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Export-led Growth: A Case Study of Mexico

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Abstract

Against the backdrop of export-oriented policy reforms to Mexico's trade regime in the mid 1980s, the present study undertakes a case study of economic growth in Mexico. Using an export-augmented neoclassical production function, the validity of the Export-led Growth Hypothesis for Mexico is also tested over the period 1960-2003. Evidence offers support for the Hypothesis in the short run; however, contrary to the Hypothesis, long-run results suggest an inverse relationship between exports and GDP. A likely explanation is the high import content and diminishing local content of exports, and weak linkages with domestic suppliers, thus reducing possible spillover or multiplier benefits. If Mexico is to succeed in its quest to achieve high and steady economic growth, current incentive schemes that allow tax-free entry of imported inputs and raw materials for export purposes must be reconsidered. Finally, policies that promote technological innovation in manufacturing and linkages with local suppliers are imperative.

Keywords: import substitution; export-orientation; trade reform; export-led growth hypothesis

1. Introduction

In the 1950s to 1970s, the policy of import substitution (IS) formed a major plank upon which many developing countries hoped to achieve significant economic growth. However, from the mid-1970s, there was a considerable shift towards adoption of the strategy of export promotion (EP). By the early 1980s the EP strategy had attained wide consensus among researchers and policymakers to such an extent that it had become ‘conventional wisdom’ among most economists in the developing world (Balassa, 1985).

Advocates of the export-led growth hypothesis (ELGH) contend that Latin American countries which pursued inward-oriented policies under the IS strategy had underperformed. Several recorded no growth on average, while real income declined between 1960 and 1990 (Barro and Sala-i-Martin, 1995). Moreover, countries in the region increasingly faced ballooning fiscal deficits, acute inflation, supply shortages and ultimately, severe balance-of-payments crises coupled with economic recession. Consequently, the 1980s—the ‘lost decade’ in Latin America’s economic development—were marked by a series of attempts to correct these macroeconomic disequilibria in the face of serious constraints to accessing foreign credit and capital markets. Following the ‘conventional wisdom’, Latin American governments adopted outward-looking strategies as integral components of their adjustment and stabilization programs.

Mexico was not spared from the need to reform. From the 1940s until the 1970s, Mexico’s economic development was based on strong state intervention to foster industrialization through import substitution. This strategy was initially quite successful; it transformed the country from an agrarian to an urban, semi-industrial society. However, during the early 1980s, in the aftermath of a dramatic balance-of-payments crisis, the Mexican government implemented a series of economic reforms to shift the economy away from its traditional state-led development strategy. One major policy shift was the change from IS initiatives to an export orientation.

Against this backdrop, the broad objective of this paper is to undertake a case study of Mexico’s economic growth under export-oriented policies. The specific objective is to test

the validity of the ELGH for Mexico. Study of the relationship between export growth and national income is important as export promotion industrialization (EPI) has been identified as a key to growth and development. In addition, the World Bank and the International Monetary Fund (IMF) have advocated EPI within the context of trade liberalization. Mexico provides an interesting case for study as it is highly open¹, and a petroleum-exporting economy.

The remainder of the paper is structured as follows: Section 2 analyses the economic environment which fostered the need for reform in Mexico and the policies implemented as a result. This section also looks at the impact of reform on the composition of exports. Section 3 provides a select review of the theoretical and empirical literature on the ELGH. Section 4 describes the empirical model, econometric methodology and data sources while Section 5 presents our results and analysis. The final section contains some concluding remarks.

2. Trade Reform in Mexico

2.1 The Background for Trade Reform in Mexico

Industrial policy in Mexico during the 1940s to 1970s operated through sector-specific program, with the aim of developing a manufacturing sector capable of producing capital goods and, to some extent, complex intermediate inputs (Ros, 1994). To achieve this goal, tax cuts and trade restrictions were implemented, with strict requirements regarding, for instance, the degree of local content and net-export performance. In addition, a fundamental element of Mexico's industrial strategy was, and still is, the *Maquiladora* program. Initiated in 1966, its objective was to stimulate the establishment of labour-intensive, in-bond export processing plants (known as *maquiladoras*), by offering them tax-free access to imported inputs and machinery, as well as exemption from sales and income taxes. These assembly plants transformed imported parts and components into finished or semi-finished products for export.

¹ By the 1990s Mexico was considered to be one of the most open economies in the world (OECD 2002).

The IS strategy on the whole was initially quite successful. It transformed the country from an agrarian to an urban, semi-industrial society. From 1940 to the mid-1970s, Mexico's real per capita GDP grew at an average annual rate of three percent. Manufacturing was the driving force of this growth process, with output expanding annually at an average of nearly eight percent, boosted by domestic demand. During this period, the share of manufacturing in GDP rose from 15 percent to 25 percent. Nonetheless, several concerns with the design and application of the IS strategy were not sufficiently addressed (Mereno-Brid *et al.*, 2005).

