \\ s \end{bmatrix} = \begin{bmatrix} p_T \\ p_C \end{bmatrix}.$$

The determinant of the matrix of technical coefficients is $|A| = a_{UT} \cdot a_{SC} - a_{UC} \cdot a_{ST}$. This determinant is positive if textile production uses unskilled labor relatively more intensively than does computer production (that is, $a_{UT}/a_{ST} > a_{UC}/a_{SC}$), an assumption we make. Note that if these relative intensities are the same, then the determinant is zero. In that case the two industries are basically the same, and the two equations are either redundant (if $p_T = p_C$) or mutually inconsistent (if $p_T \neq p_C$).

Changes in the prices of computers or textiles affect the wages of both skilled and unskilled workers. The solution of this system of equations, $w = A^{-1}p$, shows this explicitly. Using the results above to find A^{-1}, we have

$$\frac{1}{|A|} \begin{bmatrix} a_{SC} & -a_{ST} \\ -a_{UC} & a_{UT} \end{bmatrix} \cdot \begin{bmatrix} p_T \\ p_C \end{bmatrix} = \begin{bmatrix} w \\ s \end{bmatrix}.$$

In this model the effect of greater trade with developing countries is to lower the relative price of textiles. Considering the comparative static experiment of a decrease in P_T and no change in P_C and rewriting the solution in terms of changes, we have

$$\frac{1}{|A|}\begin{bmatrix} a_{SC} & -a_{ST} \\ -a_{UC} & a_{UT} \end{bmatrix} \cdot \begin{bmatrix} \Delta p_T \\ 0 \end{bmatrix} = \begin{bmatrix} \Delta w \\ \Delta s \end{bmatrix}.$$

The solution shows that $\Delta w = a_{SC}/|A|\Delta p_T$ and $\Delta s = -a_{UC}/|A|\Delta p_T$. Since Δp_T is negative, this result shows that wages to the unskilled fall and wages to the skilled rise. So there is a theoretical possibility of a link between increased trade with developing countries and an increase in the wage gap between skilled and unskilled workers in the United States. The actual extent to which the increasing wage gap in the United States is attributable to increasing international competition, however, is a matter of continuing debate.[5]