EMPIRICAL INVESTIGATION OF THE RELATIONSHIP BETWEEN NAFTA AND KEY ECONOMIC VARIABLES IN MEXICO

Morsheda Hassan, Wiley College
morshedat@yahoo.com

Raja Nassar, Louisiana Tech University
ran1@suddenlink.net

ABSTRACT

This study investigates the relationship between the North American Free Trade Agreement (NAFTA) and foreign direct investment (FDI), GDP growth rate, unemployment rate, total export, export to and from the US, total industry production, and total factor productivity in Mexico. Results from the statistical analysis, using intervention time series and auto-regression models, showed a positive relationship between NAFTA and total export from Mexico. On the other hand, NAFTA had no definitive relationship with foreign direct investment or any of the other economic variables.

INTRODUCTION

The North American Free Trade Agreement (NAFTA) was signed on December 17, 1992 by the United States, Canada, and Mexico. According to the Congressional Budget Office, it took effect on January 1, 1994. The purpose of the agreement was to phase out restrictions on trade and foreign investment among the three countries. Proponents of NAFTA argued for its positive impact on the economies of countries involved in terms of imports, exports, foreign direct investment, employment, and labor income. Of the three countries, there was general agreement that Mexico stood to benefit most because of its small economy relative to that of the United States and Canada (Kehoe & Kehoe 1994). Since NAFTA is a free trade agreement, it may benefit both import and export. Of interest, however, is how NAFTA would affect the economy in general such as the GDP, employment, foreign direct investment, industrial output and total factor productivity (TFP). TFP can be taken as a measure of an economy's long-term technological change or dynamics. There have been many empirical studies in the literature on the effect of NAFTA on different aspects of the economy of Mexico. However, most of the data analyses used were descriptive in nature and limited in the number of economic variables investigated. In this study, a comprehensive quantitative analysis is performed to assess the impact of NAFTA on foreign direct investment and on the GDP, import from the US, total export, export to the US, unemployment, industrial output, and factor productivity.

REVIEW OF LITERATURE

The Congressional Budget Office (2003) over 8 years after NAFTA reported on its effects on the US-Mexican trade and GDP. The study concluded that the effect of NAFTA on Trade with Mexico was hard to determine since trade was growing between the two countries for many years before NAFTA and the assumption is that it would have continued to grow with or without NAFTA. The effect of NAFTA on the GDP in Mexico and the U.S. has been positive, but slight. By eliminating trade barriers and quotas, Mexico under NAFTA has become a more attractive place for foreign investment, particularly in plants for final assembly of products destined back to the U.S. However, the effect of NAFTA on foreign investment was difficult to determine since Mexico has had liberalization of trade and other economic policies prior to NAFTA.

Stracke (2003) analyzing the effect of NAFTA on Mexico reported that while there have been some benefits in terms of trade, economic growth has not improved. The average growth rate was 2.7% after NAFTA. However, this was the rate for a decade before NAFTA. In addition, the income of workers has fallen after NAFTA. Also, there was no evidence of increased labor productivity since NAFTA went into effect. The fact that Mexico's economic benefit from NAFTA did not meet expectation was attributed to a number of factors, salient among them are: the brain drain of skilled workers to the United States, lack of adequate human capital, and structural problems.

Moreno-Brid et al. (2005) in a study on Mexico's industrialization and economic growth concluded that the economy after NAFTA has been characterized, on one hand, by low inflation, low deficits, and an increase in export, but on the other hand, by less than expected growth in the economy and employment. Authors discuss the need for a new development plan if Mexico were to succeed in attaining high and sustainable economic growth.

Arguing in the defense of NAFTA, Maser (1991) presented four reasons why NAFTA is in the interest of US business. These are the large market value of Mexico and an opportunity for US business to expand. Further, joint production with Mexico is a good manufacturing strategy for competition in global markets, and a trade agreement with Mexico could be used as a model for future trade and investment agreements with Latin America and other regions.

Cypher (2011) in an article on Mexico since NAFTA pointed out the failure of NAFTA to remedy economic stagnation, falling wages, a growing "jobs deficit," income disparity, poverty, and surging migration out of the country. It was pointed out that Mexico fell from the 12th largest exporter in 2000 to the fifteenth in 2010.

Ito (2010), using total factor productivity (TFP) as a measure of technology, reported that across industries there was an increase in gap in TFP level between Mexico and the US since NAFTA came into effect. This finding is in contradiction to previous reports in the literature of technology convergence between the two counties.

Esquivel (2011) examined income inequality in Mexico since the inception of NAFTA in 1994. Income inequality was measured by the GINI coefficient. The author reported that since 1994

there has been a reduction in income inequality. This reduction has been attributed to labor income in urban areas and to public transfer in rural areas. However, remittances contributed to reduction in income inequality at the national level since 1994.

Béjar (2014) examined energy in Mexico before and after NAFTA. His conclusion was that NAFTA had a negative effect on energy in Mexico in spite of its free trade with the US. The country, according to the study, has witnessed a setback for its energy companies (especially PEMEX), environmental problems, and the exhaustion of its non-renewable natural resources.
Stevens (2001) reported on a shift after 1989 in an explanatory model that explained the data well for plant and equipment spending by US direct investment in Mexico through 1989. After 1989, the under prediction from the model was attributed to the relaxation of restrictions on direct investment as well as to the effect of NAFTA on increasing foreign direct investment.

