1995

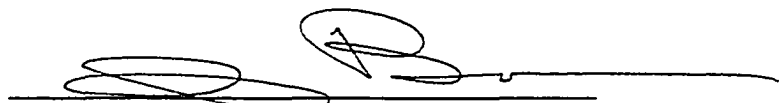
The effects of international trade on income inequality in the United States, 1979-1992

Thomas James Milton

THE EFFECTS OF INTERNATIONAL TRADE ON INCOME INEQUALITY IN THE UNITED STATES: 1979-1992

By
James Thomas Milton

M.A., State University of Iowa, 1964
B.A., Princeton University, 1962



Irving Buchen, Ph.D., Adviser
Professor of Administration/Management

Dissertation Submitted in Partial Fulfillment of
the Requirement for the Degree of
Doctor of Philosophy

WALDEN UNIVERSITY
May, 1995

ABSTRACT

THE EFFECTS OF INTERNATIONAL TRADE ON INCOME INEQUALITY IN THE UNITED STATES: 1979-1992

By
James Thomas Milton

M.A., State University of Iowa, 1964
B.A., Princeton University, 1962

Irving Buchen, Ph.D., Adviser
Professor of Administration/Management

Dissertation Submitted in Partial Fulfillment of
the Requirement for the Degree of
Doctor of Philosophy

WALDEN UNIVERSITY
May, 1995

ABSTRACT

The primary purpose of this study was to find out if international trade was a cause of the increase in income inequality that occurred in the United States after 1979. The secondary purposes were to test the predictions of international trade theory regarding the effects of trade on income distribution within nations and to see if trade is a cause of diverging productivity growth between economic sectors.

The general hypothesis was that international trade affects income inequality through its effects on wage structure and employment structure. With the relationship between income inequality and the labor market variables established by definition, the general hypothesis had to be tested only for possible relationships between the labor market variables and trade variables. Specific hypotheses, based on trade theory, were used to examine such relationships with quantitative data from government sources and statistical methods of data analysis.

The results supported the general hypothesis, indicating that international trade contributed to changes in wage structure and employment structure that increased income inequality from 1979 to 1992. The results indicated that trade performance affected the labor market variables through its effects on product demand, rather than through its effects on productivity. The results supported an alternative hypothesis that industry productivity affects

trade performance. At the same time, the results indicated that trade raised the average level of productivity for the trading sector, thereby increasing the productivity gap between this sector and the nontrading sector. The results further indicated that technology affected wages through its effect on trade performance. Generally, the results supported the main predictions of international trade theory as well as some modified predictions regarding the effects of trade on income distribution within nations.

The policy implication of this study is that as U.S. trade shifts toward developing countries, its effects on income inequality will accelerate, resulting in a more widely polarized society. Instead of trying to prevent these effects by reimposing trade barriers, the government should try to remedy them by supporting a private sector system of retraining and job placement. This system would be financed by a national tax on consumption.

ACKNOWLEDGEMENTS

I would like to acknowledge the helpful inputs from Dr. Louis Lopilato, Charles Matero Professor of Industrial and Labor Relations at Mercy College, and Dr. John B. Garbarino, Lecturer in Human Resources Management at Long Island University.

I would like to thank Dr. Norman Pearson, my Faculty Reader, and Dr. Douglas J. McCready, my External Consultant/Examiner, for their very helpful comments and suggestions as well as for their keen interest in the subject matter.

I would especially like to thank Dr. Irving Buchen, my Faculty Adviser, for his guidance and encouragement during what has been for reasons other than graduate work an extremely difficult period.

Finally, I would like to thank my wife for her being able to live with someone who became obsessed with the research questions and single-mindedly pursued them through dense forests of government data.

CONTENTS

CHAPTER 1 - INTRODUCTION.....1
Background.....1
Statement of the Problem.....4
Purpose of the Study.....7
Significance of the Study.....8
Research Hypotheses.....10
Methodology.....12
Limitations.....15
Summary.....16

CHAPTER 2 - LITERATURE REVIEW.....19
The Trend Toward Greater Income Inequality.....19
Trade Theory and Income Distribution.....29
Some Real World Conditions.....39
Empirical Studies.....54
Summary.....60

CHAPTER 3 - METHODOLOGY.....65
Two Approaches.....65
Measures of Income Inequality.....68
Research Hypotheses.....72
Sources of Data.....83
Methods of Analysis.....88
Summary.....99

CHAPTER 4 - RESULTS.....104
Data Analysis.....104
Summary.....127
Tables.....132

CHAPTER 5 - CONCLUSION.....179
Trade and Income Inequality.....179

REFERENCES.....193

CURRICULUM VITAE.....206

LIST OF TABLES

TABLE 4.1 INCOME INEQUALITY - PRIVATE SECTOR.....132
TABLE 4.2 INCOME INEQUALITY - TWO SECTORS.....133
TABLE 4.3 WAGE DISPERSION BETWEEN SECTORS.....135
TABLE 4.4 EMPLOYMENT SHIFTS BETWEEN SECTORS.....136
TABLE 4.5 WAGES AND PRODUCT DEMAND.....137
TABLE 4.6 WAGES AND PRODUCTIVITY.....138
TABLE 4.7 PRODUCT DEMAND AND DOMESTIC DEMAND, IMPORTS, AND EXPORTS.....139
TABLE 4.8 PRODUCTIVITY AND TRADE.....141
TABLE 4.9 WAGES AND TRADE.....142
TABLE 4.10 WAGES AND TRADE.....143
TABLE 4.11 WAGES AND TRADE.....144
TABLE 4.12 WAGES AND TRADE.....145
TABLE 4.13 WAGES AND TRADE.....146
TABLE 4.14 WAGES AND TRADE.....147
TABLE 4.15 WAGES AND TECHNOLOGY.....148
TABLE 4.16 WAGES AND TECHNOLOGY.....149
TABLE 4.17 WAGES AND TECHNOLOGY.....150
TABLE 4.18 WAGES AND TECHNOLOGY.....151
TABLE 4.19 WAGES AND TECHNOLOGY.....152
TABLE 4.20 WAGES AND TECHNOLOGY.....153
TABLE 4.21 EMPLOYMENT, PRODUCT DEMAND, AND PRODUCTIVITY.....154
TABLE 4.22 EMPLOYMENT, PRODUCT DEMAND, AND PRODUCTIVITY.....156
TABLE 4.23 EMPLOYMENT AND TRADE.....158
TABLE 4.24 EMPLOYMENT AND TRADE.....159
TABLE 4.25 EMPLOYMENT AND TRADE.....160
TABLE 4.26 EMPLOYMENT AND TRADE.....161
TABLE 4.27 EMPLOYMENT AND TECHNOLOGY.....162
TABLE 4.28 EMPLOYMENT AND TRADE - TWO SECTORS.....163
TABLE 4.29 EMPLOYMENT FLUCTUATIONS - TWO SECTORS.....164
TABLE 4.30 WAGES AND TRADE - TWO SECTORS.....165
TABLE 4.31 WAGE DISPERSION AND EMPLOYMENT SHIFTS.....166
TABLE 4.32 PRODUCTIVITY AND TRADE.....167
TABLE 4.33 PRODUCTIVITY AND TRADE.....168
TABLE 4.34 PRODUCTIVITY AND TRADE.....169
TABLE 4.35 PRODUCTIVITY AND TRADE.....170
TABLE 4.36 PRODUCTIVITY AND TRADE.....171
TABLE 4.37 PRODUCTIVITY, TECHNOLOGY, AND TRADE.....172
TABLE 4.38 PRODUCTIVITY, TECHNOLOGY, AND TRADE.....173
TABLE 4.39 TRADE AND ECONOMIC GROWTH.....174
TABLE 4.40 PRODUCTIVITY AND TRADING SECTOR.....175
TABLE 4.41 PRODUCTIVITY AND TRADE.....176
TABLE 4.42 PRODUCTIVITY AND TRADE - TWO SECTORS.....177
TABLE 4.43 PRODUCTIVITY AND TRADE - TWO SECTORS.....178

CHAPTER 1

INTRODUCTION

This chapter will begin with some background on the problem investigated by this study, followed by a statement of the problem. The purpose of the study will then be stated, and the research strategy will be formulated. The significance of the study will be explained. The general hypothesis as well as the specific hypotheses regarding the problem will be presented. The methodology used in the study will be outlined, some definitions will be provided, and the limitations of the approach will be duly noted.

Background

In the early 1980s some researchers discovered that income inequality in the United States, which had decreased during the 1960s and well into the 1970s, had begun to increase (Plotnik 1982; Dooley and Gottschalk 1984; Lawrence 1984a; Medoff 1984). Though income inequality was expected to increase during the early stages of economic development, it was not expected to increase at advanced stages (Kuznets 1955), so this discovery was a surprise. Researchers offered various explanations for the trend, including the baby boom, the influx of women into the work force, and the decline in union membership, but as they

studied the empirical evidence, they gradually narrowed the list to only three explanations: technology, productivity, and international trade.

According to the first explanation, the adoption of skill-biased technology increased wage dispersion between unskilled workers and skilled workers (Howell and Wolff 1991; Bound and Johnson 1992; Murphy and Welch 1992), and according to the second explanation, differences in productivity growth increased wage dispersion between sectors of the economy (Bell and Freeman 1991; Katz and Murphy 1992; Lawrence and Slaughter 1993). Neither hypothesis has been much debated, since economists agree that technology and productivity are determinants of wages. Both hypotheses, however, beg the question of why things changed in the early 1980s: why technology became more skill-biased and why productivity growth became more differentiated. So both may be good explanations, but unless they explain why things changed they are not good enough.

According to the third explanation, international trade increased wage dispersion as well as shifted employment by changing the relative demand for labor factors used in the production of traded goods (Katz and Summers 1988; Bluestone 1990; Murphy and Welch 1991). Trade exposed U.S. industries to foreign competition, which

drove them to adopt skill-biased technology and to increase productivity. This hypothesis may explain why things changed, but it has been much debated, since economists do not agree on exactly how international trade affects wages and employment (e.g., the debate on NAFTA, in which both sides based their positions on econometric forecasts).

Meanwhile the problem is becoming more urgent. If trade is indeed a cause of the trend toward greater income inequality, then there are reasons for believing that the trend will accelerate in the years ahead. Since the end of World War II U.S. trade has been dominated by the exchange of goods with developed countries (Ball and McCulloch 1993), which have similar labor factors. According to the theory that explains such trade, its effects on income inequality in the United States should have been minimal (Krugman 1981). But recently U.S. trade has shifted toward developing countries (Wood 1994), which have different labor factors. In particular, they have a great abundance of unskilled labor, which is relatively cheap. According to the theory that explains such trade, its effects on income inequality should be considerable (Heckscher 1919; Ohlin 1933). Indeed, the theory predicts that trade will equalize prices of labor factors between nations. While this process would increase wages of unskilled workers in developing countries, it would decrease wages of such workers in the

United States, thereby widening its wage gap between unskilled workers and skilled workers. So its changing trade pattern would intensify the effects of trade on income inequality.

Statement of the Problem

Researchers agreed that wage dispersion between labor factors, between industries, and between economic sectors increased during the 1980s (Davidson and Reich 1988; Ryscavage and Henle 1990; Murphy and Welch 1992). They agreed that employment shifted from the manufacturing sector to the service sector, which pays lower wages (Bluestone 1990; Mishel and Bernstein 1992). And they agreed that these changes in wage structure and employment structure were proximate causes of the trend toward greater income inequality (Levy and Murnane 1992). They did not, however, agree on why these changes occurred. In other words, they agreed on the proximate causes of the trend but not on the ultimate causes.

The changes in wage structure and employment structure that occurred during the 1980s had been well documented, and their effects on income inequality were not in doubt, since income inequality by any accepted definition is mainly or completely determined by wage structure and employment structure (Fields 1987; Braun 1988; Davidson and

Reich 1988; Ryscavage and Henle 1990; Cutler and Katz 1992; Levy and Murnane 1992). What was in doubt were the effects of international trade on wage structure and employment structure. So the problem investigated by this study was the relationship between these two labor market variables and international trade.

The basis for assuming that such a causal relationship exists is international trade theory, which makes certain predictions regarding the effects of trade on wages and employment. With respect to wages, the main predictions are that the labor factor used intensively in imports will lose from trade, whereas the labor factor used intensively in exports will gain from trade, and that trade will equalize labor factor prices between nations (Heckscher 1919; Ohlin 1933; Samuelson 1948, 1949). With respect to employment, the main prediction is that trade will shift employment within the trading sector from industries that have import competition to industries that have export success (Smith 1776; Heckscher 1919; Ohlin 1933). These predictions were supported by empirical evidence, but they had at least two deficiencies: they were far from having been confirmed, and they failed to explain some important changes in wage structure and employment structure that increased income inequality during the 1980s.

The first deficiency could be overcome by systematic testing, which would either support or undermine the main predictions of trade theory. The second deficiency could be addressed by revising some assumptions underlying the theory and deriving some modified predictions. The revised assumptions, which are based on real world conditions, are unbalanced trade, sticky wages, changes in productivity, different production techniques between nations, capital mobility between nations, labor immobility within nations, and unemployment. The modified predictions are that trade will increase wage dispersion in the trading sector, since industries that use common technology will have greater import competition than industries that use high technology; that trade will increase wage dispersion between the trading sector and the nontrading sector; that trade will shift employment between the two sectors; and that trade may increase unemployment. These modified predictions, together with the main predictions of trade theory, provide a more useful theoretical framework for examining the effects of trade on wage structure and employment structure, since they include some effects of the two other leading proposed explanations for the trend toward greater income inequality (the adoption of skill-biased technology and differences in productivity growth). They also include some effects of trade on wages and employment in the nontrading sector,

which were not contemplated by trade theory and had not been addressed by empirical studies of the problem.

Purpose of the Study

As indicated by the statement of the problem, the primary purpose of this study was to find out if international trade was a cause of the increase in income inequality that occurred in the United States after 1979. The secondary purposes were to find out (1) if the main predictions of trade theory regarding the effects of trade on wages and employment are supported by empirical evidence, (2) if the modified predictions derived from real world conditions are useful for investigating the problem, and (3) if trade is a cause of diverging productivity growth between sectors of the economy.

The research strategy for achieving these objectives had three steps. The first was to establish a measure of income inequality that is completely determined by wage structure and employment structure, so that there would be no slippage in transmission from the two labor market variables to income inequality. Fortunately, such a measure existed (the coefficient of variation of earnings) and had been widely used in studies of income inequality. The second step was to develop a set of testable hypotheses regarding the effects of trade on the labor market variables (wage structure and employment structure). Such hypotheses

were derived from trade theory (main predictions) and from revised assumptions underlying the theory (modified predictions). The third step was to test some implications of these hypotheses with quantitative data from government surveys and statistical methods of data analysis.

Significance of the Study

This study contributes to scholarship in the fields of international trade and labor economics in several important ways.

First, it makes a connection between two fields that have been investigated mainly by different groups of scholars, with different interests. It thereby widens the channels of intellectual exchange between academic fields and broadens the perspectives of researchers.

Second, this study tests some main predictions of trade theory regarding the effects of trade on wages and employment that until now have been tested by only a limited number of studies. It thereby helps to determine the usefulness of these predictions.

Third, this study tests some modified predictions of trade theory regarding the effects of trade on wages and employment that have never been tested. It thereby helps to determine the usefulness of revising some assumptions underlying trade theory and modifying its predictions.

Fourth, this study examines the possible relationship between productivity growth and foreign competition, which has not been done by any study of the effects of trade on wages and employment. It thereby helps to settle the question of whether international trade is a cause of diverging productivity growth between sectors of the economy.

Fifth, this study broadens the scope of inquiry to include the possible effects of trade on wages and employment in the nontrading sector.

Sixth, this study updates the work of previous scholars, whose published studies generally do not include data beyond 1987. Because U.S. trade is shifting toward developing countries, it is important to use data that may capture the effects of this change.

Beyond its interest to scholars, this study has important policy implications. If trade is indeed a cause of growing income inequality, then U.S. policymakers should know this so that they can either shape trade policy to prevent the undesired effects or shape labor policy to remedy them. If nothing is done and the trend continues, then it will lead to a labor market that is more distinctly segmented between primary jobs and secondary jobs, which in turn will lead to a society that is more widely polarized and more rigidly stratified.

Beyond the U.S. perspective, the trend toward income inequality has been identified in other developed countries (Gottschalk 1993; Katz, Loveman and Blanchflower 1993; Wood 1994). In fact, it has been confirmed in a number of European countries as well as in Canada and Australia, all of which have experienced a growth in trade. The increase in income inequality is more pronounced in the United States, but this difference is attributed to the fact that its labor market is more flexible. On the other hand, unemployment is significantly lower in the United States, which suggests that there might be a trade-off between income inequality and unemployment. Since trade might be a cause of both problems, this study has relevance for all developed countries, including Japan.

Research Hypotheses

The general hypothesis is that *international trade affects income inequality through its effects on wage structure and employment structure*. This hypothesis assumes a transitive relationship between three sets of variables: income inequality, labor market variables, and trade variables. The logic of such a relationship is that if trade affects the labor market variables (wage structure and employment structure) and the labor market variables affect income inequality, then trade affects income inequality. With the relationship between income inequality and the

labor market variables established by definition (i.e., by the use of the coefficient of variation of earnings as a measure of income inequality), the general hypothesis had to be examined only for possible relationships between the labor market variables and the trade variables. Specific hypotheses, based on trade theory, were used to examine such relationships.

With respect to wages, the basic hypothesis is that wages are related directly to both product demand and productivity, which in turn are related to trade. The specific hypotheses are (1) trade performance affects wages in the trading sector through its effect on product demand, (2) technology affects wages in the trading sector through its effect on trade performance, and (3) trade affects wage dispersion between the trading and nontrading sectors through its effect on labor supply.

With respect to employment, the basic hypothesis is that employment is related directly to product demand and inversely to productivity. The specific hypotheses are (1) trade performance affects employment in the trading sector through its effect on product demand, (2) technology affects employment in the trading sector through its effect on trade performance, and (4) trade causes employment shifts between the trading and nontrading sectors through its effect on product demand.

With respect to productivity, the specific hypothesis is that productivity in the trading sector is related directly to foreign competition.

Methodology

The methodology used in this study followed the research strategy of establishing a measure of income inequality that is completely determined by wage structure and employment structure, and then examining the effects of trade on the labor market variables. This partial equilibrium approach used simple models, with industries as units of analysis and objectively defined variables that are measured by comparable standards. As explained in the chapter on methodology, the disadvantages of such an approach could be partly overcome by including productivity models to examine the indirect effects of trade on wages and employment through its effects on productivity and by using two-sector models to examine the broader effects of trade on wages and employment in the nontrading sector, whereas the disadvantages of a general equilibrium approach could not be practically overcome.

As already mentioned, the specific hypotheses were tested with quantitative data from government surveys and statistical methods of data analysis. The study therefore had a survey design in that observations were taken at one or more points in time and there was no control group. The

sources of data were secondary, and all data were obtained from either the U.S. Department of Commerce (Bureau of the Census) or the U.S. Department of Labor (Bureau of Labor Statistics). The advantage of these sources is that the data, which are collected by extensive surveys, are available for a large number of industries over many years, so both cross-sectional and longitudinal designs could be used to test hypotheses.

The sample size for data collection was 310 industries in the trading sector and 396 industries in the nontrading sector, which were identified at the 4-digit SIC level. The sample included all industries for which there were consistent data over the study period. It should be noted that the size of this sample was considerably larger than that of any previous published study.

The main variables of the data analysis were defined as follows:

Income inequality is measured by the coefficient of variation of earnings, as described by Davidson and Reich (1988). With this measure, which is based on income from employment, income inequality is completely determined by wage structure and employment structure.

Wage structure is wage distribution by industry, derived from average industry wages as compiled by the Bureau of Labor Statistics.

Employment structure is employment distribution by industry, derived from average industry employment as compiled by the Bureau of Labor Statistics.

Import intensity is a measure of import competition. It is defined as M/(S + M), where M is industry imports and S is industry shipments, as compiled by the Bureau of the Census.

Export intensity is a measure of export success. It is defined as X/S, where X is industry exports, as compiled by the Bureau of the Census.

Net export intensity is a measure of trade performance. It is defined as (X - M)/(S + M).

Trade intensity is a measure of trade importance. It is defined as (M + X)/(S + M).

Productivity growth is the annual rate of increase in output per employee, as compiled by the Bureau of Labor Statistics.

Productivity level is defined as S/E, where S is deflated industry shipments and E is industry employment, as compiled by the Bureaus of the Census and Labor Statistics.

Trading sector is the manufacturing sector.

Nontrading sector is construction; transportation and public utilities; wholesale trade; retail trade; finance, insurance, and real estate; and services.

Common-tech and high-tech industries are the industries so designated by Lawrence (1984b) and Partridge (1991), based on the type of technology they use in production.

Limitations

The approach used in this study has several limitations, beginning with the fact that its scope is by definition limited to income from employment. Income from investment is therefore excluded. Such income would be relevant if returns on investment have been significantly affected by capital mobility between nations, a question that could be the subject of another study. In that study, the problem would be the effects of global economic integration on investment returns for U.S. owners of capital.

Other limitations of this study are (1) it focuses on the demand side of the labor market and ignores the supply side; (2) it ignores the indirect effects of trade on industries that supply goods and services to industries that have import competition or export success; (3) it ignores the possibility that by lowering prices of manufactured goods, imports may lead to an increase in demand that would benefit domestic producers; (4) it assumes that imports are perfect substitutes for domestic goods; (5) it assumes that the effects of trade on wages and employment are immediate, meaning that they can be observed within a year; and (6) it ignores government policies (e.g., income supplements, minimum wages, and trade interventions) that may distort the effects of trade on wage structure and employment structure.

Though such limitations do not impair the usefulness of this study, as will be shown in the chapter on methodology, they should still be noted.

Summary

The trend toward greater income equality in the United States was reversed around 1979. Researchers who had investigated this surprising development agreed that its proximate causes were changes in wage structure and employment structure. They did not agree on its ultimate causes, though they gradually narrowed the list of probable explanations to technology, productivity, and international trade.

The first explanation is that changes in wage structure were due to the adoption of skill-biased technology, and the second explanation is that they were due to differences in productivity growth. While neither of these explanations has been much debated, neither explains why technology became more skill-biased or why productivity became more differentiated in the early 1980s. So both may be good explanations, but unless they explain why things changed they are not good enough. The third explanation is that wage structure and employment structure in the United States were affected by international trade, which changed the relative demand for labor factors used in the production of traded goods. This hypothesis may explain why things changed, but it has been much debated.

The changes in wage structure and employment structure that occurred during the 1980s had been well documented, and their effects on income inequality were not in doubt since income inequality by any accepted definition is mainly or completely determined by wage structure and employment structure. What was in doubt were the effects of international trade on wage structure and employment structure. So the problem investigated by this study is the relationship between these two labor market variables and international trade.

The basis for assuming that such a causal relationship exists is international trade theory, which makes certain predictions regarding the effects of trade on wages and employment (main predictions). Since these predictions failed to explain some important changes in wage structure and employment structure that affected income inequality in the 1980s, some underlying assumptions of trade theory were revised and some other predictions were generated (modified predictions). The latter, together with the main predictions, provide a more useful theoretical framework for investigating the problem, since they include the other two leading explanations for the trend toward greater income inequality (the adoption of skill-biased technology and differences in productivity growth). They also include the effects of trade on wages and employment in the nontrading sector.

The general hypothesis is that *international trade affects income inequality through its effects on wage structure and employment structure.* This hypothesis assumes a transitive relationship between three sets of variables: income inequality, labor market variables, and trade variables. With the relationship between income inequality and the labor market variables established by definition, the general hypothesis had to be examined only for relationships between the labor market variables and the trade variables. Specific hypotheses, based on trade theory, were used to examine such relationships. These hypotheses were tested with quantitative data from government surveys and statistical methods of data analysis.

In the next chapter the relevant literature on income inequality and international trade will be reviewed. In that chapter the theoretical foundation for this study will be explained, and the principal results of other studies regarding the effects of trade on wages and employment will be evaluated. In the third chapter the methodology used in this study will be explained. In that chapter a set of models that define the relevant variables and describe their relationships will be presented, along with specific hypotheses and their testable implications. The methods of data collection and data analysis will then be described. In the fourth chapter the results of the data analysis will be presented, and in the fifth chapter the conclusions drawn from these results will be presented, along with policy implications, recommendations, and areas for future research.

CHAPTER 2

LITERATURE REVIEW

In this chapter the relevant literature on income inequality and international trade will be reviewed. The evidence of the trend toward greater income inequality in the United States will be cited. The proposed causes of this trend, both proximate and ultimate, will be examined. The predictions of international trade theory regarding the effects of trade on wages and employment will be reviewed. Some real-world conditions that may undermine the assumptions of trade theory and thereby modify its predictions will be discussed. Within this theoretical framework, the empirical studies of the effects of trade on wages and employment will be reviewed. And finally the gaps in the literature that this study was intended to fill will be identified.

The Trend Toward Greater Income Inequality

During the early 1980s some researchers discovered that income inequality in the United States, which had decreased during the 1960s and well into the 1970s, had begun to increase (Plotnik 1982; Dooley and Gottschalk 1984; Lawrence 1984a; Medoff 1984). This reversal in the trend

toward greater income equality was confirmed by a large number of researchers using various approaches. Some researchers examined income inequality by family or individual, with breakdowns by gender, age, and/or race (Dooley and Gottschalk 1985; Harrison, Tilly, and Bluestone 1986; Grubb and Wilson 1989; Burtless 1993). Some examined income inequality by occupation (Medoff 1984; Rosenthal 1985; McMahon and Tschetter 1986), some by labor factor (Blackburn, Bloom, and Freeman 1990; Ryscavage and Henle 1990; Howell and Wolff 1991; Bound and Johnson 1992; Murphy and Welch 1992; Capelli 1993), and some by industry (Dickens and Katz 1986; Davidson and Reich 1988; Katz and Summers 1988; Bell and Freeman 1991; Katz and Murphy 1992). Whatever their approach, researchers agreed that income inequality in the United States increased during the 1980s.

