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Income Inequality and Trade: How to Think, What to Conclude

J. David Richardson

In many of the older industrial economies of Europe and the United States, wage inequality has widened since the 1980s. In addition, employment shares of manual and production workers have declined in favor of skilled workers, and structural unemployment has risen (OECD, 1993; Bloom and Brender, 1993). Some of these trends—such as the shift in employment mix toward higher skill groups—are, intriguingly, seen in newer industrial economies, too.[1] Just a few years ago, these trends were generally ignored by international economists and left to the attention of labor economists. Analyses of the causes of the growing inequality, like Levy and Murnane (1992), gave little weight to foreign trade or global factors. But lately, there has been a surge

[1] See Fields (1994) for Hong Kong, Korea, Singapore, and Taiwan. See Revenga (1994), Feenstra and Hanson (1994), Hanson and Harrison (1994), or Revenga and Montenegro (1995) for Mexico. See Currie and Harrison (1994) for Morocco. Andrew Bernard at MIT has work in progress for Brazil, and Edwards and Tzannatos (1995) for case studies of 10 countries. Lawrence (1994a) finds the shift in the skill composition of employment even in the overseas affiliates of U.S. multinational corporations, and Oman (1994, p. 17) claims it extends to almost all multistage production and distribution around the world.

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of research on the possible connections between global trade and rising inequality of wages and incomes.[2]

Some contributions to this research reach alarming conclusions; trade is chiefly responsible for growing inequality and even declining median wages. Others are soothing, even forgiving; trade plays a tiny role, if any. In this paper, I aim to adjudicate.

The starting point of this analysis is the fact that most measures of national openness to the world economy have also been rising along with inequality. This is well known for the United States, where imports and exports were about 3 percent of GDP in 1970, as opposed to 10–12 percent today. It is less well known for the world, but between 1965 and 1990, according to World Bank figures, the share of output exported rose for low-income countries from 8 to 18 percent, for middle-income countries from 17 to 25 percent, and for high-income countries, from 12 to 20 percent. Over that time, the cross-penetration of markets by multinational corporations became more than just a U.S. phenomenon, and strategic cross-corporate alliances among multinationals and trade in technology have grown.[3]

Of course, the coincidence that trade and investment have increased at about the same time as wage inequality does not prove that one caused the other. Many other things have changed, as well: technology, demographics, regulation, unionization, and other factors. Much of the recent research is aimed at sorting out the various contributions of these trends to income inequality, identifying interactions among them, and trying to discern which may be causing which. But among the various candidate causes, "trade" and "technology" have been isolated for special attention. This reflects both careful theory, organized below, and important empirical trends.

This focus on trade and technology is not an unmixed blessing. For one thing, it neglects certain interesting elements of the growth in inequality. For example, inequality of wages in the United States has grown in even the finest subcategories—for example, among workers with the same occupational background working in the same firms. And one-third to one-half of the growing inequality seems to be growing year-to-year volatility of the average worker's

[2]The interested reader might begin with Bhagwati and Kosters (1994), Bloom and Brender (1993), Fieleke (1994), Baldwin (1995) and the Federal Reserve Bank of New York (1995). Some other recent and impending contributions are worth mentioning here. In late 1992, the University of Notre Dame sponsored a conference on "The Changing Distribution of Income in an Open U.S. Economy," now Bergstrand et al. (1994). The OECD has an ongoing research program on the themes and a corresponding series of working papers. The World Bank held a July 1994 workshop on global labor markets, and the 1995 *World Development Report* will be devoted to the issue (World Bank, 1995). The Brookings Institution sponsored a February 1995 conference on "Imports, Exports, and the American Worker," organized by Susan M. Collins.

[3]Feenstra and Hanson (1994), Lawrence (1994a) and Sachs and Shatz (1994, 1995) examine the influence of these forces on inequality as well as trade. For a time, some analyses used the aggregate trade imbalance as a measure of globalizing forces. However, trade imbalances are now more usually seen as concomitant of macroeconomic imbalances between saving and investment, and not as an independent source of greater trade.

own individual income (Gottschalk and Moffitt, 1994). At these levels, neither trade nor technology seems very compelling as an explanation. Another danger is that the focus on trade and technology feeds potentially destructive populist instincts, discussed at the end of this paper.

This paper will attempt to organize the debate on the connections among trade, technology and inequality. I will offer a theoretical framework, distill the existing empirical consensus, assess neglected issues, and isolate anomalies that remain.[4] Consensus has begun to form, slowly, on specification and conclusions.

By specification, I mean how to analyze and measure the effects of trade on income inequality. There seems to me to be increasing agreement that general equilibrium perspectives must play prominent roles in the analysis. Partial equilibrium analysis is applicable if one makes assumptions that labor is not mobile between sectors, at least in the short run (Revenga, 1992; Grossman, 1986, 1987; Brauer and Hickok, 1994). But these trends of increased trade and inequality have now extended over decade-long intervals and concern input markets that serve a multiplicity of output markets. The appropriate general equilibrium approach must string together such temporary or partial equilibria to describe the long-term evolution of labor outcomes.

Moreover, the general equilibrium models that are most relevant to this debate must feature technology and growth. Explicit treatment of technology is needed to compare it to trade as a source of inequality. Explicit treatment of growth is valuable as a source of unique gains from trade, and as a backdrop for conclusions about wage inequality. As Freeman notes (1995, pp. 3–4), growing inequality with strong overall growth evokes more acceptance than growing inequality with weak overall growth. Getting a disproportionately small share of the gains feels tolerable, if problematic, while bearing the brunt of the losses feels intolerable. Fortunately for international economists, these are precisely the directions in which general equilibrium analysis of the open economy has been going in the past 10 years. But international economists usually work with models that ignore any natural rate of unemployment (or hold it exogenous); that neglect the way education and training can change the endowments of human capital and pure labor; and that pay little attention to transitional dynamics, including intersectoral and interregional immobility of labor, and how subtle and chronic (often across generations) the frictions can be.

