

# Globalization and the distribution of income: The economic arguments

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**One of the issues currently being debated in the ongoing discussion of the pros and cons of today's globalization concerns the effects of greater world trade as well as of the changes in technology on a country's internal distribution of income, especially on skilled versus unskilled wage rates. In this article, I attempt to spell out some of the arguments concerning internal income distribution that have been put forth both by labor economists and international trade theorists. The impact of globalization on the wage premium between the skilled and unskilled may not be as obvious as is first imagined.**

Have globalization pressures and the expansion of world trade been responsible for the widening disparity in the distribution of income between skilled and unskilled workers within many countries? Questions such as this have been at the forefront of interest to many economists in the fields of labor and international trade for over a decade now. In this paper, my objective is not to examine the evidence, for there is considerable similarity in the view that the wage premium has been growing for some time, although leveling out in the past few years in the United States. (The experience in Western Europe has been somewhat different in that unemployment rates have been higher for the less skilled even if the wage premium has not widened.) Rather, I take this opportunity to examine more carefully the underlying logic used by economists in connecting a nation's distribution of income both to changes in the world trading scenario and to current changes in the rate and bias of technological progress.

## Changes in World Prices

One of the most widely heard remarks about the effects of globalization on the internal distribution of income in the United States is that the entry on the world stage of less developed countries, such as China and other countries of Asia, has tended to lower world prices of certain of our imported commodities. The reference most frequently cited in this regard is the article published >60 years ago by Wolfgang Stolper and Paul Samuelson (1). Broadly stated, their argument shows how a change in the relative price of imports, in their case initiated by a tariff, could have such a profound effect on the internal distribution of income that the real income of a broad-based productive factor such as labor would unambiguously be improved (or worsened). In the context of present-day trading patterns, the argument suggests that if a country's imports are made up of products that require relatively heavy use of unskilled labor (if produced at home), a reduction in the relative price of such imports would unambiguously worsen the position of unskilled labor and benefit that of the other factor of production, say, skilled labor. Hence, this argument states that the recent tide of globalization has widened the premium received by the skilled members of the labor force.

To understand the Stolper/Samuelson argument, suppose that a developed country produces two commodities for the world market, namely, a commodity that competes with imports from abroad and a commodity that is exported. Furthermore,

assume that in this country, the techniques used to produce the two commodities differ from each other. Keeping to the simple scenario, let unskilled and skilled labor be the only two inputs required in either production process, with the import-competing commodity employing a greater proportion of unskilled workers relative to skilled than does the export sector. With this in mind, what can be said about the effect of commodity price changes on the two types of wages if (as assumed) markets are competitive, with prices reflected in average production costs?

Should both commodity prices fall by the same percentage, so also would both wage rates and, therefore, both unit costs. Suppose instead that only the price of import-competing goods falls. With unskilled labor representing a greater component of such costs than in the exportable sector, the wages of the unskilled workers must fall. But more can be said: with unskilled wages falling and the price of exportables unchanged, the only way in which costs of exportables can also be unchanged is for the wage rate for skilled workers to rise. Each commodity uses the two inputs. Therefore, any percentage price change must represent an average of the percentage wage changes, and this requires the unskilled wage rate to fall by more, relatively, than the price of importables, and the skilled wage rate to rise (by more than the unchanged price of exportables). In the language of international trade theory, the change in relative commodity prices has resulted in a magnified change in the wage rates. Thus, a 15% fall in the price of importables, brought about by greater supplies being provided in the world market, could serve to depress the unskilled wage rate by 25% and raise the skilled wage rate by 10%.

