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CHAPTER I

INTRODUCTION

Theoretical interest in the subject of wage differentials among industries engaged in foreign trade has increased substantially in recent years. Most of the discussion of wage differentials and foreign trade has been concerned with the effects that the existence of wage differentials have on the standard theorems of international trade theory. These theorems involve commonly accepted conclusions about the effects of foreign trade on employment, output, incomes, prices and costs in export industries and import-competing industries as well as conclusions about the welfare of the total economy. The usual conclusions of international trade theory are that foreign trade increases the overall welfare of the trading economy and increases the income and output in export industries while decreasing income and output in the import competing industries.[1]

The existence of wage differentials may alter these

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[1]Chalres P. Kindleberger, International Economics (Homewood, Illinois: Richard D. Irwin, 1973), p. 194.

standard conclusions. There is a vast body of literature on the effects of introducing the existence of wage differentials into the standard analyses of the effects of international trade.[1]

There has not been a great deal of empirical work in the studies of wage differentials. The initial empirical study of wage differentials by Kravis[2] established the existence of a consistent wage differential between leading export industries and leading import-competing industries but did not determine whether or not this differential was distortionary. This limitation of his study makes it impossible to determine if wage differentials that exist are the type that lead to modifications of many of the theoretical and policy conclusions of standard international trade theory.

This study will attempt to provide some empirical evidence to the ongoing study of wage differentials and foreign trade. This study will attempt to answer two basic questions: (1) Do wage differentials exist between leading export and leading import-competing industries? and (2) If

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[1] A clear and comprehensive survey of much of the recent work can be found in Stephen P. Magee, "Factor Market Distortions, Production, and Trade: A Survey," Oxford Economic Papers, 25 (March 1973), pp. 1-43; and in Bharat R. Hazari, The Pure Theory of International Trade and Distortions (New York: John Wiley and Sons, 1978), pp. 33-104.

[2] Irving B. Kravis, "Wages and Foreign Trade," Review of Economics and Statistics, 38 (February 1956), pp. 14-30.

wage differentials exist, are they distortionary? Distortionary wage differentials are differentials not based upon actual differences in labor services. The answers to the second question will involve the major part of this study. It is the existence of wage differentials between export and import-competing industries not explained by productivity differences that is of interest to international trade theorists. If there is a systematic difference between wages in export industries and wages in import-competing industries, then the standard theorems of international trade theory will need continued questioning.

This study will proceed in the following manner. Chapter 2 will review the theoretical and empirical literature on the subject of wage differentials and international trade. Chapter 3 will discuss the model used to test for the existence of distortionary wage differentials between leading export and leading import-competing industries. Chapter 4 will describe the data used to test the model. Chapter 5 will contain a discussion of the results of testing the model using a variety of specifications. Chapter 6 will include a review of the empirical results with respect to the theoretical and policy conclusions that the results imply. The empirical results will be discussed with specific reference to some of the theoretical issues and policy prescriptions that are discussed in Chapter 2.

CHAPTER II

REVIEW OF THE THEORETICAL AND EMPIRICAL LITERATURE

The effects on the standard theorems of international trade theory of distortionary wage differentials have been divided into two groups by Magee.[1] The first group of effects is classified as structural effects and the second group is classified as welfare effects.

The group of effects classified as structural effects include: output effects, shrinkage effects, nontangency effects, factor market effects, convexity effects, and trade effects.

The output effect is so labelled because a distortionary wage differential in a two-good, two-factor model will cause the economy to produce an output combination not determined by the usual isoquant-isocost tangency. A distortionary wage differential will cause the isocost line to rotate toward the origin on the axis of the industry paying the differential. Output will thus be on a lower isoquant

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[1] Stephen P. Magee, "Factor Market Distortions, Production, and Trade: A Survey," Oxford Economic Papers, 25 (March 1973), pp. 1-43.

compared to the output level with no differential. Furthermore, the opening of trade may further reduce welfare and call for protection to improve welfare. This last point will be discussed further when Hagen's[1] analysis of the welfare effects of wage differentials are reviewed below. Magee summarizes the output effect by concluding ". . . the differential reduces output of the industry paying the differential, causes non-tangency in autarky, and can reverse the pattern of trade."[2]

The non-tangency effect as discussed by Batra[3] is closely related to the output effect. Batra explains that, in a two-good model, a distortionary wage differential will cause the marginal rate of substitution (MRS) line and the marginal rate of transformation (MRT) curve to intersect rather than lie tangent to one another. If the wage differential is paid by the industry represented by the good on the vertical axis, then the MRS will intersect the MRT from below. If the wage differential is paid by the industry represented by the good on the horizontal axis, then the MRS will intersect the MRT from above. In either case, the output produced will not be an amount greater than the

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[1]Everett E. Hagen, "An Economic Justification of Protectionism" Quarterly Journal of Economics, 72 (November 1958), pp. 54-58.

[2]Magee, "Factor Market Distortions," p. 13.

[3]R. N. Batra, Studies in the Pure Theory of International Trade (New York: St. Martins Press, 1973), pp. 248-249.

output produced in a model with no distortionary wage differential.

Both Batra[1] and Johnson[2] discuss the effect of distortionary wage differentials on the movement of the production possibilities curve (PPC) and the shape of the PPC.

The production possibilities curve is derived from the efficiency locus in the Edgeworth-Bowley box model. If one industry is paying a wage differential, then production will not occur on the efficiency locus in the Edgeworth-Bowley box. That is, production will not occur where the marginal rates of transformation for each of the two goods are equal since the marginal rates of substitution for the factors of production in each industry are not equal due to the wage differential between industries. Because production is located off the efficiency locus, the production possibilities curve derived will lie inside the production possibilities curve that would exist were there no wage differential. Hence the "shrinkage" label given to this effect.

Johnson[3] also analyzes the effects of wage differentials on the shape of the production possibilities curve. If the industry which uses labor relatively intensively pays

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[1]Ibid., pp. 249-250.

[2]Harry G. Johnson, "Factor Market Distortions and the Shape of the Transformation Curve," Econometrica, 34 (July 1966), pp. 686-698.

[3]Ibid.

the wage differential, then the production possibilities curve may actually become convex to the origin along some portion of the PPC.

Johnson concludes his article with a demonstration that the size of the wage differential would have to be very large to cause significant losses in welfare.

The existence of a wage differential may break the relationship between factor intensities in the value sense and factor intensities in the physical sense. In a two-good, two-factor model with no wage differential paid to labor in one of the industries, an industry that is labor intensive in the physical sense will also necessarily be labor intensive in the value sense. If the two factors of production are labor and capital, then, if one industry uses relatively more units of labor per unit of capital than the other industry, it is designated as labor intensive in the physical sense. If there is no wage differential paid by either industry, then the industry that is labor intensive in the physical sense will pay a larger relative share of its total factor payments to labor and thus will also be factor intensive in the value sense. The existence of a wage differential may reverse this relationship. If the industry that is capital intensive in the physical sense is paying a positive wage differential, then the ratio of the value of its factor payments to labor relative to the value of its factor payments to capital may be greater than the similar ratio in the other industry. Hence, one industry is labor intensive in the physical sense and the other industry is labor intensive in the value sense. The existence of the wage differential breaks the link between financial variables and physical variables in production theory.[1]

Batra[2] analyzes the output response elicited by price changes in a model with inconsistent physical factor intensity ratios and value factor intensity ratios. Output responses may be perverse in the sense that an increase in the price of a good may result in a decline in output. Bhagwati and Srinivasan[3] have demonstrated the interesting result that the perverse price-output responses are independent of the convexity or concavity of the production possibilities curve. They have demonstrated that, in the presence of a wage differential, there is no consistent relationship between the curvature of the PPC and output responses to price changes. Under different assumptions

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[1]For a discussion of the explicit relationship between the physical factor intensity and the value factor intensity, see Eden S. H. Yu, "On the Theory of Interregional Wage Differential and Technical Change," Journal of Regional Science, (May 1979), pp. 245-256.

[2]Batra, Studies in the Pure Theory of International Trade, p. 250.

[3]Jagdish N. Bhagwati and T. N. Srinivasan, "The Theory of Wage Differentials: Production Response and Factor Price Equalization," Journal of International Economics, 1 (February 1971), pp. 19-35.

of factor intensities, in the physical factor intensity sense and the value factor intensity sense, and the size and direction of the wage differential, output responses may be normal even with a PPC that is convex to the origin.

In a model where a fixed capital-labor ratio is assumed, Manning and Sgro[1] explain the necessity of opposite physical factor intensities and value factor intensities in order to obtain perverse price-output movements.

Magee[2] demonstrates that physical factor intensity reversals can never be induced by changes in factor price differentials above, except in the case of complete specialization, the limiting case in the Edgeworth-Bowley box diagram. In a discussion of the effects of wage differentials on trade patterns, he demonstrates that trade reversal can occur only if the export industry pays the differential.

If wage differentials cause value factor intensity reversals, Sgro[3] has demonstrated that multiple equilibria are possible in a two-good model where differential savings

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[1] R. Manning and Pasquale M. Sgro, "Wage Differentials and Growth in Fixed Coefficient Models," Southern Economic Journal, 41 (January 1975), pp. 403-409.

[2] Stephen P. Magee, "Factor Market Distortions, Production, Distribution, and the Pure Theory of International Trade," Quarterly Journal of Economics, 85 (November 1971), pp. 623-643.

[3] Pasquale M. Sgro, "Classical Savings, Wage Differentials and Growth," Southern Economic Journal, 45 (January 1979), pp. 874-884.

rates are assumed for workers and capitalists.

Batra[1] and Magee[2] both discuss the effects of wage differentials on trade patterns. The trade effects involve analyses of both patterns of trade specialization and the relationship between the volume of trade and national income. The existence of a positive wage differential paid by the export industry may cause the volume of trade to decline relative to national income. Batra and Pattanaik[3] explain that a wage differential may cause not only a diminution of the volume of trade but also a reversal in the pattern of trade if the export industry pays the wage differential.

The welfare effects of wage differentials involve discussions of policy prescriptions that attempt to increase economic welfare when a wage differential exists. These policy prescriptions are often different from the policy prescriptions of standard international trade theory. When wage differentials exist, policy prescriptions to raise welfare could include tariffs, factor taxes, factor subsidies, and trade-diverting customs unions.

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[1]Batra, Studies in the Pure Theory of International Trade, p. 250.

[2]Magee, "Factor Market Distortions, A Survey," pp. 28-29.

[3]Raveendra N. Batra and P. K. Pattanaik, "Factor Market Imperfections, the Terms of Trade and Welfare," American Economic Review, 61 (December 1971), pp. 946-955.

Batra and Pattanaik[1] demonstrate that, if a reversal in the pattern of trade is caused by a wage differential, free trade may be inferior, welfare reducing, compared to no trade. Furthermore, a higher tariff on the imported good may be superior, welfare increasing, to a lower tariff. Batra[2] discusses the effects of adding a nontraded good to the standard two-good model of international trade. He demonstrated that changes in welfare depend upon the direction of wage differentials and the relative physical factor intensities and value factor intensities of the three goods. A result that is consistent with earlier conclusions is that tariffs may increase welfare in the presence of factor market distortions. In a comment on Batra's results, Kemp and Tower[3] discuss the relationship between the presence of a nontraded good and the shape of the transformation curve and the subsequent welfare and policy conclusions to be derived.

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[1]Raveendra N. Batra and P. K. Pattanaik, "Domestic Distortions and the Gains from Trade," Economic Journal, 80 (September 1970), pp. 638-649.

[2]Raveendra N. Batra, "Nontraded Goods, Factor Market Distortions and the Gains from Trade," American Economic Review, 63 (September 1973), pp. 706-713.

[3]Murray C. Kemp and Edward Tower, "Nontraded Goods, Factor Market Distortions and the Gains from Trade: Comment," American Economic Review, 65 (March 1975), pp. 249-250.

Batra and Scully[1] have demonstrated that growth induced improvement in the terms of trade may decrease welfare if a wage differential exists between the exportable good sector and the importable good sector. They further demonstrate that a country with monopoly power in trade may find their rate of growth reduced by an improvement in their terms of trade.

In a classic article, Hagen[2] advocates protection for an industry paying a positive wage differential. Hagen explains that, in a developing economy, the manufacturing sector will be growing faster than the agricultural sector and, therefore, will have a relatively faster increase in demand for labor. This is the basis for a wage differential paid by the manufacturing sector that is also likely to be the import-competing sector in a developing economy. Protection of this import-competing manufacturing sector will raise welfare if the gains in income due to protected output outweight the costs of the relatively more expensive domestically produced manufactured output. Bhagwati and Ramaswami[3] criticized Hagen's conclusions on several points.

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[1]Raveendra N. Batra and Gerald W. Scully, "The Theory of Wage Differentials: Welfare and Immiserizing Growth," Journal of International Economics, 1 (May 1971), pp. 241-247.

[2]Everett E. Hagen, "An Economic Justification of Protectionism," Quarterly Journal of Economics, 72 (November 1958), pp. 496-514.

[3]Jagdish Bhagwati and V. K. Ramaswami, "Domestic

First, in one of the best discussions of the difference between a distortionary and a nondistortionary wage differential, they explain that the wage differential between urban and rural, or manufacturing and agricultural, workers may not be distortionary because it reflects utility preference differences, differences in human capital, and costs of movement from rural employment to urban employment. Second they are "skeptical about the degree to which such distortions obtain in the actual world."[1] Finally, they disagree on the proper policy if a wage differential does, in fact, exist. They point out that Hagen's policy proposal does not act upon the source of the distortion, namely the domestic wage differential. They propose, instead of a protective tariff, a factor tax-cum-subsidy because it affects the domestic distortion and the source of the welfare loss. In a related article, Fishlow and David[2] propose subsidies on the higher cost sector and/or taxes on the lower cost sector. They suggest that this policy may completely eliminate the welfare losses due to a distortionary wage differential.

Distortions, Tariffs and the Theory of Optimum Subsidy," Journal of Political Economy, 71 (February 1963), pp. 44-50.

[1]Ibid., p. 48.

[2]Albert Fishlow and Paul A. David, "Optimal Resource Allocation in an Imperfect Market Setting," Journal of Political Economy, 69 (December 1961), pp. 529-546.

In a more recent discussion, Lapan[1] and Cassing and Ochs[2] demonstrate that a wage subsidy may be necessary to reallocate labor resources if a wage differential causes a change in the terms of trade that is welfare reducing. Intervention in the market process, in the form of a wage subsidy, may be necessary as congestion occurs due to workers leaving the contracting industry. The subsidy, however, must not be large enough to remove the incentive necessary for the reallocation of resources.