In attempting to explain this trend, they distinguished between proximate causes and ultimate causes. Proximate causes are changes in wage structure and employment structure that are reflected by all commonly used measures of income inequality (Braun 1988). Ultimate causes are changes in conditions of the labor market that affect wage structure and employment structure. The proximate causes will be reviewed first. Though changes in wage structure and employment structure will be discussed separately, it should be kept in mind that they operate together and

that they may interact (e.g., a shift in employment may affect wages). Also, a change in employment structure may intensify or offset the effects of a change in wage structure (e.g., a shift in employment to a sector where wage dispersion is increasing will intensify the effect of the latter on income inequality).

Changes in wage structure. Studies of wage structure examine this variable across industries, within industries, and between industries. In the first and second types of study researchers look for changes in wage distribution by labor factors (e.g., skilled and unskilled workers) or occupations. In the third type of study they look for changes in wage distribution by industries or sectors. The main findings of these studies are as follows:

(1) Wage dispersion between skilled and unskilled workers increased both across industries and within industries (Freeman 1986; Grubb and Wilson 1989; Blackburn, Bloom, and Freeman 1990; Ryscavage and Henle 1990; Howell and Wolff 1991; Levy and Murnane 1992; Berman, Bound, and Griliches 1993; Lawrence and Slaughter 1993).

(2) Wage dispersion between more educated and less educated workers increased both across industries and within industries (Bluestone 1990; Burtless 1990; Grusky and DiPrete 1990; Kosters 1991; Bound and Johnson 1992; Murphy and Welch 1992; Capelli 1993; Rose 1993).

(3) Wage dispersion between industries and between sectors increased (Lawrence and Lawrence 1985; Bulow and Summers 1986; Dickens and Katz 1986; Krueger and Summers 1987; Thurow 1987; Davidson and Reich 1988; Katz and Summers 1988; Grubb and Wilson 1989; Maxwell 1989; Mishel 1989; Katz and Murphy 1992).

(4) Wage dispersion increased more within the service sector than within the manufacturing sector (Grubb and Wilson 1989; Bluestone 1990; Ryscavage and Henle 1990; Howell and Wolff 1991).

The first two findings overlap because education is used as a variable (along with experience) to determine skill levels in most of these studies. The usual measures are years of education and years of experience.

Any one of these changes in wage structure would have increased income inequality, provided that there were no offsetting change in employment structure.

Changes in employment structure. Studies of employment structure examine this variable between jobs, between industries, and between sectors. In the first type of study researchers look for changes in employment distribution by job (e.g., low-wage jobs and high-wage jobs). In the second and third types of study they look for changes in employment distribution by industry or sector (e.g., manufacturing and service). The main findings of these studies are as follows:

(1) Employment shifted from middle-wage jobs to low-wage and high-wage jobs (Bluestone and Harrison 1986; Kosters and Ross 1987; Thurow 1987; Harrison and Bluestone 1988; Loveman and Tilly 1988; Mishel and Simon 1988; Mishel 1989; Tilly 1991).

(2) Employment shifted from the manufacturing sector to the service sector (Bluestone and Harrison 1982; Harrison, Tilly, and Bluestone 1986; Ryscavage and Henle 1988; Galloway, Vedder, and Boyd 1989; Grubb and Wilson 1989; Mishel 1989; Waldstein 1989; Bluestone 1990; Burtless 1990; Maxwell 1990; Mishel and Bernstein 1992).

(3) Employment shifted from a sector with less wage dispersion to a sector with more wage dispersion (Blackburn and Bloom 1987; Thurow 1987; Grubb and Wilson 1987; Blackburn, Bloom, and Freeman 1990; Bluestone 1990; Howell and Wolff 1991).

The first two findings overlap because average wages were higher in the manufacturing sector than in the service sector (Waldstein 1989). These findings are separated because they do not completely overlap (i.e., employment shifts from middle-wage jobs to low-wage jobs also occurred within sectors).

Any one of these changes in employment structure would have increased income inequality, provided that there were no offsetting change in wage structure.

Though researchers generally agreed on the proximate causes of growing income inequality, they diverged widely on the ultimate causes, which included business cycles, demographics, unionization, technology, productivity, and international trade.

Business cycles. Since the 1980s began with a recession, it was possible that the trend toward greater income inequality was only a cyclical phenomenon. But this hypothesis was undermined by data that showed that the trend had continued through recession and recovery (Harrison, Tilly, and Bluestone 1986; Bluestone and Harrison 1988; Danziger and Gottschalk 1989; Gottschalk 1989).

Demographics. One demographic hypothesis was developed before the trend became apparent. It predicted that the large supply of baby boomers entering the labor market would depress their wages, widening the income gap between them and older workers (Easterlin 1978; Welch 1979; Lawrence 1984a). While this hypothesis explained growing income inequality between generations (Maxwell 1989), it could not explain data that showed growing income inequality among baby boomers (Dooley and Gottschalk 1985; Harrison, Tilly, and Bluestone 1986; Thurow 1987; Bluestone and Harrison 1988; Danziger and Gottschalk 1989; Gottschalk 1989; Burtless 1990; Tilly 1991).

A similar hypothesis predicted that the large supply of women entering the labor market would depress their

wages, widening the income gap between them and men (Thurow 1987; Kosters and Ross 1987). This hypothesis was undermined by data that showed a narrowing income gap between genders (Bound and Johnson 1992). Nor could it explain data that showed growing inequality among women (Loveman and Tilly 1988; Ryscavage and Henle 1990; Bound and Johnson 1992; Karoly 1992).

A different hypothesis attributed the trend toward greater income inequality to a change in the composition of families, which created a wide income gap between families headed by a single parent (usually a woman) and families with two-income parents (Blackburn and Bloom 1987; Thurow 1987). While this hypothesis explained growing income inequality among families (Kosters 1991), it could not explain data that showed growing income inequality among individuals (Loveman and Tilly 1988; Grubb and Wilson 1989). Nor could it explain data that showed growing income inequality among single parents (Danziger and Gottschalk 1989).

Unionization. The hypothesis is that the decline in union membership was a major cause of growing income inequality (Freeman 1980; Plotnik 1982; Bluestone and Harrison 1988; Blackburn, Bloom, and Freeman 1990; Belman and Heywood 1990; Bluestone 1990). This hypothesis is supported by the finding that union workers had higher wages than nonunion workers (Bluestone and Harrison 1988;

Bluestone 1990; MacPherson and Stewart 1990), so any decline in union membership would increase income inequality by shifting employment from a middle-wage group to a low-wage group. The hypothesis is also supported by the finding that there is less wage dispersion among union workers than among nonunion workers (Freeman 1980; Belman and Heywood 1990; Davis and Haltiwanger 1991), so any decline in union membership would increase income inequality by shifting employment from a low-dispersion group to a high-dispersion group. While this hypothesis explained growing income inequality resulting from employment shifts between union and nonunion groups, it could not explain data that showed growing wage dispersion within both union and nonunion groups (Bell and Freeman 1991).

Technology. The hypothesis is that the introduction of new technology has caused an increase in demand for skilled workers in relation to unskilled workers, increasing wage dispersion between them (Danziger and Gottschalk 1989; Davis and Haltiwanger 1991; Mincer 1991; Bound and Johnson 1992; Katz and Murphy 1992; Murphy and Welch 1992; Johnson and Stafford 1993; Lawrence and Slaughter 1993). According to this hypothesis, which offers an explanation for the growing wage dispersion between more educated and less educated workers, the driving force behind structural changes in the U.S. labor market since the late 1970s has been skill-biased technological change. While this is a

logical explanation, it still begs the question of why such change was more biased toward skills during the 1980s than it was during the 1960s or the early 1970s. It may, however, be a good penultimate explanation.

Productivity. The hypothesis is that differences in productivity growth between labor factors or between industries have changed wage structure and/or employment structure (Krueger 1980; Lawrence 1983; O'Neill 1987; Bluestone and Harrison 1988; Tyson and Zysman 1988; Thurow 1989; Bluestone 1990; Bell and Freeman 1991; Katz and Murphy 1992; Lawrence and Slaughter 1993). This explanation is based on the theory that wages ultimately depend on productivity. It is also based on the fact that if an industry increases productivity it will need relatively fewer workers (with productivity defined as output per unit of labor). Yet few researchers have included an analysis of productivity changes in their studies of income inequality, and those who have included such an analysis (O'Neill 1987; Bluestone and Harrison 1988; Lawrence and Slaughter 1993) have done surprisingly little with it. In their pursuit of the ultimate cause of growing income inequality, researchers may not have paid enough attention to the role of productivity. Though it may be only a penultimate cause, it could provide a useful link to further explanations.

International trade. The general hypothesis is that international trade affects income inequality through its

effects on wage structure and employment structure. One specific hypothesis is that trade has increased income inequality in the United States by destroying middle-wage jobs in its manufacturing sector and shifting employment to low-wage jobs in the service sector (Bluestone and Harrison 1982; Harrison, Tilly, and Bluestone 1986; Thurow 1987; Mishel and Simon 1988; Mishel 1989; Bluestone 1990; Peterson 1991; Tilly 1991; Scott 1993). The effect of this employment shift on income inequality has been intensified by the fact that there is less wage dispersion in manufacturing than in services.

Another specific hypothesis is that trade has increased income inequality by increasing wage dispersion between skilled and unskilled workers (Katz and Summers 1988; Murphy and Welch 1991; Levy and Murnane 1992; Murphy and Welch 1992, 1993a, 1993b; Wood 1994). According to this hypothesis, foreign competition has increased demand for skills in the trading sector, thereby raising the wage premium for education and experience.

After considering these hypotheses, some researchers concluded that international trade was not a major cause of growing income inequality (Davidson and Reich 1988; Davis and Haltiwanger 1991; Lawrence and Slaughter 1993). In their arguments they usually pointed to sources of growing inequality that could not be explained by trade. For example, Davidson and Reich (1988) concluded that the

growing wage dispersion within the nontrading sector could not be explained by trade. Davis and Haltiwanger (1991) concluded that the growing wage dispersion between plants in the same industry could not be explained by trade. Lawrence and Slaughter (1993) concluded that the growing wage dispersion between skilled and unskilled workers in the same industry could not be explained by trade. But these researchers left open the possibility that other changes in wage structure could be explained by trade.

Before reviewing the evidence, it will be useful to review the theory underlying the general hypothesis that international trade affects income inequality through its effects on wage structure and employment structure.

Trade Theory and Income Distribution

There are four main bodies of international trade theory: classical theory (Smith 1776; Ricardo 1817), factor proportions theory (Heckscher 1919; Ohlin 1933; Samuelson 1939), product life cycle theory (Vernon 1966), and scale economy theory (Ethier 1979; Krugman 1979, 1980). These theories, which are complementary, are primarily concerned with explaining the benefits of trade and the patterns of trade. They are only secondarily concerned with the problem of how the gains and losses of trade are distributed within a country. In fact, the two more recent theories have little to say about this problem, presumably because

the earlier theories seemed to demonstrate that for a country the gains from trade always outweigh the losses, so its government could make everyone better off simply by taxing the winners and compensating the losers (Heckscher 1919; Viner 1937; Samuelson 1939). This review will concentrate on the theories that have more to say about the problem.

Classical theory. In his theory of international trade, Adam Smith (1776) showed how nations could benefit by abandoning protectionist policies and adopting free trade. His argument was based on the then radical idea that consumption is the sole purpose of economic activity, and that therefore the interests of consumers should never be sacrificed to those of producers, which happens when governments intervene in trade. With free trade, nations will specialize in the industries at which they are more productive than other nations (absolute advantage), and there will be a more efficient allocation of resources between nations. The net result for consumers will be a greater quantity of goods in return for a given amount of work.

Smith did not pursue the question of how the gains from trade would be distributed, though he did observe that when a nation moved toward free trade the workers in formerly protected industries would become unemployed and thereby lose from trade. His solution to this problem was to

introduce free trade gradually and remove impediments to labor mobility, so that workers could shift from the less productive industries (which would contract because of imports) to the more productive industries (which would expand because of exports). In short, he envisioned an employment shift from import-contracted industries to export-expanded industries, with the implication that average wages would then be higher because workers would be employed more productively.

In his model of two nations and two industries, Ricardo (1817) demonstrated that both nations could benefit from trade even if one were more productive than the other in both industries. With free trade they will specialize in the industry at which they are more productive internally (comparative advantage), and there will be a more efficient allocation of resources within nations. As in Smith's theory, the net result for consumers is a greater quantity of goods in return for a given amount of work.

Ricardo, however, did examine some implications of his theory with respect to income distribution. In touting the advantages of free trade for English factory owners, he argued that they would benefit from imports of cheap food not primarily as consumers but as producers. His premise was that profits could be increased only by a fall in wages, and that there could be no permanent fall in wages unless prices of the necessities of working people were reduced.

On this basis he argued that the elimination of barriers to imports of food (the Corn Laws) would reduce the price of food and thereby enable factory owners to reduce wages. Of course, the fall in wages would be nominal, whereas real wages would not be lower, since the cost of food--which at that time accounted for almost three-quarters of family expenditures (Stigler 1956)--would be lower. But if nominal wages were lower, then nominal profits would be higher, and there would be a redistribution of income between workers and owners, with workers getting a smaller share and owners getting a larger share of national income.

Factor proportions theory. In the theory of Heckscher (1919) nations will trade whenever they can obtain a good at a lower cost by exchanging another good for it than they could by producing the good themselves. The comparative costs of goods between nations depend on the relative abundance of their factors of production as well as on the proportion of factors used to produce the goods. It follows that a country will import goods that use a high proportion of its scarce factors and will export goods that use a high proportion of its abundant factors. Such trade will decrease demand for the country's scarce factors in relation to its abundant factors, thereby affecting their relative prices. In this way the factors used intensively in imports will lose from trade, while the factors used intensively in exports will gain from trade. The losses will be less than

the gains, so there will always be a net gain, but income distribution among the factors of production will always be affected.

Though he began with the three broad factors of production (land, capital, and labor), Heckscher stressed that his conclusions applied as well to different qualities of the factors. In particular, labor could be divided into a number of subfactors according to the different skills required for the production of different goods. For example, if a country has a relatively scarce supply of unskilled labor and a relatively abundant supply of skilled labor, it will import goods that use a high proportion of the former and export goods that use a high proportion of the latter. The income distribution effect will be lower wages for unskilled labor in relation to skilled labor.

According to Heckscher, trade will eventually lead to an equalization of factor prices between nations, assuming that they use the same production techniques. If they use different production techniques, then factor prices will not be equalized. For example, the United States might use a higher proportion of capital than other countries to produce the same good, substituting an abundant factor for a scarce factor. This difference would maintain higher wages for U.S. workers employed in such production.

Ohlin (1933), who was a student of Heckscher, emphasized that trade arises not from differences in

productivity between nations (the classical argument) but from differences in factor abundance, which determine factor prices. He argued that if one factor is very productive but is relatively expensive, then it will be replaced by a less expensive factor, even though the latter is less productive. For example, if labor in the United States is more productive but more expensive than in another country, it will be replaced by less productive but less expensive labor in that country as long as the same good can be produced there at a lower cost. It follows that if wages in the United States are relatively high because of the relative scarcity of labor, then they will be reduced by trade. The decrease in nominal wages might be compensated by a increase in purchasing power, as Ricardo postulated, but workers' share of national income will be reduced.

Like his mentor, Ohlin recognized different qualities of the factors of production, especially those of labor. He divided labor into three subfactors: (1) unskilled labor, (2) skilled labor, and (2) technical labor. He concluded that if two industries in a country employ labor of different qualities, when international trade leads to specialization then wages will fall in the contracting industry and rise in the expanding industry, unless there is a continued flow of labor from the former to the latter. The problem is the extent to which one type of labor can be substituted for another type. If unskilled workers cannot

be used in the expanding industry, then they must either be changed in quality or else receive a smaller share of national income through unemployment in the short run and lower wages in the long run. Ohlin assumed that the displaced workers would be changed, and that the direction in which labor is educated and trained would to some extent be determined by trade.

Using factor proportions theory, Stolper and Samuelson (1941) examined the question of how trade affects real wages. They showed that in an economy with two factors trade will reduce both the relative and the absolute price of the scarce factor. If labor is the scarce factor and capital the abundant factor, trade will transfer production from labor-intensive industries to capital-intensive industries, and even if the factors are fully employed after trade, there will necessarily be a decline in the marginal productivity of labor. This decline will occur because as production is transferred, more labor will be released from the labor-intensive industries than can be reemployed by the capital-intensive industries at the same productivity as before, since the capital released from the former will be insufficient to maintain the same factor proportions in the latter. Since real wages ultimately depend on the marginal productivity of labor, there will be a decline in real wages. Therefore, if labor is the relatively scarce factor, trade will reduce real wages.

In subsequent papers Samuelson (1948, 1949) used a model to show how trade will equalize real factor prices between nations, assuming that they use the same production techniques. His model had only two factors (land and labor), but it led him to conclude that as long as the number of goods is greater than the number of factors (which does not seem to be a very limiting assumption), trade will equalize factor prices between nations. While these papers do not explicitly address the question of how such equalization will affect income distribution within nations, it is clear from the dynamics of the model that there will be a change in the relative shares of national income between the two factors.

Samuelson (1971) and Jones (1971) expanded the model to three factors (capital, land, and labor), with two goods. They assumed that capital and land were specific to certain industries, and that labor was mobile. They showed that trade hurts the factor that is specific to the import industry but benefits the factor that is specific to the export industry. For example, if capital is specific to manufacturing and land is specific to food production, and if trade induces a country to specialize in the latter, then the owners of capital will lose while the owners of land will gain. The effects on labor are ambiguous, since factor prices and commodity prices will be equalized between nations with the result that nominal wages will be

lower, the price of food will be higher, and the price of manufactures will be lower. Real wages will depend on the relative importance of the two goods in family expenditures.

Scale economy theory. In the theories reviewed so far, trade arises from national differences in productivity or factor abundance. But if such differences were the only causes of trade, then there would not be much trade between similar countries. Yet today a great volume of world trade is conducted between developed countries (Ball and McCulloch 1993), which are similar in productivity and factor abundance. Further, a significant volume of such trade is within the same industries. Some of this intraindustry trade was explained by the product life cycle theory, according to which trade arises from product innovation (Vernon 1966). Another explanation for this type of trade was offered by Ohlin (1933) and was developed by Ethier (1979) and Krugman (1979, 1980)--namely, that economies of scale may be an important reason for trade.

In this theory the benefits of trade are due to increasing returns from production on a larger scale. If a company can expand its market by exporting its output to foreign countries and thereby achieve a more efficient level of production, then there will be gains. The potential for such gains will lead to specialization not between industries but within industries. So there will be intraindustry trade, and since specialization does not

depend on national differences in productivity or factor abundance, the pattern of trade cannot be predicted. Only the volume of trade can be predicted, based on optimum levels of production.

According to Krugman, trade between similar countries that is motivated by increasing returns to scale creates no serious problems of income distribution because the countries already have similar factor prices. In fact, he showed that in an economy with two factors, one scarce and one abundant, both gain from such trade. He further suggested that these gains might offset the losses incurred by the scarce factor from trade that is motivated by differences in factor abundance. In any case, the gains from trade would exceed the losses.

Main predictions. At this point it will be useful to summarize the main predictions of trade theory regarding the effects of trade on income distribution, wages, and employment.

(1) Trade will redistribute income from one factor of production to another (Ricardo 1817).

(2) Trade will redistribute income in the trading sector, since it will hurt the factor that is specific to imports and benefit the factor that is specific to exports (Jones 1971; Samuelson 1971).

(3) Trade will increase wage dispersion in the trading sector, since it will decrease the relative price of

the labor factor used intensively in imports and increase the relative price of the labor factor used intensively in exports (Heckscher 1919; Ohlin 1933).

(4) Trade will tend to equalize wages between nations, assuming that they use the same production techniques (Heckscher 1919; Ohlin 1933; Samuelson 1948, 1949), and if labor in a country is relatively scarce, then trade will reduce real wages (Stolper and Samuelson 1941).

(5) Trade will shift employment within the trading sector from industries that have import competition to industries that have export success (Smith 1776; Heckscher 1919; Ohlin 1933).

(6) Trade that is motivated by increasing returns to scale will have no significant effects on income distribution (Krugman 1990).

Some Real-World Conditions

The theories of international trade depend on some underlying assumptions, which may or may not be valid in the real world. Generally, they assume balanced trade, flexible wages, static productivity, similar production techniques between nations, immobile capital between nations, mobile labor within nations, and full employment. Also, the theories focus only on the trading sector of an economy, while ignoring the possible effects of trade on wages and employment in the nontrading sector.

In order to apply trade theory to the problem of income inequality, it is necessary to examine some real world conditions that may undermine the assumptions of the theory and thereby modify its predictions regarding the effects of trade on wages and employment.

Trade deficits. International trade theory assumes that trade is balanced, at least in the long run. If trade is balanced, and if exports and imports use the same number of workers for a given dollar value of production, then trade creates as many jobs as it destroys. But if there is a trade deficit, then trade creates fewer jobs than it destroys, and the displaced workers from the trading sector must either be absorbed by the nontrading sector or remain jobless. In that case, the employment shift predicted by trade theory will be accompanied by a shift from the trading sector to the nontrading sector or into a pool of the unemployed.

Since the United States began to experience a chronic trade deficit, trade has created fewer jobs than it has destroyed. According to data from various studies, during the early 1980s trade destroyed about 3 million net jobs in the manufacturing sector (Stone and Sawhill 1987; Tyson and Zysman 1988; Dickens and Lang 1988a; Duchen and Lange 1988; Office of Technology Assessment 1988). During the same period the service sector created about 9 million net jobs (Bureau of Labor Statistics 1988). This sector absorbed

most of the workers who had been displaced from manufacturing (Horvath 1987). So as a result of the trade deficit, there was an employment shift from the trading sector to the nontrading sector.

Such a shift would have a different effect on income inequality than the shift that is predicted by trade theory. Since jobs destroyed by imports tend to pay lower wages than jobs created by exports (Tyson and Zysman 1988), a shift within the trading sector would increase employment at the middle-wage level and thereby decrease income inequality. In contrast, since jobs destroyed by imports tend to pay higher wages than jobs created by services (Waldstein 1989), a shift from the trading sector to the nontrading sector would increase employment at the low-wage level and thereby increase income inequality. At the same time, the increase in the supply of labor available for jobs in the nontrading sector as a result of the trade deficit would depress wages in this sector and thereby increase wage dispersion between the trading and nontrading sectors, intensifying the effect of the employment shift on income inequality.

It could be argued that the emergence of the trade deficit had a one-time effect on the labor market and that as long as the deficit is not growing, it has no further negative effect. It could also be argued that in the long run U.S. trade will balance and that as it moves toward equilibrium, the negative effect of the deficit will be

reversed. The problem with these arguments is that as long as the trade deficit persists the labor market will carry its effect, and in the meantime there is no evidence that U.S. trade is moving toward equilibrium.

Sticky wages. In trade theory wages rise or fall in response to changes in demand for labor, facilitating the adjustment process. In reality, however, wages may be sticky. Also, wages may be stickier in some industries than in others (e.g., because of higher unionization). Whatever the cause, the differential stickiness of wages will affect both wage structure and employment structure. For example, if wages are stickier in the trading sector than in the nontrading sector, then industries in the former will adjust to foreign competition by reducing employment instead of wages, and there will be an employment shift from the trading sector to the nontrading sector.

One cause of sticky wages is union policy to maintain or increase wages whether or not an industry is prospering. Manufacturing industries are more likely to be unionized than service industries (Bluestone and Harrison 1988). Wages in unionized industries are relatively sticky (Freeman 1980; Belman and Heywood 1990), and they are relatively unresponsive to foreign competition (Staiger 1988; MacPherson and Stewart 1990). So because of higher unionization, wages would be stickier in the trading sector than in the nontrading sector.

Another cause of sticky wages is the willingness of employers to pay relatively high wages because of efficiency considerations (i.e., to motivate, retain, and recruit workers) and because of rent sharing (Katz 1986). Studies have indicated that equivalent workers in different industries receive different wages for such reasons irrespective of union demands (Dickens and Katz 1986; Murphy and Topel 1987; Katz and Summers 1989). Some researchers have concluded that wage differentials between industries that have import competition and industries that have export success are at least partly due to efficiency wages and/or rent sharing (Katz and Summers 1988; Partridge 1991). If they are correct, then wages would be stickier in export industries than in import industries, affecting both wage structure and employment structure in the trading sector.

Changes in productivity. Productivity is generally defined as the relationship between output and input. It is usually expressed in terms of labor input since this relationship affects wages and ultimately the standard of living in terms of the goods and services available to workers. In classical theory trade depends on differences in productivity between nations, which are translated into differences in wages. In factor proportions theory trade depends on differences in factor abundance between nations, which are also translated into differences in wages.

Whatever the cause for differences in wages, trade depends on commodity prices, which in turn depend on wage and productivity levels.

In trade theory productivity is static over time. In reality, however, there may be changes in productivity that affect trade. For example, a country with lower productivity than the United States will be able to sell at a lower price as long as its wages are sufficiently lower, all other things being equal. In order to compete, U.S. firms must either lower their wages or raise their productivity. Mainly, they have adopted the strategy of raising productivity since there are constraints to lowering wages (e.g., unions and government regulations). But higher productivity means relatively fewer jobs. While manufacturing output as a percentage of GNP has not changed significantly since 1950, the percentage of employment in manufacturing has dropped precipitously (Aggarwal 1991).

The implication is that trade may indirectly destroy jobs in the trading sector because of pressures from foreign competition to increase productivity. At the same time, in the absence of such pressures productivity may increase more slowly in the nontrading sector. The result of this divergence in productivity growth would be an employment shift from the trading sector to the nontrading sector as well as greater wage dispersion between them, since wages ultimately depend on productivity.

For many years productivity has increased at a greater rate in the manufacturing sector than in the service sector (Bureau of Labor Statistics 1994b). Some researchers have suggested that differences in productivity growth between sectors have been a major cause of changes in wage structure (Bell and Freeman 1991; Katz and Murphy 1992; Lawrence and Slaughter 1993) and changes in employment structure (Krueger 1980; Bluestone and Harrison 1988; Thurow 1989), so a case has been presented for the role of productivity in the trend toward greater income inequality. A relationship between productivity growth and foreign competition has not been established, but a model of how trade affects wages and employment should include a dynamic role for productivity.

