NBER WORKING PAPER SERIES

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Douglas A. Irwin

Working Paper 7641
http://www.nber.org/papers/w7641

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
April 2000

This paper was prepared for the Centennial Celebration of Bertil Ohiln, Stockholm, Sweden, October 14-16, 1999. I wish to thank Don Davis, Carl Hamilton, Ron Jones, and Robert Margo for helpful comment, William Congdon for research assistance, and the NSF for financial support. The views expressed herein are those of the author and do not necessarily reflect the position of the National Bureau of Economic Research.

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NBER Working Paper No. 7641
April 2000
JEL No. F13, F16, N71

ABSTRACT

This paper examines Bertil Ohlin's analysis of trade policy and factor rewards in the context of the late nineteenth and early twentieth century United States. A leading question of the day was whether labor could benefit from protection. Ohlin suspected that labor could benefit from protection and his writings helped spawn the Stolper-Samuelson theorem, which was different from but consistent with Ohlin's approach. This paper seeks to find evidence on whether U.S. tariffs on imported labor-intensive manufactures helped enhance the income of labor at the expense of capital and land. The answer is unclear: vastly different conclusions arise from a calibrated general equilibrium Ohlin-style model and a factor content of trade calculation, and indirect evidence from lobbying and voting patterns over the tariff are also ambiguous.

Douglas A. Irwin
Department of Economics
Dartmouth College
Hanover, NH 03755
and NBER
douglas.irwin@dartmouth.edu

1. Introduction

Anyone who has dipped into Interregional and International Trade (1933) knows that Bertil Ohlin's theoretical vision was much broader than the standard two-factor, two-good model that has been handed down to us as the textbook Heckscher-Ohlin-Samuelson model of international trade. Ohlin not only set out a theory of trade based on factor proportions, but also investigated trade in relation to increasing returns to scale, economic geography, international factor movements, and a host of other topics that continue to be active areas of economic research.

While Ohlin's principal contribution will always be the sharp focus on relative factor abundance as a force driving international trade, his broad and eclectic approach is evident even here. An example of this is his treatment of the effects of product price changes, including those induced by trade policy interventions, on relative factor prices and factor incomes. At the time Ohlin wrote, the prevailing view of Frank Taussig (1927) and others was that while specific factors may be harmed as a result of free trade, mobile factors (such as labor) would be insulated from any potential losses precisely because of their mobility across sectors. In his analysis, Ohlin advanced the contrary notion that the scarce factor of production might benefit from protection, regardless of its ability to move between sectors. This conflict between the then prevailing view and Ohlin's novel approach, which he did not fully spell out, spawned the classic paper by Wolfgang Stolper and Paul Samuelson (1941), who used a two-factor, two-good model to develop what we now know as the "Stolper-Samuelson" theorem.[1]

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[1] Samuelson (1994, p. 343) relates that Stolper asked him, "How can Haberler and Taussig be right about the necessary harm to a versatile factor like labor from America's tariff, when the Ohlin theory entails that free trade must hurt the factor of production that is scarce relative to land?" Precisely

Yet it is not clear that Ohlin would have endorsed the Stolper-Samuelson framework as the most appropriate one in which to analyze the question of trade policy and factor returns. Ohlin himself analyzed the effects of trade policy on factor prices in a broader three-factor framework that included land, labor, and capital. Samuelson (1971) also recognized the important differences between Ohlin's implicit model and that of the two-factor, two-good model, but more in the context of factor price equalization rather than Stolper-Samuelson theorem.

The first question posed by this paper is whether Ohlin's own theory of the factor price response to tariff intervention is consistent with the Stolper-Samuelson theorem. This question is addressed first by setting out Ohlin's theory and then selecting among the multitude of extant three-factor models the one that seems most congruent with his framework. That model turns out to be the one described by Fred Gruen and Max Corden (1970), which blends elements of the specific-factor model and the standard Heckscher-Ohlin-Samuelson model. This model was also the basis for Anne Krueger's (1977) analysis of trade and development and has been further explored by Alan Deardorff (1984) and Edward Leamer (1987).

At the time when Ohlin was writing, the issue of whether labor could benefit from protection was a burning controversy among international economists, particularly in the context of the United States and Australia.[2] This question is now a live one for economic historians. Therefore the second question posed by this paper is whether in fact Ohlin's theory was correct in predicting that labor could

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that question prompted the fruitful collaboration.

[2] Indeed, the "Australian" case for protection hinged on exactly this issue; see chapter 11 of Irwin (1996).

have benefitted from protection. The major political justification for the high U.S. import tariffs during the late-nineteenth and early-twentieth century was that it protected high American wages against the low wages paid by European producers. Was this rationale justified? Unfortunately, this paper will not provide a definitive answer to this question, but will explore some of the empirical evidence for and against that proposition.