In short, the work that needs to be done in this area will bridge the gap between international and labor economics. Such cooperation is promising, among other reasons, for merging the "blatantly empirical" (Freeman's wry caricature of labor economics) with the airily abstract stereotype of international economics. Labor economists are expert forensic investigators; international economists are expert forensic analysts. They ought to work together. So far,

[4]Deardorff and Hakura (1994), Bhagwati (1995) and Jones (1995) also offer a useful starting point on the theoretical and empirical issues.

there has been little joint effort, although Baldwin and Cain (1994) is a synthetic and promising beginning.

Early empirical contributions to this debate relied on familiar specifications, raw data and simple correlations, and sensible but arguable scaling and rescaling of estimated magnitudes (for example, Wood, 1994). Recent empirical contributions have better modeling, better specification, or better data. Four of the more persuasive (or provocative) contributions for the United States are summarized in Table 1. Taken together, they suggest to me an important role for trade, close to or larger than its 10–15 percent share of U.S. output: not tiny, but not overwhelming either.

A Basic Model of Trade, Technology and Wages

I will present a basic model in which both trade and technology can be seen as exogenous causes of changes in wages. I believe that there is a growing consensus that this is the most meaningful way to structure the general equilibrium framework. I will then present a variation of the basic model that is relevant to periods of adjustment between general equilibria. The model, although it is clearly a simplification of more sophisticated approaches, will also provide a useful way of introducing these approaches and the conceptual and empirical debate. International economists often work with the basic model, although their way of laying claim to it for their sovereigns (Ricardo, Heckscher, Ohlin and so on) obscures its robust applicability. Labor economists often work with the variation, although their rush to the numbers sometimes obscures that they work with any model at all.

The model underlines the way an economy's international trade can rise significantly, while some sectors grow and others shrink, all without *necessarily* changing the relative rewards of workers and resource owners. Yet this model can also describe structural dislocations that afflict workers from many sources —trade, technology, tastes and so on. Consequently, it provides a useful checklist of exogenous conditioning variables for empirical attempts to measure the impact of trade on income inequality. One of the shortcomings of early empirical contributions was their focus on covariation in mutually endogenous variables.

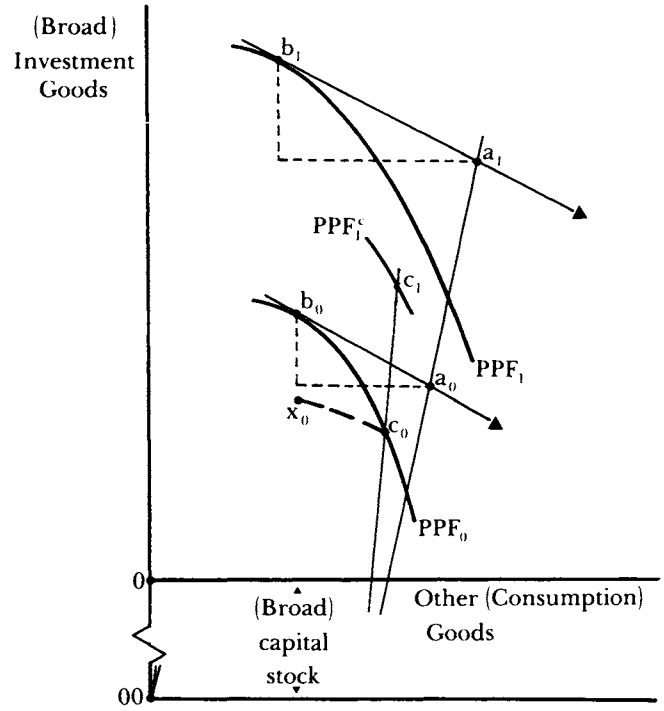
A graphical version of this model is presented in Figure 1, based on Richardson (1995).[5] The curved lines PPF_0, PPF_1^c, and PPF_1 depict production possibilities for an economy like the United States between "investment" goods and other (or consumption) goods. Investment goods are broadly defined to include all outputs that contribute to an economy's future production potential,

[5]Some will recognize this as the same model that international economists use to generate a Lerner-Pearce diagram, that is, a diagram involving unit-value isoquants in factor space. The graphical version in the text has the virtue of greater familiarity to other economists.

Table 1
Recent Econometric Estimates of Trade's Impact on U.S. Wage Inequality: A Persuasive Sample

Study	*Worker Categories*	*Summary*
Longer-Term Trends:		
Baldwin and Cain (1994)	More than 12 years of education; 12 or fewer years of education.	Trade pressures explain at most 9 percent of growing U.S. wage inequality from 1977–87, but less of the further growth in inequality after 1987, and little of declining inequality from 1967–77. After 1987, unskilled-labor-augmenting technological change seems most important; for 1967–77, factor-supply growth seems most important.
Bernard and Jensen (1994)	Production workers (less skilled); nonproduction workers (more skilled).	Shifts between exporting and nonexporting plants (within the same industry) are associated with roughly 50 percent of the 1980–87 growth in U.S. employment and payroll shares of U.S. nonproduction relative to production workers. Explicit measures of plant-level technological investment are associated with these same 1980–87 worker trends *within* a typical plant, but not with the empirically more important shifts *between* plants that export and those that do not.
Shorter-Term Adjustment:		
Haveman (1993)	Workers displaced because of plant shutdown, slack work or abolition-of-position for 5 U.S. Displaced Worker Surveys, 1981–89 observations; subclassified by 3 industry-year indicators: tradeables industries in decline or in expansion, nontradeables industries, all judged by relative product-price movements.	Workers displaced from tradeables industries in decline suffer 37 weeks of transitional unemployment, compared with 21–22 weeks for other displaced workers; roughly 4 weeks of the 16-week gap are due to the trade designation of the industry, with 12 weeks associated with personal characteristics of the worker. Two years after displacement, workers from tradeables industries in decline recover 5–9 percent less of their predisplacement wage than other displaced workers recover.
Kletzer (1994)	Workers displaced 1–3 years prior to being surveyed in 5 U.S. Displaced Worker Surveys; 1979–86 observations; subclassified by industry measures of import penetration and export intensity for manufactures.	The elasticity of an industry's displacement rate with respect to its import penetration ratio was 0.11, but −0.07 with respect to the ratio of exports to shipments. The negative estimated effect of the import penetration ratio on the probability of survey-date worker reemployment could not be disentangled from the negative effects of worker characteristics, especially being female. Import penetration ratios had no significant explanatory power in predicting earnings recovery.