The first concern was the uneven distribution of the benefits from economic growth. Second, the public sector's dependence on external debt was not reduced by fiscal reforms that would strengthen tax revenues. Third, with the exception of a small number of special development sectoral program, there were few policies in place to efficiently promote exports. The failure to adequately address these concerns proved fatal. In the late 1970s, Mexico's economic expansion lost momentum, especially caused by difficulties in substituting imports of high-technology capital goods. In response, the government launched an ambitious development program in 1977 funded by the vast inflow of oil revenues and by external debt. This oil-driven boom was, however, short-lived. As a result, fiscal and foreign exchange revenues, increasingly dependent on petroleum exports, became very vulnerable to external shocks. In turn, imports of intermediate and capital goods rapidly increased, causing a huge trade deficit.

Given Mexico's vulnerability to external shocks, the collapse of the international oil market in 1981, coupled with the rise in United States (US) interest rates, severely affected the economy, triggering twin fiscal and foreign exchange crises. These events ended Mexico's forty-year economic expansion, and were the catalyst for a series of economic reforms directed towards positioning the private sector and the market as the pivotal agents of investment and industrialization (Mereno-Brid *et al.*, 2005).

It became increasingly evident that Mexico required reforms to diversify its sources of foreign revenues, and to improve the structure of the productive sector. As oil exports decreased and foreign debt servicing requirements rose, the need to increase non-oil exports became imperative. Thus, in the aftermath of the most dramatic balance-of-payments crisis that Mexico had faced in decades, the government began setting up a series of economic reforms to shift the economy away from its traditional state-led development strategy.

Mexico started reform of its trade regime in 1985. It eliminated import licenses on capital and intermediate goods and reduced tariffs. Specifically, the percentage of imports subject to licensing dropped from 64.7 percent in 1984 to 10.4 percent by the end of 1985, and the average tariff dropped from 27 percent in 1983 to 23.8 percent in 1985 (Li, 1999). Inspired by the Washington Consensus, a major policy shift from IS policies to export-oriented growth strategies was embraced.

Export orientation was also accompanied by greater efforts in regional integration. As part of a broader policy of privatization, deregulation and liberalization, Mexico joined the General Agreement on Tariffs and Trade (GATT), the predecessor to the World Trade Organization (WTO), in 1986. Trade links with the US and Canada were also reinforced through membership in the North American Free Trade Agreement (NAFTA) in 1994.

According to Mereno-Brid *et al.*, (2005), NAFTA was seen as a vehicle for achieving two goals. The first was to set the Mexican economy on a non-inflationary, export-led growth path, driven by sales of manufactured goods mainly to the US. The second was to escape from the series of repeated economic and financial crises that had plagued the country from the mid-1970s through the mid-1990s² by guaranteeing the lock-in of Mexico's macroeconomic reform process.

² During the 1980s, Mexico was hit by two major crises, namely the 1982 debt crisis (the peso was devalued by over 57 percent from the previous year's level) and the collapse of oil prices in 1986 (from US\$25.50 per barrel in 1985 to US\$12 per barrel in 1986). The peso was further devalued on December 20, 1994 and the financial crisis that followed sent inflation soaring and set off a severe recession in

2.2 *The Impact of Trade Reform on the Composition of Exports in Mexico*

In the late 1970s, Mexico was fundamentally an oil-exporting economy. As of 1985 Mexico ranked fifth in the world in terms of petroleum reserves, and was the largest supplier to the US (McCarville and Nnadozie, 1995). Petroleum provided significant revenues until a decline in international petroleum prices in 1985. Due to declines in prices and volume of exports, the petroleum industry was adversely affected, causing revenue loss for the country; the value of Mexico's oil exports plummeted from US\$13 billion in 1985 to less than US\$6 billion in 1986. The oil sector's share of total export revenue consequently fell from 78 percent in 1982 to 42 percent in 1987 and the value of Mexico's exports fell from US\$24 billion in 1984 to US\$16 billion in 1986. Consequently, oil exports ceased to be a major factor in Mexican growth during the period of low real oil prices from about 1987 through 1999 (Blecker, 2006).

In more recent times, there has been renewed importance of oil export revenue as a result of increasing global prices since 2000. Thus, even with its limited capacity to export oil and other energy products, Mexico has benefited from the higher prices of oil exports. The value of Mexico exports of crude oil rose by 27.3 percent between 2003 and 2004. Virtually all of this increase was due to a 25.2 percent increase in the average price of the country's crude oil exports in 2003-2004. Additionally, the volume of such exports rose by 1.4 percent over this period (Blecker, 2006).

Unfortunately, Mexico's energy policies, since the short-lived oil boom of the late 1970s, have failed to create an efficient energy sector that could maximize the revenues of high energy prices. According to Blecker (2006), much of the revenue from the state-owned oil company has been siphoned off for other uses, including debt service, corruption, and general government revenues, rather than reinvested in modernization of the energy sector or other infrastructure needs. Furthermore, the country's capacity to produce natural gas has never been fully exploited. Northern Mexico now imports natural gas from Texas at

Mexico in 1995. For more detailed analyses of the peso/tequila crises, see Lustig (1998), Blecker (1996) and Williamson (1997).

high prices (partly offsetting the benefits of high prices for its oil exports), despite Mexico's substantial natural gas reserves in the southern and Gulf regions and possibly in the north as well.