Results similar to those discussed above were derived by Hazari.[3] If a distortion exists in one factor market, creating a distortion in the other factor market will lead to the same welfare-increasing results as the factor tax-cum-subsidy policy. In another interesting conclusion, he demonstrates that if distortions exist in both factor markets, then the normal welfare conclusions of standard international trade theory may hold true.

Using an approach similar to Hagen, Yu and Scully[4]

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[1]Harvey E. Lapan, "International Trade, Factor Market Distortions, and the Optimal Dynamic Subsidy," American Economic Review, 66 (June 1976), pp. 335-346.

[2]James Cassing and Jack Ochs, "International Trade Factor Market Distortions, and the Optimal Dynamic Subsidy: Comment," American Economic Review, 68 (December 1978), pp. 950-955.

[3]Bharat R. Hazari, "Factor Market Distortions and Gains from Trade Revisited," Weltwirtschaftliches Archiv, 110 (October 1974), pp. 413-429.

[4]Eden S. H. Yu and Gerald W. Scully, "Domestic

demonstrate that a trade-diverting customs union may actually increase welfare when a wage differential is present. Their analysis is based upon the fact that, when a wage differential is present, the internal domestic opportunity costs of a country differ from the marginal rate of transformation of its trading partners. Therefore, there is no unequivocal "best" policy of free trade and "interference" with free trade may be welfare improving.

The effect of a wage differential on national income when economic growth occurs has been discussed by Yu[1] using a model with two final products and one pure intermediate good. Economic growth was shown to be normal, that is, raising national income or immiserizing, reducing national income, depending upon the factor intensity rankings of the three industries and whether the wage differential was paid by the industry producing the exportable good or by the industry producing the importable good.

In a related paper, Yu[2] examines the implications of neutral technical progress for factor intensities, factor rewards, labor allocations, output levels, and national

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Distortions and the Theory of Customs Unions," Southern Economic Journal, 42 (October 1975), pp. 218-224.

[1]Eden S. H. Yu, "Wage Differential, Pure Intermediate Goods and Economic Growth," Southern Economic Journal, 44 (April 1978), pp. 968-973.

[2]Eden S. H. Yu, "Economic Growth, Interindustry Flows, and Wage Differential," Southern Economic Journal (January 1980), forthcoming.

income in an integrated framework allowing for a distortionary wage differential and interindustry flows. This model represents a synthesis of several well-known lines of reasoning developed from the separate analyses of the wage-differential and intermediate-input cases. The results highlight the significance of the phenomenon of value intensity reversal in explaining the changes in the output level and, hence, the ultra-biased growth.

Bhagwati[1] has discussed the fact that immiserizing growth is a possibility in the presence of any type of distortion, of which wage differentials are one type. Immiserizing growth can occur where wage differentials exist and growth is caused by either neutral technical progress in the importable good industry, increases in the factor that the importable good industry uses intensively, or biased technical progress in the importable good industry increasing the use of the factor that the exportable good industry uses intensively. He also demonstrates that wage differentials have a similar effect on welfare as tariff protection.

Hazari[2] has shown that, depending upon the type of technical progress assumed, technical progress may cause output in the progressive industry to fall if a value factor

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[1]Jagdish N. Bhagwati, "Distortions and Immiserizing Growth: a Generalization," <u>Review of Economic Studies</u>, 35 (October 1968), pp. 481-485.

[2]Bharat R. Hazari, "Factor Market Distortions, Technical Progress, and Trade," <u>Oxford Economic Papers</u>, 27 (March 1975), pp. 47-60.

intensity reversal exists. Technical progress may also cause immiserizing growth in the presence of an improved terms of trade if the progressive industry is the exportable good industry. Technical progress in the import-competing industry may cause the terms of trade to deteriorate. The last two results are shown to be due to the nontangency between the Production Possibilities Curve and the relative price line. Hazari and Sgro[1] have shown that perverse output responses and immiserizing growth may occur without the presence of a value factor intensity reversal if: (1) technical progress occurs in the non-traded good sector; (2) the wage distortion occurs in the non-traded good sector; or, (3) the non-traded good is an inferior good in consumption.

Again using a model that includes a non-traded good, Hazari and Sgro[2] have shown that economic growth, assumed to be an increase in capital stock, may either lower or raise welfare depending upon the direction of the wage differential and the ranking of the physical factor and value factor intensities.

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[1] Bharat R. Hazari and Pasquale M. Sgro, "Some Notes on Technical Progress in the Framework of Factor Market Imperfections and Non-traded Goods," Australian Economic Papers, 15 (June 1976), pp. 76-86.

[2] Bharat R. Hazari and Pasquale M. Sgro, "Theorems on Immiserizing Growth (Normal Growth) in the Non-traded Goods and Wage Differentials Framework," Southern Economic Journal, 41 (January 1975), pp. 515-519.

Hazari[1] recently developed a model in which the wage differential was treated as an endogenous variable, unlike the majority of other discussions of wage differentials where they are assumed to be a fixed parameter. He also discusses some of the possible sources of wage differentials. These include minimum wages, a subsistence wage floor, and a union induced fixed wage. He demonstrates that technical progress, induced by the wage differential itself, may lead an economy to an optimum welfare equilibrium by eliminating the wage differential and the distortions generated by the wage differential.

In an early discussion of the effects of distortions on welfare, Haberler[2] discusses the conclusion that trade may be detrimental to welfare in the presence of factor immobility or factor price rigidity. However, the major part of his paper argued that, even with distortions present in factor markets, trade may still be superior to protection or no trade. Yu,[3] following Haberler and, also

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[1]Bharat R. Hazari, "The Theory of Wage Differentials, Induced Technical Progress and the Pure Theory of International Trade," Weltwirtschaftliches Archiv, 114 (1978), pp. 146-159.

[2]Gottfried Haberler, "Some Problems in the Pure Theory of International Trade," Economic Journal, 60 (June 1950), pp. 223-240.

[3]Eden S. H. Yu, "Rigid Wage, Factor Immobility and Immiserizing Growth," Economic Record, 54 (December 1978), pp. 387-393.

Bhagwati,[1] demonstrates that economic growth may lower welfare in the presence of factor price rigidity.

In an article critical of some of the factor-market distortion literature, Neary[2] maintains that the perverse output-price responses and perverse price-real wage relationships, demonstrated in much of the literature discussed above, will rarely occur. His conclusion is based on a demonstration that a small, open economy can never be in a stable equilibrium where the physical factor intensities and value factor intensities are not consistent. Using several different adjustment mechanisms, Neary shows that, with distortions present, reallocation of factors will occur and move the economy to a stable equilibrium that eliminates some of the paradoxical outcomes discussed in much of the literature reviewed above.

In general, the existence of wage differentials can alter and even reverse the welfare and policy conclusions derived from the standard theorems of international trade.

There have been few empirical studies of the existence of wage differentials between export industries and import-competing industries. Some studies have been done in the general area of labor force characteristics and wages

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[1]Bhagwati, "Distortions and Immiserizing Growth," p. 485.

[2]J. Peter Neary, "Dynamic Stability and the Theory of Factor Market Distortions," American Economic Review, 68 (September 1978), pp. 671-682.

in industries affected by foreign trade.

Keesing[1] developed a model to explain the pattern of international trade. He hypothesized that international trade is actually trade in labor services embodied in products traded. He divided labor services into eight categories of skill levels and found that U.S. exports required a higher proportion of the higher skill categories of labor services relative to U.S. trading partners. Conversely, U.S. imports embody a higher proportion of the lower skill categories of labor services. He explains this pattern of U.S. trade with a Heckscher-Ohlin type explanation that the U.S. has a relatively larger endowment of higher skill labor services.

In a similar study, Mitchell[2] uses a variant of the CES production function incorporating a separate skilled labor input and a separate unskilled labor input with the usual capital input to explain the U.S. pattern of trade. U.S. exports were again found to be those products whose production functions contained a relatively higher ratio of skilled to unskilled labor input.

In an attempt to develop a more complex version of

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[1] Donald Keesing, "Labor Skills and Comparative Advantage," American Economic Review, 56 (May 1966), pp. 249-258.

[2] Edward J. Mitchell, "Explaining the International Pattern of Labor Productivity and Wages: A Production Model with Two Labor Inputs," Review of Economics and Statistics, 50 (November 1968), pp. 461-469.

the basic Heckscher-Ohlin model, Baldwin[1] measured the average years of education and the percentage of scientists and engineers in the industry labor force of leading export industries and leading import-competing industries. He found results similar to those mentioned above. U.S. export industries had labor forces with higher average years of education and higher percentages of scientists and engineers in the industry labor force than U.S. import-competing industries. Baldwin also found higher yearly earnings in export industries.

The three studies cited above all indicate that, if wage differentials exist between U.S. leading export industries and U.S. leading import-competing industries, these wage differentials may not be distortionary since higher skilled labor is more productive and their higher wage rates reflect this fact.

The most comprehensive empirical study of the existence of wage differentials between leading U.S. exporters and leading U.S. import-competitors was done by Kravis.[2] He found a consistent wage differential between leading exporters paying the higher average wage rate. As mentioned in Chapter 1, Kravis made no determination in his study as

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[1]Robert E. Baldwin, "Determinants of the Commodity Structure of U.S. Trade," American Economic Review, 61 (March 1971), pp. 126-146.

[2]Irving B. Kravis, "Wages and Foreign Trade," Review of Economics and Statistics, 38 (February 1956), pp. 14-30.

to whether the differentials he found were or were not distortionary. There is an implication in his analysis of the empirical results that the wage differentials he found cannot be justified by productivity differences. This would lead to the conclusion that some of the wage differentials may be distortionary, although he does not test this proposition and his results yield no definite conclusion. Industries were classified as leading exporters if the dollar value of their exports exceeded a specified amount. Similarly, industries were classified as leading import-competitors if there were competitive imports in that industry above a specified amount. The group of industries classified as leading exporters paid higher average wages in both 1947 and 1952. The consistency of wage differentials existed even when Kravis subdivided industries into durable and non-durable goods categories. Leading exporter durable goods industries paid higher average wages than leading import-competitor durable goods industries. The same relationship held for the non-durable goods industry categories.

This result suggests that there may be a systematic and distortionary wage differential between leading export industries and leading import-competing industries. Kravis assumes durable goods industries would employ the same category of labor skills and the existence of a wage differential between leading durable goods exporters and leading durable goods import-competitors may be due to a wage differential not explained by skill and productivity differences.

The empirical studies reviewed above do not give a definite answer to the question whether a distortionary wage differential exists between leading export industries and leading import-competing industries.

Using more recent data, this study will attempt to answer the questions discussed above. Namely, do wage differentials still exist between industries classified as leading exporters and industries classified as leading import-competitors and if wage differentials still exist are these differentials explained by skill and productivity differences or are systematic wage differentials distortionary.

In the next chapter, the model used to answer the questions raised above will be developed.

CHAPTER III

DEVELOPMENT OF THE MODEL

The first step necessary to the process of determining if there is a distortionary wage differential between export industries and import-competing industries is to identify the leading export industries and the leading import-competing industries. An approach similar to the one used by Kravis[1] will be employed. Industries that have exports above a specified dollar amount will be classified as leading export industries. Industries that face competing imports above a specified dollar amount will be classified as leading import-competing industries. An absolute criterion has been chosen because it identifies those industries that account for the largest portion of U.S. foreign trade and, therefore, the largest portion of employment associated with export industries or import-competing industries.

Once these industries are identified, a determination of whether a wage differential exists between leading export industries and leading import-competing industries

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[1] Kravis, "Wages and Foreign Trade," pp. 15-16.

can be made by comparing the average wage rates in the two classifications.

If a wage differential exists between the industries classified as leading exporters and those classified as leading import-competitors, then a method must be developed to test if the wage differential is distortionary or not. Some theoretical underpinnings for the specification of the model to be tested in Chapter 5 are presented below.

The technique used in this study is adapted from the method used by Scully[1] in his analysis of interstate wage differentials. Scully developed a model with average wage rates as the dependent variable in a function with physical capital-labor ratios, human capital per worker, social composition of the industry labor force, female percentage of the industry labor force, and union membership percentage of the industry labor force as the independent variables.

Physical capital per worker is included as an explanatory variable because standard economic theory concludes that wages should be directly related to the amount of physical capital available for each worker to use. A standard linear homogeneous production function is of the form,

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[1]Gerald W. Scully, "Interstate Wage Differentials: A Cross Section Analysis," American Economic Review, 59 (December 1969), pp. 757-773.

$$X = F(K,L) \tag{1}$$

where X denotes output, K denotes physical capital inputs and L denotes labor inputs. Differentiating (1) with respect to each factor input, the marginal products of each factor are obtained

$$MP_L = F_L \; ; \; MP_K = F_K \tag{2}$$

and using Euler's Theorem explains that the payment to each factor input equal to their respective marginal products

$$F_L L + F_k K = X \tag{3}$$

exactly exhausts the total output produced. Under perfect competition and profit maximization, wage rates and returns to capital are equal to the respective value marginal products of labor and capital,

$$w = P\,F_L \; ; \; r = P\,F_k \tag{4}$$

where w denotes the wage rate, r denotes the return to capital and P denotes the product price.

Since the production function is assumed to be linear homogeneous and concave in both inputs, the original form of the function,

$$X = F(K,L) \tag{5}$$

may be rewritten in the intensive form:

$$X = LF\ (K/L,1) = Lf\ (k) \tag{6}$$

and the expected relationship between labor productivity, as measured by the wage rate, and the physical capital-labor ratio, k, should be,[1]

$$dw/dk > 0. \tag{7}$$

In his text on microeconomic theory, Ferguson[2] explains the relationship between the marginal products of inputs and the quantity of other inputs by saying, ". . . the greater the quantity of cooperating inputs the greater the marginal product of the input in question." In the simple two-factor model discussed above, physical capital is the cooperating input and, as its quantity increases, we should expect the marginal product of labor, and, therefore, the wage rate, to increase also.

In his pioneering study of regional wage differentials, Gallaway[3] confirms that the difference in physical capital-labor ratios is one of the major explanations of wage differentials between northern and southern workers.

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[1]Raveendra N. Batra, Studies in the Pure Theory of International Trade (New York: St. Martins Press, 1973), pp. 2-6.

[2]C. E. Ferguson, Microeconomic Theory (Homewood, Illinois: Richard D. Irwin, Inc., 1969), pp. 368-369.

[3]Lowell E. Gallaway, "The North-South Wage Differential," Review of Economics and Statistics, 45 (August 1963), pp. 264-272.

