Mexico: Economic Performance of Local Economies. 2003-2013

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Abstract

Siegel et al method (1995) was used to analyse the effects of changes in final demand structure of the Mexican economies, both national and local levels (32 states and 7 regions) on its economic performance. This method combines input output production model with portfolio theory in order to measure the economic performance in terms of expected growth in the gross production value and the stability of it (measured by its standard deviation). Sharpe ratio (1994) was used to assess the feedback between economic growth and stability. The study comprehends a span of time that runs from 2003 until 2013. The paper uses three national input-output tables (IOT), developed by the Mexican agency of statistic upon the SNA-UN (System of National Accounts-United Nations) methodology for 2003 and 2008, and a 2012 IOT made by a RAS actualization of 2008 table. The regionalization of IOT's was done using the FLQ method and the series of state gross domestic product produced by INEGI (Instituto Nacional de Estadística y Geografía). We work with 31 economic activities.
(150-200 words)

Input-output models; regional input-output models; regional economic performance.

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Introduction

In the mid-eighties of the last century, Mexico undertook qualitative changes in its trade policy, moving rapidly from an internal market heavily protected by quotas and tariffs to a one of the schemes of international exchange of goods, services and capital more open of the world. [1]

During the thirty years following those decisions, gross domestic product (GDP) doubled in real terms and the share of exports in terms of GDP increased from 15.3 to 35.2 percent, while in the case of imports, the same indicator passed from 7.5 to 33.8. Consequently, the coefficient of openness of the Mexican economy, which was 22.8 in 1985, reached 69 percent in 2015. [2]

Throughout those years, the share of oil exports dropped from 68.2 to 6.2 percent, while non-oil exports reached a peak of 93.8 in 2015. Within this latter group, international sales of manufactured goods expanded their participation quota from 72.2 to 95.1 percent, the remainder being agricultural (3.6 percent in 2015) and mining exports (1.3).

In the specific case of manufacturing exports, its value in constant dollars multiplied 31 times, recording an average annual real growth rate of 12.1 percent, 5.2 times higher than that observed by GDP in the same period (2.3).

Perceived changes in the real value of goods exports were characterized by high variability and concentration. Three of the 97 chapters of the Harmonized System of Commodity Description and Coding accumulated 60.5 percent of its real value in 2015: chapter 87, Land vehicles and parts, with 23.7%; chapter 85, Machinery and electrical equipment, 21.3%; chapter 84, Mechanical appliances, boilers and parts, 15.5%.

At a specific level, 11 of the 599 tariff lines of the Harmonized System, 1.8 percent, accounted for 50.6 real value of goods exports in 2015: Automobiles (8.6); Vehicle parts and accessories (6.6); Vehicles for transport of goods (6.6); Crude petroleum (4.9); Machines for data process (4.8); Televisions (4.4).

Telephonic or telegraphic electrical equipment (4.2); Other machinery and electrical equipment (3.1); Insulated electric conductors (3); Other mechanical equipment and parts (2.9) and Tractors (2.3).

The dynamics of the GDP and foreign trade of the Mexican economy reveals substantial changes in the level, composition and the sectoral structure of final demand. In the first case, GDP as the main source of income that supports its absolute level; in the second case, because the dynamism of exports has strengthened the presence of this component of final demand to the relative detriment of other (private and government consumption and gross domestic investment) and finally; because the sectoral structure of exports of goods and services, has also changed significantly.

[1] The Ministry of Economy of the Federal Government reported the existence of 11 Free Trade Agreements with 46 countries, 32 Agreements for the Promotion and Reciprocal Protection of Investments with 33 countries and 9 limited reach agreements within the framework of the Latin American Integration Association. The Ministry notes that; "Mexico is actively involved in multilateral and regional organizations and forums such as the World Trade Organization (WTO), the Asia-Pacific Mechanism (APEC) Economic Cooperation, the Organization for Economic Cooperation and Development (OECD) and ALADI": http://www.gob.mx/se/acciones-y-programas/comercio-exterior-paises-con-tratados-y-acuerdos-firmados-con-mexico, visited on April 28, 2016.

[2] The indicators used in this section are calculated using data from the Bank of Electronic Information of INEGI, consulted on April 28, 2016.

What have been the impacts of these changes on the performance of the Mexican economy? How have these effects manifested in their spatial and sectoral scope?

The standard model of foreign trade is built on four basic relations: 1. The link between the production possibility frontier and the relative supply curve; 2. Link between relative prices and demand; 3. Relationship between supply and demand, which determines the trade balance in the world economy, and; 4. The effect of trade terms[3] in the welfare of nations (Krugman and Obstfeld, 2001).

This theory postulates that the expansion of international trade produces overall benefits, allowing specialization and access to the benefits of economies of scale. This occurs even when there are absolute differences in productivity and wages, as long as countries specialize in the production and exports of goods and services whose manufacture requires factors that the country has relatively abundant and import goods and service that demand intensive use of relatively scarce factors in its territory (the principle of comparative advantage). However, within nations, international trade tends to produce different effects on income, on the dynamics of sectoral performance (Krugman and Obstfeld 2001) and, consequently, at the regional level.

The spatial and sectoral dimension of transformations linked to changes in trade policy in developing countries, was theorized by Krugman and Livas (1992).

According to their approach, the spatial location of productive factors is the result of a tension between centripetal and centrifugal forces. In the theoretical formulation, the centripetal forces are primarily determined by the interaction between economies of scale, market size and transportation costs, aspects linked with the backward and forward productive linkages. The model identifies the increased costs of urban mobility and the amount of land rent, as the main dispersion forces.

From their perspective, the formation of megacities in these countries is a byproduct of trade protectionism in relatively small domestic markets. Under these conditions, the balance between centripetal and centrifugal forces promotes a strong spatial concentration of productive factors. Trade liberalization and strengthening the external market alter this balance and allow a spatial relocation of economic activities.

The empirical evidence for the case of Mexico is consistent with this theoretical formulation, since trade liberalization led to a relative reallocating of industrial activities, from Mexico City, the megalopolis formed during the protectionist stage, towards twenty metropolitan areas located, all of them, to the north of Mexico City (Dávila, 2011).

Multiple research works has found that this relocation has not been homogeneous in space and sectors, as the growth dynamics has focused on the metalworking, iron and steel, electronics, textile and automotive industries. [4]

[3] It is the quotient resulting from dividing the exports price index over imports.

[4] The interested reader may consult: (Gutiérrez 1994), (Guillermo and Graizbord 1995), (Hiernaux-Nicolás 1995), (Hanson 1997), (Graizbord and Ruiz 1999), (Mendoza and Martínez 1999), (Dávila 2000, 2004, 2005, 2011 and 2015), (Chamboux-Leroux 2001), (Mendoza 2002), (OECD 2003) and (Félix 2005).

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The economic rationality of these movements has to do with optimizing transport costs of inputs, goods and services to the external market, which is heavily concentrated in the United States of America (USA). But this movement of manufacturing activities to the north of the country tends to concentrate on a few metropolitan areas: The search for economies of agglomeration, especially scale and location economies, [5] as well as Marshallian externalities,[6] constitute the economic logic of these space relocation patterns.

These trends also suggest structural changes in the final demands of local economies (state and regional level). If this is so: What have been the effects on their economic performance?

Siegel et al. (1995) developed a model that allows to answer this question. The method combines the basic input output model of Leontief (1941) with analysis techniques proposed by Markowitz (1959) to evaluate investment portfolios.

This paper uses this methodology to evaluate the performance of the Mexican economy in three spatial areas: National; mesoregional (seven regions that cover the entire national territory), and for each of the 32 states of Mexico. Within this general framework, the objectives of the article are:

1) Analyze the evolution of final demand for state, mesoregional and national economies during the period 2003 to 2013;

2) Build input-output models for the national economy, as well as for its seven mesoregions and the 32 federal entities of Mexico, for the years 2003 and 2008 and 2012;

3) Use the model of Siegel et al. (1995) to assess, in each geographical area, the impact of the transformations observed in final demand on their respective economic performance. This will be for the period from 2003 to 2013, and;

4) Apply the Sharp ratio (1994) to evaluate, in each case, feedback between economic growth and volatility.

