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WAGE AND EMPLOYMENT FLUCTUATIONS IN THE US MANUFACTURING INDUSTRY

by

Amal Mendis

B.S., Southern Illinois University, 2009
M.S., Southern Illinois University, 2013

A Research Paper
Submitted in Partial Fulfillment of the Requirements for the
Master of Science Degree

Department of Economics
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RESEARCH PAPER APPROVAL

WAGE AND EMPLOYMENT FLUCTUATIONS IN THE US MANUFACTURING INDUSTRY

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Fulfillment of the Requirements

for the Degree of

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Approved by:

AKM Morshed, Faculty Advisor

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TITLE: WAGE AND EMPLOYMENT FLUCTUATIONS IN THE US MANUFACTURING INDUSTRY

MAJOR PROFESSOR: Dr. AKM Morshed

The volume of trade between the US and developing nations has increased substantially over the past three decades. The resulting fluctuations in employment and wages of domestic and foreign workers, as well as export and import trends, are in agreement with Hoeschker-Ohlin-Samuelson. We take as our base case the manufacturing industry. We find that the wages of unskilled relative to skilled US workers has increased, while overall employment of unskilled workers has decreased. We also look at a subsample of plants in the Mexican automobile industry following the implementation of NAFTA and find that exports and TFP growth have increased, in line with standard HOS theory.

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CHAPTER 1

INTRODUCTION

The Heckscher-Ohlin Theory, conceived by Eli Heckscher (1919) and Bertil Ohlin (1933), is a theory of international trade that describes the relationship between countries' factor endowments and ensuing pattern of imports and exports. It also predicts how income will be distributed within the countries.

There are two critical assumptions which underpin Heckscher-Ohlin Theory. The first is that countries differ in the nature and amount of factors of production that they possess. This is particularly true in the case of labor and capital. A country is said to be capital abundant if it has a higher ratio of capital to other factors of production, compared to its trading partner. The second assumption is that the production of different goods within a country requires different levels of factory intensity. For example, holding all other factors equal, the production of an automobile will be more labor intensive than the production of a bicycle, since the production of the automobile requires more labor per worker than does the bicycle. When applied to two countries, Heckscher-Ohlin assumes one country is capital intensive, while the other is labor intensive.

We have seen that different countries have different factor endowments. This means that given two countries A and B, and A is more relatively well-endowed in a given factor of production, then it follows that A will incur a lower opportunity cost in the production of a commodity which requires large amounts of that particular factor of production. We say that compared to B, A has a comparative advantage in the production of such a commodity and hence, should specialize in the production of that commodity. Going one step further, Heschker-Ohlin predicts that if A and B possess identical technology for the production of a commodity,

and differ only in their relative factor endowments, then A will export more of the commodity. This last condition – that countries with identical technologies can still trade – implies that differences in technology are no longer essential for trade.

Heckscher-Ohlin tells us what happens to factor prices when an economy, formerly an autarky, opens itself to trade. Consider a two-sector model of the US consisting of an export producing industry, corn, and an import-competing industry, cloth. As a result of trade, the price of corn will rise and the price of cloth will fall in the US. Since the US is producing more corn and less cloth, there will be a shift in the demand for factors of production. In the case of corn, there will be a large increase in the demand for land as well as an increase in the demand for labor. In the cloth industry, the demand for land will decrease and while the demand for labor will decrease significantly. In the short run, there is limited mobility of factors between the two sectors. Therefore, in the short run, we can expect the rental rate for corn producing land to increase, as well as an increase in wages for workers employed in growing the corn. Correspondingly, the rental rate for cloth producing factories will decrease, and the wages of workers employed in the corn industry will decrease. In the long run, however, factors are mobile between the two sectors, so that the rental rate for all land will increase, relative to the pre-trade period, while wages for workers in all sectors will diminish, relative to the pre-trade period. We should see the opposite happening in the rest of the world, that is, in the long run, rents will fall and wages will rise. For example, consider a two-good model consisting of two countries, Mexico and the US. Suppose the US has a comparative advantage in the production of steel and is capital abundant, while Mexico has a comparative advantage in the production of cloth and is labor abundant. Moreover, the production of steel is capital intensive and the

production of cloth is labor intensive. Thus, we would expect the price of steel to be lower in the US than in Mexico, and the price of cloth to be lower in Mexico than in the US.

Another proposition of Heschker-Ohlin, the Stolper-Samuelson Theorem, explains the relationship between factor prices and commodity prices. Formally, the Stolper-Samuelson Theorem states that if the price of a capital-intensive good increases, then the return to capital increases and the return to the other factor (labor) decreases. Assume, for example, that the price of steel in the United States increases to match the world price, while the price of cloth in Mexico also increase to match the world prices. Then by the Stolper-Samuelson Theorem, the wage rate in the US will fall and the rental rate in the US will increase, while in Mexico, the wage rate will rise and the rental rate will fall. The so-called magnification effect is also at work here. That is, increased trade causes income to move in the direction of the owners of the abundant factor of production. In this case, the rise in steel prices in the US implies that the increase in the rental rate in the US is greater than the fall in the wage rate.