According to Blecker (2014), NAFTA did not help Mexican per capita income converge to the U.S. Also, it did not help employment in the country or stem migration. In addition, labor wages have stagnated while productivity increased leading to profit in the hands of few, thus contributing to income inequality. On the positive side, export of manufactured goods has increased substantially after NAFTA.

Salvatore, D. (2007) in a study of the economic effects of NAFTA on Mexico reported that the increase in export and inflow of FDI after NAFTA was due to the liberalization of trade and investment in general and to NAFTA per se. Increase in export and FDI led to increased productivity and competition. However, it was noted that the increase in FDI inflows from the rest of the world was as large as or larger than that from the U.S. Further, more benefits were received in the years directly before NAFTA than directly after. This was attributed to the economic crises in 1994-1995 that affected Mexico, to the economic slowdown in the U.S., and to the Chinese competition. However, the most important reason sited was the failure of Mexico to restructure and liberalize its economy and improve the education and training of labor in the country.

Correa and Seccareccia (2009) considered the linkage between Mexico under NAFTA and the U.S. financial crisis. They were of the opinion that the structural make-up of the NAFTA agreement contributed to the unfolding of the recent financial crisis in the U.S. and its international transmission. The authors argued that the model of export-led economic growth under NAFTA is flawed since it did not consider effective demand. They argued for domestic policies that boost income growth and domestic demand.

Cole and Ensign (2005) examined the effect of NAFTA on US direct foreign investment into Mexico with regard to technology, skilled and unskilled labor, and environmental expenditures. Authors reported that there was no evidence that US industries were moving to Mexico because of lower environmental standards. The study could not confirm the argument that highly skilled jobs will move to Mexico to take advantage of lower wages, or the position that only low skilled jobs will move to Mexico. Also, it could not be determined whether movement to Mexico favored low or high technology workers. Results of the study showed that US FDI into Mexico is supporting lower polluting industries.

Kose et al. (2004) in a study examining the effect of NAFTA on the Mexican economy reported that most studies showed that NAFTA had a substantial effect on increasing trade and foreign direct investment in Mexico. FDI rose from $12 billion in 1991–93 to about $54 billion in 2000–02. Also, Mexico's export in dollars to the US and Canada tripled between 1993 and 2002. In 2002, Mexico's trade with the US and Canada accounted for 40% of the GDP. Mexico's output and investment volatility decreased dramatically under NAFTA. However, in order to sustain the benefits under NAFTA there is a need for structural reform in education, labor, energy, judicial, security, and telecommunication.

Villarreal (2012) reported that Mexico under NAFTA is the US second most important trading partner. In terms of exports by the US, Mexico ranks second and is ranked third in US imports. Under NAFTA, the US is the most important Mexico's trading partner. Also, the US is the major source of FDI in Mexico. The economic effect of the US trade with Mexico on the Mexican economy has been substantial. However, its effect on the US economy has been minimal mainly because bilateral trade with Mexico amounts to less than 3% of the US GDP. The economic ties between the US and Mexico have strengthened considerably under NAFTA.

Gamboa (2012) modeled the location pattern of FDI in Mexico utilizing spatial econometric techniques. His conclusion was that variables that were influential in attracting FDI were GDP per capita, proximity to the US and Mexico City, years of schooling, wages, infrastructure, FDI in neighboring regions, and delinquency rates. However, most important among these variables were years of schooling, low delinquency rates, and FDI in neighboring regions. Investment in infrastructure is essential for flow of foreign direct investment. However, FDI concentration is likely to remain in the northern states with proximity to the US.

Weisbrot et. al. (2014) compared the economy in Mexico with that of the rest of the region over the past 20 years under NAFTA. The authors concluded that (1) Mexico ranked 18 among the 20 Latin American countries in growth of real GDP per person; (2) Mexico's real GDP per person grew by 98.7 percent from 1960-1980, but only by 18.6% (about half the rate for the other Latin American countries) in the last 20 years under NAFTA; (3) The poverty rate did not improve. The rate is almost the same for 1994 and 2014. The rest of Latin America showed a drop in poverty rate; (4) inflation adjusted wages were almost the same in 1994 as in 2012; (5) there was a significant deterioration in employment in general and agricultural employment in particular under NAFTA; (6) the poor economy in Mexico contributed significantly to the surge of emigration to the United States.

Peters (2008) in a study on the impact of FDI in Mexico reported that FDI has remained roughly constant for the period, 1994-2006. FDI in terms of new investments has diminished considerably. Manufacturing accounted for 49% of total FDI. Since 2000, there has been a significant increase of FDI in the financial sector. With regard to the 20 most important industries in terms of FDI, there was a lack of job creation, a growing gap between wages and productivity, and a lack of R&D expenditures. Also, FDI may have contributed to the worsening of the socio-economic and territorial polarization situations. The author advocates a long term national development strategy in order to exploit the potential benefits of FDI flow to Mexico under NAFTA. For instance, there should be a guided FDI in terms of location in Mexico in

order to diffuse polarization and a liberalization of FDI in the energy sector, namely petrochemicals and electricity.