Diversity, diversification and economic performance

Most of regional economic analyzes focus on the magnitude of growth, underestimating or ignoring fluctuations (Brown and Pheasant 1985). However, the relationship between diversity and economic performance is quite old in the literature, reflection on the issue was driven by the catastrophic impact of the Great Depression of the 30s of last century in the US (Dissart 2003; Wagner 2000).

[5] Citing Ohlin (1933) Keilbach (2000) lists three types of agglomeration economies: 1) scale, which directly benefit the companies that generate them; 2) location, forged by the spatial concentration of establishments in the same industry, and 3) urbanization, derived from the size of the local economy.

[6] An externality, positive or negative, is generated when the production or utility function of an economic agent is affected by the action of external economic agents. They are classified in technological (when they are not necessarily transmitted through market mechanisms) and financial (those propagated via the price system). The distribution is imputed to spatial dissemination of knowledge (spatial spillovers of knowledge). Two types of externalities are identified: 1) Jacobs (1969, cited in Keilbach 2000), these result from the variety of products and technologies in a locality 2) Marshall (1920, cited in Keilbach 2000), attributed to the productive specialization of a city in a particular industry. Keilbach (2000) relates them to the localization and urbanization economies: Marshall type Externalities are external to the firm but internal to the industry, which links them with location economies. Meanwhile, urbanization economies may occur in a highly specialized or highly diversified local economy. Thus, although both agglomeration economies and externalities are related to the process of spatial concentration factors, they are different concepts.

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The starting point is a review of the concepts of diversity and diversification, as there is a recurring confusion. As Malizia (1990) observed, many of the indices created as indicators of diversification are actually measures of diversity. With the intention to clarify the meaning of these concepts, Siegel et al. (1995) propose the following definitions: "The noun diversity and the adjective diverse, related to a static and positive concept (state of, difference, variety, inequality). The verb diversify and the noun diversification, concern: 1) the process that makes things more different or varied (positive and dynamic concept) and; 2) the selection of assets (sectors) to minimize the risk (instability in output or employment) (dynamic and normative concept)."

Same authors conducted an extensive review of literature on the subject, identifying eight economic theories that address the topic: Industrial organization, economic base, regional economic cycle, commercial, portfolio, location and regional economy, economic development and the combination of two analysis techniques: portfolio and input-output models, the latter being proposed by the authors. In each case they describe the concept and measure of diversity, associated notions of diversification and economic performance as well as general comments and reviews of each approach (Siegel et al 1995).

Typology of diversity measures

Meanwhile, Wagner (2000) proposed a typology to classify and analyze the measures of economic diversity, grouping them into the following four sets:

Equiproportional measures

The first set is made up of indicators that Wagner called equiproportional.

They are based on the assumption of equal participation for all industries in an economy would achieve an optimal level of diversity. It is a derivative concept of entropy (a measure of disorder based on the second law of thermodynamics). Consequently, a greater concentration of economic activity in a few industries, causes less diversity or greater specialization.

In this set of indicators, the emphasis is on the greater or lesser variety of industries and not in the type of activities (Siegel et al 1995). It is about measures initially used in the industrial organization literature, which provide global indicators of concentration (Stigler 1968, cited in Wagner 2000). The best known are the Ogive, Herfindalh, National Participation and Logarithmic Participation indices. Their formulas are provided in Wagner (2000), and due to its ease of computation and smaller data requirements, have been the most used (Kort 1981, Attaran 1987, Smith and Gibson 1987, Deller and Chicoine 1989, Malizia and Ke 1993 Akpadock 1996; cited in Wagner 2000).

These indicators have been criticized in both terms; theoretical and empirical. There are two criticisms in the first group: 1) The criterion of equiproportionality is arbitrary (Conroy 1974 and 1975, Brown and Pheasant 1985), and; 2) Does not include intersectoral linkages and the number of sectors is usually fixed, so they do not include regional variations (Wagner and Deller 1998).

Empirical objections include: 1) Some regions identified as highly specialized based on these indicators, are relatively stable (Wasylenko and Erickson 1978, cited in Wagner, as the rest of references in this paragraph).

2) policy analysis results show sensitivity to entropy measure used (Kort 1981 Attaran 1987, Smith and Gibson 1987 and Malizia and Ke 1993); 3) the most specialized regions recorded higher growth and small relationship between levels of diversity and employment was observed (Kort 1981 and Attaran 1987); 4) (Smith and Gibson 1987 and Kort 1982) suggest the possibility of additional factors to diversity that influence the stability levels, and; 5) empirical studies on the subject have not been rigorous enough in modeling important economic regions (Malizia and Ke 1993).

Measures based on the type of industries

These measures emphasize the type rather than the variety of industries in an economy. In this set are listed: The percentage share of durable goods in regional exports, location coefficients, shift and share analysis and multi-model replicants technique (MMR).

We anticipate that this set of indicators receive some of the same questions targeted in the previous section for measures of entropy (Kort 1981, Smith and Gibson 1987, and Malizia and Ke 1993, cited in Wagner 2000. See also Wagner and Deller 1998).

In the first case, the stability of the regional economy is associated with their exports demand. Being durable goods sensitive to changes in income, the share of these goods in foreign sales of the region is used as a measure of diversity (Siegel et al 1995).

In the so-called export base theory, regional growth is driven by exports demand. Location coefficients have been used as a technique for estimating regional exports and as a manner to define their specialization patterns. This option has received three objections: 1) The assumptions for estimating exports are very restrictive (the same supply and demand functions at national and regional level).

2) Calculations are sensitive to sectoral disaggregation levels, and; 3) does not include intrasectorial trade and its effects on location quotients (Shaffer 1989, cited in Wagner 2000).

The shift and share analysis is another widely used technique to screen the evolution of regional employment or production. Changes in the studied variable are broken down into three elements; national share, sectoral mix, and residual or competitive element. The second one (the sectoral mix) has been used as a measure of diversity, and is the result of comparing variations of a sector in the reference area (often the country) with respect to those observed in the region of analysis. If the sum of the differences is positive, it is considered that the regional structure is diverse, otherwise, it is taken as an indicator of specialization. This technique has two basic shortcomings: 1) It does not explain the reasons for changes in the variable analyzed, therefore can not be used as a forecast tool, and; 2) the selection of the initial and final years may alter the results.

A fourth approach in this category is the technique of multi-replicants model (MMR), which combines three elements: 1) Analysis of shift-share, as described; 2) the Lorenz curve and 3; the Gini coefficient. Each component has its statistical interpretation and the results show the existence of diversification trends (Akpadock 1996, cited in Wagner 2000). In the previous paragraph the criticisms of MMR were stated, meanwhile the Lorenz curve measures inequality in income or employment distribution with respect to an ideal distribution (proportional), while the Gini coefficient is a scalar associated with the Lorenz curve (Nicholson 1978, cited in Wagner 2000). Therefore, they apply the same criticisms that those directed against entropy measures.

Measures based on portfolio theory

This approach is based on the financial portfolio theory (Markowitz 1959) to analyze regional economic growth. The seminal works are Conroy (1974 and 1975), who scan the regional diversity in a similar way applied for the process of selection of financial assets (which are replaced by economic activity sectors) to integrate an investment portfolio (a structure with sectoral participation in final demand). Considering the returns of individual industries (their expectations of economic growth), the stability and the covariance between net income of the regional portfolio, the model calculates a scalar measure of the portfolio variance (determined by the sectoral structure of final demand), which is used as a measure of economic diversity: A lower variance, the greater diversity of the regional economy and vice versa (Siegel et al 1995).

This approach has received three basic criticisms: 1) The financial portfolios are much more flexible than portfolios integrated by the sectoral share of final demand. The degree of control over them and the response time to change decisions in their integration, is much smaller and slower in the second case (Siegel et al 1995); 2) the expected performance of the industries and the variance covariance matrix are calculated using time series, for which the portfolio variance is dynamic and not static, unlike previous measurements of diversity (Brown and Pheasant 1985); 3) the variance of the regional portfolio is not weighted by interregional flows of intermediate inputs (direct, indirect and induced) (Siegel et al 1995 and Wagner 2000).

