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1995

International Trade, Multinational Corporations,  
and American Wages: Dissertation Summary

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# **"International Trade, Multinational Corporations, and American Wages"**

**by Matthew J. Slaughter**

## *Introduction*

In the last few years, a number of economists, politicians, and pundits have argued that in the 1980's the American economy became more tightly integrated into the world economy. By a lot of measures, this seems to be true. For example, between 1970 and 1990 America's exports plus imports as a percentage of gross national product rose from 12.7% to 24.9%. Similarly, during the 1980's the stock of inward foreign direct investment, valued on a historic cost basis, grew from 3% to 8.1%.

In particular, people often argue that American labor-market trends have been increasingly driven by this "globalization" of the economy. Two facts commonly pointed to are sluggish real-wage growth and rising wage inequality between more-skilled and less-skilled workers. Surely, the argument runs, international linkages such as trade and foreign direct investment must have contributed to these labor-market developments? A lot of prima facie evidence is forwarded to support this claim. It usually goes something like, "Because increases in trade, FDI, and the like have accompanied these wage trends, the former must surely have helped cause the latter."

This belief in the globalization of the American labor market has already played a big role in public policy. For example, Ross Perot, who won 19% of the popular vote in the 1992 presidential election, is adamantly against free trade with developing nations and predicts that NAFTA will rapidly push American wages down to Mexican levels. Support for this view nearly prevented congressional ratification of NAFTA, and it is still strong today: the cover of a recent *Business Week* reads "America's New Populism: Angry citizens are rebelling against big government, stagnant incomes, moral decay, and the global economy." But it is an open question whether such trade and investment policies are warranted.

In my dissertation I try to go beyond the *prima facie* evidence of globalization to investigate whether international trade and multinational corporations influenced trends in the American labor market during two periods: the 1980's and the antebellum years. In each of the three chapters, my basic approach is to articulate the theory of how trade and multinationals can affect labor markets, and then apply this theory to the relevant data. My main finding is that in both the 1980's and the antebellum years, the strong *prima facie* evidence pointing to a role for either trade or multinationals in labor-market developments was not supported by more rigorous empirical analysis. In the 1980's international trade and multinational corporations contributed very little, if

anything, to either sluggish real-wage growth or rising wage inequality. Similarly, in the antebellum years strong integration of commodity markets between the Northeast and the Midwest did not lead to wage convergence between these regions. The overall policy implication is that current policy proposals designed to ameliorate the labor-market effects of the globalization of the American economy are very likely unwarranted. Policies aiming to increase real wages and reduce wage inequality should not involve trade and FDI.

The first chapter, "International Trade and American Wages in the 1980's: Giant Sucking Sound or Small Hiccup?" was co-authored with Robert Lawrence and was published in *Brookings Papers on Economic Activity: Microeconomics* 1993. Two facts about the American labor market in the 1980's motivate this paper. First, average real wages barely grew. Second, the wages of less-skilled Americans fell relative to those of their more-skilled counterparts. The paper investigates the contribution of international trade to these two developments. We first present the standard trade theory on factor returns, and then apply this theory to the data. Our main finding is that trade through the standard channels seems to have contributed nothing to either of these developments: import prices did not rise sufficiently to restrain real wages, and the terms of trade through the Stolper-Samuelson process did not diverge relative wages.

Instead, trends in the domestic side of the economy seem to have dominated the wage structure. Sluggish labor-productivity growth in the service sector accounts for most of the sluggish real-wage growth, and skill-biased technological change appears to account for most of the unequal wage growth.

The second chapter, "International Trade, Multinational Corporations, and American Wage Divergence in the 1980's," focuses more closely on the wage-divergence issue addressed in the first chapter. The literature on this wage divergence has demonstrated that a shift in relative labor demand away from the unskilled and toward the skilled was its main cause. However, the literature has not adequately addressed the hypothesis that the "globalization" of the American economy helped cause the demand shift. This paper evaluates whether international trade or multinational outsourcing contributed to the demand shift and resulting wage divergence. First, the paper articulates the theory of how trade or multinationals can shift relative labor demand. On the trade side, it analyzes the theoretical issues more fully than the first chapter did. The paper then analyzes the relevant data in light of this theory. My main finding is that neither international trade through the Stolper-Samuelson process nor outsourcing by multinationals contributed significantly to America's wage divergence in the 1980's.