Capital mobility. Classical trade theorists recognized that the movement of capital to a foreign country will result in the creation of fewer jobs at home. They believed, however, that owners of capital prefer to invest in the home country because of the greater perceived risk of investing in a foreign country, so these theorists assumed that capital is essentially immobile between nations. Factor proportions theorists were comfortable with this assumption since they regarded trade as a substitute for factor mobility and they concluded that both would have the same effects on commodity prices, factor prices, and income distribution. In their view capital mobility is stimulated by trade barriers, and trade is stimulated by capital barriers.

A contrary view is held by some current theorists, who believe that trade is stimulated by capital mobility. Drucker (1983, 1986) suggested that capital mobility is the driving force behind global economic integration. In particular, he emphasized the trend toward global economic integration by stages of the production process within multinational firms. As evidence of this trend, Krugman and Obstfeld (1991) pointed out that half of U.S. imports are transactions between affiliates of multinational firms, which have rationalized their production among different locations around the world. Encarnation (1992) showed that trade between the United States and Japan is largely determined by investment patterns. He calculated that two-thirds of U.S. exports to Japan are transactions between affiliates of multinationals. He argued that investments by Japanese in the United States have given them control of trade between the two countries.

Porter (1992) showed that from 1983 to 1989 foreign direct investment worldwide increased four times as rapidly as merchandise trade, supporting the hypothesis that capital mobility has become an important agent for change. Branson and Jaffee (1990) attributed the recent increase in capital mobility to greater availability of information resulting from technological advances in data processing and communications. Their explanation is consistent with the basic reason given by earlier theorists all the way

back to Smith and Ricardo for the immobility of capital between nations--the perceived greater risk of investing in a foreign country. The operative word of course is "perceived." With better information investors should have a better idea of the risk involved in moving their capital to a foreign country and should therefore no longer require such a large risk premium. Whether or not this hypothesis fully explains the recent upsurge in capital mobility, the flow of capital between nations before the 1980s was only a trickle compared with what it is now.

If capital is mobile between nations, then the employment shift predicted by trade theory may not occur. For example, if owners of capital that is employed in labor-intensive industries in the United States are unable to compete with imports, they will not necessarily move their investment into domestic capital-intensive industries, which presumably have a comparative advantage. Instead, they may move their investment into labor-intensive industries in foreign countries where labor is more abundant and therefore less expensive. The result of such capital mobility would be a net destruction of jobs in the United States. Indeed, some researchers have proposed that international capital mobility is a major cause of job destruction (Bluestone and Harrison 1982; Culbertson 1986; Mishel and Simon 1988; Tyler 1991). They have argued that the outflow of capital to foreign countries in order to

produce goods that were previously produced in the United States is deindustrializing its economy. Since these goods are then either imported or no longer exported, capital mobility affects trade. So a model of how trade affects wages and employment should include a role for international capital mobility, which trade theory has largely ignored.

Differences in production techniques. Classical theory assumed that countries use different techniques of production, which implies that technology is immobile between nations, whereas factor proportions theory assumed that countries use the same techniques, which implies that technology is perfectly mobile. The product life cycle theory of Vernon (1966) seems closer to reality in assuming that there are restrictions on the flow of technology between nations that result in temporary differences in their production techniques. Over the stages of a product's life its technology is transferred and modified until it becomes available in developing countries. In this theory a main channel of technology transfer is foreign direct investment (Aggarwal 1991). Technology flows with capital from developed countries to developing countries, its use controlled by multinational corporations. Of course, technology also spills out of the main channel into the hands of competitors, who refine and improve it. Wherever it ends up, the volume of technology transfer is expanded by capital mobility, which reduces the impediments to factor price equalization.

Though the diffusion of technology may be accelerating, there are still lags between the introduction of a new technology in one country and its routine use in other countries. So at any given time countries may use different production techniques in some industries, while using the same techniques in others. Industries that use the same techniques (common technology) will have greater import competition than industries that use different techniques (high technology). The effect will be wage dispersion between common-tech industries and high-tech industries.

Various studies have indicated that the United States has a competitive advantage in high technology goods and a competitive disadvantage in common technology goods (Leamer 1984; Lawrence 1984b; Arndt and Bouton 1987). Further, the importance of technology in the competitive position of the United States may be increasing, as suggested by Maskus (1983). His study, which examined the changes in factor content of U.S. traded goods during the period 1958-76, confirmed the findings of other researchers that the labor content of imports and the technology content of exports were increasing (Mitchell 1975; Stern and Maskus 1981). If such changes in the factor content of traded goods affect factor prices, as indicated by Deardorff and Staiger (1987), then they must contribute to wage dispersion between industries that have import competition and industries that have export success.

Labor immobility. In trade theory labor is mobile within nations, so as one industry contracts and another expands because of trade, workers will move from one to the other. Problems with this assumption arise when labor is divided into subfactors, reflecting different qualities or levels of skill. If the workers who lose their jobs because of imports are unskilled, then they will not be able to move easily into jobs that require certain skills. Retraining will be necessary, and even then some workers may simply not have the capacity to develop the required skills (e.g., not everyone is capable of becoming a computer programmer). What happens to such workers? In theory they could lower their wage demands to a level at which they could be employed in their former jobs. But that would mean earning third-world wages, which would not be enough for them to subsist in a first-world country. In practice they might find employment in the nontrading sector at wages that are lower than they received before but high enough for them to subsist.

In the model of Samuelson (1971) and Jones (1971) labor is the mobile factor, whereas land and capital are specific to certain industries. The factor specific to imports loses and the factor specific to exports gains. The effect on labor is ambiguous. But if unskilled labor were specific to imports and skilled labor were specific to exports, with capital the mobile factor, the effects on labor would

presumably be unambiguous: the unskilled workers would lose from trade and the skilled workers would gain. In the short run such a model might be closer to reality. In the long run there may still be problems with the assumption of labor mobility. For a hundred years people at the bottom of U.S. society found jobs in manufacturing that required few or no skills, and from such jobs either they or their children were able to move into jobs that required certain skills or education. If the former are eliminated by trade, then what type of jobs will provide the first rung in the ladder of upward mobility?

Some researchers have used segmented labor market theory to examine the effects of labor immobility on wages and employment (Bulow and Summers 1986; Davidson and Reich 1988; Dickens and Lang 1988b; Burtless 1990). In this theory the labor market is segmented into primary and secondary markets, with restricted mobility between them. The primary market, which is characterized by relatively high wages, favorable working conditions, and employment stability, consists of structured internal labor markets in which wage determination is partly sheltered from external supply and demand conditions. The secondary market, which is characterized by low wages, poor working conditions, and employment instability, operates in a more competitive environment in which wages are more responsive to changes in external conditions. The relatively protected nature of the

primary market leads to diverging wages between the two markets in periods of increased competition and structural change. Because of the restricted mobility between the primary and secondary markets, the labor market does not clear as trade theory assumes, so when there is foreign competition the unprotected secondary market responds more than the primary market. The effects are wage reductions and/or employment reductions in the secondary market, which already pays lower wages than the primary market. Also, since the secondary market includes low-skill jobs in both the trading sector and the nontrading sector, there is more labor mobility between these sectors at the secondary level than there is within the trading sector between the secondary and primary levels. In this way the effects of international trade on wages and employment spill over into the nontrading sector.

Unemployment. Trade theory assumes full employment, at least in the long run. In reality, however, unemployment may increase because of trade. If a country has a trade deficit, then trade will increase unemployment. But even if trade is balanced and imports are more labor-intensive than exports, then trade will increase unemployment. In both cases, unless the unemployed workers are compensated at the full amount of their former wages, income inequality will increase. This effect would not be captured by measures of income inequality that are based on industry

wages and employment, since unemployed people are not included. But it would be captured by measures of income inequality that are based on the income of households, families, or individuals.

As previously noted, studies have shown that trade destroyed about 3 million net jobs in the U.S. manufacturing sector during the early 1980s. While most of the displaced workers were absorbed by the nontrading sector, some of them were unemployed for long periods (Horvath 1987). So there is no doubt that trade contributed to unemployment during this period. Indeed, trade may be one of the factors that has contributed to the increase in the natural unemployment rate since the mid-1970s, which Weiner (1993) suggests is now 6 1/4 percent and may soon rise to 6 1/2 percent. If so, then the gains from trade have been at least partly offset by job losses. Whether there are net gains depends on the extent of unemployment. If a relatively small number of displaced workers are unable to find reemployment, then the gains of trade should outweigh the losses. But if there is widespread unemployment, then the losses could outweigh the gains, as Keynes (1933) pointed out.

Modified predictions. The primary effects of these conditions on wage structure and employment structure are reinforcing. Together, they would modify the predictions of trade theory in the following ways:

(1) Trade will increase wage dispersion in the trading sector, since industries that use common technology will have greater import competition than industries that use high technology, which will affect relative wages between the two groups (differences in production techniques).

(2) Trade will increase wage dispersion between the trading sector and the nontrading sector (trade deficits, sticky wages, changes in productivity, capital mobility, labor immobility).

(3) Trade will shift employment between the trading sector and the nontrading sector (trade deficits, sticky wages, changes in productivity, capital mobility, labor immobility).

(4) Trade may increase unemployment (trade deficits, sticky wages, capital mobility, labor immobility).

These effects of trade on wage structure and employment structure would all increase income inequality.

Empirical Studies

Before this study a number of empirical studies examined the effects of international trade on wage structure and/or employment structure. In these studies the usual trade variables were measures of import competition or export success, and the usual labor market variables were industry wages and industry employment.

Generally, the studies found that before 1980 trade had little effect on wages or employment (Krueger 1980; Grossman 1982; Lawrence 1983; Stone and Sawhill 1987; Dickens 1988), but that in the early 1980s trade began to have significant effects on the labor market (Lawrence and Lawrence 1985; Rosen 1986; McKenzie 1987; Stone and Sawhill 1987; Dickens 1988; Parsons 1988; Scott 1988; Tyson and Zysman 1988; Vroman and Abowd 1988; Katz and Summers 1989; Brauer 1990; MacPherson and Stewart 1990; Partridge 1991; Katz and Murphy 1992; Murphy and Welch 1992; Revenga 1992; Singleton 1992). Again, the effects on wages and employment will be considered separately.

Effects of trade on wages. These studies examine the relationship between wages and measures of import competition or export success. Their main findings are as follows:

(1) Industry wages were related inversely to import competition (Lawrence and Lawrence 1985; Katz and Summers 1989; Vroman and Abowd 1989; Brauer 1990; MacPherson and Stewart 1990; Freeman and Katz 1991; Partridge 1991).

(2) Industry wages were related directly to export success (Katz and Summers 1989).

(3) Wage dispersion between unskilled workers and skilled workers increased with import competition (Murphy and Welch 1991; Katz and Murphy 1992).

(4) Trade had greater effects on wages in industries that were low-skill (Katz and Summers 1988), labor-intensive (Dickens 1990), low-wage (Brauer 1990), and common-tech (Partridge 1991).

The first three findings agree with the prediction that trade will decrease the relative price of the labor factor used intensively in imports and increase the relative price of the labor factor used intensively in exports. Since industries that have import competition use higher proportions of unskilled workers than industries that have export success (Katz and Summers 1988), the changes in relative labor factor prices should be reflected by industry wages.

The finding that trade had greater effects on wages in low-skill, labor-intensive industries is also consistent with trade theory, according to which the United States should have a competitive disadvantage in such industries because it has a relative scarcity of unskilled labor. With their share of the domestic market reduced by import competition, these industries have relatively less product demand and therefore have relatively less labor demand. The result is relatively lower wages for their workers.

The finding that trade had greater effects on wages in low-wage industries is not only consistent with trade theory but is also detrimental to the argument for a reverse causality between wages and imports (i.e., that high-wage

industries are more vulnerable to imports). As Rhoades (1984) explained, U.S. industries with the highest import penetration tend to be labor-intensive, so even though they have lower wages than the average U.S. manufacturing wage, they are overwhelmed by the competitive advantage of countries that have much more abundant labor.

The finding that trade had greater effects on wages in common-tech industries supports the modified prediction that trade will increase wage dispersion in the trading sector, since industries that use common technology will have greater import competition than industries that use high technology.

Effects of trade on employment. These studies examine the relationship between employment and measures of import competition or export success. Their main findings are as follows:

(1) Industry employment was related inversely to import competition (McKenzie 1987; Stone and Sawhill 1987; Parsons 1988; Scott 1988; Brauer 1990; Abowd and Lemieux 1991; Freeman and Katz 1991; Singleton 1992).

(2) Trade had greater effects on employment in industries that were low-skill (Dickens 1990), labor-intensive (Rosen 1986; Dickens 1988), and low-wage (Dickens 1988; Tyson and Zysman 1988).

(3) Trade had a greater effect on employment than on wages (Revenga 1992).

The first finding agrees with the prediction that trade will shift employment within the trading sector from industries that have import competition to industries that have export success.

The finding that trade had greater effects on employment in low-skill, labor-intensive, low-wage industries supports the modified prediction that trade will shift employment between the trading sector and the nontrading sector because of real-world conditions (trade deficits, sticky wages, changes in productivity, capital mobility, differences in production techniques, and labor immobility).

The finding that trade had a greater direct effect on employment than on wages also supports this modified prediction. The explanation was that wages are sticky in the trading sector, so U.S. manufacturing industries are more likely to respond to import competition by laying off workers than by cutting wages.

With two exceptions, these studies were limited to the direct effects of trade on employment. McKenzie (1987) found that imports had an indirect effect on employment in the textile industry through competitive pressures to increase productivity, and Parsons (1988) found that imports had a similar indirect effect on employment in the apparel industry. These findings further support the modified prediction of employment shifts.

Gaps in the literature. Though many aspects of the problem had been examined, there were still gaps in the literature regarding the effects of international trade on income inequality.

(1) Most of the previous empirical studies were concerned with the effects of trade on wages, and though a few included its effects on both wages and employment, there had not been a comprehensive study of its effects on income inequality. There was a need for such a study, which would test specific hypotheses regarding the effects of trade on wage structure and employment structure--the labor market variables that determine income inequality.

(2) Most of the previous studies considered only the direct effects of trade on wages and employment, ignoring or only suggesting the indirect effects. In particular, the role of productivity had not been adequately examined. Since productivity affects both wage structure and employment structure, there was a need for a study that examines the relationship between foreign competition and productivity growth as a vehicle by which trade may have indirectly affected income inequality.

(3) Virtually all of the previous studies considered only the effects of trade on wages and employment in the trading sector (i.e., manufacturing), ignoring or only suggesting the possible effects of trade on wages and employment in the nontrading sector. Since the nontrading

sector represents a large share of the labor market, there was a need for a study that includes it.

(4) With a few exceptions, the published studies did not go beyond 1987. Since U.S. trade may be shifting toward developing countries where labor is extremely abundant, there was a need for a study that updates the previous research in order to capture the effects of this change.

Summary

Income inequality in the United States, which decreased during the 1960s and 1970s, began to increase around 1979. The proximate causes of this reversal in the trend toward greater income equality were changes in wage structure and changes in employment structure.

Wage dispersion between skilled and unskilled workers increased both across industries and within industries, reflecting an increase in the wage premium for education and experience. Wage dispersion also increased between industries and between sectors of the economy. At the same time, wage dispersion increased more within the service sector than within the manufacturing sector.

Employment shifted from middle-wage jobs to low-wage jobs, from the manufacturing sector to the service sector, and from a sector with less wage dispersion to a sector with more wage dispersion.

Researchers initially proposed a variety of ultimate causes for these changes in wage structure and employment structure, but they eventually narrowed the list of major causes to technology, productivity, and international trade. Some researchers indicated possible relationships between these causes, all of which would change relative demand for the labor factors of production.

For those who believe that international trade is an ultimate cause of growing income inequality, the general hypothesis is that trade affects income inequality through its effects on wage structure and employment structure. Specific hypothesis regarding the effects of trade on these two labor market variables are derived from international trade theory.

With respect to wages, the theory predicts that trade will decrease the relative price of the labor factor used intensively in imports and increase the relative price of the labor factor used intensively in exports. The effect will be wage dispersion between labor factors in the trading sector.

Though the theory predicts that trade will equalize wages between nations, industries that use the same production techniques as in other countries (common technology) will have greater import competition than industries that use different techniques (high technology). The effect will be wage dispersion between common-tech industries and high-tech industries.

Wage structure may be affected by differences in productivity growth (as well as by sticky wages and labor immobility). Industries in the trading sector may respond to import threats and export opportunities by increasing productivity at greater rates than industries in the nontrading sector, which are not exposed to foreign competition. Since wages ultimately depend on productivity, the effect will be wage dispersion between the trading sector and the nontrading sector.

With respect to employment, trade theory predicts that employment will shift from industries that have import competition to industries that have export success. Since wages should be higher in the latter, the effect will be higher average wages in the trading sector.

Employment structure may be affected by differences in productivity growth (as well as by trade deficits, sticky wages, capital mobility, and labor immobility). If industries in the trading sector respond to import threats and export opportunities by increasing productivity, then relatively fewer jobs will be created by that sector. Workers who might otherwise have found jobs in the trading sector will then have to seek employment in the nontrading sector. If the latter is growing along with the economy and has lower rates of productivity growth than the trading sector, then employment will shift to the nontrading sector. By increasing the relative supply of labor available to

the latter, this shift will intensify the effect of differences in productivity growth on wage dispersion between the trading and nontrading sectors.

Before this study a number of empirical studies examined the effects of international trade on wage structure and/or employment structure. In these studies the usual trade variables were measures of import competition or export success, and the usual labor market variables were industry wages and industry employment.

Generally, the studies found that trade had little effect on wages or employment before 1980, but that in the early 1980s it began to have significant effects.

With respect to wages, the studies found that industry wages were related inversely to import competition and directly to export success; that wage dispersion between unskilled workers and skilled workers increased with import competition; and that trade had greater effects on wages in industries that were low-skill, labor-intensive, low-wage, and common-tech.

With respect to employment, the studies found that industry employment was related inversely to import competition and that trade had greater effects on employment in industries that were low-skill, labor-intensive, and low-wage. One study found that because wages were sticky in the trading sector, trade had greater effects on employment than on wages. Two studies found that employment was

affected by increases in productivity that were responses to import competition.

Though many aspects of the problem had been examined, there were important gaps in the literature which this study helped to fill. It tested specific hypotheses regarding the effects of trade on wage structure and employment structure--the labor market variables that determine income inequality. It examined the relationship between productivity growth and foreign competition as a possible vehicle by which trade may have indirectly affected income inequality. It considered the effects of trade on wages and employment in both the trading and nontrading sectors. And it included data through 1992.

CHAPTER 3

METHODOLOGY

In this chapter the methodology of the study will be explained. Two different approaches to the problem will be compared, and the rationale will be given for the one used. The commonly used measures of income inequality will be reviewed, and a rationale will be given for the measure used. A general model of the relationships between income inequality, the labor market variables, and the trade variables will be presented. Specific models of how trade affects wage structure and employment structure will then be presented. With these models, specific hypotheses and their testable implications will be generated. The sources of data and the methods of data analysis will be described in detail.

Two Approaches

Studies of the effects of trade on wages and employment have used either a partial equilibrium approach (Krueger 1980; Lawrence and Lawrence 1985; Stone and Sawhill 1987; Katz and Summers 1989; MacPherson and Stewart 1990; Freeman and Katz 1991; Partridge 1991; Revenga 1992) or a general equilibrium approach (Leontief 1956; Baldwin 1971; Leamer

1974; Grossman 1982; Lawrence 1983; Maskus 1983; Deardorff and Staiger 1987; Murphy and Welch 1991; Katz and Murphy 1992; Wood 1994). Both approaches have advantages, and both have disadvantages.

Partial equilibrium. This approach examines the sources of change in wages and employment. It uses two simple models: one in which wages are related to product demand and productivity, and the other in which employment is related to product demand and productivity. It usually focuses on product demand and assumes that productivity is unrelated to trade (Dickens 1988; Wood 1994). It decomposes the sources of change in product demand, using a model in which product demand is related to domestic demand, exports, and imports. It shows how these three sources of change affect wages and employment. A typical study examines a representative group of industries in the trading sector in order to determine the effects of trade on industry wages and industry employment.

The partial equilibrium approach has the following advantages:

(1) It uses simple models.

(2) It uses industries as units of analysis, for which data on variables (e.g., wages, employment, trade, production, and productivity) are readily available.

(3) It uses objectively defined variables (e.g., industry employment).

(4) It uses variables that are measured by comparable standards (e.g., industry production and industry trade, which are both measured in gross flows).

(5) It uses disaggregated data (e.g., industry production), which may reveal relationships that would be obscured by aggregated data.

On the other hand, the partial equilibrium approach has the following disadvantages:

(1) It ignores indirect effects (e.g., the effects of trade on wages and employment through its effect on productivity).

(2) It ignores broad effects (e.g., the effects of trade on wages and employment in the nontrading sector).

General equilibrium. This approach examines the factor content of trade. It uses complex models in which factor price is related to factor supply and demand. It estimates the factor requirements (e.g., skilled and unskilled labor) for production of exports and imports. From net exports, it infers the effects of trade on the demand for specific factors. There are two main types of studies: those which perform an input-output analysis of related industries (e.g., textiles and apparel), and those which perform a factor content analysis of the trading sector, which includes inputs from the nontrading sector.

The general equilibrium approach has the following advantages:

(1) It examines indirect effects.

(2) It examines broad effects.

On the other hand, the general equilibrium approach has the following disadvantages:

(1) It uses complex models.

(2) It uses factor contents of trade as the units of analysis, for which data on variables (e.g., materials inputs, labor inputs, and capital inputs) are not readily available.

(3) It uses subjectively defined variables (i.e., skilled and unskilled labor).

(4) It uses variables that are not measured by comparable standards (e.g., factor content, which is measured in value added, and trade, which is measured in gross flows).

For this study, it was decided to use a partial equilibrium approach, since the general equilibrium approach presented serious methodological difficulties, whereas the disadvantages of the partial equilibrium approach could be partly overcome by expanding the focus of the research. In particular, the indirect effects of trade on wages and employment through its effect on productivity could be examined by including productivity models, and the broader effects of trade on wages and employment in the nontrading sector could be examined by using two-sector models.

Measures of Income Inequality

The four commonly used measures of income inequality are shares of aggregate income, the Gini index, the variance

of the logarithm of earnings, and the coefficient of variation of earnings (Fields 1987; Braun 1988; Davidson and Reich 1988; Ryscavage and Henle 1990; Cutler and Katz 1992; Levy and Murnane 1992).

Shares of aggregate income. In this measure families or households are ranked from lowest to highest on the basis of income and then divided into equal population groups, typically quartiles, quintiles, or deciles. The aggregate income of each group is then divided by the overall aggregate income to derive shares (Bureau of the Census 1993). The two independent variables are families or households and annual income. There are more households than families since the former variable consists of families plus individuals living alone or with unrelated individuals.

Gini index. This measure summarizes income inequality in a single statistic which ranges from 0 (perfect equality) to 1 (perfect inequality). Perfect equality would occur if all individuals had identical income, and perfect inequality would occur if only one individual received all the income. The Gini index is derived from the Lorenz curve, which shows the relationship between the cumulative percentage of total income, measured on the vertical axis, and the cumulative percentage of individuals, measured on the horizontal axis (Ryscavage and Henle 1990). Dividing the area between the diagonal line emanating from the origin and the Lorenz curve by the total area beneath the diagonal yields a Gini index.

The independent variables are individuals, families, or households, and annual income.

Variance of the log of earnings. This measure has been used mainly to examine income inequality between labor factors or between industries (Dooley and Gottschalk 1984; Harrison, Tilly, and Bluestone 1986; Blackburn and Bloom 1987; Davidson and Reich 1988; Bluestone 1990; Bound and Johnson 1992; Burtless 1993). For this measure the independent variables are the number of employees per sector and the log of sector average income per employee. The calculation of the variance is weighted by the number of employees per sector, so the results should be similar to those obtained by the Gini index for individuals.

Coefficient of variation of earnings. This measure has been used for the same purpose as the variance of the log of earnings (Blackburn and Bloom 1985; Davidson and Reich 1988; Leonard and Jacobson 1990; Davis and Haltiwanger 1991). The independent variables are the number of employees per sector and the sector average income per employee. The calculation of the variance is weighted by the number of employees per sector, and the resulting standard deviation is divided by the mean to obtain the coefficient of variation.

While these measures have similar meanings, they have different strengths and weaknesses. The shares of aggregate income measure is the most descriptive of what is actually

happening to income distribution. For example, it may show that the pattern of change is a gain in income share for the top quintile of households and a loss for the bottom quintile, indicating that the rich are getting richer and the poor are getting poorer. The weakness of this measure is that the results are unwieldy and difficult to compare from year to year. The Gini index overcomes this weakness, showing the change in income inequality in a single statistic. It is, however, more responsive to changes in the middle of the earnings distribution than in the lower or upper tails (Braun 1988; Ryscavage and Henle 1990). Also, it does not show which part of the distribution may be causing an increase or decrease in inequality. The Bureau of the Census uses both the shares of income measure and the Gini index in its reports on income distribution, combining the strengths of the two approaches.

The variance of the log of earnings and the coefficient of variation of earnings are useful for relating changes in income inequality to changes in wage structure and changes in employment structure. The two measures differ in that the variance of logs gives greater weight to changes in the lower tail of the distribution but is less sensitive to changes in the upper tail (due to the compression of the logarithm), whereas the coefficient of variation is equally sensitive to changes in both tails (Braun 1988; Davidson and Reich 1988). The weakness of these measures is that they

are not as descriptive as the shares of aggregate income measure.

Despite their differences, the four commonly used measures of income inequality all reflect changes in two variables: wage structure and employment structure (Braun 1988). Wage structure is defined as wage distribution by labor factor, occupation, industry, or sector, and employment structure is defined as employment distribution by the same categories. Each of these variables can affect income inequality independently of the other. For example, if there is a change in wage distribution between industries without any change in relative employment, or if there is a change in employment distribution between industries without any change in relative wages, such changes will be reflected by all four measures of income inequality.

The coefficient of variation of earnings was suitable for this study because it is completely determined by labor market variables (wage structure and employment structure) that can be related to trade variables. Also, it has the advantage of being equally sensitive to changes in both the upper and lower tails of income distribution.

Research Hypotheses

The general hypothesis is that *international trade affects income inequality through its effects on wage structure and employment structure*. This hypothesis assumes

a transitive relationship between three sets of variables: income inequality, labor market variables, and trade variables. Their relationship was examined using partial equilibrium models.