Measures using input-output models and indicators

By including intersectoral flows in the analysis of economic diversity, it is achieved a better perception of complexity, structure and performance of regional economies (Siegel et al 1995 and 1998 Wagner and Deller).

In this direction, we have explored two different ways: Wagner and Deller (1998) used the input-output matrix to estimate two diversity indices, which were combined with a third measure regarding the type of industry to build two composite indicators of diversity, one multiplicative and other additive. They analyzed the econometric relation of these indicators with stability indices. The results of their study showed a positive relationship between diversity, stability and economic growth (Dissart 2003).

Two relevant criticisms for this approach are: 1) It is insensitive to industry production levels (Wagner and Deller 1998); 2) It uses overall coefficients constructed from regional and national input-output (a density indicator, which is the ratio of the absolute value of the cells in the Leontief matrix and other regarding linear independence between rows and columns from the same matrix), whereby the sectoral detail of the structural interrelationships of economies is lost and it is unclear how changes in vector representations create changes in matrix interactions (Siegel et al 1995).

The second way (Siegel et al 1995), achieves a structural link between the portfolio theory and input-output model. A scalar, variance of gross production, is used as a measure of economic instability.

As will be seen later, its computational formula relates the structure of final demand with the Leontief inverse matrix and variance covariance of expected returns in each sector (the latter measured by the average changes in the sectoral final demand throughout the study period). This methodology does not provide a direct measure of diversity, but provides an analytical framework to study "... the relationship between changes in the economic structure and performance, which is the basic purpose of the studies on diversity and economic diversification." Siegel et al (1995).

With this model it is possible to simulate the impact of economic diversification strategies on stability (measured by the variance of production) and economic growth (expected growth of output and/or employment). The most important policies to diversify the economy would be those capable of causing changes in: the level and structure of final demand, or increases of regional participation in the supply of intermediate inputs. Its effects can be analyzed separately or jointly, both globally and at sectoral level. Wundt and Martin (1993) formulated the model of Siegel et al as a constrained optimization problem, which allows assessing regional diversification strategies.

Like in the case of portfolio theory, methods using the variance covariance to assess economic performance are not independent of stability. Therefore, it is not possible to test statistical hypotheses linking diversity with growth and economic stability.

Similarly, this method combines dynamic analysis (for the portfolios variance covariance, which is calculated using time series) with a static (input-output model of fixed coefficients) (Wagner and Deller 1998). According to Dissart (2003), this may cause conceptual and empirical problems.

However, the author points out that these limitations can be solved by improving the generation of information systems, both for time series for the exogenous final demand variables, and for the updates of input-output matrices.

In the Mexico case, we see notable progress in the generation of economic information. This is combined with new and better indirect and hybrid methods for generating regional input-output matrices, as well as new techniques and resources for evaluate its performance (Dávila 2015).

In addition to integrating the concepts of stability, structure and economic growth if the basic model of Leontief is replaced by an expanded model built with social accounting matrices, it is possible to integrate the effects of diversity and diversification over income distribution (Dissart 2003).

In conclusion, of all the methods available to assess the relationship between diversity and economic performance, the one postulated by Siegel et al (1995) is the most suitable for the analysis proposed in this paper.

The method of economic performance analysis and information sources

The process of economic structure diversification of a region is based on the premise that establishes the negative relationship between diversity and volatility. This idea underlies the portfolio investment theory approach in the sense that diversification of financial assets that comprise it, can reduce risk (volatility performance).

In an analogous manner to financial assets, sectors of economic activity can register different evolution dynamics of production and employment over time.

Therefore, as in financial risk diversification strategies, it is possible to think of a transformation process of the economic structure as a way to boost stability (Essletzbichler 2007).

Empirical evidence from studies shows: 1) larger economies are more diverse and stable; 2) there is a direct relationship between diversity and stability, and 3) an inconclusive inverse relationship between diversity and employment growth (Dissart 2003).

The model for assessing economic performance

In Siegel et al (1995) proposal, the level of diversity attained by an economy is measured by calculating the variance of the gross production value and/or regional employment. Using matrix notation, the formula to get the first is:

$$V[\mathbf{x}] = \mathbf{wR}Cov[\mathbf{F}]\mathbf{R}^T\mathbf{w}^T \quad (1)$$

Where:

$V[\mathbf{x}]$= Variance in the gross production value; $\mathbf{w}$ = Row vector of dimension *1xn* ($0\leq w_i\leq 1$, $\Sigma w_i=1$), with the participation of each sector in total final demand; $\mathbf{R}$ = Leontief inverse matrix, dimension nxn ; $Cov[\mathbf{F}]$ = Variance covariance matrix of the n sectors final demand, dimension nxn; $\mathbf{R}^T$ = Transpose of matrix $\mathbf{R}$; $\mathbf{w}^T$ = Transpose of vector $\mathbf{w}$.

Alterations in the weighted variance of different sectors in final demand of an economie, are transmitted to the employment or gross production value through regional intersectoral linkages. [7] In turn, regional production expected value, the other component of economic performance, is determined as follows:

$$E[\Delta\mathbf{x}] = \mathbf{R}E\mathbf{f}_{t+1} - \mathbf{R}E\mathbf{f}_t \quad (2)$$

Where: $E[\Delta\mathbf{x}]$ represents the expected growth in the sectoral production from period t to period $t+1$; $E[\mathbf{f}]$ represents the expected value vector of exogenous final demand by sector.

The advantage of this method is that it allows modeling, explicitly, economic performance (measured in terms of expected growth and stability) as a function of the economic structure. The interindustrial linkages determine regional input-output coefficients matrix, which, in turn, is the basic element for calculating the Leontief matrix and its inverse (matrix R). This way to incorporate local intermediate flows allows comprehensively analyze the structure and performance of the regional economy (Siegel et al.1995a and 1995b; Wagner 2000).

In this approach, production and/or employment volatility are related to the structural relationships underlying the supply and demand of the economy studied (Siegel et al 1995a), so the impacts of changes in the economic structure on its stability can be identified. When an economy records a diversification associated with the implementation of public policies with that purpose, we would be facing a normative phenomenon. If these variations occur regardless of public policy, it would be a positive process. Two would be the economic policy strategies implemented with the aim of achieving greater structural diversification and improve consequently the performance of an economy: 1) Promote actions to change the level and/or structure of final demand, so that a reduction is achieved in the gross production variance;

[7] It is input-output matrices in type B format, in which only intermediate and final transactions of national, state or regional origin are disaggregated (it depending of the spatial scope of analysis). International and interregional imports, both intermediate goods and final consumption are handled as rows at the bottom of the table and are not included in the computation of the inverse of Leontief matrix. For more details, see: Kronenberg 2011.

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By implementing measures to achieve increase regional share in the intermediate inputs supply.

Information sources

In Mexico there are no state and mesoregional input-output tables built with the conventional methodology of the United Nations (UN). Therefore, these tables are to be estimated using national matrices of years 2003, 2008 and 2012 years, all of them prepared by the INEGI. The tables for 2003 and 2008 were built with the methodology of the System of National Accounts of the UN and the 2012 table was built through the RAS method. For the estimation of state and regional tables, it is used the indirect method best evaluated in the literature on the subject; this is the procedure formulated by Flegg et al. (1995 and 1997) [8] . For the construction of these models also we require information of gross domestic product for each state of Mexico, also generated by the INEGI. [9] It is annual series covering the period 2003-2013, which are being broken down into 31 economic activities.

The use of three input output tables to calculate production variances on the study period (2003-2013) provides two important advantages: 1) It allows to quantify the impact of regional trade coefficients changes over the gross production variance, and; 2) it reduce the possible discrepancies resulting from combining a dynamic analysis (variance covariance is calculated using time series) with a static one (input-output model).

By using the basic components of input-output model to calculate the portfolio variance, the Siegel et al method assumes its same assumptions; market structure, state of technology and relative prices are fixed. Furthermore, in regional models, because they are obtained by an indirect method of regionalization, each sector of the region has the same production technology as the reference region, in this case, the country.

Changes in level and structure of the final demands

Using regionalized matrices and series of gross domestic product for each of the mesoregions and states of Mexico, it was estimated the gross production value and the final demand. [10]

The criteria for the formation of the mesoregions were "geographical contiguity; exclusiveness; distance from the northern border and; relevant geographical conditions, specifically the relative location of the entities with respect to major mountain ranges and coastlines." (Dávila et al 2015).