Since 1985, a number of initiatives have been taken to promote non-oil exports, such as the easing of requirements for importing intermediate and capital goods, the greater access of credit for exporters, and the reduction of restrictions on the use of export earnings. Trade liberalization, crowned by NAFTA, has also been associated with Mexico's insertion into global markets and its rising importance in non-oil exports, consequently allowing the economy to be more resilient to possible price changes in the international oil markets and less vulnerable to external shocks. Manufactures accounted for more than 50 percent of the country's total exports by 1988, and in 2004 their share exceeded 85 percent, as their rapid growth more than compensated for weak performances in the exports of oil, minerals and agricultural commodities. From 1985 to 1994, Mexico ranked fifth among countries with the largest increases in their share of world manufactures exports; during 1994-2001, it moved to second place, behind China. The *Maquiladoras* also constituted a vital force behind the export drive in manufactures. In the early 1990s, they provided more than half of Mexico's total exports of manufactured goods, and more than 40 percent of Mexico's total exports. As a result of the dynamism in non-oil exports, total exports represented 16 percent of Mexico's real GDP in 1994. By 2000, total exports had more than doubled, reaching 35.1 percent.

Finally, it is important to note that parallel to the export boom in manufactures, the Mexican economy has experienced a massive penetration of imports, mainly manufactured goods, since the 1980s. In 1982, manufactures represented 90 percent of total imports, measured in constant pesos. By 1994, their share was 95 percent, a level which still maintains. As a share of GDP, they climbed from 10 percent in 1982 to more than 30 percent by the mid-1990s. From 1988 to 2003, imports of manufactures at constant prices grew more than twice as quickly as exports. As such, the trade deficit in manufacturing has been widening, putting extra pressure on the overall trade balance.

3. Literature Review

3.1 Theoretical Review of the Export-Led Growth Hypothesis

The export-led growth hypothesis postulates that exports are the main determinant of overall economic growth. One of the main arguments in support of the hypothesis is that export growth may affect total factor productivity through dynamic spillover effects on the rest of the economy (Feder, 1983). Empirical studies based on the production function framework include exports because of this spillover effect. In short, this is ‘learning by doing’, or more precisely, ‘learning by exporting’ (Tyler, 1981; Lucas, 1988).

In theory, there are several ways in which exports can potentially cause an increase in productivity. An expansion in exports may promote specialization in the production of export products, which in turn may boost productivity levels and may cause the general level of skills to rise in the export sector. This then leads to a reallocation of resources from the (relatively) inefficient non-trade sector to the higher productive export sector. This productivity change leads to output growth. Balassa (1985) asserts that in general, the production of export goods is focused on those economic sectors of the economy which are already more efficient. Therefore, export expansion helps to concentrate investment in these sectors, which in turn increase the overall total productivity of the economy.

These arguments have been reinforced by the endogenous growth literature. The new endogenous growth models have made major modifications to the neoclassical growth theory’s approach to handling trade effects.³ Endogenous growth theory emphasizes that exports are likely to increase long-run growth by allowing a higher rate of technological innovation and dynamic learning from abroad (Lucas, 1988; Romer, 1986, 1989; Grossman and Helpman, 1991; Edwards, 1992).

The support for the ELGH is, however, not universal. Moon (1998) argues that nations characterized as following outward-oriented policies do not manifest levels of trade notably

³ In the neoclassical model, trade and other ancillary variables affected the equilibrium level of aggregate output but not its rate of growth. However, critics argue that this does not explain the origin of growth.

higher, or expand their trade at rates higher, than those regarded as inward-oriented. In addition, he notes that it is not apparent that export expansion is the principal source of superior macro-economic performance of outward-oriented nations. Critics point out that the experiences in the East and Southeast Asian countries are unique in many ways and not necessarily replicable in other countries (Buffie 1992). Moreover, the production and composition of exports was not left to the market but resulted as much from carefully planned intervention by their governments. Jaffee (1985) also questions whether a reliance on exports to lead the economy will result in sustained long-term economic growth in lesser developed countries (LDCs), due to the volatility and unpredictability in the world market.

3.2 *Empirical Evidence*

Early studies of the ELGH used cross-section analysis. Among these studies, Emery (1968), Kravis (1970), and Krueger (1978) should be mentioned. This group of studies used bivariate correlation—the Spearman rank correlation test—to illustrate the effects of the ELGH. The general conclusion was that high levels of economic growth are significantly associated with high levels of export growth. However, results were likely due to spurious correlation since exports are a component of GDP. This led some researchers to use output net of exports or alternative export variables. The latter research concluded that there may be a need for a minimum threshold of development before any association may exist. Nations which are heavily dependent on agricultural commodities are less likely to benefit from exports, in comparison with countries that have a higher level of development and whose exports contain a higher domestic value added (Kohli and Singh, 1989).

