

The Impact of Free Trade Agreement with Mexico on Real Wages of Production Workers in Manufacturing in the United States

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Abstract

The U.S. free trade agreement with Mexico is often cited as the main cause of the recent declines in the real wages of production workers in manufacturing. This paper examines the impact of the U.S. free trade agreement with Mexico on real wages of U.S. manufacturing workers. The U.S. free trade agreement with Mexico, which also includes Canada, is commonly known as the North American Free Trade Agreement (NAFTA). But the free trade agreement with Canada is less controversial because it is not believed to have a negative impact on the U.S. labor markets. Consequently, the paper examines the impact of NAFTA on the real wages of U.S. production workers in manufacturing only from the Mexican side. The results obtained from a regression analysis suggest that real wages are significantly influenced by exports, imports, foreign direct investment, and supply of unskilled labor. More specifically, the results show that real wages of manufacturing workers are positively and significantly impacted by increases in exports and imports, and negatively and significantly impacted by increases in foreign direct investment and supply of unskilled labor. An interesting finding is the positive and significant impact of imports from Mexico on the real wages of the U.S. manufacturing workers contrary to the commonly held belief that imports are the major cause of the decline in the wages of manufacturing workers.

I. Introduction

Free trade agreement between the United States, Mexico and Canada was formed to increase trade and investment among the member countries by cutting tariffs and reducing other investment and trade barriers. This regional trading bloc became effective on 1 January 1994 and called for complete phase out of tariffs on goods and services among member countries over a period of 15 years. The final provisions of the free trade agreement were thus fully implemented on January 1, 2008 (<http://www.fas.usda.gov/>). In addition to tariff elimination mostly on agricultural and industrial products, the agreement also established the rules for foreign direct investment, environmental issues, work standards, and intellectual property rights. Proponents of this agreement argued that trade and investment liberalization would result in reallocation of resources towards activities where they have greater comparative advantage and thus raise productivity and economic growth in all member countries. For the United States though, the overriding motivating force for the creation of the free trade agreement was the potential market for U. S. export products in Mexico. It was generally believed that the potential market for the U.S. consumer goods in Mexico would more than offset the possible negative effects on wages and employment that the free trade agreement might create in the U.S. labor markets. However, some analysts argued then that free trade with Mexico would have negative effects on wages and employment of manufacturing workers in the United States. These analysts still believe that the free trade agreement is largely responsible for the recent decline in the wages of production workers in manufacturing workers. They believe that the free trade agreement will eventually reduce the wages of production workers in

manufacturing in the United States to the level of the wages of unskilled workers in Mexico. Most of these views are however primarily based on descriptive studies not on empirical models. Trade issues and the effect of international trade on the earnings and employment of manufacturing workers and unskilled labor in general are controversial topics in the United States, and consume an increasing part of the U.S. public policy debate. To date, however, there is no comprehensive empirical model that tests the hypothesis that free trade with Mexico has significantly affected the real wages of production workers in manufacturing in the U.S.

The goal of this study is to develop an empirical model and analyze the impact of the free trade agreement and outsourcing on the real wages of production workers in manufacturing in the U.S. Even though the free trade agreement also includes Canada, the study examines only the effects of the free trade between the United States and Mexico for two main reasons. First, the free trade agreement is less controversial between U.S. and Canada. Second, U.S. and Canada already had free trade agreement before NAFTA was implemented and it would be very difficult to discern NAFTA's effects from the U.S.- Canada free trade agreement that was implemented in 1989. The paper is organized as follows. Section II reviews the literature on the effects of international trade on wages and employment in the United States in general, and examines the theoretical channels through which the free trade agreement is believed to impact wages. Section III reviews the free trade experience between U.S. and Mexico since NAFTA became effective. The basic model is developed in section IV and the empirical model is specified in section V. The empirical results are presented in section VI, and summary of the results and conclusions are offered in section VII.

II. Review of the Literature

There is no consensus among researchers on the effect of international trade on wages of production or unskilled workers in the United States and the other industrialized countries to date¹. The effect of international trade on wages of production workers in the industrialized countries in general and the United States in particular is thus still unresolved issue empirically. On the one hand, Bound and Johnson (1992), Revenga (1992), Berman, Bound and Griliches (1994), Lawrence and Slaughter (1993), Bhagwati and Dehejia (1994), and Kusters (1994) argue that international trade has no significant effect on the recent decline in the wages of unskilled workers relative to the wages of skilled workers in the United States and most other developed countries. These researchers and many others, such as Lavoie and Therrien (1999) attribute the decrease in the wages of manufacturing workers to technological change rather than to international trade. These studies conclude that there has been a steady shift in demand away from manufacturing workers to more-skilled labor in the United States and the other industrialized economies due to increases in productivity and education, and this shift, not international trade, has created most of the decline in wages of manufacturing workers.