Table 1 lists the states that integrate each region, as well as their respective shares in population, gross production and surface of the country. With shades of black to grey highlights the three regions with the largest share in each category. For its part, the map 1 defines the territories within the country.

[8] Dávila (2015, pp. 7-18.) provides a description of this input-output regionalization method, as well as the assessment of the relative performance in respect other indirect methods.

[9] The data are provided at basic prices, excluding transportation and trade costs and net indirect taxes less subsidies. These series considered imputed bank service payments.

[10] In the first case, the estimate is based on GDP data available (equivalent to value added, both at basic prices) and the ratio of value added relative to gross production value (obtained from the national input-output matrix). Knowing gross production values of each sector (**x_i**), final demand (**f_i**) is obtained by subtracting to the gross production value, the production value for the supply of intermediate demand.

Evolution of final demand levels.

During the period of study, at national level, final demand grew at an average real annual rate of 2.5 per cent. At regional level, the Northeast and the Central-North Plateau registered the largest dynamism (3.5 and 3.3 percent, respectively), while in the Southeast-Gulf region, this single variable reached a rate of 0.9 percent.

		Participation (%) on		
REGION	**STATE**	**Surface**	**Population**	**Gross Production**
1. Northwest.	Baja California; Chihuahua; Sonora; Baja California Sur; Sinaloa.	32.1%	11.1%	13.1%
2. Northeast.	Coahuila; Nuevo León; Tamaulipas.	15.1%	9.3%	15.6%
3.Center North Plateau.	Aguascalientes; Durango; Guanajuato; San Luis Potosí; Zacatecas.	15.1%	10.9%	9.2%
4. West.	Colima; Jalisco; Michoacán; Nayarit.	8.7%	11.9%	10.2%
5. Center.	Distrito Federal; Hidalgo; México; Morelos; Puebla; Querétaro; Tlaxcala.	5.1%	33.7%	34.8%
6. South.	Chiapas; Guerrero; Oaxaca.	11.8%	10.0%	4.7%
7. Southeast Gulf.	Campeche; Quintana Roo; Tabasco; Veracruz; Yucatán.	12.1%	12.4%	13.0%
TOTAL	**MEXICO**	**100%**	**100%**	**100%**

Table 1 Regions of Mexico: Participation (%) on the surface, population and national gross production, 2003. Source: (Davila et al. 2015)

In regards to states, and because of the abatement of the oilfields, Campeche was the only state that had negative growth annual rates (-3.2 percent). At the other extreme, seven states reached annual final demand real growth rate above four per cent during those years (2003-2013): Aguascalientes (5.2), Baja California Sur (5.1), Zacatecas (4.9), Sonora and Querétaro (4.7), Quintana Roo (4.5) and Nuevo Leon (4.3).

Changes in the final demand structure

Table 2 presents a summary of the major changes in the final demand structures during the period 2003-2013. The first two columns contain the concentration indices of the eight and four most important sectors in final demand for the year 2013. In the first three rows are the average for regions, states, and the nationwide. In the following two, are the maximum and minimum values registered by the regions, and in the last two rows, the values registered by the states. Columns three and four compute percentage changes observed in the concentration levels between the initial (2003) and the final year (2013). The last column calculates the participation of the four sectors with the most relevant change in concentration indices.

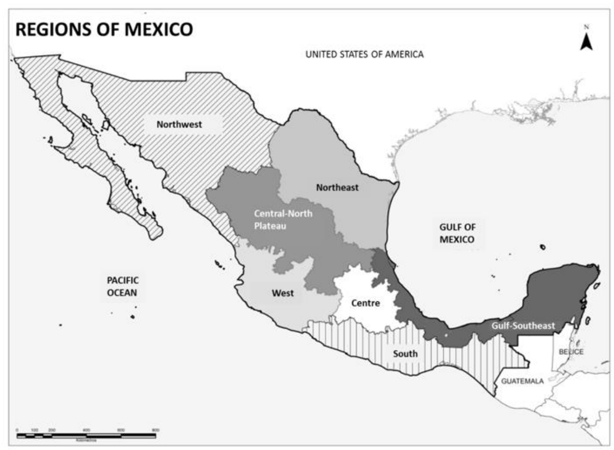

Figure 1 Mesoregions of Mexico
Source: (Davila et al. 2015)

At the national level, eight of the 31 economic activities have improved in terms of final demand level between 2003 and 2013. On the whole, they increased their participation in this variable in 9.7 points, from 34.2 percent of the final demand in 2003 to 43.9 in 2013. Four of these activities concentrated the 86.2 percent of the relative increase in final demand:

ECORFAN Journal-Mexico
June 2016 Vol.7 No.16 1-22

Machinery and equipment (333 to 336 subsectors according to NAICS classification - North American Industrial Classification System-); financial services and insurance; trade and; information in mass media. This select group of economic activities doubled its relative weight in the final demand during the period (from 8.4 to 16.8 percent).

		Final demand :entration lnde 2013		Change on inal demand oncentration :xes. 2003-2013		Total hange tribution
		8 ctors	4 ctors	8 ctors	4 ctors	4 /8 :ctors
	Average					
	Regions	43.0%	29.0%	9.2%	7.6%	83.1%
	States	44.5%	30.6%	10.7%	8.9%	82.9%
	National	43.9%	32.1%	9.7%	8.4%	86.2%
Extreme values on ons						
a	Maximum	50.8%	37.7%	10.2%	9.4%	91.5%
b	Minimum	38.0%	23.4%	7.8%	6.7%	na
Extreme values on s						
c	Maximum	67.2%	59.8%	18.9%	18.5%	97.7%
d	Minimum	18.5%	6.6%	4.8%	4.0%	82.4%

a Northeast region in all cases
b South, West, Central-North Plateau, respectively
c Tabasco, Tabasco, Sonora and Sonora, respectively
d Campeche, Puebla, Guanajuato y Guanajuato, respectively

Table 2 Mexico, mesoregions and states of Mexico: Indices of sectoral concentration of the final demand in 2003 (%) and changes in concentration levels during the periods 2003-2013, 2003-2013, 2003-2013 (%)
Source: Regional input-output models. Developed by the authors based on the methodology described in this document with information from INEGI (Input Output Tables: 2003, 2008 and 2012m and statistics of the Gross Domestic Product of the Federal Entities)

This expansion greatly influenced the detriment of three industrial activities: oil mining; petrochemical, chemical and plastic and rubber industries (324 to 326 NAICS subsectors) and; the basic metal and the metal products manufacture (subsectors 331 and 332). This subset of activities lost more than one third (34.2 percent) of its relative weight in aggregated demand, moving from 15.7 percent of the total in 2003 to 10.4 ten years after (5.3 points less).

The state and regional patterns were very similar to the national, with concentration indices and changes slightly more pronounced in the federal entities.

The Northeast region is the one that reaches the maximum values about concentration levels of four sectors (37.7 percent) and eight sectors (50.8), as well as its variations over the years analyzed (9.4 and 10.2 percent, respectively). Three of the four sectors with the highest concentration levels in this region match with those sectors located in this same category at national level. The exception is the food industry in the Northeast region, which appears in this group in replacement of trade sector.

In the case of states, Tabasco reached the higher concentration indices, as the most significant increases during the period were recorded in the state of Sonora. In Tabasco, oil mining was the sector with higher specific weight in the final demand, the three remaining activities match the sectors located in the same group at national level (trade, financial services and information services). In the case of Sonora, non-oil mining is among the most important activities, the remaining three (machinery and equipment, financial services and information services) are also in this subset at national level.

Thus, data show changes in final demand structures and a deepening in sectoral specialization levels. How have these trends impacted the evolution of its economic performance?

Local economies performance

In the methodological framework adopted, the performance of an economy is a direct function of the average expectancy of growth in the gross production value, and inverse of the levels of volatility of the same variable.

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Initially we will analyze the evolution of each one of these items separately, and subsequently we will observe both criteria simultaneously.

Expected growth in the gross production value

In line with the behaviour of final demand, the estimated growth of the gross production value in Mexico reached real annual rates of 2.5 percent between 2003 and 2013.[11] Also regional and state dynamics in the evolution of this variable are very similar to those already described for the case of final demand.

