Journal of Economics and Development Studies
March 2015, Vol. 3, No. 1, pp. 133-172
ISSN: 2334-2382 (Print), 2334-2390 (Online)

Published by American Research Institute for Policy Development
DOI: 10.15640/jeds.v3n1a8
URL: http://dx.doi.org/10.15640/jeds.v3n1a8

Exports, Imports, FDI and GDP in Mexico: 1989-2013

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Abstract

This paper studies the impact of trade liberalization on economic growth for Mexico. A four-variable vector autoregression (VAR) is used to study the relationships between trade, FDI and economic growth using quarterly data from 1989 to 2013. The estimated results from the Granger causality/Block exogeneity test show that economic growth is affected by real non-oil exports, real imports and real foreign direct investment. There is only one bidirectional causality, that between GDP an FDI, and two additional one-way causalities, one between FDI and imports and one between imports and non-oil exports. Thus the system is circular: all variables directly or indirectly affect each other. The Impulse Response Functions and Variance Decomposition show that non-oil exports and FDI have little or no impact on GDP, not supporting the growth-led hypothesis or the one that postulates that FDI promotes growth; nor dowe find that GDP has a significant effect on non-oil exports, rejecting the hypothesis that growth induces exports. Finally we find that imports have a significant effect on GDP, supporting the import-compression hypothesis.

I. Introduction

From December 1, 1982, the administration of Miguel de la Madrid gradually abandoned the strategy of industrialization that had been in place since 1940, and began on the path toward indiscriminate economic liberalization. In 1986,Mexico joined the General Agreement on Tariffs and Trade (GATT), committing itself to eliminating official reference prices, continuing the replacement of direct controls with tariffs, and reducing the maximum tariff to 50% (which by1988 had already fallen to 20%). The State abandoned its role as a promoter of development.

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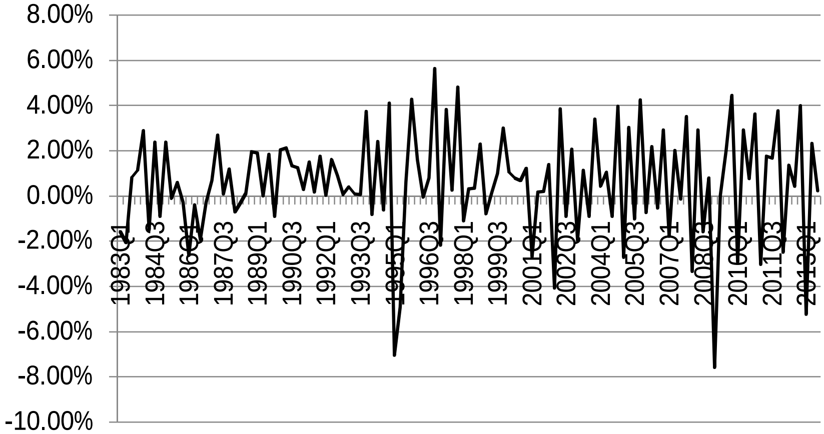
Most state-run enterprises were privatized, public investment shrank drastically, and many aspects of economic life such as transport and financial institutions were deregulated. In addition, this new approach gave Foreign Direct Investment (FDI) a central role in the development strategy, which included opening up the country to capital markets. In 1994, after a significant reduction in tariffs and licensing initiated in 1983, Mexico signed a Free Trade Agreement with the U.S. and Canada (NAFTA) mainly to attract FDI. Since 2008, the Mexican economy has been fully open to goods and capital from the United States and Canada, in line with the commitments made under NAFTA.

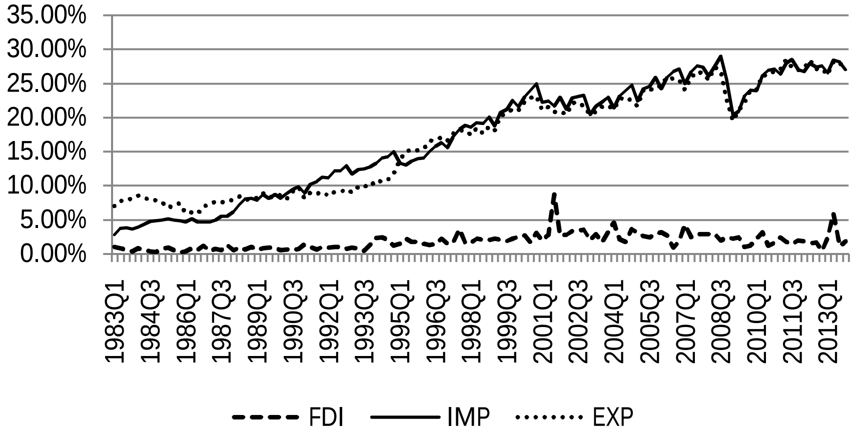
Figure 1: Quarterly Real Gdp Growth Rate



Source: INEGI.

From 1983 to 2013, the average growth rate was 2.35%, with a standard deviation of 2.30%, revealing a volatile and meager growth rate (see Figure 1). During this same period, the increase in exports and imports has been spectacular, starting in the first quarter of 1983 with 6.04% and 6.24% of GDP respectively, reaching 27.83% and 28.12%, respectively in the fourth quarter of 2013. Additionally, FDI has been on average 1.66% of GDP, with two important peaks, one in the third quarter of 2001 and the other in the second quarter of 2013 (see Figure 2).

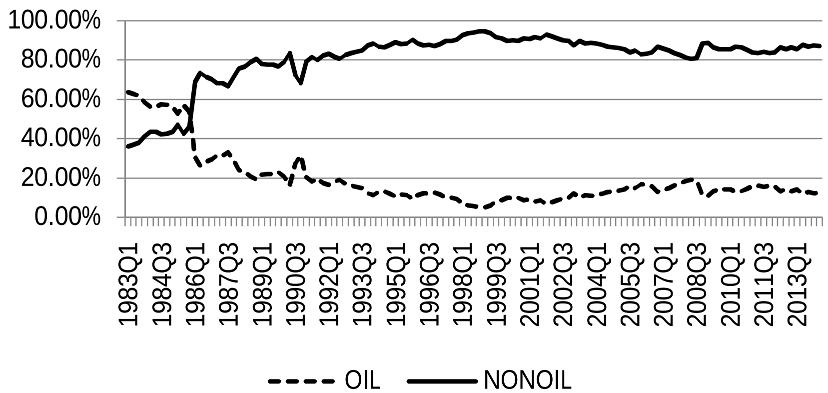
Figure 2: Exports, Imports and Fdi as Percentage of GDP



Source: Bank of Mexico (Banco de Información Económica).

Over those years, non-oil exports rose from 7.71% of GDP in 1983 to a peak of 27.31% of GDP in 2008, and since 1994 they have maintained an average of 88.12% of total exports (see Figure 3).

Figure 3: Oil and Non Oil Exports as a Percentage of Total Exports



Source: Bank of Mexico (Banco de Información Económica).

This study tests the long- and short-run relationships between GDP, exports, imports and FDI for Mexico from 1989 to 2013 using quarterly data, thus contributing to the debate on sources of economic growth in Mexico, as well as to the literature on the connection between economic growth and trade liberalization.

Our methodology is close to Nguyen (2011), who implements a set of econometric procedures, including the unit root test of four series, lag structure, the VAR diagnostic, the Johansen cointegration test, the Granger causality/Block exogeneity Wald test (GCBEW test), the analysis of impulse response and of variance decomposition, in order to study the impact of trade liberalization on economic growth for Malaysia and South Korea. This methodology is relevant for our study for two reasons. First, it has the advantage of avoiding misspecification and minimizing the resulting omitted-variables bias. Second, it allows us to test and estimate the causal relationship among variables (GDP, exports, imports and FDI) through a four-variable VAR model.

Our estimates suggest that the four variables are cointegrated. Exports, imports and FDI are a long-run source of economic growth. GDP influences FDI so there is two-way causality between RGDP and RFDI. FDI influences RIMP and RIMP influences RNOX so there is direct and indirect causality between all variables.

The remainder of the paper is organized into sections. The second section presents the theoretical justification for relating the four variables; the third section discusses some of the relevant literature; the fourth section briefly describes the data set; the fifth section describes the methodology as well as the estimate results; the sixth section presents the main findings; and the seventh and final section presents our conclusion.

II. Theoretical Background

Since the 1970s most of the developing world has seen a considerable shift towards export promotion strategies, supported by the idea that export expansion leads to better resource allocation, "creating economies of scale and production efficiency through technological development, capital formation, and employment generation" (Shirazi and Abdul Manap, 2005). After a period of inward-oriented policies, it was thought that promoting exports would enable developing countries to correct imbalances in the external sector and assist them in their full recovery.

Although there has been a wide discussion among researchers over the appropriateness of trade policy for promoting economic growth and development (Todaro and Smith 2003, p. 556), theoretical agreement on export-led growth (ELG) "emerged among neoclassical economists due to the success of the free-market, and outward-oriented policies of the East Asian Tigers" (World Bank 1993). Export-led growth hypothesis has not only been widely accepted by academicians (Feder 1982; Krueger 1990), and evolved into a "new conventional wisdom" (Tyler 1981; Balassa 1985), but it has also "shaped the development of a number of countries as well as the policies of the World Bank (World Bank 1987)" (Shirazi and Abdul Manap, 2005).

But in reality international trade theory says nothing about the effects of trade liberalization on the product or the productivity growth rate. Different models, equally reasonable, can produce starkly contrasting outcomes in this respect:"conventional benefits of liberalization are once-and-for-all gains, and although such gains can accumulate over time, they do not necessarily put the economy on a superior path of technological development."(Rodrik, 1992; p. 157)

The net benefits of increased trade on economic growth are not necessarily positive, as demonstrated by Grossman and Helpman (1992), and Young (1991), among others.[2]Brunner (2003; p.3) summarizes these results as follows:

"While there might be an overall efficiency gain that raises the level of incomes, increased trade openness can also change the relative prices of tradables and divert resources away from sectors where increasing returns exist. Whether increased competition pushes an economy's resources toward or away from activities that generate increased long-run growth depends on the country's comparative advantage at the time of liberalization. Put somewhat differently, if an economy is lagging in technological development, temporary import protection can allow it to catch up to more advanced economies rather than being forced to specialize in the production of traditional goods and experience a reduction in long-run growth."