Heckscher-Ohlin-Samuelson (HOS) provides us with important insights into the consequences of trade. For example, it explains how trade can replace the migration of labor. Suppose that there is a labor shortage. In order to make up for the shortfall, the country will import those products which are labor-intensive. This causes the demand for labor in labor-intensive industries to fall. Consequently, wages will decrease in the scarce labor country. If, on the other hand, labor is cheap, the tendency will be for the country to increase its exports of labor-intensive products. This causes labor demand to increase, and hence wages to increase in the cheap labor country. To take another example, the income differential between skilled and unskilled workers in the US has been widening. Is trade the culprit here? HOS suggests employers should decrease the number of skilled workers relative to unskilled workers and

increase the number of skilled workers. The trend, however, has been for most industries to hire more skilled workers.

In this paper, we survey the state of the U.S. manufacturing industry from 1978 onwards, within the framework of increased trade with developing nations. The ensuing fluctuations in wages and labor of skilled and unskilled workers in U.S. manufacturing, as well as their counterparts in foreign nations, and import and export trends, are captured by such standard models of international trade as Hechsker-Ohlin-Samuelson (HOS). Indeed, as we will see, much of our data is consistent with the predictions of HOS. Following the work of Sachs (1994), we see that the period 1978-1990 is particularly suitable for testing HOS, as during this time many developing nations adopted policies favoring trade liberalization. We conclude with an examination of the Mexican manufacturing industry. We see how NAFTA, in conjunction with pre-existing free-trade reforms, has significantly increased the level of TFP and TFP growth for a sample of Mexican manufacturing plants.

CHAPTER 2

LITERATURE REVIEW

Since the early 1970's, the US manufacturing industry has seen intense fluctuations in wages and employment. Sachs, Shatz, Deardoff, and Hall (2002) examined the state of the US manufacturing industry in the period ranging from 1978-1990. Among other things, they found that while certain sectors declined in response to increased competition, other sectors grew. On the domestic end, the wages of low skilled workers decreased while the wages of foreign unskilled workers increased. Moreover, the wage gap between skilled and unskilled workers in the United States increased. They also found that imports from developing nations grew substantially, as a total percentage of GDP. All of these trends are in line with predictions from conventional models of trade theory, such as Heckscher-Ohlin-Samuelson. Indeed, Shepard, Szirmai, and Rao (2006) find that a similar result holds when comparing Australian and Indonesian manufacturing sectors for the years 1975-1990. For example, the Indonesian manufacturing price level decreased from 105% to 60% of the Australian level, while labor productivity saw an increase from 12% to 17% of the Australian level. As was the case with the US and developing world, they find that the rate of convergence is particularly high during the 1980's, a period which saw significant trade liberalization in East Asia.

Berman, Bound, and Griliches (1994) argue that the primary culprit behind labor market trends in US manufacturing is not trade but technological change. They make three principle arguments. The first is that trade cannot be the source of unemployment because if it were, workers would simply be reassigned to a different industry. Instead, what we see is an increase in the use of skilled workers that is indicative of technological change. Secondly, an increase in trade causes only moderate shifts in inter-industry worker relocation. And finally, the

involvement of more and more nonproduction workers (workers not directly involved in the production process) is not independent of increased investment in computers and more R & D. As further evidence for the crucial role played by technological change, they point to the staggering decline in employment of production workers between 1979 and 1989, and the increase in relative wages of nonproduction workers over the same period.

As a result of the US becoming a more open economy (reflected, for example, in the increased volume of trade with developing nations), domestic firms have had to face increased import competition from low wage nations. The US manufacturing industry is no exception. As Revenga (1994) notes, between 1975 and 1985, the proportion of foreign produced to domestically produced manufacturing imports increased by a factor of two, a 6.5% increase. At the same time, manufacturing employment in the US fell dramatically, while real wage growth was also slow to increase. By examining wage, employment, exchange rate, and import price data for 38 three-and-four-digit SIC manufacturing industries between 1977 and 1987, Revenga (1994) finds that between 1980 and 1985, employment decreases in all except three industries. At the same time, the price of imports decreased and most industries increased their share of imports, thereby suggesting the possibility of a connection between an increase in import competition and a decrease in employment. Based on the analysis of Revenga (1994) , we can conclude that trade did indeed have an impact on domestic manufacturing employment. Both labor and wages are affected by increased import competition. In particular, firms that have the highest share of manufacturing imports experience the highest rate of unemployment, while the increase in imports drives up the real exchange rate, leading to downward pressure on real wages.

Many economists believe that the increase in trade has not merely caused labor market fluctuations and exacerbated wage differentials in the manufacturing industry, but led to an array of other interesting consequences. As Bernard, Jensen, and Schott (2002) point out, for example, while manufacturing employment may have fallen dramatically, the opposite is true of real output. Secondly, the manufacturing industry has undergone a fair amount of restructuring, whereby labor intensive products– such as T-shirts and televisions – are eschewed in favor of more skill and capital intensive goods such as pharmaceuticals. This trend is further enhanced by the fact that the US removed trade barriers with developing nations like China, India, and Mexico that have an abundance of low-skilled workers. Thus, it should come as no surprise that the least capital and skill intensive firms are hit the hardest by import competition from low wage nations. One can deduce a general consequence from the previous discussion: firms that incorporate the desired elements of restructuring – that is, switching production from labor intensive to capital and skill intensive goods and changing their product mix to stay competitive with low-wage competitors – are most likely to survive the onslaught of low-wage import competition. The same is true of firms that face the *least* amount of import competition.