This analysis lays the foundation for price effects in world markets to have a significant role in affecting the internal distribution of income. Now consider a variation in the setting, one that introduces the possibility that some productive factors are specifically used in some industry but not in others. For example, unskilled labor might be mobile between sectors, whereas physical capital, say, is used only in the production of import-competing goods and a third input, skilled labor, is concentrated in the export sector. In such a scenario, what effect on income distribution would follow from a reduction in the price of the import-competing good brought about by new supplies on world markets? The return to unskilled labor, the factor used in both sectors, would be driven down, but not by as much (in relative terms) as the price of imports, because unskilled labor is also used in producing exportables, whose price has been assumed not to change. Taking into account that unskilled labor consumes both types of commodities, its real wage rate would not be altered very much. By contrast, the return to physical capital, trapped in the sector experiencing a price decline, must fall by relatively more than the price of importables, whereas the return to skilled workers must actually rise in nominal terms, and therefore unambiguously in real

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terms. In each case, the logic is familiar from the earlier case: the relative change in each commodity price must be bounded by the relative changes in input prices. Now consider a slight alteration: let physical capital be mobile between sectors, unskilled labor used only in helping to produce import-competing goods, whereas skilled labor, as before, is specific to the exportable sector. A price fall in importables unambiguously hurts the unskilled while improving the real return to skilled workers. Some might argue that this fits the recent experience and setting in the United States fairly well.

### Improvements in Technology

Although the effects of globalization working through the terms of trade may be important, many economists have argued that changes in the wage premium in recent years are more likely to be the result of the extent and type of changes in technology that have been developed. A key observation, made by Robert Lawrence and Matthew Slaughter (2), was that the ratio of the use of skilled to unskilled labor in a number of industries in the United States had been rising, despite the increase in the wage premium. This is behavior that could not be explained unless the underlying technology was changing. In particular, those stressing the technology explanation would emphasize two aspects of this change: (i) it has been more pronounced in the past 15 years or so than in the preceding decade, and (ii) it has been biased in its effect on economizing more on the use of unskilled labor than on the use of skilled labor. I begin by examining the effects of technological progress on the unskilled and skilled wage rates in a stripped-down environment in which (again) only two commodities are produced and the two types of labor are the only inputs required in production. Furthermore, I assume, in this section, that world commodity prices are not disturbed by these improvements in technology. This assumption may sound unrealistic, and is adjusted in the following section of the paper. However, it turns out that an interpretation of the simple setting it provides may indeed be suggestive of events in the real world.

Any improvement in technology has its analog in two more simple kinds of changes. First, a technological improvement in a particular sector of the economy has an effect on factor returns much like a subsidy to production. In that sense it works like an increase in the price of the commodity, to be passed on in some combination to the factors involved in its production. Thus, if both sectors experience technological progress, a comparison of the extent of cost reduction in the two sectors would be analogous to a change in relative commodity prices in tracing through the impact on factor returns. Secondly, there may be a factor bias in the technological improvement in that the reduction in the use of skilled labor required per unit output may be greater or smaller than that of unskilled labor. Many economists claim that the recent improvements in technology are indeed biased in the sense that they have reduced the need for less skilled workers by more, relatively, than they have for those possessing greater skills. Improvements resulting from changes in the computer and information sectors are often cited in support of this bias. In any case, the analogy to this bias is found in a change in relative factor supplies in the economy; requiring less of an input to produce a unit of output has an effect on outputs similar to having more of the input available overall.

Labor economists and international trade economists often have strikingly different views as to the effects of changes in factor supplies in influencing factor returns. To many labor economists, an increase in the quantity of unskilled labor available in an economy will serve to drive down the unskilled wage rate. It is a straightforward story of supply and demand. To a trade theorist familiar with the workings of the simple Stolper/Samuelson economy described here, where two inputs (skilled and unskilled labor) are fully used, producing two outputs (exportables and import-competing goods), and world prices for