Income inequality model. As measured by the coefficient of variation of earnings, income inequality is completely determined by wage structure and employment structure. The relationship between income inequality and these two labor market variables can be formally expressed as $V_K = f(V_W, V_E)$, where V_K is income inequality, V_W is wage structure, and V_E is employment structure. In this model wage structure is defined as wage distribution by industry, and employment structure is defined as employment distribution by industry, so $V_W = f(W)$ and $V_E = f(E)$, where W is the industry wage and E is the industry employment.

The use of industry variables instead of labor factor variables for wages and employment can be justified on theoretical and empirical grounds. According to factor proportions theory, industries that have import competition and industries that have export success use different proportions of the labor factors of production (Hecksher 1991; Ohlin 1933). In this respect, the theory is supported by considerable empirical evidence (Leontief 1956; Baldwin 1971; Branson and Junz 1971; Leamer 1974; Maskus 1983; Dickens and Lang 1988a; Katz and Summers 1988; Brauer 1990;

Murphy and Welch 1991; Lawrence and Slaughter 1993). So changes in the relative prices of labor factors should be reflected by changes in relative industry wages, and changes in the relative use of labor factors should be reflected by changes in relative industry employment.

Another reason for using industry wages and employment is that they should reflect differences in industry productivity growth, which has been proposed as a major cause of the trend toward greater income inequality (O'Neill 1987; Tyson and Zysman 1988; Bell and Freeman 1991; Katz and Murphy 1992; Lawrence and Slaughter 1993). Productivity growth in turn reflects both factor proportions and technology, so this should be a useful variable for understanding changes in wage structure and employment structure.

Finally, there is a practical reason for using industry variables instead of labor factor variables. They have been used by most studies of the effects of trade on wages and employment, so the results of this study are comparable with the results of those studies.

General model. In the general model the transitive relationship between income inequality, the labor market variables, and the trade variables can be formally expressed as $V_K = f(V_W, V_E) = f(T_X, T_Y)$, where T_X and T_Y are appropriate trade variables. The hypothesis is that *international trade affects income inequality through its effects on wage*

structure and employment structure. This model assumes that wage structure and employment structure transmit the effects of the trade variables to income inequality, but it does not specify how trade affects the labor market variables. So wage models and employment models are required in order to generate testable hypotheses.

Wage models. Since it was established that $V_W = f(W)$, where V_W is wage structure and W is the industry wage, the wage models were used to examine relationships between industry wages and trade variables.

In a basic model wages are related directly to both product demand and productivity. This relationship can be expressed as $W = f(S,P)$, where W is the industry wage, S is industry shipments, and P is industry productivity. Wages are affected by trade through its effects on product demand and productivity. Product demand is decomposed in the equation $S = D - M + X$, where D is domestic demand, M is imports, and X is exports. Productivity is related to trade in the equation $P = f(M,X)$.

In one specific wage model, which is based on factor proportions theory, wages in the trading sector are related to import competition and export success. This relationship can be expressed as $W = f(M,X)$. The hypothesis is that *trade performance affects wages in the trading sector through its effect on product demand.* An implication is

that industry wages will decrease with import competition and increase with export success. A second implication is that wage dispersion between industries that have import competition and industries that have export success will increase over time. A third implication is that wage dispersion in the trading sector will increase with trade.

As measures of import competition and export success, most researchers have used import intensity and export intensity (O'Neill 1987; Tyson and Zysman 1988; Brauer 1990; MacPherson and Stewart 1990; Partridge 1991; Katz and Murphy 1992; Revenga 1992). Import intensity (M_I) is usually defined as M/(S + M), where M is industry imports and S is industry shipments. Export intensity (X_I) is usually defined as X/S, where X is industry exports.

The use of import intensity and export intensity as trade variables has been criticized by Lawrence and Slaughter (1993), who argued that they are not appropriate because the underlying theory (Stolper and Samuelson 1941) is predicated on relative prices of imports and exports. Against their position, however, it can be argued that price alone may not be a good indicator of import competition or export success. Import competition may be due to product quality, and export success may be due to product innovation, in which cases price variables would not be as useful as intensity variables for indicating the effects of trade on product demand. In short, it can be argued that

import intensity and export intensity will capture any effects of price, whereas the reverse will not necessarily occur. There is also a practical reason for using intensity variables. They have been used by most studies of the effects of trade on wages and employment, so the results of this study are comparable with the results of those studies.

In another specific wage model, which adapts factor proportions theory to a real world condition (i.e., differences in production techniques), the effect of trade on wages depends on technology. The underlying logic of this model is that industries that use common technology will have greater import competition than industries that use high technology, which will affect relative wages between the two groups. The relationship between wages and type of technology can be expressed as $W = f(C)$, where C is the technology classification according to Lawrence (1984b) and Partridge (1991). The hypothesis is that *technology affects wages in the trading sector through its effect on trade performance*. An implication is that import competition for industries that use common technology will increase in relation to industries that use high technology, and therefore wages in the former will decrease in relation to wages in the latter. A second implication is that wage dispersion between common-tech industries and high-tech industries will increase with trade.

Employment models. Since it was established that $V_E = f(E)$, where V_E is employment structure and E is industry employment, the employment models are used to examine relationships between industry employment and trade variables.

In a basic model employment is related directly to product demand and inversely to productivity. This relationship can be expressed as $E = f(S,P)$, where E is industry employment, S is industry shipments, and P is industry productivity. The actual equation is $E = S/P$. Since productivity is defined as S/E, which is output per employee, the equation $E = S/P$ is an identity. Employment is affected by trade through its effects on product demand and productivity. As in the basic wage model, product demand is decomposed in the equation $S = D - M + X$, where D is domestic demand, M is imports, and X is exports. Productivity is related to trade in the equation $P = f(M,X)$.

In one specific employment model, which is based on classical trade theory, employment in the trading sector is related to imports and exports. This relationship can be expressed as $E = f(M,X)$. The hypothesis is that *trade performance affects employment in the trading sector through its effect on product demand.* An implication is that employment will decrease with imports and increase with exports, resulting in an employment shift within the trading sector.

In another specific employment model, which adapts factor proportions theory to a real world condition (i.e., differences in production techniques), the effect of trade on employment depends on technology. The logic, again, is that industries that use common technology will have greater import competition than industries that use high technology, which will affect relative employment between the two groups. The relationship between industry employment and type of technology can be expressed as $W = f(C)$, where C is the technology classification according to Lawrence (1984b) and Partridge (1991). The hypothesis is that *technology affects employment in the trading sector through its effect on trade performance.* An implication is that import competition for industries that use common technology will increase in relation to industries that use high technology, and therefore employment in the former will decrease in relation to employment in the latter.

Two-sector models. In these models there are two sectors in the economy: the trading sector and the nontrading sector. They are used to examine the effects of trade on wages and employment in the nontrading sector.

In a two-sector model of employment there are industries that contract because of imports, industries that expand because of exports, and nontrading industries. In trade theory an employment shift occurs only within the

trading sector from import-contracted industries to export-expanded industries. In reality, however, there are conditions (trade deficits, sticky wages, changes in productivity, capital mobility, and labor mobility) that may limit this employment shift and cause a shift from the trading sector to the nontrading sector, as suggested by Harrison, Tilly, and Bluestone (1986), Thurow (1987), Dickens (1988), Mishel (1989), Bluestone (1990), Burtless (1990), Bound and Johnson (1992), and Revenga (1992). This effect can expressed as $E_R = f(M,X)$, where E_R is the ratio of employment between the two sectors. The hypothesis is that *trade causes employment shifts between the trading and nontrading sectors through its effect on product demand.* An implication is that employment shifts from the trading sector to the nontrading sector will occur with increases in import competition.

The employment shifts resulting from trade will affect wages. As noted earlier, a shift within the trading sector from import-contracted to export-expanded industries would raise the average wage in this sector since wages in the latter industries should be higher. On the other hand, a shift from the trading sector to the nontrading sector would lower the average wage in the latter, since there would be a greater supply of labor available for that sector. This effect can be expressed as $W_R = f(M,X)$, where W_R is the ratio of wages between the two sectors. The hypothesis is

that *trade affects wage dispersion between the trading and nontrading sectors through its effect on labor supply.* An implication is that increases in wage dispersion between the two sectors will occur with increases in import competition.

Productivity model. As explained in the previous chapter, trade may indirectly affect both wage structure and employment structure through its effects on productivity. If productivity increases are responses by manufacturers to import threats and export opportunities, then productivity is related to trade, and this relationship can be expressed as $P = f(M,X)$, where P is industry productivity. The hypothesis is that *productivity in the trading sector is related directly to foreign competition.* An implication is that the rate of productivity growth will be higher in industries that have greater import competition. A second implication is that productivity growth will be greater in the trading sector than in the nontrading sector. A third implication is that the productivity ratio between the trading sector and the nontrading sector will increase with trade.

Limitations. These models have several limitations, which may affect their usefulness in predicting the effects of trade on income inequality.

(1) They focus on the demand side of the labor market and ignore supply factors such as the baby boom, the influx of women into the work force, and immigration. The

omission of these factors may be justified by evidence that they have not had significant effects on income inequality (Harrison, Tilly, and Bluestone 1986; Loveman and Tilly 1988; Danziger and Gottschalk 1989; Ryscavage and Henle 1990), but they may still have had some effects.

(2) The models do not include the indirect effects of trade on industries that supply goods and services to import-contracted or export-expanded industries. If trade were balanced, these positive and negative effects would be more or less cancelled out, but since the country has a deficit their exclusion will bias the study toward an underestimate of the impact of trade on wages and employment (i.e., the approach is conservative).

(3) The models ignore the possibility that by lowering prices of manufactured goods, imports may lead to an increase in demand, which in turn may lead to an increase in domestic production. Data on consumer expenditures indicate that such an increase has not occurred (Bureau of Labor Statistics 1994a), but the possibility cannot be ruled out.

(4) The models assume that imports are perfect substitutes for domestic goods, which may not always be the case. In fact, the phenomenon of intraindustry trade indicates that at least to some extent international specialization has developed at the product level rather than at the industry level, as suggested by Krugman (1981).

There is evidence that imperfect substitutability is not an important consideration (Pelzman and Martin 1981; Grossman 1982), but its existence should be noted.

(5) The models assume that the effects of trade on wages and employment are immediate, when in reality they may lag. Though lags were not revealed by the data analysis, they may still exist.

(6) The models ignore government policies (e.g., income supplements, minimum wages, and trade interventions) that may distort the effects of trade on wage structure and employment structure. Though such distortions were diluted by the large sample size, they may still be reflected in the results.

Sources of Data

The research design of this study was based on the nature of the variables, which operate in a complex system. Though it would have been possible to test the research hypotheses by simulating this system on a computer, the results would have lacked the validity that can be provided only by empirical evidence, so it was decided to use the data that are regularly produced by federal government agencies. The main limitation of this approach is that unlike an experiment it cannot eliminate or control the effects of other variables.

Since data were collected through government surveys, this study had a survey design in that observations were taken at one or more points in time and there was no control group. With data available for a large number of industries over many years, it was possible to use both cross-sectional and longitudinal designs. In the cross-sectional design the variable (e.g., wages) could be observed across a number of industries at the same time in order to test for differences between industries as well as for relationships between this variable and another variable (e.g., trade). In the longitudinal design the variable could be observed over a period of years in order to test for changes in the variable as well as for relationships between this variable and another variable. The combination of cross-sectional and longitudinal designs reinforced any conclusions drawn from the results.

An important decision was the selection of a period for this study. The principle for selecting the beginning year was to find a year that represented a logical base for the two trends being investigated: growing trade and growing income inequality. For trade, which has a special effect on employment distribution when a country has a deficit (as explained earlier), a logical base was a year when the country had a surplus. The most recent years of surplus were 1979-82. Because the years 1980-82 were disrupted by a shallow recession, a brief recovery, and a deep recession, they did not provide a stable base. So 1979, in which economic growth was 2.5 percent (about average), was a

suitable base year for trade. As for income inequality, the consensus among researchers is that the turning point occurred during the period 1976-79. In fact, some researchers used the year 1979 as a base for their studies of the trend toward greater income inequality (Stone and Sawmill 1987; Levy and Murnane 1992). Since the suitable base for trade fell within the period of the turning point for income inequality, the year 1979 was selected as the beginning year for this study. The principle for selecting the ending year was to use the most recent year that was similar to the beginning year with respect to economic activity. So 1992, in which economic growth was 2.6 percent, was selected as the ending year for this study.

With the period established, the sources of data required to test the research hypotheses were identified. All of the data were obtained from surveys conducted by the U.S. Department of Commerce (Bureau of the Census) and the U.S. Department of Labor (Bureau of Labor Statistics). The specific sources of data for each variable, along with brief descriptions of the methodology of data collection, are given below.

Income inequality. Data on income inequality were obtained from Money Income of Households, Families, and Persons in the United States, a publication of the Bureau of the Census. Money income is before taxes and does not include the value of noncash benefits such as food stamps,

Medicare, Medicaid, public housing, or employer-provided fringe benefits. Income inequality is measured by the shares of aggregate income approach as well as by the Gini index. The information for this report is drawn from the Current Population Survey, a nationwide survey of 60,000 households that is conducted annually by the Bureau of the Census.

Wages. Data on wages were obtained from Employment and Wages, a publication of the Bureau of Labor Statistics. Average weekly wages are given for different industries by 4-digit SIC (more than 900 industries). Information is collected from the employment security agencies of 50 states and the District of Columbia, almost 6 million reporting units. Employment and wages are reported for all workers covered by unemployment insurance, which accounts for about 98 percent of total employment.

Wage deflator. Data for a wage deflator, which converts nominal wages to real wages, were obtained from the CPI Detailed Report, a publication of the Bureau of Labor Statistics. The Consumer Price Index for All Urban Consumers, which covers 80 percent of the total population, was used for this purpose. Information is collected monthly in 85 urban areas across the country from 57,000 housing units and 19,000 retail establishments.

Employment. Data on employment were obtained from Employment and Wages, a publication of the Bureau of Labor Statistics, described above.

Domestic production. Data on domestic production of manufacturing industries were obtained from the Annual Survey of Manufactures, a publication of the Bureau of the Census. Domestic production is given for different industries by 4-digit SIC in millions of dollars (nominal value). Information is collected through an annual survey of 55,000 manufacturing establishments, which represents a sample selected at random from about 200,000 establishments.

Imports and exports. Data on imports and exports were obtained from U.S. Imports, SIC Based Products and U.S. Exports, SIC Based Products, publications of the Bureau of the Census. Figures are given for different industries by 4-digit SIC in millions of dollars (nominal value). Information is collected by the Departments of Commerce, Agriculture, and Interior.

Price deflator. Data for a price deflator, which converts nominal values of domestic production, imports, and exports to real values, were obtained from Producer Price Indexes, a publication of the Bureau of the Census. Price indexes for different industries are available in most cases at a 4-digit SIC level. Information is collected monthly for a sample of about 3,100 commodities, using about 75,000 quotations.

Productivity. Data on productivity were obtained from Productivity Measures for Selected Industries, a publication of the Bureau of Labor Statistics. Productivity is given as

an average annual rate of change in output per employee hour for different industries by 2-digit, 3-digit, and 4-digit SIC. Information is collected from surveys conducted by the Bureau of Labor Statistics and the Bureau of the Census.

The data provided by these surveys have two main limitations:

(1) The figures for domestic production, imports, and exports are in dollars rather than in units. When they are used in proportional relationships or are deflated by a price index, they are representative of unit volume (Dickens 1988), but they are not completely accurate measures of unit volume.

(2) The data are all time series, meaning that they are chronological observations of variables. The successive values of a given variable may therefore not be independent of one another in a statistical sense, and because the procedures for testing hypotheses assume such independence, the data could have presented a problem (autocorrelation). Tests for detecting autocorrelation (Box and Jenkins 1979; Bowerman and O'Connell 1983) indicated that there was no such problem.

Methods of Analysis

The basic method of data analysis was to test the implications of each research hypothesis with data from the sources described above. Most of the tests were simple or

multiple linear regressions to determine whether there were significant relationships between dependent and independent variables (e.g., employment and imports). A 95 percent level of confidence was required for all tests. The regressions and other statistical tests were performed on a personal computer using NCSS Version 5.02 (Hintze 1989).

Income inequality model. As measured by the coefficient of variation of earnings, income inequality (V_K) is determined by wage structure (V_W) and employment structure (V_E), so $V_K = f(V_W, V_E)$. Since wage structure is defined as wage distribution by industry and employment structure is defined as employment distribution by industry, then $V_W = f(W)$ and $V_E = f(E)$, where W is the industry wage and E is the industry employment.

To confirm an underlying assumption of this study, a test was performed to determine if the coefficient of variation of earnings indicates the same trend as the Gini index for the period 1979-92. For this coefficient there are two independent variables: industry wages and industry employment. Average weekly earnings by industry were used as the wage variable and average annual employment by industry were used as the employment variable. The data covered the private sector of the U.S. economy at the 4-digit SIC level, represented by 804 industries. There was no need for a wage deflator since the test compared measures of variance that would not have been affected by inflation.

The coefficients of variation for 1979 and 1992 were calculated weighting wages by the number of employees per industry in order to capture the combined effects of wage dispersion and employment shift on income inequality. The coefficients for 1979 and 1992 were then compared, and the difference was tested for significance using an F test. Based on evidence provided by the shares of income approach and the Gini index, it was expected that the results would show a significant increase in income inequality during the study period.

In order to isolate the wage dispersion effect on income inequality, the coefficient of variation was calculated with 1992 wages but with the same employment structure as in 1979, a technique used by Davidson and Reich (1988) and Burtless (1993). It was expected that this coefficient would fall between the coefficients previously calculated for 1979 and 1992, showing that income inequality increased not only because of wage dispersion but also because of employment shifts.

General model. The relationship between income inequality, the labor market variables, and the trade variables is expressed as $V_K = f(V_W, V_E) = f(T_X, T_Y)$, where T_X and T_Y are appropriate trade variables. The general hypothesis is that *international trade affects income inequality through its effects on wage structure and*

employment structure. Since this hypothesis does not specify how trade affects the labor market variables, it was tested at the level of the wage and employment models.

Wage models. In a basic model wages are related directly to both product demand and productivity, and their relationship is expressed as $W = f(S,P)$, where W is the industry wage, S is industry shipments, and P is industry productivity. This model was used in two cross-sectional regression analyses to estimate the relative importance of product demand and productivity as determinants of wages in the trading sector. In the first analysis, where $W = f(S)$, the dependent variable was the percentage change in weekly wages from 1979 to 1992, and the independent variable was the percentage change in annual shipments over the period. Wages were deflated with the Consumer Price Index, and shipments were deflated with the appropriate Producer Price Indexes. In the second analysis, where $W = f(P)$, the dependent variable was the percentage change in weekly wages from 1979 to 1992, and the independent variable was the percentage change in productivity over the period. The productivity variable was calculated by dividing annual shipments by the average annual employment, which yielded a productivity level in terms of output per employee for each industry. Wages and shipments were deflated as in the preceding analysis.

To investigate the effects of trade on wages through its effect on product demand, a cross-sectional regression analysis was performed on the equation $\Delta S = \Delta D - \Delta M + \Delta X$, with the change in annual shipments as the dependent variable and the changes in domestic demand, imports, and exports as the independent variables. These variables were deflated with the appropriate Producer Price Indexes.

To investigate the effects of trade on wages through its effect on productivity, a cross-sectional regression analysis was performed on the equation $P = f(M,X)$, with the percentage change in productivity from 1979 to 1992 as the dependent variable and the percentage change in net export intensity as the independent variable. The productivity variable was obtained as in an earlier analysis, and net export intensity was calculated with the equation $NetX_I = (X - M)/(S + M)$, where X is annual exports, M is annual imports, and S is annual shipments. There was no need for a price deflator since net export intensity is a relationship of industry variables that would have been affected by inflation in the same way.

Following these analyses, specific hypotheses were tested to examine more precisely the effects of trade on wages in the trading sector.

In the wage model $W = f(M,X)$ the hypothesis is that *trade performance affects wages in the trading sector through its effect on product demand.* An implication is

that industry wages will decrease with import competition and increase with export success. This implication was tested by a cross-sectional regression analysis, with the percentage change in weekly wages from 1979 to 1992 as the dependent variable and the change in net exports as a percentage of 1979 shipments as the independent variable. The wage variable was obtained as in earlier analyses. The trade variable was based on the equation $S = D - M + X$, from which is derived the equation $\%\Delta S = \Delta(D - M + X)/S_b$, where Δ is a symbol for change and S_b is 1979 shipments. If trade is isolated from domestic demand, then $\%\Delta S$ becomes a function of $\Delta(X - M)/S_b$, which is the change in net exports as a percentage of 1979 shipments. Exports, imports, and shipments were deflated as in an earlier analysis.

A second implication of this model is that wage dispersion between industries that have import competition and industries that have export success will increase over time. This implication was tested by a comparison of net importers and net exporters with respect to wages. Net importers were defined as industries with negative average net exports for the study period, and net exporters as industries with positive average net exports for the period. Wage dispersion between the two groups was measured by the ratio of average wages between net importers and net exporters. This ratio was obtained for the years 1979 and 1992, and the change was observed.

A third implication of this model is that wage dispersion in the trading sector will increase with trade. This implication was tested by a longitudinal regression analysis, with the annual coefficient of variation of earnings for the trading sector as the dependent variable and annual trade intensity as the independent variable. In order to isolate wage dispersion, the coefficient of variation was calculated for each year of the study period with the same employment structure as in 1979. Trade intensity was calculated with the equation $T_I = (M + X)/(S + M)$, where M is annual imports, X is annual exports, and S is annual shipments. There was no need for a price deflator since trade intensity is a relationship of industry variables that would have been affected by inflation in the same way.

In the wage model $W = f(C)$ the hypothesis is that *technology affects wages in the trading sector through its effect on trade performance*. An implication is that import competition for industries that use common technology will increase in relation to industries that use high technology, and therefore wages in the former will decrease in relation to wages in the latter. The first part of this implication was tested by a t-test for the difference in the average change in net exports as a percentage of 1979 shipments between the two groups. The second part of this implication was tested by a t-test for the difference in the

average percentage change in weekly wages over the period between the two groups. The variables were obtained as in earlier analyses. Industries were classified as common technology or high technology in accordance with Lawrence (1984b) and Partridge (1991).

A second implication of this model is that wage dispersion between common-tech industries and high-tech industries will increase with trade. This implication was tested by a longitudinal regression analysis, with the annual ratio of high-tech wages to common-tech wages as the dependent variable and annual trade intensity as the independent variable. The wage and trade variables were obtained as in earlier analyses.

Employment model. In a basic model employment is related directly to product demand and inversely to productivity, and their relationship is expressed as $E = S/P$, where E is industry employment, S is industry shipments, and P is industry productivity. This model was used in two cross-sectional regression analyses to estimate the relative importance of product demand and productivity as determinants of wages in the trading sector. The first analysis was performed on the equation $\ln(\%\Delta E + 1) = \ln(\%\Delta S + 1) - \ln(\%\Delta P + 1)$, where Δ is a symbol for change. This equation was derived from the model $E = S/P$. The dependent variable was a function of the percentage change in employment from 1979 to 1992, while the independent

variables were functions of the percentage changes in shipments and in productivity over the period. Productivity was obtained as in earlier analyses, and shipments were deflated as in earlier analyses. The second analysis was performed on the equation $\%\Delta E = \%\Delta S - \%\Delta P$, an approximate form of the equation used in the preceding analysis. The variables were obtained as in that analysis. The purpose of this analysis was to see if the approximate form was a reasonably good model of the relationships between the variables.

To investigate the effects of trade on employment through its effect on product demand, the results of an earlier analysis of the equation $\Delta S = \Delta D - \Delta M + \Delta X$ were used, and to investigate the effects of trade on employment through its effect on productivity, the results of an earlier analysis of the equation $P = f(M,X)$ were used.

Following these analyses, specific hypotheses were tested to examine more precisely the effects of trade on employment in the trading sector.

In the employment model $E = f(M,X)$ the hypothesis is that *trade performance affects employment in the trading sector through its effect on product demand.* An implication is that industry employment will decrease with imports and increase with exports, resulting in an employment shift within the trading sector. This implication was tested by a cross-sectional regression analysis, with the change in

employment from 1979 to 1992 as the dependent variable and the change in net exports as the independent variable. The trade variable was deflated as in earlier analyses. This implication was examined further by comparing the changes in employment by net importers and net exporters to determine if employment had indeed shifted from the former group to the latter group.

In the employment model $E = f(C)$ the hypothesis is that *technology affects employment in the trading sector through its effect on trade performance*. An implication is that import competition for industries that use common technology will increase in relation to industries that use high technology, and therefore employment in the former will decrease in relation to employment in the latter. The first part of this implication was tested by a t-test for the difference in the average change in net exports as a percentage of 1979 shipments between the two groups. The second part of this implication was tested by comparing the two groups with respect to the change in their relative employment over the period. The variables were obtained as in earlier analyses. Industries were classified as common technology or high technology in accordance with Lawrence (1984b) and Partridge (1991).

Two-sector models. In the employment model $E_R = f(M,X)$ the hypothesis is that *trade causes employment shifts between the trading and nontrading sectors through its*

effect on product demand. An implication is that employment shifts from the trading sector to the nontrading sector will occur with increases in import competition. This implication was tested by a longitudinal regression analysis, with the annual ratio of trading sector employment to nontrading sector employment as the dependent variable and annual net exports as the independent variable. The trade variable was deflated as in earlier analyses.

In the wage model $W_R = f(M,X)$ the hypothesis is that *trade affects wage dispersion between the trading and nontrading sectors through its effect on labor supply.* An implication is that increases in wage dispersion between the two sectors will occur with increases in import competition. This implication was tested by a longitudinal regression analysis, with the annual ratio of trading sector wages to nontrading sector wages as the dependent variable and annual net exports as the dependent variable.

Productivity. In the productivity model $P = f(M,X)$ the hypothesis is that *productivity in the trading sector is related directly to foreign competition.* An implication is that the rate of productivity growth will be greater in industries that have greater import competition. This implication was tested by a t-test for the difference in average productivity growth from 1979 to 1992 between net importers and net exporters. It was further tested by two cross-sectional regression analyses, with productivity

growth over the period as the dependent variable in both. The respective independent variables were average net export intensity and average trade intensity. The variables were obtained as in earlier analyses.

A second implication of the model is that productivity growth will be greater in the trading sector than in the nontrading sector. This implication was tested by a t-test for the difference in average productivity growth between the two sectors.