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[2] The lack of fundamental theories linking trade with productivity has been replaced by a myriad of arguments about how free trade increases productivity, most of them without much rationale, notably "X-efficiency," economies of scale, and "macroeconomic discipline." For the limitations of each of these arguments see Rodrik (1988).

On the other hand, empirical work is inconclusive about the idea that greater openness in general leads to a higher rate of growth. Although numerically speaking most empirical works support the idea that trade promotes growth (Dollar, 1992; Sachs and Warner, 1995; Ben 1997; Berg and Krueger, 2003),these works are very controversial and subject to a variety of criticisms (Rodríguez and Rodrik, 2003). Many of these studies have found a positive relationship between trade and income, but the relationship is generally not robust. There are methodological and econometric problems that explain these limitations (Brunner, 2003; p. 3). Most of this literature consists of analyses of cross-section data for many countries (with very different realities), where income or income growth in several countries is correlated with some measure of "openness." The problem of these works is precisely that these openness measures are built, in most cases, using highly questionable quantitative and qualitative judgments (Rodríguez and Rodrick, 2003; p. 3).

In fact, the consensus is that there is no empirical evidence solid enough to establish that trade liberalization implies increases in productivity and per-capita income. As Rodrik (1992; p. 172) eloquently puts it: "[...]We do not have any good reason to expect that trade liberalization will generally be helpful to overall technological performance."And he adds:

"Until more evidence becomes available, then, a healthy skepticism is in order. In the meantime, if truth-in-advertising were to apply to policy advice, each prescription for trade liberalization would be accompanied with a disclaimer: "Warning! Trade liberalization cannot be shown to enhance technical efficiency; nor has it been empirically demonstrated to do so." Rodrick (1992; p. 172)

But let us assume that growth and exports are correlated. Then we can ask: Do exports determine growth? Does growth determine exports? Or is there feedback between both variables? Should a country promote exports to speed up economic growth or should it primarily focus on economic growth, which in turn would generate exports? There are basically four propositions. According to the so-called export-led growth hypothesis, export activity leads economic growth. Trade and macroeconomic theory provides several plausible explanations to support this idea; besides classical effects, there exists the possibility of exploiting economies of scale, the induction of technological change, increased labor productivity, capital efficiency, etc.

The second proposition, the growth-driven exports hypothesis, postulates a reverse relationship.[3] It is based on the idea that economic growth induces trade flows, as this can create comparative advantages in certain areas leading to specialization and facilitating exports. These two approaches certainly do not exclude each other; therefore the third notion is a feedback relationship between exports and economic growth. Finally, there is also potential for a simple contemporaneous relationship between these two variables.

There is another possible source of growth, especially for developing countries: multinational corporations. In fact, according to Nguyen (2011), multinational firms consider the option of exporting goods or establishing factories in foreign markets. The choice between exports and FDI depends on the level of convenience, risk, profit and long-run developing strategy of firms, competitors, etc. (Liu et al., 2001). In consequence, multinational corporations face the dilemma of whether to export to a market or to establish a subsidiary to avoid obstacles to trade.

"The profit is determined by the gap between goods-exporting fees (including money to pay for tariffs and transportation costs) and the cost of establishing a new factory in a particular foreign market. Exports are usually easier and less risky, but they face trade barriers such as tariffs and nontariff barriers (import quotas, import licensing, and others). Almost all Asian countries limit imports in order to protect both main and infant industries, while at the same time usually encouraging FDI. However, for multinational firms, the choice of FDI also depends on how much advantage can be derived from foreign countries through factors such as cheap labor costs, availability of natural resources and the priorities of foreign governments with regard to FDI. For example, some Asian countries implement exports-promoting policies, which offer many special benefits, such as tax holidays and free import duties for firms manufacturing export goods. So, to better receive those benefits, FDI flows into Asian countries in order to produce the export goods. Therefore, export promotion attracts FDI, and then FDI increases exports. So, we may have two-way causality between exports and FDI."(Nguyen 2011, p. 3)

But what can we say about FDI as a promoter of exports, efficiency, and the diffusion of technologies in developing countries?

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3 Scholars such as Bhagwati (1988) have argued that an increase in GDP generally leads to a corresponding expansion of trade.

This lacks both a theoretical and an empirical basis. In fact, since the reason that moves foreign firms towards FDI is precisely to prevent the spread of industrial know-how, so it would be naïve to expect that the host country would benefit from the mere presence of FDI. One reason for multinational companies' wide expansion is precisely related to the maximum use of their knowledge capital (once created, the marginal cost of using it in another plant is zero) preventing these intangibles from being appropriated by other companies. In theory, this could be achieved through licensing, but the possibility to foresee all the possibilities and avoid "holes" in contracts makes this alternative infeasible most of the time (Caves, Frankel and Jones, 2002; p. 157).

"The same characteristics that make the capital of knowledge easy to transfer to a new plant make their value to dissipate easily outside the company if this is not checked very carefully. The plans, formulas and reputation are only a few examples of capital of knowledge that can be lost in favor of competitors if they are not carefully monitored." (Caves, Frankel and Jones, 2002; p. 406)

There is scant empirical evidence for positive externalities in the host countries due to the presence of FDI. As Rodrik (1992) points out: "today's policy literature is filled with extravagant claims about the existence of positive spillovers from FDI, but the evidence is sobering." Smarzynska (2002) states: "indeed the difficulties associated with disentangling different effects at play and data limitations have prevented researchers from providing conclusive evidence of positive externalities arising from FDI." Furthermore, in regards to the Mexican situation, Romo Murillo (2005; p.25) remarks "it is interesting to note that these studies found evidence of association using data from the 1970s when the Mexican economy was still closed and highly regulated. More recent analyses based on data from 1985, as well as more complex econometric techniques, found evidence only for levies applying to market access, not productivity."

Moreover, Helpman and Krugman (1985) point out that the effect of trade on technical efficiency is inconclusive in models of imperfect competition and increasing returns to scale. In such cases the effects of trade depend on the type of competition assumed in the domestic market, entry, exit and on how market structures change in response to a trade disruption. As a result, trade's effect on technical efficiency remains an empirical issue.

Finally, we can examinethe relationship between imports and economic growth. The import-substitution policies in Latin America were accused of having a negative impact on economic growth. After these policies were abandoned, some economists emphasized the importance of imports on economic growth. Actually, the imports-compression growth hypothesis suggests that a shortage of imports will restrict economic growth.[4] The imports-compression growth hypothesis (Asafu-Adjaye and Chakraborty, 1999, p.164; Esfahani, 1991, p.95-99; Kim et al., 2009, p.1821) is based on the following arguments: "(1) Importing consumption goods forces the domestic import-substitution firms to innovate and restructure themselves, which improves their productivity, (2) Imports can increase productivity through improving input quality, varieties of inputs and the reallocation of capital and labor to importers, (3) Imports of capital and intermediate goods can increase economic growth through technological diffusion." (Nguyen, 2011)

In contrast, imports in developing countries could displace import-competing industries and destroy domestic productive chains, producing low levels of domestic value added. The opening up of the economy to imports may produce a reallocation of resources from productive employment to unemployment or underemployment.

On the other hand, the relationship between exports and imports can occur through two channels. Exports provide foreign exchange which might be used for importing consumption goods, as well as intermediate or capital goods. Moreover, importing high-technological equipment intermediate goods for production will accelerate production for exports (Nguyen, 2011). Conversely, imports of intermediate and capital goods might discourage the increase of national content of exports, which leads to a diminishing impact of exports on GDP.

Moreover, "an increase in FDI may require a high level of importing essential intermediate goods and capital goods for production.

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[4]The imports-compression hypothesis was originated in the early nineteen-eighties as a result of the debt crisis. Import compression refers to the effect of government policies that are specifically intended to reduce the volume of imports in order to obtain a rapid improvement in the merchandise trade balance in the face of binding external finance constraints. In other words, import compression occurs when the domestic authorities impose tariffs, quotas, or licensing schemes – or engage in severe domestic deflation – with the purpose of servicing external debt or rebuilding official exchange reserves,Khan and Knight (1986). Later on, this hypothesis was extended to link imports and growth.

But, a higher level of importing consumption goods may have a negative effect on the import-substitution industry with foreign capital, and thus FDI may decrease. Therefore, there may be causality between FDI and imports." (Nguyen, 2011).

A priori, we have no reasons to support or deny the existence of an array of interactions between GDP, exports, imports and Foreign Direct Investment (FDI).

III. Literature Review

There are numerous studies on the relation between economic growth, export and FDI. Jung, and Marshall (1985) perform causality tests between exports and growth for 37 developing countries; the results cast considerable doubt on the validity of the export promotion hypothesis. Henriques and Sadorsky (1996) investigate the export-led growth hypothesis for Canada by constructing a vector autoregression (VAR) in order to test for Granger causality between real Canadian exports, real Canadian GDP, and real Canadian terms of trade; they find that these variables are cointegrated and evidence of a one-way Granger causal relationship in Canada whereby changes in GDP precede changes in exports (i.e. growth-driven export hypothesis). Zestos (2002) studies the relations between the growth rates of exports, imports, and the GDP, for the 1948-1996 period for Canada and the United States, finding bidirectional causality for Canada from the foreign sector to GDP and vice versa, and a weaker relationship between the foreign sector and GDP for the United States. Kónya (2004) investigates the possibility of export-led growth and growth-driven export by testing for Granger causality between the logarithms of real exports and real GDP in twenty-five OECD countries with annual data for the 1960-1997 period, and finds mixed results.[5] Shirazi and Abdul Manap (2005) examine the export-led growth hypothesis for five South Asian countries through cointegration and multivariate Granger causality tests, also finding mixed results.[6]

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[5] "There is no causality between exports and growth (NC) in Luxembourg and in the Netherlands, exports cause growth (ECG) in Iceland, growth causes exports (GCE) in Canada, Japan and Korea, and there is two-way causality between exports and growth (TWC) in Sweden and in the UK. Although with less certainty, we also conclude that there is NC in Denmark, France, Greece, Hungary and Norway, ECG in Australia, Austria and Ireland, and GCE in Finland, Portugal and the USA. However, in the case of Belgium, Italy, Mexico, New Zealand, Spain and Switzerland the results are too controversial to make a simple choice.