On the other hand, Murphy and Welch (1991), Borjas et al (1992), Johnson and Stafford (1999), Wood (1995), Leamer (1996), Cline (1997), Baldwin and Cain (2000), and Haskel and Slaughter (2001) attribute the decline in real wages of manufacturing workers to an increase in trade openness. 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 are based on increased volume of trade resulting

from reduction in trade barriers. So the inconsistencies in the results may be due to differences in assumptions and model specifications rather than actual differences.

The studies cited above indicate that the effect of international trade on the labor markets of the United States had always been a controversial issue, and it appears that the free trade agreement with Mexico has magnified this controversy. Disagreements on the effects of free trade agreements on all the economies involved in general and the U. S. economy in particular are getting more divisive. At the theoretical level, the issues that a free trade agreement raises are argued mainly on the distributive effects on earnings within countries and the equalizing effects on earnings across countries. The belief that the free trade agreement between U.S. and Mexico has contributed or is contributing to the decline in the wages of manufacturing workers in U.S. is based on the Heckscher-Ohlin trade theory. This theory suggests that import competition lowers the prices of the products made by unskilled labor (manufacturing workers) relative to the prices of the products made by skilled labor. As the prices of the products made by unskilled labor fall, the domestic demand for unskilled labor and consequently its earnings are negatively impacted. The theory also suggests that an increase in import volume has an equivalent adverse effect on the wages of unskilled labor. From this perspective, as Slaughter and Swagel (1997) argue, free trade agreement 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 United States imports unskilled labor-intensive products from Mexico, it can be argued that free trade agreement with Mexico can effectively increase the supply of unskilled labor relative to the supply of skilled labor in United States, and consequently decrease the earnings of unskilled labor. Some recent studies however down play the negative effects of free trade agreements on the U.S. labor markets. For example, Burfisher et al. (2001) and Thorbecke and Eigen-Zuccki (2002) argue that free trade agreement between Mexico and U.S. (NAFTA) will have a negligible effect on the U.S. unskilled labor markets, and Gaston and Trefler (1997) conclude that the free trade agreement between the United States and Canada that was implemented in 1989 did not lead to significant wage decreases in the Canadian manufacturing industries during the period 1989-93.

The other prediction of the Heckscher-Ohlin theory is that free international trade will lead to factor price equalization across all trading partners. According to the factor price equalization theorem of Heckscher-Ohlin, free trade between U.S. and Mexico is expected to lower the wages of unskilled workers in the United States and increase the wages of unskilled workers in Mexico until the wages in both countries converge. However, this free trade agreement may not result in wage convergence because wage convergence could only occur under very restrictive assumptions, 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, which do not exist in the current free trade agreement between these two countries. Furthermore, for wage convergence to occur, there should be free movement of both labor and capital between the two countries, but the current trade agreement allows only free movement of capital to Mexico. Wage convergence of the unskilled labor in the U.S. and Mexico is therefore a remote theoretical possibility at best.

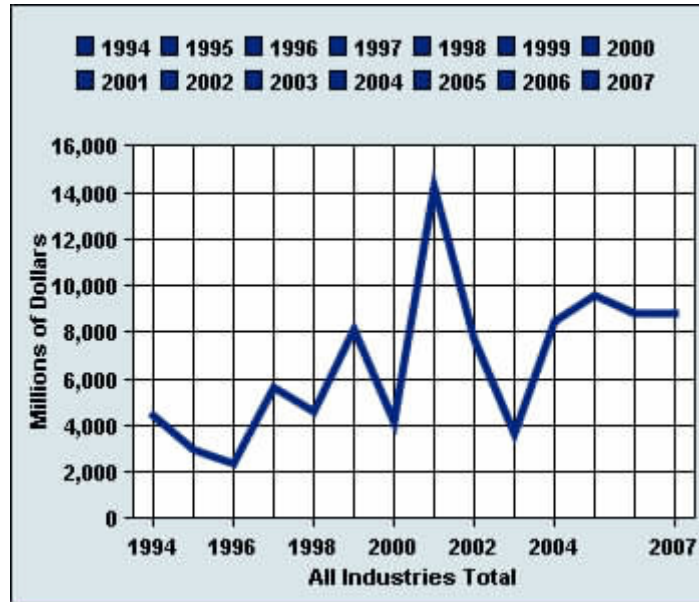
However, if the free trade agreement makes labor mobility easier between U.S. and Mexico, the free trade agreement may lead to either a decline in wages or an increase in unemployment of manufacturing and all other unskilled workers in U.S. Whether increased labor flow from Mexico to U.S. will affect wages or unemployment will crucially depend on the competitiveness of the market for the unskilled labor in U.S.