The second explanatory variable used in our model is human capital per worker. Much emphasis has been placed on human capital, however measured, in recent years as an important explanatory variable in explaining differences in earnings among workers. Human skills, experience, education, and training have been shown to be important in explaining differences in earnings.[1]

In his major work on human capital and education, Becker[2] refers to the effects of differences in human capital on wage rates in export industries and import-competing industries. He discusses some of the empirical work mentioned above as evidence that differences in human capital among workers lead to differences in productivity among workers and, therefore, to wage differentials among workers. These wage differentials would not be a distortionary differential because they reflect differences in productivity. They do not upset the theoretical and policy conclusions of standard international trade theory.

Recent empirical work in wage differentials has confirmed the importance of human capital differences. In a study of North-South wage differentials, Bellante[3] found

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[1]Theodore W. Schultz, Investment in Human Capital (New York: The Free Press, 1971), p. 173.

[2]Gary S. Becker, Human Capital, 2nd ed. (New York: National Bureau of Economic Research, 1975), p. 82.

[3]Don Bellante, "The North-South Wage Differential and the Migration of Heterogeneous Labor," American Economic Review, 69 (March 1979), pp. 166-175.

that human capital differences explained approximately thirty-eight percent of the North-South regional wage differential. A study of racial wage differentials by Smith, et al.,[1] found that human capital differences, measured as differences in median school years completed, were a highly significant variable in explaining racial wage differential. In their critique of Hagen's[2] article, Bhagwati and Ramaswami[3] explain that differences in human capital are one of the major sources of nondistortionary wage differentials.

Just as physical capital per worker was included in the model to capture differences in wages that are not distortionary, a variable measuring human capital per worker will be included in the model to capture additional differences in wages that are due to productivity differences. These first two variables will be used to determine the nondistortionary differences in wages that may exist between leading export industries and leading import-competing industries.

The final three variables included in the model are percentage of the industry labor force unionized, percentage of the industry labor force that is female, and percentage

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[1]Lewis H. Smith, Vernon M. Briggs, Jr., Brian Rungeling, and James O. Smith, Jr., "Wage and Occupational Differences Between Black and White Men: Labor Market Discrimination in the Rural South," Southern Economic Journal, 45 (July 1978), pp. 250-257.

[2]Hagen, "An Economic Justification of Protectionism."

[3]Bhagwati and Ramaswami, "Distortions, Tariffs and Optimum Subsidy."

of the industry labor force that is black. These three variables are included in an attempt to capture the effects of unions and discrimination on wage rates.

Previous studies have not found conclusive evidence that unions have a significant effect on wage rates. Maher[1] found little evidence that unions affected wage differentials among industries although they may have had some effect on the overall level of wages. Scully[2] does find some effects of unions in his study of interstate wage differentials. The variable for industry unionization will be included because the available evidence does not definitely conclude that it should not be included.

The variables on race and sex will attempt to capture differences in industry wage rates that may be due to demographic differences in the percentages of blacks and females employed. If discrimination exists on a systematic basis against blacks and females, then wage differentials may exist between export and import-competing industries due to differences in the percentages of blacks and females they employ. While discrimination in wage rates not based on productivity differences is distortionary, this study will attempt to isolate a systematic distortionary differential specifically related to export industries vis-a-vis

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[1]John E. Maher, "Unions and Wage Differentials," Perspectives on Wage Determination, edited by Campbell R. McConnell (New York: McGraw-Hill, 1970).

[2]Scully, "Interstate Wage Differentials," p. 770.

import-competing industries. Differentials based upon race and sex discrimination are still relevant from a welfare and efficiency standpoint.[1]

Based on the above discussions, the general form of the model is specified as:

$$w_i = f\ (CL_i,\ HC_i,\ PU_i,\ PF_i,\ PB_i,\ e) \tag{8}$$

where w denotes the average wage rate in each industry, CL denotes the physical-capital labor ratio in each industry, HC denotes the human capital per worker in each industry, PU denotes the percentage of each industry's labor force that is unionized, PF denotes the percentage of each industry's labor force that is female, PB denotes the percentage of each industry's labor force that is black, i is the subscript denoting the particular leading export or leading import-competing industry, and e is the error term assumed to be normally distributed with an expected value of zero and a constant variance.

The sign of the physical capital variable, the human capital variable, and the unionization variable are expected to be positive. The signs of the race and sex variables are expected to be negative:

$$\frac{\partial w_i}{\partial (CL_i)} > 0, \quad \frac{\partial w_i}{\partial (HC_i)} > 0, \quad \frac{\partial w_i}{\partial (PU_i)} > 0, \quad \frac{\partial w_i}{\partial (PF_i)} < 0, \quad \frac{\partial w_i}{\partial (PB_i)} < 0 \tag{9}$$

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[1]Magee, "Factor Market Distortions," p. 2.

Various versions of this model will be tested using multiple regression analysis. Briefly, the first phase of the test will determine the amount of the wage differential due to productivity differences alone. The equation estimated will therefore be:

$$w_i = a + b(CL_i) + c(HC_i) + e_i. \tag{10}$$

The residuals generated from the above equation will then be analyzed to determine how much of the remaining wage differential can be explained by unionization effects and discrimination. The equation to be estimated next will be:

$$w_i - \hat{w}_i = a + b(PU_i) + c(PF_i) + d(PB_i) + e_i \tag{11}$$

where $\hat{w}$ denotes the predicted wage rate from equation (10). The residuals generated from equation (11) will be analyzed to determine if there is a significant difference between the residuals of the leading export industry group and the residuals of the leading import-competing industry group. This test of the two groups of residuals will be the key to determining if a distortionary wage differential exists between export industries and import-competing industries. If there is a significant difference between the residuals of the leading export industry group and the residuals of the leading import-competing industry group, then the hypothesis that a distortionary wage differential exists cannot be rejected. Since the residuals generated from equation (11) will not be explained by productivity reasons or discrimination reasons, it is reasonable to assume that any systematic difference between the two groups of residuals will indicate a distortionary wage differential between export industries and import-competing industries. This is the type of wage differential that is relevant to the theoretical literature reviewed in Chapter 2.

CHAPTER IV

DESCRIPTION OF THE DATA

The types of data and data sources that could be useful to this study were limited by the quality and quantity of U.S. Census Bureau data on individual industrial characteristics. Data on race, sex, and human capital measures were available only for SIC 2-digit and 3-digit industry classifications.[1] Therefore, other data had to be found that conformed to the data available on racial composition, percentage female, and educational characteristics that were available only at the 2-digit and 3-digit SIC classifications since this was the most detailed classification level available. The years covered in this study will be 1960 and 1969. This choice is determined again by the quality of the Bureau of the Census data on industrial characteristics. The data in the 1960 report on industrial characteristics for race, sex, and education

[1]U.S. Bureau of the Census, U.S. Census of Population: 1960. Subject Reports. Industrial Characteristics. U.S. Government Printing Office, Washington, D.C., 1967; U.S. Bureau of the Census, Census of Population: 1970. Subject Reports. Industrial Characteristics. U.S. Government Printing Office, Washington, D.C., 1973.

are for the year 1960. However, in the 1970 report on industrial characteristics, the data on race, sex, and education are for the year 1969.[1] To keep the data as consistent as possible, and since data on other variables were available for both 1969 and 1970, the years 1960 and 1969 were the years chosen as the ones to be studied.

Two separate years, 1960 and 1969, were chosen rather than only one year as an attempt to determine any changes in the size, direction or determinants of wage differentials. It was felt that a study that included two different time periods would prove more valuable on historical grounds as well as being less susceptible to transitory influences that could bias a study using data for only one time period. The years 1960 and 1969 were chosen also because they are the two most recent census reporting years and therefore the most likely to be useful to current discussions of international trade theory and international economic policy.

The data used to determine the industries classified as either leading exporters or leading import-competitors came from the Bureau of the Census Reports, U.S. Commodity Exports and Imports as Related to Output.[2] This study will

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[1]Ibid.

[2]U.S. Bureau of the Census, U.S. Commodity Exports and Imports as Related to Output, 1961 and 1960, U.S. Government Printing Office, Washington, D.C., 1963; U.S. Bureau of the Census, U.S. Commodity Exports and Imports as Related to Output 1970 and 1969, U.S. Government Printing Office, Washington, D.C., 1973.

focus on trade in manufactured commodities for two reasons. The first reason is that trade in commodities accounts for about eighty percent of all U.S. foreign trade.[1] The second reason is that data on manufacturing industries are the most complete and comprehensive. Data on trade in manufactured commodities are available for SIC classes from the 2-digit level to the 8-digit level of classification. The Bureau of the Census Reports, U.S. Commodity Exports and Imports as Related to Output, were chosen because they present data on exports and imports that are the most conformable to other data necessary for this study.[2] From these reports, the 3-digit industry groups classified as either leading exporters or leading import-competitors will be chosen.

The data on wage rates were obtained from the Bureau of Labor Statistics Bulletin, Employment and Earnings, United States, 1909-1975. This bulletin reports data on: number of production workers, average weekly earnings, average hourly earnings, and employee turnover rates. The data are presented at the SIC 2-digit, 3-digit, and 4-digit level of industry classification. The 3-digit classification data will be used because they conform to the foreign trade reports discussed above. The data on average hourly earnings will be used as the wage variable because they come

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[1]Ibid., p. 1.

[2]For a more detailed description of the data development and other foreign trade data available, see U.S. Bureau

closest to measuring payment to labor services that is comparable among industries. Average hourly earnings are most comparable among industries because they are not biased by differences in work-week hourly length, or seasonal variations in employment. Both of these factors make average weekly earnings and average annual earnings distorted measures for different industries. Average hourly earnings are not perfectly comparable among industries because they do not include fringe benefits, that may vary substantially from industry to industry. However, no data are available on a systematic basis that measures fringe benefits or other nonmonetary earnings.[1]

Measurements of physical capital per worker will be obtained from the Bureau of the Census, Annual Surveys of Manufactures. A statistical series on the value of fixed assets was begun in 1962 that reported capital assets for industries classified by SIC 2-digit, 3-digit, and 4-digit industry group levels. The series entitled, "Gross Book Value of Depreciable Assets" is defined as, ". . . the original cost of fixed assets on the books of this establishment such as buildings, structures, machinery and equipment

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of the Census, U.S. Commodity Exports and Imports as Related to Output, 1970 and 1969, U.S. Government Printing Office, Washington, D.C., 1973, pp. 201-204.

[1]Bureau of Labor Statistics, Employment and Earnings, United States 1909-75, U.S. Government Printing Office, Washington, D.C., 1976, pp. 773-784.

for which depreciation reserves are maintained."[1] Since this data series conforms to the SIC 3-digit data available for the other variables in this study, it is a particularly useful series. However, since this data series is available only back to 1962, it is less than perfect for our purposes. The data for 1962 were used for the physical capital per worker variable in the 1960 test of the model. This should not present many difficulties since it is reasonable to assume that the value of fixed assets should not fluctuate greatly over a two year period. The data are available for the test of the model using 1969 data for all other variables. The variable measuring physical capital per worker will be obtained by dividing the Gross Book Value of Depreciable Assets for each 3-digit industry by the number of production workers in the particular 3-digit industry classification.

The attempt to measure human capital per worker is an especially difficult task. There is no particular measure that is suitable for all purposes. Additionally, limited statistics are available that could be used in an attempt to measure human capital per worker. Schultz[2] discusses various measures of educational experience as

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[1]U.S. Bureau of the Census, Annual Survey of Manufactures: 1968 and 1969. U.S. Government Printing Office, Washington, D.C., 1973, Appendix C-8.

[2]Schultz, Investment in Human Capital, pp. 120-131.

proxies for human capital measurements. The most often used variable and the most widely available statistic is median years of school completed. He mentions that the major defect of this particular measure is that it does not measure differences in the quality of years completed at different schools or in different time periods.[1] However, this measure is usually the only one found on an individual industry basis. Median school years completed was found to be a significant variable in explaining North-South wage differentials in a study by Scully.[2] In this study, we will use median schools years completed as our proxy for human capital per worker. These data are available on a SIC 3-digit industry classification level from the Bureau of the Census, Subject Reports, Industrial Characteristics. These data were the best measure available that conformed to the level of classification of the other variables used in this study. The variable measuring human capital per worker in each industry will be the number for median school years completed in each industry.

The data used to measure racial composition and percentage of the labor force that is female will also be obtained from the Bureau of the Census, Subject Reports, Industrial Characteristics. The number of blacks and the

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[1] Ibid.

[2] Gerald W. Scully, "The North-South Manufacturing Wage Differential, 1869-1919," Journal of Regional Science, 11 (1971), p. 250.

number of females is available for each SIC 3-digit industry class.[1] The variable measuring the percengage of blacks in the individual industry's labor force will be obtained by dividing the number of blacks by the total labor force in each industry. The variable measuring the percentage of females in each industry will be obtained by dividing the number of females in the individual industry's labor force by the total labor force in each industry.

The variable measuring union influence or power in a particular industry is difficult to derive. The measure used in this study will be similar to the measure used by Scully in his study of interstate wage differentials.[2] He used data from the Bureau of Labor Statistics bulletins on work stoppages to estimate union power in individual industries. The Bureau of Labor Statistics bulletins report the: number of work stoppages, mean duration of work stoppages, and number of workers involved in work stoppages.[3] These data are published for SIC 3-digit industry classi-

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[1]U.S. Bureau of the Census, U.S. Census of Population: 1960. Subject Reports. Industrial Characteristics. U.S. Government Printing Office, Washington, D.C., 1967, pp. 1-7; U.S. Bureau of the Census, Census of Population: 1970. Subject Reports. Industrial Characteristics. U.S. Government Printing Office, Washington, D.C., 1973, pp. 1-10.

[2]Scully, "Interstate Wage Differentials," p. 762.

[3]Bureau of Labor Statistics, Analysis of Work Stoppages, 1960, U.S. Government Printing Office, Washington, D.C., 1961; Bureau of Labor Statistics, Analysis of Work Stoppages, 1969, U.S. Government Printing Office, Washington, D.C., 1971.

fications and is, therefore, conformable to other data in this study. The particular measure of union percentage of the industry labor force will be percentage of workers involved in work stoppages in each industry. This measure was chosen because it is the best indicator of union membership in each industry classification. The mean duration of work stoppages was not chosen because it does not indicate the number of workers involved or the number of work stoppages. An individual industry may be almost totally unorganized by unions but have one small union carry on a long strike and it would therefore be considered as an industry that was heavily unionized. The number of work stoppages was not chosen because it does not indicate how many workers were involved and therefore what percentage of the entire industry is affected by union power.

The variable measuring percentage of the industry unionized will be obtained by dividing the number of workers involved in work stoppages in each industry by the total labor force of that industry.