Gould (1998) pointed out that NAFTA, being a free trade agreement, should be judged by whether it increases both imports and exports. By this criterion, NAFTA has been a success to both Mexico and the United States, but not to Canada. NAFTA had a positive effect on the flow of trade between the US and Mexico. However, it had no effect on trade between Mexico and Canada or the US and Canada. This was attributed to the fact that the US and Canada had a free trade agreement in place five years before NAFTA and that most of the free trade negotiated under NAFTA was between the United States and Mexico. NAFTA's effect on jobs in Mexico and the United States was difficult to determine. This was because factors such as business cycles and economic shocks in a country and not trade have a dominant effect on employment.

METHODS

In order to determine if NAFTA had any effect on different factors of the economy, two analytical procedures (intervention time series analysis, and auto-regression analysis) were utilized using the SAS software.

Intervention Analysis

Intervention analysis (Box & Tiao, 1975) is used to study the effect of an intervention on a time series response variable when the time (T) of the intervention is known. The intervention in this case is NAFTA and is entered in the model as a step function (0 before 1994 and 1 at and after 1994). If the response due to the impact is felt b periods after the intervention at time T, the impact of the intervention on the response variable can be specified in general as

$$wB^bS_t^T, \quad (1)$$

where, B is the backshift operator and w is the impact coefficient and

$$S_t^T = \begin{cases} 0, & t < T \\ 1, & t \geq T \end{cases}$$

However, if the response due to the impact is gradual, the impact can be specified as

$$(wB^b/(1-\delta))S_t^T \quad (2)$$

Where δ is between 0 and 1 (Wei, 2006).

For the purpose of this analysis, both (1) and (2) were used. The intervention model can be written as

$$y_t = x_t + wB^bS_t^T \quad \text{or} \quad y_t = x_t + (wB^b/(1-\delta))S_t^T \qquad (3)$$

where y_t is the observed series and x_t is the series with no intervention.

Auto-regression

The auto-regression model employed takes the form

$$y_t = a + bx_t + n_t \qquad (4)$$

Where n_t is an auto-regressive process of the first order, $n_t = \theta n_{t-1} + e_t$ ($|\theta| < 1$) and e_t is random error. The order was determined using the Durbin-Watson statistic.

DATA

Data on GDP growth rate, unemployment rate, total export (as percent of the GDP), and total industry production (index, with 2010 = 1) were obtained from the online economic data of the Federal Reserve in Saint Louis (FRED). Foreign direct investment data (in US dollars) were obtained from the World Bank Data on line. Data for Export to the US (millions of dollars) and import from the US (millions of dollars) were obtained from the US. Bureau of Economic Analysis, US. Bureau of the Census. Total factor productivity (index USA = 1, source: Feenstra et al. 2013). A common source for most of these data is the Federal Reserve Economic Data in St. Louis (FRED). The time period for this analysis was 1980-2014. Plots of the time series data are presented in the Appendix.

RESULTS

For the time series analyses, we checked for stationarity using the autocorrelation and partial autocorrelation dampening pattern approach (Wei, 2006). Results indicated that all series, except for growth rate and unemployment rate, (foreign direct investment, import from the US, total export, export to the US, industrial output, and factor productivity) were not stationary. However, first differences were stationary. Stationary series were used in the analysis.

Intervention analysis

From this analysis, it was determined that NAFTA had a highly significant positive impact (according to equation (1)) on export and unemployment. Also, it had a positive effect on FDI that was only significant at the 0.08 level. NAFTA, on the other hand, had no significant effect

on the other economic variables (growth rate, total factor productivity, export to the US, import from the US, and total industry production).

For export, the model is

$$Export_t = Export_{t-1} + 11.618\ NAFTA_{t+1} + e_t \quad (5)$$

where the coefficient 11.618 is significant with $p < 0.0001$

NAFTA had an effect ($w = 8.05x10^9$, from equation (1) with no lag) on FDI which was significant only at the 0.08 level.

$NAFTA_{t+1}$ had a positive impact on unemployment. The response due to the impact was felt one year after NAFTA went into effect in 1994. W from (1) was 2.52 with a p value < 0.0001.

Auto-regression analysis

The model in (4) was used with year and NAFTA in the model and with NAFTA alone in the model. Year can be viewed as a proxy for factor or factors that may have an effect on the response variable y.

NAFTA at positive lag 1 had a positive and significant effect on export. This was in agreement with the analysis result from equation (1) above. The coefficient b in equation (4) was 10.19 (with year in the model) and b = 12.52 (with NAFTA alone in the model). Both b estimates were significant with $p < 0.0001$.

Also, NAFTA at positive lag 1 had a positive relationship with the unemployment rate. The b coefficient was 2.45, significant at the 0.0001 level. The effect was still significant when year entered the model

NAFTA alone in the model had a significant positive relationship with FDI ($b = 1.75x10^{10}$ with a p value <0.0001), but the effect was not significant when year entered the model.

NAFTA had no significant relationship with any of the other variables, namely growth rate, export to the US, import from the US, total factor productivity, and total industry production). Results from this analysis are in agreement with those of the intervention analysis above.