Figure 1
A Basic Model of Trade, Technology, and Wages



as well as to its present activity. In addition to machinery and equipment, those sectors include education, consulting, training, basic and applied research, and activities that help diffuse and broker technology. The production possibilities frontiers are drawn with familiar convexity to reflect the usual diminishing returns to sectoral reallocation of specialized resources. Their convexity will be sharper the more strongly each sector relies on a unique mix of inputs. Their construction so far rests on remarkably few, generally unobjectionable assumptions.[6]

The preexisting stock of physical, human, and technological capital is indicated by the lower extension of the diagram to an origin 00. Rays from that

[6]I emphasize this point because the zeal of international economists to name and describe precisely the particular model they choose, from their vast array of candidates, has all too often led labor economists to dismiss the importance of general equilibrium modeling on the grounds that these models can spin a thousand tales. To get a feeling for some of the different yet *inconsequential* possibilities, consider different shapes for the production possibility frontiers given in Figure 1. Special versions of the production possibility frontier include fixed-coefficient cases (two straight-line segments meeting in the interior of the axes, a single interior point in the extreme of perfectly specialized resources); cases where there is a sector-specific resource; and special convex-around-a-cusp production possibility frontiers that will be used below to describe economies adjusting to structural shocks. If there are positive production externalities, also known as external returns to scale, then the frontier will turn less and less convex, and eventually can even become concave.

origin include all points where the ratio of capital stock to consumption is constant. These rays offer useful reference lines for the steady states of many growth (and trade) models.

First think about the evolution of this model in a situation where there is no trade, so it represents the path of a single economy. Say that the original production possibility frontier is PPF_0 and the original capital-consumption ratio is described by the ray going through c_0. There are three possibilities about the capital-output ratio represented by c_0: either the economy's production of (broad) investment goods exceeds the depreciation of its initial stock of (broad) capital, and the capital stock grows; or investment exactly covers the depreciation of capital, and the total capital stock remains unchanged; or investment is insufficient to cover depreciation of capital, and the capital stock shrinks. Let's assume that the first case holds, and that the capital stock is growing. Then the production possibility frontier will shift out in the next period, and with the same investment-consumption ratio, this "closed" economy will be able to produce and spend at a point like c_1 on PPF_1^c. Of course, the exact extent of the outward shift in the production possibility frontier depends also on the growth of other factor endowments, and on which sectors are especially dependent on (intensive in) which factors. In this model, the line through c_0 and c_1 in fact is the economy's expansion path—its growth trajectory—with no trade.

Now consider the same with trade. In the previous example, the economy consumed only what it produced directly. Now, the economy will shift toward production of one kind of good, and trade for the other good at world market prices. Since the diagram is depicting an advanced economy, like the United States, assume that its comparative advantage is in the investment goods sector, which is more capital intensive. The sector for other goods, consumption goods, will be assumed to depend more on labor, and in particular on less-skilled, less-experienced, "pure" labor.

In the first time period, the economy starts on PPF_0. But instead of producing and consuming at c_0, trade opens up the possibility of the economy's producing at point b_0, exporting its excess production of investment goods (the dashed vertical line measures its exports), and importing its excess demand for consumption goods (the dashed horizontal line measures its imports). The slope of the line b_0a_0 represents world relative prices for the two goods. As a result of trade, this economy is now at a_0 rather than at c_0 in first-period expenditure (acquisition): it has both more investment and more consumption. Thus, in the next time period, the production possibility frontier will be shifted out further than in the previous example. On that new frontier, labelled PPF_1, the country can produce at point b_1 and trade at world market prices to enjoy the "acquisition point" a_1 in the next period. (Notice that the slope of the line through a_1 and b_1, representing the relative prices of the two goods, has not changed since the first time period.) This economy's reliance on trade increases both its consumption possibilities and its growth.

The line through a_0 and a_1 represents the ratio between what the economy ends up consuming and investing in that time interval.[7] The line through a_0a_1 is drawn to have a flatter slope than c_0c_1, because opening this kind of economy to trade will usually reduce the internal price of consumption goods relative to investment goods, and will shift relative expenditure toward consumption.

A line through b_0 and b_1 would represent the growth trajectory of this economy with trade, in terms of what it produces. However, the line through b_0 and b_1 will not be a ray from the origin; as drawn, the ratio of investment goods to others produced rises between b_0 and b_1. Production of other goods actually falls. This will occur when growth of physical, human, and technological capital is the dominant determinant of the shift, rather than labor-force growth. Then a line through b_0b_1 will have a negative slope.[8]

In this sort of model, there are five local[9] reasons why the volume of trade might increase. One is an opening of the economy, along a given production possibility frontier; for example, the shift from c_0 to b_0. Second is the natural (and endogenous) growth of the economy; for example, from b_0 to b_1. A third reason is any extra exogenous growth in the capital stock, relative to the labor force, say because of capital-augmenting technological change, which will tug PPF_1 even further in the vertical direction. Fourth is exogenous sectoral technical change that is more rapid for investment goods than for other sectors (that is, relatively faster total factor productivity growth in investment goods), which will also tug PPF_1 vertically. Fifth is a shift of tastes (or demands) away from investment goods (for example, defense downsizing that reduces the economy's overall demand for technological capital, or demographics that reduce its demand for education) that will shift the a_0a_1 line in a southeast direction.

Interestingly enough, however, only two of these five local reasons for increased trade would shift relative wages in a way that would produce greater inequality—the first and the fourth. The other three would have no effect on relative wages.

This conclusion is arresting, important, and not immediately obvious.[10] It is arresting because it shows how early research that examined changes in overall labor supply and sectoral labor demands as sources of wage inequality was misleading for long-run trends. Equally misleading was research that

[7]The a_0a_1 and c_0c_1 lines are Engel curve counterparts for open and closed economies.

[8]This is because of the Rybczinski theorem. At given world relative prices, growth in any factor causes growth in the sector that employs it relatively intensively, and *shrinkage* in the other sector.