these goods are (assumed to be) unchanged, the factor supply changes are completely absorbed by changes in the composition of outputs, with no changes in factor prices required. Instead, an increase in the supply only of unskilled labor would result in an increase in the output of the commodity in which unskilled labor is intensively used. The other sector must contract in order that supplies of skilled labor are made available to the expanding sector. This is the celebrated so-called Rybczynski effect (3), whereby output changes are magnified reflections of input supply changes. Thus, alterations in the extensive margin (output changes) completely obviate the necessity of changes in the intensive margin (the factor requirements per unit of output) if there are sufficient numbers of different commodities (at least equal to the number of different inputs). As noted in the next section, in an economy closed to trade or one large enough to have an effect on world prices, the accommodating output changes would have an effect on the prices of commodities and through this mechanism also affect factor prices. But our assumption here is that world prices remain unchanged, thus cutting off this route by which input supply changes can influence factor prices.

What are the implications of these remarks for the effect on factor rewards of technological change that is biased in the sense of reducing input requirements for one factor by more than for another? Because such changes are analogous to factor supply changes, the bias in factor saving does not directly affect factor returns if commodity prices are kept constant. However, if costs are reduced more in one sector than another, wage rates will be altered. Thus, if technological progress is more pronounced in the skilled labor-intensive sector than in the other sector (that requires relatively intensive use of unskilled labor), the wage premium will rise and unskilled wages may fall in real terms. This outcome might appear surprising if technical change is generally biased in economizing on the use of skilled labor.

In reconciling the views of these two groups of economists, it must be stressed that the results discussed above are quite dependent on the specification of the model. In general settings, economists would tend to agree that commodity prices and factor supplies both have an influence on the distribution of income. The separate role of each is emphasized in settings in which the number of individual productive factors exceeds the number of commodities produced. The so-called "specific-factors model" (4), discussed briefly in the last section, usefully illustrates the point. Thus, suppose once again that unskilled labor is used only in the import-competing sector of the economy, physical capital is mobile between sectors, and skilled labor is only used in the export sector. How could this economy absorb an increase in the supply of unskilled workers if world commodity prices remain unchanged? Output changes alone will not suffice. There would indeed be pressure for output in the import-competing commodity to expand. But such output requires physical capital as well as unskilled labor. To obtain this capital without changing factor prices, it would be necessary to reduce the output of exportables. But this would throw some skilled labor out of work because that is the only sector in which it is used. As a consequence, changes in factor rewards are required in order that production techniques can be altered to absorb the extra supply of the unskilled. To be more precise, the return to physical capital would be bid up to obtain its release from the exportable sector and the wage rate for skilled labor will be reduced to ensure its continued employment in that sector. Changes are required both in the extensive margin (output of importables goes up and of exportables falls) and in the intensive margin (the wage rates for both specific factors fall and for mobile capital rises). The view of labor economists that changes in factor supplies do directly affect factor returns even if commodity prices are set on world markets is justified in this scenario.

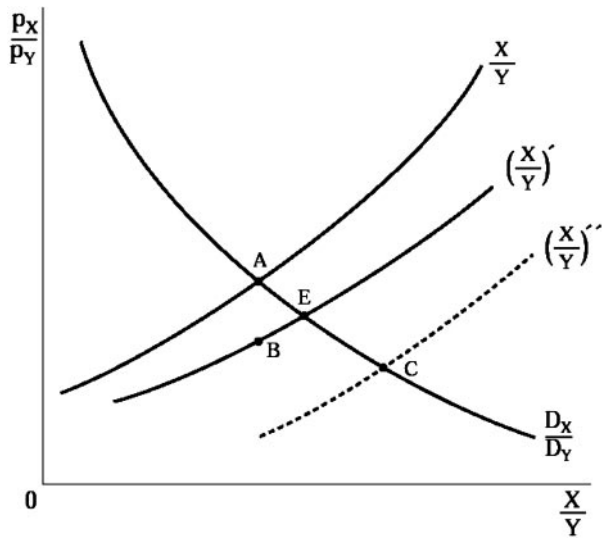


Fig. 1. Relative supply and demand curves.