Grant and Wallace (1994) show that because of a transition from a manufacturing-based to services based economy, employment in the manufacturing sector has decreased rapidly since the 1970's and continued on a steady path of decline ever since. They argue that such job losses can be understood in the context of the de-industrialization of America. From this vantage point, not only have manufacturing jobs gone overseas, but so too has the capital (machines) corresponding to the production process. If one accepts that capitalist economies experience periods of growth and decline, as can be inferred from the real business cycle, then the decline of the US manufacturing sector – relative to domestic jobs and wages – corresponds to a period of

decay, as the groundwork for a new period of capital accumulation is laid through experimentation, particularly with regard to geographic relocation. Indeed, it has become easier for firms to relocate thanks to the subdivision of the production process into simpler tasks and advances in transportation and telecommunications that make it possible to coordinate globally diverse labor pools. As Harvey (1982) notes, seeking out new locations during periods of profit decline is not novel, but endemic to capitalism. Moreover, Grant and Wallace contend that this process of geographical labor dispersion – what they term *spatialization* – is part of an ongoing labor control strategy that has been around since the 1970's. Spatialization can mean businesses relocate within domestic borders, or relocate overseas. Grant and Wallace argue that its consequences for the labor market include increased automation and the decline and redistribution of manufacturing employment in the US.

Brauer and Hickok (1995) look at the roles played by technology and trade in creating a wage gap between skilled and unskilled workers. They conclude that the combination of technological innovation and increases in capital stock play a far more significant role than does trade.

Ghose (2005) argues that, due to lack of physical and social infrastructure, trade liberalization has been beneficial to only a few of developing nations. As evidence, he points to the diminished volume of world trade and GDP growth over the past two decades. Therefore, manufacturing imports from developing countries has had a small impact on manufacturing employment in industrialized nations, but any effect on wages, wage inequality, and unemployment is negligible. The few developing nations that have benefitted from trade liberalization are those with economies that became major exporters of manufactures. Indeed, for

these handful of nations, the increase in trade has resulted in increased manufacturing employment and wages.

While the Heckscher-Ohlin-Samuelson Model suggests a developing nation will, as a result of trade with a developing nation, experience wage inequality between skilled and unskilled workers, other studies suggest that for a developing nation, increased trade - with any nation - along with sweeping trade reforms, can also lead to wage inequality. Hanson and Harrison (1999) study the widening of the wage gap between skilled and unskilled workers in Mexico during the 1980's. They look for a correlation between the latter and Mexico's far-ranging trade reform in 1985. Using data from Mexican manufacturing plants for 1984-1990 and Mexican Industrial Census data for 1965-1988, they find that removal of tariff protection in 1985 had a large, adverse impact on low-skilled industries. The authors argue that due to an increase in competition with economies having an even larger pool of unskilled workers than Mexico's, the prices of Mexican manufacturing exports may have fallen. At the relative price of skill-intensive goods produced by Mexican manufacturing increased, as a result of which overall wage inequality also increased.

Wood (1995) argues that trade with a developing country adversely affects unskilled workers in the developed country. Indeed, Wood (1994) argues that reducing barriers to trade has caused developed nations to shift production from skill-intensive and labor intensive manufactures, to the production of skill-intensive manufactures while importing labor intensive manufactures. In looking at a panel of developed nations, all of which had increased trade with developing nations, Wood (1995) found that manufacturing unemployment was highest in those developed countries that had the largest volume of imports from developing nations. He also argues that trade, and not technological growth, has adversely affected unskilled workers,

because technological growth would not have made a difference relative to the welfare of unskilled workers had industrial nations remained industrially self-sufficient; that is, not relied on manufacturing imports from developing nations for the production of goods.

Wood (1997) examines the widening of the wage gap between skilled and unskilled workers in Latin America, since the mid-1980's. Such increasing wage inequality is in contrast to the impact that trade had on East Asia in the 1960's and 1970's. In this case, East Asian countries saw a narrowing of the wage gap. Wood argues that this discrepancy is not attributable to differences between East Asia and Latin America. Rather, the discrepancy has to do with events between the 1960's and 1980's, particularly China's entry into the global marketplace as well as the advent of new technology unfavorable to unskilled workers.

Beyer, Vergara, and Rojas (1999), look for an empirical link between trade liberalization and wage inequality in China from the late 1970's to late 1990's. Using the Heckscher-Ohlin-Samuelson model as their primary tool, they employ cointegration techniques to see if there is a correlation between skill level in Chile and product prices, openness of the economy, and factor endowments. They find that the wage inequality in Chile over the period in question is due to the decline in the relative price of labor-intensive goods. In contrast, they find a positive correlation between the rising percentage of the Chilean labor force with college degree and the narrowing of the wage gap. They also find that the more open to trade is the economy, the greater the wage gap between skilled and unskilled labor.