This concern led to a second group of cross-section studies that estimated aggregate production functions which included exports as an explanatory variable along with other proposed economic growth determining fundamentals, such as labour, capital, and investment. In this group of studies, exports were included in an ad hoc manner in the production function, together with labour and capital. Many of these studies, published in the late 1970s, found a significant positive relationship between export performance and the growth of national income. Balassa (1978) summarized them, stating that ‘The

evidence is quite conclusive: countries applying outward oriented development strategies performed better in terms of exports, economic growth and employment than countries with continued inward orientation.’

Several doubts were raised about the usefulness of results from cross-section studies. Countries in similar stages of development were grouped together. Therefore, the empirical results obtained are averages that do not capture the peculiarities of many developing countries. Implicitly, by assuming the same production function across different types of economies, they do not take into account the level of technology, which is likely to differ across countries. Moreover, cross-section analysis ignores the shifts in the relationship between variables overtime within a country, while export growth and economic growth is a long-run phenomenon, which cannot be studied by using cross-section analysis. Finally, studies which used large samples were limited to specific types of LDCs. Most researchers chose a priori middle-income countries and excluded low-income countries and major oil exporters (Feder, 1983; Kavoussi, 1984).

Recent emphasis has been placed on time series analyses to determine whether a long-term relationship between export and economic growth exists and the direction of causality. Jung and Marshall (1985), use standard bivariate Granger causality tests to analyze the relationship between export growth and economic growth for 37 developing countries and find evidence to support the ELGH in only 4 (Indonesia, Egypt, Costa Rica, and Ecuador). Using Sims procedure, Chow (1987) investigates the causal relationship between export growth and industrial development in eight newly industrialized countries (NICs). He finds evidence of a strong bi-directional causality between export growth and industrial development for Brazil, Hong Kong, Israel, Korea, Singapore and Taiwan; one-way causality from export growth to output growth for Mexico; and no causality for Argentina. Chow’s results are contrast to Jung and Marshall, who find no significant causality in Brazil or Mexico, and causality only from output to exports in Korea and Taiwan. The contrast in empirical findings of the two studies may be partly explained by the fact that Chow uses output of the manufacturing sector as a measure of aggregate output as opposed to Jung and Marshall who utilize GDP.

The contribution by Bahmani-Oskooee and Alse (1993) was perhaps the first to utilize an error correction mechanism in their analysis of exports and GDP. They find strong empirical support for bidirectional causality between export and GDP in eight out of nine countries; the only exception was Malaysia. They concluded that there is evidence that export-promotion contributes to economic growth in LDCs and vice-versa.

A recent study on Taiwan by Chang *et al.* (2000) departs from previous research by including imports as a factor in the relationship between exports and GDP. According to Riezman, Whiteman and Summers (1996), omitting imports can result in spurious conclusions regarding the ELGH, because capital goods imports in particular are necessary inputs for enhancement of export and domestic production. Furthermore, export growth may relieve the foreign exchange constraint, allowing capital goods to be imported to boost economic growth. Chang *et al.* find bidirectional feedback between income and exports, income and imports, and exports and imports respectively.

Few studies have focused on Mexico as an individual case study of the ELGH. Using Granger-causality tests, McCarville and Nnadozie (1995) report evidence of a relationship between export growth and GDP growth in Mexico. Thornton (1996) also finds similar results. Using cointegration and Granger-causality tests within a two-variable framework, he concluded that real exports and real GDP in Mexico over 1895–1992 were cointegrated and there was a significant and positive Granger-causal relationship running from exports to economic growth. Li (1999) took a different approach by examining the relationship between economic growth, exports and export diversification in the context of the ELGH. The empirical findings suggest an important role for exports on output in the long run, and for export diversification on economic growth in the short run.

Alam (2003) examines the ELGH for Mexico and Brazil, using an augmented production function framework.⁴ The main argument is that the wide variations in empirical results can be attributed to the fact that causality tests are extremely sensitive to omitted variables. Even if exports are found not to cause growth in bivariate models, this same inference does not necessarily hold in the context of larger economic models that include other relevant variables such as capital and labour (Awokuse, 2003). Alam's empirical evidence does not support the ELGH. Moreover, the results indicate that imported capital goods appear to be very significant in the growth process of these two countries. The results in this study were found to be robust across estimation techniques.

4. Empirical Model, Econometric Methodology and Data Sources

4.1 Empirical Model

Our empirical model starts with a simple neoclassical production function:

$$Y_t = A_t K_t^\alpha L_t^\beta \tag{1}$$

where Y_t denotes the aggregate production of the economy at time t ; A_t is the level of total factor productivity; K_t, L_t are the levels of the capital stock, and the stock of labour, respectively; and α and β are constants between zero and one that measure capital and labour's share of income respectively.