[9]There are also external (exogenous) reasons. For every economy depicted in this way, there is a counterpart diagram for the "rest of its world." Shifts in that diagram due to overseas demographics, investment, or technology spill over to our economy in the form of changing relative product prices in world markets—our budget line, or in a more general model, in the form of a moving rest-of-world excess supply (offer) curve. Bloom and Brender (1993) is a good source for charting the fundamental rest-of-world trends, or also Freeman (1994).

[10]Some commentators, for example, think it depends on the so-called factor price equalization theorem—that trade equalizes global factor rewards. It does not depend on this; factor rewards can still differ by across-the-board (neutral) gaps in technological capability; it does depend on the tendency of trade to equalize *relative* factor rewards.

translated trade into the implicit net factor content it added to net labor supplies. In the long-run equilibria of this kind of open economy, three of these five changes have no impact on relative wages, though all affect the production mix, the volume of trade, and other variables.

This conclusion also undermines research that sweepingly but limply invokes "technology" (technological karma) for trends in wage inequality. Only some kinds matter. Variable-rate sectoral growth in total factor productivity matters; factor-augmenting technological change does not (for example, computers that make skilled workers even more skilled).

This conclusion is important because it differentiates exogenous from endogenous forces. It shows that a reduced-form general equilibrium equation for relative wages does not have a "kitchen sink-full" of variables on the right-hand side. In fact, it has only two kinds: relative sectoral prices and total factor productivities.[11]

This conclusion has obvious econometric importance. A naive researcher could find correlations galore in the nexus of long-term trends in trade, technology, tastes, and factor supply growth—simple correlations, multiple correlations, in endless assortment. Only some are meaningful. Most important for this paper, any correlation uncovered between trade volumes (the lengths of the dashed lines in Figure 1) and trends in wage inequality would be uninterpretable without further information. It could have either positive or negative sign, and its size could be anything.

The most straightforward way to understand this point is to consider what factors *would* cause relative factor rewards to change. Notice that an opening of the economy shifts relative product prices: the old product prices would be represented by the tangent through c_0, while the new relative prices would be shown by the line from b_0 to a_0. Increased openness to trade reduces the internal relative price of other goods and the pure labor they employ, shifting all factors to the investment-goods sector.[12] Relative growth in total factor productivity in the investment sector sucks all resources out of the other-goods sector. The investment-goods sector can absorb the large number of pure workers released only if their relative wage falls. Increased inequality can be seen as a multiplicative interaction of the effects of trade opening and (localized) sector-specific technological change (Leamer, 1994a, pp. 10–14).

[11] Neither relative prices nor local technology are, of course, really exogenous either. Among other things, they are influenced by trends in technology, tastes, investment and other factor-supply growth in the rest of the world, as well as by the trade opening policies of the country depicted in Figure 1, when it is large enough to influence world markets. Krugman (1995) is a simple calibrated model of symmetric economies along these lines. Francois (1994) and Martin and Fallon (1995) are more sophisticated calibration research along these lines. No one has yet tackled the problem of econometrically modelling several generic types of economies (for example, older industrialized, newly industrializing, preindustrial) in a sophisticated way. Wood's (1994) identification and discussion of the world distribution of three labor groups is a promising (and seemingly neglected) contribution along these lines: workers with skills, with basic education, and with no education.

[12] In fact, these insights are the roots of the Stolper-Samuelson theorem.

By contrast, in the broad growth of the economy from one production possibility frontier with free trade to another frontier with free trade—that is, from b_0 to b_1—there is no change in relative prices of the two goods, which are set on the world market in both cases. Lots of other things change. There is overall growth, technological investment, capital deepening, and decline in the other-goods sector coupled with increased other-goods imports. The economy's dynamics are hardly dull. But relative factor rewards are constant. They are *not* linked in any rigid way to trade volumes, nor to sectoral production shares, nor to the economy's overall factor supplies, nor to technology that augments effective units of factors by simply changing their generic productivity, nor to changing demand patterns within the society (for example, for defense-related products, as in Berman, Bound and Griliches, 1994).

It is a remarkable conclusion of general equilibrium theory that relative factor prices under free[13] trade are dictated solely by relative sectoral total factor productivity and relative goods prices. Since these factors do not change in this scenario, neither will wages. The relative compensation of pure (unskilled) workers and skilled workers (and other owners of capital) is actually the *same* at b_0 as it is at b_1.

Leamer (1995) makes the same point in a striking way. In a completely open trading economy with little influence over world prices, every sector's labor demand curve is horizontal, at a wage dictated by the goods price set by the equally horizontal world (excess) demand for its products. Output and trade volumes no longer shift this infinitely elastic labor demand curve, nor do many of the most familiar types of technological change.[14]

These insights are now widely appreciated outside the international economists who have cherished them for decades. They have helped refine the debate and its econometric specification, especially in cross sections over long time intervals. The debate increasingly and properly isolates trade prices and sectoral total factor productivity differences as the causes of long-run factor-price movements. Trade volumes are correspondingly treated endogenously. Neutral and factor-augmenting technological change is seen to be just like factor-supply change, with innocuous impacts on factor prices. And the econometric specifica-

[13]The forcefulness of this conclusion can be blunted, naturally, by assuming impediments to global price equalization forces, such as trade barriers, transport costs, and inherently nontradeable sectors. Nontradeables sectors will be treated below. Even these impediments, however, have long-run impacts on wage inequality through local relative prices. Along these lines, one of the most provocative experiments of Baldwin and Cain (1994) is to try to use revealed trade to infer what U.S. factor returns would have been if it had had sealed borders.

[14]Older readers may recall, like this writer, microeconomics demonstrations of how factor-demand elasticities are indeed a simple nonlinear combination of cost shares, substitution elasticities, and product-market price elasticities, becoming infinite as either of the last two elements does. Leamer's implication is that fully *half* of the typical labor economics approach to issues of wage inequality—"let's look at supply factors; let's look at demand factors"—boils down to global product prices and the sector's total factor productivity alone!

tion increasingly emphasizes the former variables, and downplays the others.