A third implication is that the productivity gap between the trading sector and the nontrading sector will increase with trade. This implication was tested by a longitudinal regression analysis, with the annual ratio of productivity growth between the two sectors as the dependent variable and annual trade intensity as the independent variable.

Summary

The general hypothesis is that *international trade affects income inequality through its effects on wage structure and employment structure*. This hypothesis assumes a transitive relationship between income inequality, labor market variables, and trade variables. Their relationship was examined using partial equilibrium models.

In the income inequality model, income inequality is measured by the coefficient of variation of earnings, which is determined by wage structure and employment structure. These labor market variables are respectively defined as wage distribution by industry and employment distribution by industry.

In the general model income inequality is related to wage structure and employment structure, which in turn are related to trade. This model assumes that wage structure and employment structure transmit the effects of the trade variables to income inequality, but it does not specify how trade affects the labor market variables. So wage and employment models are required to generate testable hypotheses.

In a basic model wages are related directly to both product demand and productivity. Product demand and productivity are related to trade, so wages are affected by trade through its effects on product demand and productivity.

In one specific wage model the hypothesis is that *trade performance affects wages in the trading sector through its effects on product demand.* Some implications are that industry wages will decrease with import competition and increase with export success; that wage dispersion between industries that have import competition and industries that have export success will increase over time; and that wage dispersion in the trading sector will increase with trade.

In another specific wage model the hypothesis is that *technology affects wages in the trading sector through its effect on trade performance.* Some implications are that import competition for industries that use common technology will increase in relation to industries that use high technology, and therefore wages in the former will decrease in relation to wages in the latter; and that wage dispersion between common-tech industries and high-tech industries will increase with trade.

In a basic model employment is related directly to product demand and inversely to productivity. Product demand and productivity are related to trade, so employment is affected by trade through its effects on product demand and productivity.

In one specific employment model the hypothesis is that *trade performance affects employment in the trading sector through its effects on product demand.* An implication is that industry employment will decrease with imports and increase with exports, resulting in an employment shift within the trading sector.

In another specific employment model the hypothesis is that *technology affects employment in the trading sector through its effect on trade performance.* An implication is that import competition for industries that use common technology will increase in relation to industries that use high technology, and therefore employment in the former will decrease in relation to employment in the latter.

In a two-sector model the hypothesis is that *trade causes employment shifts between the trading and the nontrading sectors through its effect on product demand.* An implication is that employment shifts from the trading sector to the nontrading sector will occur with increases in import competition.

In another two-sector model the hypothesis is that *trade affects wage dispersion between the trading and nontrading sectors through its effects on labor supply.* An implication is that increases in wage dispersion between the two sectors will occur with increases in import competition.

In the productivity model the hypothesis is that *productivity in the trading sector is related directly to foreign competition.* An implication is that the rate of productivity growth will be higher in industries that have greater import competition. A second implication is that productivity growth will be greater in the trading sector than in the nontrading sector. A third implication is that the productivity gap between the trading sector and the nontrading sector will increase with trade.

The implications of these hypotheses were tested with data that are regularly produced by federal government agencies. Data were available for a large number of industries over many years, so it was possible to use both cross-sectional and longitudinal research designs. The period 1979-92 was selected for the study because it

begins at the turning point for trends in income inequality and trade, while it ends at a point that is similar to the beginning year with respect to economic activity. The basic method of data analysis was to test the implications of each hypothesis with data from surveys conducted by the Bureau of the Census and the Bureau of Labor Statistics. Most of the tests were either regression analyses or tests for differences in means.

CHAPTER 4

RESULTS

In this chapter the results of the data analysis will be presented, beginning with the results of the analysis of income inequality. Then the results of the analyses of wage structure and employment structure, which determine income inequality as measured in this study, will be presented. For each of these labor market variables, the results showing how trade affects wages and employment in the trading sector through its effects on product demand and productivity will be presented. The results showing how technology affects wages and employment in the trading sector through its effect on trade performance will be presented. The results showing how trade affects wages and employment in the nontrading sector through its effects on product demand and labor supply will be presented. And finally the results of the examination of the relationship between trade and productivity will be presented.

Data Analysis

Income inequality. The data analysis confirmed that income inequality, measured by the coefficient of variation of earnings, increased significantly from 1979 to

1992 (p = 0.0000). As shown in Table 4.1, this index of income inequality increased from 0.3316 to 0.4200 during the study period, indicating the same trend as the Gini index and the shares of income approach.

When employment distribution was held constant from 1979 to 1992, the data analysis indicated that both wage dispersion and employment shifts contributed to the increase in income inequality during this period. As shown in Table 4.1, the coefficient of variation of earnings increased from 0.3316 to 0.3869 due to wage effects alone, and from 0.3869 to 0.4200 due to the combined effects of wage dispersion and employment shifts. This analysis suggests that about 63 percent of the increase in income inequality was due to wage dispersion and 37 percent of the increase was due to employment shifts.

Within the trading sector, the coefficient of variation of earnings increased significantly (p = 0.0000). As shown in Table 4.2, this index of income inequality increased from 0.2440 to 0.2874 during the study period. When employment distribution was held constant from 1979 to 1992, the data analysis showed that wage dispersion accounted for virtually all of the increase in income inequality within this sector. Employment shifts within the sector neither contributed to the increase nor played an equalizing role.

Within the nontrading sector, the coefficient of variation of earnings increased significantly (p = 0.0000).

As shown in Table 4.2, this index of income inequality increased from 0.3468 to 0.3894 during the study period. When employment distribution was held constant from 1979 to 1992, the data analysis showed that wage dispersion accounted for virtually all of the increase in income inequality within this sector. Employment shifts within the sector neither contributed to the increase nor played an equalizing role.

Since the increases in income inequality within both sectors were less than the increase for the private sector, increases in wage dispersion and/or employment shifts between sectors must have contributed to the overall increase. Wage dispersion between the two sectors did increase, as indicated by the increase in the ratio of trading sector wages to nontrading sector wages (Table 4.3). Though employment shifts within sectors did not contribute to the increase in income inequality within sectors, they did contribute to the increase in wage dispersion between sectors. As shown in Table 4.3, the employment shift within the trading sector raised average wages in that sector, whereas the employment shift within the nontrading sector lowered average wages in that sector. These shifts therefore contributed to the overall increase in income inequality.

At the same time, employment shifted between the two sectors, as indicated by the decrease in the ratio of

trading sector employment to nontrading sector employment (Table 4.4). The employment shift from the trading sector to the nontrading sector contributed to the overall increase in income inequality in at least two ways: it shifted employment to a sector with a much higher index of income inequality, and it shifted employment mainly to industries with much lower wages than the average wage for the economy (Table 4.4).

These analyses identify six changes in wage structure and employment structure that increased income inequality during the study period: (1) an increase in wage dispersion within the trading sector, (2) an employment shift within that sector, (3) an increase in wage dispersion within the nontrading sector, (4) an employment shift within that sector, (5) an increase in wage dispersion between the two sectors, and (6) an employment shift from the trading sector to the nontrading sector. The following analyses indicate the extent to which trade contributed to these changes in the labor market variables.

Wage structure. The wage model $W = f(S,P)$ was used to estimate the relative importance of product demand and productivity as determinants of wages in the trading sector. For this purpose, cross-sectional regression analyses were performed on the equations $W = f(S)$ and $W = f(P)$.

In the first analysis, with the percentage change in weekly wages from 1979 to 1992 as the dependent variable and

the percentage change in annual shipments as the independent variable, there was a positive correlation between the two variables ($r = 0.3488$, $p = 0.0000$). As shown in Table 4.5, the prediction equation obtained from this analysis indicates that for a 1 percent change in shipments there was a 0.1034 percent change in wages. The probable range of variation in shipments (two standard deviations) suggests that the probable range of variation in wages associated with that variable was 8.98 percent. This was a relatively large effect since the average change in wages over the study period was 2.04 percent

In the second analysis, with the percentage change in weekly wages from 1979 to 1992 as the dependent variable and the percentage change in productivity as the independent variable, there was a positive correlation between the two variables ($r = 0.2342$, $p = 0.0000$). As shown in Table 4.6, the prediction equation obtained from this analysis indicates that for a 1 percent change in productivity there was a 0.0702 percent change in wages. The probable range of variation in productivity (two standard deviations) suggests that the probable range of variation in wages associated with that variable was 6.01 percent. This was also a relatively large effect.

To investigate the effect of trade on wages through its effect on product demand, a cross-sectional regression analysis was performed on the equation $\Delta S = \Delta D - \Delta M + \Delta X$,

where Δ is a symbol for change. As shown in Table 4.7, there was a positive correlation between annual shipments and domestic demand ($r = 0.9606$, $p = 0.0000$), a negative correlation between shipments and imports ($r = -0.3630$, $p = 0.0000$), and a positive correlation between shipments and exports ($r = 0.5546$, $p = 0.0000$). The results indicate that trade had a significant effect on product demand, which in turn had a relatively large effect on wages. The results also indicate that domestic demand had a much greater effect than either imports or exports on product demand, and that exports had a somewhat greater effect than imports.

To investigate the effect of trade on wages through its effect on productivity, a cross-sectional regression analysis was performed with the percentage change in productivity as the dependent variable and the percentage change in net export intensity as the independent variable. As shown in Table 4.8, there was no significant correlation between the two variables, indicating that trade had no significant effect on changes in industry productivity. A further examination of the relationship between trade and productivity will be presented later in this chapter.

The results of these analyses indicate that wages during the study period were affected by both product demand and productivity, but they were affected more by product demand. The analyses also indicate that wages were affected by trade through its effect on product demand,

rather than through its effect on productivity. On the basis of these analyses, specific hypotheses were tested to examine more precisely the effect of trade on wage structure in the trading sector.

In the wage model $W = f(M,X)$ the hypothesis is that *trade performance affects wages in the trading sector through its effect on product demand.* An implication is that industry wages will decrease with import competition and increase with export success. This implication was supported by a cross-sectional regression analysis, with the percentage change in weekly wages from 1979 to 1992 as the dependent variable and the change in net exports as a percentage of 1979 shipments as the independent variable ($r = 0.2008$, $p = 0.0003$). As shown in Table 4.9, the prediction equation obtained from this analysis indicates that for a 1 percent change in net exports there was a 0.2575 percent change in wages. The probable range of variation in the change in net exports (two standard deviations) suggests that the probable range of variation in wages associated with that variable was 14.98 percent. This was a relatively large effect.

When the trade variable was disaggregated, there was a negative correlation between the percentage change in wages and the change in imports as a percentage of 1979 shipments ($r = - 0.1356$, $p = 0.0163$) and a positive correlation between the percentage change in wages and

the change in exports as a percentage of 1979 shipments ($r = 0.3205$, $p = 0.0000$). These results (Tables 4.10 and 4.11), together with the results of an earlier analysis (Table 4.7), suggest that export success (or failure) had a greater effect than import competition on wages.

A second implication is that wage dispersion between industries that have import competition and industries that have export success will increase over time. This implication was supported by a comparison of net importers and net exporters with respect to wages. As shown in Table 4.12, the ratio of wages between the two groups decreased from 0.8326 to 0.8002 over the study period. While this was not a large effect, the cumulative effects of trade on wages may be reflected by the wage structure of the trading sector. As shown in Table 4.13, the average weekly wage of net importers for the period was $400, whereas the average weekly wage of net exporters was $498, which was significantly higher ($p = 0.0036$).

A third implication of the wage model is that wage dispersion in the trading sector will increase with trade. This implication was supported by a longitudinal regression analysis, with the annual coefficient of variation of earnings for the trading sector as the dependent variable and annual trade intensity as the independent variable ($r = 0.9323$, $p = 0.0000$). As shown in Table 4.14, the prediction equation obtained from this analysis indicates

that for a unit change in trade intensity there was a 0.2613 change in the coefficient of variation of earnings. The probable range of variation in trade intensity (two standard deviations) suggests that the probable range of variation in the coefficient of variation of earnings associated with that variable was 0.0160. This was a relatively small effect since the average coefficient of variation for the period was 0.2658.

In the wage model $W = f(C)$ the hypothesis is that *technology affects wages in the trading sector through its effect on trade performance*. An implication is that import competition will increase for industries that use common technology in relation to industries that use high technology, and therefore wages in the former will decrease in relation to wages in the latter. The first part of this implication was supported by a test for the difference in the average change in net exports as a percentage of 1979 shipments between the two groups ($p = 0.0010$). As shown in Table 4.15, the average change in net exports for common-tech industries was - 13.05 percent over the study period, whereas the average change in net exports for high-tech industries was - 0.07 percent. The second part of this implication was supported by a test for the difference in the average percentage change in weekly wages over the period between the two groups ($p = 0.0073$). As shown in Table 4.16, the average change in wages for

common-tech industries was 0.86 percent over the period, whereas the average change for high-tech industries was 5.06 percent. Support for a link between trade and wages was provided by an earlier regression analysis (Table 4.9), with the percentage change in weekly wages over the period as the dependent variable and the change in net exports as a percentage of 1979 shipments as the independent variable ($r = 0.2008$, $p = 0.0003$).

A second implication of this model is that wage dispersion between common-tech industries and high-tech industries will increase with trade. This implication was supported by a longitudinal regression analysis, with the annual ratio of high-tech wages to common-tech wages as the dependent variable and annual trade intensity as the independent variable ($r = 0.8973$, $p = 0.0000$). As shown in Table 4.17, the prediction equation obtained from this analysis indicates that for a unit change in trade intensity there was a 0.8946 change in the wage ratio between the two sectors. The probable range of variation in trade intensity (two standard deviations) suggests that the probable range of variation in the wage ratio was 0.0549. This was a relatively small effect since the average wage ratio for the study period was 1.3701.

A further examination of changes in wages for the two groups of industries showed that from 1979 to 1992 wages in common-tech industries decreased in relation to the

average wage for the trading sector, whereas wages in the high-tech industries increased in relation to the average wage (Table 4.18). Wage dispersion did not increase within the common-tech group, but it did increase within the high-tech group (Table 4.19). The increase in wage dispersion within the trading sector can therefore be at least partly attributed to an increase in wage dispersion between the common-tech and high-tech groups as well as to an increase in wage dispersion within the high-tech group.

The two groups were compared with respect to their economic growth rates, as measured by the percentage change in shipments from 1979 to 1992. A test for difference in means showed that common-tech industries had a significantly lower rate of growth than high-tech industries ($p = 0.0000$). As shown in Table 4.20, the common-tech group actually had a negative growth over the study period (- 6.07 percent), whereas the high-tech group had a positive growth (21.05 percent). These changes resulted in a shift in production from the common-tech group to the high-tech group, with common-tech industries declining from 43.19 percent of total production for the sector to 40.56 percent and high-tech industries increasing from 31.47 percent to 35.92 percent.

Employment structure. The employment model $E = S/P$ was used to estimate the relative importance of product demand and productivity as determinants of employment.

For this purpose, a cross-sectional regression was performed on the equation $\ln(\%\Delta E + 1) = \ln(\%\Delta S + 1) - \ln(\%\Delta P + 1)$, with a function of the percentage change in employment from 1979 to 1992 as the dependent variable and functions of the percentage changes in shipments and in productivity as the independent variables (Table 4.21). As expected, there was a positive correlation between employment and product demand ($r = 0.6880$, $p = 0.0000$) and a negative correlation between employment and productivity ($r = -0.3617$, $p = 0.0000$). Because the basic equation of the model is an identity, the prediction equation obtained from this analysis accounts for all of the variation in the dependent variable ($r^2 = 1.0000$).

A similar analysis was performed on the equation $\%\Delta E = \%\Delta S - \%\Delta P$, which is an approximate form of the equation tested above. The dependent variable was the percentage change in employment from 1979 to 1992, and the independent variables were the percentage changes in shipments and productivity. The results showed that this equation is a reasonably good model of employment, product demand, and productivity. As shown in Table 4.22, there was a positive correlation between employment and shipments ($r = 0.5385$, $p = 0.0000$) and a negative correlation between employment and productivity ($r = -0.3097$, $p = 0.0000$). The prediction equation obtained from this analysis indicates that for a 1 percent change in shipments there was a 0.8088 percent change in employment. The probable

range of variation in shipments (two standard deviations) suggests that the probable range of variation in employment associated with that variable was 70.20 percent. This was a relatively large effect since the average change in employment over the period was - 13.80 percent. The prediction also indicates that for a 1 percent change in productivity there was a - 0.6739 percent change in employment. The probable range of variation in shipments (two standard deviations) suggests that the probable range of variation in employment associated with that variable was 57.73 percent. This was also a relatively large effect.

To investigate the effect of trade on employment through its effect on product demand, a cross-sectional regression analysis was performed on the equation $\Delta S = \Delta D - \Delta M + \Delta X$. As shown earlier (Table 4.7), there was a positive correlation between shipments and domestic demand ($r = 0.9606$, $p = 0.0000$), a negative correlation between shipments and imports ($r = - 0.3630$, $p = 0.0000$), and a positive correlation between shipments and exports ($r = 0.5546$, $p = 0.0000$). The results indicate that trade had a significant effect on product demand, which in turn had a relatively large effect on employment. The results also indicate that domestic demand had a much greater effect than either imports or exports on product demand and that exports had a somewhat greater effect than imports.

To investigate the effect of trade on employment through its effect on productivity, the results of an earlier cross-sectional regression analysis were used (Table 4.8). Since there was no significant correlation between the percentage change in productivity and the percentage change in net export intensity, there was no evidence that trade had a significant effect on employment through its effect on productivity. Again, a further examination of the relationship between trade and productivity will be presented later in this chapter.

The results of these analyses indicate that employment during the study period was affected by both product demand and productivity, but it was affected more by product demand. The analyses also indicate that employment was affected by trade through its effect on product demand, rather than through its effect on productivity. On the basis of these analyses, specific hypotheses were tested to examine more precisely the effect of trade on employment in the trading sector.

In the employment model $E = f(D,M,X)$ the hypothesis is that *trade performance affects employment in the trading sector through its effect on product demand.* An implication is that industry employment will decrease with imports and increase with exports, resulting in an employment shift within the trading sector. This implication was supported by a cross-sectional regression analysis, with the change

in employment from 1979 to 1992 as the dependent variable and the change in net exports as the independent variable ($r = 0.1667$, $p = 0.0030$). As shown in Table 4.23, the prediction equation obtained from this analysis indicates that for every $1 million change in net exports there was a change of 3.14 jobs. The probable range of variation in net exports (two standard deviations) suggests that the probable range of variation in employment was 5,035 jobs per industry. Since average employment per industry during the study period was 54,700, an average of about 9 percent of jobs per industry were exposed to the direct effects of trade, and since average employment for the trading sector was about 17 million during the study period, the results suggest that about 1.5 million jobs were exposed to the direct effects of trade.

When the trade variable was disaggregated, there was no significant correlation between the change in employment from 1979 to 1992 and the change in imports, but there was a significant correlation between the change in employment and the change in exports ($r = 0.1655$, $p = 0.0033$). These results (Tables 4.24 and 4.25), together with the results of an earlier analysis (Table 4.7), suggest that export success (or failure) had a greater effect than import competition on employment.

An examination of employment in industries that were net importers and net exporters during the study period

supported the prediction that employment would shift within the trading sector from the former to the latter. As shown in Table 4.26, employment by net importers decreased by 2.1 million whereas employment by net exporters decreased by only 0.3 million. Though employment decreased in both groups, there was a shift in relative employment, with the net importing group's share of trading sector employment falling from 58.30 percent to 53.78 percent and the net exporting groups's share rising from 41.70 percent to 46.22 percent.

In the employment model $E = f(C)$ the hypothesis is that *technology affects employment in the trading sector through its effect on trade performance.* An implication is that import competition will increase for industries that use common technology in relation to industries that use high technology, and therefore employment in the former will decrease in relation to employment in the latter. The first part of this implication was supported by an earlier test for the difference in the average change in net exports as a percentage of 1979 shipments between the two groups (Table 4.15). But the second part of this implication was not supported by a comparison of the two groups with respect to employment. As shown in Table 4.27, the absolute number of jobs lost from 1979 to 1992 was much larger in the common-tech group than in the high-tech group, but there was virtually no change in their relative employment.

The common-tech group's share of total employment in the trading sector decreased slightly from 52.19 percent to 51.42 percent and the high-tech group's share increased very slightly from 31.09 percent to 31.37 percent. These results provide no evidence of an employment shift from common-tech industries to high-tech industries, whereas the results of the preceding analysis (Table 4.26) do provide evidence of an employment shift from net importers to net exporters. Together, the results of these two analyses suggest that during the study period trade had an effect on employment that was independent of technology.

It should be pointed out that despite the fact that the high-tech group had a much higher economic growth rate than the common-tech group (Table 4.20), it did not have a corresponding increase in employment. In fact, employment in the high-tech group decreased by virtually the same proportion as it did in the common-tech group, so high-tech industries were not a source of net job creation.

Effects on nontrading sector. In the employment model $E_R = f(M,X)$ the hypothesis is that *trade causes employment shifts between the trading and nontrading sectors through its effect on product demand.* An implication is that employment shifts from the trading sector to the nontrading sector will occur with increases in import competition. This implication was supported by a longitudinal regression analysis (Table 4.28), with the

annual ratio of trading sector employment to nontrading sector employment as the dependent variable and annual net exports as the independent variable ($r = 0.7046$, $p = 0.0024$). As shown in Table 4.4, the ratio of trading sector employment to nontrading sector employment declined over the study period, indicating an employment shift from the former to the latter. During the period net exports went from positive to negative.

Of course, employment in both sectors fluctuated during the study period as a result of business cycles. An analysis of such fluctuations indicated that employment in the trading sector was less variable than employment in the nontrading sector. As shown in Table 4.29, the coefficient of variation of employment over the period was significantly lower in the trading sector ($p = 0.0000$). So jobs shifted to a sector with relatively unstable employment, making employment more sensitive to business cycles and probably raising the average level of unemployment.

In the wage model $W_R = f(M,X)$ the hypothesis is that *trade affects wage dispersion between the trading and nontrading sectors through its effect on labor supply.* An implication is that increases in wage dispersion between the two sectors will occur with increases in import competition. This implication was supported by a longitudinal regression analysis, with the annual ratio of

trading sector wages to nontrading sector wages as the dependent variable and annual net exports as the dependent variable ($r = -0.7690$, $p = 0.0010$). As shown in Table 4.30, the prediction equation obtained from this analysis indicates that for a $1 million decrease in net exports there was a 0.0001 increase in the wage ratio between the two sectors. The probable range of variation in net exports (two standard deviations) suggests that the probable range of variation in the wage ratio associated with that variable 0.0268. This was a relatively small effect since the average wage ratio during the period was 3.0211.

Further analysis indicated that the increase in wage dispersion between the two sectors was related to the employment shift between them (Table 4.31). In a longitudinal regression analysis, with the annual ratio of trading sector wages to nontrading sector wages as the dependent variable and the annual ratio of trading sector employment to nontrading sector employment as the independent variable, there was a negative correlation between the two variables ($r = -0.5739$, $p = 0.0403$). The results of this analysis indicate that as employment shifted between the two sectors, wage dispersion between them increased. Since there was a correlation between such employment shifts and net exports (Table 4.28), the results implied that the wage ratio between the two sectors was affected by trade.

Productivity. In the productivity model $P = f(M,X)$ the hypothesis is that *productivity in the trading sector is related directly to foreign competition.* An implication is that the rate of productivity growth will be higher in industries that have greater import competition. This implication was not supported by a test for the difference in average productivity growth between net importers and net exporters during the study period. In fact, net importers had a lower rate of productivity growth than net exporters (22.87 percent versus 25.29 percent), though the difference was not statistically significant (Table 4.32). The implication was not supported by a cross-sectional regression analysis, with productivity growth as the dependent variable and average net export intensity as the independent variable (Table 4.33). Nor was the implication supported by a similar analysis, with average trade intensity as the independent variable (Table 4.34).

The fact that net importers had a lower rate of productivity growth suggested that there might be a reverse causality. This possibility was supported by a cross-sectional regression analysis, with average net export intensity as the dependent variable and the average productivity level as the independent variable ($r = 0.2818$, $p = 0.0000$). As shown in Table 4.35, the prediction equation obtained from this analysis indicates that for a unit change in the productivity level there was a 0.6697

change in net export intensity. The probable range of variation in the level of productivity (two standard deviations) suggests that the probable range of variation in net export intensity associated with that variable was 0.0972. This was a relatively large effect since average net export intensity for the period was - 0.0501.

To examine the possible influence of technology on productivity, the common-tech and high-tech groups were compared with respect to their average productivity levels. As shown in Table 4.36, the average productivity level of the high-tech group was significantly higher than that of the common-tech group ($p = 0.0094$), suggesting that technology affected productivity levels. Within both groups there were similar positive correlations between average net export intensity and average productivity levels (Tables 4.37 and 4.38), supporting the alternative hypothesis that higher levels of productivity contribute to export success or mitigate import competition.

Of course, the notion that productivity influences trade is the fundamental principle of classical trade theory (i.e., an industry with a relatively high level of productivity has a comparative advantage), so the findings have a theoretical basis. But even if productivity influences the trade performance of individual industries, trade may influence productivity of the trading sector as a whole through a process analogous to natural selection.

In this process industries with relatively high levels of productivity have export success (as shown in Table 4.35), which in turn causes them to grow at higher rates than industries that have import competition (as shown in Table 4.39), thereby raising the weighted average productivity level of the trading sector. The possibility of such a process was supported by an analysis of the general level of productivity in the trading sector, which indicated that at least a part of the sector's productivity increase during the period was due to the fact that industries with higher levels of productivity had higher economic growth rates (Table 4.40). Most of the sector's increase, however, was evidently due to productivity increases by individual industries, suggesting that the selection process works slowly and takes time to have any great effect.

The possibility that trade influenced the productivity level of the trading sector as a whole was further supported by a longitudinal regression analysis, with the annual productivity level of the trading sector as the dependent variable and annual trade intensity of the sector as the independent variable. As shown in Table 4.41, there was a strong positive correlation between the two variables ($r = 0.8822$, $p = 0.0001$).

A second implication of the model is that productivity growth will be greater in the trading sector than in the nontrading sector (because of the selection process whereby

trade raises the general level of productivity in the trading sector through higher economic growth rates of industries that have export success). This implication was supported by a test for the difference in average productivity growth between the sectors ($p = 0.0000$). As shown in Table 4.42, the average annual productivity growth of industries in the trading sector over the study period was 2.14 percent, whereas the average productivity growth of industries in the nontrading sector was only 0.79 percent.

