

TRADE LIBERALIZATION AND ITS IMPACT ON THE RELATIVE WAGE AND EMPLOYMENT OF UNSKILLED WORKERS IN THE UNITED STATES

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ABSTRACT

It is commonly believed that an increase in international trade reduces the wages of unskilled workers relative to the wages of skilled workers in the United States. However, current evidence on the impact of international trade on the relative wages and employment of unskilled workers is mixed at best. This study derives more comprehensive empirical equations for the relative wage and employment of unskilled workers and further examines the relationship using time-series data for the period 1980-2005. Trade liberalization is measured by imports, exports, foreign direct investment, and immigration. The explanatory variables of both equations thus consist of these variables plus labor productivity. Labor productivity is included mainly to serve as a control variable. The empirical results suggest that an increase in exports significantly increases the relative wage of unskilled workers, whereas increases in foreign direct investment abroad and immigration both significantly reduce the relative wage of unskilled workers. The results also suggest that increases in exports and productivity both have significant positive influence on employment of unskilled workers while increases in foreign direct investment abroad and immigration have significant negative influence on employment of unskilled workers. Imports, however, do not have statistically significant negative effect on the relative wage or employment of unskilled workers.

INTRODUCTION

There is no consensus among researchers on the effect of international trade, or on its relative importance on wages and employment differentials between skilled and unskilled workers in the United States and the other developed countries to date. The effect of international trade on wages and employment of unskilled workers in the developed countries in general and in the United States in particular is still unresolved issue empirically. Some analysts argue that trade liberalization has negative effects on wages and employment of unskilled workers. These researchers believe that free trade is largely responsible for the widening gap between the wages of skilled and unskilled workers and for the increase in the unemployment of unskilled labor in the United States. They also believe that trade liberalization will eventually reduce the wages of unskilled workers in the United States to the level of the wages of unskilled workers in the developing countries. Others, however, attribute the decline in the real wages of unskilled workers and the increase in real wages of skilled workers in U.S. to technological changes and increases in the productivity of skilled workers, and not to an increase in U.S. trade openness. The views on the effects of trade liberalization on the unskilled labor market in the United States are

varied and conflicting, and consume an increasing part of the public policy debate. Currently, however, there are very few empirical models that attempt to accurately estimate the effect of international trade on the relative wage and employment of unskilled workers. Most of the studies from which the prevailing views and conclusions are drawn are primarily based on descriptive analysis. A more rigorous research is therefore needed to empirically establish the link between trade liberalization and wage inequality between unskilled and skilled workers in the United States.

This paper develops two empirical models; one for the relative wage of unskilled workers and the other for employment of unskilled workers and tests the models using aggregate trade and employment time-series data from the United States. The paper is organized as follows. The next section reviews the literature on the effects of international trade on wages and employment of unskilled labor in the United States and examines the theoretical channels through which trade liberalization affects wages and employment. The basic theoretical model is developed in the third section, and the empirical models are specified in the fourth section. The results are presented in the fifth section, and summary of the results and conclusions are offered in the last section.

REVIEW OF THE LITERATURE

As briefly discussed in the introduction, the views on the effects of trade liberalization on the unskilled labor markets in the United States are controversial. On the one hand, Bound and Johnson [6], Revenga [26], Berman, Bound and Griliches [4], Lawrence and Slaughter [21], Bhagwati and Dehejia [5], and Kosters [19] believe that international trade has no significant effect on the recent increase in wage differences between skilled and unskilled workers in the United States as well as in most other developed countries. These studies and many others, such as Feenstra and Hanson [11,12], Lavoie and Therrien [20], Gera, Gu and Lin [15], and Allen [1] attribute the increases in wage and employment differences between unskilled and skilled workers to technological changes rather than to an increase in international trade. The conclusions of these studies suggest that there has been a steady shift in demand away from the less-skilled labor to more-skilled labor in the United States and the other industrialized economies due to productivity and education gaps between skilled and unskilled workers, and this shift, not an increase in international trade, has created most of the differences in wages and unemployment between the less-skilled and the more-skilled labor in the United States and the other industrialized economies.