With this sort of model in mind, Lawrence (1994a, b), Krugman and Lawrence (1993) and Lawrence and Slaughter (1993) absolve trade of having much influence on U.S. income inequality, because the product prices they examine show that the relative prices of investment goods are falling, not the relative prices of pure-labor-intensive goods. Sachs and Shatz (1994) hesitate to draw the same conclusion, only because computer prices (they claim) uniquely explain most of the decline in investment goods prices. Leamer (1995) also disagrees by showing how powerfully falling textile and apparel prices influence the prices of the goods produced by *really* unskilled workers. Feenstra and Hanson (1994) disagree with the Lawrence verdict, because they claim that the relevant price ratios always concern domestic to foreign prices in each sector, which rise over the relevant period. Their conclusion is better understood in the differentiated-goods form of this model described below.

Problems associated with measuring prices in various sectors are at the heart of these controversies. Using common and reliable U.S. series for export, import, and domestic prices, published by the Bureau of Labor Statistics, one can reach opposite conclusions by characterizing U.S. exportable and importable sectors differently. If U.S. export sectors are taken to be the intermediate- and capital-goods sectors together, then their price has declined relative to consumer goods over most of the period since 1982. This would tend to imply that trade has not much driven down the price of goods produced by relatively low income labor.

The U.S. export prices of intermediates, however, have risen slightly compared with U.S. import prices of intermediates, whereas the opposite is strongly true for capital goods. This offers at least some reason for suspecting that import prices are hurting employment in intermediate-goods sectors. Furthermore, U.S. domestic prices of all categories have risen relative to U.S. import (or export) prices of all categories, at least since the strong dollar of the early 1980s, as Feenstra and Hanson (1994) emphasize. This evidence offers some stronger evidence that trade prices contribute to U.S. inequality.

Some of these researchers, especially Lawrence, correspondingly indict technology. If trade prices had been the culprit, he points out, driving down the prices of products produced by low-skilled labor, then the fall in the relative cost of pure workers would have led to increased substitution of them for skilled workers and capital in other (and all) industries. But the substitution has been exactly the opposite in almost all industries in almost all industrial countries. Therefore, he implies, technology is guilty by default. Indirect support for the importance of sectoral technological change comes from Berman, Bound and Griliches (1994, pp. 389–91) and Kletzer (1994), who find that sectors with the largest share of computer investment to total investment, *ceteris paribus*, also have the largest decline in the cost share accruing to (unskilled) production workers. Both studies seem to have in mind a twist in respective isoquants away

from unskilled workers; neither demonstrates that the impact of such a twist increases total factor productivity growth in the investment-goods sector more than others.

Not that anyone has a very good measure of technological change. Bernard and Jensen (1994) come closest, using four different plant-level variables: computer investment, research and development spending (R&D), scientists and engineers employed and number of distinct technologies adopted. They find that R&D helps explain U.S. 1980–87 shifts in skilled and less-skilled employment within plants (the isoquant twist), but not between plants, nor shifts in wages, both of which are more closely related to whether or not the plant exported.

Other issues of measurement bedevil the general equilibrium side of the debate. The most readily usable proxy for unskilled and skilled workers is production workers and nonproduction workers. Yet the former uncomfortably includes supervisors, bookkeepers, and product development staff, while the latter includes truck drivers and clerical/office workers, as Leamer (1994a, pp. 17–18) points out. Borjas and Ramey (1993, 1994), Baldwin and Cain (1994), Brauer and Hickok (1994), and Sachs and Shatz (1995) are perhaps leading the way toward better measurement on this front by differentiating workers with and without 12 years of education, using the Current Population Survey.

Another conceptual and measurement issue is whether the focus on trade alone is too narrow. A proper conception of globalization would also involve the international migration of physical, human, and technological capital, as well as pure (unskilled) workers. Wood (1994) sees the issue, but avoids it by assuming perfect (physical) capital migration as a maintained hypothesis to focus his attention on how trade affects returns to human and infrastructural capital, relative to pure labor. Labor economists have devoted significant amounts of time to measuring the effects of immigration (Abowd and Freeman, 1991; Borjas and Freeman, 1992), and Feenstra and Hanson (1994) use capital migration (or differential capital formation) as the exogenous driving force in their differentiated-product models. The basic model outlined here, however, provides a useful discipline on these other globalizing forces. In its regime, for these forces to have a long-run equilibrium impact on wage inequality, they must be shown in some way to influence relative prices or sectoral total factor productivity. The connection is far easier to draw in some cases (migration of technological capital) than in others (pure immigration).

Problems Caused by Transitional Factors

The framework presented so far represents a movement from one general equilibrium to another, with the passage of time. However, labor economists have always emphasized the difficulties and distortions in the dynamics of labor market adjustment. International economists usually ignore them or find them

to be small in industrialized countries (for example, see Baldwin, Mutti and Richardson, 1980).

As pictured, the stylized economy enjoys intersectoral mobility of resources and, implicitly, internal geographic mobility, too. But *im*mobility is vital to the debate. An economy that opens up to trade moves from one point on its production possibility frontier to another: from c to b in Figure 1. Such a movement cannot be costless. Temporary dislocation is almost inevitable. For the example in Figure 1, the other-goods sector must shrink in response to its declining internal prices, and the factors that are displaced must be reabsorbed into the expanding investment-goods sector. This may prove little problem for company cars, which can be literally driven from one sector to another, or for adaptable workers, like accountants, lawyers, secretaries, and truck drivers, as long as they can move geographically. It is a much greater problem for specialized resources and workers, and for nontransferable experience that they may have accumulated. In addition to the costs of retraining, retooling, and relocating, all of which divert time and energy from normal employment, workers may choose to delay accepting reemployment: perhaps until the permanence of the change is discerned; perhaps while they search—often vainly—for an ideal new job; or perhaps because compensation from the old job continues for a while via severance packages. At least some of these costs and delays show up in temporary unemployment and excess capacity.