A third implication of the model is that the productivity gap between the trading sector and the nontrading sector will increase with trade (again, because of the selection process). This implication was supported by a longitudinal regression analysis, with the annual ratio of productivity growth in the trading sector to productivity growth in the nontrading sector as the dependent variable and annual trade intensity as the independent variable ($r = 0.9076$, $p = 0.0000$). As shown in Table 4.43, the prediction equation obtained from this analysis indicates that for a unit change in trade intensity there was a 5.2498 change in the productivity ratio between the two sectors. The probable range of variation in trade intensity (two standard deviations) suggests that the probable range of variation in the productivity ratio associated with that variable was 0.3223. This was a relatively large effect since the average productivity ratio over the period

was 2.7089. The increase in the productivity gap between the two sectors presumably contributed to the increase in the wage gap between them.

Summary

The results of the data analysis confirmed that income inequality, measured by the coefficient of variation of earnings, increased significantly from 1979 to 1992. The analysis identified six changes in wage structure and employment structure that contributed to this increase: (1) an increase in wage dispersion within the trading sector, (2) an employment shift within that sector, (3) an increase in wage dispersion within the nontrading sector, (4) an employment shift within that sector, (5) an increase in wage dispersion between the two sectors, and (6) an employment shift from the trading sector to the nontrading sector.

The results indicated that wages in the trading sector were affected by both product demand and productivity, but they were affected more by product demand. The results further indicated that wages were affected by trade through its effect on product demand, rather than through its effect on productivity.

The results supported the hypothesis that trade performance affects wages in the trading sector through its effect on product demand. Changes in wages over the period

were positively correlated with changes in net exports. They were negatively correlated with changes in imports and positively correlated with changes in exports. Wage dispersion between net importers and net exporters increased over the period, and wage dispersion within the trading sector increased with trade.

The results supported the hypothesis that technology affects wages in the trading sector through its effect on trade performance. Import competition for industries that use common technology increased in relation to industries that use high technology. Wages in the common-tech group decreased in relation to wages in the high-tech group. Wage dispersion between the common-tech group and the high-tech group increased with trade, accounting for some of the increase in wage dispersion within the sector. The high-tech group had a higher rate of economic growth than the common-tech group.

The results indicated that employment in the trading sector was affected by both product demand and productivity, but it was affected more by product demand. The results further indicated that employment was affected by trade through its effect on product demand, rather than through its effect on productivity.

The results supported the hypothesis that trade performance affects employment in the trading sector through its effect on product demand. Employment was correlated

with net exports. It was not correlated with imports, but it was positively correlated with exports, suggesting that export success (or failure) had a greater effect than import competition on employment. Relative employment shifted from net importers to net exporters.

The results did not support the hypothesis that technology affects employment in the trading sector through its effect on trade performance. The change in employment over the period was positively correlated with the change in net exports, but there was virtually no change in the relative employment of the common-tech group and the high-tech group. So there was no evidence of an employment shift from common-tech industries to high-tech industries, whereas there was evidence of an employment shift from net importers to net exporters, suggesting that during the study period trade had an effect on employment that was independent of technology. A notable finding was that during the period high-tech industries were not a source of net job creation.

The results supported the hypothesis that trade causes employment shifts between the trading and nontrading sectors through its effect on product demand. Employment shifts from the trading sector to the nontrading sector occurred with increases in import competition. Employment fluctuated in both sectors, but it fluctuated more in the nontrading sector. So jobs shifted to a sector with relatively unstable employment, making employment in the U.S. economy

more sensitive to business cycles and probably raising the average level of unemployment.

The results supported the hypothesis that trade affects wage dispersion between the trading and nontrading sectors through its effect on labor supply. The wage gap between the two sectors increased with trade, and this gap was related to the employment shift between them.

The results did not support the hypothesis that productivity in the trading sector is related directly to foreign competition. The rate of productivity growth was actually lower in industries that had import competition than in industries that had export success. Further analysis supported the alternative hypothesis that export success is related directly to productivity. There was a positive correlation between average net export intensity and the average level of productivity. The average productivity level was higher in the high-tech group than in the common-tech group, suggesting that technology influenced productivity. Within both groups there were similar correlations between average net export intensity and average productivity levels, supporting the alternative hypothesis.

Though productivity evidently influences the trade performance of individual industries, it is still possible that trade influences productivity of the trading sector as a whole through a process analogous to natural selection.

The results indicate that industries with higher levels of productivity have greater export success and that industries with greater export success have higher economic growth rates. This process, in which there may be a transitive relationship between productivity levels, export success, and growth rates, would raise the weighted average productivity level of the trading sector.

Productivity growth was greater in the trading sector than in the nontrading sector, and the productivity gap between the two sectors widened with trade. This widening of the productivity gap between the two sectors may have contributed to the increase in wage dispersion between them, which accounted for much of the overall increase in income inequality.

TABLE 4.1

INCOME INEQUALITY - PRIVATE SECTOR

MODEL: $s^2 = \sum[(MW - W)^2 \times E/TE]$

where MW = weighted average wage
W = industry wage
E = industry employment
TE = total employment

$CV = s/MW$

RESULTS:

	1979	1992
N	804	804
Mean wage	253.24	494.87
Variance	7,052.31	43,200.27
Standard deviation	83.98	207.85
Coefficient of variation	0.3316	0.4200

CV 1992 > CV 1979

F = 5.85 p = 0.0000

Employment held constant at 1979 structure:

	1979	1992
N	804	804
Mean wage	253.24	512.86
Variance	7,052.31	39,380.21
Standard deviation	83.98	198.44
Coefficient of variation	0.3316	0.3869

CV 1992 > CV 1979

F = 5.58 p = 0.0000

TABLE 4.2

INCOME INEQUALITY - TWO SECTORS

(A) TRADING SECTOR:

	1979	1992
N	310	310
Mean wage	296.05	607.59
Variance	5,216.79	30,529.53
Standard deviation	72.23	174.73
Coefficient of variation	0.2440	0.2874

CV 1992 > CV 1979

F = 5.85 p = 0.0000

Employment held constant at 1979 structure:

	1979	1992
N	310	310
Mean wage	296.05	601.20
Variance	5,216.79	29,241.13
Standard deviation	72.23	171.00
Coefficient of variation	0.2440	0.2844

CV 1992 > CV 1979

F = 5.60 p = 0.0000

(B) NONTRADING SECTOR:

	1979	1992
N	396	396
Mean wage	227.94	451.24
Variance	6,250.11	30,879.05
Standard deviation	79.06	175.72
Coefficient of variation	0.3468	0.3894

CV 1992 > CV 1979

F = 4.94 p = 0.0000

TABLE 4.2 (continued)

INCOME INEQUALITY - TWO SECTORS

Employment held constant at 1979 structure:

	1979	1992
N	396	396
Mean wage	227.94	454.90
Variance	6,250.11	30,450.98
Standard deviation	79.06	174.50
Coefficient of variation	0.3468	0.3836

CV 1992 > CV 1979

F = 4.87 p = 0.0000

TABLE 4.3

WAGE DISPERSION BETWEEN SECTORS

(A) RATIO OF TRADING SECTOR WAGE TO NONTRADING SECTOR WAGE

YEAR	WEIGHTED AV WAGE		RATIO
	TRADING	NONTRADING	
1979	296	228	1.2939
1980	325	249	1.3052
1981	357	270	1.3222
1982	380	289	1.3149
1983	404	303	1.3333
1984	424	318	1.3333
1985	448	330	1.3576
1986	472	344	1.3721
1987	485	364	1.3324
1988	509	380	1.3395
1989	522	393	1.3282
1990	548	412	1.3301
1991	567	428	1.3248
1992	608	451	1.3459

(B) EFFECT OF EMPLOYMENT SHIFT WITHIN TRADING SECTOR

Average weekly wage 1992
Weighted by 1979 employment structure: 601

Weighted by 1992 employment structure: 608

(C) EFFECT OF EMPLOYMENT SHIFT WITHIN NONTRADING SECTOR

Average weekly wage 1992
Weighted by 1979 employment structure: 455

Weighted by 1992 employment structure: 451

TABLE 4.4

EMPLOYMENT SHIFTS BETWEEN SECTORS

(A) RATIO OF TRADING SECTOR EMPLOYMENT TO NONTRADING SECTOR EMPLOYMENT

YEAR	EMPLOYMENT		
	TRADING	NONTRADING	RATIO
1979	18,353,950	50,232,893	0.3653
1980	17,857,765	51,015,555	0.3500
1981	17,714,480	51,928,042	0.3411
1982	16,607,931	51,883,037	0.3201
1983	16,195,495	52,906,340	0.3061
1984	17,024,492	58,130,742	0.2928
1985	16,908,390	58,817,496	0.2874
1986	16,652,247	60,838,502	0.2737
1987	16,734,457	61,624,898	0.2715
1988	17,122,181	65,517,846	0.2613
1989	17,197,861	67,814,570	0.2536
1990	16,953,588	69,202,735	0.2450
1991	16,220,004	68,063,778	0.2383
1992	15,898,802	68,815,813	0.2310

(B) LARGEST INCREASES IN EMPLOYMENT - NONTRADING SECTOR

INDUSTRY GROUP	EMPLOYMENT INCREASE	1992 WAGE	IND WAGE/ AV WAGE
Health Services	3,522,357	536	1.08
Business Services	2,391,975	416	0.84
Eating and Drinking	2,082,729	175	0.35
Miscellaneous Services	1,533,127	749	1.51
Social Services	1,001,213	278	0.58
Food Services	854,411	273	0.55
Banking	590,785	543	1.10
Miscellaneous Retail	572,648	307	0.62
Hotels and Motels	508,431	278	0.56
TOTAL	13,046,676		

These industry groups account for 71.11 percent of the total increase in employment for the nontrading sector.

TABLE 4.5

WAGES AND PRODUCT DEMAND

MODEL: $W = f(S)$

HYPOTHESIS: Wages are affected by product demand.

TEST: Cross-sectional regression analysis.

DEPENDENT VARIABLE (Y): Percentage change in weekly wages from 1979 to 1992.

INDEPENDENT VARIABLE (X): Percentage change in annual shipments from 1979 to 1992.

RESULTS:

$r = 0.3488$	$n = 310$	
$r^2 = 0.1217$	$F = 42.67$	
$b = 0.1034$	$t = 6.53$	$p = 0.0000$

$Y = .0188 + 0.1034X$

	Y	X
Mean	2.04%	1.57%
Standard deviation	12.84%	43.40%

TABLE 4.6

WAGES AND PRODUCTIVITY

MODEL: $W = f(P)$

HYPOTHESIS: Wages are affected by productivity.

TEST: Cross-sectional regression analysis.

DEPENDENT VARIABLE (Y): Percentage change in weekly wages from 1979 to 1992.

INDEPENDENT VARIABLE (X): Percentage change in productivity from 1979 to 1992.

RESULTS:

$r = 0.2342$	$n = 310$	
$r^2 = 0.0548$	$F = 17.87$	
$b = 0.0702$	$t = 4.23$	$p = 0.0000$

$Y = .0036 + 0.0702X$

	Y	X
Mean	2.04%	23.91%
Standard deviation	12.84%	42.83%

TABLE 4.7

PRODUCT DEMAND AND DOMESTIC DEMAND, IMPORTS, AND EXPORTS

MODEL: $S = D - M + X$

EQUATION: $\Delta S = \Delta D - \Delta M + \Delta X$, where Δ is a symbol for change.

HYPOTHESIS: Product demand is affected by domestic demand, imports, and exports.

TEST: Cross-sectional regression analysis.

DEPENDENT VARIABLE (Y): Change in annual shipments from 1979 to 1992.

INDEPENDENT VARIABLE (X_1): Change in annual domestic demand from 1979 to 1992.

INDEPENDENT VARIABLE (X_2): Change in anuual imports from 1979 to 1992.

INDEPENDENT VARIABLE (X_3): Change in annual exports from 1979 to 1992.

RESULTS:

Overall $r^2 = 1.0000$ $F > 999$

$Y = 0 + 0.9515X_1 - 0.1465X_2 + 0.1950X_3$

Y and X_1

$r = 0.9606$ $n = 310$

$b = 0.9515$ $t > 100$ $p = 0.0000$

	Y	X_1
	(millions)	
Mean	$302	$395
Standard deviation	$2,874	$2,847

TABLE 4.7 (continued)

PRODUCT DEMAND AND DOMESTIC DEMAND, IMPORTS, AND EXPORTS

Y and X_2

r = - 0.3630 n = 310

b = - 0.1465 t > 100 p = 0.0000

	Y (millions)	X_2
Mean	$302	$366
Standard Deviation	$2,874	$1,160

Y and X_3

r = 0.5546 n = 310

b = 0.1950 t > 100 p = 0.0000

	Y (millions)	X_3
Mean	$302	$273
Standard Deviation	$2,874	$1,010

TABLE 4.8

PRODUCTIVITY AND TRADE

MODEL: $P = f(M,X)$

HYPOTHESIS: Productivity is related directly to foreign competition.

TEST: Cross-sectional regression analysis.

DEPENDENT VARIABLE (Y): Percentage change in productivity from 1979 to 1992.

INDEPENDENT VARIABLE (X): Change in net export intensity from 1979 to 1992.

RESULTS:

$r = -0.0326$ $n = 310$

$r^2 = 0.0011$ $F = 0.33$

$b = -0.1147$ $t = 0.57$ $p = 0.5669$

$Y = .2347 - 0.1147X$

	Y	X
Mean	23.91%	- 0.0383
Standard deviation	42.90%	0.1220

TABLE 4.9

WAGES AND TRADE

MODEL: $W = f(M,X)$

HYPOTHESIS: Trade performance affects wages in the trading sector through its effect on product demand.

IMPLICATION: Industry wages will decrease with import competition and increase with export success.

TEST: Cross-sectional regression analysis.

DEPENDENT VARIABLE (Y): Percentage change in weekly wages from 1979 to 1992.

INDEPENDENT VARIABLE (X): Change in annual net exports as a percentage of 1979 shipments.

RESULTS:

$r = 0.2008$	$n = 310$	
$r^2 = 0.0403$	$F = 12.93$	
$b = 0.2575$	$t = 3.60$	$p = 0.0003$

$Y = 0.0046 + 0.2575X$

	Y	X
Mean	2.04%	- 6.42%
Standard deviation	12.84%	29.08%

TABLE 4.10

WAGES AND TRADE

MODEL: $W = f(M,X)$

HYPOTHESIS: Trade performance affects wages in the trading sector through its effect on product demand.

IMPLICATION: Industry wages will decrease with import competition and increase with export success.

TEST: Cross-sectional regression analysis.

DEPENDENT VARIABLE (Y): Percentage change in weekly wages from 1979 to 1992.

INDEPENDENT VARIABLE (X): Change in annual imports as a percentage of 1979 shipments.

RESULTS:

$r = -0.1356$	$n = 310$	
$r^2 = 0.0184$	$F = 5.77$	
$b = -0.0614$	$t = 2.40$	$p = 0.0163$

$Y = 0.0122 - 0.0614X$

	Y	X
Mean	2.04%	13.40%
Standard deviation	12.84%	28.40%

TABLE 4.11

WAGES AND TRADE

MODEL: $W = f(M,X)$

HYPOTHESIS: Trade performance affects wages in the trading sector through its effect on product demand.

IMPLICATION: Industry wages will decrease with import competition and increase with export success.

TEST: Cross-sectional regression analysis.

DEPENDENT VARIABLE (Y): Percentage change in weekly wages from 1979 to 1992.

INDEPENDENT VARIABLE (X): Change in annual exports as a percentage of 1979 shipments.

RESULTS:

$r = 0.3205$	$n = 310$	
$r^2 = 0.1027$	$F = 35.26$	
$b = 0.2848$	$t = 5.94$	$p = 0.0000$

$Y = 0.0006 + 0.2848X$

	Y	X
Mean	2.04%	6.97%
Standard deviation	12.84%	14.48%

TABLE 4.12

WAGES AND TRADE

MODEL: $W = f(M,X)$

HYPOTHESIS: Trade performance affects wages in the trading sector through its effect on product demand.

IMPLICATION: Wage dispersion between industries that have import competition and industries that have export success will increase over time.

TEST: Comparison of net importers and net exporters with respect to wages.

VARIABLE: Ratio of average weekly wages for net importers to average weekly wages for net exporters.

RESULTS:

	NET IMPORTERS	NET EXPORTERS
N	177	133
Av weekly wage 1979	$266	$320
Wage ratio 1979	0.8326	
Av weekly wage 1992	$500	$624
Wage ratio 1992	0.8002	

TABLE 4.13

WAGES AND TRADE

MODEL: $W = f(M,X)$

HYPOTHESIS: Trade performance affects wages in the trading sector through its effect on product demand.

IMPLICATION: Wage dispersion between industries that have import competition and industries that have export success will increase over time.

TEST: Comparison of net importers and net exporters with respect to wages.

VARIABLE: Average weekly wages for study period.

RESULTS:

	NET IMPORTERS	NET EXPORTERS
N	177	133
Average Weekly Wage	$400	$498
Standard Deviation	111	95

$t = 2.69$

$p = 0.0036$

TABLE 4.14

WAGES AND TRADE

MODEL: $W = f(M,X)$

HYPOTHESIS: Trade performance affects wages in the trading sector through its effect on product demand.

IMPLICATION: Wage dispersion in the trading sector will increase with trade.

TEST: Longitudinal regression analysis.

DEPENDENT VARIABLE (Y): Annual coefficient of variation of earnings for the trading sector.

INDEPENDENT VARIABLE (X): Annual trade intensity for the trading sector.

RESULTS:

$r = 0.9323$	$n = 14$	
$r^2 = 0.8692$	$F = 73.10$	
$b = 0.2613$	$t = 8.55$	$p = 0.0000$

$Y = 0.2119 + 0.2613X$

	Y	X
Mean	0.2658	0.2063
Standard deviation	0.0086	0.0307

TABLE 4.15

WAGES AND TECHNOLOGY

MODEL: $\dot{W} = f(C)$

HYPOTHESIS: Technology affects wages in the trading sector through its effects on trade performance.

IMPLICATION: Import competition for industries that use common technology will increase in relation to industries that use high technology, and therefore wages in the former will decrease in relation to wages in the latter.

TEST: T-test for difference in means.

VARIABLE: Change in net exports as a percentage of 1979 shipments.

RESULTS:

	COMMON-TECH	HIGH-TECH
N	149	87
Mean	- 13.05%	- 0.07%
Standard Deviation	37.14%	16.71%

COMMON-TECH < HIGH-TECH

t = 3.08 p = 0.0010

TABLE 4.16

WAGES AND TECHNOLOGY

MODEL: $W = f(C)$

HYPOTHESIS: Technology affects wages in the trading sector through its effects on trade performance.

IMPLICATION: Import competition for industries that use common technology will increase in relation to industries that use high technology, and therefore wages in the former will decrease in relation to wages in the latter.

TEST: T-test for difference in means.

VARIABLE: Percentage change in wages from 1979 to 1992.

RESULTS:

	COMMON-TECH	HIGH-TECH
N	149	87
Mean	0.86%	5.06%
Standard Deviation	10.63%	15.80%

COMMON-TECH < HIGH-TECH

t = 2.44 p = 0.0073

TABLE 4.17

WAGES AND TECHNOLOGY

MODEL: $W = f(C)$

HYPOTHESIS: Technology affects wages in the trading sector through its effects on trade performance.

IMPLICATION: Wage dispersion between common-tech industries and high-tech industries will increase with trade.

TEST: Longitudinal regression analysis.

DEPENDENT VARIABLE (Y): Annual ratio of high-tech wages to common-tech wages.

INDEPENDENT VARIABLE (X): Annual trade intensity of the trading sector.

RESULTS:

$r = 0.8973$	$n = 14$	
$r^2 = 0.8052$	$F = 45.47$	
$b = 0.8946$	$t = 6.74$	$p = 0.0000$

$Y = 1.8540 + 0.8946X$

	Y	X
Mean	1.3701	0.2063
Standard deviation	0.0306	0.0307

TABLE 4.18

WAGES AND TECHNOLOGY

MODEL: $W = f(C)$

HYPOTHESIS: Technology affects wages in the trading sector through its effects on trade performance.

IMPLICATION: Wage dispersion between common-tech industries and high-tech industries will increase with trade.

TEST: Comparison of two groups with respect to wages.

VARIABLE: Ratio of average group wages to average wages of the trading sector.

RESULTS:

	COMMON-TECH	HIGH-TECH
N	149	87
Average group wages 1979	$256	$340
Group/sector wages	0.8858	1.1765
Average group wages 1992	$511	$720
Group/sector wages	0.8661	1.2203

TABLE 4.19

WAGES AND TECHNOLOGY

MODEL: $W = f(C)$

TEST: Comparison of common-tech and high-tech groups with respect to change in wage dispersion over the study period.

VARIABLE: Coefficient of variation of wages.

RESULTS:

	COMMON-TECH	HIGH-TECH
N	149	87
Average group wages 1979	$256	$340
Standard deviation	67.70	49.75
Coefficient of variation	0.2643	0.1465
Average group wages 1992	$511	$720
Standard deviation	135.48	130.99
Coefficient of variation	0.2650	0.1818

TABLE 4.20

WAGES AND TECHNOLOGY

MODEL: $W = f(C)$

HYPOTHESIS: Technology affects industry growth through its effects on trade performance.

TEST: Comparison of two groups with respect to economic growth.

VARIABLE: Percentage change in shipments from 1979 to 1992.

RESULTS:

	COMMON-TECH	HIGH-TECH
N	149	87
Mean	- 6.07%	21.05%
Standard Deviation	32.99%	55.51%

COMMON-TECH < HIGH-TECH

t = 4.71 p = 0.0000

Share of sector 1979	43.19%	31.47%
Share of sector 1992	40.56%	35.92%

TABLE 4.21

EMPLOYMENT, PRODUCT DEMAND, AND PRODUCTIVITY

MODEL: $E = S/P$

EQUATION: $\ln(\%\Delta E + 1) = \ln(\%\Delta S + 1) - \ln(\%\Delta P + 1)$, where Δ is a symbol for change.

HYPOTHESIS: Employment is affected by product demand and productivity.

TEST: Cross-sectional regression analysis.

DEPENDENT VARIABLE (Y): $\text{Ln}(\%\Delta E + 1)$, where $\%\Delta E$ is the percentage change in annual employment from 1979 to 1992.

INDEPENDENT VARIABLE (X_1): $\text{Ln}(\%\Delta S + 1)$, where $\%\Delta S$ is the percentage change in annual shipments from 1979 to 1992.

INDEPENDENT VARIABLE (X_2): $\text{Ln}(\%\Delta P + 1)$, where $\%\Delta P$ is the percentage change in productivity from 1979 to 1992.

RESULTS:

Overall $r^2 = 1.0000$ $F > 999$

$Y = 0.0003 + 1.0315X_1 - 0.8029X_2$

EMPLOYMENT AND SHIPMENTS (Y and X_1)

$r = 0.6880$ $n = 310$

$b = 1.0315$ $t > 100$ $p = 0.0000$

	Y	X_1
Mean	- 23.14%	6.86%
Standard deviation	40.21%	41.47%

TABLE 4.21 (continued)

EMPLOYMENT, PRODUCT DEMAND,
AND PRODUCTIVITY

EMPLOYMENT AND PRODUCTIVITY (Y and X_2)

r = - 0.3617	n = 310	
b = - 0.8029	t > 100	p = 0.0000

	Y	X_2
Mean	- 23.14%	16.24%
Standard Deviation	40.21%	32.29%

TABLE 4.22

EMPLOYMENT, PRODUCT DEMAND, AND PRODUCTIVITY

MODEL: $E = S/P$

EQUATION: $\%\Delta E = \%\Delta S - \%\Delta P$ where Δ is a symbol for change.

HYPOTHESIS: Employment is affected by product demand and productivity.

TEST: Cross-sectional regression analysis.

DEPENDENT VARIABLE (Y): Percentage change in annual employment from 1979 to 1992.

INDEPENDENT VARIABLE (X_1): Percentage change in annual shipments from 1979 to 1992.

INDEPENDENT VARIABLE (X_2): Percentage change in productivity from 1979 to 1992.

RESULTS:

Overall $r^2 = 0.6980$ $F = 353.66$

$Y = 0.0109 + 0.8088X_1 - 0.6739X_2$

EMPLOYMENT AND SHIPMENTS (Y and X_1)

$r = 0.5385$ $n = 310$

$b = 0.8088$ $t = 24.70$ $p = 0.0000$

	Y	X_1
Mean	- 13.80%	1.57%
Standard deviation	39.97%	43.40%

TABLE 4.22 (continued)

EMPLOYMENT, PRODUCT DEMAND,
AND PRODUCTIVITY

EMPLOYMENT AND PRODUCTIVITY (Y and X_2)

r = - 0.3097 n = 310

b = - 0.6739 t = 20.33 p = 0.0000

	Y	X_2
Mean	- 13.80%	23.91%
Standard Deviation	39.97%	42.83%

TABLE 4.23

EMPLOYMENT AND TRADE

MODEL: $E = f(M,X)$

HYPOTHESIS: Trade performance affects employment in the trading sector through its effect on product demand.

IMPLICATION: Employment will decrease with imports and increase with exports, resulting in an employment shift within the trading sector.

TEST: Cross-sectional regression analysis.

DEPENDENT VARIABLE (Y): Change in annual employment from 1979 to 1992.

INDEPENDENT VARIABLE (X): Change in annual net exports from 1979 to 1992.

RESULTS:

$r = 0.1667$	$n = 310$	
$r^2 = 0.0278$	$F = 8.78$	
$b = 3.1390$	$t = 2.96$	$p = 0.0030$

$Y = -6539 + 3.1390X$

	Y	X (millions)
Mean	- 6,906	- $93
Standard deviation	25,795	$802

TABLE 4.24

EMPLOYMENT AND TRADE

MODEL: $E = f(M,X)$

HYPOTHESIS: Trade performance affects employment in the trading sector through its effect on product demand.

IMPLICATION: Employment will decrease with imports and increase with exports, resulting in an employment shift within the trading sector.

TEST: Cross-sectional regression analysis.

DEPENDENT VARIABLE (Y): Change in annual employment from 1979 to 1992.