The third chapter, "The Antebellum Transportation Revolution and Factor-Price Equalization," applies the techniques developed in the first two chapters to the antebellum labor market. In antebellum America an extensive network of canals and railroads was constructed which slashed transportation costs between the Northeast and the Midwest. This "transportation revolution" provides a nearly ideal case study of the factor-price equalization (FPE) theorem. The paper documents that the lower transportation costs helped equalize commodity prices across regions. It then presents wage series which surprisingly display no evidence of wage equalization across regions. The interesting question then becomes why FPE didn't arise. The paper argues that regional specialization of production in the Midwest prevented it. To support this argument the paper presents historical evidence that the Midwest was effectively specialized. It then presents a simple model that shows how the nature of regional shifts in factor demands depends on whether the region specializes in production. Thus, the transportation revolution was realizing one of FPE's usual assumptions---zero trade barriers. But the fact that a second assumption--no regional specialization of production--was not being realized prevented the first from equalizing factor prices.

Thus, the overall finding of my dissertation is that in two labor-market episodes where strong prima facie evidence pointed

to a role for either trade or multinationals, this evidence was not supported by more rigorous empirical analysis. In light of this, policy aiming to restrict trade or FDI because of their believed labor-market effects seems unwarranted.

*Chapter 1 International Trade and American Wages in the 1980's: Giant Sucking Sound or Small Hiccup?*

The American dream is that each generation should live better than its predecessor. Over the century prior to 1973, real average hourly earnings rose by 1.9 percent per year. At that rate earnings doubled every thirty-six years, and the dream was realized.

The dream no longer holds. Since 1973, the United States has failed to match its historic track record. In 1973, real hourly earnings, measured in 1982 dollars by the Consumer Price Index (CPI), were \$8.55. By 1992 they had actually declined to \$7.43--a level that had been achieved in the late 1960's. Or consider real hourly compensation (a more comprehensive measure of the payments to labor): between 1973 and 1991, real hourly compensation rose by only 5%.

A second ominous development in the American economy has accompanied this slump: a dramatic increase in the earnings of skilled workers relative to those of their less-skilled counterparts. Several economists have documented this fall in

terms of education, experience, and job classification. For example, Davis (1992) calculates this divergence in terms of work experience and finds that between 1979 and 1987, the ratio of weekly earnings of males in their forties to weekly earnings of males in their twenties rose by 25%. Similarly, we calculate this divergence based on job classification and find that in manufacturing between 1979 and 1989, the ratio of average annual wages of non-production workers to average annual wages of production workers rose by nearly 10%.

These two developments--sluggish and unequal real-wage growth--have coincided with major changes in America's international economic relations. The coincidence of America's accelerated integration into the world economy with its slow and uneven wage growth makes it scarcely surprising that the former has frequently been advanced as a primary cause of the latter. In this paper, we try to advance the debate by a data analysis which uses insights from theory to investigate the role of international trade on America's recent wage performance.

In the first section of the paper, we look at the sluggish growth of average real wages. In a large group of standard labor-market models, as a first approximation we expect the performance of average real wages to mirror the performance of output per worker. At first glance, however, there appears to be a gap between the two. From 1979 to 1991, output per worker



grew by 10.5% but real compensation (average hourly compensation deflated by the CPI-U, the Consumer Price Index for Urban consumers) grew by only 1.5%. One possible explanation for this gap is that foreigners may have been "appropriating" some of this output gain through rising import prices. Our analysis indicates, however, that this explanation can be rejected in favor of a more straightforward one which involves the basket of goods used to deflate things. First, we point out that the CPI-U is a basket of consumption goods, but the output per worker is deflated by the price of a basket of producer goods. If we deflate nominal compensation by the output deflator used in the business-output measures of productivity, we find that between 1979 and 1991 real product compensation actually increased by 9.5%--basically the same as the increase in output per worker. Thus, deflating wages with the appropriate prices eliminates the output-wage gap. Second, we analyze whether rising prices for imports (which are consumed in the U.S. but not consumed here) caused the faster growth in consumption prices. We find that they did not: real consumption compensation growth lagged behind real product compensation because of a rise in the relative price of housing (which workers consume but do not produce) and a decline in the relative price of investment goods (which workers produce but do not consume). Thus, our main

finding is that trade had nothing to do with the slow increase in average real compensation.