This paper goes beyond the traditional neoclassical theory of production by estimating an augmented Cobb-Douglas functional form, which includes exports. The inclusion of exports as a third input provides an alternative procedure to capture total factor productivity (TFP) growth. Following Herzer et al. (2006), we assume that total factor productivity can be rewritten as a function of exports (X_t), imports (M_t)⁵ and other exogenous factors (C_t)

⁴ Other studies which have used the export-augmented production function approach include Van den Berg and Schmidt (1994) and Herzer et al. (2006).

⁵ Riezman, Whiteman and Summers (1996) point out that the inclusion of imports is crucial in testing this hypothesis to avoid producing spurious causality results.

assumed to be uncorrelated with X_t and M_t . This implies that our estimates will be unbiased. The resulting specification is:

$$A_t = f(M_t, X_t, C_t) = M_t^\delta X_t^\gamma C_t \quad (2)$$

Combing (2) with (1) we obtain:

$$Y_t = C_t K_t^\alpha L_t^\beta M_t^\delta X_t^\gamma \quad (3)$$

where α , β , δ and γ are the elasticities of production with respect to K_t , L_t , M_t and X_t .

Taking natural logs (Ln) of equation (3) and expressing it econometrically for estimation purposes we obtain:

$$LY_t = a + \alpha LK_t + \beta LL_t + \delta LM_t + \gamma LX_t + e_t \quad (4)$$

where L stands for Ln ; a is a constant parameter; all coefficients are constant elasticities; and e_t is an error term, which captures the influence of all other exogenous factors.

Some studies have argued that it is necessary to separate the economic influence of exports on output from the influence incorporated into the growth accounting relationship (Heller and Porter, 1978; Islam, 1998; Herzer et al., 2006). We address this issue by using aggregate output net of exports:

$$LNY_t = a + \alpha LK_t + \beta LL_t + \delta LM_t + \gamma LX_t + e_t \quad (5)$$

where NY_t represents Y_t net of exports. The signs of the coefficients α , β , γ are expected to be positive, while the sign of δ could be positive or negative.

4.2 *Econometric Methodology*

This study empirically examines the ELGH using the multivariate cointegration techniques of Johansen (1988) and Johansen and Juselius (1990). This method applies the maximum likelihood procedure to determine the presence of cointegrating vectors in nonstationary time series. They have proposed two test statistics for testing the number of cointegrating vectors: the trace (Tr) and the maximum eigenvalue (L -max) statistics. The Schwarz Information Criterion (SIC) will be used to select the number of lags required in the cointegration test.

A necessary precondition to testing for cointegration is to inspect the unit root properties of the variables under consideration. We test for unit roots using the Augmented Dickey-Fuller (ADF) test by Dickey and Fuller (1979, 1981), the Phillips-Perron (PP) test by Phillips and Perron (1988) and the KPSS test by Kwiatkowski *et al.* (1992). A conclusion on the degree of integration is made based on the agreement of *at least* two of the three unit root tests.

The next step is to estimate the short-run dynamics by means of Granger-causality test from an error correction model. The objective is to ascertain whether exports leads growth, growth leads exports, both, or neither hold true for Mexico. For illustration purposes, we outline the procedure for exports and non-export GDP only:

$$\Delta LNY_t = c_0 + \sum_{i=1}^n [\alpha_i \Delta LK_{t-1} + \beta_i \Delta LL_{t-1} + \delta_i \Delta LM_{t-1} + \gamma_i \Delta LX_{t-1} + \varpi_i \Delta LNY_{t-1}] + \phi_i ECT_t + u_t \quad (6)$$

$$\Delta LX_t = c_0 + \sum_{i=1}^n [\alpha_i \Delta LK_{t-1} + \beta_i \Delta LL_{t-1} + \delta_i \Delta LM_{t-1} + \gamma_i \Delta LX_{t-1} + \varpi_i \Delta LNY_{t-1}] + \phi_i ECT_t + e_t \quad (7)$$

where Δ is the difference operator and the ECT is the error correction term which represents the lagged error from the cointegration equation.

Innovation accounting is used to determine the dynamic responses of the variables. We use the impulse response function to trace how economic growth responds over time to a shock in exports and compare this to responses to shocks from other variables. If the impulse response function shows a stronger and longer reaction of economic growth to a shock in exports than shocks in other variables, this is support for the ELGH. Similarly, if the impulse response function shows a stronger and longer reaction of exports to a shock in economic growth than to shocks in other variables, we would find support for the hypothesis that economic growth leads exports.

Variance decomposition provides information concerning the relative importance of each innovation towards explaining the behaviour of endogenous variables. In this study, variance decomposition is used to answer the question: How much of the variance in forecast error of future income growth can be attributed to innovations in export growth?

If, for example, a shock to exports leads subsequently to a large change in economic growth, but that a shock to economic growth has only a small effect on exports, this is evidence in support of the ELGH.