Performance of the gross production value variance

In the approach proposed by Siegel et al., (op. cit.), changes in the the gross production value (or employment) variance level can be explained by: 1) alterations in the level and structure of the final demand, or; 2) changes in regional intersectoral trade quotients. In order to identify the source of fluctuations in the stability, three series were calculated using observed annual variance between 2003 and 2013 with each of the three input-output matrices available, corresponding to the years 2003, 2008 and 2012. All these computations were made for each of the 32 federal entities of the Mexican Republic, for each of the seven mesoregions considered and for the country as a whole. The results are presented in Annex 1 of the work.

To illustrate the procedure, we will analyze the case of the North-Central Plateau region of Mexico (see Graph 1). The three lines in the graph measure the evolution of the variance in the gross production with each of the three input-output matrices employed.

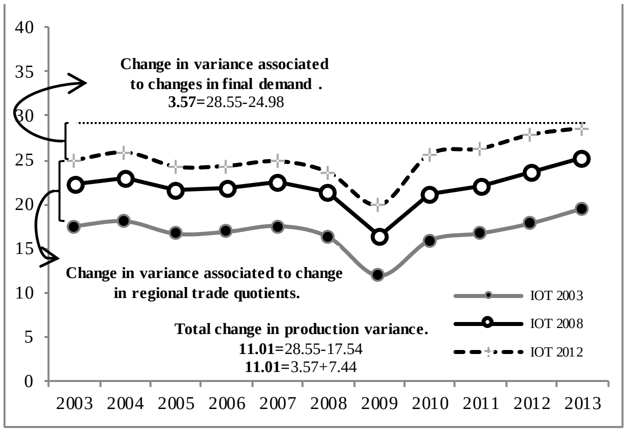
The total change (+11.01) results from subtracting to the level of variance quantified in 2013 with the 2012 matrix (28.55 units), the value of the variance registered in the initial year, 2003, obtained through the matrix of this same year (17.54).

Afterwards, variations associated with each of the two components mentioned above are calculated: The change in the absolute level of variance caused by alterations in the level and structure of the final demand (3.57 units) is obtained by measuring the difference between the values of the variance corresponding to the year 2013 with respect to the year 2003 (3.57 =28.55 -24.98), calculated both with the 2012 matrix.

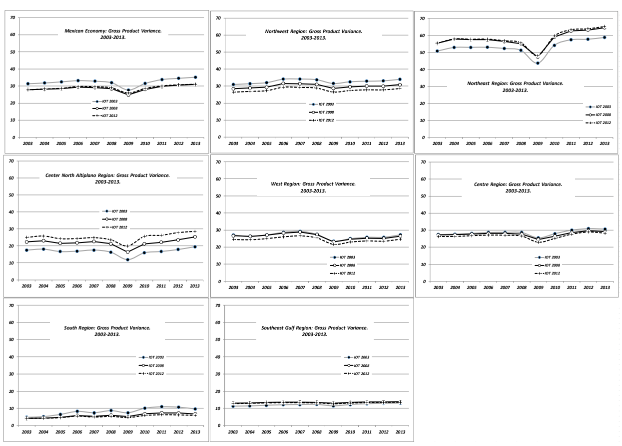
The impact over the production variance associated to changes in regional trade quotients; is estimated by the difference between the variance calculated for 2003 with the matrices of years 2012 and 2003. These values were 24.98 and 17.54, respectively, resulting in a variation of 7.44 units. Combining the two components yields the total change in variance (3.57 +7.44 =11.01).

Using the same scale to facilitate comparison, Graph 2 shows the behaviour of the gross production variance in the country and in each of its seven mesoregions. As indicated above, the results for the federal entities can be found in Annex 1.

[11] This value reflects the growth expentancy in the gross production value.



Graphic 1 North-Central Plateau region of Mexico. Variance of the gross production value. Period 2003-2013. Source: Regional input-output Models. Developed by the authors based on the methodology described in this document with information from INEGI (Input-Output Matrices: 2003, 2008 and 2012 and statistics of the Gross Domestic Product of the Federative Entities)

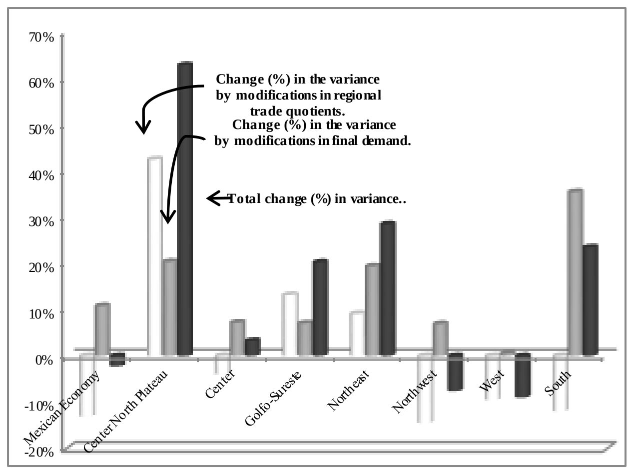


Graphic 2 Mexico and mesoregions of mexico. Variance of the gross value of production. Period 2003-2013

For the Mexican economy as a whole, even when the volatility associated with the structure of the final demand grew by 3.3 units (from 27.7 in 2003 to 31 in 2013), these changes were more than offset by the reduction associated with the regional trade quotients (-3.6). The net result was a slight decrease in the volatility indicator.

At mesoregional level, the Northeast region reached the highest levels of volatility, while the Northwest, North-Central Plateau, West and Center regions recorded similar amounts to those of the country as a whole. The lowest levels of instability were observed in the regions South and Gulf-Southeast.

The percentage changes of the gross production variance for the country as a whole, as well as for each of its seven mesoregions and its 32 federal entities were also computed. This information is detailed in Annex 2. The results at national and mesoregional level are presented in Graph 3.



Graphic 3 Mexico and mesoregions of mexico. Factors of changes in the variance of the gross production value. Period 2003-2013. (Percentage of the total)

Source: Regional input-output models. Developed by the authors based on the methodology described in this document with information from INEGI (2003, 2008 and 2012 Input-Output Tables and statistics of the Gross Domestic Product of the Federal Entities).

Changes in regional trade quotients helped to temper the gross production volatility in Mexico, as well as in the Northeast, South, Occident and Center regions. This same factor led to its greater instability in the Central-North Plateau, Southeast-Gulf and Northeast regions.

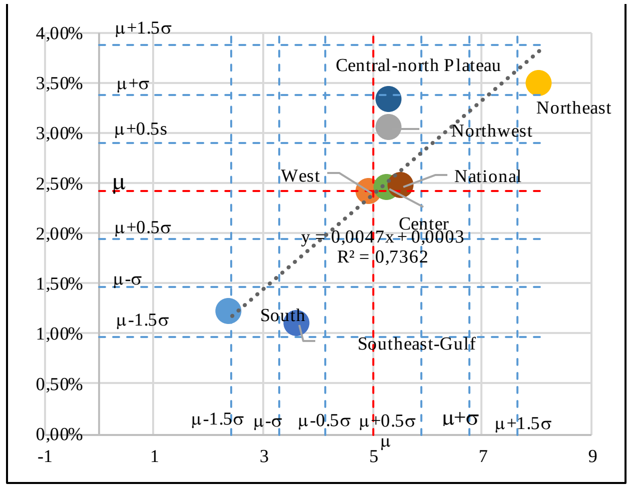
For its part, transformations in the final demand structure led greater volatility in the production level of the country, the seven regions and in 20 of 32 entities. The greater instability linked to this component was particularly important in the South, Central-North Plateau and Northeast regions. Combining both factors, the largest percentage increases in volatility levels were observed in the North-Central Plateau, Northeast and South regions.
In the case of the states, the behaviour can be summarized as follows: Total volatility increased in 19 of 32 states; changes in the final demand increased it in 20 entities and the local intermediate inputs coefficients reduced it in 17 entities.

Economic performance evaluation

Once the volatility is computed, the performance of an economy can be analyzed as a direct function of its expected growth (determined by the average rate of real growth in the gross production value) and as an inverse function of its instability (measured by the standard deviation of the gross production, which is obtained by calculating the square root of the variance).