[6] "Strong support for a long-run relationship among exports, imports, and real output for all the countries except Sri Lanka. Feedback effects between exports and GDP for Bangladesh and Nepal and unidirectional causality from exports to output in the case of Pakistan were found. No causality between these variables was found for Sri Lanka and India, although for India GDP and exports did

Our paper is methodologically close to Nguyen (2011), who analyzes the impact of trade liberalization on economic growth for Malaysia and South Korea; he uses a four-variable vector autoregression (VAR) to study the relationship between trade, FDI and economic growth over the time period from 1970 to 2004 (for Malaysia) and from 1976 to 2007 (for Korea). Using Granger causality/Block exogeneity tests, impulse response functions and variance decompositions, he finds different results for each country, arguing that these differences in the estimated results are explained by the dissimilarities in the economic policies between the two countries.[7]

For Mexico, Thornton (1996) studies the relationship between real exports and real GDP with annual data over the 1985-1992 period and finds that these two variables were cointegrated and have a significant and positive Granger-causal relationship running from exports to economic growth. Van den Berg (1997), using data from 1960 to 1991, finds that the available empirical evidence on the relationship between international trade and economic growth in Mexico is inconclusive. However, he mentions that the sample period includes three decades of import substitution policies; therefore the econometric results are likely to understate the actual strength of the trade-growth relationship under Mexico's current open trade regime. On the other hand, Pacheco-López (2005a) attempts to disentangle the effects of trade liberalization in Mexico during the mid-1980s from the liberalization involved in the North American Free Trade Agreement (NAFTA) on exports, imports, and the balance of trade; she argues that, since the mid-1980s, the propensity to import has exceeded the propensity to export, and this has worsened the growth rate consistent with balanced trade, which is a major explanation of the slowdown of Mexico's growth in recent years.

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induce imports. A feedback effect between imports and GDP was also documented for Pakistan, Bangladesh, and Nepal, as well as unidirectional causality from imports to output growth for Sri Lanka."

[7] "Although both countries implemented policies of export-orientated industrialization, the Malaysian government promoted FDI as a tool of industrialization, while the Korea government built an "integrated national economy" using "chaebol" industrial structures and minimizing the role of FDI."

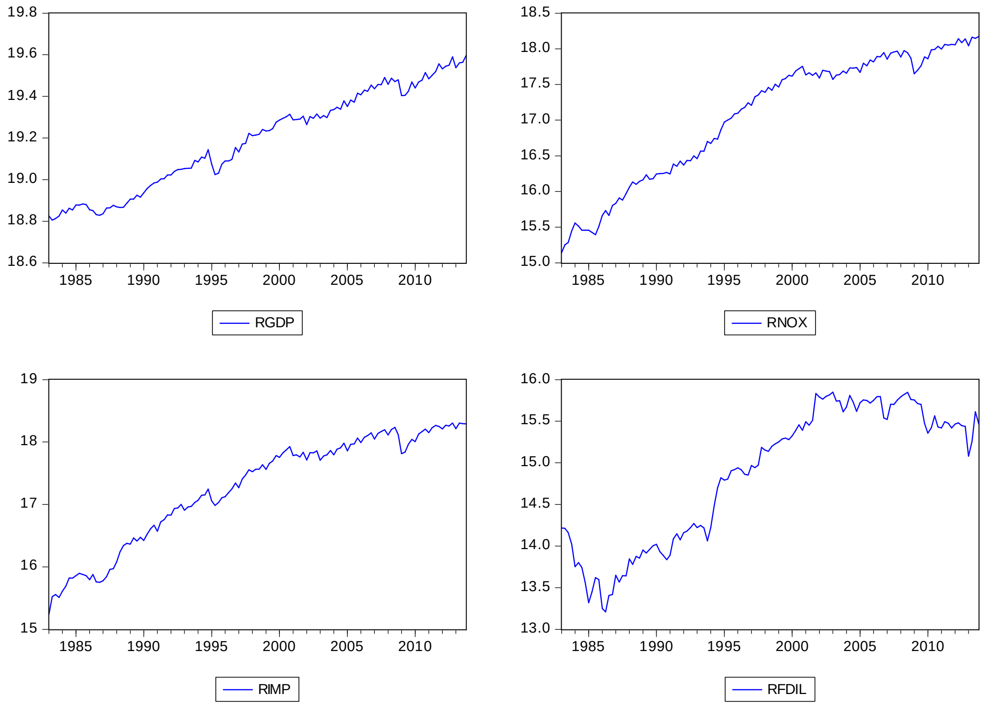
In another paper, Pacheco-López (2005b) uses annual data from 1970 to 2000 to study the liberalization of foreign direct investment (FDI) in Mexico since the late-1980s, and its relationships with exports and imports; she finds bidirectional Granger causality – between exports, imports and FDI; however the sample period that she uses includes two decades of import substitution policies; therefore the econometric results are likely to understate or overestimate the actual relationship.

IV. The Data Set

Although we have quarterly data information since 1980 we did not use all the information available from 1980 to 2013. Structural changes in Mexico were initiated on December 1, 1982, but these changes did not occur all at once but progressively during the years of Miguel de la Madrid's administration, and these changes were affected by the debt crisis, which was accompanied by frequent devaluations and high rates of inflation. Macroeconomic stability was not attained until the Salinas de Gortari administration (December 1, 1988 to November 30, 1994). Therefore we decided to analyze the 1989-2013 period, when macroeconomic stabilitywas achieved and most structural changes have taken place.

Our four time series are *RGDP*, *RNOX*, *RIMP* and *RFDIL*.*RGDP* is the logarithm of real GDP; *RNOX* is the logarithm of real non-oil exports; *RIMP* is the logarithm of real imports and *RFDIL* is the logarithm of real foreign direct investment liabilities. The data is sourced from INEGI (BIE), Banco de México and Federal Reserve Bank of St. Louis, Federal Reserve Economic Data (FRED). All variables are expressed in millions of 2010 US dollars before taking logs. Figures 4 describes the four series, *RGDP, RNOX, RIMP* and *RFDIL* for Mexico.

Figure 4: RGDP, RNOX, RIMP and RFDIL for Mexico, 1983-2013



V. Methodology and Results

Following Nguyen (2011), our strategy includes the following steps:

- Test unit root of four time series;
- Construct four-variable VAR model;
- VAR diagnostics;
- Johansencointegration test;
- Causality test;
- Dynamic simulation (impulse response function and variance decomposition).

A. VAR tests, Diagnostics and Causality Tests

We begin by implementing a unit root test for our four series (RGDP, RNOX, RIMP,RFDIL) by using the Philips-Perron test (Phillips, P.C.B and P. Perron, 1988). If the series are I(1), they will be used to construct a four-variable VAR. Table 1 and Table 2 provide the evidence that the four time series (*RGDP*, *RNOX*, *RIMP* and *RFDIL*) are non-stationary of order one.

Table 1: Philips-Perron Test (Levels)

Variables	*Intercept*	*Trend and Intercept*	*None*
RGDP	0.0439	-4.3160	4.3733
RNOX	-2.8339	-1.5211	4.4252
RIMP	-3.0359	-2.2166	3.6670
RFDIL	-3.3670	-7.6256	0.6506

Note: the critical values for the PP test with intercept, with trend and intercept, and none at the 1%, 5% and10%significance levels are respectively: -3.4842 , -2.8851, -2.5794; -4.0344, -3.4468, -3.1484; -2.5839, -1.9434, -1.6150.

Table 2: Philips-Perron Test (First Differences)

Variables	*Intercept*	*Trend and Intercept*	*None*
RGDP	-15.8325	-15.7708	-13.8050
RNOX	-14.1931	-14.8722	-12.6893
RIMP	-13.5751	-13.9456	-12.1427
RFDIL	-9.8119	-9.9785	-9.8565

Note: the critical values for the PP test with intercept, with trend and intercept, and none at the 1%, 5% and 10% significance levels are respectively: -3.4847, -2.8852, -2.5795; -4.0350, -3.4471, -3.1486;
-2.5841, -1.9435, -1.6150.

The result from unit root test in levels reported in Table 1 shows that for most tests we cannot reject the null hypothesis (non-stationary) at a 0.01 significant level. Thus, they have a unit root and we continue to test the unit root of their first difference. Since their absolute values are higher than the absolute value of 5 percent critical values, we can reject the null hypothesis of non-stationary at a 0.05 level. Thus, we can conclude that the four series are non-stationary with the root of order 1. Therefore we construct a four-variable VAR.

Now consider a four-variable standard VAR model of order p as (unstructured form) (Shin and Pesaran, 1998):

$$y_t = \sum_{i=1}^{p} A_i y_{t-i} + Bx_i + e_t \qquad (1)$$

Where y_t is n x1 random vector. In our model, four-variable VAR, n = 4 and y_t = (*RGDP*, *RNOX*, *RIMP* and *RFDIL*);the A_i is n x n fixed coefficient matrices; *p* is order of lags; B is a n x d coefficient matrix of exogenous variables; x_i is d x 1 vector of exogenous variables.

According to Shin and Pesaran (1998), the model satisfies the following conditions:

Assumption 1: $E(e_t) = 0$; $E(e_t\, e_t') = \Sigma e$ (nonsingular) ; $E(e_t\, e_s') = 0$ if s = t.
Assumption 2: No roots are inside the unit circle.
Assumption 3: There is not full colinearity among y_{t-1}, y_{t-2}… y_{t-p}, x_t,.