As a result of such dislocations and adjustment delays, the economy operating along PPF_0 in Figure 1 may actually move from its original no-trade position c_0 over to some point in the area of x_0, before gradually moving up to b_0. In other words, resources quickly leave the shrinking other-goods sector, and while some of them can be put to immediate use in the growing investment sector, other dislocated resources temporarily lose all productivity. Downsizing movements can take place very rapidly, and will do so if the underlying trade-opening stimulus and internal price changes are abrupt and clear. One might call this the "shock therapy" scenario. Then only slowly, as workers and other resources are retrained, retooled, and relocated, will production points creep vertically from x_0 toward the new long-run production point b_0. The gap from x_0 to the normal production possibility frontier is in fact a good measure of the output foregone from involuntary (though often temporary) structural unemployment. It is larger when resources are less mobile (or when the production possibility frontier is less convex).

Transitionally unemployed workers and others who own hard-to-adapt resources are often significant losers from a shift toward more open trade. Haveman (1994a) comes closest to estimating how much. He models the degree of intersectoral labor mobility explicitly, and looks at gainers from trade as well as losers. He finds that once export expansion is factored in, trade prices explain less than 5 percent of involuntary U.S. worker dislocation during 1984 through 1992. On the other hand, he also finds that the elasticity of worker displacements with respect to the import price alone is a rather high (negative) 3.5 in

industries that compete strongly with imports; that is, a 10 percent drop in the import price leads to a 35 percent rise in the number of displaced workers.

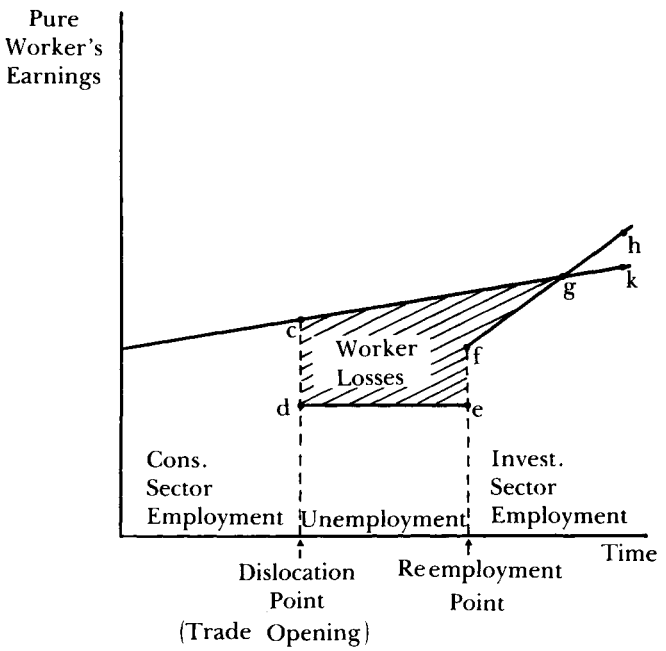
It is also possible that some dislocated workers are never reemployed, adding to structural and "natural" unemployment. In this case, trade-opening initiatives could increase the aggregate unemployment rate, and the relevant *PPF* in the future will lie *inside* of PPF_1. This might happen, for example, if large numbers of the workers being released were less skilled than others at job search, job match, and job adaptation, or if they were subject to congestion/contagion effects due to their skills being most suitable to similar declining industries (Haveman, 1993; Wood, 1994, ch. 8) or if their rooted geographical location supports no other industries. Haveman, in fact, estimates that the increased duration of unemployment during the late 1980s for trade-displaced workers was 390,000 person years, equivalent to about 0.4 percentage points in terms of the aggregate unemployment rate.

As discussed earlier, a trade opening will also cause a movement of relative factor prices against pure, less-skilled labor, and in favor of skilled workers, experienced workers, knowledge workers, and physical and technological capital. In fact, there is also a "magnification effect"—the proportional impact on factor prices is a multiple of the product-price change. Thus, one cannot assume that a relatively small decline in relative prices, as a result of trade opening, will guarantee a correspondingly small effect on factor prices.

The pattern of income for a pure (less-skilled) worker displaced by trade might look something like Figure 2. The worker begins in the "other goods" sector, gradually receiving wage increases to match increases in experience and productivity. The worker loses that job, and is without a job for a time. The eventual new job, in the investment sector, starts off at lower pay than the worker had been receiving in the other goods sector. However, trade increases the possibilities for welfare-enhancing investment and growth; the worker's wage and productivity will grow more rapidly in the new sector than if trade had been impeded and the worker had not been displaced. In the end, whether the worker's lifetime income is higher or lower depends on the duration of the periods of employment and unemployment, on the worker's age and discount rate, and the sharpness of the growth gains from trade. It is possible, at least in theory, that the displaced worker eventually may be absolutely better off because of more rapid income growth from trade, but relatively worse off, compared with those skilled workers who benefitted even more from the trade opening.

Jacobson (1995) records average annual income losses of $2000 (in 1987 dollars) for trade-displaced workers as long as six years after separation. Haveman (1993) and Kletzer (1994) independently use the U.S. Displaced Worker Surveys, supplements to the Current Population Surveys, to estimate the patterns of income for a displaced worker following the life pattern just described. Also, they try to find out whether trade displacement differs from other sorts of job displacement. Haveman finds longer spells of unemployment and greater earnings losses (5–9 percent after two years) for trade-displaced workers than for

Figure 2
Earnings Over Time for a Pure Trade-Displaced Worker



Notes: cdefgh = earnings trajectory with trade opening.
cgk = earnings trajectory with no trade opening (base case).
slope of *fgk* = growth rate with trade opening.
slope of *cgk* = growth rate with no trade opening.
height of *f* = postdisplacement earnings of pure worker in investment-goods sector.
height of *c* = predisplacement earnings of pure worker in consumption-goods sector.

others. Kletzer (1994) finds that similar results could alternatively be explained by gender (trade-displaced workers are disproportionately female) or by dummy variables for years (1982 displacements were especially harsh; 1985, especially mild). The two studies differ in their definition of trade pressure: Haveman uses the preferred price-based measure; Kletzer uses trade (volume) penetration.

In this regard, Bernard and Jensen (1995, Tables 6–9) find that U.S. exporting plants pay 5 to 9 percent higher wages to *both* production and nonproduction workers than nonexporting firms, holding constant the plant's age, size, location, capital intensity, and other characteristics. And since the differential is especially high for production workers (somewhat surprisingly), export expansion might be taken to be a source of rising standards of living and declining inequality (eventually, after enough workers shift out of low-wage, nonexporting plants). They also find that exporting plants had faster wage growth in the 1980s than other plants, though the opposite was true for plants that were initial exporters but ceased.