The Stolper-Samuelson theorem suggests that, as a result of trade liberalization, a country will shift its output in the direction of its most abundant factor of production. Davis (1996) notes that such a shift should benefit developing nations, given their abundance of unskilled labor. On the other hand, the empirical evidence says otherwise. Davis explains the discrepancy by arguing

that countries with a large labor pool - relative to the rest of the world - may, as a result of trade liberalization, experience a decline in wages if they are also capital abundant, albeit in a local sense.

That internationalization is beneficial to a developing, low-wage nation is exemplified in the case of Mexico. As López-Córdova (2002) points out, the implementation of the North American Free Trade Agreement (NAFTA) in 1994 was a turning point in Mexico's economic history. The Mexican economy had already pursued a path of economic liberalization since the early 1980's, without much success. NAFTA was the synthesis of this push towards liberalization. By eliminating tariffs, NAFTA allowed Mexico to greatly increase the volume of exports to the USA. Between 1993 and 1999, for example, approximately 7 years to the date that NAFTA took effect, import competing industries in Mexico saw a productivity increase of 4.2%, while exporting industries experienced productivity growth of 1.6 and 1.3 percent, relative to world and North American markets, respectively. At the same time, those industries that were relatively isolated from world markets saw an annual growth rate of 0.3%. A closer look at the data suggests that between 1993 and 1999, NAFTA contributed to a 7.5% decrease in tariffs in Mexico. Furthermore, López-Córdova shows that for Mexican manufacturing, this reduction corresponds to a total factor productivity increase of 3.75 to 6.5 percent as well as increasing the growth rate of TFP by 9%. At the same time, imported inputs increased from 27.3 to 33.7 percent of all non-wage costs of production. It is also seen that imported inputs increased TFP by 0.96%, while imported intermediate inputs decreased TFP. Finally, López-Córdova shows that had Mexico not been integrated into world markets, TFP in 1998 would have been 10% less than what the data indicate.

CHAPTER 3

DISCUSSION

Between 1978 and 1990, the volume of trade between the US and the rest of the world, particularly developing nations, increased dramatically. At the same time, we notice particular industry-specific labor market trends. For example, if we look at manufacturing, then we see that overall employment declined, fewer unskilled workers were employed, and the wage gap between skilled and unskilled workers grew larger. These trends are not random, but are exactly what we would expect from the Heckscher-Ohlin-Samuelson (HOS) model.

According to HOS theory, if the low-wage trading partners of the US which formerly had protectionist trade policies suddenly adapt trade policies that favor market liberalization, then for the domestic country, non-skill intensive goods become cheaper compared to skill-intensive goods (since the low-wage countries are exporting these). Furthermore, the wages of low-skilled workers declines relative to the wages of high-skilled workers, since the demand for low-skilled workers has diminished. This leads to an income gap or wage inequality. At the same time, goods requiring high-skilled labor will be produced in more abundance than those that require low-skilled labor, and the domestic country will export more skill-intensive goods and import more non-skill-intensive goods while productive sectors will employ more high-skilled workers compared to low-skilled ones. By analyzing, among other things, NBER employment and wage data for skilled and unskilled workers, data on manufacturing imports as a percentage of total GDP (relative to trade with developing nations), and data on imports and exports – as a percentage of total trade from high-skilled and low-skilled countries – Sachs and Schutz (1994) find that HOS accurately predicts many of the trends described earlier. In particular, the data they use stems from 1978 – 1991, when the volume of trade between the US and seven East

nations (China, Hong Kong, Korea, Malaysia, Singapore, Taiwan, and Thailand) and two Latin American economies (Brazil and Mexico) reached an all-time high. Given that, in the period under consideration, all of these developing nations had an abundance of unskilled labor – relative to the US – it follows that they provide an abundant testing ground for HOS. Moreover, as Sachs and Schutz (1994) demonstrate, the 1980's were economic turning points for these nations. East Asian economies were industrializing, while at the same time experiencing export growth due to low-wage labor, highly flexible labor markets, macroeconomic stability, very high rates of national savings, and government support for manufacturing. Latin American nations, meanwhile, adopted more liberal trade policies, also resulting in export growth. Brazil's manufacturing export sector, for example saw especially high growth in the 1980's, following an earlier debt crisis, while Mexico emerged as a manufacturing exporter in the mid-1980's.

Between 1950 and 1998, manufacturing as a share of total US GDP decreased by 10.8%, while manufacturing as a share of total domestic employment declined by 16.3%. At the same time, the wage gap between nonskilled (production) and skilled (production) workers widened after the 1960's, with little downward movement, reaching a peak in the 1980's. Between 1982 (the lowest point) and 1990 (the maximum), for example, the ratio increased by 7.9 percent. This finding is very much in line with HOS theory, which predicts that the wage gap between low-skilled and high-skilled workers should increase as the volume of trade with developing nations increases. Moreover, as Sachs and Schatz note, the wage inequality is not unique to the US, but is a global phenomenon, implying that a "global" candidate, such as increased trade competition with developing nations, is at work. Indeed, between 1978 and 1990, manufacturing imports as a share of total GDP increased by 1.9 percentage points, while the contribution of manufacturing imports to overall manufacturing GDP increased by 12.4 percent. The source of this increase in