Now consider the usefulness of the specific-factors model in evaluating the effect of biased technological progress on wage rates. Change the scenario to let unskilled labor be the factor that is mobile between the two sectors of the economy, and let each sector use as well an input required only in that sector (physical capital or skilled labor). To see the importance of the bias in technical progress, suppose that in both sectors of the economy progress takes place at the same rate (say, 10% at initial inputs), but that at unchanged factor prices it would reduce the required inputs of unskilled labor but not change at all of the other input requirements. Thus, technical progress is unskilled labor-saving throughout the economy, a description that to some fits quite well the changes taking place in the past decade. Retain our assumption that world prices for commodities remain unaltered. Must the wage rate for unskilled labor be driven down? Not necessarily. Technical progress must help some factors because it helps the economy that faces given world commodity prices. If progress were completely “neutral” (in the sense of reducing all factor requirements by the same relative amount at initial factor prices), all factor returns would rise by the amount of the economy-wide rate of technical progress. But if it has an unskilled labor-saving bias, it will tend to improve returns for the specific factors at the expense of labor. This need not be the outcome: if unskilled labor is sufficiently substitutable in production for the specific factors, labor can gain as well. The degree of substitutability required is not great (5).

### Technological Progress with Commodity Prices Endogenous

It is often the case that technological progress is not confined to a single economy, so that the effects of such progress on relative world commodity prices should be considered. Such price changes have an effect on factor returns that is additional to those examined in the preceding section. Indeed, the bias in technological progress now comes fully into its own, because (magnified) changes in the composition of outputs can be expected to have significant effects on market-clearing commodity prices.

To simplify the discussion, I assume that technological progress is world-wide, so that it is possible to consider a world market for the two commodities, with world demand and supply determining price. (The arguments put forth here follow closely those in ref. 6.) Fig. 1 shows an initial market-clearing equilibrium at point *A*, with demand and supply for the two commodities, *X* and *Y*, in balance. To emphasize that with two commod-

ities there is only a single market (in which *X* is exchanged for *Y*), demand and supply curves are expressed in relative terms; the ratios of *X* to *Y* demanded and supplied are functions of the relative price of *X* in terms of *Y*, with the demand curve downward sloping and the relative supply curve upward sloping. The purpose of this diagram is to illustrate the effect of technical progress on relative commodity prices. Bearing in mind that technical progress works both like an industry subsidy to the sector in which progress is more pronounced and like an increase in the relative supply of the factor that is saved more by the progress, two new relative supply curves are drawn. The first, labeled  $(X/Y)'$ , only illustrates the change that is like an industry subsidy. Here I have assumed that progress in the *X* sector is relatively more pronounced than in the *Y* sector, so that the new supply curve represents a downward shift. For example, if there were a 25% rate of technological progress in the *X* sector, with no change in the *Y* sector, point *B*, at which relative outputs are the same as at *A*, would be 25% lower than at *A*. That is, a relative price fall for *X* of 25% would just counteract the effect of technical progress and leave outputs, factor proportions, and relative factor prices completely unchanged.

Now consider the effect of any factor bias in technical progress. Suppose *X* is the relatively unskilled labor-intensive sector and that technological progress reduces the ratio of unskilled labor that is required to produce a unit of output (at initial factor prices). Such an unskilled-labor-saving bias works on the relative supply curve much as would an increase in the unskilled labor endowment. That is, it would shift the supply curve to the right, increasing the relative output of unskilled labor-intensive *X* at any given commodity price ratio. The curve  $(X/Y)''$  [compared with  $(X/Y)'$ ] captures the extra effect of such bias on the supply curve so that this curve shows the total impact on supplies of an unskilled-labor-saving technological progress in the unskilled-labor-intensive *X* sector of the economy.