On the other hand, Murphy and Welch [23], Katz and Murphy [18], Borjas and Ramey [8], Borjas, Freeman, and Katz [7], Johnson and Stafford [17], Wood [35, 36], Leamer [22], Cline [10], Baldwin and Cain [2], and Haskel and Slaughter [16] attribute the wage differentials between unskilled and skilled workers in the U.S. to an increase in trade openness, or an increase in immigration. The results and conclusions of each of these studies are, however, drawn under different assumptions and model specifications. Some are based on factor-content and others on an increase in imports or the volume of trade due to reductions in trade barriers.

The theoretical basis of the studies that conclude an increase in international trade negatively impacts the relative wages and employment of unskilled workers is the Heckscher-Ohlin trade theory. This theory sheds some light on how import competition impacts the domestic unskilled labor market. It suggests that import

competition lowers the prices of the goods produced at home by unskilled workers relative to the prices of the goods produced by skilled workers. As the prices of the goods made by unskilled workers fall, domestic demand for the unskilled workers decreases, and consequently their earnings are negatively impacted according to this theory. The theory also suggests that an increase in the volume of imports has an equivalent adverse effect on the wages and employment of unskilled workers. From this perspective, as Slaughter and Swagel [27] argue, international trade can be viewed as a means of increasing the supply of unskilled labor in the importing country and reducing the supply of unskilled labor in the exporting country. Since the United States mostly imports unskilled labor-intensive products from the developing countries, international trade can effectively increase the supply of unskilled labor relative to the supply of skilled labor in the U.S., and consequently decrease the earnings of unskilled labor and increase the earnings of skilled labor and thereby widen the earnings gap between these two types of labor. Some recent studies however down play the negative effects of international trade on the U.S. labor markets. For example, Burfisher, Robinson, and Thierfelder [9], and Thorbecke and Eigen-Zucchi [28,29] argue that free trade between the United States and Mexico will have a negligible negative effect on the U.S. unskilled labor market. Gaston and Trefler [14] also conclude that the free trade agreement between the United States and Canada that was implemented in 1989 did not lead to significant wage inequality and job losses in the Canadian manufacturing industries during the period 1989-93.

The Heckscher-Ohlin theory also predicts that free international trade leads to factor price equalization across all trading partners. According to the factor price equalization theorem, international trade is expected to lower the wages of unskilled workers in the United States and increase the wages of unskilled workers in other labor-abundant countries until wages in all countries converge. The role that free or increased international trade can play on the convergence of wages of the unskilled labor in the United States and the unskilled labor of its trading partners, with relatively abundant unskilled labor, is though very unlikely. This is because wage convergence could occur only under very restrictive conditions, such as perfect labor mobility across industries within each country, production of the same mix of goods and services across countries, and identical production technologies across countries. These restrictive conditions and the productivity differences of unskilled workers in U.S. and the unskilled workers in its labor-abundant trading partners will always work against international wage convergence. Thus, the notion that international trade will increase the wages of unskilled workers in the developing countries, like Mexico, to the level of the wages of unskilled workers the United States, or will lead to a decrease of the wages of unskilled workers in the United States to the level of the wages of unskilled workers in the developing countries is a remote theoretical possibility at best. Furthermore, for factor price equalization to occur there should be free movement of both labor and capital among the trading partners. Currently, there is some but not completely free movement of labor among U.S. and its labor-abundant trading partners.

However, if trade liberalization actually makes labor mobility a lot easier between U.S. and its major trading partners with abundant unskilled labor, either a decline in wages or an increase in unemployment of unskilled workers in U.S. may take place. Whether increased immigration will affect wages or unemployment will crucially depend on the competitiveness of the market for the unskilled labor in U.S. Increased immigration will likely decrease wages if the unskilled labor market is

competitive, and it will likely increase unemployment if the unskilled labor market is rigid.