imports: unsurprisingly, are low-wage and developing nations. In this case, low-wage is taken to mean the average manufacturing wage is 50% or less than that of the US wage. In 1978, for example, low-wage nations contributed to 1.5 percent of US manufacturing imports as a share of total US GDP, while for developing nations the figure was 1.6. By 1990, the contribution of low-wage nations was 2.6 and that of developing nations was 2.7. The results are even more dramatic if we look at the share of US manufacturing imports relative US manufacturing value-added. The contribution of low wage countries was 5.1 in 1978, while from developing nations it was 5.3. By 1990, the figure had grown to 10.9 for low-wage nations and 11.2 for developing nations. What about after 1990? It is seen from Table 1 that manufacturing as a percentage of total US employment has steadily declined. For example, between 1990 and 2012, manufacturing as a percentage of total US employment decreased by nearly 45 percent. Also from Table 1, manufacturing as a percentage of total GDP decreased by nearly 35%, between 1992 and 2012. Finally, manufacturing imports increased by 140 percent between 1990 and 2001, while during the same period, exports grew at a modest rate of 87 percent. We shall look at a particular case of a low-wage nation – Mexico – and its increase in exports to the US following NAFTA, in some detail later. For now, it suffices to note that the increase in imports from developing and low-wage nations is consistent with HOS.

As noted earlier, many of the trends in US manufacturing pertaining to the years 1978-1990 have continued well after 1990. For example, as Figure 1 below shows, with few exceptions, overall manufacturing employment has been on a steady path of decline between 1990 and 2011. For example, in the first quarter of 1992, manufacturing employment was at 800,000, peaked at close to 1200000 around the first quarter of 2001, but them plummeted to

400,000 by the second quarter of 2010. Figure shows that while the aggregate manufacturing salary has largely increased since 1998, it has decreased below it's 1998 level, by 2009.

Figure 1: Quarterly Employment Data for US Manufacturing

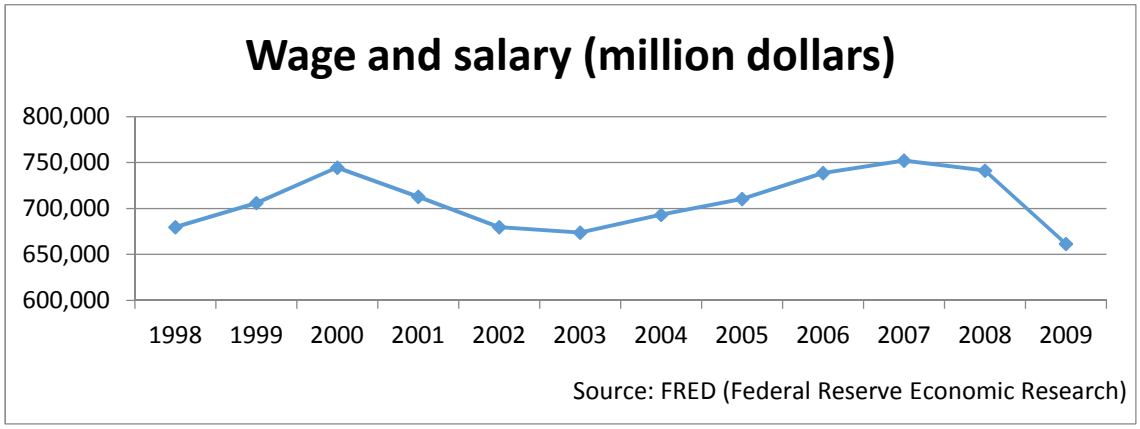


Figure 2: Aggregate Wage and Salary Data for US Manufacturing

Krugman and Lawrence (1994) place little emphasis on the implications of trade with low-wage nations. They claim that today's low-wage nations are the source of tomorrow's "high-wage" competition. Europe and Japan, for example, were once low-wage nations but are now high-wage competition, having been replaced by the likes of China, Brazil, and Mexico. As Sachs and Schutz (1994) point out, however, fluctuations in trade with low-wage nations corresponds well to changes in wage inequality between low-skilled and high-skilled workers. This would mean that rising wages in Europe and Japan between 1961 and 1978 reduced the amount of downward pressure on wages of low-skilled workers in the US, resulting in decreased wage inequality. Indeed, this claim is consistent with the data. Between 1961 and 1965, for example, the wage gap between production and nonproduction workers decreased. It is instructive to ask whether HOS supports the claim that the US became a net exporter of skill-intensive products and a large net importer of non-skill intensive products. Sachs and Schutz (1994) address this issue by looking at the data for net trade balance relative to net trade flows. If the net trade balance is positive, then exports are greater than imports. If the net trade balance is negative, then imports are greater than exports. A disaggregation of US trading partners is employed, as well as the basic equation $(X_i - M_i)/(X_i + M_i)$, where X_i is the dollar value of exports, M_i is the dollar value of imports, and I corresponds to the decile of the skill intensity. Ranking skill level by decile, with a decile of 1 corresponding to the highest skill level and a decile of 10 corresponding to the lowest skill level, Sachs and Schutz (1994) find that as the decile increases, the trade deficit is much greater for trade with developing nations than it is for trade with developed nations. Therefore, the answer to our question is yes for developing nations and no for developed nations.