CHAPTER V

EMPIRICAL RESULTS

The procedure used to identify leading export industries and leading import-competing industries is an arbitrary one regardless of the method chosen. The intention to identify those industries that are the most prominent in U.S. foreign trade requires a procedure that selects those industries with a relatively large dollar amount of exports or competitive imports. The specific dollar amount of exports that an industry should exceed to be classified as a leading exporter must be large enough to include only a minority of the total number of industries and, at the same time, the amount specified as the cutoff level should be small enough to include those industries that are responsible for a large percentage of total exports. The same considerations apply to the leading import-competitor category.

There are approximately 150 industry classes at the SIC 3-digit level of classification. Therefore, the dollar level used to identify leading export industries and leading import-competing industries should isolate a number of industries that is much less than 150. After several different dollar amounts were tried, it was decided the amount for the 1960 sample would be 100 million dollars and the amount for the 1969 sample would be 200 million dollars. These amounts were chosen for several reasons. They both identified a relatively small number of industries to be classified as leading exporters or leading import-competitors. The number of industries in the 1960 sample is twenty-nine and the number in the 1969 sample is thirty-three. The industries identified are thus only about twenty percent of the total industries' number. The industries with exports of over 100 million dollars or competitive imports of over 100 million dollars in 1960 and those with exports of over 200 million dollars or competitive imports of over 200 million dollars in 1969 accounted for approximately sixty percent of all U.S. foreign trade in those years.[1] The two to one ratio in dollar levels for 1969 and 1960 seemed appropriate also because the amounts of exports and imports in 1969 were roughly twice the amounts of exports and imports in 1960.[2]

If an industry had both exports and competitive

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[1] U.S. Bureau of the Census, U.S. Commodity Exports and Imports as Related to Output, 1961 and 1960, U.S. Government Printing Office, Washington, D.C., 1963; U.S. Bureau of the Census, U.S. Commodity Exports and Imports as Related to Output, 1970 and 1969, U.S. Government Printing Office, Washington, D.C., 1973.

[2] Ibid.

imports of over 100 million dollars in 1960 or 200 million dollars in 1969, it was classified as a leading exporter if its exports exceeded its imports and, conversely, it was classified as a leading import-competitor if it had competitive imports that were greater than its exports. This was done to make the designation of an industry as a leading exporter or leading import-competitor less ambiguous.

The only exception to the above procedure was the elimination of the motor vehicle industry from both categories. The integration of the U.S. and Canadian motor vehicle industries makes it impossible to classify it as either a leading exporter or leading import-competitor.[1]

The particular industries identified as either leading exporters or leading import-competitors in 1960 and 1969 are listed in Tables 1 through 4. In the 1960 census data on industrial characteristics there is no 3-digit classification in the electrical machinery class. The 2-digit industry class had to be used to make up for this deficiency. The 1960 census data did have a separate classification for the 4-digit industry class of Blast Furnaces, Steel Works and Rolling and Finishing Mills, SIC code number 3312 and, since other data were availble at this 4-digit level of classification, this industry classification was

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[1]Raymond Vernon, Storm Over the Multinationals (Cambridge: Harvard University Press, 1977), p. 200.

TABLE 1

LEADING EXPORT INDUSTRIES 1960

SIC Code	Industry
202	Dairy products
203	Canning and preserving fruits, vegetables and seafoods
204	Grain-mill products
221	Yarn, thread and fabric mills
281	Miscellaneous chemicals and allied products
282	Synthetic fibers
283	Drugs and medicines
344	Fabricated structural metal products
351	Miscellaneous machinery
352	Farm machinery and equipment
357	Office, computing and accounting machines
36	Electrical Machinery, equipment and supplies
372	Aircraft and parts
373	Ship and boat building and repairing
374	Railroad and miscellaneous transportation equipment
381	Professional equipment and supplies
386	Photographic equipment and supplies

Source: U.S. Department of Commerce, Bureau of the Census, U.S. Commodity Exports and Imports as Related to Output, 1960 and 1959.

TABLE 2

LEADING IMPORT-COMPETING INDUSTRIES 1960

SIC Code	Industry
201	Meat products
206	Miscellaneous food preparations and kindred products
208	Beverage industries
229	Miscelaneous textile mill products
231	Apparel and accessories
242	Sawmills, planing mills and millwork
261	Pulp, paper and paperboard mills
291	Petroleum refining
314	Footwear, except rubber
3312	Blast furnaces, steel works and rolling and finishing mills
333	Primary nonferrous industries
387	Watches, clocks and clockwork-operated devices

Source: U.S. Department of Commerce, Bureau of the Census, U.S. Commodity Exports and Imports as Related to Output, 1960 and 1959.

TABLE 3

LEADING EXPORT INDUSTRIES 1969

SIC Code	Industry
202	Dairy products
204	Grain-mill products
272	Printing, publishing and allied industries, except newspapers
281	Industrial chemicals
282	Plastics, synthetics and resins
283	Drugs and medicines
287	Agricultural chemicals
344	Fabricated structural metal products
346	Metal stampings
351	Engines and turbines
352	Farm machinery and equipment
353	Construction and material handling machines
354	Metalworking machinery
355	Machinery except electrical, n.e.c.
357	Office and accounting machines
3573	Electronic computing machines
372	Aircraft and parts
373	Ships and boat building and repairing
381	Scientific and controlling equipment
386	Photographic equipment and supplies

Source: U.S. Department of Commerce, Bureau of the Census, U.S. Commodity Exports and Imports as Related to Output, 1970 and 1969.

TABLE 4

LEADING IMPORT-COMPETING INDUSTRIES 1969

SIC Code	Industry
201	Meat products
203	Canning and preserving fruits and vegetables and seafoods
208	Beverage industries
221	Yarn thread and fabric mills
242	Sawmills, planing mills and millwork
261	Pulp, paper and paperbaord mills
291	Petroleum refining
314	Footwear, except rubber
3312	Blast furnaces, steelworks, rolling and finishing mills
333, 334	Fabricated structural metal products
365	Radio, television and communication equipment
375	Cycles and miscellaneous transportation equipment
387	Watches, clocks and clockwork-operated devices

Source: U.S. department of Commerce, Bureau of the Census, U.S. Commodity Exports and Imports as Related to Output, 1970 and 1969.

included.[1]

The 1969 census report on industrial characteristics contains separate data on the Electronic Computing Machines industry, SIC code number 3573 and, since data on other variables at this classification level were available, this industry class was included. Similar reasons explain the inclusion of SIC code number 3312. The 1969 report on industrial characteristics also contains a category that combines two 3-digit SIC code industries, number 333 and 334. Other data for this category are reported using the same combined industry classes so that no problems arise due to this special reporting case.[2]

One of the striking features of the particular group of industries included in the 1960 sample and the group of industries included in the 1969 sample is their similarity. There are thirteen industries classified as leading exporters in both 1960 and 1969 and nine industries classified as leading import-competitors in both 1960 and 1969. There is only one industry, SIC code number 203, Canning and Preserving Fruits, Vegetables and Seafoods, that appears in the leading exporter category in one year and the leading import-competitor category in the other year. This similarity can

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[1] U.S. Bureau of the Census, U.S. Census of Population: 1960. Subject Reports. Industrial Characteristics. U.S. Government Printing Office, Washington, D.C., 1967.

[2] U.S. Bureau of the Census, Census of Population: 1970. Subject Reports. Industrial Characteristics. U.S. Government Printing Office, Washington, D.C., 1973.

be taken as evidence that there are industries that can be consistently identified as leading exporters or leading import-competitors and that the procedure used in this study has identified them by using a relatively unambiguous method.

The data for mean average hourly earnings in each category and for each year are presented in Table 5. In each year the category of leading export industries paid higher wage rates, on an average basis, than the category of leading import-competing industries. The average hourly earnings for all manufacturing industries was $2.26 in 1960 and $3.19 in 1969. Thus, in 1960 the industries classified as leading exporters paid wages higher than the average for all manufacturing industries while the industries classified as leading import-competitors paid wages equal to the average hourly earnings for all manufacturing industries. In 1969, industries classified as leading exporters paid wages higher than the average hourly earnings for all manufacturing industries while industries classified as leading import-competitors paid wages lower than the average hourly earnings for all manufacturing industries. There was a seven percent differential in mean average hourly earnings between leading export industries and leading import-competing industries in 1960. There was a fourteen percent differential in mean average hourly earnings between leading export industries and leading import-competing industries in 1969. Average hourly earnings for each industry

TABLE 5

MEAN AVERAGE HOURLY EARNINGS,[1] LEADING EXPORT INDUSTRIES AND LEADING IMPORT-COMPETING INDUSTRIES 1960 AND 1969

Year	Mean Average Hourly Earnings Leading Export Industries	Mean Average Hourly Earnings Leading Import-Competing Industries
1960	\$2.42	\$2.26
1969	\$3.52	\$3.08

[1]Expressed in current dollars. Constant dollar amounts are \$2.35 and \$2.19 for 1960 and \$2.76 and \$2.41 for 1969. 1957-59 = 100.0.

can be found in the Appendix. These data are fairly consistent with the results produced by Kravis in his study of wage differentials for 1947 and 1952.[1] He found a wage differential of approximately eight percent between leading export industries and leading import-competing industries with the leading export industries paying the higher mean average hourly earnings. This consistency with the findings of Kravis gives additional corroboration to the findings of this study that industries categorized as leading exporters pay consistently higher wage rates than industries categoried as leading import-competitors. The differentials in this study are significant only at the ten percent level of significance, again fairly similar to Kravis's results.[2] The consistency, through time, of the existence of wage differentials between leading export industries and leading import-competing industries warrants further study.

The next step in this study is to determine if the wage differential that exists between leading export industries and leading import-competing industries contains a systematic distortionary differential. The model described in Chapter 3 will be used to make this determination.

The first part of this determination is the identification of that part of the wage differential that can be

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[1] Kravis, "Wages and Foreign Trade," p. 20.

[2] Ibid.

explained by differences in the stocks of physical capital and human capital among leading export industries and leading import-competing industries. This will be done by estimating the value of the parameters and the explanatory power of the multiple regression equation below.

$$W_i = a + b(CL_i) + c(HC_i) + e_i \tag{1}$$

which was developed in Chapter 3 where W denotes the average industry wage rate, CL denotes the physical capital-labor ratio, HC denotes the human capital per worker, and e is the error term assumed to be normally distributed with an expected value of zero and a constant variance. The values for individual industry average hourly earnings, physical capital-labor ratios and human capital measures can be found in the Appendix.

The results of testing equation (1) using the data from 1960 for one test and the data from 1969 for a second test are found in Table 6. For both the 1960 test and the 1969 test the independent variables are statistically significant and the regression equation is statistically significant. The physical capital-labor ratio variable is significant at the five percent level in both years. The human capital per worker variable, measured as median school years completed by the labor force in each industry, is significant at the one percent level. The multiple regression equations explain approximately fifty percent of the

TABLE 6

REGRESSION RESULTS FOR EQUATION (1), 1960 AND 1969[1]

Dependent Variable: W

Independent Variables	1960	1969
CL	.0059** (.0025)	.0056** (.0024)
HC	.2034*** (.0501)	.4206*** (.0869)
Constant Term	.0157	-1.8595
R^2	.5433	.5382
$\bar{R}^2$	.5081	.5074
F-value	15.46***	17.48***

1, **, *** indicate significance at the 5 percent, and 1 percent levels, respectively. Standard errors of the regression coefficients are indicated in parentheses.

total variation in average hourly earnings for both years and are both significant at the one percent level.

The values of the individual coefficients suggest that the increase in physical capital by a value of ten thousand dollars adds approximately six cents to average hourly earnings in both 1960 and 1969 and that an additional one year of median school years completed added approximately twenty cents to average hourly earnings in 1960 and forty-two cents to average hourly earnings in 1969. It would be expected that the values of the coefficients should rise due to inflation. Why the value of the coefficient for the physcial capital-labor ratio did not rise cannot be explained by this study. Both coefficients have the expected positive signs.

Different specifications of the model tested by equation (1) were also explored to see if a different form of equation (1) could be used to increase the explanatory power of the model. In particular, an attempt was made to determine if the relationship between human capital and average hourly earnings was nonlinear and if there was some interaction between the physical capital-labor ratio and the human capital per worker variables. In his work on human capital, Becker suggests that there may be some complimentarity between amounts of physical capital per worker and human capital per worker.[1] To test these two possi-

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[1] Becker, Human Capital, 2nd ed., p. 83.

bilities, five spearate equations were estimated by multiple regression analysis. The five equations tested are listed below.

$$W_i = a + bCL_i + c(HC_i)^2 + e_i \tag{2}$$

$$W_i = a + bCL_i + cHC_i + d(HC_i)^2 + e_i \tag{3}$$

$$W_i = a + bCL_i + c(HC_i)\cdot(CL_i) + dHC_i + f(HC_i)^2 + e_i \tag{4}$$

$$W_i = a + b(HC_i)\cdot(CL_i) + cHC_i + e_i \tag{5}$$

$$W_i = a + b(HC_i)\cdot(CL_i) + c(HC_i)^2 + e_i \tag{6}$$

Equations (2) and (3) attempt to discover if there is a nonlinear relationship between median years of school completed and average hourly earnings that can be captured by a quadratic form using least squares estimators. Equations (4), (5) and (6) attempt to discover if there is interaction between the physical capital-labor ratio variable, gross book value of assets per worker, and the human capital variable, median school years completed. Equation (4) includes both an interaction variable, measured in this study by the product of HC and CL, and a nonlinear human capital variable, the square of the number of median school years completed by workers in each industry. Equation (5) contains the interaction variable and the simple measure of human capital. Equation (6) contains only the interaction variable and the nonlinear human capital variable.

The results obtained from estimating the parameters of equations (2), (3), (4), (5) and (6) are found in Tables 7 through 11. Table 7 contains the results of estimating equation (2). Table 8 contains the results of estimating equation (3). Table 9 contains the results of estimating equation (4). Table 10 contains the results of estimating equation (5). Table 11 contains the results of estimating equation (6).

Equation (2) does not improve the performance of the model over equation (1). The adjusted R^2 and F-value are both smaller although both independent variables are significant. The physical capital-labor ratio variable is significant at the five percent level and the nonlinear human capital variable is significant at the one percent level. Both coefficients have the expected positive signs.

Equation 3 improves the performance of the model if improvement is defined only as a higher adjusted R^2. It does not improve on the basis of F-values or the expected signs of the coefficients. The signs of the coefficients of the nonlinear human capital variable are negative, possibly due to multicollinearity since both the linear and nonlinear human capital variables are included in this equation. The partial correlation coefficient between the linear and nonlinear human capital variable for the 1960 data is 0.9987. However, it should be noted that the

TABLE 7

REGRESSION RESULTS FOR EQUATION (2), 1960 AND 1969[1]

Dependent Variable		
W		
Independent Variables	1960	1969
CL	.0061**	.0057**
	(.0026)	(.0024)
HC^2	.0092***	.0176***
	(.0024)	(.0037)
Constant Term	1.1290	.6448
R^2	.5263	.5266
$\bar{R}^2$	.4898	.4951
F-value	14.44***	16.69***

[1]*, **, *** indicate significance at the 10 percent, 5 percent, and 1 percent levels, respectively. Standard errors of the regression coefficients are indicated in parentheses.