In Fig. 1 I have arbitrarily shown that the unskilled-labor-saving bias is so strong that the new market-clearing price for *X* at *C* is lower than at *B*. Clearly, this involves a comparison of the extent of the rightward shift in supply from the  $(X/Y)'$  curve to the  $(X/Y)''$  curve compared with the increase in quantity demanded for the price drop from point *A* to point *B*. (The explicit comparison is made in ref. 6.) At *C*, the relative price of unskilled-labor-intensive *X* is lower than at *B*, where factor prices were unchanged. Thus, in Fig. 1, the favorable effect of technical progress on the unskilled wage stemming from having progress take place in the unskilled labor-intensive sector is outweighed by its unskilled-labor-saving bias, so that the wage at *C* is lower than at *B*. If this bias were less pronounced, the relative wage rate for the unskilled could rise instead.

In the introduction, mention was made of the effects on income distribution of the new, greater supplies of unskilled-labor-intensive commodities on the world market. One problem faced by researchers of the data in the United States is that it is difficult to find pronounced falls in the relative price of unskilled-labor-intensive commodities (7). But this might represent a combination of pressures for price falls in unskilled-labor-intensive goods combined with more rapid technological progress in the sectors producing skilled-labor-intensive products. As shown here for sector *X*, if equilibrium in world markets is brought about, the price of the commodity in which there has been technological progress will tend to fall, although perhaps not as much as the rate of technical progress. (Fig. 1 shows the price fall exceeding the extent of progress.) Combining these two sets of forces, technological progress in one sector, with prices adjusting, and new goods coming onto the market in the other, may lead to an outcome in which relative commodity prices do not change much (as observed in the United States), but technical progress is more rapid in skill-intensive sectors than elsewhere. The upshot is that the analysis in which relative

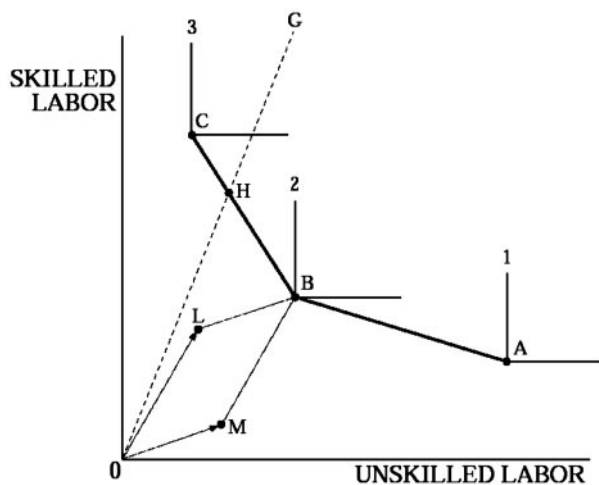


Fig. 2. Unit-value isoquants.

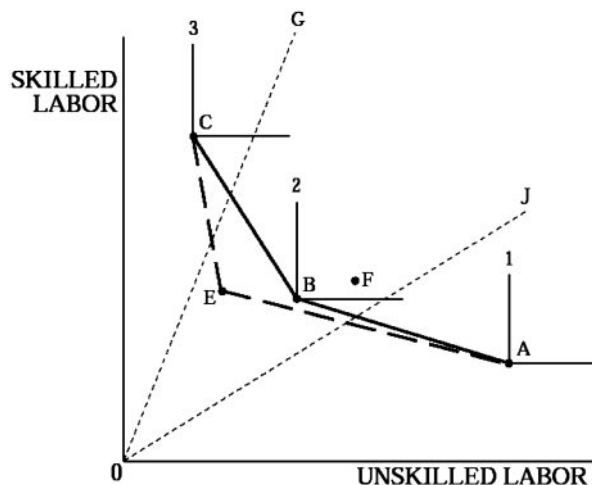


Fig. 3. Fragmentation in sector 2.

commodity prices were held fixed may indeed be more relevant than the analysis in which commodity prices are endogenous.