In the second section of the paper, we consider the rise in the relative wages of non-production workers. Standard international-trade theory, as laid out by Stolper and Samuelson, suggests that changes in the relative returns of factors will reflect changes in the prices of the goods that they produce. International trade thus redistributes income by changing the terms of trade. Many studies of relative wage performance have ignored this process, however. Instead, they focus on trade volumes and trade deficits. As Bhagwati (1991) has emphasized, trade deficits are not the most suitable measures of the effects of trade because they are not necessarily associated with relative wage behavior. We focus instead on the behavior of traded-goods prices. All other things equal, in the Stolper-Samuelson framework a rising relative wage of skilled labor is triggered by an increase in the international price of skilled-labor intensive products relative to those of unskilled-labor-intensive products. When we look at America's terms of trade over the 1980's, however, we do not find this. In fact, the relative price of non-production-labor-intensive products fell slightly, indicating that the Stolper-Samuelson process actually nudged relative wages towards greater equality. From this evidence, we conclude that relative wages were not driven by the Stolper-Samuelson process.

We do, however, find a positive association between total-factor productivity growth and the intensive use of non-production labor. This points to technological change as the major source of relative wage changes: under the assumption of given prices, Hicks-neutral technological change occurring more rapidly in the non-production-labor-intensive industries should increase the relative wage of non-production labor. Indeed, we argue that the pervasive decline in the ratio of production to non-production workers actually employed--despite the decline in the relative wages of production workers--points to a large role for technological change which has augmented employment of non-production workers. This accords well with anecdotal evidence of the shift toward computer-controlled flexible manufacturing systems and with recent work by Berman, Bound, and Griliches (1992) (who find strong correlations between skill upgrading within industries and with increased spending by firms on computers and R & D), Krueger (1991) (who estimates that from one- to two-thirds of the 1984-89 increase in the premium on education was related to the use of computers), and Bartel and Lichtenberg (1991) (who find that industries which use young technologies pay a premium wage).

In conclusion, we find that international trade contributed basically nothing to America's average and relative wage performance in the 1980's. Instead, developments on the domestic

side of the economy--sluggish productivity growth in the service sector and skill-biased technological change--seem to have mattered the most.

*Chapter 2      International Trade, Multinational Corporations,  
and American Wage Divergence in the 1980's*

In this chapter I revisit the fact that the wages of less-skilled Americans fell sharply in the 1980's relative to those of their more-skilled counterparts. First, I extend the work of the first chapter on international trade and relative wages by analyzing under what conditions the Stolper-Samuelson theorem is empirically relevant. Second, I study the contribution to the wage divergence of outsourcing: a variety of foreign direct investment which decomposes existing production techniques and shifts unskilled-intensive activities to foreign countries.

The Stolper-Samuelson theorem originally was and usually is stated in the classic "2x2x2" model with two countries, two goods, two factors of production, and a host of other simplifying assumptions. In this framework the theorem is quite strong: a rise in the international price of one good will unambiguously raise the real wage of the factor used intensively in the production of that good and will unambiguously lower the real wage of the other factor. For empirical work, the crucial question is how the Stolper-Samuelson theorem generalizes to

more realistic frameworks. In the previous chapter, we largely assumed that the theorem easily applies to the activity in the 1980's. Here, I analyze the theorem more rigorously by considering two important extensions. First, I introduce higher dimensions; then I introduce increasing returns to scale.

First, introduce more factors and goods. With either more than two factors or many factors and goods, the theorem cannot make unambiguous predictions about real-wage changes. However, the strong Stolper-Samuelson theorem does have a higher-dimension generalization which makes predictions about relative wages without restrictive assumptions. Ethier (1984) states it as follows: "there is a tendency for changes in relative commodity prices to be accompanied by increases in the rewards of factors employed most intensively by those goods whose prices have relatively risen the most and employed least intensively by those goods whose relative prices have fallen the most." This generalization follows directly from cost minimization, and therefore requires no restrictions on technology or dimensionality. Moreover, just like the strong Stolper-Samuelson, this generalization involves shifting demands for factors of production across industries and shifting relative employment within industries.

The second extension allows one or more of the industries to produce under increasing returns to scale. Helpman and

Krugman (1985) point out that this introduces a second channel through which trade can affect the utility of factors. Notice the use of "utility of factors" rather than factor prices: in a broad class of models summarized in Helpman and Krugman, this second channel does not operate on factor prices per se but rather on the utility of the owners these factors through an increase in available product variety. Distinct from this variety effect, Stolper-Samuelson still moves factor prices in these models (one of which I analyze more completely).

Thus, generalizing the  $2 \times 2 \times 2$  framework to allow higher dimensions and increasing returns to scale changes the Stolper-Samuelson theorem only slightly. Instead of predictions about real-wage movements, it now makes predictions about relative-wage movements. The generalized theorem says that a rise in the price of a group of products tends to raise the wage of the factors used relatively intensively in these products relative to the wages of the factors used relatively unintensively in these products. Insofar as the concern is explaining shifts in relative wages in the U.S. in the 1980's, this theorem is a very relevant one for studying the effects of international trade on relative wages.