Increased immigration from Mexico will likely lower wages if the labor market is competitive, and will likely increase unemployment if the labor market is rigid. The most likely scenario is that wages would fall if the free trade agreement leads to increased inflow of unskilled workers from Mexico because the unskilled labor markets in U.S. are believed to be semi-competitive. The general belief thus seems to be that free trade will harm unskilled workers in U. S. either directly through increased immigration or indirectly through increased trade between U.S. and Mexico. The purpose of this study is to empirically examine this general belief.

III. Overview of the Free Trade Agreement Experience

Since the adoption of the free trade agreement, trade in goods between the U.S. and Mexico has grown significantly. U.S. exports to Mexico grew by 22% and U.S. imports from Mexico grew by about 24% between December 1993 and December 1994, the first year the agreement became effective. U.S. exports to Mexico and imports from Mexico shot up respectively by 168% and 326% between December 1994 and December 2007 (U.S. Census Bureau, Foreign Trade Division, 2008). NAFTA in general and the free trade agreement with Mexico in particular also made North America one of the most active trading regions in the world. North America now accounts 19 percent of global exports, 25 percent of global imports, 24 percent of global inward FDI, and 25 percent of global outward FDI. Figure 1 shows U.S. FDI flows to Mexico since the free trade agreement between the U.S. and Mexico has been in effect (<http://www.ustr.gov>). As shown in the figure, FDI flows from U.S. to Mexico were highest in 2001.

Figure 1 US FDI Flows to Mexico: 1994-2007



Source: U.S. Department of Commerce.

But the free trade agreement between the U.S. and Mexico is still a controversial and contentious trade policy mainly because Mexico is a lot less developed partner with abundant unskilled labor resource. Nevertheless, the free trade agreement is expected to have some positive impact on the U.S. economy in the long run, mainly through increases in exports. The effect of increased exports to Mexico on the United States economy and manufacturing workers can be examined through two different channels. First, if the United States exports consist of finished products, an increase in exports can lead to an increase in Mexican consumption of U.S. goods and this can boost the U.S. export sector, and consequently the demand for manufacturing workers and their wages. Second, if the U.S. exports consist of raw materials and semi-finished products sent to Mexico for processing and then sent back to U.S. for consumption, costs of production for the U. S. firms will decrease but employment in the U.S. manufacturing sector could be negatively impacted. Thus, an increase in U.S. exports to Mexico can positively affect the wages of manufacturing workers in U.S. through the expansion of the export sector but it can also negatively influence employment of manufacturing workers through outsourcing of production and jobs.

IV. The Basic Model

There are two types of empirical approaches that attempt to examine the impact of trade on wages of unskilled workers in the industrialized countries. These two approaches are 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 the country's imports. The price effect studies analyze whether trade negatively affects the prices of unskilled labor-intensive products, and consequently the demand for unskilled labor and its earnings. This study falls within the price effect studies of international trade and begins the analysis with the basic microeconomics theory of wage determination.

According to the basic microeconomics theory, the main determinants of real wages are the demand for labor and supply of labor. Real wages are positively related to the demand for labor holding supply of labor constant, and are negatively related to supply of labor holding the demand for labor constant. The link between real wages and the demand for labor and supply of labor can be expressed in general functional form as:

$$\frac{W}{P} = \frac{W}{P}(PRO, EMM) \quad (1)$$

Where, $\frac{W}{P}$ is the real wage rate in manufacturing, *PRO* is the average product of labor, a proxy for the demand for labor, and *EMM* (employment in manufacturing) is the supply of labor in manufacturing. Equation (1) represents the basic model for wage determination. It states that an increase in *PRO* (the demand for labor) holding *EMM* constant will increase the real wage rate and an increase in *EMM* holding *PRO* constant will decrease the real wage rate. This equation can be used as the basis for analyzing the effects of free trade on real wages of manufacturing workers. The three main channels

through which free trade can affect real wages of manufacturing workers are increased volume of trade, increased direct foreign investment, and increased immigration.