To check whether the assumptions of our VAR model are met, the following tests should be implemented (Nguyen, 2011):

- Lag order selection;
- VAR residual serial correlation LM test;
- VAR residual normality.

We constructed the VAR system with four endogenous variables (*RGDP, RNOX*, *RIMP* and *RFDIL*) and 12 dummy variables to obtain normality in the residuals.[8] The result from the test for lag length criteria, based on the four-variable VAR system with the maximum lag number of 10, is reported in Table 3. The lag order chosen by FPE and AIC criterion is 10. In addition to this information we implemented the VAR residual correlation LM test and the residual normality test (Lutkepohl, 2005). An appropriate lag order needs to satisfy those tests.

[8] D1: 1990Q2=1, D2: 1993Q3=1, D3: 1993Q4=1, D4: 1994Q3=1,D5: 1995Q1=1, D6: 1998Q4=1, D7:2001:Q1, D8: 2001Q3=1, D9: 2002Q2=1, D10: 2008Q4=1, D11: 2009Q1=1 and D12: 2012Q4=1.

Table 3: Test for Lag Length Criteria

VAR Lag Order Selection Criteria
Endogenous variables: RGDP RNOX RIMP RFDIL
Exogenous variables: C D1 D2 D3 D4 D5 D6 D7 D8 D9 D10 D11 D12
Date: 12/02/14 Time: 21:43
Sample: 1989Q1 2013Q4
Includedobservations: 100

Lag	LogL	LR	FPE	AIC	SC	HQ
0	237.4539	NA	2.90e-07	-3.709078	-2.354389	-3.160811
1	729.2138	816.3215	2.15e-11	-13.22428	-11.45276	-12.50731
2	782.5133	84.21315	1.03e-11	-13.97027	-11.78192*	-13.08460
3	813.3469	46.25045	7.81e-12	-14.26694	-11.66177	-13.21258
4	853.4458	56.94034	4.95e-12	-14.74892	-11.72692	-13.52586*
5	877.0696	31.65600	4.40e-12	-14.90139	-11.46257	-13.50964
6	890.0877	16.40271	4.88e-12	-14.84175	-10.98610	-13.28130
7	905.5846	18.28639	5.22e-12	-14.83169	-10.55921	-13.10254
8	921.4461	17.44764	5.63e-12	-14.82892	-10.13962	-12.93108
9	951.3665	30.51881*	4.67e-12	-15.10733	-10.00120	-13.04079
10	979.1072	26.07624	4.13e-12*	-15.34214*	-9.819183	-13.10690

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaikeinformationcriterion
SC: Schwarzinformationcriterion
HQ: Hannan-Quinninformationcriterion

We ran VAR with the lag order of 10. The main results of the VAR model are reported in Table 4.

Table 4: Var Model with 12 Lags and 12 Exogenous Variables

Vector Autoregression Estimates
Date: 12/02/14 Time: 21:45
Sample: 1989Q1 2013Q4
Included observations: 100
Standard errors in ( ) & t-statistics in [ ]

	RGDP	RNOX	RIMP	RFDIL
R-squared	0.998440	0.998457	0.997923	0.989078
Adj. R-squared	0.996715	0.996749	0.995625	0.976995
Sum sq. resids	0.005795	0.058035	0.064550	0.434996
S.E. equation	0.011104	0.035139	0.037060	0.096204
F-statistic	578.6666	584.7496	434.2479	81.85364
Log likelihood	345.9003	230.7004	225.3801	129.9856
Akaike AIC	-5.858007	-3.554009	-3.447601	-1.539712
Schwarz SC	-4.477266	-2.173269	-2.066861	-0.158972
Mean dependent	19.26878	17.39714	17.59855	15.14384
S.D. dependent	0.193743	0.616310	0.560280	0.634280
Determinant resid covariance (dof adj.)		7.54E-13		
Determinantresid covariance		3.68E-14		
Log likelihood		979.1072		
Akaikeinformationcriterion		-15.34214		
Schwarzcriterion		-9.819183		

The results from the VAR residual normality test and the VAR residual serial correlation LM test are reported in Table 5 and Table 6, respectively.

Table 5: Var Residual Normality Test

VAR Residual NormalityTests
Orthogonalization: Cholesky (Lutkepohl)
Null Hypothesis: residuals are multivariate normal
Date: 12/02/14 Time: 21:48
Sample: 1989Q1 2013Q4
Includedobservations: 100

Component	Skewness	Chi-sq	df	Prob.
1	-0.344971	1.983414	1	0.1590
2	-0.317570	1.680847	1	0.1948
3	-0.056691	0.053565	1	0.8170
4	-0.190258	0.603305	1	0.4373
Joint		4.321131	4	0.3643
Component	Kurtosis	Chi-sq	df	Prob.
1	3.762915	2.425166	1	0.1194
2	3.503285	1.055400	1	0.3043
3	3.278383	0.322904	1	0.5699
4	3.624751	1.626309	1	0.2022
Joint		5.429778	4	0.2460

Component	Jarque-Bera	df	Prob.
1	4.408580	2	0.1103
2	2.736247	2	0.2546
3	0.376469	2	0.8284
4	2.229613	2	0.3280
Joint	9.750909	8	0.2829

With the data from Table 5, we cannot reject the hypothesis of normality properties, since all individual Chi-sq values for Skewness and Kurtosis are lower than the critical value of $\chi^2_{.05,1}$ = 3.84. The joint values for Skewness and Kurtosis 4.32 and 5.43 are also lowerthan the critical value of$\chi^2_{.05,4}$= 9.49. The Jarque-Bera joint value of 4.33 is lowerthan the critical value $\chi^2_{.05,8}$ =15.50. This provides some support for the hypothesis that residuals from our VAR model have a normal distribution.

Table 6 shows that we also cannot reject the null hypothesis of no autocorrelation up to lag 10, since the LM-Stat for the lag order of 1, 2, 3, 4, …12,almost all the values are lower than the critical value $\chi^2_{.95,16}$ = 26.296 at 5% and 16 degrees of freedom.

Table 6: Var Residual Serial Correlation Lm Test

VAR Residual Serial Correlation LM Tests
Null Hypothesis: no serial correlation at lag order h
Date: 12/02/14 Time: 21:49
Sample: 1989Q1 2013Q4
Includedobservations: 100

Lags	LM-Stat	Prob
1	16.19725	0.4393
2	26.71753	0.0447
3	20.92824	0.1813
4	20.52706	0.1974
5	23.14369	0.1099
6	12.83846	0.6845
7	14.12236	0.5896
8	20.26601	0.2085
9	18.73970	0.2824
10	9.964033	0.8685

Probs from chi-square with 16 df.

To test the long-run cointegration relationship between the four time series, we carriedout the Johansen cointegration test (1993). The test results, reported in Table 7, indicate that the four series are cointegrated and there are two cointegrating vectors.

Table 7: Johansen Cointegration Test with Optimal Lag Length of 12

Date: 12/02/14 Time: 21:50
Sample: 1989Q1 2013Q4
Includedobservations: 100
Trend assumption: No deterministic trend (restricted constant)
Series: RGDP RNOX RIMP RFDIL
Exogenous series: D1 D2 D3 D4 D5 D6 D7 D8 D9 D10 D11 D12
Warning: Critical values assume no exogenous series
Lags interval (in first differences): 1 to 10

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 CriticalValue	Prob.**
None *	0.442093	104.8732	54.07904	0.0000
At most 1 *	0.256140	46.51695	35.19275	0.0020
At most 2	0.139982	16.92669	20.26184	0.1353
At most 3	0.018295	1.846473	9.164546	0.8080

Trace test indicates 2 cointegratingeqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 CriticalValue	Prob.**
None *	0.442093	58.35621	28.58808	0.0000
At most 1 *	0.256140	29.59026	22.29962	0.0040
At most 2	0.139982	15.08022	15.89210	0.0667
At most 3	0.018295	1.846473	9.164546	0.8080

Max-eigenvalue test indicates 2 cointegratingeqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Since we can affirm the existence of cointegration within the four series, we continued to the next step, testing the causality relationships between them. In order to find the causality between those four time series, we should apply the Granger causality/Block exogeneity Wald test (GCBEW, Enders, 2003). This test detects whether the lags of one variable can Granger-cause any other variables in the VAR system. It tests bilaterally whether the lags of the excluded variable affect the endogenous variable.

The null hypothesis: all the lagged coefficients of one variable can be excluded from each equation in the VAR system. In Table 8, "All" means: joint test that the lags of all other variables affect the endogenous variable.

The GCBEW process does not cause *y* if all coefficients in each equation in the VAR system (1) are not significantly different from zero (or a joint test of at all lags is rejected).This concept involves the effect of past values of the right side variables on the current value of *y*. So it answers the question whether past and current values of right side variables help predict the future value of *y*. For example, this test helps to answer whether or not all lags of FDI can be excluded from the equation of GDP. Rejection of the null hypothesis means that if all lags of FDI cannot be excluded from the GDP equation, then GDP is an endogenous variable and there is causality of FDI on GDP.

Table 8 reports the results from the GCBEW test. Table 8 includes four parts; the first part reports the result of testing whether we can exclude each variable out of the equation of *RGDP*. Similarly, the next parts report the results of testing for the equation of *RNOX*, *RIMP* and *RFDIL* respectively. Each part of Table 8 includes four columns. The first column lists the variables which will be excluded from the equation. The next columns are the value of Chi-sq, degrees of freedom and P-value. The last row in each part of Table 8 reports the joint statistics of the three variables excluded from the equation.