More Sophisticated Approaches

Virtually every contributor to this field works within a framework that is more sophisticated than the one I have chosen to organize the debate. The most important sophistications concern sectoral disaggregation, differences between marginal and average, market power, and the interdependence of trade and technology. Nevertheless, many of the key elements of both the general equilibrium and transitional approaches are still valid in more realistic settings. This point is sometimes obscured by the recurrent jousting among researchers over who has the most relevant approach.

Most obviously, almost every contributor assumes a multiplicity of sectors, although usually only a small number of worker types and other factors. Leamer (1994a, pp. 23–6) shows how the linkage described above between output prices, technologies, and factor rewards generalizes to a setting with more sectors than factors.[15]

A few contributors (Sachs and Shartz, 1994, 1995) include explicit nontradeables sectors—sectors in which, by assumption, barriers and natural arbitrage costs prevent global forces from influencing local product markets directly. In this environment, intuition suggests reduced influence for trade in wage inequality, since sectors such as services are (often falsely) perceived to be mostly nontradeable and account for 50–70 percent of value added in industrial economies. The intuition is too glib, however. The trade tail might still wag the nontradeable dog. Most economists accept that the "margin rules" in setting outcomes, even when inframarginal transactions are large. At the margin, trade-opening forces pull resources out of nontradeables sectors, and into investment-goods sectors. Suppose, for the sake of argument, that technologies for an admittedly large nontradeables sector had the same range of skilled-labor/pure-labor intensities as those of the import-competing consumer-goods sectors. Then the impact of trade-opening on wage inequality would be exactly as described in Figure 1: it would draw workers and other resources out of sectors with dependence on pure labor and into the investment-goods sector, which is dependent on skilled labor.[16] Suppose, at another extreme, that the nontradeables sector and the investment-goods sector had the same relative

[15] The somewhat arcane discussion among international economists about "cones of diversification" can be translated into a discussion about the number of distinct sectors in which each economy is producing, and about the margin between sectors represented in its production mix and those not represented. See Jones (1995). The issues can be analyzed in a framework very similar to that which follows incorporating nontradeables sectors, which are often characterized as unique to each economy.

[16] Envision a three-dimensional *PPF*, with nontradeables measured along an axis rising perpendicularly from the page. The *PPF* projections in nontradeables/other-goods planes are straight lines because these sectors both use factors in the same intensity. Relative wages are the same at any point along such straight-line curves. The *PPF* projections in Figure 1's space for various prechosen levels of nontradeables production are radially parallel to the *PPF*s already drawn in Figure 1, making the one that is drawn representative of a much larger family of *PPF*s for *any* level of nontradeables production.

factor intensities. Then the impact of trade opening would still be qualitatively the same as in Figure 1, though quantitatively smaller. To give the most alarming case, suppose that nontradeables sectors are even *more* intensive in the use of pure labor than importable consumption goods—domestic housekeeping in contrast to apparel employment, say. Only then is there some chance that trade opening might cause more acute worsening of wage equality than is described in Figure 1. But the facts about U.S. service-sector reliance on workers with a high school education or less suggest this is not the relevant case; such pure workers made up 70 percent of the labor force in manufacturing in 1979, but only 55 percent in nonmanufacturing (Sachs and Shatz, 1995). Recent reports show service-sector wages only slightly behind manufacturing-sector wages and closing (*Wall Street Journal*, July 9, 1994, p. A2).

Still another group of contributors disaggregates these models by introducing a margin of workers or products, different from the inframarginal workers or products, whose prosperity is most directly influenced by trade. Criteria for defining the margin include product differentiation within sectors, export dependence, and subnational pockets of regional labor immobility. (This, of course, merely increases the dimensions of the model.) Wood (1994) makes the most of this approach rhetorically, arguing that imports from developing countries displace a marginal segment of every industry that employs workers of especially low skills, below those of average workers in any (every) well-defined industry or occupational group. Studies that use average data, as almost all do, therefore understate the income-distributional effect of trade. Sachs and Shatz (1994), however, expect on this basis to see the greatest skill upgrading in the low-skill industries where developing countries have made the sharpest gains; in fact, they find the opposite—high-skill industries have the greatest skill upgrading.

Bernard and Jensen (1994) argue that the margin that really matters is between exporting and other *plants*, not subindustries or subproducts. In a careful decomposition and regression analysis of U.S. manufacturing from 1973 through 1987, they show that half or more of the increased employment and payroll shares of nonproduction (skilled) workers, and virtually all of their wage gains, are associated with the movement of workers, and the plants themselves, from establishments that do not export to those that do. The persuasive aspect of this demonstration that "trade matters for inequality trends" is their ability to control econometrically for all sorts of important alternative explanations (plant size, capital intensity, industry, and so on), including technological change. Technological investment explains some of the shift toward nonproduction workers within plants, but exporting explains the much more important shifts between plants.

Leamer (1995) makes similar points with a regional slant: in subregions of nations that are well endowed with workers similar to those in developing countries, international competition will bring intense pressure on their wages and labor market outcomes; these workers are the margin. Workers in other

subregions will, however, gain from trade with the same countries. Leamer's point, of course, is that there is subregional factor immobility, a point that has already been addressed in the transitional version of Figure 1.

In a similar vein, Feenstra and Hanson (1994) define a marginal sector rigorously, and apply their model to U.S.-Mexican data, with unique predictions for worker prospects and income inequality. In their approach, finished manufactures are assumed to be produced from a large number of differentiated intermediate products—in fact, a continuum of them—ordered by the intensity of their use of skilled as opposed to unskilled labor. Mexico specializes on one end of the continuum, the United States on the other. Differentially rapid capital formation in Mexico, or a movement of physical capital from the United States to Mexico, then causes a shift of production for marginal intermediate goods to Mexico. These come from the least skill-intensive intermediates that the United States produces, but become the most skill-intensive intermediates that Mexico produces. The result is that the demand for skilled workers relative to unskilled goes up in *both* countries, as does their relative reward. Feenstra and Hanson observe that this prediction corresponds very well to U.S.-Mexican data and experience.