4.3 Data

The required series for NY_t , K_t , M_t and X_t were taken from the World Bank World Development Indicators online database, while L_t was collected from the Yearbook of Labour Statistics published by the International Labour Office (ILO). The variables NY_t , M_t and X_t , represent non-export real GDP, real imports, and real exports respectively. K_t , is proxied by real gross fixed capital formation, while L_t , is proxied by the total number of people employed each year. All data are annual and run from 1960 to 2003, and are logged for estimation purposes.

5. Results and Analysis

The ADF, PP and KPSS tests are in agreement that at conventional levels of significance, LNY , LK , and LM are integrated of order 1 or I(1), and LL integrated of order 2, I(2). However, the ADF and PP test fail to reject the null of non-stationarity for LX at the level and at first difference, contradicting the KPSS, which indicates it is stationary at first difference. However, using the rule that a conclusion will be drawn based on agreement between at least two of the three tests, we conclude with further analysis that LX is I(2). The linear combination of LL and LX can be I(2) or I(1); however, the order of integration must be one for cointegration to exist.

To verify if these variables are cointegrated, we proceed with the Johansen test. The results are summarized in Table 2. The trace and max test both indicate the presence of a one cointegrating vector. We thus conclude that there exists a long-run relationship among LNY , LK , LL , LX and LM .

After normalizing on LNY , we obtain the long-run relation shown in Table 3. The estimated cointegrating vector has plausible coefficients; however, contrary to expectations, the

results indicate a negative relationship between exports and non-export GDP. That is, in the long run an increase in exports will lead to a decrease in economic growth. A possible explanation for this surprising result is that although Mexico's exports, especially its manufactures, experienced a surge in the late 1990s, after adoption of NAFTA and the depreciation of the peso in 1994-95, the import content of exports was high and thus greatly reduced the spillover or multiplier benefits. According to Blecker (2006), the most dramatic case is the *Maquiladoras*, since approximately three-quarters of the gross value of *Maquiladora* exports are offset by *Maquiladora* imports. Thus the net benefit to the Mexican domestic economy is minimal. As Moreno-Brid *et al.* (2005) point out, around 70 percent of Mexico's exports of manufactures are produced through assembly processes involving imported inputs that enter the country under preferential tax schemes such as PITEX, which allows tax-free entry of imported inputs and raw materials for export purposes and ALTEX, which allows tax-free entry of temporary inputs to large exporters.

Mexico's manufactured exports have also become increasingly characterized by reduced local content and weak linkages with domestic suppliers. Its export industries are well integrated into regional (North American) and global production chains, and more and more disintegrated from the domestic Mexican economy (Blecker, 2006). The result is that even if exports growth is high, the net stimulus to the overall growth of the economy and to job creation is relatively small. Indeed, statistics show that the value added in the Mexican manufacturing sector has been stagnant, even though the gross value of exports has grown considerably (UNCTAD, 2002, pp. 77-81). As a result, the relief that Mexico obtains from the balance-of-payments constraint through export growth has been minimal, because much of the foreign exchange earnings are needed to pay for imported inputs.

Table 3 also shows the importance of investment and imports as a source of long-term economic growth: A one percent increase in investment leads to an increase of 0.94 percent

in non-export GDP; while a one percent increases in imports leads to a 2.24 percent increase, which accords with findings by Alam (2003).⁶

The significance of the error correction term in the *LX* vector implies that real exports in Mexico adjust to changes in labour, non-export GDP, imports and investment. The estimated error correction term has the correct sign and is statistically significant at five percent. The coefficient of 0.11 indicates that adjustment towards long run equilibrium is approximately 11 percent each year.

Given the presence of only one cointegrating relationship, the error correction specification can be used to test for Granger causality. Results indicate that exports Granger-causes non-export GDP at the 10 percent level (p-value = 0.08). This result is evidenced by Mexico's export drive, which is mainly based on the dynamism of manufactured exports. GATT and especially NAFTA led to a rapid growth in manufactures and, as a result, by 2003 total exports represented 34.9 percent of Mexico's real GDP. In addition, since 2000, there has been a renewed importance of oil revenue as a result of increased global oil prices. However, results do not suggest that growth leads exports (GLE). Our findings agree with Thornton (1996) and McCarville and Nnadozie (1995), who found unidirectional causation running from exports to GDP.

Table 3 shows that in the short run, investment and imports Granger-cause non-export GDP at the five percent and one percent significance levels respectively. Causation from imports to income gives credence to the view that imports provide the capital and technology to generate increased incomes, productivity and economic growth. Applied studies (see for example, Pacheco-López, 2004) reveal that, in the last fifteen to twenty years, the Mexican economy's structural dependence on imports has increased significantly. His findings indicate that the long-term income-elasticity of demand for imports (essentially manufactured goods) has more than doubled over this period; previously it was valued

⁶ This result is consistent with Rodrik's (1995) hypothesis that export orientation is the result of an increase in demand for imported capital goods for many of the foreign exchange constrained developing countries.

between 1.2 percent and 1.5 percent and has now risen to almost three percent. Pacheco-López further notes that it is doubtful that the upturn detected thus far in Mexico's long-run income elasticity of imports is permanent. It is more likely to abate, and then decline to a certain degree as some effects of the trade liberalization process on the demand for foreign goods and services wear off. But if it remains at current highs, the external sector will become a major obstacle in Mexico's struggle to steer a path of solid economic growth, away from recurrent balance-of-payments crises.