Table 8: Granger Causality/Block Exogeneity Wald Test

VAR Granger Causality/Block Exogeneity Wald Tests
Date: 12/02/14 Time: 22:05
Sample: 1989Q1 2013Q4
Includedobservations: 100

Dependent variable: RGDP			
Excluded	Chi-sq	df	Prob.
RNOX	20.71130	10	0.0232
RIMP	40.90470	10	0.0000
RFDIL	25.82568	10	0.0040
All	85.15544	30	0.0000
Dependent variable: RNOX			
Excluded	Chi-sq	df	Prob.
RGDP	3.063609	10	0.9799
RIMP	18.69568	10	0.0443
RFDIL	13.99665	10	0.1731
All	45.91771	30	0.0316
Dependent variable: RIMP			
Excluded	Chi-sq	df	Prob.
RGDP	14.08920	10	0.1690
RNOX	11.72987	10	0.3035
RFDIL	21.82096	10	0.0160
All	57.96368	30	0.0016
Dependent variable: RFDIL			
Excluded	Chi-sq	df	Prob.
RGDP	22.12863	10	0.0145
RNOX	4.926266	10	0.8960
RIMP	15.95767	10	0.1009
All	32.83478	30	0.3298

In the first part of Table 8, which corresponds to the RGDP equation, the second column shows that the Chi-sq for RNOX, RIMP and RDFIL are respectively 20.71, 40.90 and 25.83, all greater than$\chi^2_{.05,10}$ = 18.307. Therefore we can reject the null hypothesis in all cases, and conclude that RGDP is endogenous and there is causality of RNOX, RIMP and RFDIL on RGDP.

This is confirmed by the fact that the joint Chi-sq is 85.16 >$\chi^2_{.05,30}$ =43.773. This result supports the export-led growth hypothesis, the imports-compression hypothesis and the argument that RFDIL has a positive effect on economic growth.

In the second part of Table 8, which corresponds to the RNOX equation, the second column shows that the respective Chi-sq for RGDP, RIMP and RDFIL are 3.06, 18.70 and 14.00. The corresponding values for RGDP and RFDI are less than$\chi^2_{.05,10}$ = 18.307, and we cannot reject the null hypothesis in both cases, concluding that there is no causality of RGDP and RFDIL on RNOX. These results do not support the hypothesis that economic growth and *RFDIL* promotes exports. However the corresponding value for RIMP is greater than the critical value which indicates that RIMP causes RNOX. This is confirmed by the fact that the joint Chi-sq is 45.91 >$\chi^2_{.05\ 30}$ = 43.773.

In the third part of Table 8, which corresponds to the RIMP equation, the second column shows that the respective Chi-sq for RGDP, RNOX and RFDIL are 14.09, 11.73 and 21.82.

The corresponding values of RGDP and RNOX are less than the critical value $\chi^2_{.05,10}$ = 18.307and we cannot reject the null hypothesis in those two cases, so we conclude that RIMP is not caused by RGDP and RNOX. However the corresponding value for RFDIL is greater than the critical value $\chi^2_{.05,10}$ = 18.307, and therefore we conclude that RFDIL causes RIMP. This is confirmed by the fact that the joint Chi-sq is 57.96 >$\chi^2_{.05\ 30}$ = 43.773.

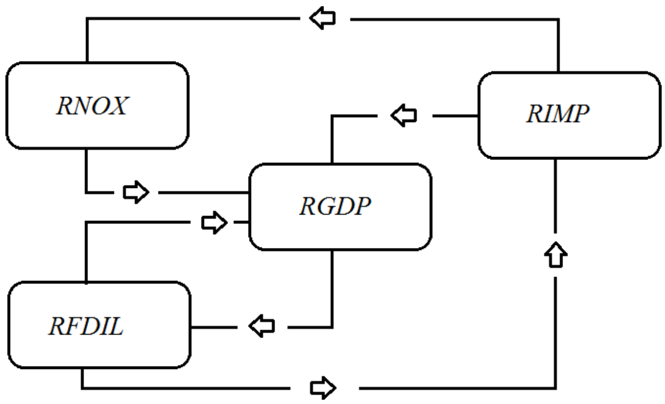
In the fourth part of Table 8, which corresponds to the RFDIL equation, the second column shows that the respective Chi-sqfor RGDP, RNOX, RIMP are 22.13, 4.93 and 15.96. The corresponding value for RGDP is greater than the critical value of$\chi^2_{.05,10}$ = 18.307 and therefore we reject the null hypothesis that RGDP doesn't cause RFDIL, therefore we could conclude that RGDP causes RFDIL, however this result is not confirmed by the joint Chi-sq is 32.83 <$\chi^2_{.05\ 30}$ = 43.773. This weakness is confirmed by the fact that the corresponding values of RNOX and RIMP are less than the critical value $\chi^2_{.05,10}$ = 18.307.

In summary:

1. Wereject the null hypothesis of excluding, RNOX, RIMP and RFDIL from RGDP equation at a 0.50. It suggests that RNOX, RIMP and RFDIL do cause RGDP.
2. We fail to reject the null hypothesis of excluding *RGDP,* and *RFDIL* from *RNOX* equation at a 0.50. It suggests that *RGDP* and *RFDIL* do not cause *RNOX*. However we reject the null hypothesis of excluding RIMP from RNOX equation at a 0.50, suggesting that RIMP does cause RNOX.
3. We fail to reject the null hypothesis of excluding *RGDP, RNOX* from *RIMP* equation at a 0.50 significance level. It suggests that *RGDP and RNOX* does not cause *RIMP*. However we reject the null hypothesis of excluding RFDIL from RIMP equation at a 0.50, suggesting that RFDIL does cause RIMP.
4. We reject the null hypothesis of excluding *RGDP* from *RFDIL* equation at a 0.50 significance level, suggesting that RGDP does cause RFDIL. However we fail to reject the null hypothesis of excluding *RNOX* and RIMP from RFDIL equation at a 0.50 significance level, suggesting that RNOX an RIMP does not cause RFDIL.

This test provides some evidence to believe that there is one bidirectional causality, that between RGDP and RFDIL; and four unidirectional causalities those between RNOX and RIMP on RGDP, that between RIMP on RNOX and that between RDFIL on RIMP. These four unidirectional causalities seem circular in the sense that RNOX causes RGDP, RIMP causes RNOX and RDFIL causes RIMP, therefore there must be an indirect connection between RGDP and RNOX and between RGDP and RIMP (see Diagram 1).

Diagram 1: **Direction of Causalities According to the GCBEW Test**



However, the GCBEW test does not provide information about the direction of the impact, nor the relative importance between variables that simultaneously influence each other.

Based on this test, we do not know whether or not exports and imports have a positive effect on *RGDP*. It is also unclear whether or not the impact of *RNOX* on *RGDP* is stronger than that of *RIMP*. To answer these questions, we analyze the impulse-response function and the variance decomposition (Shin and Pesaran, 1998).

B. Impulse-Response Analysis

Impulse responses trace the response of current and future values of each of the variables to a one-unit increase (or to a one-standard deviation increase, when the scale matters) in the current value of one of the VAR errors, assuming that this error returns to zero in subsequent periods and that all other errors are equal to zero. The implied thought experiment of changing one error while retaining the others constant makes most sense when the errors are uncorrelated across equations, so impulse responses are typically calculated for recursive and structural VARs.

Figure 5 exhibit the generalized asymptotic impulse response function. It includes 16 small figures which are denoted Figure 5.1, Figure 5.2… and so forth. Each small figure illustrates the dynamic response of each target variable (*RGDP*, *RNOX*, *RIMP* and *RFDIL*) to a one-standard-deviation shock on itself and other variables. In each small figure, the horizontal axis presents ten quarters following the shock. The vertical axis measures the quarterly impact of the shock on each endogenous variable.

Figure 5.1 presents the long-run positive effect of a shock to *RGDP* on *RGDP*. This shock has a short- and long-run positive effect on *RGDP*. Figure 5.2 show that a shock to *RNOX* has nosignificant effect on RGDP. Figure 5.3 shows that a shock on RIMP has a small but significant effect on RGDP. Figure 5.4 shows that a shock to *RFDIL* has a small significant negative effect on *RGDP*. All these effects do not conflict with the GCBEW test.

Figure 5.1

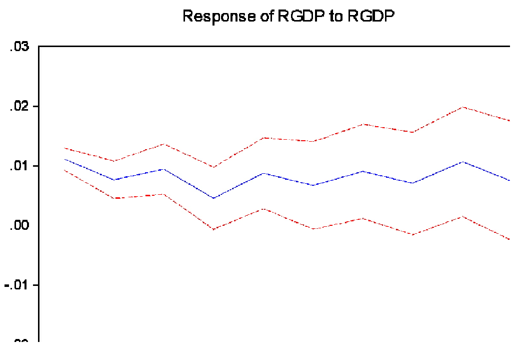


Figure 5.2

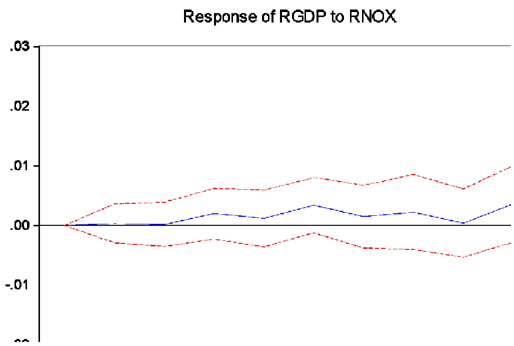


Figure 5.3

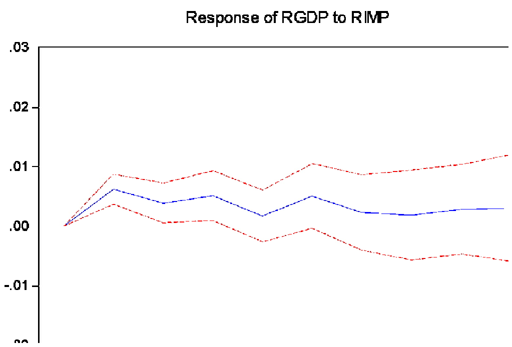
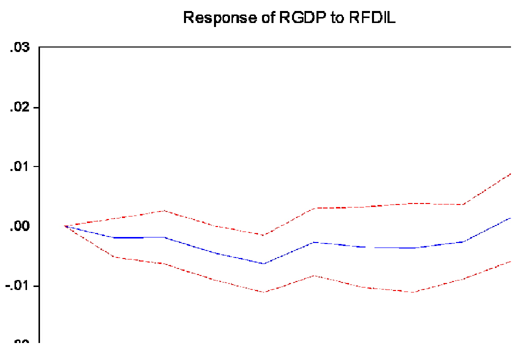


Figure 5.4



Figures 5.5 suggest that in the long run, a shock on *RGDP* has small effect on RNOX. Figure 5.6 suggest that RNOX has a positive effect on RNOX, as expected. Figure 5.7 shows no significant effect of RIMP on RNOX and Figure 5.8 shows no significant effect of RFDIL on RNOX. These results also do not conflict with the GCBEW test.