DISCUSSION

This study is a comprehensive quantitative analysis involving the effects of NAFTA on key macroeconomic variables in Mexico. It is of interest to find that NAFTA had no effect on a number of important economic variables

It seems that the one variable that was positively affected by NAFTA (as shown from the intervention and auto-regression analyses) was total export. This was perhaps to be expected since NAFTA is a free trade agreement. It is of interest, however, that export to and import from the US were not affected. Based on the auto-regression analysis results, NAFTA alone in the model had a significant positive effect on foreign direct investment, but the effect was not significant when year entered the model. One may conclude that NAFTA had no effect on FDI when one controls for the growth in FDI over years. Also, from the intervention analysis, one cannot make a strong case for an effect of NAFTA on FDI. It was of interest to find that NAFTA and unemployment were positively related. From Figure 2 in the Appendix, one finds that unemployment decreased for four years after NAFTA. However, it was on the increase after year 2000. This could be due to other factors, internal and external, which overcame any benefit NAFTA may have had on employment.

The results of this analysis are in agreement with most of the studies in the literature above. Stracke (2003) concluded that the fact that Mexico's economic benefit from NAFTA did not meet expectation is attributed to a number of factors, salient among them are: the brain drain of skilled workers to the United States, lack of adequate human capital, and infra-structural problems. Also, as pointed out by Salvatore, D. (2007) Mexico has failed to restructure and liberalize its economy and improve the education and training of labor in the country. These may be reasons for the lack of a NAFTA effect. Under NAFTA, US multinational corporations (MNCs) have invested mainly in Mexico-US border states, but under the NAFTA accord, their supply chain was mainly in the US and not Mexico. This has not benefited the Mexican economy beyond the Border States, Villarreal (2012).

The budget office (2003) study concluded that the effect of NAFTA on Trade with Mexico was hard to determine since trade was growing between the two countries for many years before NAFTA and the assumption is that it would have continued to grow with or without NAFTA Also, the effect of NAFTA on foreign investment was difficult to determine since Mexico has had liberalization of trade and other economic policies prior to NAFTA. These conclusions are supported by the statistical analysis in this paper.

CONCLUSION

In this quantitative study, the authors investigated the effect (relationship) of NAFTA on important economic variables in Mexico, namely GDP growth rate, foreign direct investment, total export, import from the US, export to the US, unemployment rate, total industry production, and total factor productivity.

Results from the statistical analysis, using time series intervention and auto-regression techniques, showed that NAFTA had a positive impact on total export, but no definitive impact on FDI or the rest of the economic variables above. Many of the economic variables that were not impacted by NAFTA could be characterized by positive drift terms which represent the slopes of their growth curves over years. This growth may be attributed to factors, other than NAFTA, not observed in this study.

REFERENCES

Béjar, A. A. (2014). Economic Integration and Energy in Mexico, Before and After NAFTA. *International Journal of Political Economy, 43,* 82–99.

Blecker, A. (2014). The Mexican and U.S. Economies After Twenty Years of NAFTA. *International Journal of Political Economy, 43,* 5–26.

Box, G. E. P., & Tiao, G. C. (1975). Intervention analysis with applications to economic and environmental problems. *J. Amer. Statist. Assoc. 70*, 70-79.

Cole, E. T., & Ensign, P. C. (2005). An Examination of US FDI into Mexico and Its Relation to NAFTA: Understanding The Effects of Environmental Regulation and The Factor Endowments That Affect the Location Decision. *The International Trade Journal, XIX, 1-30.*

Congressional Budget Office (2003). The Effects of NAFTA on U.S.-Mexican Trade and GDP. *Washington D.C, Government Printing Office*.

Correa, E., & Seccareccia, M. (2009). The United States Financial Crisis and Its NAFTA Linkages. *International Journal of Political Economy, 38,* 70–99.

Cypher, J. M. (2011). Mexico Since NAFTA: Elite Delusions and the Reality of Decline. *New Labor Forum 20(3): 61-69.*

Esquivel, G. (2011). The Dynamics of Income Inequality in Mexico since NAFTA. *ECONOMIA. Brookings Institution Press*.

Feenstra, R. C., Inklaar, R., &. Timmer, M. P. (2013). "the next generation of the Penn World Table" available at *www.ggdc.net/pwt.*

Gamboa, O. R. E. (2012). FDI determinants and spatial spillovers across Mexico's states. *The Journal of International Trade & Economic Development. Available online at: http://www.tandfonline.com/10.1080/09638199.2011.624190, 1-28.*

Gould, D. M. (1998). Has NAFTA Changed North American Trade? Federal Reserve Bank of Dallas, *ECONOMIC REVIEW FIRST QUARTER,* 12-23.