The generally prevailing belief is though that trade liberalization will harm unskilled workers in U. S. either directly through increased immigration or indirectly through increased volume in U.S. imports from the developing countries, such as Mexico. But this belief seems to be in conflict with the conclusions of some recent studies, including OECD [25] that finds an increase in trade volume does not contribute to the decline of wages of the unskilled workers in the United States. Thus, there is little conclusive empirical evidence to date that supports the prevailing belief that an increase in international trade is the cause of the increase in wage inequality between unskilled and skilled workers and the decline in the employment of unskilled workers in the United States.

THE BASIC THEORETICAL MODEL

The impact of trade on wages and employment of unskilled workers in the developed countries are mainly examined through two types of theoretical approaches. These two approaches are known as factor content studies and price effect studies. The factor content studies attempt to estimate the content of unskilled labor employed in the production of a country's exports and the amount of unskilled labor that would have been employed to domestically produce a country's imports. The price effect studies analyze whether trade negatively affects the prices of the products that intensively use unskilled labor, and examine the effect of the decrease in the prices of these products on the demand for unskilled labor and its earnings. These price effect studies use the microeconomics theory of wage determination as the basic framework for analysis. According to the basic microeconomics theory, wages are positively related to the demand for labor, given supply of labor. The main determinant of the demand for labor is its productivity. That is, an increase in the productivity of labor increases the demand for labor and its earnings, given the supply of labor. The present study falls within the price effect studies of international trade and thus uses the basic microeconomics theory of wage determination as the theoretical framework for examining the effects of trade liberalization on the relative wages and employment of unskilled workers.

Trade liberalization is measured by increases in exports and imports, foreign direct investment, and immigration. The effects of trade liberalization on the relative wages and employment of unskilled workers are hence examined through increases in exports and imports, foreign direct investment, and immigration. The underlying hypothesis is that an increase in exports has a positive effect on the relative wage and employment of unskilled workers, and an increase in imports has a negative effect on the relative wage and employment of unskilled workers. The unskilled labor market is thus expected to be positively impacted if an increase in exports leads to a greater production of exports, and is expected to be negatively impacted if trade liberalization leads to a greater import penetration and a decrease in domestic production of import competing goods. This is how exports and imports are expected to impact the unskilled labor market in a multi-partner trade system. In a two-country trade model, however, the hypothesis that exports affect an economy positively and imports affect an economy negatively may not hold because an increase in one country's exports also leads to an increase in the other country's imports in a two-country model through the foreign trade repercussion effect.

In addition, the relative wage and employment of unskilled workers can be influenced by increases in foreign direct investment abroad and immigration. An increase in foreign direct investment abroad can encourage outsourcing of production to low-cost trading partners. That is, domestic producers, attracted by relatively lower wages in other countries, can move or outsource jobs to other countries, and this can negatively affect wages and employment of unskilled workers in the U.S. Thus, outsourcing or the threat of outsourcing production abroad can reduce the bargaining power of domestic unskilled workers and hold their wages down. Some studies however suggest that outsourcing of production or increased foreign direct investment does not have significant negative effect on the labor markets in the developed countries [24]. The effect of immigration is relatively more direct and straight forward. Trade liberalization can allow more unskilled workers to migrate to U.S. from unskilled labor-abundant countries, particularly from south of the border. Entry of a large number of low-skilled workers can then flood the U.S. unskilled labor market, and cause the unskilled labor supply curve to shift down to the right. If the demand for unskilled labor does not increase or increases by less than the increase in the supply of unskilled labor, an increase in immigration can hold down the wages of unskilled workers.

The arguments above can be summarized in general functional form as:¹

$$\frac{WP}{WNP} = f(\text{PRO}, \text{EX}, \text{IM}, \text{FDI}, \text{IMM}) \quad (1)$$

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where, WP, WNP, $\frac{WP}{WNP}$, PRO, EX, IM, FDI, and IMM stand for wages of production workers, wages of non-production workers, the relative wage of production workers, productivity of production workers, exports, imports, foreign direct investment, and immigration, respectively. The sign under each exogenous variable indicates the expected impact of that variable on the relative wage of production workers, holding the effects of the remaining independent variables constant. Namely, an increase in PRO or EX is expected to increase the relative wage of production workers, other things equal. This is because an increase in the productivity of production workers, or an increase in exports is expected to increase their demand, and consequently increase their wages (WP) relative to the wages of non-production. An increase in the wages of production workers relative to the wages of non-production workers can then increase the relative wage of production workers. An increase in IM, FDI, or IMM, however, is expected to affect the wages of production workers negatively as discussed above, and thereby decrease the relative wage of production workers.