The results are shown in Graphs 4 and 5. The first one contains information about regions, while the second one shows federative entities data. Both were evaluated using the input-output matrices of 2012[12] and have the same composition: the volatility indicator is located in the horizontal axis, i.e. the average standard deviation of the gross production during the period 2003-2013; as the vertical axis measures the other performance criteria , the gross production expected growth.

Using dispersion measures of every variable; mean, ranges of volatility and expected growth are identified, which are delimitated with dotted lines perpendicular to each axle.[13]



Graphic 4 Economic performance of the regions of mexico: average real growth rate of gross production (%) and average standard deviation (%). 2003-2013. The assessment with input-output matrices from 2012

Source: Regional input-output Models. Developed by the authors based on the methodology described in this document with information from INEGI (Input Output Matrices: 2003, 2008 and 2012, and statistics of the Gross Domestic Product of the Federal Entities).

The results show a trade-off between growth and volatility: A greater production dynamism, less stability or, equivalently, greater volatility. Similarly, a trend line is drawn, which identifies the average levels of correlation between growth and volatility.

[12] Same exercise was done with the matrices of the 2003 and 2008 years. Both are consistent with those observed in the 2012 matrix and show similar results.
[13] Five level ranges were defined in each of the two variables: very low (observations with a value lower than the average minus one and a half standard deviation; low (level between the mean minus one standard deviation); medium (values between the mean plus/minus half of the standard deviation); high (values located between the mean plus one standard deviation); and very high (values higher than the mean plus one and a half standard deviation).

Article

ECORFAN Journal-Mexico

June 2016 Vol.7 No.16 1-22

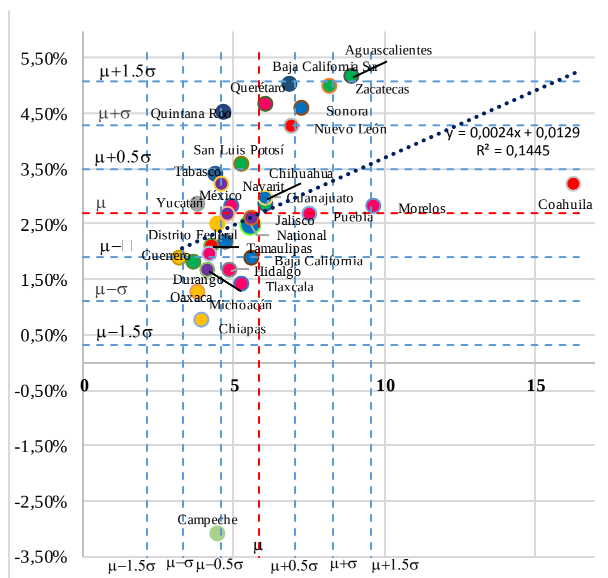
During those years, the Northeast was the region with the higher growth rate in gross production (3.48 percent per year), being located in the area "very high" in this aspect. Nonetheless, this region was also the one with the highest volatility (on average, the gross production standard deviation was 8.07), being the only mesoregion of the country located in the "very high" area of volatility. For its part, the Central-North Plateau achieved a high growth level (3.32), but unlike the Northeast, remained in a zone of average volatility (5.34). In the same strip of volatility were located three other regions; Northweast, Central and Occident (with deviations values of 5.35, 5.32 and 4.96 percent, respectively), but the last two remained in medium growth area, with rates of 2.44 and 2.41 percent, while the Northwest region is ranked in the range of high growth (3.05), but with a slower rhythm than Central-North Plateau region. Thus, it can be concluded that the Central-North Plateau region was the one that showed the best combination of growth and volatility, since it achieved an expansion of production slightly lower than Northeast, but much more stable. Similarly, with a level of stability similar to the one registered by the Northweast, Center and Occident regions, the region was able to achieve better rates of economic growth.

At the other extreme are the two regions with lower growth (Gulf-Southeast and South). Clearly the first one was the worst performer, because with higher levels of volatility to those registered in the South region, Gulf-Southeast obtained a lower growth rate (1.08 per cent, against 1.21).

The analysis of the economic performance of the federal entities shows two extreme values:

1) The state of Coahuila, with a volatility value (16.4) almost three times higher than the national average and an economic growth located at the top of the mid-range area (3.19 percent), and; 2) Campeche, the only state of the Mexican Republic with negative growth rates (-3.11 percent) of its gross production over the period 2003-2013.

Six states are located in a very high gross production growth area: Aguascalientes (5.17), Baja California Sur (4.99), Zacatecas (4.97), Queretaro (4.63), Sonora (4.57) and Quintana Roo (4.52). In this group, the lower volatility values were observed in Quintana Roo (4.73, low range), Queretaro and Baja California Sur (placed in a medium instability level, with standard deviations of 6.13 and 6.89, respectively). With the evaluation criteria employed, these entities attained the best economic performance during the period.



Graphic 5 Economic performance of the federal states of Mexico: average real growth rate of gross production (%) and average standard deviation. 2003-2013. Estimations with 2012 input-output matrices

Source: Regional input-output models. Developed by the authors based on the methodology described in this document with information from INEGI (2003, 2008 and 2012 Input-Output Tables and statistics of the Gross Domestic Product of the Federal Entities)

The reverse of the medal was occupied by nine states, located in the “low” (Tlaxcala, Oaxaca, Michoacán, Guerrero, Hidalgo, Durango and Baja California) and “very low” (Campeche and Chiapas) strata of gross production variation. Within this conglomerate, the standard deviations were highest in Baja California (5.64), Tlaxcala (5.28), Hidalgo (4.89) and Campeche (4.51), being the entities with the most precarious levels of economic performance.

In the Markowitz theory (1959), a portfolio is efficient when there is no someone else who can provide higher performance at the same level of risk, or; that a certain amount of “profits”, guarantees the minimum standard deviation (lower volatility or risk). With these elements of valuation, it is clear that at the mesoregional level, the Central-North Plateau region is emerging as the top performer. However, at the state level, it is not possible to determine unambiguously the state with the best economic performance during the period.

In order to establish evaluation criteria, William F. Sharpe (1994) developed an indicator that bears his name, which allows to identify the portfolio with the best performance and risk combination. This index measures the performance per risk unit by estimating the difference between the expected benefit of a portfolio relative to a benchmark portfolio. The result is divided by the standard deviation of the portfolio examined. The formula is as follows:

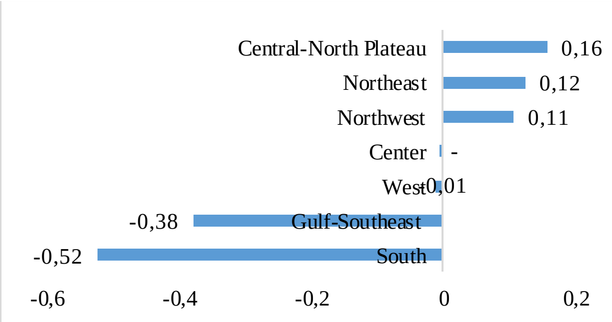
$$S = \frac{\mathrm{R[F]} - \mathrm{R[B]}}{\sigma[F]} \tag{3}$$

Where: R[F] corresponds to the portfolio performance F, R[B] corresponds to the performance of the reference portfolio B, and σ[F] is the estimate of the standard deviation associated with the portfolio F.

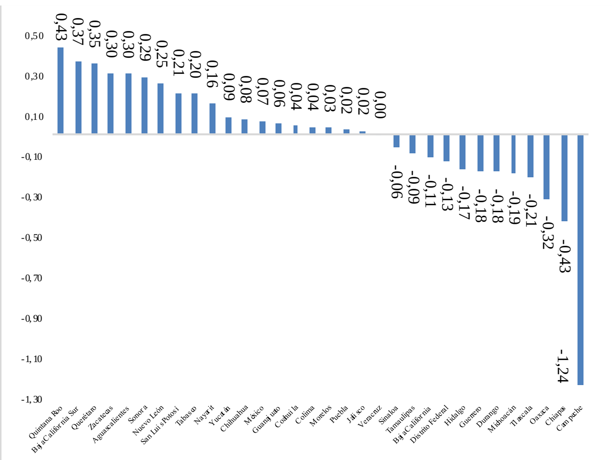
Originally, the reference portfolio was risk free. Subsequently applications emerged where the reference portfolio was similar of the examined, but with less risk. Even, in some applications the reference return is omitted, estimating only performance-volatility ratio for the option evaluated. The latter solution was questioned by Sharpe (1994).