This paper is organized as follows. Section 2 sets out Ohlin's theory of how product price changes affect factor rewards, including his discussion of the possible impact of free trade on U.S. factor incomes. Section 3 modifies the Gruen-Corden approach in a way that seems most congruent with Ohlin's own analysis of factor prices in the U.S. case. Section 4 examines the evidence regarding the structure of the U.S. tariff and the possible implications of free trade for income distribution around the turn of the century. Section 5 concludes the paper.

2. Ohlin on Trade Policy and Factor Prices

Ohlin (1933, p. 306, n. 2) opens his discussion of trade policy and factor prices by observing that "[i]nternational trade theory has, in my opinion, given far too much attention to the effects of certain variations, for example, in duties, on the national incomes, and too little to the effects on individual incomes. In many cases, changes in the sums count for very little, while changes in the individual incomes are distinctly relevant." This statement marks his break with the "real costs" approach which focused on labor as the only factor of production and thus tended to ignore any income distributional

consequences of trade.[3]

Ohlin (1933, p. 307) then considered the effect of tariff policy on labor income. "It seems beyond doubt that the tariff policy pursued during the last half century has not raised the standard of living of the labouring classes. It is doubtful if agricultural duties increase the relative scarcity of manual labour compared with other factors, and they certainly raise the cost of living for the working classes." That may have been true for agricultural-importing countries in Europe, but what about the United States where tariff protection for manufacturers was the issue? "It is, however, true that manufacturing duties tend to depress the rent of farm land . . . . It is on the whole not at all unlikely that the sum total of rent is reduced in countries with high manufacturing duties. . . . In most countries, however, the sum of rents is small compared with the sum of wages to manual workers. Even a substantial reduction of the former brings only a slight increase in the latter."

Ohlin continued by adding capital to the analysis: "The effect of manufacturing duties upon the relative scarcity of labour and capital is rather to the advantage of the latter, although lack of statistical material prevents reliable conclusions. It seems probable that manufacturing industries in Europe require a greater amount of capital per labourer than agriculture; in the United States, where agriculture is more industrialised, it seemed before the War to require as much capital per worker as other industries."

Ohlin (p. 308) summed up in this way: "We must conclude that there is no reason for assuming

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[3] It is somewhat ironic that the "real labor costs" approach championed by Taussig (1927) and others is associated with David Ricardo when Ricardo himself explicitly sought to examine income distributional effects of trade policy; see Findlay (1974).

that the share of the labouring class in the national income has been so much increased by the tariff policy pursued in the last half-century that the depressing effect of this policy on the size of the national income has been more than offset." Therefore, Ohlin generally subscribed to the standard view that labor would not benefit from the tariff. Ohlin (p. 308), however, then added this crucial caveat: "The situation would be different if manufacturing duties were placed specially upon products from industries using little capital and much manual labour. But such is not the case, at least in the countries for which statistical material is available." Yet Ohlin was soon to conclude that this caveat may indeed apply in the case of the United States.

Ohlin (pp. 316-17) later turned to the issue of how free trade would affect the United States. Agriculture, he thought, would clearly expand: "Farm land would be more in demand, and the utilisation of forests, mines, etc. would be extended." On the other hand, he continued, "industries using large quantities of labour, particularly of the skilled type, would be reduced. The distribution of income would thus change in favour of natural resources, while the relative position of labour would be less advantageous. Whether demand for capital would rise or fall is difficult to say. A superficial study of American industries gives the impression that those dependent upon protection use more labour and less capital than those in export industries. If that is correct, an expansion of the latter would mean a tendency to a higher rate of interest."[4] In the case of the United States, therefore, Ohlin concluded that

[4] Ohlin also introduced another complication: the possible favorable effect of U.S. tariffs on its terms of trade. He (p. 317) concludes: "it is not entirely unthinkable that the terms of exchange in international trade should be somewhat less favourable under free trade than now. . . . It is not certain, therefore, that the national income in the United States would be increased by a free trade policy, still less that the standard of living of manufacturing workers would rise. But the farming population would benefit."

labor would benefit from protection and be harmed by free trade.[5]

3. Factor Prices in a Three-Factor Model

The previous section's brief review of Ohlin's writings makes it clear that he did not have a simple two factor (capital and labor) model in mind when analyzing the impact of trade policy on factor rewards. Rather, Ohlin worked with a three factor model consisting of land, labor and capital.[6] The three-factor, three-good model of Gruen and Corden (1970) appears to be the most appropriate for illuminating Ohlin's approach and examining the impact of U.S. trade policy on factor rewards during this period.[7]

To adopt this model to an Ohlin-style analysis of the United States, we look to his description

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[5] At one point, Ohlin (p. 44) seems to deny Stolper-Samuelson reasoning and conclude that all factors would benefit from trade: "we are satisfied to know that the total value of all productive factors in terms of goods will rise in all regions as a result of trade. . . a relative decline in the price of one of them, say labour, compared to another, land, does not necessarily mean that the wage level is lowered in terms of goods. Should Australian labour be worse off because of international trade? Of course not."