Employment of production workers is also expected to be affected by the same exogenous variables specified in equation (1). As in the relative wage case, an increase in the productivity of production workers, or an increase in exports is expected to positively influence employment of the production workers because either increase will lead to an increase in their demand. Whereas, an increase in imports, FDI outflows, or immigration is expected to impact employment of domestic

production workers negatively. This can occur if an increase in imports leads to a decrease in the production of import competing goods, an increase in FDI outflow leads to job outsourcing, and domestic unskilled workers lose their jobs due to increased immigration (if immigrants take away jobs from domestic unskilled workers). The employment function for production workers in manufacturing is thus expressed as:

$$EMP = g(\overset{+}{PRO}, \overset{+}{EX}, \overset{-}{IM}, \overset{-}{FDI}, \overset{-}{IMM}) \quad (2)$$

where, EMP represents employment of production workers in manufacturing and the other variables are as defined in equation (1).

DATA ANALYSIS AND EMPIRICAL MODEL SPECIFICATION

The preceding section has developed the theoretical framework for the study. This section describes how exactly the dependent and the independent variables described in equations (1) and (2) are specified and measured for the empirical analysis. The following adjustments and transformations have been made to the data. First, to scale down the magnitude of the data, exports, imports, and FDI have been expressed as fractions of GDP, and immigration has been expressed as a fraction of the total labor force in manufacturing (LFM). Second, the data for all variables have been transformed to natural logs. This is a common practice when the data are mostly in positive dollar values. The studies by Willis [33], Gaston and Trefler [14], and Beaudry and Green [3], are a few examples. Thus, these specifications and transformations are consistent with the general practice in empirical work. Some benefits can also be obtained from expressing the data in logs. For example, Wooldridge [34] argues data in log forms can make the estimates less sensitive to outlying observations and mitigate the heteroscedasticity problem. Furthermore, following the current standard practice that involves time-series, the data were tested for unit roots using the Dickey-Fuller and Phillips-Perron tests.² The test results, provided in Table 1, show that the data are non-stationary in natural log forms but become stationary when first-differenced.

Also, when the data are first-differenced, the correlation matrix, given in Table 2, indicates no serious multicollinearity problem for most of the variables.

Hence, equations (1) and (2) have been specified for empirical estimation in logarithmic first-differenced forms as:

$$\begin{aligned} \text{dln}\left(\frac{WP}{WNP}\right)_t = & \alpha_0 + \alpha_1 \text{dln}PRO_t + \alpha_2 \text{dln}\left(\frac{EX}{GDP}\right)_t + \alpha_3 \text{dln}\left(\frac{IM}{GDP}\right)_t + \\ & \alpha_4 \text{dln}\left(\frac{FDI}{GDP}\right)_t \end{aligned}$$

$$+ \alpha_5 \text{dln} \left(\frac{IMM}{LFM} \right)_t + u_t \quad (3)$$

$$\begin{aligned} \text{dlnEMP}_t = & \beta_0 + \beta_1 \text{dlnPRO}_t + \beta_2 \text{dln} \left(\frac{EX}{GDP} \right)_t + \beta_3 \text{dln} \left(\frac{IM}{GDP} \right)_t + \beta_4 \text{dln} \left(\frac{FDI}{GDP} \right)_t \\ & + \beta_5 \text{dln} \left(\frac{IMM}{LFM} \right)_t + \varepsilon_t \end{aligned} \quad (4)$$

where

d is the first-difference operator (i.e., $\text{dln} \left(\frac{WP}{WNP} \right)_t = [\ln \left(\frac{WP}{WNP} \right)_t - \ln \left(\frac{WP}{WNP} \right)_{t-1}]$).

The variables are empirically measured as follows.