TABLE 8

REGRESSION RESULTS FOR EQUATION (3), 1960 AND 1969[1]

Dependent Variable		
W		
Independent Variable	1960	1969
CL	.0050** (.0024)	.0052** (.0023)
HC	2.2319*** (.8675)	3.3147** (1.8152)
HC^2	-.0943** (.0403)	-.1231* (.0771)
Constant Term	-10.7568	-18.7895
R^2	.6254	.5755
$\bar{R}^2$	.5805	.5315
F-value	13.91***	13.10***

[1]For significance levels see Table 7.

TABLE 9

REGRESSION RESULTS FOR EQUATION (4), 1960 AND 1969[1]

Dependent Variable		
W		
Independent Variables	1960	1969
CL	.0127 (.0373)	.0127 (.1171)
(HC)·(CL)	-.0007 (.0032)	-.0006 (.0094)
HC	2.1163** (1.0476)	3.3018** (1.8581)
HC^2	-.0885** (.0496)	-.1223* (.0794)
Constant Term	-10.1916	-18.7543
R^2	.6261	.5755
$\bar{R}^2$	.5638	.5148
F-value	10.05***	9.49***

[1]For significance levels see Table 7.

TABLE 10

REGRESSION RESULTS FOR EQUATION (5), 1960 AND 1969[1]

Dependent Variable		
W		
Independent Variables	1960	1969
(HC)·(CL)	.0004* (.0002)	.0005** (.0002)
HC	.1996*** (.0514)	.4162*** (.0873)
Constant Term	.0517	-1.8042
R^2	.5433	.5377
$\bar{R}^2$	.5081	.5068
F-value	15.46***	17.44***

[1]For significance levels see Table 7.

TABLE 11

REGRESSION RESULTS FOR EQUATION (6), 1960 AND 1969[1]

Dependent Variable		
W		
Independent Variables	1960	1969
(HC)·(CL)	.0005**	.0005**
	(.0002)	(.0002)
HC^2	.0090***	.0174***
	(.0024)	(.0038)
Constant Term	1.1633	.6752
R^2	.5167	.5262
$\bar{R}^2$	.4795	.4946
F-value	13.90***	16.66***

[1]For significance levels see Table 7.

usefulness of partial correlation coefficients as a diagnosis of multicollinearity is questionable. Wichers[1] has recently shown that a given value of a partial correlation coefficient may be compatible with two very different multicollinearity patterns. More succinctly stated, a simple correlation coefficient may not be the appropriate measure of multicollinearity.

The results for equation (4), presented in Table 9, again show improvement over equation (1) only in a higher adjusted R^2. The F-values for both years are lower and the variables representing physical capital-labor ratios and interaction between physical capital and human capital are not statistically significant. The coefficients for the interaction variable and the nonlinear human capital variable are both negative for both the 1960 and 1969 data.

Equation (5) was tested and the results, presented in Table 10, are similar to the results obtained from equation (1). The adjusted R^2 and F-values are slightly lower for equation (5) compared to equation (1). The coefficients have the expected positive signs.

The last attempt to improve upon the results obtained using equation (1) by using equation (6) are presented in Table 11.

The adjusted R^2 and F-values are lower than those

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[1] C. Robert Wichers, "The Detection of Multicollinearity: A Comment," Review of Economics and Statistics, 57 (August 1975), pp. 366-368.

obtained using equation (1). The interaction variable is significant at the five percent level and the nonlinear human capital variable is significant at the one percent level.

Since none of the alternative specifications of the model were clearly superior to equation (1), it will be used to explain the variation in wage differentials due to productivity differences. It will be used in the second step of the procedure to generate the residuals used to explain the remaining sources of the wage differential between leading export industries and leading import-competing industries.

The remaining wage differential, not attributable to productivity differences, may be due to discrimination or differences in union influence. To test this hypothesis, equation (7) will be estimated where

$$W_i - \hat{W}_i = a + bPU_i + cPF_i + dPB_i + e_i \qquad (7)$$

$W_i - \hat{W}_i$ is the residual generated by equation (1) and PU is the percentage of the industry's labor force involved in work stoppages, PF is the percentage of the industry's labor force that is female, and PB is the percentage of the industry's labor force that is black.

The results obtained from estimating the paramters of equation (7) are presented in Table 12. Using the data for 1960, the union variable and the percentage female

TABLE 12

REGRESSION RESULTS FOR EQUATION (7), 1960 AND 1969[1]

Dependent Variable		
$W - \hat{W}$		
Independent Variables	1960	1969
PU	.0211*	-.0000
	(.0153)	(.0084)
PF	-.0067**	-.0125***
	(.0027)	(.0041)
PB	.0094	-.0174
	(.0109)	(.0152)
Constant Term	.0362	.4246
R^2	.3147	.2860
$\bar{R}^2$	.2325	.2121
F-value	3.83**	3.87**

[1]For significance levels see Table 7.

variable are shown to be significant. The union variable is significant at the ten percent level and the percentage female variable is significant at the five percent level. The equation itself is significant at the five percent level as indicated by the F-value. The variable for percentage of the industry's labor force that is black is not significant and does not have the expected negative sign for its coefficient. The union variable and the percentage female variable both have the expected signs.

The results obtained from using the data from 1969 are somewhat different. The variable measuring percentage of the industry's labor force that is female is again significant and this time at the one percent level. The variable measuring union influence is not significant and also extremely small. The variable measuring racial discrimination is significant only at the fifteen percent level but the value of the coefficient is relatively large and does have the expected negative sign. The equation is significant again at the five percent level.

Two alternative forms were tested in an attempt to improve the results obtained from equation (7). The 1960 data were used to test equation (8),

$$W_i - \hat{W}_i = a + bPU_i + cPF_i + e_i \tag{8}$$

where only PU and PF were included since the variable for percentage of the industry's labor for that is black was not significant in the 1960 test of equation (7). The results of testing equation (8) using 1960 data are presented in Table 13.

The results obtained from using equation (8) with the 1960 data are a moderate improvement over the results obtained from the use of equation (7). The differences are: the variable for percentage of the labor force that is female is now significant at the one percent level, the adjusted R^2 is slightly higher, and the F-value is increased.

The other alternative form used was specified as follows:

$$W_i - \hat{W}_i = a + bPF_i + cPB_i + e_i \tag{9}$$

with the data for 1969. The variable measuring union influence was dropped because of its insignificance and miniscule value in the 1969 run of equation (7).

The results obtained from using 1969 data to estimate the parameters of equation (9) are presented in Table 14. Again the results obtained by dropping an insignificant variable show improvement. The variables maintain their same levels of significance but the equation is now significant at the one percent level as indicated by the significantly higher F-value. The adjusted R^2 is also higher. Both the independent variables have the expected negative signs.

It is interesting to note that in both years and

TABLE 13

REGRESSION RESULTS FOR EQUATION (8), 1960[1]

Dependent Variable	
$W - \hat{W}$	
Independent Variables	1960
PU	.0222* (.0152)
PF	-.0070*** (.0027)
Constant Term	.1011
R^2	.2943
$\bar{R}^2$	.2400
F-value	5.42**

[1]For significance levels see Table 7.

TABLE 14

REGRESSION RESULTS FOR EQUATION (9), 1969[1]

Dependent Variable	
$W - \hat{W}$	
Independent Variables	**1969**
PF	-.0125*** (.0038)
PB	-.0174 (.0145)
Constant Term	.4241
R^2	.2860
$\bar{R}^2$	.2384
F-value	6.01***

[1]For significance levels see Table 7.

all three equations the variable for percentage of the labor force that is female is significant. The statement that there may be consistent discrimination in pay on the basis of sex cannot be rejected.

The variable on union influence could possibly be more significant if a different measure was used or if the work stoppages proxy variable was obtained by using more than one year's data. Although the variable measuring racial discrimination, the percentage of an industry's labor force that is black, is not highly significant in either year or any of the equations, the fact that it is somewhat more significant in the 1969 data than in the 1960 data is a somewhat disturbing piece of evidence on the subject of racial equality.

The residuals generated by equation (1) can be used to test for the existence of a distortionary wage differential due to discrimination, union influence, or the export or import-competing nature of the industry. If there is a significant difference between the residuals of the leading export industry group and the residuals of the leading import-competing industry group, this could indicate the existence of a distortionary wage differential.

Equations (8) and (9) will be used to generate the residuals that will allow a test for a systematic distortionary wage differential related only to the export or import-competing nature of the industry. Equation (8) will be used to generate residuals for the test using 1960 data. Equation (9) will be used to generate residuals for the test using 1969 data.

The residuals generated by equations (1), (8), and (9) will be divided into two groups. The first group will be the residuals for the leading export industry category and the second group will be the leading import-competing industry category. The two groups of residuals will then be analyzed to determine if there is a significant difference between them. If there is a significant difference between them, then the hypothesis that a distortionary wage differential exists between leading export industries and leading import-competing industries cannot be rejected.

The analyses of the residuals generated by equations (1), (8), and (9) are presented in Table 15 and Table 16. Table 15 contains the analysis of residuals generated by equations (1) and (8) using the data from 1960. Table 16 contains the analysis of the residuals generated by equations (1) and (9) using the data from 1969.

The analysis of the residuals includes a test of the differences in the mean values of the residuals in the leading export industry group and the mean values of the residuals in the leading import-competing industry group. The analysis also includes a test for equality of the variances of the residuals in each group.

The results for both equations using the 1960 data do not show a significant difference in the mean values of

TABLE 15

ANALYSIS OF RESIDUALS FROM EQUATION (1), 1960

Category	Leading Export Industries	Leading Import-Competing Industries
Residual Mean	-.0045	.0064
Residual Standard Deviation	.278	.298
Residual Standard Error	.067	.086
F-value	1.15[1]	
t-value	-0.10	

ANALYSIS OF RESIDUALS FROM EQUATION (8), 1960

Category	Leading Export Industries	Leading Import-Competing Industries
Residual Mean	-.030	.042
Residual Standard Deviation	.244	.228
Residual Standard Error	.059	.066
F-value	1.138[1]	
t-value	-0.81	

[1]Test for equality of variances.

TABLE 16

ANALYSIS OF RESIDUALS FROM EQUATION (1), 1969

Category	Leading Export Industries	Leading Import-Competing Industries
Residual Mean	.0843	-.1297
Residual Standard Deviation	.327	.347
Residual Standard Error	.073	.096
F-value	1.12[1]	
t-value	1.79*	

ANALYSIS OF RESIDUALS FROM EQUATION (9), 1969

Category	Leading Export Industries	Leading Import-Competing Industries
Residual Mean	.018	-.028
Residual Standard Deviation	.307	.279
Residual Standard Error	.069	.077
F-value	1.207[1]	
t-value	0.44	

[1]Test for equality of variances.

*Indicates significance at the 10 percent level.

the residuals between the leading export industry group and the leading import-competing industry group. The t-values for both equations are not statistically significant at the 10 percent level.

The results for equations (1) and (9) using the 1969 data yield somewhat different results. The difference in the mean values of the residuals generated by equation (1) is statistically significant at the 10 percent level. While this is not a very high level of significance, it does indicate that a distortionary wage differential could be present in the 1969 sample. The distortion is probably explained by the discrimination variables in the model. This conclusion is supported by the lack of significantly different mean values of residuals generated by equation (9). Equation (9) contains the race and sex discrimination variables and, once these variables are included as explanatory factors of wage differentials, the significant difference in the mean values of residuals does not exist. Therefore, there is no distortionary wage differential specifically related to the export or import-competing nature of the industries in this study.

An attempt to corroborate the findings discussed above was made by using all the variables in the complete model in one equation to generate a third set of residuals to be analyzed. Equation (10),

$$W_i = a + bCL_i + cHC_i + dPU_i + fPF_i + e_i \tag{10}$$

was used to generate residuals from the 1960 data and equation (11) was used,

$$W_i = a + bCL_i + cHC_i + dPF_i + fPB_i + e_i \tag{11}$$

to generate residuals from the 1969 data.

The regression results obtained from estimating equations (10) and (11) are presented in Tables 17 and 18. Both equations perform very well. The equations are significant at the 1 percent level. All independent variables, except the union variable in equation (10), are statistically significant. The human capital and percentage female variables are highly significant in both years. The signs of all the coefficients are the expected ones. Both equations explain approximately 70 percent of the total variation in average hourly earnings among leading export industries and leading import-competing industries.

The residuals generated by equations (10) and (11) will be analyzed to determine if the remaining variation in average hourly earnings contains a systematic distortionary wage differential specifically related to the export or import-competing nature of the industries in the sample. This is the same procedure that was used with the residuals from equations (1), (8), and (9).

The analyses of the residuals generated from equations (10) and (11) are presented in Tables 19 and 20. Table 19 contains the analysis of the residuals generated by equation (10) using the data from 1960 and Table 20 contains the

TABLE 17

REGRESSION RESULTS FOR EQUATION (10), 1960[1]

Dependent Variable	
W	
Independent Variables	1960
CL	.0040* (.0023)
HC	.1734*** (.0434)
PU	.0195 (.0157)
PF	-.0086*** (.0030)
Constant Term	.5285
R^2	.6963
$\bar{R}^2$	.6456
F-value	13.75***

[1]For significance levels see Table 7.

TABLE 18

REGRESSION RESULTS FOR EQUATION (11), 1969[1]

Dependent Variable	
W	
Independent Variables	1969
CL	.0035** (.0021)
HC	.3036*** (.0824)
PF	-.0155*** (.0040)
PB	-.0282** (.0160)
Constant Term	.1765
R^2	.7072
$\bar{R}^2$	.6654
F-value	16.91***

[1] For significance levels see Table 7.

analysis of the residuals generated by equation (11) using the data from 1969.

The results of analyzing the residuals generated from equations (10) and (11) are very similar to the analysis of the residuals generated from equations (8) and (9). The mean values of the residuals in the leading export industry group are not significantly different from the mean values of the residuals in the leading import-competing industry group for both 1960 and 1969. The hypothesis that the variances of the two groups of residuals in each year are equal cannot be rejected.