The volume of trade is measured by the volume of exports and imports. It is generally believed that an increase in exports will have a positive effect on real wages, and an increase in imports will have a negative effect on real wages. Real wages in manufacturing will thus be positively impacted if free trade leads to a greater production of exports and will be negatively impacted if free trade leads to an increase in the volume of imports, and decreases domestic production of import competing goods. 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. Thus, in this model, an increase in U.S. imports from Mexico will also most likely increase U.S. exports to Mexico because an increase in U.S. imports from Mexico will generate more income for the Mexicans and enable them to buy more U.S. goods. Hence, an increase in imports may also lead to an increase in exports and might positively affect real wages of manufacturing workers in U.S.

The effect of an increase in direct foreign investment or immigration on real wages of manufacturing workers is however expected to be negative. An increase in foreign direct investment to Mexico including outsourcing will most likely negatively affect the wages of manufacturing workers in the U.S. because direct foreign investment and outsourcing of production to Mexico will reduce the bargaining power of domestic workers and thereby hold their wages down. The effect of increased immigration is relatively easy to understand. As discussed earlier under literature review, if free trade allows easy labor movement between U.S. and Mexico, more unskilled Mexican workers will enter U.S., and entry of a large number of low-skilled Mexican workers will flood the unskilled labor market and reduce wages of unskilled domestic workers. Increased immigration will thus lead to an increase in the domestic supply of labor of unskilled workers in U.S. and hold down their wages.

Considering all factors that can possibly influence the wages of manufacturing workers, equation (1) can be expanded to:

$$\frac{W}{P} = \frac{W}{P}(PRO, EMM, EX, IM, FDI, IMM) \quad (2)$$

where, EX, IM, FDI, IMM represent exports, imports, foreign direct investment, and immigration, respectively. As discussed above, an increase in PRO or EX is expected to affect wages of manufacturing workers in U.S positively, other things equal. This can occur because an increase in productivity or exports is expected to increase the demand for the domestic workers relative to foreign workers, and thereby increase in their wages. However, an increase in $EMM, IM, FDI, or IMM$ is expected to have a negative effect on wages of manufacturing workers in the United States.

V. Empirical Analysis

The study uses quarterly data for the period 1994.I-2008.I, which consists of 57 observations for each variable². The start of the period coincides with the year the free trade agreement with Mexico became effective. The data were smoothed and scaled

down by transforming all the variables to their natural logs. Obviously, this transformation does not change the nature of relationships between the dependent variable and the independent variables but reduces the magnitude and variance of the data. As shown in the descriptive statistics tables, Tables 1 and 2, the standard errors of the transformed data are very low compared to the standard errors of the raw data.

Table 1 Descriptive Statistics of Raw Data

Variable	Obs.	Mean	Standard Error	Minimum	Maximum
RWM	57	110.0842	8.7014	97.2200	124.0300
PRO	57	160.7847	32.2086	106.9100	215.4700
EMM	57	99.2107	8.2970	87.2500	109.7500
EX	57	23409.6368	7302.0743	10867.7000	35871.0000
IM	57	32255.4193	12782.4299	11316.7000	56708.000
FDI	57	160.7847	32.2086	106.9100	215.4700

Table 2 Descriptive Statistics of Transformed Data

Variable	Obs.	Mean	Standard Error	Minimum	Maximum
lnRWM	57	4.698	0.0796	4.5770	4.8205
lnPRO	57	5.0595	0.2066	4.6720	5.3728
lnEMM	57	4.5938	0.0844	4.4688	4.6982
lnEX	57	10.0063	0.3461	9.2936	10.4877
lnIM	57	10.2942	0.4383	9.3340	10.9457
lnFDI	57	7.0418	0.8272	4.1431	8.2282

Also, comparing Figure 2 with Figure 3, the transformed time series data illustrated in Figure 3 are more stationary than the raw time series data shown in Figure 2. In regression analysis, it is a common practice to check the stationarity of time-series data because stationarity of the data is a necessary condition for the validity of the regression results. But it is not critical to formally test the data for stationarity in this study because it uses only short run quarterly data. Nevertheless, as shown in Table 2 and Figure 3, the transformed data appears to be stationary.