[6] Or possibly land, skilled and unskilled labor. Ohlin (pp. 308-9) noted that "Skilled workers in the United States, for instance, may profit from protection. The gap between skilled and unskilled workers in this country is unusually large . . . The relatively high expenses incurred as soon as skilled labour is employed would tend to keep back industries which use much of this factor, if protection did not prevent competition from foreign industries with lower costs of production . . . . If skilled workers are favoured by the American tariff, the owners of natural resources are, on the other hand, almost certainly put in a less favourable position."

[7] The Gruen-Corden stylized model of Australia consists of a Heckscher-Ohlin agricultural sector that produces wool and grain with land and labor (grain is assumed to be labor intensive), appended to which is a manufacturing sector that produces textiles with labor and capital. Capital is specific to the manufacturing sector, land is specific to the two-good agricultural sector, and labor is mobile between the sectors. Variations on this model have been examined by Krueger (1977), Deardorff (1984), and Leamer (1987).

of an agricultural sector that produces with labor and land and a manufacturing sector that produces several goods with differing proportions of capital and labor. In this vein, consider the following simple framework: an agricultural sector produces a single output with a combination of labor and sector-specific land and manufacturing sector produces two-goods, one labor-intensive and the other capital-intensive, with both labor and sector-specific capital. Labor is homogeneous and perfectly mobile within manufacturing and between the two sectors.

Such an arrangement is shown geometrically using the dual of the production function in Figure 1. This figure extends Michael Mussa's (1979) dual exposition for the two-sector model by depicting the isoprice contours for the three goods. The quadrants for the agriculture and manufacturing sector share the wage axis because the two sectors compete for labor, while the respective land and capital axes are independent. The absolute value of the slope of the isoprice contour indicates the capital-labor ratio used in production. The contour is convex to the origin, reflecting the fact that the capital-labor ratio is an increasing function of the wage-rental ratio. The elasticity of substitution between the two factors is represented by the curvature of the contour. Because land is sector-specific and assumed to be fixed in inelastic supply, substitutions reflected in the labor-land ratio in agriculture are made solely through adjustments in the amount of labor employed.

The right quadrant displays the isoprice contours of the two manufacturing goods, $P_1(w, r)$ and $P_2(w, r)$. Good 1 is assumed to be more labor-intensive than good 2 for all factor prices. Mussa's (1979) exposition explores this quadrant in detail and should be referred to for details. The left quadrant shows the isoprice contour for the agricultural sector, $P_A(w, r_A)$, which produces output from labor and the immobile factor land, which earns the return r_A. With the prices of all goods determined

exogenously, the equilibrium wage rate is set by the intersection of the isoprice contours in the manufacturing sector.

Because another sector with a specific factor is grafted onto the two-sector model, the Gruen-Corden model retains some, but not all, of the comparative static properties of the two-sector model. Consider an increase in the price of the labor-intensive good 1. The isoprice contour P_1 shifts out to P_1', leading to a new factor price equilibrium with higher wages and lower returns to land and capital. As with Stolper-Samuelson, these are real changes in factor prices. Wages rise by more than the increase in P_1 because, in addition to the outward shift of P_1 that boosts wages, there is a substitution toward more capital-intensive production techniques. The real return to land and to capital fall, and there is a reallocation of labor between sectors. The agricultural sector sheds labor and adopts a more land-intensive production method, whereas the manufacturing sector absorbs the additional labor, sees its overall capital-labor ratio fall, and yet adopts more capital-intensive production methods (a seemingly paradoxical result). An increase in the manufactured sector's labor endowment also gives rise to a Rybczynski-effect on the manufactured outputs, with an increase in the output of the labor intensive good 1 and a fall in the output of the capital-intensive good 2 (above and beyond that induced by the increase in P_1 alone). Similarly, an increase in the price of the capital-intensive good decreases the real wage and increases the real return to capital. The effect on the real return to land is ambiguous although it increases in nominal terms.

If the price of the agricultural good increases, its isoprice contour shifts out. The return to land will increase, but if the economy remains diversified neither the wage nor the return to capital changes. Hence the real wage and return to capital fall in terms of the agricultural good while the return to land

increases in a proportion greater to the increase in P_A.[8] Like the above examples, however, labor is reallocated in the economy. The agricultural sector attracts labor and switches to more labor-intensive methods. The capital-labor ratio in manufacturing rises as labor migrates to agriculture, leading to a Rybczynski-effect on manufacturing output with no changes in the prices of those outputs.

Thus, changes in the price of the manufactured goods and the agricultural good are not symmetric: a change in the price of a manufactured good affects all factor prices, while a change in the price of the agricultural good only alters the return to land if the manufacturing sector remains diversified.