Ito, T. (2010). Nafta and Productivity Convergence Between Mexico and The US. *Cuadernos De Economía, 47, 15-55, 2010.*

Kehoe, P. J., & Kehoe T. J. (1994). Capturing NAFTA's Impact with Applied General Equilibrium Models. *Federal Reserve Bank of Minneapolis Quarterly, Review, Spring, 17–34.*

Kose, M. A., Meredith G. M., & Towe1, C. M. (2004). How Has NAFTA Affected the Mexican Economy? Review and Evidence. *International Monetary Fund WP/04/59. 1-48.*

Masur, S. (1991). The North American Free Trade Agreement: Why It is in the Interest of U.S, Business. *The Columbia Journal of World Business. Elsevier Science Publishing*

Moreno-Brid, J. C., Santamarıa, J., & Rivas, V. J. C. (2005). Industrialization and Economic Growth in Mexico after NAFTA: The Road Travelled. *Development and Change 36(6):* 1095–1119. *Blackwell Publishing, Oxford, UK and MA.*

Peters, E. D. (2008). The Impact of Foreign Direct Investment in Mexico. Discussion Paper Number 11. *The Working Group on Development and Environment in the Americas.* 1-20.

Smith, G., & Lindblad, C. (2003). Mexico: was NAFTA worth it? *Businessweek, December 21.*

Salvatore, D. (2007). Economic Effects of NAFTA on Mexico. *Global Economy Journal. 7,* 1-13.

Stevens, V. G. (1998). U.S. Direct Investment to Mexico: Politics, Economics, and NAFTA. *Contemporary Economic Policy. XVI*, 197-210.
Stracke, C. (2003). Mexico—The Sick Man of NAFTA. *World Policy Journal,* 29-36.
Villarreal, M. A. (2012). U.S.-Mexico Economic Relations: Trends, Issues, and Implications. *CRS Report for Congress, Order Code RL32934*, 1-23.
Wei, W. S. (2006). Time Series Analysis: Univariate and Multivariate Methods. *Addison-Wesley, New York.*
Weisbrot, M., Lefebvre, S., & Sammut, J. (2014). Did NAFTA Help Mexico? An Assessment After 20 Years. *Center for Economic and Policy Research, Washington, DC.*, 1-21.