Taking as reference the "national portfolio", whose performance (average annual growth rate) was 2.48%, the Central-North Plateau region reached the best performance, because in computing its growth differential compared to the national average and divided by the standard deviation, reached the maximum value of the Sharpe ratio (0.157). At the opposite, the South region (-0.524) stood. Two other regions (Northeast and Northwest) were placed in the second and third positions, respectively, with positive coefficients of 0.124 and 0.107. The places four, five and six were occupied by the Central, West and Gulf-Southeast regions (See Figure 6).

Analyzing federal entities, the results are presented in Figure 7, where Sharpe coefficient values of the five states located at the ends are displayed. With a ratio of 0.43, Quinta Roo ranked first, followed by Baja California Sur (0.37), Querétaro (0.35), Zacatecas and Aguascalientes (both 0.3). At the bottom they were placed Michoacán (-0.19), Tlaxcala (-0.21), Oaxaca (-0.32), Chiapas (-0.43) and Campeche (-1.21).



Graphic 6 Economic performance of the regions of mexico. Sharpe coefficient. Reference Portfolio Performance: 2.48%, National average real growth rate.
Source: Regional input-output models. Developed by the authors based on the methodology described in this document with information from INEGI (2003, 2008 and 2012 Input-Output Tables and statistics of the Gross Domestic Product of the Federal Entities)



Graphic 7 Economic performance of the federal entities of mexico. Sharpe coefficient. Reference Portfolio Performance: 2.48%, National average real growth rate
Source: Regional input-output models. Developed by the authors based on the methodology described in this document with information from INEGI (2003, 2008 and 2012 Input-Output Tables and statistics of the Gross Domestic Product of the Federal Entities)

Conclusions

The data reflect the deepening of local economies specialization as a result of the progress of foreign trade liberalization in Mexico. This trend is explained by the new balance between transportation and agglomeration economies fostered by access to foreign markets.

The effects on economic performance have been contrasting, although some local economies have reached acceptable rates of expansion in gross production, growth has been moderate in most federal entities. Moreover, the increasing productive specialization has increased instability levels, particularly in federal entities and regions in which industry of machinery and equipment has a preponderant weight.

With the dynamism of exports, changes in the amount and structure of the final demand of the Mexican economy deepened. Furthermore, its sectoral concentration was accentuated and the volatility levels of gross production associated with these transformations rose. This occurred in the three geographical levels: Country, mesoregions and federal entities.

The impact of changes in local intermediate inputs coefficients on volatility were differentiated: At national level, they had a positive contribution to offset the instability caused by changes in final demand, so the total variance recorded a slight net fall (-0.9%). Something similar happened in the Northwest and West regions. As well, Central and South regions also had a positive effect, but this was not enough to offset the increased instability related to structural changes in final demand, so the net variance increased. In the remaining three regions (North-Central Plateau, Gulf-Southeast and Northeast), both factors combined to accentuate the instability of gross production. Regarding federal entities, the overall level of volatility increased in 19 federal entities; changes in the final demand increased volatility in 20 federal entities and the growth of intermediate inputs coefficients produced a reduction on volatility in 17 federal entities.

By integrating the two indicators of economic performance (growth expectancy and standard deviation) with the Sharpe ratio, the North-Central Plateau region was the best evaluated (0.43), followed by the Northeast (0.124) and then Northwest (0.107). At the other end were the South (-0.524) and Gulf –Southeast (-0.379) regions. At the state level, Quintana Roo (0.43), Baja California Sur (0.37), Querétaro (0.35), Zacatecas and Aguascalientes (0.3 in both cases) achieved the best results. On the opposite side stood Campeche (-1.24), Chiapas (-0.43), Oaxaca (-0.32), Tlaxcala (-0.21) and Michoacán (-0.19).

By crossing these trends with previous research results, it can be concluded that the largest share of exports in gross production does not guarantee the best results. For example, in the mesoregional area, the Northwest and Northeast regions, both achieved export quotas higher than the Central-North Plateau region (22.7, 20.4 and 16 percent, respectively) (Davila et al 2015), nevertheless, the latter recorded a higher economic performance ratio. When considering the national content exported in gross production, Central-North Plateau outperformed the Northwest region (10.2 and 8.8 in each case) (Davila et al 2015). Therefore, in order to obtain better economic performance, it can be more relevant other factors like; the net exported content, sectoral diversity and highest density of local production chains.

We have identified the following two lines of research as relevant to deepen the study of performance of local economies in Mexico:

1. Apply the Siegel et al method, replacing input-output Leontief basic model for extended models built with social accounting matrices. This will facilitate the adequate integration of income effects and take account of the impact of exogenous changes on their distribution.

2. In the analytical framework described in the previous section, and applying constrained optimization techniques, it can be useful to run simulation exercises of different policy options impacts on economic performance, especially policies about diversification strategies based on innovation cluster approach.

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Article

ECORFAN Journal-Mexico

June 2016 Vol.7 No.16 1-22

Annexes

	IOT 2003				IOT 2008				IOT 2012			
REGION	**2003**	**2008**	**2012**	**2013**	**2003**	**2008**	**2012**	**2013**	**2003**	**2008**	**2012**	**2013**
Total nacional	**31.32**	**31.90**	**34.49**	**35.14**	**27.86**	**28.37**	**30.56**	**30.93**	**27.71**	**28.91**	**30.70**	**31.04**
South	4.75	8.66	10.67	9.60	4.15	6.00	7.29	6.75	8.37	5.29	6.15	5.87
West	27.03	27.41	25.75	27.17	26.65	27.34	25.10	26.45	24.46	25.36	23.46	24.60
Northwest	30.94	33.76	33.08	34.01	28.45	31.04	29.98	30.83	26.45	28.86	27.79	28.59
Northeast	50.80	51.18	57.74	58.78	55.39	55.14	63.18	64.53	55.42	55.69	63.87	65.25
Southeast Gulf	11.25	12.28	12.90	13.04	13.02	13.49	13.73	13.85	12.73	13.16	13.42	13.52
Center	27.37	28.60	30.87	30.64	73.67	75.06	79.35	82.14	26.29	26.53	28.90	28.26
Plateau	17.54	16.30	17.87	19.52	22.34	21.29	23.59	25.27	42.73	38.87	54.42	50.10
Aguascalientes	40.91	60.21	66.45	76.47	47.02	68.29	75.07	85.46	42.81	63.60	70.09	80.07
Baja California	37.41	38.92	36.19	35.85	35.01	36.36	33.63	33.27	33.53	34.84	32.15	31.78
B.C. Sur	43.03	55.68	53.41	52.98	45.40	56.58	54.99	53.54	37.57	50.27	48.10	47.43
Campeche	24.57	22.58	20.99	21.23	24.41	22.48	20.34	20.71	23.53	21.85	19.99	20.35
Chiapas	20.22	57.43	46.95	32.84	22.01	34.05	28.38	19.60	21.44	21.92	21.04	15.85
Chihuahua	33.61	36.32	36.38	36.96	31.78	34.64	34.44	34.95	32.00	36.23	36.51	37.52
Coahuila	202.88	177.32	240.85	257.49	216.99	192.41	257.08	274.07	209.40	188.02	251.49	268.19
Colima	27.13	31.94	30.00	31.17	23.87	27.74	24.80	24.85	22.41	25.62	23.87	23.66
Distrito Federal	25.35	26.27	24.83	24.32	19.08	20.30	18.91	18.29	18.27	19.64	18.58	18.00
Durango	8.76	10.33	9.91	11.08	9.45	11.11	10.63	12.54	10.56	12.11	11.08	13.80
Guanajuato	37.48	29.59	32.22	33.28	42.16	34.48	36.74	37.81	40.47	33.83	36.17	37.14
Guerrero	13.07	15.70	17.45	17.30	9.70	12.63	12.43	12.30	8.55	11.20	10.79	10.68
Hidalgo	20.49	23.33	21.55	23.08	24.89	25.48	22.67	23.56	25.84	26.09	23.37	23.93
Jalisco	37.37	35.16	34.27	35.74	35.69	34.38	33.53	34.71	32.09	31.54	30.88	31.82
México	23.60	22.37	24.34	23.06	25.30	24.01	26.32	25.05	24.40	23.40	25.69	24.50
Michoacán	15.68	19.86	15.68	17.24	18.90	23.78	15.29	18.01	18.76	23.20	14.89	17.57
Morelos	35.10	39.06	89.63	87.75	38.17	43.26	100.48	98.40	37.30	42.45	95.99	94.42
Nayarit	24.41	55.92	30.85	32.17	17.87	40.53	23.41	24.48	15.52	29.72	20.78	21.61
Nuevo León	37.57	42.13	42.91	42.45	40.68	45.45	47.11	46.96	41.80	46.69	48.44	48.35
Oaxaca	8.29	7.03	12.28	11.63	9.31	7.81	10.60	10.62	9.20	6.91	14.70	15.00
Puebla	54.51	56.25	69.20	59.18	53.57	55.13	66.53	57.36	47.52	49.73	65.70	57.14
Querétaro	32.07	27.04	30.63	30.63	38.67	32.07	37.13	37.11	38.47	32.50	37.71	37.61
Quintana Roo	21.95	24.81	22.82	23.08	21.28	25.34	23.15	23.45	20.41	24.33	22.09	22.42
San Luis Potosí	32.00	30.06	31.15	30.38	41.75	39.60	42.14	41.52	31.70	31.40	27.60	27.84
Sinaloa	22.03	26.58	24.24	24.47	23.03	28.29	24.12	24.12	22.43	27.32	23.12	23.06
Sonora	72.01	83.06	78.31	89.56	35.37	55.83	48.09	60.55	33.89	49.75	43.11	53.30
Tabasco	16.99	16.07	15.78	16.36	26.02	21.82	19.95	21.05	24.46	20.49	18.67	19.77
Tamaulipas	19.81	22.01	20.06	19.03	20.41	22.34	20.15	19.40	19.46	21.40	19.34	18.56
Tlaxcala	34.98	23.76	25.46	24.13	45.16	28.16	31.02	29.03	43.33	27.10	29.60	27.92
Veracruz	15.41	16.51	17.05	16.54	20.48	22.95	23.14	22.57	17.58	20.32	20.85	20.19
Yucatán	13.90	17.33	18.53	18.36	11.89	14.62	15.49	15.36	11.61	14.10	14.97	14.96
Zacatecas	18.83	21.48	22.11	20.96	23.90	23.00	37.77	34.24	31.40	30.17	76.19	67.70