### International Fragmentation of Production

An important aspect of globalization is that complicated production processes that for years have been vertically integrated in a single locale are increasingly being broken up into separate components. These “fragments” of the original process need to be connected by what can be called “service links” in the form of transportation, communication, and coordination (8). The costs of such service links have been undergoing significant reduction in recent years, especially the costs of linking fragments located in different countries. Such outsourcing may reflect the different productivities of skilled and unskilled labor in various countries. Alternatively, the outsourcing could be promoted by the fact that relative factor prices differ between countries, as do factor proportions between fragments. Thus, some countries, such as the United States, may be better suited to producing skilled-labor-intensive fragments, and others, such as China, may provide a more suitable setting for unskilled-labor-intensive fragments.

As this kind of outsourcing has become more prominent, concerns arise that it spells difficulty for wage rates of unskilled labor in more developed countries. Although this may be the result, here I shall show that just the opposite could occur, international fragmentation that takes the form of a developed country losing production of an unskilled-labor-intensive fragment to foreign competition may serve to improve the real wage situation of the country’s unskilled workers.

A little background preparation is called for, and Fig. 2 is used for this purpose. Consider, first, the three right-angled loci labeled 1, 2, and 3, with corners labeled A, B, and C. Each refers to a different commodity, and the corner point for each represents the minimal amount of the two inputs, skilled and unskilled labor, required in this country to produce \$1 worth of output of each of the goods at given world prices. By drawing these loci right-angled, I have assumed that each unit-value isoquant reveals only a single technique whereby the particular commodity can be produced; no substitution between the two inputs is allowed. This is purely to simplify the argument. The connecting chords, AB and BC are also important, for they indicate that the country’s endowments of the two types of labor may allow it to produce a diversified pair of commodities in world trade instead of only one. Thus, suppose the country’s resource bundle lies along the ray OG. One dollar’s worth of output in such a country would consist of ≈40 cents worth of commodity 2 and 60 cents

worth of commodity 3, as indicated by point H. The chord BC also reveals, by its slope, what the ratio of the unskilled wage rate is to the skilled wage rate. To see this, note that all points along the BC chord show inputs of the two types of labor that will produce exactly \$1 worth of output. Because the slope of the chord indicates the amount of skilled labor that can be saved by using one more unit of unskilled labor, its slope shows the ratio of the two wage rates. (Note that although skilled and unskilled labor cannot be substituted for each other directly in producing either commodity, by assumption, this substitution can take place indirectly by producing more of commodity 2 and less of commodity 3.) Finally, suppose that two stages of production are required to produce \$1 worth of commodity 2. The more skilled labor-intensive fragment involves use of the two inputs in amounts indicated by point L, whereas the more unskilled-intensive fragment uses the bundles indicated by M. The vector sum of the two (point B) thus shows the total amounts of the two inputs required to produce \$1 worth of the second commodity.

Now consider how this kind of diagram can be used to illustrate the following change in world markets: suppose that reductions in transport, coordination, or communication costs allow, for the first time, the two separate fragments required in the production of the second commodity to be traded on world markets. Such an expansion in trading opportunities will serve to alter the locus showing for this country the minimal combination of inputs required to earn \$1 on world markets (see Fig. 3). In particular, there may be countries that are particularly good producers of the unskilled-labor-intensive fragment, although originally their total costs of production for commodity 2 were kept high by having to produce the skilled-labor-intensive fragment as well. And, let us suppose by contrast that the country shown in Fig. 2 is particularly good at producing the more skilled-labor-intensive fragment, so that in the new world equilibrium its trade price exceeds the original cost of production (for that fragment). The upshot of international fragmentation is that now there are four possible traded items instead of three. Our country is assumed not to be competitive in the unskilled-labor-intensive fragment, because greater competition in world markets now suggests that point F in Fig. 3 shows the combination of inputs required to produce \$1 worth at the new world prices. However, the country’s great ability in producing the skilled-labor-intensive fragment suggests that the input bundle shown by point E is sufficient to produce a dollar’s worth of that fragment. The new, improved, combined locus of input bundles that can produce a dollar is shown in Fig. 3 by the broken line contour CEA.