Another group of contributors to this literature introduces market power. For example, if there is market power in the production of investment goods, then they will be underproduced compared with the perfectly competitive situation, since market power will allow firms to raise the product price above marginal (opportunity) cost. Increased trade openness is an implicit invitation to market entry; in that way, it will raise the production of investment goods and reduce their price.[17] To the extent that trade openness reduces market power, this imparts an extra reason why investment sectors would expand in the simple model described here at the expense of other sectors, and therefore an extra reason why skilled workers (and other resources in the investment sector) would gain at the expense of pure workers.

Borjas and Ramey (1993, 1994) find a reflection of this effect in explaining the movement over time in the relative wage of U.S. workers who graduated from high school and those who did not. They look both across geographic subregions and across industrial sectors, and find that the growing wage gap is correlated with higher net imports in durables-goods sectors, which tend to display a relatively high degree of industrial concentration. Oliviera-Martins (1994) finds more mixed results. He shows that interindustry wage premiums in 12 OECD countries fall into two groups. In industries with low product differentiation, import penetration undermines any wage differential that exists between industries. But in industries with high product differentiation—which usually means potential scale economies and higher industrial

[17]A market power equilibrium could be illustrated in Figure 1 between c_0 and b_0 by drawing a wedge between the price line and opportunity costs to reflect market power in either the product market or the factor markets. Increased trade opening will then shave the market power wedges.

concentration—the higher import penetration is associated with higher wage premiums. Haveman (1994b) is work in progress on the same themes for the United States, examining both import competition and export dependence.

Another sophistication referred to often in this debate is that trade and technology are in fact interdependent. It has been argued that international competition exerts substantial additional pressure, above and beyond the pressure from domestic competition and profit-seeking behavior, for firms to adopt innovations more rapidly. In this view, trade is an important causal factor for changes in technology; an appropriate model of the effect of trade on wages must look both for direct effects, and for indirect effects happening through technology. However, the most thorough study I know of this potential linkage did not find that exposure to trade was an important cause of gains in productivity on average. Scherer (1992) found that greater international competition spurred roughly offsetting responses in different kinds of firms. Aggressive firms increased their R&D spending, but submissive firms decreased their R&D spending, with little effect overall.

Few have observed a converse interdependence that would absolve trade. The intense competitive quest for best technology may force seekers to look abroad as well as at home. Trade is merely the innocent vehicle in today's intense technological race. Consistent with this is that world trade in high-technology intermediate and capital goods and business services is mushrooming.

In sum, it may be difficult to separate trade from technology as a cause of growing income inequality, but that does not point the finger toward either one.

Policy Implications and Peculiarities

My own reading of this research is that trade is a moderate contributing source of income inequality trends; it may not overshadow other sources, but it cannot be shrugged away.[18] Its influence is especially strong in the short run following some shock to tradeables prices or to supply conditions abroad. But trade is also a stimulus to growth, and the incomes of both poor and rich can rise because of it. In any event, the policy question remains: what to do.

In the most alarmist contributions to this literature, the unspoken default option is to "tame trade" in some way. But there are several problems with any such "sand-in-the-wheels" solution. The most common trade-impeding policies will usually be one-shot palliatives. They will equalize the income distribution somewhat, after which adverse trends will resume. For trade-impeding policies to stop an income distributional trend, they must be progressively tightened, with increasing marginal costs of each notch of tightening on social welfare.

[18] Mishel (1994) complains properly of the triumphalist tendency of some researchers to dismiss the influence of trade if it cannot be shown to be the king of the hill.

Therefore, most contributors to this literature rule out the "tame trade" option as a second- or third-best way of reducing inequality. It would sacrifice potential growth gains from trade that allow the poor to be better off than they used to be even if not relative to the nonpoor. And it always invites unsavory side effects like rent seeking, regulatory capture, and so on.

Another problem is philosophical, having to do with the controversy over whether actions should be taken if total benefits exceed total costs, or only if those who are injured by the action are fully compensated. Lots of otherwise desirable trends leave some people with lower relative incomes. Take education, for instance. It makes those who participate in it better off compared to those who choose not to, and may lead the former to fill jobs that would otherwise be available for the latter, imposing absolute losses, too. But no one seriously argues for slowing the rate at which we educate ourselves just to keep those who gain from getting too far ahead of those who drop out. Why don't we embrace the opportunities to gain from trade with the same enthusiasm as we embrace the opportunities to gain from education? Everyone is free to participate if they choose, and to share the gains.

Those who take seriously the question of how to reduce inequality often end up with prescriptions that have little to do with the diagnosis that trade is a contributing influence. For example, Wood (1994) strongly argues that trade is the cause of growing inequality and then recommends education, training, and earned income tax credits. Rather than appeals to parenthood, one might rather have suspected instead some attention to optimal gradualism as a principle, or a resurrection of mechanisms for trade adjustment assistance, or perhaps consideration of small taxes on trade that were earmarked for national adjustment programs (such taxes were sought by the Reagan administration during the Uruguay round negotiations, but failed to attract much support).

A final interesting point about the debate over international trade and inequality is whether the same lessons and concerns should relate to trade within a country. For example, within a society, few believe that free exchange between rich and poor people makes the rich worse off. If anything, the prejudice is the opposite—the rich exploit the poor. So why between societies might some imagine that free exchange impoverishes the rich?

To slice the question another way, consider different income classes in society. Within a society, few believe that free exchange impoverishes the upper middle class (the poorer of the rich) in favor of the lower middle class (the richer of the poor). Teachers trade with secretaries; engineers trade with draftsmen; assembly-line workers trade with retail workers. So why between societies might we imagine that free exchange impoverishes those who are poorer in the richer societies? Why has the argument become so compelling that when newly industrializing economies of Asia and Latin America trade freely with older industrialized economies, they gain at the expense of our poor and middle classes? Is there an economic difference in trade within and trade between

societies? Or perhaps the answer is yes, but comes from deeper cultural prejudice; the first is trade among "us," while the second is trade with "them."

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