Thus, in the context of his model, Ohlin was "right" in that a tariff that protected labor-intensive manufactured goods would raise the real return to labor and reduce the real return to capital and land.[9] Note, however, that there is no basic conflict between the Ohlin and the Stolper-Samuelson prediction since, in the Gruen-Corden model, the diversified manufacturing sector (what Ronald Jones calls the 2-by-2 tradable "nugget") pins down factor prices for other sectors.

4. Tariffs and Income Distribution: United States Evidence circa 1909

In his stylized model of the U.S. economy, Ohlin showed that labor as a class could benefit from import protection. Is there evidence that this could have been the case?

The model sketched out in the previous section provides a useful stylized framework in which to

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[8] Deardorff (1984) was in error with regard to the change in the real return to land.

[9] Samuelson (1971) also thought Ohlin was "right" in the context of a similar model on the issue of partial versus full factor price equalization.

think about the U.S. economy during this period. The United States had a comparative advantage in agricultural products (such as raw cotton and grains), a comparative disadvantage in labor-intensive manufactured goods (such as cotton and woollen textiles), and a changing comparative advantage in capital-intensive manufactured goods (such as iron and steel products and machinery). Prior to the mid-1890s, the United States was a net importer of these capital-intensive manufactures, but an export surge dating from that period quickly turned the United States into a net exporter of such goods (see Irwin 2000).

The rhetoric of U.S. trade policy was that high tariffs were necessary to protect the high wages of American workers. Economists then were justifiably skeptical of this extreme view. Taussig and others did not believe that the wages depended upon tariffs and frequently countered that high U.S. wages reflected not protection but the high productivity of U.S. workers. Of course, average real wages and average labor productivity proved to be highly correlated then as now. Figure 1 plots labor productivity and real wages for the United States from 1889 to 1929. This relationship is frequently depicted today with recent data to counter the charge that the sluggish wage growth in the United States and in other industrialized countries is due to increasing trade with developing countries. Although this chart clearly shows that real wage growth is correlated with labor productivity, Taussig and Ohlin were grappling with the different issue of labor's share in national income.

J. Bradford De Long (1998, p. 351) has recently came down on Taussig's side in examining the effect of protection on wages and growth during this period: "Economists's standard tools suggest that the tariff reduced the living standard of Americans — the real wage of American workers — by about 0.7 percent of national product in the short run." Assuming the elasticity of demand for imports is

one, De Long states that a 30 percent tariff would then reduce the import share of national demand from a counterfactual level of 9 percent to the actual level of 7 percent. Taking foregone producer and consumer surplus as 15 percent of the value of imports, De Long concludes that U.S. tariffs resulted in "a reduction in real incomes of 0.3 percent of national product, with little reason to think that this reduction in real incomes fell disproportionately on capital rather than on labor."

Yet Ohlin's theory suggests that the burden of the tariff could have fallen disproportionately on land and capital to the benefit of labor. Such a result hinges on whether import tariffs were skewed toward protecting labor-intensive industries, as Ohlin suspected in his "superficial study" of the matter. The validity of this assumption can be assessed by examining the structure of the U.S. tariff in 1909 using data from the Census of Manufactures of that year and tariff data available in the Statistical Abstract of the United States. The Census of Manufactures provides data that allow two measures of an industry's factor intensity to be calculated: the capital-labor ratio (k_i), and the wage share in industry value-added (2_{Li}).

Table 1 reports regression results of the nominal tariff on the two measures of factor intensity for a sample of 17 manufacturing industries.[10] Using either measure, the nominal tariff is lower for industries with a higher capital-labor ratio and higher for industries with a high labor share in industry value-added. (The statistical significance of these coefficients is marginal except in column 2.) The Spearman rank correlation between tariffs and the capital-labor ratio (-0.22) and the industry wage

[10] The industries include chemicals, clocks, cotton manufactures, furs, glass, jewelry, hats and bonnets, iron and steel manufactures, leather, metals, paints, paper, silk, tobacco, toys, wood, and wool.

share (0.40) gives us the same conclusion, although again neither of these correlations is statistically significant.

This evidence suggests, somewhat weakly, that Ohlin was correct in his impression that the tariff tended to be higher on labor-intensive goods. The next step is to determine the magnitude of the tariff's effect on wages.

A. Calibrated Evidence

How much could the tariff have helped labor? There is no "natural experiment" in which tariffs were significantly reduced so that we can observe the resulting wage effects.[11] Nor is there much variation in the tariff level or structure that would enable us to estimate a relationship between tariffs, product prices, and wages. While a full examination of the wage effects of import tariffs is beyond the scope of this paper, there are two simple methodologies for calculating the effects of changes in trade on wages — a simple general equilibrium calculation and a factor content of trade calculation. Both of these methods rely on the calculation of a counterfactual rather than on direct estimation techniques and, unfortunately, both methods give radically different assessments of the potential wage impact of (in this case) trade liberalization.