As an example of how trade benefits manufacturing in a developing nation, we look at Mexico. López-Córdova (2002), uses micro-level data from a group of Mexican power plants to examine how the North American Free Trade Agreement (NAFTA) and an overall trend towards trade liberalization has increased TFP in these plants over the period 1993-1999. He finds that import competition, increased FDI, and greater access to US markets have all contributed to an increase in TFP. As López-Córdova notes, NAFTA, implemented in 1994, represents a turning point in Mexican economic history. Liberalization reforms had been in place since the mid-1980s, with a gradual doing away of import and export licenses and a reduction in tariffs between January 1983 and July 1985. Furthermore, after it joined GATT in 1986, Mexico bound tariffs at a 50-percent level, while tariffs continued to be eliminated. Despite these reforms, overall TFP from the early 1980's and through the late 1990's resulted in average annual growth between -1 and -2 percent [World Bank (2000)]. NAFTA did far more than any other trade reform to eliminate tariffs. Indeed, as we can see from Figure 1, in 1993 a mere 10 percent of all Mexican manufacturing imports from the United States were subject to import duties less than 5 percent ad valorem while 15 percent of imports paid duties less than 10 percent. After NAFTA came into effect, tariff cuts increased the those numbers to 40 percent and 60 percent, respectively, while by 2000, 93 percent of all manufacturing imports paid duties less than 5 percent and less than 1 percent of imports were subject to duties 10 percent or greater. Thus, it should come as no surprise that exports to North America and imports from Mexico more than quadrupled between 1990 and 2000.

Another indication of the impact of NAFTA are the large increases in FDI as a percentage of GDP. From 1994 to 2000, incoming FDI from the US equaled 18.4 billion dollars (in 1995 prices), of which 10.3 billion was channeled into the manufacturing sector. FDI inflows

into the Mexican manufacturing sector increased from 6.4 to 7.2 percent, as a percentage of total U.S. investment abroad. López-Córdova gives several explanations as to how trade policy can impact manufacturing productivity. The import discipline effect, for example, results in domestic producers facing increased competitive pressure. This, in turn, is accomplished in any of three ways: a reduction in management slack (X-efficiency), forcing firms to increase their output (resulting in gains in scale efficiency), and thirdly, by giving firms more motivation to engage in innovation. X-efficiency was introduced by Liebenstein (1966) and refers to the ability of a firm to maximize outputs relative to inputs. Competition may provide a lack of incentives to perform such a task, leading to so-called X-inefficiency. On the other hand, an improvement in X-efficiency is thought to lead to gains from trade. Scale efficiency gains are such that increased competition does not prevent firms from restricting output and raising prices. In turn, lower prices lead to more output and ultimately, lower average costs. Innovation and its positive impact on long-term productivity growth is widely accepted. See for example, Gordon (2000). Another effect of trade is a crowding out effect. By inducing firms to become more productive, the least efficient are forced to exit, while the more productive firms expand. The removal of trade barriers also facilitates technology transfers, allowing greater access to cutting-edge technologies. As is the case with trade liberalization, an increase in FDI leads to enhanced firm management, increases scale efficiency, and gives firms more reason to innovate. In the long-term, knowledge spillovers and linkage effects have the most impact on productivity growth, because of their potential to improve a firms' ability to innovate. FDI knowledge spillovers occur when local firms copy the technology of foreign firms, thereby increasing their own productivity. Even though the spreading of such technology is thought to be beneficial to developing countries, one should note that the process is not open-ended; e.g. there are limitations. For

example, human capital in the form of a qualified workforce and investment in research and development are essential if FDI spillovers are to occur. Secondly, since foreign firms have an incentive to retain their competitive edge and hence keep technology transfers to a minimum, spillovers will more than likely be "vertical" (among their clients and suppliers) as opposed to "horizontal" (among their competitors) (Kugler 2000). FDI is also taught to enhance both the quality of variety of intermediate goods available at the local level, either through investment in domestic industries or else via investment in final consumer goods. In the latter case, the ensuing demand and technology spillovers leads to a formation of intermediate industries.

To empirically investigate total factor productivity in Mexican manufacturing, López-Córdova looked at a sample of 5300 plants in 8 different manufacturing subsectors. He found that between between 1993 and 1998, Mexican manufacturing productivity grew at a rate of 1.1 percent on average.

In order to present a case for the connection between total factor productivity and the integration of Mexico with greater North America, López-Córdova looks at productivity figures for import-competing industries from 1993 to 1999. He finds that import-competing industries saw a 4.2 percent increase in productivity from 1993 to 1999, while exporting industries competing in world markets experienced a 1.6 percent increase and those competing in North American markets saw a 1.3 percent increase. Most significant, perhaps, is the fact that those industries with few trade links to world markets saw an annual growth of only 0.3 percent.

Further econometric analysis by López-Córdova established a more substantive connection between NAFTA and the extent of the Mexican economies integration with greater North America. Previously found TFP estimates were regressed on annual measures of trade policy that affected Mexican manufacturers. Variables such as plant, industry, geographical

characteristics were controlled to the maximum extent possible. Factored into the analysis were Mexican tariffs on world trade as well as the United States' preferential tariff margin on Mexican goods. Greater weight was placed on Mexican trade with the U.S. as opposed to Canada. The analysis incorporates data on a plant's exporting activities, its use of imported inputs, and foreign capital participation.