INDEPENDENT VARIABLE (X): Change in annual imports from 1979 to 1992.

RESULTS:

$r = 0.0386$	$n = 310$	
$r^2 = 0.0015$	$F = 0.46$	
$b = 0.5139$	$t = 0.68$	$p = 0.4981$

$Y = -7,312 + 0.5139X$

	Y	X (millions)
Mean	- 6,906	$366
Standard deviation	25,795	$1,160

TABLE 4.25

EMPLOYMENT AND TRADE

MODEL: $E = f(M,X)$

HYPOTHESIS: Trade performance affects employment in the trading sector through its effect on product demand.

IMPLICATION: Employment will decrease with imports and increase with exports, resulting in an employment shift within the trading sector.

TEST: Cross-sectional regression analysis.

DEPENDENT VARIABLE (Y): Change in annual employment from 1979 to 1992.

INDEPENDENT VARIABLE (X): Change in annual exports from 1979 to 1992.

RESULTS:

$r = 0.1655$	$n = 310$	
$r^2 = 0.0274$	$F = 8.65$	
$b = 2.3299$	$t = 2.94$	$p = 0.0033$

$Y = - 8473 + 2.3299X$

	Y	X (millions)
Mean	- 6,906	$273
Standard deviation	25,795	$1,010

TABLE 4.26

EMPLOYMENT AND TRADE

MODEL: $E = f(M,X)$

HYPOTHESIS: Trade performance affects employment in the trading sector through its effect on product demand.

IMPLICATION: Employment will decrease with imports and increase with exports, resulting in an employment shift within the trading sector.

TEST: Comparison of net importers and net exporters with respect to employment.

VARIABLE: Annual employment.

RESULTS:

	NET IMPORTERS	NET EXPORTERS
Employment 1979	10,699,920	7,654,030
Employment 1992	8,551,110	7,347,691
Change in employment	- 2,148,810	- 306,339
Share of sector 1979	58.30%	41.70%
Share of sector 1992	53.78%	46.22%

TABLE 4.27

EMPLOYMENT AND TECHNOLOGY

MODEL: $E = f(C)$

HYPOTHESIS: Technology affects employment in the trading sector through its effect on trade performance.

IMPLICATION: Import competition will increase for industries that use common technology in relation to industries that use high technology, and therefore employment in the former will decrease in relation to employment in the latter.

TEST: Comparison of common-tech industries and high-tech industries with respect to employment.

VARIABLE: Annual employment.

RESULTS:

	COMMON-TECH	HIGH-TECH
Employment 1979	9,579,150	5,696,501
Employment 1992	8,175,006	4,987,475
Change in Employment	- 1,404,144	- 709,026
Share of sector 1979	52.19%	31.04%
Share of sector 1992	51.42%	31.37%

TABLE 4.28

EMPLOYMENT AND TRADE - TWO SECTORS

MODEL: $E_R = f(M,X)$

HYPOTHESIS: Trade causes employment shifts between the trading and nontrading sectors through its effect on product demand.

IMPLICATION: Employment shifts from the trading sector to the nontrading sector will occur with increases in import competition.

TEST: Longitudinal regression analysis.

DEPENDENT VARIABLE (Y): Annual ratio of trading sector employment to nontrading sector employment.

INDEPENDENT VARIABLE (X): Annual net exports for the trading sector.

RESULTS:

$r = 0.7046$	$n = 310$	
$r^2 = 0.4965$	$F = 11.83$	
$b = 0.0001$	$t = 3.44$	$p = 0.0024$

$Y = - 0.3051 + 0.0001X$

	Y	X (millions)
Mean	0.2884	- $25,564
Standard deviation	0.0414	$44,748

TABLE 4.29

EMPLOYMENT FLUCTUATIONS - TWO SECTORS

TEST: Comparison of fluctuations in sector employment over the study period.

VARIABLE: Sector employment.

RESULTS:

SECTOR	TRADING SECTOR	NONTRADING
Mean employment	16,960,117	59,417,055
Coefficient of variation	0.1169	0.1432

TRADING < NONTRADING

F > 100 p = 0.0000

TABLE 4.30

WAGES AND TRADE - TWO SECTORS

MODEL: $W_R = f(M,X)$

HYPOTHESIS: Trade affects wage dispersion between the trading and nontrading sectors through its effect on labor supply.

IMPLICATION: Increases in wage dispersion between the two sectors will occur with increases in import competition.

TEST: Longitudinal regression analysis.

DEPENDENT VARIABLE (Y): Annual ratio of trading sector wages to nontrading sector wages.

INDEPENDENT VARIABLE (X): Annual net exports for the trading sector.

RESULTS:

$r = -0.7676$ $n = 14$

$r^2 = 0.5893$ $F = 17.22$

$b = -0.0001$ $t = 4.15$ $p = 0.0010$

$Y = 0.3226 - 0.0001X$

	Y	X (millions)
Mean	3.0211	- $25,564
Standard deviation	0.0020	$44,748

TABLE 4.31

WAGE DISPERSION AND EMPLOYMENT SHIFTS

MODEL: $W_R = f(M,X)$

HYPOTHESIS: Trade causes affects the wage dispersion between the trading and nontrading sectors through its effect on labor supply.

IMPLICATION: Increases in wage dispersion between the two sectors occur with increases in import competition.

TEST: Longitudinal regression analysis.

DEPENDENT VARIABLE (Y): Annual ratio of trading sector wages to nontrading sector wages.

INDEPENDENT VARIABLE (X): Annual ratio of trading sector employment to nontrading sector employment.

RESULTS:

$r = -0.5739$	$n = 14$	
$r^2 = 0.3294$	$F = 5.40$	
$b = -0.2808$	$t = 2.32$	$p = 0.0403$

$Y = 0.4120 - 0.2808X$

	Y	X
Mean	3.0211	0.2884
Standard deviation	0.0020	0.0414

TABLE 4.32

PRODUCTIVITY AND TRADE

MODEL: $P = f(M,X)$

HYPOTHESIS: Productivity in the trading sector is related directly to foreign competition.

IMPLICATION: The rate of productivity growth will be higher in industries that have greater import competition.

TEST: T-test for difference in mean productivity growth between net importers and net exporters.

VARIABLE: Productivity growth from 1979 to 1992.

RESULTS:

	NET IMPORTERS	NET EXPORTERS
N	177	133
Mean productivity growth	22.87%	25.29%
Standard deviation	38.91%	47.51%

NET IMPORTERS < NET EXPORTERS

$t = 0.49$ $p = 0.3121$

TABLE 4.33

PRODUCTIVITY AND TRADE

MODEL: $P = f(M,X)$

HYPOTHESIS: Productivity in the trading sector is related directly to foreign competition.

IMPLICATION: The rate of productivity growth will be higher in industries that have greater import competition.

TEST: Cross-sectional regression analysis.

DEPENDENT VARIABLE (Y): Productivity growth from 1979 to 1992.

INDEPENDENT VARIABLE (X): Average net export intensity for the study period.

RESULTS:

$r = 0.0126$

$r^2 = 0.0002$ $F = 0.05$

$b = 0.0314$ $t = 0.22$ $p = 0.8245$

$Y = 0.2406 + 0.0314X$

	Y	X
Mean	23.91%	- 0.0501
Standard deviation	42.83%	0.1723

TABLE 4.34

PRODUCTIVITY AND TRADE

MODEL: $P = f(M,X)$

HYPOTHESIS: Productivity in the trading sector is related directly to foreign competition.

IMPLICATION: The rate of productivity growth will be higher in industries that have greater import competition.

TEST: Cross-sectional regression analysis.

DEPENDENT VARIABLE (Y): Productivity growth from 1979 to 1992.

INDEPENDENT VARIABLE (X): Average trade intensity for the study period.

RESULTS:

$r = 0.1070$

$r^2 = 0.0114$ $F = 3.57$

$b = 0.2484$ $t = 1.89$ $p = 0.0590$

$Y = 0.1810 + 0.2484X$

	Y	X
Mean	23.91%	0.2338
Standard deviation	42.83%	0.1842

TABLE 4.35

PRODUCTIVITY AND TRADE

MODEL: $P = f(M,X)$

ALTERNATIVE HYPOTHESIS: Export success is related directly to productivity.

IMPLICATION: Export success will be greater for industries that have higher productivity levels.

TEST: Cross-sectional regression analysis.

DEPENDENT VARIABLE (Y): Average net export intensity for the study period.

INDEPENDENT VARIABLE (X): Average productivity level for the study period.

RESULTS:

$r = 0.2818$ $n = 310$

$r^2 = 0.0794$ $F = 26.58$

$b = 0.6697$ $t = 5.16$ $p = 0.0000$

$Y = - 0.1100 + 0.6697X$

	Y	X
Mean	- 0.0501	0.0895
Standard deviation	0.1723	0.0726

TABLE 4.36

PRODUCTIVITY AND TECHNOLOGY

MODEL: $P = f(M,X)$

HYPOTHESIS: Productivity levels are related to technology.

TEST: Comparison of common-tech industries and high-tech industries with respect to productivity levels.

VARIABLE: Average productivity level for the study period.

RESULTS:

	COMMON-TECH	HIGH-TECH
N	149	87
Mean productivity level	0.0696	0.0850
Standard deviation	0.0521	0.0422

COMMON-TECH < HIGH-TECH

$t = 2.35$ $p = 0.0094$

TABLE 4.37

PRODUCTIVITY, TECHNOLOGY, AND TRADE

MODEL: $P = f(M,X)$

ALTERNATIVE HYPOTHESIS: Export success is related directly to productivity.

IMPLICATION: Export success will be greater for industries that have higher productivity levels.

TEST: Cross-sectional regression analysis.

DEPENDENT VARIABLE (Y): Average net export intensity for the study period.

INDEPENDENT VARIABLE (X): Average productivity level for the study period.

RESULTS FOR COMMON-TECH GROUP:

$r = 0.3050$	$n = 149$	
$r^2 = 0.0930$	$F = 15.07$	
$b = 1.1085$	$t = 3.88$	$p = 0.0002$

$Y = - 0.1834 + 1.1085X$

	Y	X
Mean	- 0.1062	0.0696
Standard deviation	0.1894	0.0521

TABLE 4.38

PRODUCTIVITY, TECHNOLOGY, AND TRADE

MODEL: $P = f(M,X)$

ALTERNATIVE HYPOTHESIS: Export success is related directly to productivity.

IMPLICATION: Export success will be greater for industries that have higher productivity levels.

TEST: Cross-sectional regression analysis.

DEPENDENT VARIABLE (Y): Average net export intensity for the study period.

INDEPENDENT VARIABLE (X): Average productivity level for the study period.

RESULTS FOR HIGH-TECH GROUP:

$r = 0.2846$ $n = 87$

$r^2 = 0.0810$ $F = 7.49$

$b = 0.7953$ $t = 2.74$ $p = 0.0075$

$Y = - 0.0472 + 0.7953X$

	Y	X
Mean	0.0204	0.0850
Standard deviation	0.1187	0.0422

TABLE 4.39

TRADE AND ECONOMIC GROWTH

MODEL: $S = f(M,X)$

HYPOTHESIS: Industry growth is related inversely to import competition and directly to export success.

TEST: Cross-sectional regression analysis.

DEPENDENT VARIABLE (Y): Change in annual shipments from 1979 to 1992.

INDEPENDENT VARIABLE (X): Change in annual net exports from 1979 to 1992.

RESULTS:

$r = 0.1107$ $n = 310$

$r^2 = 0.0123$ $F = 3.82$

$b = 0.3778$ $t = 1.95$ $p = 0.0256$

$Y = 884 + 0.3778X$

	Y	X
	(millions)	
Mean	$302	- $93
Standard deviation	$2,874	$802

TABLE 4.40

PRODUCTIVITY AND TRADING SECTOR

MODEL: $P = f(M,X)$

HYPOTHESIS: Trade raises the productivity level of the trading sector as a whole through its effect on economic growth.

TEST: Analysis of productivity growth in trading sector.

VARIABLE: Sector productivity level.

RESULTS:

Productivity level 1979 (weighted by shipments)	0.0980
Productivity level 1992 (weighted by shipments)	0.1115
Productivity level 1992 (unweighted)	0.1102
Due to economic growth	0.0013

TABLE 4.41

PRODUCTIVITY AND TRADE

MODEL: $P = f(M,X)$

HYPOTHESIS: Productivity of the trading sector is related to trade.

TEST: Longitudinal regression analysis.

DEPENDENT VARIABLE (Y): Annual productivity level of trading sector.

INDEPENDENT VARIABLE (X): Annual trade intensity for the trading sector.

RESULTS:

$r = 0.8822$	$n = 14$	
$r^2 = 0.7783$	$F = 35.10$	
$b = 0.3138$	$t = 5.92$	$p = 0.0001$

$Y = 0.0320 + 0.3138X$

	Y	X
Mean	0.0950	0.2063
Standard deviation	0.0094	0.0307

TABLE 4.42

PRODUCTIVITY AND TRADE - TWO SECTORS

MODEL: $P = f(M,X)$

HYPOTHESIS: Productivity is related directly to foreign competition.

IMPLICATION: Productivity growth will be greater in the trading sector than in the nontrading sector.

TEST: T-test for difference in means.

VARIABLE: Average sector productivity growth from 1979 to 1992.

RESULTS:

	TRADING SECTOR	NONTRADING SECTOR
N	98	17
Av annual prod growth	2.14%	0.79%
Standard deviation	0.33%	0.10%

TRADING SECTOR > NONTRADING SECTOR

t = 102.78 p = 0.0000

TABLE 4.43

PRODUCTIVITY AND TRADE - TWO SECTORS

MODEL: $P = f(M,X)$

HYPOTHESIS: Productivity is related directly to foreign competition.

IMPLICATION: The productivity gap between the trading sector and the nontrading sector will increase with trade.

TEST: Longitudinal regression analysis.

DEPENDENT VARIABLE (Y): Annual ratio of productivity growth in the trading sector to productivity growth in the nontrading sector.

INDEPENDENT VARIABLE (X): Annual trade intensity for the trading sector.

RESULTS:

$r = 0.9076$ $n = 14$

$r^2 = 0.8237$ $F = 51.39$

$b = 5.2498$ $t = 7.17$ $p = 0.0000$

$Y = 0.8318 + 5.2498X$

	X	Y
Mean	2.7089	0.2063
Standard deviation	0.1850	0.0307

CHAPTER V

CONCLUSION

In this chapter the conclusions of the study will be presented. The primary and secondary purposes of the study will be recalled, and the results of the data analysis will be applied. The discussion will focus on the extent to which the results support the general hypothesis, the extent to which the results are consistent with those of previous studies, and the extent to which the results support the predictions of trade theory. The policy implications of this study will then be discussed, and the areas for future research will be indicated.

Trade and Income Inequality

The primary purpose of this study was to find out if trade was a cause of the increase in income inequality that occurred in the United States after 1979. The secondary purposes were to find out (1) if the main predictions of international trade theory regarding the effects of trade on wages and employment are supported by empirical evidence, (2) if some modified predictions derived from real world conditions are useful for investigating the problem, and (3) if trade is a cause of diverging productivity growth

between economic sectors in developed countries. The basic research strategy was to use a measure of income inequality (the coefficient of variation of earnings) which is completely determined by wage structure and employment structure, and then to examine the effects of trade on these two labor market variables. This strategy was embodied in the general hypothesis that *international trade affects income inequality through its effects on wage structure and employment structure.*

The general hypothesis. The results of the data analysis confirmed that as measured by the coefficient of variation of earnings, income inequality in the United States increased significantly from 1979 to 1992. Wage dispersion and employment shifts both contributed to this increase, with the former accounting for about 63 percent of the overall effect.

Income inequality increased within both the trading and nontrading sectors, due entirely to increases in wage dispersion. Wage dispersion increased between the two sectors, at least partly because of employment shifts within the sectors which raised the average wage of the trading sector and lowered the average wage of the nontrading sector. At the same time, an employment shift from the trading sector to the nontrading sector contributed to the overall increase in income inequality in at least two ways: it shifted employment to a sector with a much higher index

of income inequality, and it shifted employment mainly to industries with much lower wages than the average wage for the economy. It may also have increased wage dispersion between the trading and nontrading sectors by increasing the supply of labor available for the latter.

The analysis therefore identified six changes in wage structure and employment structure that contributed to the increase in income inequality during the study period: (1) an increase in wage dispersion within the trading sector, (2) an employment shift within that sector, (3) an increase in wage dispersion within the nontrading sector, (4) an employment shift within that sector, (5) an increase in wage dispersion between the two sectors, and (6) an employment shift from the trading sector to the nontrading sector. This study examined the effects of trade on four of these changes (1, 2, 5, and 6).

The increase in wage dispersion within the trading sector can be at least partly attributed to trade. Specifically, wage dispersion between net importers and net exporters increased during the study period, supporting the hypothesis that *trade performance affects wages in the trading sector through its effect on product demand.* Wage changes within the sector were affected by product demand which in turn was affected by trade performance, so product demand is evidently a mediating variable between trade performance and wages, as stated in the hypothesis.

On the other hand, though wage changes were also affected by productivity, the analysis offered no evidence that productivity was affected by trade performance, so productivity is evidently not a mediating variable.

The employment shift within the trading sector can be at least partly attributed to trade. Specifically, employment decreased with imports and increased with exports (i.e., shifted from net importers to net exporters), supporting the hypothesis that *trade performance affects employment in the trading sector through its effect on product demand.* Employment shifts within the sector were affected by product demand which in turn was affected by trade performance, so product demand is evidently a mediating variable. On the other hand, though employment shifts were also affected by productivity, the analysis offered no evidence that productivity was affected by trade performance, so productivity is evidently not a mediating variable.

The increase in wage dispersion between the trading sector and the nontrading sector can be at least partly attributed to trade. Specifically, increases in wage dispersion between the two sectors occurred with increases in import competition, supporting the hypothesis that *trade affects wage dispersion between the trading and nontrading sectors through its effect on labor supply.* Wage dispersion between the two sectors was affected by employment shifts

which in turn were affected by trade, so labor supply is evidently a mediating variable, as stated in the hypothesis. Also, the employment shift within the trading sector which can be attributed to trade increased wage dispersion between the two sectors by raising the average wage in the trading sector.

The employment shifts between the trading and nontrading sector can be at least partly attributed to trade. Specifically, employment shifts from the trading sector occurred with increases in import competition, supporting the hypothesis that *trade causes employment shifts between the trading and nontrading sectors through its effect on product demand.* Employment shifts between sectors were affected by product demand which in turn was affected by trade, so product demand is evidently a mediating variable, as stated in the hypothesis.

These results all support the general hypothesis, since they indicate that trade affected at least four of the six changes in wage structure and employment structure that contributed to the increase in income inequality during the study period. It is also possible that trade affected wage dispersion within the nontrading sector (e.g., by supplying labor from the trading sector that did not have the required skills for average-wage jobs in the nontrading sector and thereby depressing wages in low-skill, low-wage industries), but such effects were not examined by this study.

The effects of trade do not account for all of the changes in wage structure and employment structure, so other factors must also have contributed to the increase in income inequality. The results of the data analysis indicate that technology and productivity both played roles.

The increase in wage dispersion within the trading sector can be at least partly attributed to differences in technology. Specifically, import competition for industries that use common technology increased in relation to industries that use high technology, and therefore wages in the former decreased in relation to wages in the latter, supporting the hypothesis that *technology affects wages in the trading sector through its effect on trade performance.* Wage changes in the sector were affected by trade performance which in turn was affected by technology, so trade performance is evidently a mediating variable. But technology must also affect wages without the mediation of trade, if only through its effect on productivity. In other words, some of the wage dispersion within the trading sector can be attributed to differences in technology that have effects which are independent of trade performance.

On the other hand, the analysis offered no evidence that employment shifts within the trading sector can be attributed to technology. During the study period employment in common-tech industries did not decrease in relation to employment in high-tech industries, undermining

the hypothesis that *technology affects employment in the trading sector through its effect on trade performance.* There was virtually no employment shift from common-tech industries to high-tech industries, and despite the fact that the latter group had a much higher economic growth rate than the former (measured by industry shipments), it did not have a corresponding increase in employment. In fact, employment in high-tech industries decreased during the study period. While this finding does not undermine the hypothesis that skill-biased technology contributed to growing income inequality, it indicates that the mediating variable is productivity (or some other variable) rather than labor demand. In other words, high-tech industries increased their relative wages during the period because they increased their relative productivity, rather than because they increased their relative demand for skilled labor. This conclusion was supported by the finding that productivity growth rates of high-tech industries were significantly higher than those of common-tech industries.

The increase in wage dispersion within the trading sector can be at least partly attributed to productivity. Wage changes were affected by productivity growth, but the analysis offered no evidence that productivity growth was affected by trade, undermining the hypothesis that *productivity in the trading sector is related directly to foreign competition.* The results supported the

alternative hypothesis that trade performance is related to productivity. Since wage changes during the study period were affected by trade performance, then there may be a transitive relationship between wage changes, trade performance, and productivity. There is also a direct relationship between wage changes and productivity, so wage dispersion within the trading sector may be affected by productivity both directly and indirectly, with trade performance as a mediating variable in the latter case.

Trade performance may affect the overall productivity level of the trading sector through a process analogous to natural selection. In this process, industries that are more productive have greater export success and therefore have higher economic growth rates, which over time would raise the weighted average productivity level of the sector. As a result, the ratio of productivity between the trading and nontrading sectors would increase, since the latter would not be subject to the trade-driven selection process (though it might be subject to other pressures). The results showed that productivity growth during the study period was indeed greater in the trading sector than in the nontrading sector and that the productivity gap between the two sectors increased with trade. The implication is that wage dispersion between the trading and nontrading sectors can be at least partly attributed to the effect of trade on the productivity gap between them.

Comparisons with previous studies. With respect to the effects of trade on wages, the results of this study were consistent with those of previous studies, as far as the latter went (Katz and Summers 1989; Vroman and Abowd 1989; Dickens 1990; MacPherson and Stewart 1990; Freeman and Katz 1991; Partridge 1991). In particular, the finding that industry wages in the trading sector are related inversely to import competition and directly to export success agreed with the findings of other studies. The finding that industry wages in the trading sector are affected by the type of technology agreed with the finding of Partridge (1991).

With respect to the effects of trade on employment, the results of this study were also consistent with those of previous studies, as far as the latter went (McKenzie 1987; Stone and Sawhill 1987; Abowd and Lemieux 1991; Freeman and Katz 1991). In particular, the finding that industry employment in the trading sector was related inversely to import competition and directly to export success agreed with the findings of other studies.

Beyond confirming the results of previous studies, the results of this study help to fill gaps in the literature. The linking of income inequality, labor market variables, and trade variables through the general model provides a useful framework of analysis. The identification of mediating variables between trade variables and labor

market variables helps to clarify the process through which trade affects wages and employment. Among other contributions, this study identifies the changes in wage structure and employment structure that increased income inequality during the period; relates these changes to trade variables; extends the range of inquiry to the nontrading sector; indicates how technology affects the labor market variables; and offers an explanation of the relationship between productivity, trade performance, and the labor market variables. Two especially notable findings are that employment in the trading sector is not shifting from common-tech industries to high-tech industries, as is often assumed, and that productivity at the industry level is apparently not affected by foreign competition but instead affects trade performance, as predicted by classical trade theory.

The predictions of trade theory. The results of this study generally support the main predictions of trade theory regarding the effects of trade on income distribution, wages, and employment. The results indirectly support the prediction that trade will redistribute income from one factor of production to another since industries that have import competition use higher proportions of unskilled labor than industries that have export success (Katz and Summers 1988). The increase in wage dispersion between net importers and net exporters indicates such a redistribution.

In the same way, the results support the prediction that trade will redistribute income in the trading sector, and they directly support the prediction that trade will increase wage dispersion in the trading sector. The results also directly support the prediction that employment will shift from industries that have import competition to industries that have export success.

The results of this study generally support the modified predictions of trade theory regarding the effects of trade on income distribution, wages, and employment. The results directly support the prediction that trade will increase wage dispersion in the trading sector between industries that use common technology and industries that use high technology. The results also support the prediction that trade will increase wage dispersion between the trading sector and the nontrading sector, and that trade will shift employment between the two sectors.

Policy implications. During the study period the dominant share of U.S. trade was conducted with developed countries, which have similar labor factors. According to the theory that explains such trade, its effects on income inequality in the United States should have been minimal. Since the mid-1980s, however, U.S. trade has been shifting toward developing countries, which have different labor factors. In particular, they have a great abundance of unskilled labor, which is relatively cheap. According to

the theory that explains such trade, its effects on income inequality should be considerable. Indeed, the theory predicts that trade will equalize prices of labor factors between nations. While this process would increase wages of unskilled workers in developing countries, it would decrease wages of such workers in the United States, thereby widening its wage gap between unskilled workers and skilled workers. The implication is that if U.S. trade continues to shift toward developing countries, then the trend toward greater income inequality in the United States will accelerate. Some recent studies have provided evidence of this effect not only for the United States but also for other developed countries (Wood 1994; Sachs and Shatz 1994). If nothing is done to prevent or remedy these undesired effects of trade, then U.S. society will become more widely polarized and more rigidly stratified in the years ahead.

The two basic policy choices are to slow the growth of trade by reimposing trade barriers, or to mitigate the effects of trade on income inequality by assisting people who are vulnerable to income loss or job loss because of import competition. Since trade theory convincingly demonstrates that the benefits of trade exceed its costs, then any policy to slow its growth would be suboptimal. The country as a whole would benefit more by continuing a policy of free trade (or fair trade) and assisting those who lose from trade with some of the proceeds of those who gain,

as suggested years ago by Heckscher (1919), Viner (1937), and Samuelson (1939). Such a policy could be proactive since the results of this study together with the results of other studies clearly show which industries and which jobs are most exposed to the negative effects of trade (e.g., common-tech industries and low-skilled jobs). Adjustment assistance in the form of retraining and job placement could therefore be targeted at people who are most at risk. Expanding industries should design and implement government-supported retraining programs since they are in a better position than government to determine their future employment needs, and employment firms should administer government-supported job placement programs since they are in a better position than government to identify job opportunities. Being directly responsive to the market, a private sector system of retraining and job placement would be more effective than the current government-administered system. An equitable method of financing such a system would be a national tax on consumption (i.e., a value-added tax), since consumers benefit from trade and would still come out ahead after paying such a tax, provided that the rates were set at appropriate levels. A value-added tax for this purpose would replace the portion of the income tax (or the budget deficit) that is being used to finance the current system of adjustment assistance, and there would be no negative effect on U.S. competitiveness, since a

value-added tax would be rebated on exports, as it is in other countries.