On the basis of this attempt to corroborate the conclusions drawn above, it can be even more certainly concluded that the hypothesis that there is no systematic distortionary wage differential specifically related to the export or import-competing nature of the industries in our sample cannot be rejected. However, there is some evidence that a distortionary wage differential due to discrimination factors may be present in the 1969 sample. There is no evidence of any distortionary wage differential in the 1960 sample.

TABLE 19

ANALYSIS OF RESIDUALS FROM EQUATION (10), 1960

Category	Leading Export Industries	Leading Import-Competing Industries
Residual Mean	-.025	.035
Residual Standard Deviation	.227	.237
Residual Standard Error	.055	.068
F-value	1.085[1]	
t-value	-0.68	

[1]Test for equality of variances.

TABLE 20

ANALYSIS OF RESIDUALS FROM EQUATION (11), 1969

Category	Leading Export Industries	Leading Import-Competing Industries
Residual Mean	.016	-.024
Residual Standard Deviation	.280	.277
Residual Standard Error	.063	.077
F-value	1.022[1]	
t-value	0.40	

[1]Test for equality of variances.

CHAPTER VI

POLICY AND THEORETICAL IMPLICATIONS

This study attempted to answer two questions. First, do wage differentials exist between leading export industries and leading import-competing industries? The second, and more complex, question was, if wage differentials exist, are they distortionary?

Leading export industries and leading import-competing industries were identified for the years 1960 and 1969. In both years, the leading export industries had higher mean average hourly earnings than the leading import-competing industries. These findings were consistent with the findings of Kravis[1] who also found that leading export industries had consistently paid higher wage rates than leading import-competing industries in the United States.

The main task of this study was to determine if these wage differentials were distortionary. That is, was there some element of these differentials that was not related to differences in productivity and was consistently biased against either the leading export industry group

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[1]Kravis, "Wages and Foreign Trade," p. 29.

or against the leading import-competing industry group.

The wage differentials between leading export industries and leading import-competing industries were examined also to determine if part of these differentials was due to sex discrimination, racial discrimination, or differences in union influence among industries.

Productivity differences were measured in two ways. First, by differences in physical capital-labor ratios among industries. The second way productivity differences were measured was by differences in median school years completed by the labor force in each industry. This was our proxy variable for human capital per worker.

After determining the amount of the wage differentials due to productivity differences, discrimination, and union influence, the remaining residual wage differentials were examined for systematic differences between the residuals of the leading export industry group and the residuals of the leading import-competing industry group.

The estimate of the sources of the wage differentials was accomplished in two steps. The first step was estimating the amount of the differentials due to productivity differences. The second step was estimating the remaining amount of the wage differentials due to differences in racial composition, sex composition, and union influence among the individual industries.

The data presented in Chapter 5 indicated that approximately fifty-four percent of the wage differentials between leading export industries and leading import-competing industries was due to differences in physical capital-labor ratios and human capital per worker among industries. This was true for data examined for both 1960 and 1969. Another fifteen percent of the wage differentials can be explained by differences in racial composition of the labor force, percentage of females in the labor force, and percentage of labor force involved in work stoppages. Of the last three variables mentioned, the variable for percentage of the industry labor force that is female was the only one significant in both 1960 and 1969. In all specifications of the model, the percentage of the labor force female variable was significant at either the one percent or five percent level. For each one percent increase in the industry labor force that is female, average hourly earnings declined approximately one cent in 1960 and two cents in 1969. This is an interesting and alarming result showing the persistence of sexual discrimination over a ten year period.

The data presented in Tables 21 and 22 provide some of the reasons why the leading export industry group paid higher average hourly earnings than the leading import-competing industry group. Of the first two independent variables listed, physical capital-labor ratio and human capital, the human capital variable was the more

TABLE 21

MEAN VALUE OF VARIABLES, 1960[1]

Category	Leading Export Industries	Leading Import-Competing Industries
Average hourly earnings	$ 2.42	$ 2.26
Physical Capital/Labor Ratio (Gross book value of assets per employee in $000's)	19.6	24.2
Human Capital (Median school years completed by industry labor force)	11.3	10.3
Percentage Union (Percentage of industry labor force involved in work stoppages)	3.1%	2.3%
Percentage Black	4.9%	8.6%
Percentage Female	22.1%	26.9%

[1]For individual industry values, see Appendix.

TABLE 22

MEAN VALUE OF VARIABLES, 1969[1]

Category	Leading Export Industries	Leading Import-Competing Industries
Average Hourly Earnings	$ 3.52	$ 3.08
Physical Capital/Labor Ratio	$16.5	$29.9
Human Capital	12.4	11.6
Percentage Union	6.7%	6.6%
Percentage Black	6.3%	9.5%
Percentage Female	20.0%	29.0%

[1]For individual industry values, see Appendix.

significant in both the 1960 and 1969 test of the model. In 1960 and 1969, the leading export industry group had a higher median school years completed by its labor force, the measure of human capital per worker used in this study, than the labor force of the leading import-competing industry group. In 1960, the difference was one year and in 1969 the difference was 0.8 years. This explanation of part of the source of wage differentials between leading export industries and leading import-competing industries due to differences in human capital is consistent with other studies on the composition of U.S. foreign trade. In an attempt to update the classical Ricardian theory of comparative advantage, Humphrey[1] presents the view that the United States has a comparative advantage in goods that require highly skilled and educated workers in the production process because the United States has a relatively abundant supply of this type of workers. This explanation of U.S. trade patterns is similar to the work of Keesing,[2] Mitchell,[3] and Baldwin[4] that was discussed in Chapter 2.

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[1] Thomas M. Humphrey, "Changing Views of Comparative Advantage," Federal Reserve Bank of Richmond Monthly Review (July 1972), pp. 9-15.

[2] Keesing, "Labor Skills and Comparative Advantage."

[3] Mitchell, "International Pattern of Labor Productivity and Wages."

[4] Baldwin, "Commodity Structure of U.S. Trade."

In both 1960 and 1969 the leading import-competing industry group has a higher physical capital-labor ratio, on average, than the leading export industry group. This average is somewhat misleading. The higher average physical capital-labor ratio for the leading import-competing industry group is due primarily to one industry, the petroleum refining industry, SIC code 291. If this one industry was taken out of the leading import-competing industry group, the average physical capital-labor ratio for this group would have been 17.5 thousand dollars per worker in 1960 instead of the listed amount of 24.2 thousand dollars per worker. This exclusion of the petroleum refining industry would have made the physical capital labor ratio average higher for the leading export industry group in 1960. There was no single industry in the leading export industry group whose physical capital labor ratio deviated from the industry average to the degree that the petroleum refining industry was atypical for the leading import-competing industry group. Therefore it would not be misleading to conclude that the individual industries in the leading export industry group had generally higher physical capital-labor ratios than the individual industries in the leading import-competing industry group.

The leading import-competing industry group had somewhat higher percentages of blacks and females in their labor force and, since these variables had negative signs in the regression equations for both 1960 and 1969, they also explain why the leading import-competing industries had lower average hourly earnings.

The variable measuring union activity was not highly significant and is not consistently higher or lower for one industry group in 1960 and 1969. Therefore, nothing definite can be inferred from the data in this study about the effect of union activity on the size or direction of wage differentials.

After determining the amount of the wage differentials due to the variables discussed above, the residual differentials of the leading export industry group and the leading import-competing industry group were examined for significant differences. A significant difference between the residuals of the leading export industry group and the residuals of the leading import-competing industry group would be interpreted as a sign of a systematic distortionary wage differential. For both the 1960 data and the 1969 data, no significant difference between the two groups of residuals was found. The existence of a distortionary wage differential systematically related to leading export industries vis-à-vis leading import-competing industries is not indicated by the evidence presented in this study. This is the main conclusion of this study. However, some evidence of a distortionary differential due to discrimination factors was found in the 1969 sample. A possible source for this change from no evidence of distortions in 1960 to some evidence for 1969 may be found in Tables 21 and 22. The percentage of female workers in import-competing industries increased from 1960 to 1969, 26.9 percent to 29.0 percent, while the percentage of the labor force female in the leading export industries declined from 1960 to 1969, 22.1 percent to 20.0 percent. This type of distortion should be remedied by labor market policies rather than by trade policies since the source of the distortion is not related to foreign trade causes.[1]

Several qualifications must be added to this conclusion. The data presented are only for the United States and therefore says nothing about wage differentials that may exist in other countries, especially less-developed countries that were the focus of Hagen's[2] classic work. Secondly, distortionary wage differentials may exist at a more disaggregated industry level and are not discovered at the SIC 3-digit level of industry class used in this study. Also, different measures of physical capital and human capital could lead to different conclusions. Inclusion of other variables or other measures of racial discrimination, sex discrimination, and union influence could alter the results.

The main theoretical implication of the findings of this study is that wage differentials between export

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[1]Bhagwati and Ramaswami, "Domestic Distortions, Tariffs and the Theory of Optimum Subsidy," pp. 45-46.

[2]Hagen, "Economic Justification of Protectionism," pp. 54-58.

industries and import-competing industries are not distortionary and, therefore, do not alter the standard theorems and conclusions of international trade theory. Johnson[1] concluded his paper on factor market distortions and their effects on the shape of the transformation curve by stating that wage differentials, of a distortionary type, would have to be very large to significantly alter the location and shape of the transformation curve and thereby reduce economic welfare. Since little evidence of a distortionary wage differential was found in this study, it can be reasonably concluded that welfare losses described by Johnson[2] do not exist for the United States.

The deleterious effects of foreign trade in the presence of distortionary wage differentials, discussed in Chapter 2, do not seem to be present in the United States. Protection in the form of tariffs, customs unions, subsidies, or factor taxes do not seem to be justified. The usual policy prescription of free trade seems justified by the evidence in this study.[3] Export industries pay higher

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[1]Johnson, "Factor Market Distortions and the Transformation Curve," pp. 697-698.

[2]Ibid.

[3]Free trade may still be inferior to restricted trade in the presence of other types of factor market imperfections, e.g., factor price rigidity or factor immobility. See Raveendra N. Batra and P. K. Pattanaik, "Domestic Distortions and the Gains from Trade," Economic Journal, 80 (September 1970), pp. 638-649. Economic growth may still lower national income and welfare in the presence of factor price rigidity. For a

wages, but this differential is not distortionary since it reflects the higher skill level and higher productivity of workers in these industries. Increased foreign trade would expand employment in these industries and, therefore, would be expected in increase national welfare. These empirical conclusions correspond to the theoretical conclusions presented by Neary.[1] Neary concluded that distortionary wage differentials were unlikely to exist in a stable equilibrium and therefore many of the perverse outcomes in the wage differential literature were not likely to be a common occurrence. This conclusion complements our empirical conclusion that a distortionary wage differential does not seem to exist in the United States.

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detailed discussion see Eden S. H. Yu, "Rigid Wage, Factor Immobility and Immiserizing Growth," Economic Record, 54 (December 1978), pp. 387-393.

[1]Neary, "Dynamic Stability and Factor Market Distortions," pp. 672-673.

BIBLIOGRAPHY

Books

Batra, R. N. Studies in the Pure Theory of International Trade. New York: St. Martin's Press, 1973.

Becker, Gary S. Human Capital. 2nd ed. New York: National Bureau of Economic Research, 1975.

Brown, H. Phelps. The Inequality of Pay. Berkeley: University of California Press, 1977.

Ferguson, Charles E. Microeconomic Theory. Homewood, Illinois: Richard D. Irwin, Inc., 1969.

Hazari, Bharat R. The Pure Theory of International Trade and Distortions. New York: John Wiley and Sons, 1978.

Kenen, Peter B. International Trade and Finance: Frontiers for Research. New York: Cambridge University Press, 1975.

Kindleberger, Charles P. International Economics. Homewood, Illinois: Richard D. Irwin, Inc., 1973.

Magee, Stephen P. International Trade and Distortions in Factor Markets. New York: M. Dekker, 1976.

McConnell, Campbell R., ed. Perspectives on Wage Determination. New York: McGraw-Hill, 1970.

Schultz, Theodore W. Investment in Human Capital. New York: The Free Press, 1971.

U.S. Department of Commerce. Bureau of the Census. U.S. Commodity Exports and Imports as Related to Output, 1961 and 1960. Washington, D.C.: Government Printing Office, 1963.

U.S. Department of Commerce. Bureau of the Census. U.S. Commodity Exports and Imports as Related to Output, 1970 and 1969. Washington, D.C.: Government Printing Office, 1973.

U.S. Department of Commerce. Bureau of the Census. Annual Survey of Manufactures: 1964 and 1965. Washington, D.C.: Government Printing Office, 1968.

U.S. Department of Commerce. Bureau of the Census. Annual Survey of Manufactures: 1968 and 1969. Washington, D.C.: Government Printing Office, 1973.

U.S. Department of Commerce. Bureau of the Census. U.S. Census of Population: 1960. Subject Reports. Industrial Characteristics. Washington, D.C.: Government Printing Office, 1967.

U.S. Department of Commerce. Bureau of the Census. U.S. Census of Population: 1970. Subject Reports. Industrial Characteristics. Washington, D.C.: Government Printing Office, 1973.

U.S. Department of Labor. Bureau of Labor Statistics. Analysis of Work Stoppages, 1960. Washington, D.C.: Government Printing Office, 1961.

U.S. Department of Labor. Bureau of Labor Statistics. Analysis of Work Stoppages, 1969. Washington, D.C.: Government Printing Office, 1971.

U.S. Department of Labor. Bureau of Labor Statistics. Employment and Earnings, United States, 1909-75. Washington, D.C.: Government Printing Office, 1976.

Vaccara, Beatrice N. Employment and Output in Protected Manufacturing Industries. Washington, D.C.: The Brookings Institution, 1960.

Vernon, Raymond, ed. The Technology Factor in International Trade. New York: Columbia University Press, 1970.

________. Storm over the Multinationals. Cambridge: Harvard University Press, 1977.

Articles

Baldwin, Robert E. "Determinants of the Commodity Structure of U.S. Trade." American Economic Review 61 (March 1971): 126-146.

Batra, Raveendra N. "Nontraded Goods, Factor Market Distortions and the Gains from Trade." American Economic Review 63 (September 1973): 706-713.

________. "Nontraded Goods, Factor Market Distortions, and the Gains from Trade: Reply." American Economic Review 65 (March 1975): 251-252.

Batra, Raveendra N. and Pattanaik, P. K. "Domestic Distortions and the Gains from Trade." Economic Journal 80 (September 1970): 638-649.

Batra, Raveendra N. and Pattanaik, P. K. "Factor Market Imperfections, the Terms of Trade and Welfare." American Economic Review 61 (December 1970): 946-955.

Batra, Raveendra N. and Scully, Gerald W. "The Theory of Wage Differentials: Welfare and Immiserizing Growth." Journal of International Economics 1 (May 1971): 241-247.