$\text{dln} \left(\frac{WP}{WNP} \right)_t$ = the first difference of the log of the ratio of average hourly earnings of

production workers in manufacturing to average hourly earnings of professional and business services, both earnings are annual and seasonally adjusted,

dlnPRO_t = the first difference of the log of the index of output per hour in manufacturing, index 1992=100,

$\text{dln} \left(\frac{EX}{GDP} \right)_t$ = the first difference of the log of the ratio of annual value of U.S. exports to U.S. GDP,

$\text{dln} \left(\frac{IM}{GDP} \right)_t$ = the first difference of the log of the ratio of annual value of U.S. imports to U.S. GDP,

$\text{dln} \left(\frac{FDI}{GDP} \right)_t$ = the first difference of the log of the ratio of total U.S. FDI outflow to U.S. GDP,

$\text{dln} \left(\frac{IMM}{LFM} \right)_t$ = the first difference of the log of total immigrants as percent of total

labor in manufacturing, and dlnEMP_t = the first difference of the log of production workers in manufacturing.

The α s are the elasticities of the relative wage with respect to each of the independent variables, and the β s are the elasticities of employment with respect to each of the independent variables. The terms u_t and ε_t are the error terms assumed to be independently and identically distributed with zero means and finite variances.

Equations (3) and (4) were estimated using data for the period 1980-2005.³ The choice of 1980 as the start of the period for this analysis is to take into account the belief that trade openness of the U.S. economy has been increasing since the early 1980s. Some analysts, such as Feenstra and Hanson [13], also argue that the wage inequality between skilled and unskilled workers in the U.S. has been rising since the

TABLE 1
DICKEY-FULLER AND PHILLIPS-PERRON UNIT ROOT TEST STATISTICS

Variable	DF- Stat.		PP- Stat.	
	Level	Differenced	Level	Differenced
$\ln \frac{WP}{WNP}$	-0.160	-5.645	-0.968	-3.313
lnEMP	-0.388	-2.934	0.470	-3.064
lnPRO	3.357	-3.313	5.637	-3.680
lnEX	-2.780	-4.454	-2.375	-4.740
lnIM	-0.753	-2.992	0.126	-3.360
lnFDI	-1.423	-3.847	-0.813	-4.041
lnIMM	-2.039	-3.223	-2.138	-3.285

All results are based on 4 lags and included and intercept terms. The critical values at 5% and 1% with the presence of an intercept term are -3.02 and -3.81, respectively. DF-Stat or PP-Stat greater than 3.02 in absolute value indicates stationarity at 5% significance level, and DF-Stat or PP-Stat greater than 3.81 in absolute value indicates stationarity at 1% significance level.

TABLE 2
CORRELATION COEFFICIENT MATRIX OF EXPLANATORY VARIABLES

	dlnPRO	dlnEX	dlnIM	dlnFDI	dlnIMM
dlnPRO	1.000	0.012	0.406	0.013	-0.489
dlnEX	0.012	1.000	0.479	0.329	0.087
dlnIM	0.406	0.479	1.000	0.309	-0.170
dlnFDI	0.013	0.329	0.309	1.000	0.070
dlnIMM	-0.489	0.087	-0.170	0.070	1.000

mid-1980s. As a routine procedure, the data were tested for heteroscedasticity. The test indicated presence of heteroscedasticity at 5 percent significance level. This result was unexpected since heteroscedasticity is believed to be mostly a problem in cross-section data. But time series data can also suffer from heteroscedasticity. Wooldridge [34, pp. 398-403] extensively discusses the problem of heteroscedasticity in time series data. Time series data can especially suffer from what is called autoregressive conditional heteroscedasticity, and probably this could have been the problem that was revealed by the test. Consequently, equations (3) and (4) were both estimated using an estimation technique that corrects the heteroscedasticity problem. There are several computer programs that are used to compute heteroscedasticity-robust standard errors. In this study, the *robusterrors* option in the RAT's program was used to correct the heteroscedasticity problem. This estimation technique was chosen because it produces more consistent standard errors of the coefficients without affecting the values of the coefficients.