Figure 2 Time Series Graphs of the Raw Data of Dependent and Independent Variables

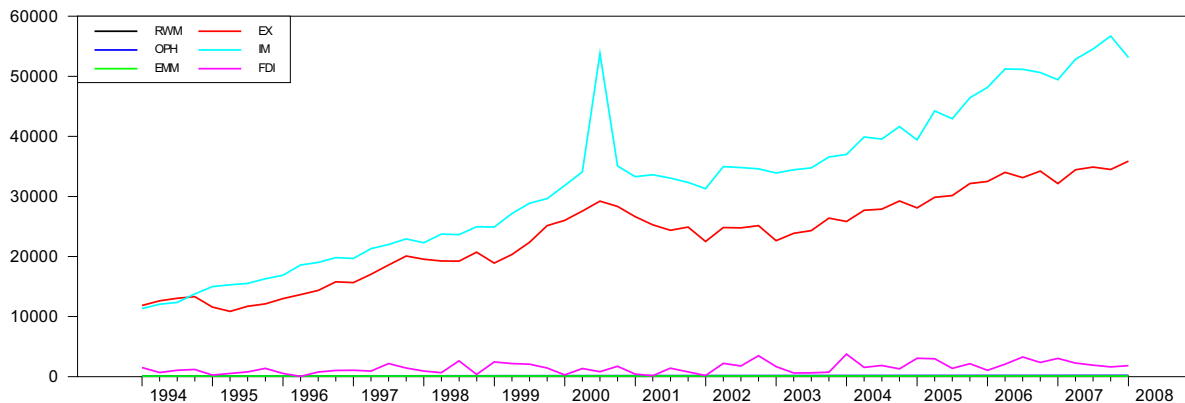
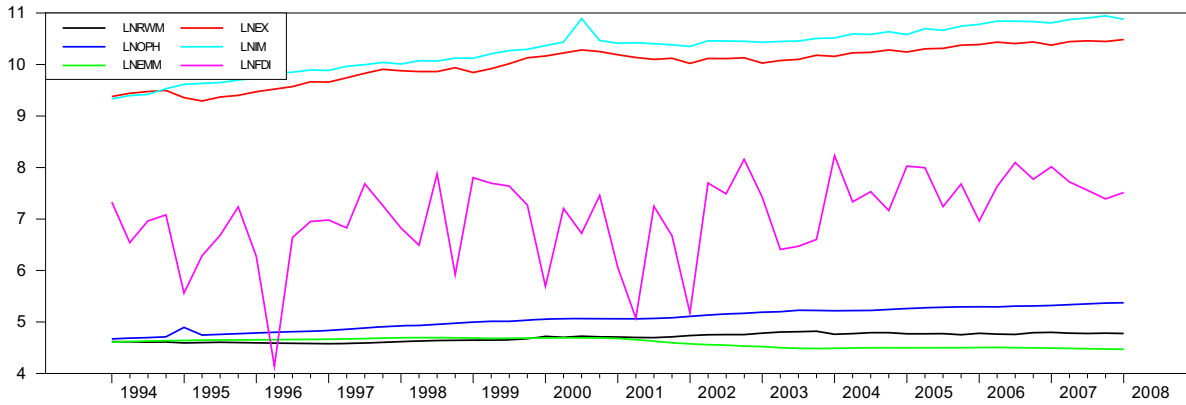


Figure 3 Time Series Graphs of the Transformed Data of Dependent and Independent Variables



The empirical model is hence specified in log-linear equations as³:

$$\ln\left(\frac{w}{p}\right)_t = \beta_0 + \beta_1 \ln \text{PRO}_t + \beta_2 \ln \text{EMM}_t + \beta_3 \ln \text{EX}_t + \beta_4 \ln \text{IM}_t + \beta_5 \ln \text{FDI}_t + \varepsilon_t \quad (3)$$

The variables are empirically measured as follows.

$\ln\left(\frac{w}{p}\right)$ = log of the index of quarterly real average hourly compensation in U.S. dollars for production manufacturing workers, index 1992 = 100,

$\ln \text{PRO}_t$ = log of the index of quarterly output per hour in manufacturing, index 1992 = 100,

$\ln \text{EMM}_t$ = log of quarterly employment of production workers in manufacturing,

$\ln \text{EX}_t$ = log of quarterly U.S. exports to Mexico in millions of U.S. dollars,

$\ln \text{IM}$ = log of quarterly U.S. imports from Mexico in millions of dollars,

$\ln \text{FDI}_t$ = log of U.S. quarterly FDI flows to Mexico in millions of dollars, and

ε_t is the error term assumed to be independently and identically distributed with zero means and finite variances.