APPENDIX

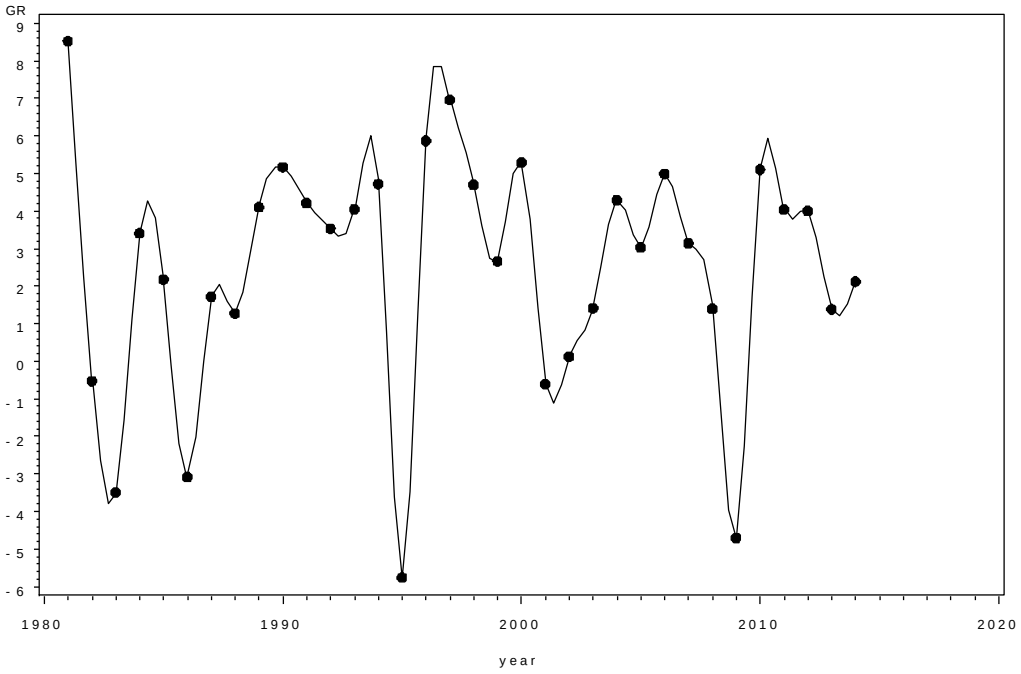


FIGURE 1: PLOT OF GROWTH RATE (GR) OVER YEARS

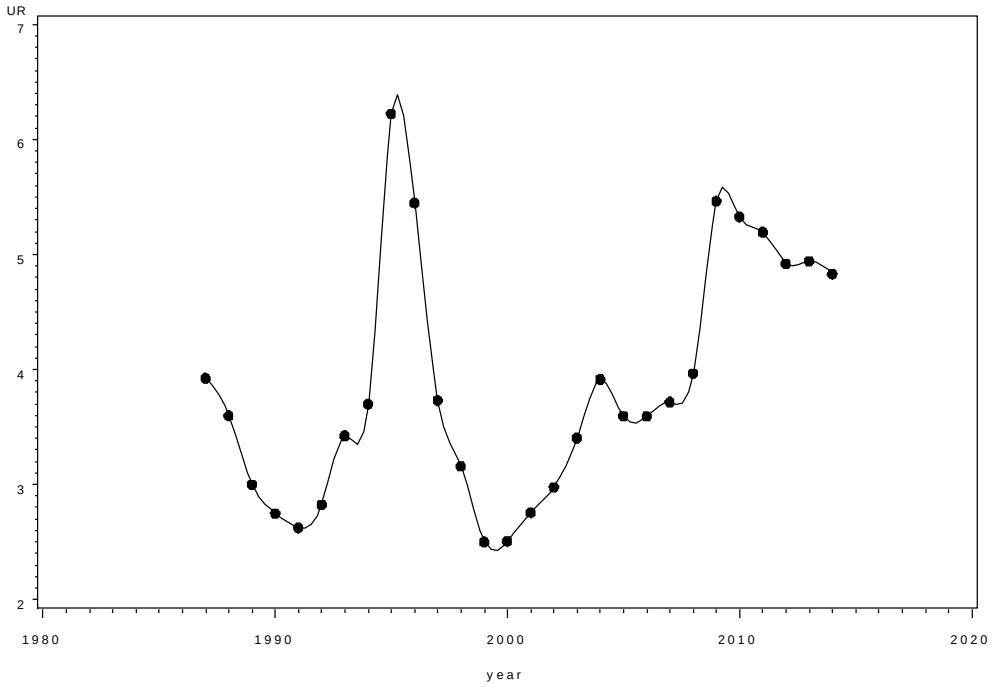


FIGURE 2: PLOT OF UNEMPLOYMENT RATE (UR) OVER YEARS

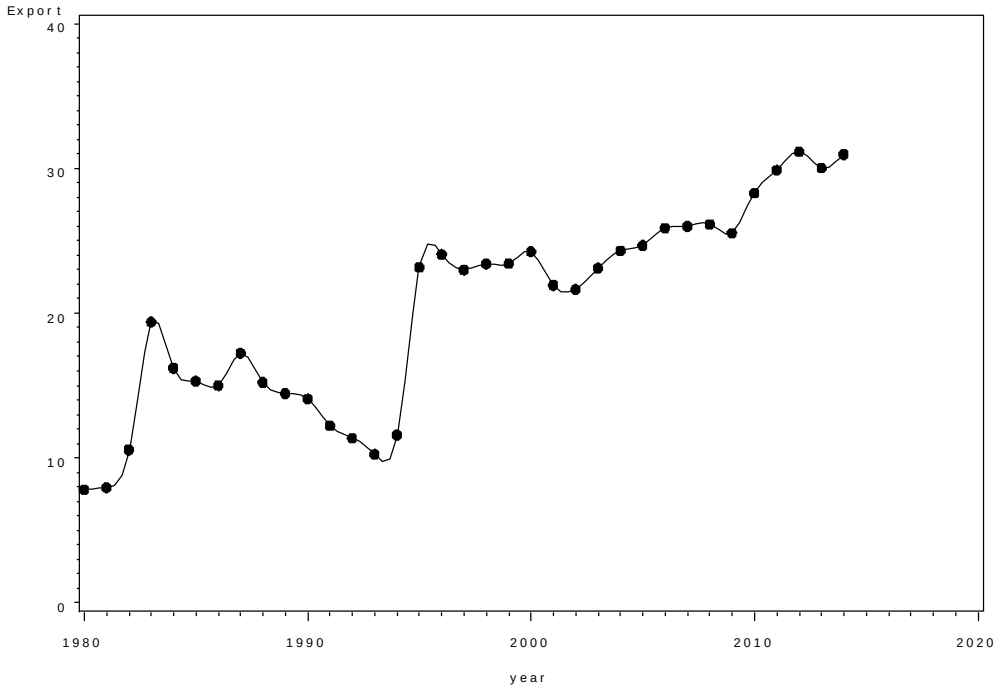


FIGURE 3: PLOT OF TOTAL EXPORT OVER YEARS