Bellante, Don. "The North-South Wage Differential and the Migration of Heterogeneous Labor." American Economic Review 69 (March 1979): 166-175.

Bhagwati, Jagdish N. "Distortions and Immiserizing Growth: a Generalization." Review of Economic Studies 35 (October 1968): 481-485.

Bhagwati, Jagdish N. and Ramaswami, V. K. "Domestic Distortions, Tariffs and the Theory of Optimum Subsidy." Journal of Political Economy 71 (February 1963): 44-50.

Bhagwati, Jagdish N. and Srinivasan, T. N. "The Theory of Wage Differentials: Production Response and Factor Price Equalization." Journal of International Economics 1 (February 1971): 19-35.

Cassing, James and Ochs, Jack. "International Trade, Factor Market Distortions and the Optimal Dynamic Subsidy: Comment." American Economic Review 68 (December 1978): 950-955.

Fishlow, Albert and David, Paul A. "Optimal Resource Allocation in an Imperfect Market Setting." Journal of Political Economy 69 (December 1961): 529-546.

Gallaway, Lowell E. "The North-South Wage Differential." Review of Economics and Statistics 45 (August 1963): 264-272.

Haberler, Gottfried. "Some Problems in the Pure Theory of International Trade." Economic Journal 60 (June 1950): 223-240.

Hagen, Everett E. "An Economic Justification of Protectionism." Quarterly Journal of Economics 72 (November 1958): 496-514.

Harberger, Arnold C. "The Incidence of the Corporation Income Tax." Journal of Political Economy 70 (June 1962): 215-240.

Hazari, Bharat R. "Factor Market Distortions and Gains from Trade Revisited." Weltwirtschaftliches Archiv 110 (October 1974): 413-429.

________. "Factor Market Distortions, Technical Progress, and Trade." Oxford Economic Papers 27 (March 1975): 47-60.

________. "The Theory of Wage Differentials, Technical Progress and the Pure Theory of International Trade." Weltwirtschaftliches Archiv 114 (1978): 146-159.

Hazari, Bharat R. and Sgro, Pasquale M. "Theorems on Immiserizing Growth (Normal Growth) in the Non-traded Goods and Wage Differentials Framework." Southern Economic Journal 41 (January 1975): 515-519.

Hazari, Bharat R. and Sgro, Pasquale M. "Some Notes on Technical Progress in the Framework of Factor Market Imperfections and Non-traded Goods." Australian Economic Papers 15 (June 1976): 76-86.

Humphrey, Thomas M. "Changing Views of Comparative Advantage." Federal Reserve Bank of Richmond Monthly Review (July 1972): 9-15.

Johnson, Harry G. "Factor Market Distortions and the Shape of the Transformation Curve." Econometrica 34 (July 1966): 686-698.

Keesing, Donald. "Labor Skills and Comparative Advantage." American Economic Review 56 (May 1966): 249-258.

Kemp, Murray C. and Tower, Edward. "Nontraded Goods, Factor Market Distortions, and the Gains from Trade: Comment." American Economic Review 65 (March 1975): 249-250.

Kravis, Irving B. "Wages and Foreign Trade." Review of Economics and Statistics 38 (February 1956): 14-30.

Lapan, Harvey E. "International Trade, Factor Market Distortions, and the Optimal Dynamic Subsidy." American Economic Review 66 (June 1976): 335-346.

________. "International Trade, Factor Market Distortions, and the Optimal Dynamic Subsidy: Reply." American Economic Review 68 (December 1978): 956-969.

Magee, Stephen P. "Factor Market Distortions, Production, Distribution, and the Pure Theory of International Trade." Quarterly Journal of Economics 85 (November 1971): 623-643.

________. "Factor Market Distortions, Production, and Trade: A Survey." Oxford Economic Papers 25 (March 1973): 1-43.

Manning, R. and Sgro, Pasquale M. "Wage Differentials and Growth in Fixed Coefficient Models." Southern Economic Journal 41 (January 1975): 403-409.

Mitchell, Edward J. "Explaining the International Pattern of Labor Productivity and Wages: A Production Model with Two Labor Inputs." Review of Economics and Statistics 50 (November 1968): 461-469.

Neary, J. Peter. "Dynamic Stability and the Theory of Factor-Market Distortions." American Economic Review 68 (September 1978): 671-682.

Scully, Gerald W. "Interstate Wage Differentials: A Cross Section Analysis." American Economic Review 59 (December 1969): 757-773.

________. "The North-South Manufacturing Wage Differential, 1869-1919." Journal of Regional Science 11 (1971): 235-252.

Sgro, Pasquale M. "Classical Savings, Wage Differentials and Growth." Southern Economic Journal 45 (January 1979): 874-884.

Smith, Lewis H.; Briggs, Vernon M.; Rungeling, Brian; and Smith, James O. "Wage and Occupational Differences Between Black and White Men: Labor Market Discrimination in the Rural South." Southern Economic Journal 45 (July 1978): 250-257.

Stern, Robert M. "Tariffs and Other Measures of Trade Control: A Survey of Recent Developments." Journal of Economic Literature 11 (September 1973): 857-888.

Weiser, Lawrence and Jay, Keith. "Determinants of the Commodity Structure of U.S. Trade: Comment." American Economic Review 62 (June 1972): 459-464.

Wichers, C. Robert. "The Detection of Multicolinearity: A Comment." Review of Economics and Statistics 57 (August 1975): 366-368.

Yu, Eden S. H. "Optimum Effective Protection and Noneconomic Objectives." Southern Economic Journal 43 (April 1977): 1560-1569.

________. "Wage Differential, Pure Intermediate Goods, and Economic Growth." Southern Economic Journal 44 (April 1978): 968-973.

________. "Rigid Wage, Factor Immobility and Immiserizing Growth." Economic Record 54 (December 1978): 387-393.

________. "On the Theory of Interregional Wage Differential and Technical Change." Journal of Regional Science (May 1979).

________. "Economic Growth, Interindustry Flows, and Wage Differential." Southern Economic Journal (January 1980) forthcoming.

Yu, Eden S. H. and Scully, Gerald W. "Domestic Distortions and the Theory of Customs Unions." Southern Economic Journal 42 (October 1975): 218-224.

APPENDIX

TABLE 23

AVERAGE HOURLY EARNINGS LEADING EXPORT INDUSTRIES 1960

SIC Code		Average Hourly Earnings in Dollars
1.	202	2.13
2.	203	1.78
3.	204	2.12
4.	221	1.56
5.	281	2.82
6.	282	2.51
7.	283	2.25
8.	344	2.45
9.	351	2.77
10.	352	2.47
11.	357	2.61
12.	36	2.28
13.	372	2.70
14.	373	2.64
15.	374	2.77
16.	381	2.68
17.	386	2.56

Source: U.S. Department of Labor, Bureau of Labor Statistics. Employment and Earnings, United States, 1909-75.

TABLE 24

AVERAGE HOURLY EARNINGS LEADING IMPORT-COMPETING INDUSTRIES 1960

SIC Code	Average Hourly Earnings in Dollars
1. 201	2.32
2. 206	2.23
3. 208	2.40
4. 229	1.84
5. 231	1.85
6. 242	1.71
7. 261	2.43
8. 291	3.02
9. 314	1.59
10. 3312	3.08
11. 333	2.63
12. 387	1.97

Source: U.S. Department of Labor, Bureau of Labor Statistics, Employment and Earnings, United States, 1909-75.

TABLE 25

AVERAGE HOURLY EARNINGS LEADING EXPORT INDUSTRIES 1969

SIC Code		Average Hourly Earnings in Dollars
1.	202	3.03
2.	204	3.08
3.	272	3.90
4.	281	3.84
5.	282	3.40
6.	283	3.30
7.	287	2.88
8.	344	3.30
9.	346	3.65
10.	351	3.87
11.	352	3.53
12.	353	3.53
13.	354	3.90
14.	355	3.36
15.	357	3.59
16.	3573	3.57
17.	372	3.86
18.	373	3.56
19.	381	3.54
20.	386	3.67

Source: U.S. Department of Labor, Bureau of Labor Statistics, <u>Employment and Earnings, United States, 1909-75</u>.

TABLE 26

AVERAGE HOURLY EARNINGS LEADING IMPORT-COMPETING INDUSTRIES 1969

SIC Code	Average Hourly Earnings in Dollars
1. 201	3.15
2. 203	2.51
3. 208	3.41
4. 221	2.34
5. 242	2.63
6. 261	3.58
7. 291	4.23
8. 314	2.31
9. 3312	4.09
10. 333,334	3.60
11. 365	2.69
12. 375	2.91
13. 387	2.55

Source: U.S. Department of Labor, Bureau of Labor Statistics. Employment and Earnings, United States, 1909-75.

TABLE 27

GROSS BOOK VALUE OF ASSETS AND GROSS BOOK VALUE OF ASSETS PER EMPLOYEE LEADING EXPORT INDUSTRIES 1962

SIC Code		Gross Book Value of Assets (millions)	Gross Book Value of Assets Per Employee
1.	202	2373	15,612
2.	203	1783	8,217
3.	204	1881	20,670
4.	221	1545	6,959
5.	281	9774	59,236
6.	282	3824	33,840
7.	283	1347	22,450
8.	344	1829	77,820
9.	351	821	14,660
10.	352	897	11,212
11.	357	996	10,060
12.	36	7286	6,932
13.	372	2497	7,154
14,	373	584	4,949
15.	374	376	12,533
16.	381	93	2,384
17.	386	737	17,975

Source: U.S. Department of Commerce, Bureau of the Census, Annual Survey of Manufactures: 1964 and 1965.

TABLE 28

GROSS BOOK VALUE OF ASSETS AND GROSS BOOK VALUE OF ASSETS PER EMPLOYEE LEADING IMPORT-COMPETING INDUSTRIES 1962

SIC Code	Gross Book Value of Assets (millions)	Gross Book Value of Assets Per Employee
1. 201	1515	5,964
2. 206	917	30,566
3. 208	2940	26,250
4. 229	511	9,125
5. 231	118	1,134
6. 242	1737	7,454
7. 261	5083	28,880
8. 291	9801	97,039
9. 314	230	1,069
10. 3312	15,984	37,966
11. 333	2137	40,320
12. 387	93	4,043

Source: U.S. Department of Commerce, Bureau of the Census, Annual Survey of Manufactures: 1964 and 1965.

TABLE 29

GROSS BOOK VALUE OF ASSETS AND GROSS BOOK VALUE OF ASSETS PER EMPLOYEE LEADING EXPORT INDUSTRIES 1969

SIC Code		Gross Book Value of Assets (millions)	Gross Book Value of Assets Per Employee
1.	202	2760.7	12,919
2.	204	2856.5	25,436
3.	272	677.5	7,961
4.	281	16,654.1	64,626
5.	282	8045.4	43,116
6.	283	2268.4	18,089
7.	287	1542.0	36,028
8.	344	2908.2	7,333
9.	346	3128.9	13,097
10.	351	1518.5	12,825
11.	352	1278.7	10,084
12.	353	2798.8	9,841
13.	354	3339.5	10,026
14.	355	1760.2	8,442
15.	357	1764.7	7,836
16.	3573	1083.9	7,748
17.	372	5554.3	7,185
18.	373	991.2	5,464
19.	381	253.4	5,369
20.	386	1669.0	17,403

Source: U.S. Department of Commerce, Bureau of the Census, Annual Survey of Manufactures: 1968 and 1969.

TABLE 30

GROSS BOOK VALUE OF ASSETS AND GROSS BOOK VALUE OF ASSETS PER EMPLOYEE LEADING IMPORT-COMPETING INDUSTRIES 1969

SIC Code	Gross Book Value of Assets (millions)	Gross Book Value of Assets Per Employee
1. 201	2423.3	7,805
2. 203	2975.4	10,987
3. 208	4667.5	20,671
4. 221	1788.5	11,019
5. 242	2287.7	10,641
6. 261	1342.0	90,067
7. 291	13,814.3	127,910
8. 314	364.4	1,736
9. 3312	24,707.1	45,950
10. 333,334	2948.6	46,072
11. 365	689.8	5,608
12. 375	81.7	6,433
13. 387	140.6	3,596

Source: U.S. Department of Commerce, Bureau of the Census, Annual Survey of Manufactures: 1968 and 1969.

TABLE 31

MEDIAN YEARS OF SCHOOL COMPLETED LEADING EXPORT INDUSTRIES 1960

SIC Code		Median Years of School Completed
1.	202	11.2
2.	203	9.3
3.	204	10.7
4.	221	8.7
5.	281	12.2
6.	282	11.1
7.	283	12.6
8.	344	11.0
9.	351	11.5
10.	352	11.0
11.	357	12.3
12.	36	12.1
13.	372	12.4
14.	373	10.6
15.	374	10.4
16.	381	12.2
17.	386	12.2

Source: U.S. Department of Commerce, Bureau of the Census, U.S. Census of the Population: 1960. Subject Reports: Industrial Characteristics.

TABLE 32

MEDIAN YEARS OF SCHOOL COMPLETED LEADING IMPORT-COMPETING INDUSTRIES 1960

SIC Code	Median Years of School Completed
1. 201	9.8
2. 206	10.0
3. 208	10.8
4. 229	9.5
5. 231	9.4
6. 242	8.8
7. 261	11.0
8. 291	12.3
9. 314	9.3
10. 3312	10.3
11. 333	10.8
12. 387	11.4

Source: U.S. Department of Commerce, Bureau of the Census, U.S. Census of the Population: 1960. Subject Reports: Industrial Characteristics.

TABLE 33

MEDIAN YEARS OF SCHOOL COMPLETED LEADING EXPORT INDUSTRIES 1969

SIC Code	Median Years of School Completed
1. 202	11.0
2. 204	12.1
3. 272	12.5
4. 281	12.6
5. 282	12.4
6. 283	13.1
7. 287	12.3
8. 344	12.0
9. 346	11.9
10. 351	12.3
11. 352	12.2
12. 353	12.3
13. 354	12.3
14. 355	12.2
15. 357	12.6
16. 3573	13.7
17. 372	12.6
18. 373	12.1
19. 381	12.5
20. 386	12.6

Source: U.S. Department of Commerce, Bureau of the Census, U.S. Census of Population: 1970. Subject Reports: Industrial Characteristics.

TABLE 34

MEDIAN YEARS OF SCHOOL COMPLETED LEADING IMPORT-COMPETING INDUSTRIES 1969

SIC Code	Median Years of School Completed
1. 201	11.7
2. 203	10.8
3. 208	12.0
4. 221	10.2
5. 242	10.4
6. 261	12.2
7. 291	12.6
8. 314	10.6
9. 3312	12.3
10. 333,334	12.0
11. 365	12.6
12. 375	12.0
13. 387	12.0

Source: U.S. Department of Commerce, Bureau of the Census, U.S. Census of the Population: 1970. Subject Reports: Industrial Characteristics.