Figure 5.5

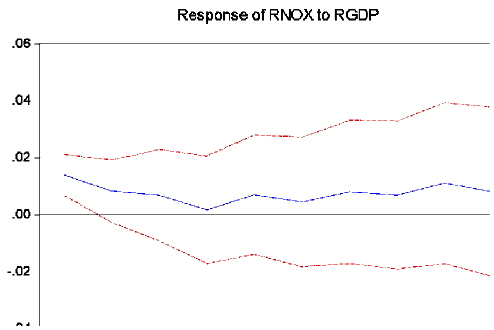


Figure 5.6

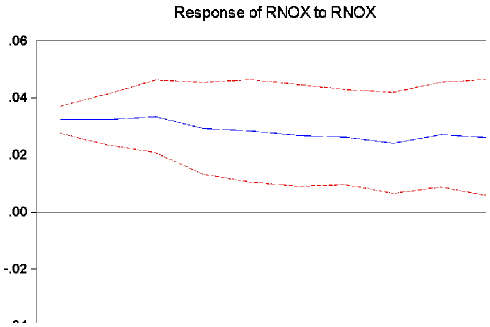


Figure 5.7

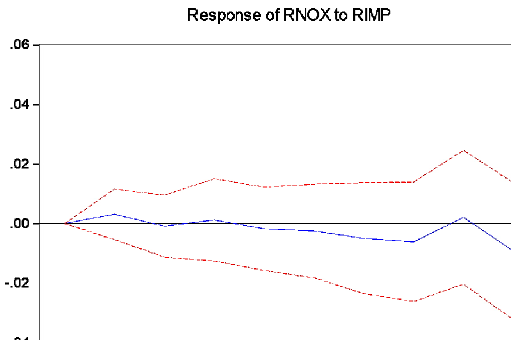
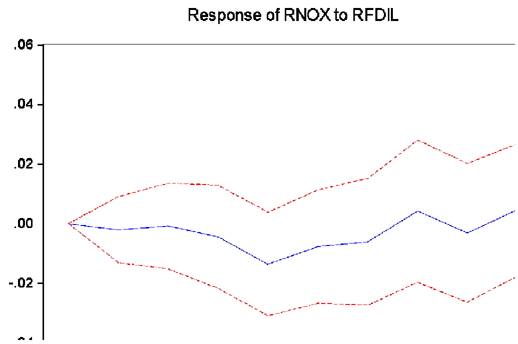


Figure 5.8



Figures 5.9 and 5.10 show the responses of *RIMP* to shocks in *RGDP* and RNOX respectively, the shocks have a positive permanent significant effect on RIMP. These results conflict with the GCBEW test. Figure 5.12 shows a negative effect of a shock in RDFIL on RIMP.

Figure 5.9

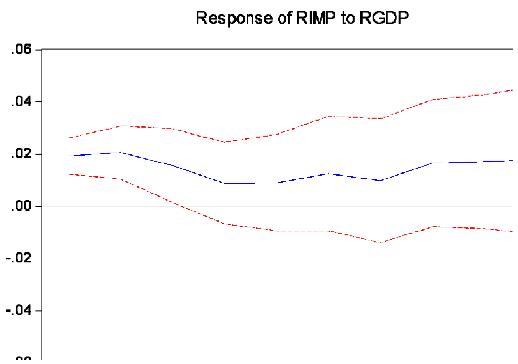


Figure 5.10

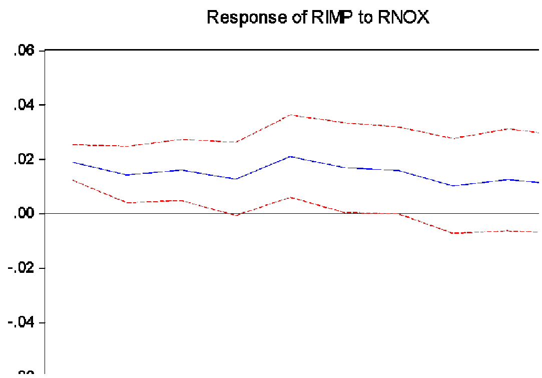


Figure 5.11

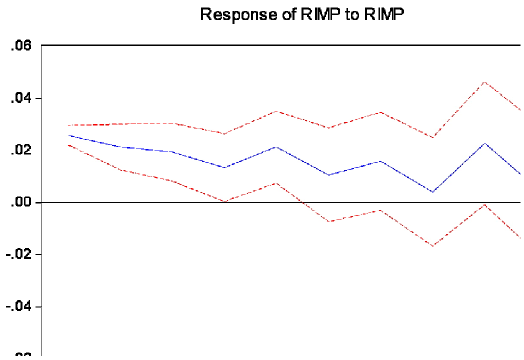
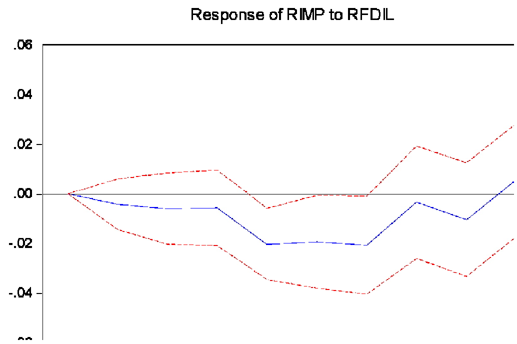


Figure 5.12



Finally looking at Figures 5.13 a shock on *RGDP* to *RFDIL* has a small statistically negative effect on RDFIL. The effect of shocks on RENOX and RIMP on RFDIL are not statistically significant at shown in Figures 5.4 and 5.15.

Figure 5.13

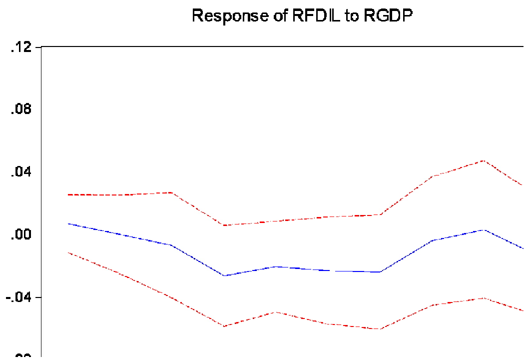


Figure 5.14

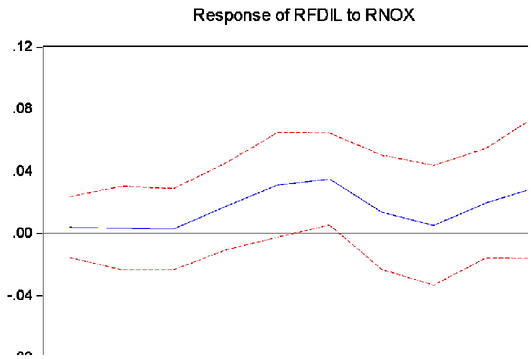


Figure 5.15

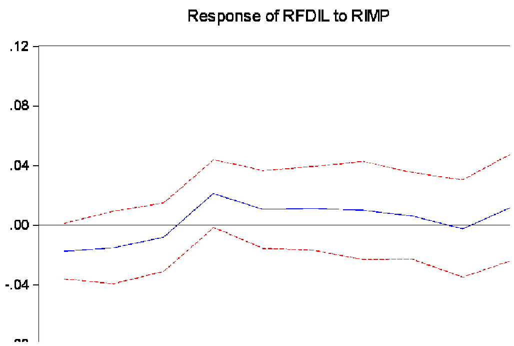
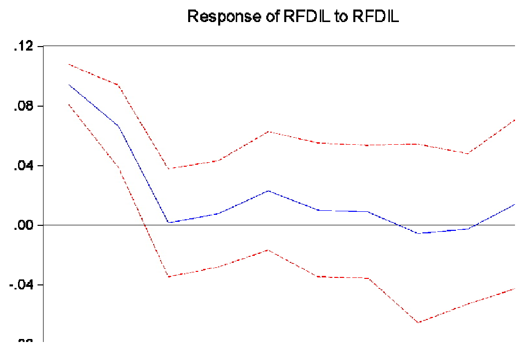


Figure 5.16



C. Variance Decomposition

Variance decomposition (or forecast error variance decomposition) indicates the amount of information each variable contributes to the other variables in a VAR model. It tells us how much of a change in a variable is due to its own shock and how much due to shocks to other variables. In the short run most of the variation is due to a shock of its own, but as the lagged variables' effect starts kicking in, the percentage of the effect of other shocks increases over time. According to Enders (2003), variance decomposition tells us how much a given variable changes under the impact of a shock of its own and the shock of other variables. Therefore, the variance decomposition defines the relative importance of each random innovation in affecting the variables in the VAR. Figure 6 includes 16 small figures which are denoted Figure 6.1, Figure 6.2 ... Figure 6.16. In each small figure, the horizontal axis presents ten quarters following the shock; the vertical axis measures the variance proportion of the shock to each variable.