VI. Empirical Results

The model was estimated with AR1 (first-order autocorrelation) method available in the RATS program. The AR1 estimation technique corrects for first-order serially correlated errors, which usually occur in time series data. Several estimation methods are available under AR1 instruction, including Cochrane-Orcutt, Hidreth-Lu, Maximum Likelihood and Prais-Winsten. All these methods provided similar results but the *maximum likelihood* method was chosen because it produced relatively better results with no evidence of positive or negative autocorrelation problem as indicated by the Durban-Watson statistic. However, the correlation matrix of the independent variables indicated

severe multicollinearity between exports and imports. The often suggested solution for a severe multicollinearity problem is to drop one of the collinear variables. But, since both variables are considered equally important in this study, neither variable was completely dropped. Instead, the model was estimated by excluding one of the variables at a time to correct for the possible multicollinearity between exports and imports. Estimation of the model in the absence of the import variable produced the results shown in Table 3, and estimation of the model in the absence of the export variable produced the results in Table 4.

Table 3 AR1 Regression Results Excluding Imports

Dependent Variable: lnRWM

Explanatory Variable	Coefficient Estimate	t-statistics
Constant	6.136	7.344
lnPRO	0.016	0.293
lnEMM	-0.500*	-3.466
lnEX	0.081**	2.716
lnIM	-----	-----
lnFDI	-0.005**	-2.173
N (Observations)	57	
Durbin-Watson Stat.	1.963	
Adjusted R ²	0.961	

* Significant at 1% level, ** Significant at 5% level.

Table 4 AR1 Regression Results Excluding Exports

Dependent Variable: lnRWM

Explanatory Variable	Coefficient Estimate	t-statistics
Constant	6.565	7.106
lnPRO	0.002	0.035
lnEMM	-0.499**	-2.946
lnEX	-----	-----
lnIM	0.043**	2.005
lnFDI	-0.004***	-1.92
N (Observations)	57	
Durbin-Watson Stat.	1.900	
Adjusted R ²	0.960	

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

The results show that both exports and imports have statistically significant positive effect at 5 percent significance level on real wages of production workers in manufacturing when estimated separately, and the supply of labor and foreign direct investment variables have statistically significant negative effects at least at 5 percent

significance level on real wages of production workers in manufacturing. The labor productivity variable, which can be considered as a control variable, is statistically insignificant. The evidence thus suggests that real wages of production workers in manufacturing are significantly influenced by increases in both U.S. exports to Mexico and U.S. imports from Mexico, and significantly influenced by an increase in U.S. FDI flows to Mexico and an increase in the supply of production workers in manufacturing. The result regarding the effect of imports on real wages provides some evidence against the commonly believed notion that imports have negative effect on real wages of manufacturing workers. That is, the traditional belief that imports negatively impact real wages of manufacturing workers is not empirically supported in this study. On the contrary, the result from this model indicates that an increase in U.S. imports from Mexico also has a positive and positive effect on the real wages of U.S. manufacturing workers. This result is consistent with the predictions of a two-country trade model where an increase in a country's imports also leads to an increase in its exports to the country where it is importing from. Based on the result of the import variable, we can conclude that an increase in U.S. imports from Mexico also leads to an increase in Mexican imports from the United States, and an increase in Mexican imports from U.S. in turn leads to an increase in the production of U. S. exports (manufactured goods) and the demand for manufacturing workers, and positively impacts their real wages.

VII. Summary and Conclusions

The paper examined the effect of free trade agreement between U.S. and Mexico on real wages of U.S. manufacturing workers using quarterly data for the period 1994.I-2008.I. This free trade agreement is commonly known as NAFTA. But since the free trade agreement between the United States and Canada is relatively less controversial than that between the United States and Mexico, the study focused only on the free trade agreement between the United States and Mexico.

The regression results suggest that real wages of manufacturing workers are positively influenced by exports and imports, and negatively influenced by an increase in the supply of U.S. manufacturing workers and an increase in FDI outflows to Mexico. The results are consistent with the specifications of the theoretical model and appear to be stable and consistent. However, they are based on short run data and the impact of the free trade agreement on the U.S. labor markets might not yet have been fully realized. Nevertheless, the results provide some empirical evidence for the impact to date of the free trade agreement between the U.S. and Mexico on the real wages of the U.S. manufacturing workers.

Notes

1. The terms production workers and unskilled workers are used interchangeably in literature.
2. The sources of data are Bureau of Labor Statistics and the U.S. Department of Commerce.
3. The immigration variable (IMM) was dropped from the empirical model due to non-existence (unavailability) of quarterly data for the variable.

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