Finally, the evidence indicates that labor, imports and exports Granger-cause investment. Table 3 also shows causation running from investment, and imports to exports. The latter causal link is substantiated by the performance of the *Maquiladoras* industry. As noted in Moreno-Brid *et al.* (2005), Mexico's vigorous export drive has transpired concurrently with a greater use of technological sophistication in the production of some of its manufactured goods sold abroad.

The results of the impulse response functions and variance decomposition lend support to the ELGH. Panel (a) of Figure 1 depicts the time paths of the responses of non-export GDP to shocks in labour, investment, imports and exports; it also illustrates the impact of non-export GDP on exports as compared to other variables (Panel (b)). The evidence shows that the response of non-export GDP to a shock in exports has a longer and stronger effect than the response of non-export GDP to the other variables. This is strong evidence for the ELGH in Mexico. On the other hand, exports respond to its own innovation with the highest intensity followed by imports. Table 4 shows the forecast error variance decomposition at a 10-period-ahead forecast horizon. The findings agree with those from the impulse response function, indicating that exports explains approximately 77.75 percent of the forecast error variance of non-export GDP, implying it is the most important factor affecting economic growth. On the other hand, after 10 periods approximately 85.67 percent of the forecast error variance of exports is accounted for by its own innovations, followed by an 11.57 percent response to shocks in imports.

6. Concluding Remarks

The present study undertook a case study of Mexico's economic growth under export-oriented policies. It also tested whether the export-led growth hypothesis holds for Mexico over the period 1960-2003. To overcome the problem of specification bias from which previous studies have suffered, an export-augmented neoclassical production function was employed. In this framework, total factor productivity was assumed to be a function of exports and imports of goods and services. The output variable of the function was defined net of exports to separate the influence of exports on output from that incorporated into the national income identity. The techniques of cointegration and error correction, and innovation accounting analysis were employed.

The empirical evidence indicates that in the short run exports Granger-causes non-export GDP. On the other hand, the results indicate a negative relationship between exports and non-export GDP. This is explained by the high import content and diminishing local content of exports, and weak linkages with domestic suppliers, thus reducing possible spillover or multiplier benefits. Hence, even if exports growth is high, the net stimulus to the overall growth of the economy and to job creation is relatively small.

Currently, the world is headed into an era of high and rising energy prices. Therefore, Mexico could try to take advantage of this situation, while avoiding the mistakes of the past. Oil revenues should be re-invested in the development of the energy sector or invested in other vital infrastructure needs; they should not be diverted to pay for general government expenditures or other uses such as leveraging large international debts, as occurred in the late 1970s. Mexico could also seek to fully exploit the possibility of producing natural gas, as the capacity is available for them to do so, thereby increasing the benefits of high prices in oil exports.

From a policy perspective, the Mexican economy can no longer base its place in the global economy on low wages and *maquiladoras*. Therefore, if Mexico is to succeed in its quest to achieve high and steady economic growth, it urgently needs to rethink key elements of its overall strategy and industrial policies. In particular, current incentive schemes that

allow tax-free entry of imported inputs and raw materials for export purposes must be reconsidered. Finally, policies that promote technological innovation in manufacturing and linkages with local suppliers are imperative.

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Table 1: Unit Root Tests

Variable	ADF	PP	KPSS	Conclusion
LN_Y	(a) -2.217(1)	(a) -1.970	(a) 0.161**	I(1)
	(b) -3.368(0)**	(b) -3.278**	(b) 0.259	
LK	(a) -2.246(1)	(a) -1.908	(a) 0.158**	I(1)
	(b) -3.548(0)**	(b) -3.508**	(b) 0.250	
LL	(a) -1.423(1)	(a) 0.206	(a) 0.182**	I(2)
	(b) -1.111(0)	(b) -1.231	(b) 0.354*	
LM	(a) -2.214(1)	(a) -1.813	(a) 0.143*	I(1)
	(b) -3.457(0)**	(b) -3.424**	(b) 0.220	
LX	(a) -2.505(1)	(a) -1.853	(a) 0.153**	I(2)
	(b) -2.170(0)	(b) -2.170	(b) 0.209	

Notes: The statistics for the level of the variable is given in (a) and for the first difference in (b). *** indicates statistical significance at the one percent level; ** indicates statistical significance at the five percent level; * indicates statistical significance at the ten percent level. The terms in parentheses are the optimal number of lags chosen by the SIC.