An extreme upper bound can be generated by use of a "Jones algebra" (1971) version of the Gruen-Corden model in Figure 1.[12] Three linear equations describe the impact of changing product

[11] The Underwood tariff of 1913 reduced tariffs considerably, but the start of World War I shortly after its enactment confounds any attempt to isolate the tariff's impact on U.S. trade or wages.

[12] Williamson (1974) constructs an elaborate Jones-styled general equilibrium model of the late nineteenth century United States, but does not consider trade policy in detail.

prices on factor prices:

$$\hat{w} = \frac{q_{2K}}{q_{1L} - q_{2L}} \hat{p}_1,$$

$$\hat{r}_K = \frac{-q_{2L}}{q_{1L} - q_{2L}} \hat{p}_1,$$

$$\hat{r}_T = \frac{-q_{AL}}{q_{AT}} \hat{w},$$

where "hat" refers to proportion change (i.e., $\hat{p}_1 = dp_1/p_1$) and θ are the factor shares (i.e., θ_{1L} is the share of labor in the cost of producing good 1), w is the wage of labor, r_K and r_T are the returns to capital and land, respectively.

We can parameterize these equations with the 1909 census data used above in Table 1. In this sample, the average wage share in the labor-intensive sector (defined as those industries with a capital-labor ratio above the median) is 0.5 and in capital-intensive sector is 0.3; i.e., $\theta_{1L} = 0.5$ and $\theta_{2L} = 0.3$. D. Gale Johnson (1948) calculates factor shares in agriculture in 1910 and finds that the labor share in agricultural income was about 0.55 to 0.60.

How do we measure the impact of free trade on product prices? The average tariff on labor-intensive goods was 47 percent while the average tariff on capital-intensive goods was 38 percent. This means that, ignoring a host of issues (intermediate goods and effective protection, terms of trade effects, etc.), the structure of the tariff increased the price of labor-intensive goods (relative to capital-

intensive goods) by about 10 percent. The impact of free trade on the United States can be considered as a 10 percent fall in the price of the labor-intensive good 1 ($\hat{p}_1 = -.1$).

Using the three equations above, a 10 percent decline in the price of the labor-intensive good implies that $\hat{w} = -.35$, $\hat{r}_K = 0.15$, and $\hat{r}_T = 0.5$. If we modify the shares slightly, so that $\theta_{1L} = 0.6$ and $\theta_{2L} = 0.4$ (yielding an unweighted average of 0.5, close to the U.S. average in 1909) and take $\theta_{AL} = 0.55$, then $\hat{w} = -.3$, $\hat{r}_K = 0.2$, and $\hat{r}_T = 0.37$. The "magnification effect" implicit in this model implies large factor price changes as a result of product price changes. The magnification is enormous: the 10 percent price shock translates into a 30 decline in wages, a 15 to 20 percent increase in the return to capital, and a 40 to 50 percent increase in the return to land. The real factor price changes are, of course, larger than these nominal changes.

These figures strike one as implausibly large and so, while this calculation is suggestive, there are several reasons for discounting them. This linear model yields extreme impacts from product price changes whereas a more conventional computable general equilibrium model would have greater curvature and imperfect substitutability that would mute the impact of such price changes.[13] Capital and land are owned by labor so the distribution of ownership is a key determinant of the true impact of the prices changes on labor's income. There is no separation of skilled and unskilled workers, thus ignoring the distribution of labor income as well as the role of human capital.[14] In addition, other non-

[13] Such imperfect substitution is not imposed, but rather is based on econometric evidence that indicate such a relationship. Incidentally, Siriwardana (1996) develops a computable general equilibrium model of Australia in the 1930s to evaluate the "Australian case for protection" referred to in footnote 2. Unfortunately, this model is only able to evaluate intersectoral resource flows and terms of trade effects of tariffs and gives no insight into the effect on real wages.

[14] On wage inequality during this period, see Margo (1999).

traded sectors such as services and distribution, often thought by labor economists to play an important role in wage determination, loom large in the actual economy but are left out of this simple model. Finally, as an empirical matter, one observes improvements in the U.S. terms of trade (consistent with a decline in the price of imported goods) during the 1920s that are orders of magnitude larger than the 10 percent price shock considered here and yet, as Figure 1 shows us, any effect on real wages is difficult to discern.[15]

An alternative method of calculating the wage effects is to consider trade as an exchange of bundles of factors and calculate the factor content of trade. The factor content of trade method focuses on changes in the volume of trade flows rather than on product prices directly and gives a distinctly different result. In 1909, U.S. imports of manufactures amounted to $525 million, or about 2 percent of GDP. The average tariff on labor-intensive goods, calculated above, was about 40 percent. Consider an extreme case: assume that all of the manufactured imports are labor-intensive and abolish the tariff. This results in a 40 percent reduction in the price of labor-intensive goods, a substantially larger shock than considered previously. If we take the price elasticity of import demand as about -2.6 (as estimated over 1869-1913 by Irwin 1998), then such a tariff reduction will more than double the amount of imports to $1,071 million, an increase of $546 million. How much labor will be displaced by this surge of imports of labor-intensive manufactured imports? To be specific, consider the textile industry, the proto-typical labor-intensive industry with large employment that was protected through high tariffs during this period. In 1909, 1,000 textile workers could produce $2.13 million in products.