The second half of this chapter analyzes the role of multinational outsourcing. There is a good deal of anecdotal evidence that outsourcing was widespread during the 1980's. Its

effects, however, are less clear. Some think it harms the U.S. economy (for example, a 1986 Business Week special report warned that outsourcing is creating "hollow corporations" in America), in particular by forcing American labor to compete more directly against foreign labor.

To study the relevance of outsourcing, I first develop a model of multinational outsourcing which follows Helpman (1984). The key result of this and similar models is that when firms face international factor-price differentials, they will spread facilities across countries (i.e., they will employ factors in more than one country, and by definition become multinational). This changes within-industry relative factor demands in these countries, which in turn changes each country's overall relative demand and overall relative wages. Thus, outsourcing actually expands the factor-price equalization set that was attainable under trade alone. After solving and describing the analytic solution to this general model of outsourcing, I then run numerical simulations of it to show how it generates within-industry relative wage and employment shifts like those observed in the U.S.

Second, I then test predictions of this model using data from the Bureau of Economic Analysis on the activity of all U.S. multinationals--both domestic parents and foreign subsidiaries--from 1977 through 1989. My primary finding is that these data are inconsistent with U.S. multinationals having

outsourced more heavily in the 1980's. I generate a set of stylized facts and find that many are inconsistent with increased outsourcing. For example, outsourcing should raise production-worker employment in American subsidiaries, or at least lower the ratio of non-production to production employment. The data do not display either of these trends. Instead, the majority of countries and industries had falling levels of production employment and rising ratios of non-production to production employment. Indeed, these two facts mirror the trends seen in America. The similarity between employment trends in subsidiaries and in America is consistent with the same force(s) operating worldwide--for example, skill-biased technological change. This is not to say that outsourcing did not happen at all. A few industries such as computers and office products (SIC #357) do seem to have outsourced heavily. But these are the exception rather than the rule. In addition to these stylized facts, I estimate the pattern of factor demands for multinationals by fitting a translog cost function to their production patterns to determine their cross elasticity of demand between home and foreign unskilled labor. Contrary to the outsourcing model, I find that home and foreign unskilled labor at best are weak price substitutes and very likely are price complements.

In conclusion, I find that neither international trade through the Stolper-Samuelson process nor outsourcing by



multinational corporations contributed significantly to America's labor-demand shift and resulting relative-wage divergence.

*Chapter 3      The Antebellum Transportation Revolution and  
Factor-Price Equalization*

The first two chapters of my dissertation found little evidence of the international economy's effect on American factor markets in the 1980's. In the third chapter I apply the same basic methods to another episode, antebellum America. In antebellum America an extensive network of canals and railroads was constructed which slashed transportation costs between the Northeast and the Midwest. This "transportation revolution" presents an excellent case study of the factor-price equalization (FPE) theorem, which says that under certain conditions when trade equalizes commodity prices across regions it also equalizes factor prices as well. This is a good case for at least three reasons. It represents a clear shock to an existing trading regime (where the "countries" are regions in the United States); it avoids the difficult question of what exchange rates to use to convert prices into a common currency; and it uses new regional factor-price data recently assembled by Margo and Villaflor (1987) and Goldin and Margo (1992) from records of United States Army posts.

International-trade economists have historically had a rather schizophrenic attitude toward the FPE theorem. In theoretical work the FPE theorem has been studied for decades, and it has been shown to be a robust idea which holds in a wide variety of models. In empirical work, however, the FPE theorem has been largely ignored. One possible explanation of this schizophrenia is that people have thought about FPE only as an equilibrium outcome in isolation from the assumptions which generate it. From this perspective, the appropriate empirical test for FPE is simply whether factor prices are equal across regions. On this criterion FPE is a spectacular failure. If this explanation is correct, then I argue that people have been evaluating FPE too strictly. One should consider not only FPE but also its motivating assumptions, because in most models it requires stringent assumptions which almost certainly do not all hold in reality. Thinking about FPE as not only an equilibrium outcome but also as a set of stringent assumptions motivates an alternative empirical approach to FPE. One can look for a tendency towards FPE that is motivated by a tendency towards realizing its stringent assumptions. The focus thus switches from factor prices alone at one point in time to the interaction between trends over time in the assumptions needed to equalize factor prices and trends over time in the prices themselves. This is the approach I adopt in this chapter.