TABLE 35

WORKERS INVOLVED IN WORK STOPPAGES AND PERCENTAGE OF WORKERS INVOLVED IN WORK STOPPAGES LEADING EXPORT INDUSTRIES 1960

SIC Code		Workers Involved in Work Stoppages	Percentage of Workers Involved in Work Stoppages
1.	202	1,240	0.4
2.	203	13,000	5.1
3.	204	8,430	5.4
4.	221	4,240	0.7
5.	281	1,690	0.2
6.	282	340	0.6
7.	283	460	0.4
8.	344	14,800	4.1
9.	351	1,350	0.1
10.	352	4,200	3.0
11.	357	650	0.4
12.	36	96,600	6.2
13.	372	82,400	12.0
14.	373	20,100	7.5
15.	374	4,170	4.5
16.	381	1,690	0.6
17.	386	850	1.3

Source: U.S. Department of Labor, Bureau of Labor Statistics, Analysis of Work Stoppages 1960.

TABLE 36

WORKERS INVOLVED IN WORK STOPPAGES AND PERCENTAGE OF WORKERS INVOLVED IN WORK STOPPAGES LEADING IMPORT-COMPETING INDUSTRIES 1960

SIC Code	Workers Involved in Work Stoppages	Percentage of Workers Involved in Work Stoppages
1. 201	5,780	1.7
2. 206	2,110	1.3
3. 208	12,600	5.6
4. 229	190	0.4
5. 231	360	0.0
6. 242	2,710	0.6
7. 261	1,510	0.5
8. 291	240	0.1
9. 3312	59,100	9.1
10. 314	4,480	1.6
11. 333	5,570	1.7
12. 387	1,410	4.8

Source: U.S. Department of Labor, Bureau of Labor Statistics, Analysis of Work Stoppages 1960.

TABLE 37

WORKERS INVOLVED IN WORK STOPPAGES AND PERCENTAGE OF WORKERS INVOLVED IN WORK STOPPAGES LEADING EXPORT INDUSTRIES 1969

SIC Code	Workers Involved in Work Stoppages	Percentage of Workers Involved in Work Stoppages
1. 202	4,100	2.5
2. 204	3,600	2.9
3. 272	8,500	1.1
4. 281	19,200	8.3
5. 282	14,000	17.8
6. 283	6,700	4.7
7. 287	1,200	2.7
8. 344	32,700	8.1
9. 346	3,200	2.2
10. 351	30,900	33.1
11. 352	9,500	6.8
12. 353	24,600	9.2
13. 354	10,300	3.1
14. 355	7,900	1.0
15. 357	3,500	2.5
16. 3573	4,800	2.4
17. 372	76,400	9.7
18. 373	29,500	10.8
19. 381	5,600	4.5
20. 386	500	0.5

Source: U.S. Department of Labor, Bureau of Labor Statistics, Analysis of Work Stoppages 1969.

TABLE 38

WORKERS INVOLVED IN WORK STOPPAGES AND PERCENTAGE OF WORKERS INVOLVED IN WORK STOPPAGES LEADING IMPORT-COMPETING INDUSTRIES 1969

SIC Code	Workers Involved in Work Stoppages	Percentage of Workers Involved in Work Stoppages
1. 201	7,800	2.7
2. 203	6,700	2.8
3. 208	28,400	13.6
4. 221	400	0.1
5. 242	5,700	1.6
6. 261	19,200	6.0
7. 291	42,100	22.8
8. 314	3,200	1.4
9. 3312	49,600	8.8
10. 333,334	4,400	2.1
11. 365	12,400	2.2
12. 375	3,700	14.3
13. 387	2,200	7.0

Source: U.S. Department of Labor, Bureau of Labor Statistics, <u>Analysis of Work Stoppages 1969.</u>

TABLE 39

FEMALES AND PERCENTAGE OF LABOR FORCE FEMALE
LEADING EXPORT INDUSTRIES 1960

SIC Code		Number of Females	Percentage of Labor Force Female
1.	202	45,500	13.9
2.	203	115,900	45.8
3.	204	21,700	14.0
4.	221	268,000	41.1
5.	281	172,700	19.5
6.	282	13,600	23.4
7.	283	39,300	35.5
8.	344	34,200	9.5
9.	351	170,800	12.8
10.	352	14,300	10.2
11.	357	41,600	24.1
12.	36	549,200	35.2
13.	372	113,900	16.6
14.	373	16,300	6.1
15.	374	9,800	10.6
16.	381	85,200	30.9
17.	386	17,900	27.0

Source: U.S. Department of Commerce, Bureau of the Census. U.S. Census of the Population: 1960. Subject Reports: Industrial Characteristics.

TABLE 40

FEMALES AND PERCENTAGE OF LABOR FORCE FEMALE
LEADING IMPORT-COMPETING INDUSTRIES 1960

SIC Code	Number of Females	Percentage of Labor Force Female
1. 201	86,000	25.3
2. 206	36,300	21.8
3. 208	27,200	12.2
4. 229	17,600	32.5
5. 231	868,900	76.7
6. 242	22,100	4.9
7. 261	37,000	12.3
8. 291	30,700	11.9
9. 314	151,000	54.8
10. 3312	32,400	5.0
11. 333	41,700	12.8
12. 387	15,700	52.5

Source: U.S. Department of Commerce, Bureau of the Census. U.S. Census of the Population: 1960. Subject Reports: Industrial Characteristics.

TABLE 41

FEMALES AND PERCENTAGE OF LABOR FORCE FEMALE
LEADING EXPORT INDUSTRIES 1969

SIC Code	Number of Females	Percentage of Labor Force Female
1. 202	25,800	15.7
2. 204	19,000	15.3
3. 272	285,900	35.9
4. 281	30,200	13.1
5. 282	14,500	18.4
6. 283	53,900	38.0
7. 287	6,500	14.5
8. 344	48,300	12.0
9. 346	34,500	23.9
10. 351	12,500	13.4
11. 352	18,400	13.1
12. 353	27,900	10.4
13. 354	47,800	14.5
14. 355	136,600	16.2
15. 357	40,200	28.5
16. 3573	54,600	27.6
17. 372	137,200	17.5
18. 373	23,300	8.5
19. 381	43,000	34.9
20. 386	28,400	28.3

Source: U.S. Department of Commerce, Bureau of the Census. U.S. Census of the Population: 1970. Subject Reports: Industrial Characteristics.

TABLE 42

FEMALES AND PERCENTAGE OF LABOR FORCE FEMALE LEADING IMPORT-COMPETING INDUSTRIES 1969

SIC Code	Number of Females	Percentage of Labor Force Female
1. 201	82,000	28.3
2. 203	111,700	46.8
3. 208	31,100	14.8
4. 221	277,400	43.5
5. 242	34,600	9.7
6. 261	44,900	14.1
7. 291	27,300	14.8
8. 314	138,000	62.0
9. 3312	36,500	6.5
10. 333,334	35,500	16.9
11. 365	229,800	40.1
12. 375	5,400	20.8
13. 387	18,300	58.3

Source: U.S. Department of Commerce, Bureau of the Census. Census of Population: 1970. Subject Reports: Industrial Characteristics.

TABLE 43

NUMBER OF BLACKS AND PERCENTAGE OF LABOR FORCE BLACK LEADING EXPORT INDUSTRIES 1960

SIC Code		Number of Blacks	Percentage of Labor Force Black
1.	202	9,100	2.8
2.	203	31,800	12.5
3.	204	14,500	9.4
4.	221	27,700	4.2
5.	281	55,300	6.3
6.	282	1,900	3.3
7.	283	4,300	3.9
8.	344	17,300	4.8
9.	351	34,600	2.6
10.	352	6,700	4.8
11.	357	3,100	1.8
12.	36	55,800	3.6
13.	372	21,700	3.2
14.	373	26,700	9.9
15.	374	5,400	5.8
16.	381	6,000	2.2
17.	386	1,900	2.9

Source: U.S. Department of Commerce, Bureau of the Census. U.S. Census of the Population: 1960. Subject Reports: Industrial Characteristics.

TABLE 44

NUMBER OF BLACKS AND PERCENTAGE OF LABOR FORCE BLACK
LEADING IMPORT-COMPTING INDUSTRIES 1960

SIC Code	Number of Blacks	Percentage of Labor Force Black
1. 201	49,600	14.6
2. 206	22,700	13.6
3. 208	15,500	6.9
4. 229	4,900	9.1
5. 231	88,400	7.8
6. 242	82,000	18.3
7. 261	19,500	6.5
8. 291	8,400	3.3
9. 314	4,400	1.6
10. 3312	75,100	11.6
11. 333	24,800	7.6
12. 387	800	2.7

Source: U.S. Department of Commerce, Bureau of the Census. U.S. Census of the Population: 1960. Subject Reports: Industrial Characteristics.

TABLE 45

NUMBER OF BLACKS AND PERCENTAGE OF LABOR FORCE BLACK
LEADING EXPORT INDUSTRIES 1969

SIC Code	Number of Blacks	Percentage of Labor Force Black
1. 202	7,800	4.7
2. 204	12,200	9.9
3. 272	47,500	6.0
4. 281	14,200	6.2
5. 282	4,400	5.6
6. 283	9,800	6.6
7. 287	6,500	14.5
8. 344	25,800	6.4
9. 346	10,100	7.0
10. 351	4,300	4.6
11. 352	8,200	5.8
12. 353	12,500	4.7
13. 354	10,100	3.1
14. 355	36,200	4.3
15. 357	7,000	5.0
16. 3573	8,300	4.2
17. 372	41,100	5.2
18. 373	34,400	12.6
19. 381	3,600	2.9
20. 386	5,700	5.7

Source: U.S. Department of Commerce, Bureau of the Census. U.S. Census of the Population: 1970. Subject Reports: Industrial Characteristics.

TABLE 46

NUMBER OF BLACKS AND PERCENTAGE OF LABOR FORCE BLACK LEADING IMPORT-COMPTEING INDUSTRIES 1969

SIC Code	Number of Blacks	Percentage of Labor Force Black
1. 201	47,200	16.3
2. 203	27,900	11.7
3. 208	19,500	9.3
4. 221	82,200	12.9
5. 242	53,900	15.1
6. 261	21,600	6.8
7. 291	10,200	5.5
8. 314	8,900	4.0
9. 3312	73,500	13.1
10. 333,334	16,400	7.8
11. 365	42,800	7.5
12. 375	1,300	5.0
13. 387	2,500	8.0

Source: U.S. Department of Commerce, Bureau of the Census, Census of Population: 1970. Subject Reports: Industrial Characteristics.

COPY

July 27, 1978

Mr. Charles Alexander
Chief, Trade Information and Cost Reports
Foreign Trade Division
Bureau of Census
Washington, DC 20233

Dear Mr. Alexander:

I am doing research on wage rates and International trade. I have been searching for data on wages, imports, and exports that is consistently classified. I have discovered that the Commerce Department has an annual summary of imports and exports based on SIC 2-digit, 3-digit, and 4-digit product codes but that this data is not published or generally available, and furthermore can only be obtained from you for $60 per report. I am referring to reports; FT-T-EA675, and FT:T-IA275. From their description in the Bureau of the Census Catalog it appears these reports would give me industry data consistent with the Employment and Earnings data that is reported annually based on SIX 2-digit, 3-digit, and 4-digit product codes.

Could you please send me a sample of the data or confirm my feelings that these reports are the data I am looking for. I would like to have some assurance these export and import data meet my needs before I ask for University support and send you the money. Thank you very much for your cooperation.

Sincerely,

Edward F. Stuart
Assistant Professor of Economics

EFS:dja

U.S. DEPARTMENT OF COMMERCE

To : Professor Edward F. Stuart
Department of Economics
University of Wisconsin
River Falls, Wisconsin 54022

From: Charles C. Alexander CCA
Chief, Trade Information and Cost Reports Branch
Foreign Trade Division

Enclosed are samples of data from the 1976 annual reports IA 275 and EA 675.

The IA 275 for 1977 has been released. However, Report EA 675 for 1977 has not been released.

Also enclosed is a copy of our "Guide to Foreign Trade Statistics." Your attention is also directed to exhibits of publications FT 210 and FT 610 in the Guide.

If we may be of further assistance, please let us know.

August 14, 1978

Mr. Charles C. Alexander
Chief, Trade Information and Cost Reports Branch
Foreign Trade Division
Bureau of the Census
Washington, DC 20233

COPY

Dear Mr. Alexander:

Thank you very much for your prompt reply to my letter of July 27, 1978. I appreciate your thoughtfulness in enclosing a copy of the "Guide to Foreign Trade Statistics," and a sample of the special tabulations, IA275 and EA675.

I have looked at publications FT210 and FT610 as you suggested and I believe that they do not meet my needs. I will attempt to explain my conclusion but please correct me if I do not understand the publications. My research involves the comparison of wage rates in leading export and leading import-competing industries. I am attempting to measure the extent of wage differentials, if any, between export and import-competing industries. The Department of Labor in its publication "Employment and Earnings, United States, 1909-75" reports average hourly earnings for 2-digit, 3-digit, and 4-digit SIC-based product codes. The 4-digit product code is the most detailed wage rate available. Publications FT210 and FT610 report imports and exports by SIC-based 8-digit product codes only. Therefore to match wages and foreign trade, I need imports and exports reported for four-digit product codes. I could either spend many hours aggregating the 8-digit data from publications FT210 and FT610 or purchase special tabulations IA275 and EA675 from you. Although the cost of these special tabulations is not small, I think the money spent will be worth all the hours saved.

I have one final question. Are IA275 and EA675 from 1974 and 1975 still available? I would appreciate this information and also your comments on the conclusions I have reached.

I am deeply grateful for all your consideration. Thank you.

Sincerely,

Edward F. Stuart
Assistant Professor of Economics

EFS:dja

UNITED STATES DEPARTMENT OF COMMERCE
Bureau of the Census
Washington, D.C. 20233

September 8, 1978

Professor Edward F. Stuart
Department of Economics
University of Wisconsin
River Falls, Wisconsin 54022

Dear Professor Stuart:

In reply to your letter of August 14, and subsequent telephone conversation with Mrs. Ware of this office, we are enclosing copies of a report entitled "U.S. Commodity Exports and Imports as Related to Output," for the years 1964-1965 and 1969-1970.

If we may be of further assistance, please let us know.

Sincerely,

Charles C. Alexander

CHARLES C. ALEXANDER
Chief, Trade Information and Cost
Reports Branch
Foreign Trade Division
Bureau of the Census

2 Enclosures