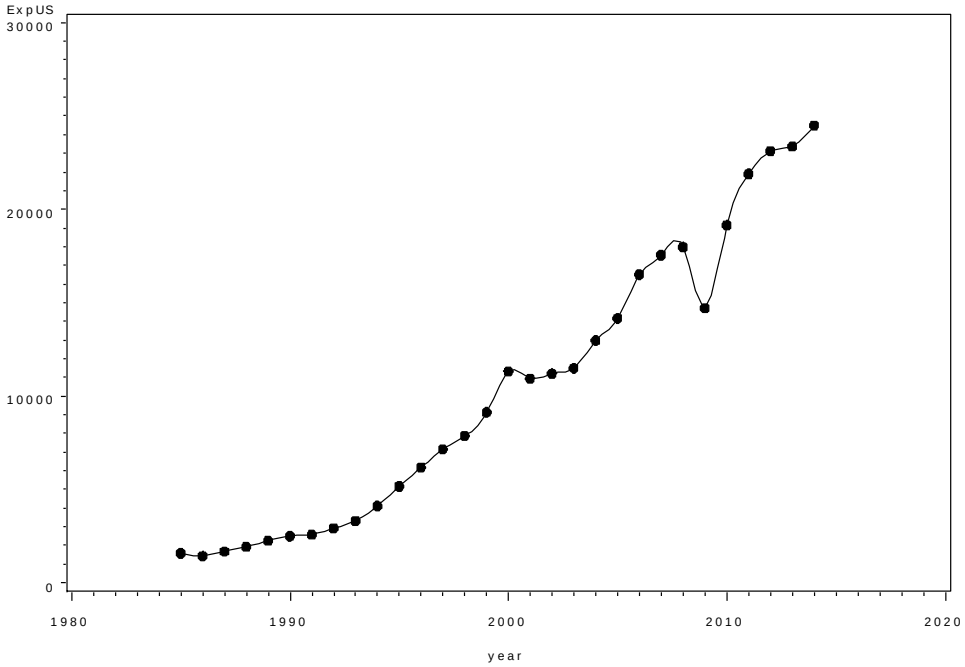


FIGURE 4: PLOT OF EXPORT TO THE US (EXPUS) OVER YEARS

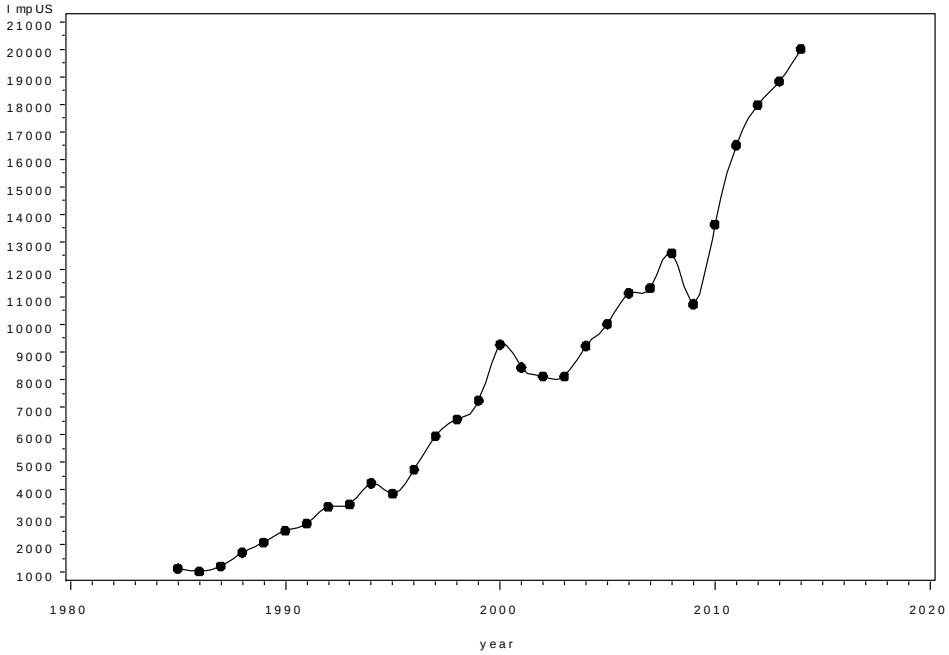


FIGURE 5: PLOT OF IMPORT FROM THE US (IMPUS) OVER YEARS

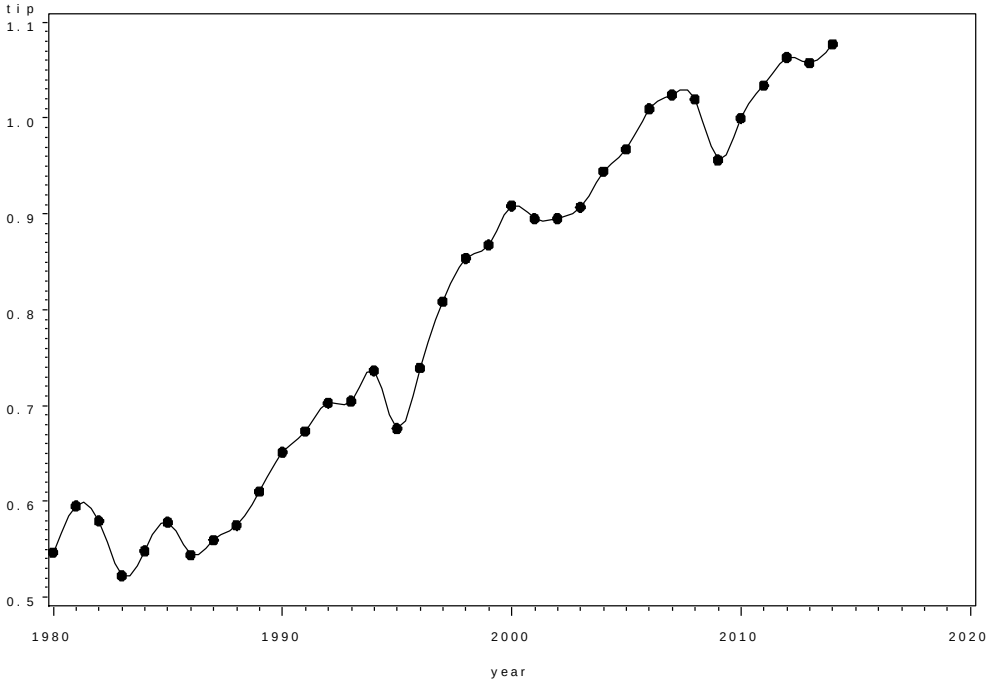
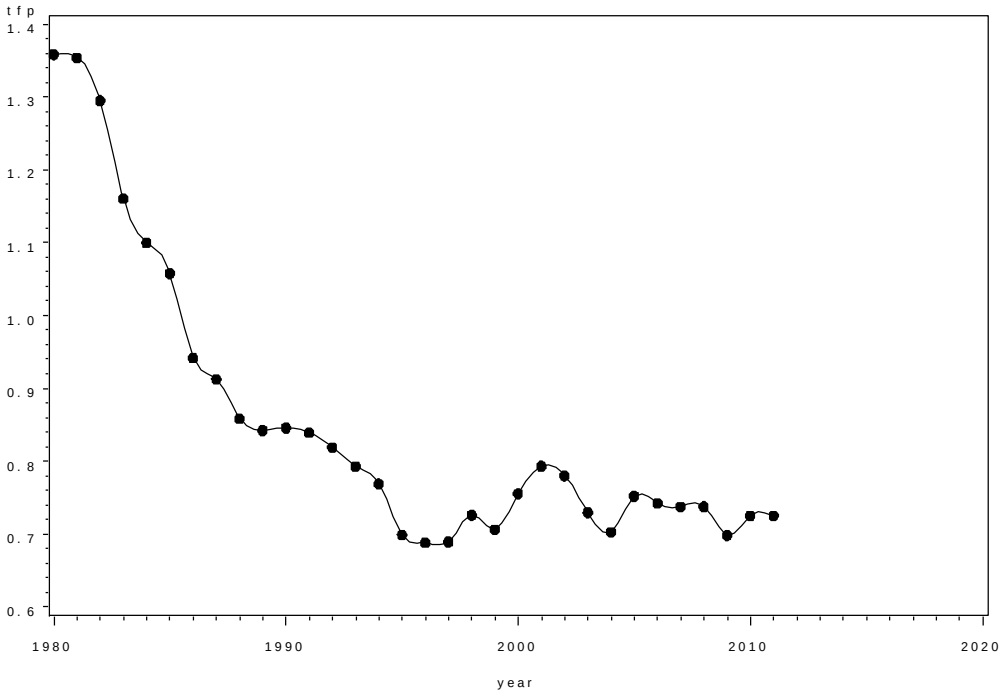