Looking at Figures 6.1 to 6.4, the fluctuations of *RGDP* in the short run are explained mainly by *RGDP* shocks, whereas *RNOX* have no significant effect on *RGDP*. *RIMP* and *RFDIL* shock accounts for 00.00% in the first quarter and its proportion increases over time. Therefore variations in RIMP and RFDIL shocks help to explain future variations in *RGDP*.

Figure 6.1

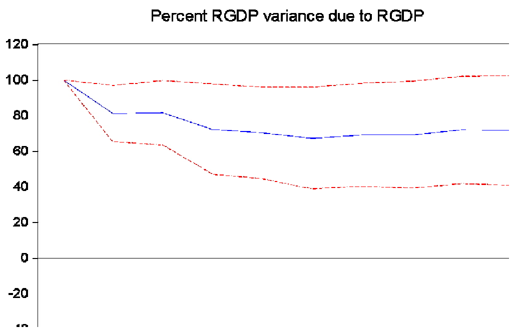


Figure 6.2

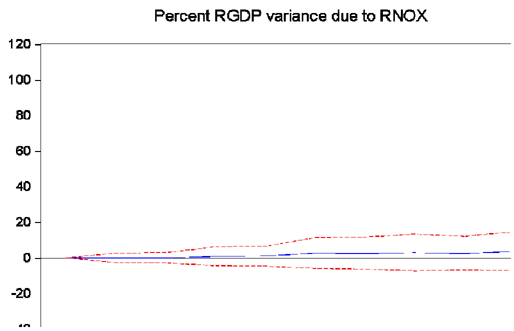


Figure 6.3

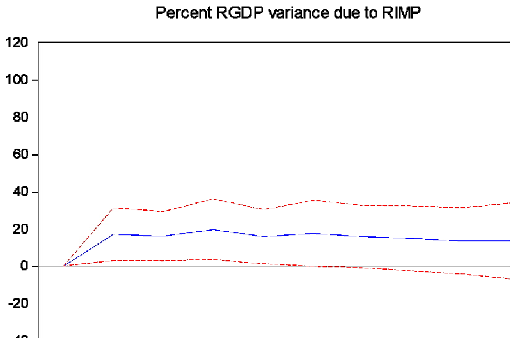
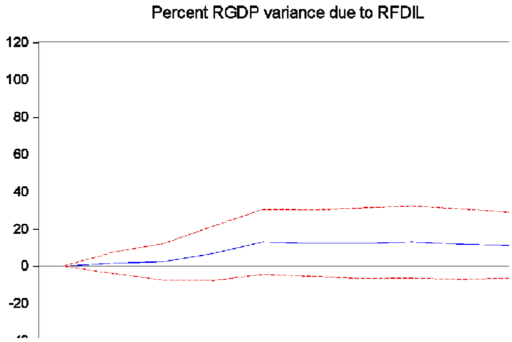


Figure 6.4



Looking at Figures 6.5 to 6.8, fluctuations of *RNOX* in the short run are explained mainly by its own shocks, and those on RGDP, whereas *RIMP and RFDIL* have no significant effect.

Figure 6.5

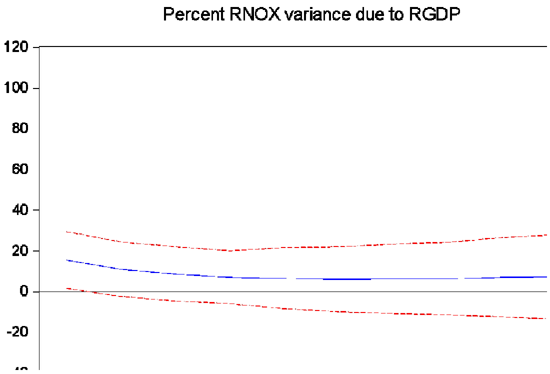


Figure 6.6

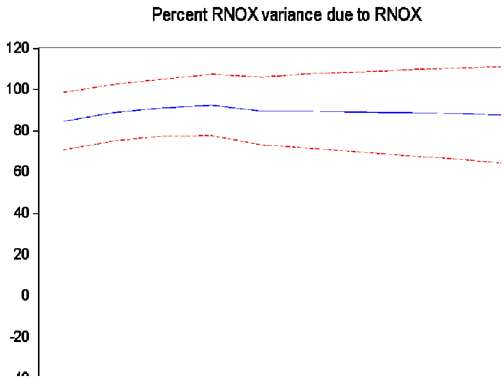


Figure 6.7

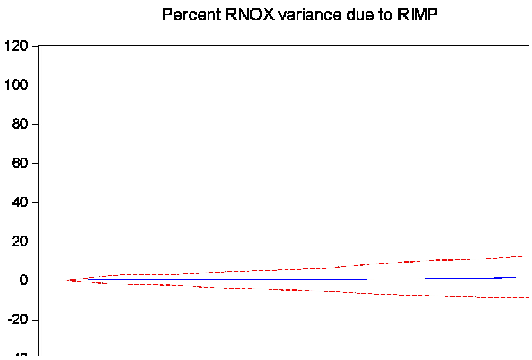
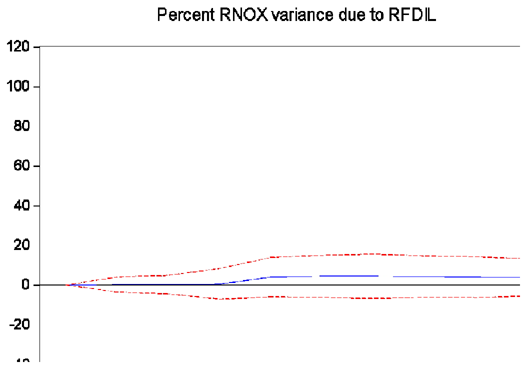


Figure 6.8



Figures 6.9 to 6.12 show that the fluctuations of *RIMP* in the short and long run are explained by its own shock and shocks on RGDP and *RNOX*. RIMP is not affected by RFDIL in the short run but by the fifth quarter it begins to have a significant effect.

Figure 6.9

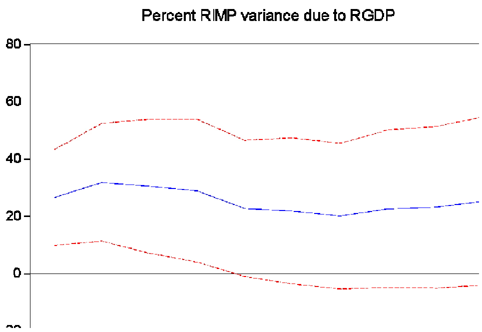


Figure 6.10

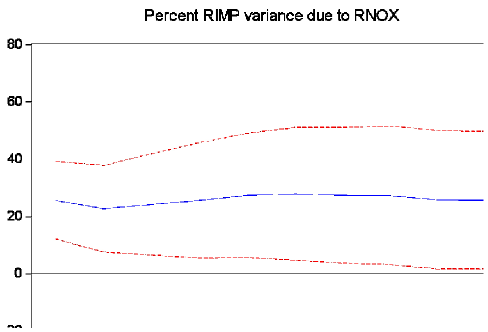


Figure 6.11

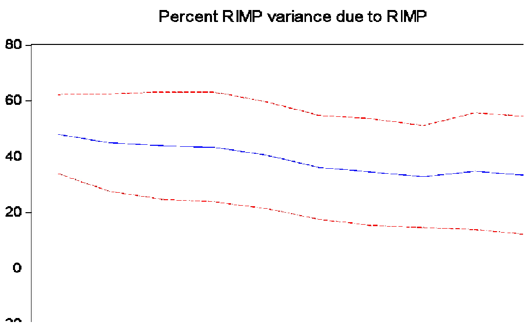
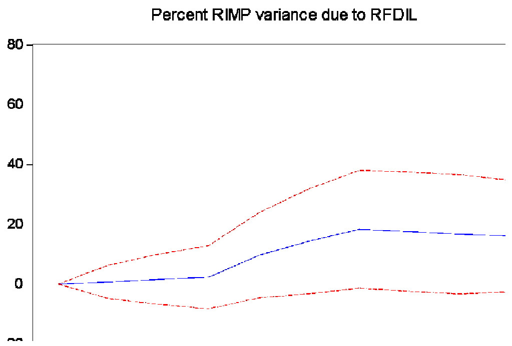


Figure 6.12



Figures 6.13 to 6.16 show the same analysis for the case of a shock in *RFDIL*. The fluctuations of *RFDIL* are explained mainly by its own shocks; changes in *RGDP*, *RNOX*, and *RIMP* are negligible in the short run but begin to have small but significant effect by the fourth quarter in the case of shocks in *RGDP* and *RIMP*, and in the fifth quarter in the case of shocks on RNOX.

Figure 6.13

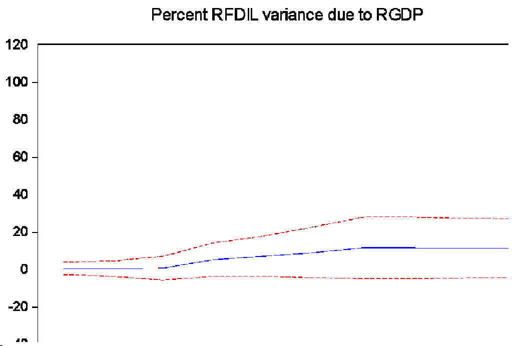


Figure 6.14

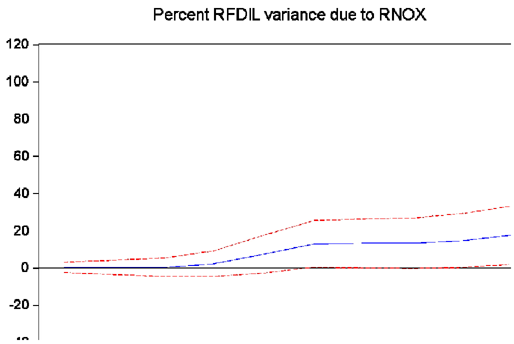


Figure 6.15

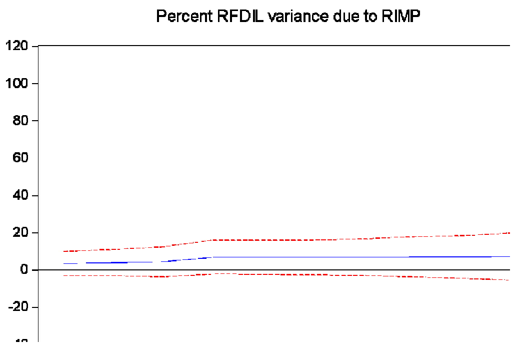
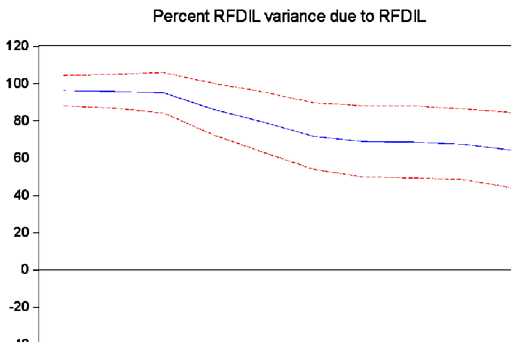


Figure 6.16



VI. Main Findings

The impact of RNOX on RGDP from the Impulse Response Function and Variance Decomposition is positive, but small and not significant. This could be explained by the large foreign content of Mexican non-oil exports. In Table 9 we show the composition of exports and imports from the maquiladora industry as a percentage of GDP.