[15] The actual impact of the terms of trade improvement, however, depends upon the underlying source of the shock that generates it.

If imports of labor-intensive goods were all textiles products and increased by the magnitude suggested above, then about 256,600 workers would be displaced. This amounts to 17 percent of all textile workers, 1.3 percent of all workers in tradable goods (agriculture and manufacturing), and 0.3 percent of total U.S. employment in 1909.

Is it really plausible that the displacement of 1.3 percent of workers in the tradable good sector could generate such enormous wage effects as calculated above? Not according to factor content of trade calculations, which — though popular with labor economists (and controversial among trade economists; see Leamer 1998 & 2000) — have recently been resurrected by Krugman (1995). In our notation, Krugman assesses the change in the wage-rental ratio as:

$$\hat{w} = \frac{\Delta(w/r)}{(w/r)} = -(l_{L1} - l_{K1})[\hat{M}(\frac{M_1}{y_1}) + \hat{X}(\frac{X_2}{y_2})] / s_{KL}$$

where θ_{L1} is the share of labor in sector 1, $\hat{M}$ is the proportionate change in imports, $\hat{X}$ the proportionate change in exports (to maintain balanced trade), M_1/y_1 and X_2/y_2 are the trade to output ratios, and σ_{KL} is the elasticity of substitution between capital and labor. There is no direct evidence on θ_{K1} and θ_{L1} because of our arbitrary delineation between capital- and labor-intensive industries, but assume that θ_{K1} = 0.4 and θ_{L1}=0.5, $\hat{M}$=1.04 and $\hat{X}$=0.8 from above, and (M_1/y_1) = 0.05 and (X_2/y_2) = 0.1 (which were roughly the case for the textile and the iron and steel industry during this period). Schmitz (1981) estimates that the late nineteenth century elasticity of substitution between capital and labor (σ_{KL}) was around 0.5. In the end, a doubling of imports of labor-intensive manufactures implies that $\hat{w}$ = -0.026, or that the wage-rental ratio falls by about 2.6 percent. This is a trivial reduction that

does not change significantly when the underlying parameters are altered around the chosen values.

The lack of a strong conclusion about the magnitude of the tariff's effect on wages mirrors the unresolved current debate over the role of international trade in generating wage inequality. Those who champion the Stolper-Samuelson theorem (such as Leamer 1998) find it difficult to believe that wage inequality is not in some way related to international trade developments, while those who champion the factor content approach insist that the magnitude of such an effect is incredibly small. It will be difficult to resolve the turn-of-the-century debate until there is a greater consensus on how to evaluate empirically the impact of international trade on the domestic wage structure.

B. Indirect Evidence

While a full examination of the wage effects of import tariffs is beyond the scope of this paper, does some corroborating evidence exists that would support the implication that labor had an economic interest in supporting tariffs? One tact would be to employ Magee's (1980) ingeniously simple test of the Stolper-Samuelson theorem when he examined the lobbying position of capital and labor representatives in Congressional testimony concerning the 1974 Trade Act. Unfortunately, it is difficult to construct a comparable test for the period under question here. While tariff hearings were held in conjunction with the 1909 tariff revision (the Payne-Aldrich act) among others, the question faced by the lobbying groups was quite different. The Trade Act of 1974 was not about any specific tariff rate but dealt with the possibility of an across-the-board reduction in import tariffs. The 1909 Payne-Aldrich act, by contrast, considered adjusting tariffs (either up or down) on each and every individual product in the tariff code.

As a result, virtually all those testifying — either labor or management (capital) — supported

maintaining or raising the tariff levied on the particular product they were producing. An examination of the 30 labor groups that testified before the House Ways and Means Committee in 1909 reveals that 23 groups took this position, while the other 7 argued for lower tariffs, not on their products but on important intermediate goods.[16]

Another avenue to consider is the popular support for protection as revealed in the votes for the political parties. The U.S. presidential election of 1888 provides an interesting test case because the tariff was the most important issue in that campaign.[17] Viewing this election as a referendum on the issue of trade policy, examining the role of factor endowments in cross-state voting patterns would be a test in the spirit of Wolfgang Mayer's (1984) model of direct democratic voting on trade policy. Such a test is, at least, plausible: The tariff ranked among the most important issues in American politics during the late nineteenth century and the two main political parties were sharply differentiated over the issue: Republicans rallied around the cause of high tariffs which, they argued, promoted national prosperity by protecting workers and home industries from foreign competition, while the Democrats called for a tariff for "revenue only" and sought lower tariffs to ease the tax burden on farmers and consumers. With few interruptions, the electorate consistently returned the presidency and the Congress to the Republicans who, in turn, maintained high tariffs. That the United States was also a competitive political democracy (for white males at any rate) suggests that the tariff must have had

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[16] For example, the Chair Makers' Union testified in favor of moving chair cane imports to the free list, and the International Stereotypers and Electrotypers' Union argued in favor of moving paper and pulp imports to the free list (U.S. House of Representatives 1909).