We see that the increase in import competition which ensues from a tariff reduction and more participation of foreign goods in the domestic market, causes productivity to increase. Average tariffs in Mexico decreased by 7.5 percentage points between 1993 and 1999, largely as a result of NAFTA. From Table 2, we see that this reduction in tariffs resulted in a log TFP increase of 2.75 percent (from 3.75 to 6.5) while TFP grew by 9.0 percent. Furthermore, the results indicate that an increase in the import to output ratio in an industry is negatively and significantly correlated to the level and growth rate of productivity. From the point estimates, it is apparent that if we increase this ratio by one standard deviation, (1.062), the level and the growth rate of productivity would increase by about 2.1 and 1.9 percent, respectively. As discussed earlier, tariff barriers were on Mexican goods coming into Canada and the U.S. were greatly reduced, while Mexican exports increased, as a result of NAFTA. Indeed, as Table 2 shows, the number of proportion of exporters, derived from the plants considered in the study, increased from 38 to 44.9 percent. Finally, Table 2 shows that if there is an increase in preferences given to Mexican goods, then the level of productivity also increases, but not its rate of growth. Was NAFTA alone responsible for the increase in foreign inputs? While the analysis cannot definitely answer that, it does at least indicate a positive correlation between imported inputs and the level of productivity. If foreign imports increase by one standard deviation (0.208), for example, productivity increases by 0.96 percent. However, a negative correlation

exists between the imported intermediate inputs and productivity growth, which might be explained by the fact that manufacturers failed to adjust their production practices so as to sufficiently be aligned – time-wise - with the increased availability of imported inputs. Table 2 also tells us a few things about the impact that foreign producers in Mexico have on domestic manufacturers. An intra-industry spillover refers to an effect on plants which are in the same industry, while inter-industry spillovers are those which occur when FDI goes either downstream or upstream to industries in the production chain. From Table 2, it is seen that intra-industry spillovers are negatively significantly correlated with the level of TFP, but do not affect the growth rate. As foreign capital participation in the industry increases by one standard deviation (0.209), productivity diminishes by about 2.6 percent. For the case of backward –linked industries, however, FDI causes TFP to increase by nearly 29 percent and its growth rate to increase by approximately 15 percent, whereas the figures from forward-linked industries are 15 percent and 10 percent, respectively.

CHAPTER 4

CONCLUSION

In this paper, we have examined the consequences for the US manufacturing industry of an increase in trade between the US and the developing world. We find that most of these consequences can be deduced from the Hekscher-Ohlin-Samuelson Model. In the case of the US, for example, we find increased levels of unemployment for the manufacturing sector, a widening of the wage gap between skilled and unskilled workers, and an increase in manufacturing imports from labor intensive developing nations. In surveying the Mexican manufacturing industry, we around that trade liberalization can be beneficial to a developing nation, by way of an increase in total factor productivity (TFP) and foreign direct investment (FDI). We do not try to formulate an answer to the question of whether trade or technological innovation has played a bigger role in labor market fluctuations for US manufacturing. Regardless of which was the bigger culprit, this paper shows that trade played a significant role.

REFERENCES

Berman, E., Bound, J., & Griliches, Z. (1994). Changes in the demand for skilled labor within US manufacturing: evidence from the annual survey of manufactures. The Quarterly Journal of Economics, 109(2), 367-397.

Bernard, A. B., Jensen, J. B., & Schott, P. K. (2002). Survival of the best fit: competition from low wage countries and the (uneven) growth of US manufacturing plants (No. w9170). National Bureau of Economic Research.

Beyer, H., Rojas, P., & Vergara, R. (1999). Trade liberalization and wage inequality. Journal of Development Economics, 59(1), 103-123.

Brauer, D., & Hickok, S. (1995). Explaining the growing inequality in wages across skill levels. Economic Policy Review, 1(1).

Davis, D. R. (1996). Trade liberalization and income distribution (No. 5693).National Bureau of Economic Research.

Ghose, A. K. (2000). Trade liberalization and manufacturing employment. International Labour Organization.

Grant, D. S., & Wallace, M. (1994). The political economy of manufacturing growth and decline across the American States, 1970–1985. Social Forces, 73(1), 33-63.

Hanson, G. H., & Harrison, A. (1999). Trade liberalization and wage inequality in Mexico. Industrial and Labor Relations Review, 271-288.

Harvey, D. (1982). The limits to capital.Blackwell Publishing.

Liebenstein, Harvey. (1966) X-efficiency. The American Economic Review, Vol. 56, Issue 3.

López-Córdova, J. E. (2002). NAFTA and Mexico's manufacturing productivity: An empirical investigation using micro-level data. International Development Bank, Washington, DC.

Revenga, A. L. (1992). Exporting jobs? The impact of import competition on employment and wages in US manufacturing. The Quarterly Journal of Economics, 107(1), 255-284.