Maquila exports represented in 2005 (the last year that imports solely used by maquiladora export industry were registered)12.7 percent of GDPand55.9 percent of total manufacturing exports. However if we subtract from total maquiladora exports the imports needed to produce them, the remainder is the national content of maquiladora exports or Mexican value added which is only 2.9% of GDP or 22.83% of total maquiladora exports. If we extrapolate this number for the total manufacture of exports we findthat the total value added for Mexican manufacturing is 5.19% of GDP instead of the reported gross exports of 22.73%. This explains the small effect of RNOX on RGDP.

Table 9: Mexican Exports as a Percentage of GDP

	Total	CrudeOil	Non-Oil	Manufacture	Maquila	Imports Maquila	ValueAdded Maquila
2005	27.79	4.14	23.65	22.73	12.70	9.80	2.90

Source: Presidencia de la República, Informe de Gobierno..Mexico.

The impact of RNOX on RIMP is large and positive, and significant in the case of the Impulse and Variance Decomposition. This is explained by the high import content of Mexican manufacturing exports: Mexican exports can thus be categorized as exports of imports!

The impact of RNOX on RFDIL is positive, small and hardly significant except for a few quarters in the case of the Impulse and positive and positive and significant in the case of the Variance Decomposition. This is explained by the fact that most manufacturing exports are carried out by companies with some degree of foreign direct investment participation (see Table 10). For example, in the year 2000 (the last year for which I obtained information) 61.3% of companies with foreign direct investment were responsible for non-oil exports, and 63% for manufacturing exports.

Table 10: Participation of Enterprises with Foreign Direct Investment In Non-Oil Exports

	1993	1994	1995	1996	1997	1998	1999	2000
Non Oil	58.0%	62.2%	62.2%	65.6%	65.2%	64.5%	61.0%	61.3%
Agriculture	4.5%	8.2%	11.0%	15.0%	17.8%	15.0%	14.4%	15.2%
Mining	44.8%	31.4%	40.4%	47.8%	45.0%	39.6%	39.9%	36.0%
Manufacture	62.6%	66.3%	66.4%	68.7%	67.9%	66.8%	63.1%	63.3%
Maquiladoras	69.0%	72.5%	73.7%	73.4%	71.6%	69.9%	66.2%	60.9%
Non-Maquiladoras	55.5%	59.5%	60.0%	64.7%	64.5%	63.8%	59.7%	66.3%

Source: Banco de México, internaldocument.

The impact of RGDP on RIMP from the Impulse Response Function and Variance Decomposition is positive, large and significant. This is explained by the fact that in a small open economy such as Mexico's, the income elasticity is quite large; Galindo and Cardero (1999) estimate an income elasticity of 1.77 for the demand for imports, other works such as Romero (2014) calculate the marginal propensity to import for the 1988-2009 period, finding that this propensity was quite large, 0.411!

The impact of RGDP on RNOX is not significant from the Impulse Response Function, and positive at first but then becomes not significant by the second quarter. This is explained by the fact that the Mexican economy's sluggish growth rate from 1989 to 2013 could hardly explain the growth of exports (see Figure 1). The demand for exports is basically explained by the growth of the US economy which absorbed an average of 80.84% total Mexican exports for the 1986-2011 periods.

The impact of RGDP on RFDIL is small, negative and significant in the case of the Impulse Response Function and not significant in the case of the Variance Decomposition. From this we can conclude that the inflow of RFDI into Mexico is hardly related to the dynamism of the Mexican economy. The reasons for this inflow must be found in other areas, such as the strategies of the multinational corporations and the evolution in both global and regional markets.

The impact of RIMP on RGDP is small at first and then becomes not significant in the sixth quarter, in the case of the Impulse Response Function; the Variance Decomposition is positive, small and significant.

This means that imports are needed to expand economic growth, thus confirming the import restriction hypothesis.

The impact of RIMP on RNOX is not significant in the case of the Impulse Response Function andVariance Decomposition. This simply means that exports explain a large portion of imports as shown in Table 1.

The impact of RIMP on RFDIL on the Impulse Response Function is small, negative and significant in the first two quarters and then becomes not significant thereafter, and is not significant in the case of variance decomposition. Therefore there is little evidence of import substitution by FDI.

The impact of RFDIL on RGDP is small, negative but insignificant in the impulse response function and is small, positive but not significant in the case of variance decomposition. Therefore RFDIL has little bearing on Mexican economic growth. This result coincides with findings by Romo Murillo (2005), Geijer (2008) and Mendoza Osorio (2008).

The impact of RFDIL on RNOX is not significant in both the impulse response function and in variance decomposition. The impact of RFDIL on RIMP is small, negative and not significant in the impulse response function, and is positive and significant in the case of variance decomposition. In recent years, FDI has been increasingly been targeted at the service sector (around 40% of total FDI)[9], and at commerce in particular, which explains the increase in imports.

VII. Conclusions

The suitability of trade policy for economic growth and development has been broadly debated in the literature. Up until the mid-1970s, import substitution policies prevailed in most developing countries, and since then the emphasis has shifted towards export promotion strategies in an effort to promote economic development. It was hoped that export expansion would lead to better resource allocation, creating economies of scale and production efficiency through technological development, capital formation, and employment generation.

9Presidencia de la República, governmentreport, multipleyears (Mexico).

The shift also included an increasing reliance on RFDIL. In this paper, we have set up an empirical analysis of the relation between economic liberalization and economic growth in Mexico between 1989 and 2013, in order to identify the potential relationships between relevant variables.

In doing so, we have implemented a methodology similar to Nguyen (2011). Our econometric procedures include the unit root test of relevant series, lag structure, the VAR diagnostic, the Johansen cointegration test, the Granger causality/Block exogeneity Wald test (GCBEW), an analysis of impulse response and an analysis of variance decomposition.

The lag selection criteria, the normality test and the serial correlation test were used to choose the appropriate lag length. The cointegration test confirms to us that our four variables are cointegrated. The inclusion of the four variables RGDP, RNOX, RIMP and RFDIL, assures us that the model is not misspecified.

The causality test GCBEW shows that RNOX, RIMP and RFDIL cause RGDP but not vice-versa, except for RFDIL in which case there is bidirectional causality. This result supports the export-led growth hypothesis, the import-compression hypothesis and the argument that RFDIL has a positive effect on economic growth. This also shows that RGDP attracts RFDIL. We also found one-way causality from RFDI to RIMP and from RIMP to RNOX, so we can find direct or indirect causality between all variables. The point is to understand the sign of the causality and the strength of each one of those variables on other variables.

From the Impulse Response Function and Variance Decomposition we found the sign and strength of shocks on other variables and itself.

The effects of RNOX on RGDP are small and not significant, not supporting the idea of export-led growth. The impact of RIMP on RGDP is small but significant, supporting the imports-compression hypothesis. The effect of RFDIL on RGDP is small and not significant, not supporting the idea that RFDIL accelerates growth.

The effect of RGDP on RNOX is small but not significant, not supporting the idea that growth induces exports. The effect of RIMP on RXNOX is also not significant, indicating that exports determine imports and not vice-versa. Finally the effect of RFDIL on RNOX is small and not significant.

The effects of RNOX and RIMP are large and positive, indicating the high content of imports in Mexican non-oil exports. The effects of RGDP on RIMP are also positive indicating the Mexican economy's high propensity for imports. Finally the effect of RFDIL on RIMP is small but significant indicating that RFDI promotes imports, rather than substituting them.

Finally the effects of RGDP on RFDIL is small and not significant, indicating that Mexican growth does not explain the inflow of RFDIL, the impact of RNOX on RFDIL is positive and significant, indicating that growth in RNOX explains growth in RFDIL; more exports require more FDI since most of Mexico's non-oil exports are made by companies with some sort of FDI. The effect of RIMP on RFDIL is small and not significant, providing scant support for the idea that FDI contributes to import substitution.

After finishing this exercise we can go back to Figures 1 to 4 and see that exports and imports grow very rapidly but with little impact on GDP which grows at a very slow rate, 2.5% per year, owing to the very high content of imports in exports. The small growth of GDP is also accompanied by a very slow growth of RFDIL; there we can find also some connection.

This leaves a number of questions open for further research. First, we must consider the behavior of the model in Mexico's previous growth strategy in the 1940-1982 period to find out if there is any difference in the interaction of those four variables with the period under analysis in this paper. Second, it may be useful to compare the behavior of a similar VAR system for South-Korea and Taiwan for the 1989-2013 periods to see if there are significant differences between the economy of these countries and that of Mexico, and if differences exist we could then propose explanations.

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