[17] "There is no question that the tariff was the central issue of the election of 1888," Reitano (1994, p. 108) argues. "If local or cultural concerns were important, it was still the tariff that determined the nominations and dominated the campaign."

broad political support for it to have been sustained.[18] Unless one wishes to explain the Republican political dominance either in terms of a bamboozled electorate that unwittingly bought the "high tariffs-high wages" rhetoric, or an electorate that voted for the Republicans for non-tariff-related reasons, then perhaps there may be some truth to the idea that, if the electorate was voting based on their economic interests, labor supported protection on self-interested grounds.

The tariff became the principal topic of political debate after President Grover Cleveland, a Democrat, devoted his entire State of the Union message to Congress to a call for tariff reform in December 1887. In the 1888 election, the two main presidential candidates offered the electorate faced a clear choice about the future of U.S. tariff policy — continued protection or tariff reform — depending upon which was elected to office. Cleveland won the popular vote with 48.6 percent of the popular vote, while his Republican rival Benjamin Harrison captured 47.8 percent of the vote, but Harrison easily won the electoral college by 233 to 168 and thus became president.[19] The extremely close popular vote could be interpreted as suggesting that the electorate was equally divided over the question, with half standing to gain from tariff reform and another half standing to lose. As Mayer (1984) points out, voting on tariffs in a direct democracy hinges crucially on the distribution of factor endowments among voters (as well as the economic structure of production). In the context of Ohlin's theory, this line of reasoning suggests that at least half of the electorate owned sufficient land and capital such that their factor incomes would rise as a result of lower tariffs.

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[18] For a strong, if not wholly convincing, argument that public policy would reflect voter preferences in this way, see Whittman (1996).

[19] This demonstrates the importance of the regional distribution of voting in the electoral college system. As president, Harrison raised tariffs considerably by signing the McKinley tariff of 1890.

The cross-state pattern of voting may help identify the underlying sources of support for and opposition to protection in terms of factor endowments. This will be a far from perfect test because the United States was a net importer of labor and capital-intensive manufactures during this period and hence one is not likely to see a sharp impact of the capital-labor ratio in manufacturing on the voting pattern; it was shortly after 1888 that the United States became a net exporter of capital-intensive manufactured goods. The results, however, could be suggestive.

The following equation enables us to study state-level voting patterns:

$$\log [r_i/(1-r_i)] = (_0 + (_1 x_i + ,_i$$

where r_i is the proportion of votes cast in state i for Republicans (total votes only include Republicans and Democrats), the column vector x_i consists of economic attributes of each state. The equation can be estimated by weighted logit (on grouped data) where the weights are $n_i r_i(1-r_i)$.

Table 2 considers the results from several specifications. The first column considers the raw quantities of the factors in each state (the logit is weighted by the number of votes in a state). In column (1), the signs on the coefficients indicate that states with greater amounts of capital tended to vote Republican while states with greater amounts of land tended to vote Democratic. This is consistent with land being an abundant factor of production and capital being a scarce factor. The next column includes labor (employment), which carries a negative coefficient and switches the sign on land. The next two columns consider factor proportions with one measure of the capital-labor ratio (capital-employment) and two measures of the land-labor ratio (the acreage-employment ratio and the value of land-labor ratio). Both measures are positively correlated with votes for the Republicans, yet neither coefficient is statistically significant and (as with the other regressions) the overall explanatory power of

the regression is poor. The last column, which examines employment shares, finds that states with a higher fraction of employment in agriculture tended to vote Democratic while those with a higher fraction in manufacturing tended to vote Republican.

At best the results can be viewed as conditional correlations, but the results are so weak and hard to interpret — partly because of the difficulty of defining and measuring factor intensity, and finding the data to match what theory suggests (see Jones, Beladi, and Marjit 1999) — that they fail to shed much light on the economic interests of labor vis-a-vis the tariff. Ohlin's hypothesis regarding labor's economic interests must remain a hypothesis for now.