If our country had an endowment ratio shown by the ray *OJ* in Fig. 3, the consequence of international fragmentation whereby this country loses its ability to compete in the newly traded unskilled-labor-intensive fragment would be to lower the relative wage rate received by unskilled workers. The country would produce a combination of the first commodity and the skilled-labor-intensive fragment for the second commodity, and the ratio of unskilled to skilled wage rates would be shown by the slope of the *EA* chord in Fig. 3. This outcome does not sound surprising. However, suppose instead that our country was relatively more abundant in skilled labor, with an endowment along ray *OG*. It would then produce a mixture of the third commodity and the skilled-labor-intensive fragment of the second commodity. But note that the relative wage for the unskilled would actually increase: the chord *CE* is steeper than the chord *CB*. The technical explanation for this result is that fragmentation allows the country to slough off the unskilled-labor-intensive fragment for producing the second commodity, in which other countries are superior in their productivity, and thus it is like this country experiencing technological progress in producing the more unskilled-labor-intensive item (the surviving fragment compared with commodity 3). As per our previous discussion, technological progress in an unskilled-labor-intensive activity works to the benefit of unskilled labor. Perhaps even more sense can be made of this paradoxical-sounding result if in Fig. 3 it is noticed that along ray *OG* after fragmentation there are more unskilled workers left in the skilled-labor-intensive fragment than originally used in the entire vertically integrated second industry. (Ray *OG* cuts relatively more closely to point *E* than it does to point *B*.)

It is important to emphasize that the possibility described above for relatively skilled-abundant countries, namely that fragmentation and the loss of an unskilled-labor-intensive fragment to increased world competition may help the local return of unskilled workers, is just that, a possibility. I choose to emphasize it, however, because the prevailing view is that such fragmentation taking place in today's globalization must put pressure on unskilled wage rates.

### Concluding Remarks

Economists have had much more to say about the consequences of globalization on income distribution than reported here. Two

recent discussions summarizing much of the discussion are available in refs. 7 and 9. The present paper tries to expose the logic that economists use in applying two standard competitive models of general equilibrium, the so-called  $2 \times 2$  model exemplified in the Stolper/Samuelson contribution, and the specific-factors model. Although trade theorists and labor economists use different lenses in viewing the real-world issue of trade, technology, and wages, the specific-factors model can usefully serve as a bridge between these two views.

Throughout I have assumed that markets are perfectly competitive. A voluminous literature in the field of international trade in the past two decades has trumpeted the importance of imperfectly competitive markets in the analysis of trade. Some elements of this "new trade theory" are of relevance to the relationship between globalization and wages. For example, George Borjas and Valerie Ramey (10) have stressed that some sectors in the United States are highly concentrated (e.g., the automobile sector), and the strength of union activity has traditionally served to create rents for workers who are unskilled or less well educated. Increased globalization has created greater competition in such markets, and this has caused rents to this kind of labor to fall. Peter Neary (11) has put forth the view that greater international competition in oligopolistic industries has encouraged a greater allocation of resources to research and development activities, and these sectors are intensive in their use of skilled labor. Thus, he argues, even without price changes, globalization has increased the wage premium as well as raised the intensity of use of skilled labor.

There is no dearth of explanations and models put forth by the economics profession to shed light on recent trends in globalization whereby it is the members of the unskilled labor force in many countries, especially in more developed nations, that have seen their returns lagging behind wage rates for skilled workers. Empirical investigations are revealing that no single explanation suffices. Globalization today is reflected in new entrants that make world markets more competitive, a greater degree of outsourcing and fragmentation, a premium on the acquisition of education, and more rapid technological progress that may be biased in saving on unskilled labor as well as in the exportable sectors of developed countries. In the present paper I have tried to sketch out some of the basic arguments used by economists in the trade and wages debate.

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