To look for FPE, first I document how canals and railroads cut transportation costs and thereby helped equalize commodity prices across regions. My transportation-cost data are largely anecdotal, but they indicate drastic drops on the order of 25% to 95%. The commodity-price data I assemble from raw data collected by Cole (1938). Price ratios which measure prices between the Northeast and the Midwest for several narrowly defined commodities converge strongly towards one between 1820 and 1860. This convergence is a necessary precondition for factor prices in turn to equalize. Next, I analyze regional wage series to see whether factor prices were also converging. Surprisingly, they were not. Wage ratios which measure wages between the Northeast and the Midwest for three types of labor (artisans, clerks, and laborers) show basically no first-order or second-order convergence between 1820 and 1860. Thus, the data reveal a puzzle. The transportation revolution equalized regional commodity prices but not regional factor prices.

Finally, I propose a simple explanation for this puzzle: regional specialization of production in the Midwest. To support this explanation I present production data from U.S. censuses. The data show that even in 1850 and 1860, the Midwest effectively produced only agricultural products whereas the Northeast produced both agricultural and manufactured products. I then present both analytically and diagrammatically a simple

model in which the nature of regional factor demands depends on whether the region specializes in production. The key result is that specialization breaks the link between converging product prices and converging factor prices. Because of specialization, commodity-price equalization does not induce the standard shifts in regional factor demands needed to equalize factor prices as well. So even though trade barriers were falling, regional specialization of production could have prevented these falling barriers from equalizing factor prices. After presenting the model, I also discuss how regional specialization of production can explain several other stylized facts such as regional divergence of interest rates.

In conclusion, I find that canals and railroads generated strong commodity-price equalization across regions but that this equalization did not lead to FPE--arguably because the Midwest was specialized in agriculture production. This finding is a good empirical example of the theoretical result that the FPE theorem is strictly a static-equilibrium condition which requires several preconditions. It is not a comparative-static proposition with unambiguous out-of-equilibrium predictions.

## *Conclusion*

The overall finding of my dissertation is that in episodes where strong prima facie evidence pointed to a role for either trade or multinationals in the level and distribution of wages in the U.S. labor market, this evidence was not supported by more rigorous empirical analysis.

In light of this, U.S. policy aiming to restrict trade or FDI because of their believed labor-market effects seems unwarranted at this time. Two points are of relevance here. First, making this point may be difficult given the presumption on the part of many in the policy debate--such as Ross Perot--that globalization is harming the U.S. labor market in some way. But second and more importantly, even if trade and FDI were influencing wage patterns, restrictions on them would not be the least distortionary policy response. Income subsidies or tax breaks for those adversely affected would distort fewer margins in the economy and thus cause a smaller overall efficiency loss.

## References

- Bartel Ann P. and Frank R. Lichtenberg, "The Age of Technology and its Impact on Employee Wages" *Economic Innovation and New Technology* 1:2, 215-231, 1991.
- Berman, Eli, John Bound, and Zvi Griliches, "Changes in the Demand for Skilled Labor Within U.S. Manufacturing Industries: Evidence from the Annual Survey of Manufacturing," Harvard University mimeograph, December 1992.
- Bhagwati, Jagdish, "Free Traders and Free Immigrationists: Strangers or Friends?" Working Paper No. 20, Russel Sage Foundation, April 1991.
- Cole, Arthur H., *Wholesale Commodity Prices in the United States, 1700-1861*, Cambridge: Harvard University Press, 1938.
- Davis, Steven J., "Cross-Country Patterns of Change in Relative Wages," in Olivier J. Blanchard and Stanley Fischer (eds), *1992 Macroeconomics Annual*, NBER, 1992.
- Ethier, Wilfred J., "Higher Dimensional Issues in Trade Theory", in R.W. Jones and P.B. Kenen (eds), *Handbook of International Economics*, Volume 1, North Holland, 1984.
- Goldin, Claudia and Margo, Robert A., "Wages, Prices, and Labor Markets Before the Civil War," in Claudia Goldin and Hugh Rockoff (eds) *Strategic Factors in 19th Century American Economic History*, University of Chicago Press: Chicago, 1992, pp 67-104.

Helpman, Elhanan, "A Simple Theory of International Trade with Multinational Corporations," *Journal of Political Economy*, 92, 1984, No. 3, 451-471.

Helpman, Elhanan and Paul R. Krugman, *Market Structure and Foreign Trade*, Cambridge: MIT Press, 1985.

Krueger, Alan B. "How Computers Have Changed the Wage Structure: Evidence from Microdata, 1984-89," *Quarterly Journal of Economics*, June 1992, 35-77.

Margo, Robert A. and Villaflor, Georgia C., "The Growth of Wages in Antebellum America: New Evidence," *The Journal of Economic History*, Volume 47, Number 4, 1987, pp 873-895.