5. Conclusions

This paper has considered Bertil Ohlin's analysis of trade policy and factor rewards in the context of the late nineteenth and early twentieth century United States. Although he examined international trade through the lens of a three factor model, Ohlin's findings are closely related to the Stolper-Samuelson result because the 2 by 2 "nugget" in his framework preserves the basic predictions from the two-sector model. Ohlin raised the issue of factor prices in the context of the controversial question of whether labor could benefit from import protection. Ohlin correctly pointed out that, in principle, this could be the case. Unfortunately, whether this was actually the case is unclear because the evidence from the turn of the century United States is decidedly mixed on the issue. Though this particular debate remains unresolved, it is a tribute to Ohlin that his ideas have formed the basis for an enduring and lasting framework in which these questions can be analyzed.

Figure 1:

The Geometric Dual of the Three-Factor, Three-Good General Equilibrium Model

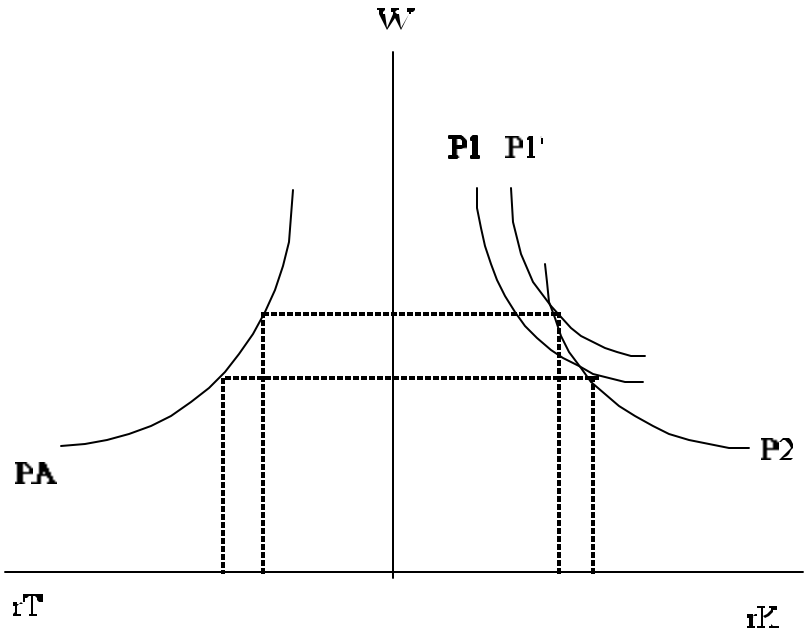

Figure 2: U.S. Labor Productivity and Real Wages, 1889-1929

Source: U.S. Bureau of the Census, Historical Statistics of the United States, Colonial Times to 1970 (Washington, D.C.: GPO, 1975), series D736, D726, W4.

Table 1: Industry Tariffs and Factor Proportions

Dependent Variable: Nominal Tariff (by industry)	(1) OLS	(2) WLS	(3) OLS	(4) WLS
Capital-Labor Ratio (k_i)	-3.6 (2.5)	-7.9 (1.7)	--	--
Labor Share in Value Added (2_i)	--	--	42.6 (29.7)	51.8 (31.6)
Adj. R^2	0.06	0.56	0.07	0.10
Weights	None	Value Added	None	Employment

Number of Observations: 17 manufacturing industries for year 1909. Source: Statistical Abstract of the United States, 1916 (Washington, D.C.: GPO, 1917).

Table 2: Voting Patterns in the Presidential Election of 1888: Weighted Logit Regression on Grouped Economic Data

The dependent variable is the log of the odds ratio of the Republican vote in the 38 U.S. states. The independent variables have been standardized (mean zero, variance one) to facilitate comparisons across coefficients. Standard errors in parentheses.

	(1) Factor Quantities	(2) Factor Quantities	(3) Factor Proportions	(4) Factor Proportions	(5) Employment Shares
Value of Capital	0.04 (0.03)	0.28 (0.17)	-	-	-
Acres of Improved Land	-0.09 (0.06)	0.01 (0.09)	-	-	-
Employment	-	-0.28 (0.20)	-		
Acres of Improved Land/Employment	-	-	0.04 (0.05)	-	-
Value of Land/Employment	-	-	-	0.14 (0.05)	-
Value of Capital/Employment	-	-	0.15 (0.08)	0.22 (0.05)	-
Share of Employment in Agriculture	-	-	-	-	-0.70 (0.40)
Share of Employment in Manufacturing	-	-	-	-	0.03 (0.09)
F-Statistic	2.05	2.02	1.98	8.80	4.39
Adjusted-R^2	0.10	0.07	0.10	0.29	0.15

Data Source: U.S. Census Office, Department of the Interior, Report on Manufacturing Industries in the United States at the 11th Census: 1890, Part 1., Totals for States and Industries (Washington, D.C.: GPO, 1895), pp. 67-69. U.S. Census Office, Department of the Interior, Report on Agriculture in the United States at the 11th Census: 1890, Totals for States (Washington, D.C.: GPO, 1895).

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