Future research. This study indicates several areas for future research, but the three most promising areas are research to link the work that has already been done using the two different approaches to the problem (partial and general equilibrium); further research on the relationship between the labor market variables, trade performance, and productivity; and further research on the role of technology. What is needed especially for the third area is a technology variable that could be related to the other variables, instead of the crude classification that was used in this and other studies. The interactions between technology, productivity, and trade performance might then be revealed.

REFERENCES

Abowd, John M., and Thomas Lemieux. 1991. The effects of international competition on collective bargaining outcomes: A comparison of the United States and Canada. In Immigration, trade, and the labor market, ed. John M. Abowd and Richard B. Freeman, 343-368. Chicago: University of Chicago Press.

Aggarwal, Raj. 1991. Technology transfer and economic growth: A historical perspective on current developments. In Technology transfer in international business, ed. Tamir Agmon and Mary Ann von Glinow, 56-76. New York: Oxford University Press.

Arndt, Sven, and L. Bouton. 1987. Competitiveness: The United States in world trade. Washington, DC: American Enterprise Institute.

Baldwin, R.E. 1971. Determinants of the commodity structure of U.S. trade. American Economic Review 61: 126-46

Ball, Donald A., and Wendell H. McCulloch. 1993. International Business, 5th edition. Homewood, IL: Irwin.

Bell, Linda, and Richard B. Freeman. 1991. The causes of interindustry wage dispersion in the United States. Industrial and Labor Relations Review 44 (January): 275-287.

Belman, Dale, and J.S. Heywood. 1990. Union membership, union organization, and the dispersion of wages. Review of Economics and Statistics 72 (February): 148-153.

Berman, Eli, J. Bound, and Zvi Griliches. 1993. Changes in the demand for skilled labor within U.S. manufacturing industries: Evidence from the Annual Survey of Manufactures. Cambridge, MA: National Bureau of Economic Research.

Blackburn, McKinley L., and David E. Bloom. 1987. The effects of technological change on earnings and income inequality in the United States. Cambridge, MA: National Bureau of Economic Research.

_____, David E. Bloom, and Richard Freeman. 1990. An era of falling earnings and rising inequality?

Brookings Review 9 (Winter): 38-43.

Bluestone, Barry. 1990. The impact of schooling and industrial restructuring on recent trends in wage inequality in the United States. American Economic Review 80 (May): 303-07.

_____, and Bennett Harrison. 1982. The deindustrialization of America. New York: Basic Books.

_____, and _____. 1986. The great American jobs machine: The proliferation of low-wage employment in the U.S. economy. Report to Joint Economic Committee of Congress, Washington, DC: U.S. Government Printing Office.

_____, and _____. 1988. The growth of low-wage employment: 1963-86. American Economic Review, Papers and Proceedings 78 (May): 124-128.

Bound, John, and George Johnson. 1992. Changes in the structure of wages in the 1980's: An evaluation of alternative explanations. American Economic Review 82 (June): 371-392.

Bowerman, B., and R.T. O'Connell. 1979. Time series and forecasting. North Scituate, MA: Duxbury Press.

Box, G.E.P., and G.M. Jenkins. 1970. Time series analysis forecasting and control. San Francisco: Holden-Day.

Branson, William H., and Dwight M. Jaffee. 1990. The globalization of information and capital mobility. Cambridge, MA: National Bureau of Economic Research.

_____, and H.B. Junz. 1971. Trends in U.S. trade and comparative advantage. Brookings Papers on Economic Activity 3: 754-759.

Brauer, David A. 1990. The effect of import competition on manufacturing wages. New York: Federal Reserve Bank of New York.

Braun, Denny. 1988. Multiple measures of U.S. income inequality. Review of Economics and Statistics (August): 398-405.

Bulow, Jeremy, and Lawrence H. Summers. 1986. A theory of dual labor markets with application to industrial policy, discrimination, and Keynesian unemployment. Journal of Labor Economics 4 (July): 376-414.

Bureau of the Census, U.S. Department of Commerce. 1994. Annual Survey of Manufactures. Washington, DC: U.S. Government Printing Office.

_____. 1994. Money Income of Households, Families, and Persons in the United States. Washington, DC: U.S. Government Printing Office.

_____. 1994. Producer Price Indexes. Washington, DC: U.S. Government Printing Office.

_____. 1994. U.S. Imports, SIC Based Products. Washington, DC: U.S. Government Printing Office.

_____. 1994. U.S. Exports, SIC Based Products. Washington, DC: U.S. Government Printing Office.

Bureau of Labor Statistics, U.S. Department of Labor. 1988. Employment and wages. Washington, DC: U.S. Government Printing Office.

_____. 1994. Employment and wages. Washington, DC: U.S. Government Printing Office.

_____. 1994a. CPI Detailed Report. Washington, DC: U.S. Government Printing Office.

_____. 1994b. Productivity measures for selected industries. Washington, DC: U.S. Government Printing Office.

Burtless, Gary, ed. 1990. A future of lousy jobs? Washington: Brookings Institution.

_____. 1993. The contribution of employment and hours changes to family income inequality. American Economic Review 83 (May): 131-135.

Capelli, Peter. 1993. Are skill requirements rising? Evidence from production and clerical jobs. Industrial and Labor Relations 46 (April): 515-530.

Culbertson, John M. 1986. The folly of free trade. Harvard Business Review 64 (September-October): 122-128.

Cutler, David M., and Lawrence F. Katz. 1992. Rising inequality? Changes in the distribution of income and consumption in the 1980s. American Economic Review 82 (May): 546-551.

Danziger, Sheldon K., and Peter Gottschalk. 1989.

Increasing inequality in the United States: What we know and what we don't. Report to Joint Economic Committee of Congress, Washington, DC: U.S. Government Printing Office.

Davidson, Carlos, and Michael Reich. 1988. Income inequality: An inter-industry analysis. Industrial Relations 27 (Fall): 263-86.

Davis, Steve J., and J. Haltiwanger. 1991. Wage dispersion between and within U.S. manufacturing plants, 1963-86. Brookings Papers on Economic Activity 1: 115-200.

Deardorff, A.V., and R.W. Staiger. 1987. An interpretation of the factor content of trade. Journal of International Economics 24 (February): 93-107.

Dickens, William T. 1988. The effects of trade on employment. In The dynamics of trade and employment, eds. Laura Tyson, William Dickens, and John Zysman, 41-86. Cambridge, MA: Ballinger.

_____. 1990. Does it matter what we trade? Cambridge, MA: National Bureau of Economic Research.

_____, and L.F. Katz. 1986. Interindustry wage differences and industry characteristics. Cambridge, MA: National Bureau of Economic Research.

_____, and Kevin Lang. 1988a. Why it matters what we trade. In The dynamics of trade and employment, eds. Laura Tyson, William Dickens, and John Zysman, 87-112. Cambridge, MA: Ballinger.

_____, and _____. 1988b. The reemergence of segmented labor market theory. American Economic Review 78 (May): 129-134

Dooley, Martin D., and Peter Gottschalk. 1984. Earnings inequality among males in the United States: Trends and the effect of labor force growth. Journal of Political Economy 92 (1): 59-89.

_____, and _____. 1985. The increasing proportion of men with low earnings in the United States. Demography 33 (February): 25-34.

Drucker, Peter F. 1983. The changing world of the executive. New York: Time Books.

_____. 1986. The changed world economy. Foreign Affairs 64 (Spring): 768-791.

Duchen, Faye, and Glenn-Marie Lange. 1988. Trading away jobs: The effects of the U.S. merchandise trade deficit on employment. Washington, DC: Economic Policy Institute.

Easterlin, R. 1978. What will 1984 be like? Socio-economic implications of recent twists in age structure. Demography 15: 397-432.

Encarnation, Dennis. 1992. Rivals beyond trade: American versus Japan in global competition. Ithaca, NY: Cornell University Press.

Ethier, Wilfred J. 1979. Internationally decreasing costs and world trade. Journal of International Economics 9: (5-23).

Fields, Gary S. 1987. Measuring inequality: Change in the economy with income growth. Journal of Development Economics 26 (August): 357-374.

Freeman, Richard B. 1980. Unionism and the dispersion of wages. Industrial and Labor Relations Review 34 (October): 3-23.

_____. 1986. Factor prices, employment, and inequality in a decentralized labor market. Cambridge, MA: National Bureau of Economic Research.

_____, and Lawrence F. Katz. 1991. Industrial wage and employment determination in an open economy. In Immigration, trade, and the labor market, ed. John M. Abowd and Richard B. Freeman, 235-260. Chicago: University of Chicago Press.

Galloway, Lowell, Richard Vedder, and Roy Boyd. 1989. The growth and distribution of income in the United States in recent years: An overview. Report to Joint Economic Committee of Congress, Washington, DC: U.S. Government Printing Office.

Gottschalk, Peter. 1989. Increased inequality in the current recovery. Report to Joint Economic Committee of Congress, Washington, DC: U.S. Government Printing Office.

_____. 1993. Changes in inequality of familty income in seven industrialized countries. American Economic Review 83 (May): 136-142.

Grossman, Gene M. 1982. The employment and wage effects of

import competition in the United States. Cambridge, MA: National Bureau of Economic Research.

Grubb, W. Norton, and Robert H. Wilson. 1989. Sources of increasing inequality in wages and salaries, 1960-80. Monthly Labor Review 112 (April): 3-13.

Grusky, David B., and Thomas A. DiPrete. 1990. Recent trends in the process of stratification. Demography 27 (November): 617-637.

Harrison, Bennett, and Barry Bluestone. 1988. Corporate restructuring and the polarizing of America. New York: Basic Books.

_____, Chris Tilly, and Barry Bluestone. 1986. Wage inequality takes a great U-turn. Challenge 29 (March-April): 26-32.

Heckscher, Eli. 1919. The effect of foreign trade on the distribution of income. Ekonomisk Tidskrift 21: 497-512. Reprinted in Readings in the Theory of International Trade, ed. Howard S. Ellis and Lloyd A. Metzler, 272-300, Philadelphia: The Blakiston Company, 1950.

Hintze, Jerry L. 1989. Number cruncher statistical system. Kaysville, UT: Jerry L. Hintze.

Horvath, Francis W. 1987. The pulse of economic change: Displaced workers of 1981-85. Monthly Labor Review 110 (June): 3-12.

Howell, David R., and Edward N. Wolff. 1991. Trends in the growth and distribution of skills in the U.S. workforce, 1960-1985. Industrial and Labor Relations Review 44 (April): 486-502.

Johnson, George, and Frank Stafford. 1993. International competition and real wages. American Economic Review 83 (May): 127-130.

Jones, Ronald W. 1971. A three-factor model in theory, trade, and history. In Trade, Balance of Payments, and Growth, ed. Jagdish Bhagwati et al., 3-21. Amsterdam: North-Holland.

Karoly, Lynn A. 1992. Changes in the distribution of individual earnings in the United States: 1967-1986. Review of Economics and Statistics 74 (February): 107-115.

Katz, Lawrence F. 1986. Efficiency wage theories: A partial evaluation. In National Bureau of Economic Research Macroeconomics Annual, ed. Stanley Fisher, 235-276. Cambridge, MA: MIT Press.

_____, and Alan B. Krueger. 1991. Changes in the structure of wages in the public and private sectors. Cambridge, MA: National Bureau of Economic Research.

_____, Gary W. Loveman, and David G. Blanchflower. 1993. A comparison of changes in the structure of wages in four OECD countries. Cambridge, MA: National Bureau of Economic Research.

_____, and Kevin M. Murphy. 1992. Changes in relative wages, 1963-1987: Supply and demand factors. Quarterly Journal of Economics 107 (Spring): 35-78.

_____, and L.H. Summers. 1988. Can inter-industry wage differentials justify strategic trade policy? Cambridge, MA: National Bureau of Economic Research.

_____, and _____. 1989. Industry rents: Evidence and implications. Brookings Papers on Economic Activity, Microeconomics: 209-290.

Keynes, John Maynard. 1933. National self-sufficiency - I. The New Statesman and Nation 6 (July): 65-67.

Kosters, Marvin H. 1991. Wages and demographics. In Workers and their wages: Changing patterns in the United States, ed. M. Kosters, 1-32. Washington, DC: American Enterprise Institute.

_____, and Murray N. Ross. 1987. The distribution of earnings and employment opportunities: A re-examination of the evidence. Washington, DC: American Enterprise Institute.

Krueger, Alan B., and Lawrence B. Summers. 1987. Reflections on the inter-industry wage structure. In Unemployment and the structure of labor markets, ed. K. Lang and J. Leonard, 33-68. New York: Basil Blackwell.

Krueger, Anne O. 1980. Restructuring for import competition from developing countries. Journal of Policy Modeling 2: 165-184.

Krugman, Paul. 1979. Increasing returns, monopolistic competition, and international trade. Journal of International Economics 9 (November): 469-79.

_____. 1980. Scale economies, product differentiation, and the gains from trade. Journal of Political Economy 70 (December): 950-59.

_____. 1981. Intraindustry specialization and the gains from trade. Journal of Political Economy 89 (October): 959-74.

_____. 1990. Rethinking international trade. Cambridge, MA: MIT Press.

_____, and Maurice Obstfeld. 1991. International economics: Theory and policy, 2nd ed. New York: HarperCollins.

Kuznets, Simon. 1955. Economic growth and income inequality. American Economic Review 45 (March): 1-28.

Lawrence, C., and R.Z. Lawrence. 1985. Manufacturing wage dispersion: An end game interpretation. Brookings Papers on Economic Activity 1: 47-106.

Lawrence, Robert Z. 1983. The myth of U.S. deindustrialization. Challenge 26 (November-December): 54-63.

_____. 1984a. Sectoral shifts and the size of the middle class. Brookings Review 3 (1): 3-11.

_____. 1984b. Can America compete? Washington, DC: Brookings Institution.

_____, and M.J. Slaughter. 1993. International trade and American wages in the 1980s: Giant sucking sound of small hiccup? Brookings Papers on Economic Activity, Microeconomics 2: 161-226.

Leamer, E.E. 1974. The commodity composition of international trade in manufactures: An empirical analysis. Oxford Economic Papers 26: 350-374.

_____. 1984. Sources of international comparative advantage: Theory and evidence. Cambridge, MA: MIT Press.

Leonard, Jonathan, and Louis S. Jacobson. 1990. Earnings inequality and job turnover. American Economic Review 80 (May): 298-302.

Leontief, Wasily. 1956. Factor proportions and the

structure of American trade. Review of Economics and Statistics 38 (August): 386-407.

Levy, Frank, and R.J. Murnane. 1992. U.S. earnings levels and inequality: A review of trends and proposed explanations. Journal of Economic Literature 30: 1333-1381.

Loveman, Gary W., and Chris Tilly. 1988. Good jobs or bad jobs: What does the evidence say? New England Economic Review (January-February): 46-65.

MacPherson, David A. and James B. Stewart. 1990. The effects of international trade on union and non-union wages. Industrial and Labor Relations Review 43 (April): 434-46.

Maskus, K.E. 1983. The changing structure of comparative advantage in American manufacturing. Ann Arbor, MI: University of Michigan Research Press.

Maxwell, Nan L. 1989. Demographic and economic determinants of United States income inequality. Social Science Quarterly 70 (June): 245-264.

_____. 1990. Income inequality in the United States, 1947-1985. New York: Greenwood Press.

McKenzie, Richard B. 1987. Loss of textile and apparel jobs: Is protectionism warranted? Cato Journal 6 (Winter): 731-746.

McKinsey & Company. 1993. Manufacturing productivity. Washington, DC: McKinsey Global Institute.

McMahon, Patrick J., and John H. Tschetter. 1986. The declining middle class: A further analysis. Monthly Labor Review 109 (September): 22-27.

Medoff, James. 1984. The structure of hourly earnings among U.S. private sector employees: 1973-84. Cambridge, MA: National Bureau of Economic Research.

Mincer, Jacob. 1991. Human capital responses to technical change. Cambridge, MA: National Bureau of Economic Research.

Mishel, Lawrence. 1989. The late great debate on deindustrialization. Challenge 32 (January-February): 35-43.

_____, and Jared Bernstein. 1992. Job destruction:

Worse than we thought. Challenge 35 (September-October): 4-8.

_____, and Jacqueline Simon. 1988. The state of working America. Challenge 31 (November-December): 50-51.

Mitchell, Daniel. 1975. Labor issues of American international trade and investment. Baltimore, MD: Johns Hopkins University Press.

Murphy, Kevin M., and Robert Topel. 1987. Unemployment, risk, and earnings: Testing for equalizing wage differentials in the labor market. In Unemployment and the structure of labor markets, ed. K, Lang and J. Leonard, 103-140. New York: Basil Blackwell.

Murphy, Kevin M., and Finis Welch. 1991. Wage differentials in the 1980s: The role of international trade. In Workers and their wages: Changing patterns in the United States, ed. Marvin Kosters, 39-69. Washington, DC: American Enterprise Institute.

_____, and _____. 1992. The structure of wages. Quarterly Journal of Economics 107 (February): 285-326.

_____, and _____. 1993a. Inequality and relative wages. American Economic Review 83 (May): 104-109.

_____, and _____. 1993b. Occupational change and the demand for skill, 1940-90. American Economic Review 83 (May): 122-126.

Office of Technology Assessment, U.S. Congress. 1988. Technology and the American economic transition. Washington, DC: U.S. Government Printing Office.

Ohlin, Bertil. 1933. Interregional and international trade, revised edition. Cambridge, MA: Harvard University Press.

O'Neill, Dave M. 1987. We're not losing our industrial base. Challenge 30 (September-October): 19-25.

Parsons, Carol A. 1988. The domestic employment consequences of managed international competition in apparel. In The dynamics of trade and employment, eds. Laura Tyson, William Dickens, and John Zysman, 113-156. Cambridge, MA: Ballinger.

Partridge, Mark. 1991. International trade's effect on the labor market: How does it affect wages? University

of Illinois: Ph.D. Dissertation.

Pelzman, Joseph, and Randolph C. Martin. 1981. Direct employment effects of increased imports: A case study of the textile industry. Southern Economic Journal 48 (October): 412-426.

Peterson, Wallace C. 1991. The silent depression. Challenge 34 (July-August): 29-34.

Plotnik, Robert. 1982. Trends in male earnings inequality. Southern Economic Review 48 (3): 724-732.

Porter, Roger B. 1992. United States investment policy. Business and the Contemporary World 4 (Summer): 17-23.

Revenga, Ana L. 1992. Exporting jobs? The impact of import competition on employment and wages in U.S. manufacturing. Quarterly Journal of Economics 107 (February): 255-284.

Rhoades, Stephen A. 1984. Wages concentration and import penetration: An analysis of the interrelationships. Atlantic Economic Journal (July): 23-31.

Ricardo, David. 1817. The principles of political economy and taxation. London: John Murray.

Rose, Stephen J. 1993. Declining family incomes in the 1980s: New evidence from longitudinal data. Challenge 36 (November-December): 29:36.

Rosen, Howard F. 1986. The impact of international trade on employment. Report to a subcommittee of the Committee on Government Operations, House of Representatives. Washington, DC: U.S. Government Printing Office.

Rosenthal, Neal H. 1985. The shrinking middle class: Myth or reality. Monthly Labor Review 108 (March): 3-10.

Ryscavage, Paul, and Peter Henle. 1990. Earnings inequality accelerates in the 1980s. Monthly Labor Review 113 (December): 3-16.

Sachs, Jeffrey D., and Howard J. Shatz. 1994. Trade and jobs in U.S. manufacturing. Brookings Papers on Economic Activity (1): 1-84.

Samuelson, Paul A. 1939. The gains from international trade. Canadian Journal of Economics and Political Science 5 (May): 195-205.

_____. 1948. International trade and the equalization of factor prices. Economic Journal 58: 163-184.

_____. 1949. International factor price equalization once again. Economic Journal 59: 181-196.

_____. 1971. Ohlin was right. Swedish Journal of Economics 73: 365-384.

Scott, Robert E. 1988. Trade and employment in automobiles: The short-run success and long-run failure of protectionist measures. In The dynamics of trade and employment, eds. Laura Tyson, William Dickens, and John Zysman, 157-204. Cambridge, MA: Ballinger.

_____. 1993. Flat earth economics: Is there a new international trade paradigm? Challenge 36 (September-October): 32-39.

Singleton, Christopher J. 1992. Auto industry jobs in the 1980s: A decade of transition. Monthly Labor Review 115 (February): 18-27.

Smith, Adam. 1776. An inquiry into the nature and causes of the wealth of nations. London: Strahan and Cadell.

Staiger, Robert. 1988. Organized labor and scope of international specialization. Cambridge, MA: National Bureau of Economic Research.

Stigler, George J. 1956. Trends in employment in the service industries. Princeton, NJ: Princeton University Press.

Stolper, Wolfgang F., and Paul A. Samuelson. 1941. Protection and real wages. The Review of Economic Studies 9 (November): 58-73.

Stern, R.M., and K.E. Maskus. 1981. Determinants of the structure of U.S. foreign trade, 1958-76. Journal of International Economics 11: 207-224.

Stone, Charles F., and Isabel V. Sawhill. 1987. Trade's impact on U.S. jobs. Challenge 30 (September-October): 12-18.

Thurow, Lester. 1987. A surge in inequality. Scientific American 256 (May): 30-37.

_____. 1989. Toward a high-wage, high-productivity service sector. Washington, DC: Economic Policy

Institute.

Tilly, Chris. 1991. Reasons for the continuing growth of part-time employment. Monthly Labor Review 114 (March): 10-18.

Tyler, Gus. 1991. Laboring to counterbalance concentrated capital. Challenge 34 (September-October): 4-11.

Tyson, Laura, and John Zysman. 1988. Trade and employment: An overview of the issues and evidence. In The dynamics of trade and employment, eds. Laura Tyson, William Dickens, and John Zysman, 1-40. Cambridge, MA: Ballinger.

Vernon, Raymond. 1966. International investment and international trade in the product cycle. Quarterly Journal of Economics 80 (May): 190-207.

Viner, Jacob. 1937. Studies in the theory of international trade. New York: Harper & Brothers.

Vroman, W., and J.M. Abowd. 1988. Disaggregataed wage developments. Brookings Papers on Economic Activity 2: 313-338.

Waldstein, Louise. 1989. Service sector wages, productivity, and job creation in the U.S. and other countries. Washington, DC: Economic Policy Institute.

Weiner, Stuart E. 1993. New estimates of the natural rate of unemployment. Kansas City, MO: Federal Reserve Bank of Kansas City.

Welch, Finis. 1979. Effects of cohort size on earnings: The baby boom babies' financial bust. Journal of Political Economy 87 (October): 65-98.

Wood, Adrian. 1994. North-South trade, employment, and inequality. Oxford: Oxford University Press.

CURRICULUM VITAE

JAMES THOMAS MILTON

16 Riverview Place
Hastings-on-Hudson, NY 101706
(914) 478-1972

Mercy College
Dobbs Ferry, NY 10522
(914) 674-7487

EDUCATION:

Ph.D. Walden University
M.A. University of Iowa
B.A. Princeton University

FIELDS OF SPECIALIZATION:

International Trade
Financial Markets
Labor Markets
Small Business Management

DISSERTATION TITLE:

"The Effects of International Trade on Income Inequality in the United States: 1979-92"

PROFESSIONAL EXPERIENCE:

Assistant Professor, Department of Business Administration and Economics, Mercy College, Dobbs Ferry, NY (1985-present). Director of International Business program. Teach courses in international business, international trade, the capstone course for international business majors, small business management, money and banking, financial markets, the capstone course for finance majors, economics and public policy, and macro- and micro-economics.

Director of Small Business Development Center (1989-present), which is sponsored by U.S. Small Business Administration and New York State. Provides one-on-one counseling to small businesses in Westchester County. Offers workshops and seminars in small business management.

Lecturer, Long Island University MBA program in Westchester Country (1985-present). Teach courses in corporate finance, financial markets, international business, international finance, and international management.

General Partner, Riverview Associates, an international business consulting firm (1980-85). Advised multinational corporations and medium-sized businesses on international projects. Advised foreign governments on economic development programs.

General Partner, Development Services International, Alexandria, VA, an international technology transfer firm (1976-79). Identified and recommended appropriate technologies for use in developing countries. Assisted countries in preparing plans and financing new projects.

Senior Vice President, Marine Midland Banks, NY (1974-75). Organized and managed the international corporate finance division, with operations in fourteen countries. Services included Eurodollar syndications, Eurobond underwritings, project financing, and export-import financing.

General Manager, International Marine Banking Company, Ltd., a London-based merchant bank (1972-74). Organized and managed operations in Latin America and Pacific Rim, which included Eurodollar syndications, project financing, equipment leasing, and foreign exchange management.

President, Citicorp Leasing International, Inc., a subsidiary of Citicorp (1969-71). Organized and managed worldwide leasing and project financing activities in 23 countries, the largest leasing operation in the world.

PROFESSIONAL AFFILIATIONS: Senior Fellow, Socio-Economic Research Institute, Rhinebeck, NY. conduct research and give seminars to business organizations on social, economic, and political trends.

GRANTS: Three-year grant from the Fund for Improvement of Postsecondary Education (FISPE) to develop an international program for undergraduate business majors.

Continuing funding from the U.S. Small Business Administration and New York State

to operate a Small Business Development Center in Dobbs Ferry, NY.

Continuing funding from the U.S. Small Business Administration and New York State to operate a Small Business Development Center in White Plains, NY in partnership with NYNEX.

Grant from Chase Manhattan Bank to conduct seminars for Westchester Hispanic business community.

Grant from Small Business Administration to operate a Small Business Institute.

HONORS AND AWARDS:

Mercy College Award for Excellence in Teaching
Sr. Gratia Maher Award for Excellence in Teaching
Chi Sigma Medal for Excellence in Teaching
Honorary Member of Delta Mu Delta
Phi Beta Kappa
Summa cum Laude
National Merit Scholar
Academy of American Poets Award

FOREIGN LANGUAGES:

Spanish and French.

PUBLICATIONS:

Trend Tracking, John Wiley & Sons, 1990 co-author with Gerald Celente.

Trend Tracking, Warner Books, 1991, an updated paperback edition of the Wiley book.