FIGURE 6: PLOT OF TOTAL INDUSTRY PRODUCTION (TIP) OVER YEARS



FIGURES 7: PLOT OF TOTAL FACTOR PRODUCTIVITY (TFP) OVER YEARS

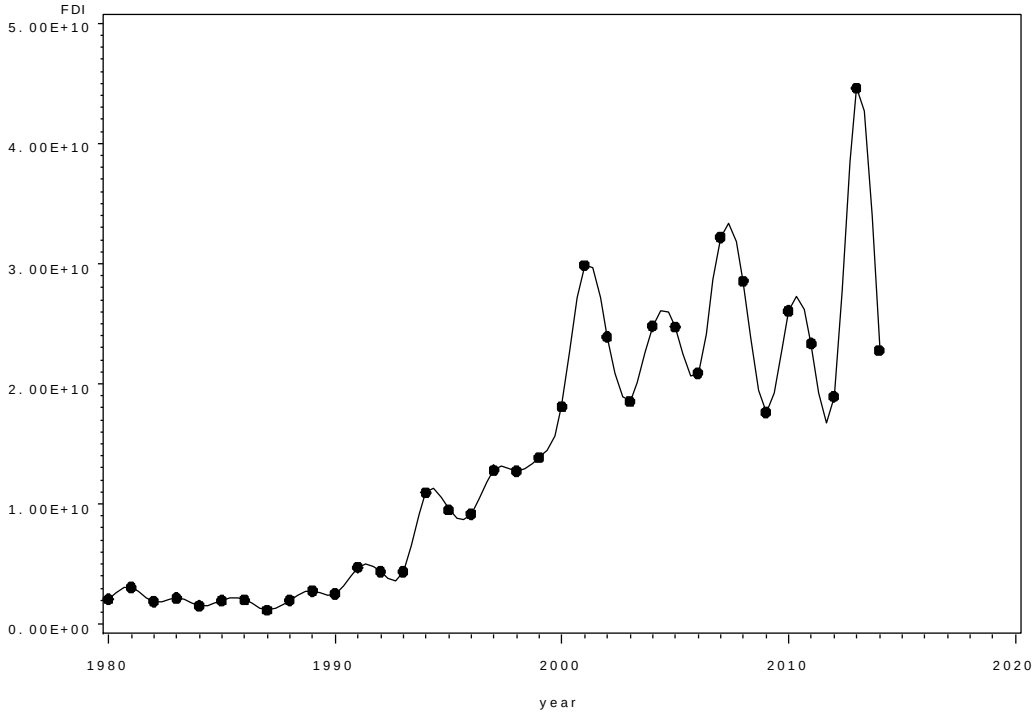


FIGURE 8: PLOT OF FOREIGN DIRECT INVESTMENT (FDI) OVER YEAR

Journal of International Business Disciplines

Volume 11, Number 2 November 2016

Published By:
International Academy of Business Disciplines and Frostburg State University

ISSN 1934-1822 WWW.JIBD.ORG