Sachs, Jeffrey D., & Shatz, Howard J. (1994). Trade and Jobs in U.S. Manufacturing. Brookings Papers on Economic Activity, 1-69.

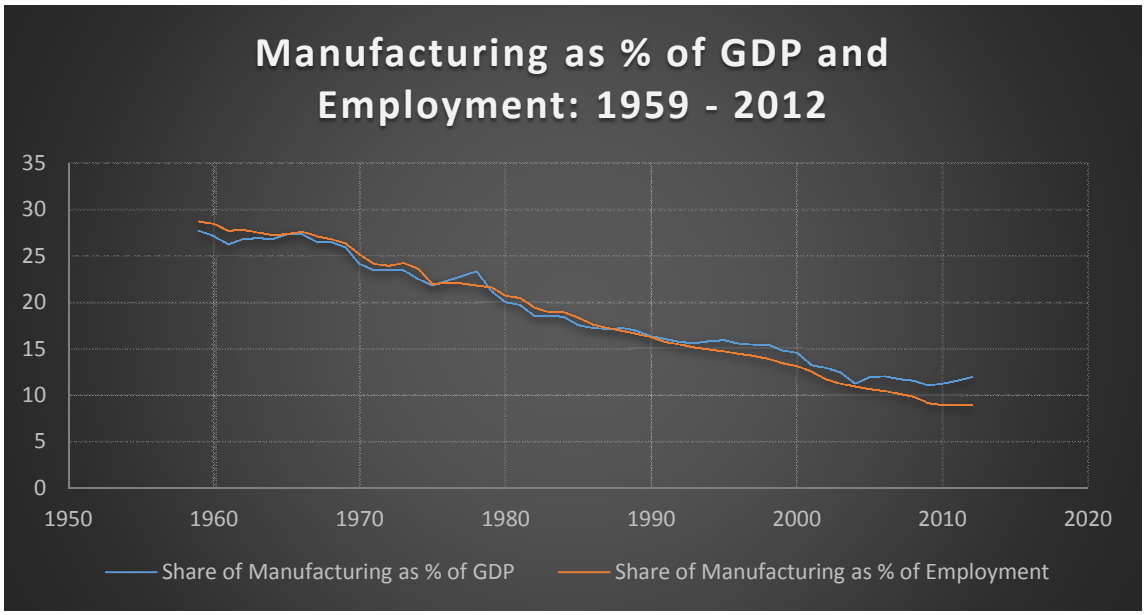
Shepard, W.F., Szirmai, A., & Rao, Prasada D.S. (2006). Indonesian Manufacturing Sector Output and Productivity: An Australian Comparative Perspective, 1975-90. Bulletin of Indonesian Economic Studies, Vol. 34, 121-142.

Wood, A. (1995). How trade hurt unskilled workers. The World Bank Economic Review, 11(1), 33-57.

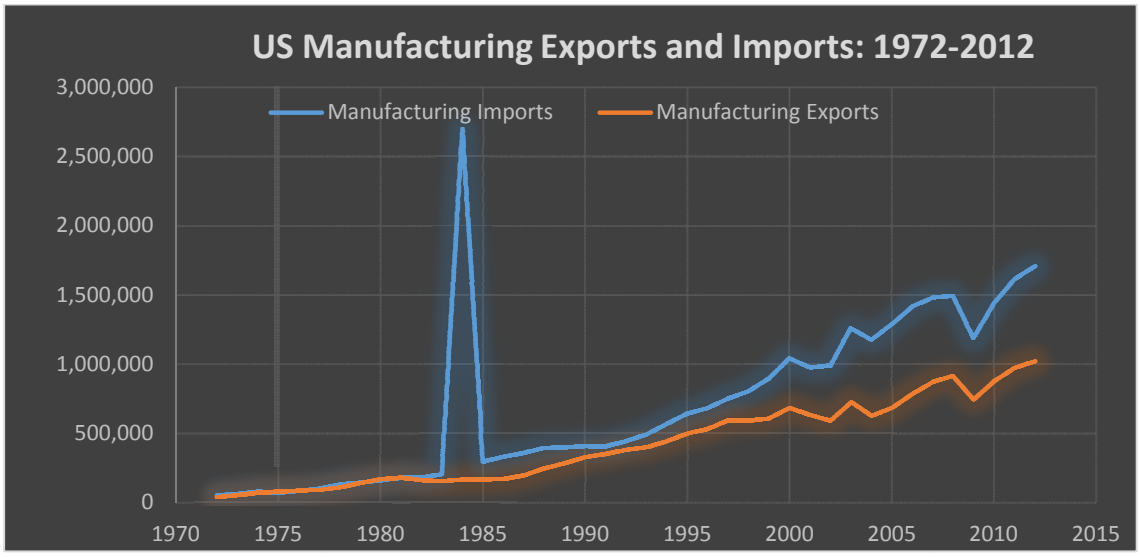
Wood, A. (1997). Openness and wage inequality in developing countries: the Latin American challenge to East Asian conventional wisdom. The World Bank Economic Review, 11(1), 33-57.

APPENDICES

Appendix A: Manufacturing Statistics



Source: Economic Report of the President (2013), Federal Reserve Economic Data



Source: United States Census Bureau, Feenstra (2002)

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