EMPIRICAL RESULTS

Estimation of equations (3) and (4) with heteroscedasticity-corrected OLS technique produced the results presented in Table 3. The results in column 2 of Table 3 show that exports, foreign direct investment abroad, and immigration have all statistically significant effects on the relative wage of production workers at least at 10 percent significance level. Each of these variables also has the expected sign. The empirical evidence thus suggests that an increase in exports significantly increases the relative wage of production workers, whereas increases in foreign direct investment abroad and immigration both lead to a decrease in the relative wage of production workers. This evidence therefore implies that an increase in exports tends to reduce the wage inequality between production and non-production workers, and increases in foreign direct investment abroad and immigration tend to increase the wage inequality between production and non-production workers. These results appear to be consistent with some conclusions of previous studies, such as Baldwin and Cain [2], and Haskel and Slaughter [16]. Imports and labor productivity, though each has the expected sign, do not have statistically significant effects on the relative wage of production workers in this study.

The results obtained from equation (4) are also shown in Table 3, column 3. These results also strongly suggest that an increase in exports significantly increase employment of production workers in manufacturing. Productivity also significantly impacts employment of production workers. However, increases in FDI abroad and immigration significantly reduce employment of production workers as expected. Imports, however, do not have statistically significant effect on employment of production workers. As shown in Table 3, the wage model explains about 87 percent of the changes in the relative wage of production workers and the employment model explains 80 percent of the changes in employment of production workers in manufacturing.

TABLE 3
HETEROSCEDASTICITY-CORRECTED REGRESSION RESULTS
 (t-statistics in the Parentheses)

Explanatory Variable	Coefficient Estimate, Eq. (3) Dependent Variable: $\ln \frac{WP}{WNP}$	Coefficient Estimate, Eq. (4) Dependent Variable: $\ln EMP$
Constant	0.1811 (1.536)	3.9038* (65.971)
dlnPRO	0.0215 (0.490)	0.0787* (4.123)
dlnEX	0.0413*** (1.770)	0.0905* (11.464)
dlnIM	-0.0920 (-1.103)	-0.0017 (-0.0644)
dlnFDI	-0.0650** (-2.503)	-0.0669* (-5.277)
dlnIMM	-0.0282** (-2.450)	-0.0132* (-3.930)
SEE	0.0129	0.0047
Adj. R ²	0.874	0.798
N	27	27

* Significant at 1%, **significant at 5%, and *** significant at 10%.

SUMMARY AND CONCLUSIONS

This paper has attempted to establish a link between U.S. trade liberalization and the changes in the relative wage and employment of unskilled/production workers in manufacturing. To investigate this possible link, two separate empirical models were developed. The models were then estimated using data for the period 1980-2005. The data were tested for stationarity using the Dickey-Fuller and Phillips-Perron unit-root tests. The data are non-stationary in level forms but become stationary when first-differenced. The data were also tested for heteroscedasticity. A test for heteroscedasticity could not be rejected at 5 percent significance level, and as a result, the regression equations were estimated by a method that produced consistent standard errors for the coefficient estimates.

The regression results indicate that an increase in exports significantly increases the relative wage of production workers but increases in FDI and immigration significantly reduce the relative wage of production workers. The results also indicate that employment of production workers in manufacturing is significantly impacted by increases in exports, FDI, immigration, and productivity. The impact of each of these variables on employment of production workers has the expected sign and is highly significant. More specifically, the evidence indicates that increases in exports and productivity of production workers significantly increase employment of production workers while increases in FDI abroad and immigration significantly reduce employment of production workers. Imports, however, do not have statistically significant effect on the relative wage or employment of production workers in manufacturing.

ENDNOTES

¹ The unskilled and skilled workers' wages are not available but are proxied by the wages of production and non-production workers, respectively. This is because production workers in manufacturing are considered unskilled and non-production workers are considered skilled or more educated. Wages of non-production workers are proxied by the wages of professional and business services in this study.

² These programs are available online at <http://www.estima.com/>

³ The sources of data are the U.S. Bureau of Labor Statistics, U.S. Department of Commerce, U.S. Department of Homeland Security, and the World Development Indicators published by the World Bank [30,31,32,37].

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