Table 2: Results from Johansen's Cointegration Test

Null Hypothesis	Alternative Hypothesis	Test Statistic	5% Critical Value
Trace Test			
$r = 0$	$r \leq 1$	70.590**	60.061
$r = 1$	$r \leq 2$	37.860	40.175
$r = 2$	$r \leq 3$	17.664	24.276
$r = 3$	$r \leq 4$	6.605	12.321
$r = 4$	$r \leq 5$	0.652	4.130
Max Eigenvalue Test			
$r = 0$	$r = 1$	37.730**	30.440
$r = 1$	$r = 2$	20.196	24.159
$r = 2$	$r = 3$	11.060	17.797
$r = 3$	$r = 4$	5.953	11.225
$r = 4$	$r = 5$	0.652	4.130

Notes: ** indicates statistical significance at the five percent level.

Table 3: Long-run and Short-run Results

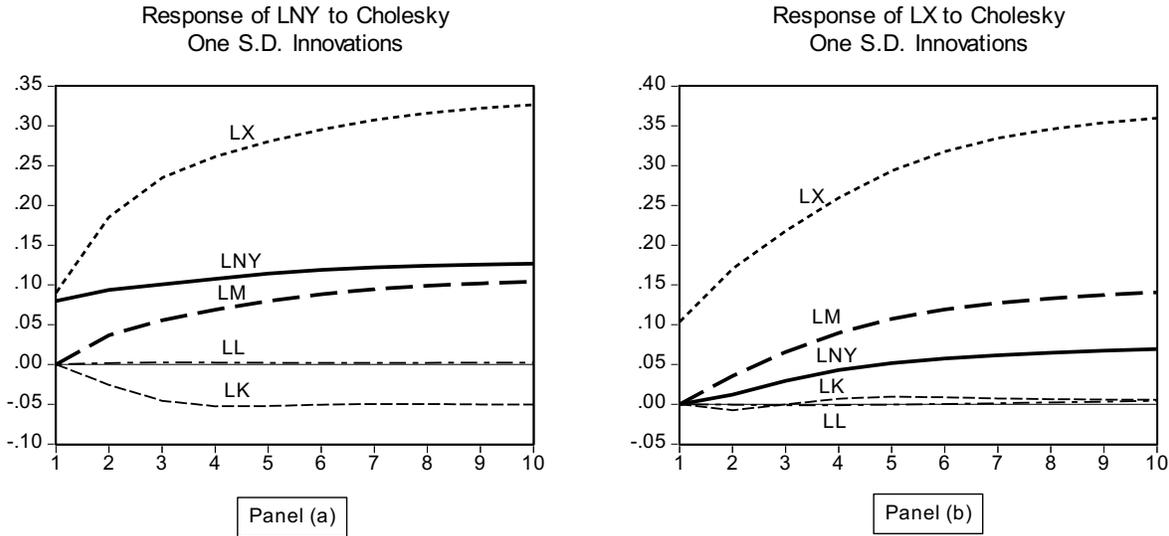
LONG-RUN: COINTEGRATING EQUATION					
$LN Y_t = 0.94 LK_t^{**} - 0.03 LL_t + 2.24 LM_t^{**} - 2.10 LX_t^{**}$					
	[1.92]	[-0.26]	[3.50]		[-5.60]
SHORT-RUN: VECTOR ERROR CORRECTION MODEL					
Independent variable	$\Delta LN Y$	ΔLK	ΔLL	ΔLM	ΔLX
$\Delta LN Y$	-	1.162 (0.281)	0.175 (0.676)	0.666 (0.415)	2.264 (0.132)
ΔLK	4.063** (0.044)	-	2.070 (0.996)	1.450 (0.229)	3.680* (0.055)
ΔLL	0.812 (0.367)	3.179* (0.075)	-	1.656 (0.198)	0.677 (0.411)
ΔLM	11.872*** (0.001)	12.485*** (0.000)	0.043 (0.835)	-	3.675* (0.055)
ΔLX	3.086* (0.080)	3.652* (0.056)	0.359 (0.549)	2.277 (0.131)	-
ECT	0.069 [0.987]	0.138 [1.601]	-0.001 [-0.659]	0.107 [1.258]	-0.114** [-1.900]

Notes: For the cointegrating equation, t-statistics are in parentheses. For the short-run results, ECT is the one period lagged error term from the cointegrating equation. T-statistics are in square parentheses [.] and p-values from chi-square tests are in circular parentheses (.). *** indicates statistical significance at the one percent level; ** indicates statistical significance at the five percent level; and * indicates statistical significance at the ten percent level.

Table 4: Variance Decomposition of 10-period-ahead Forecast Error Variance

Shock to:	Percentage of Variance Explained by Shock				
	LNy	LL	LK	LM	LX
LNy	13.353	8.911	9.362	4.185	2.708
LL	0.004	75.471	0.059	0.038	0.004
LK	2.206	14.728	0.408	0.341	0.044
LM	6.681	0.540	5.532	13.439	11.568
LX	77.756	0.351	84.639	81.998	85.677

Figure 1: Impulse Response to Cholesky One S.D. Innovations



Notes: S.D. means standard deviation. Variable labels on each curve indicate that the response of LNY (Panel (a)) and LX (Panel (b)) respectively were as a result of a shock to these variables.