Annex 1. Production Variances. Years: 2003, 2008, 2012 y 2013.
Source: Regional input-output models. Developed by the authors based on the methodology described in this document with information from INEGI (2003, 2008 and 2012 Input-Output Tables and statistics of the Gross Domestic Product of the Federal Entities).

	Δ% VQ			Δ% VQ TQ			Δ% VQ FD		
REGION	**2003-2008**	**2008-2012**	**2003-2012**	**2003-2008**	**2008-2012**	**2003-2012**	**2003-2008**	**2008-2012**	**2003-2012**
Nationall	-9.20%	9.65%	-2.24%	-11.05%	1.93%	-13.04%	1.85%	7.72%	10.80%
South	69.54%	9.57%	16.72%	-12.65%	-11.87%	43.22%	82.19%	21.43%	-26.49%
West	0.01%	-15.41%	-14.59%	-1.42%	-7.22%	-10.48%	1.42%	-8.19%	-4.11%
Northwest	1.06%	-10.42%	-11.92%	-8.05%	-7.01%	-16.96%	9.11%	-3.42%	5.04%
Northeast	9.79%	15.58%	23.59%	9.04%	1.00%	8.34%	0.76%	14.58%	15.25%
Southeast Gulf	24.94%	-0.61%	17.10%	15.77%	-2.41%	11.65%	9.16%	1.80%	5.45%
Center	173.63%	-58.93%	5.81%	169.15%	-64.65%	-4.11%	4.49%	5.73%	9.92%
Plateau	20.27%	93.37%	86.31%	27.35%	82.56%	58.94%	-7.08%	10.81%	27.37%
Aguascalientes	62.09%	3.08%	68.16%	14.92%	-6.86%	4.44%	47.17%	9.94%	63.72%
Baja California	-2.37%	-11.68%	-15.69%	-6.41%	-4.19%	-11.57%	4.04%	-7.49%	-4.12%
B.C. Sur	34.93%	-13.98%	13.51%	5.52%	-11.16%	-14.54%	29.41%	-2.82%	28.05%
Campeche	-8.74%	-12.26%	-19.45%	-0.63%	-2.76%	-4.44%	-8.11%	-9.49%	-15.01%
Chiapas	192.79%	-52.29%	3.80%	8.82%	-35.62%	5.70%	183.97%	-16.67%	-1.89%
Chihuahua	2.61%	3.99%	9.07%	-5.45%	4.57%	-5.02%	8.06%	-0.58%	14.10%
Coahuila	-5.65%	31.32%	23.21%	6.95%	-2.29%	3.11%	-12.60%	33.61%	20.10%
Colima	5.73%	-18.28%	-14.56%	-12.01%	-7.66%	-21.09%	17.74%	-10.62%	6.52%
Distrito Federal	-21.10%	-10.11%	-37.06%	-24.72%	-3.26%	-38.77%	3.62%	-6.86%	1.71%
Durango	25.85%	4.62%	22.00%	7.92%	8.99%	17.01%	17.93%	-4.38%	4.99%
Guanajuato	-8.56%	4.66%	-3.22%	12.49%	-1.89%	7.39%	-21.06%	6.55%	-10.61%
Guerrero	-5.74%	-12.95%	-26.78%	-25.78%	-11.33%	-52.99%	20.04%	-1.61%	26.21%
Hidalgo	35.40%	-8.64%	11.16%	21.52%	2.39%	20.73%	13.88%	-11.02%	-9.57%
Jalisco	-10.40%	-10.73%	-20.21%	-4.50%	-8.26%	-16.43%	-5.90%	-2.48%	-3.78%
México	2.01%	7.08%	8.58%	7.21%	-2.55%	3.28%	-5.20%	9.63%	5.30%
Michoacán	47.22%	-38.15%	-4.21%	20.57%	-2.43%	16.45%	26.65%	-35.72%	-20.66%
Morelos	20.01%	130.42%	163.26%	8.73%	-1.86%	5.89%	11.28%	132.28%	157.37%
Nayarit	102.24%	-68.90%	-23.44%	-26.79%	-26.67%	-57.27%	129.03%	-42.22%	33.83%
Nuevo León	20.42%	6.36%	26.00%	8.27%	2.71%	10.12%	12.15%	3.65%	15.89%
Oaxaca	-2.85%	24.21%	69.66%	12.33%	-11.53%	9.91%	-15.19%	35.74%	59.75%
Puebla	1.46%	10.91%	23.54%	-1.73%	-9.79%	-14.72%	3.19%	20.69%	38.26%
Querétaro	4.91%	17.15%	14.65%	20.58%	1.36%	16.63%	-15.67%	15.79%	-1.98%
Quintana Roo	10.01%	-12.65%	0.69%	-3.04%	-3.99%	-7.57%	13.05%	-8.66%	8.26%
San Luis Potosí	24.45%	-14.30%	-13.86%	30.50%	-20.71%	-0.93%	-6.05%	6.41%	-12.93%
Sinaloa	25.22%	-18.23%	4.88%	4.55%	-3.46%	1.77%	20.67%	-14.77%	3.10%
Sonora	-35.55%	-24.76%	-85.30%	-50.89%	-10.89%	-112.50%	15.34%	-13.87%	27.20%
Tabasco	47.65%	-14.69%	6.85%	53.10%	-6.11%	30.54%	-5.45%	-8.58%	-23.68%
Tamaulipas	14.18%	-14.04%	-2.42%	3.04%	-4.22%	-1.79%	11.14%	-9.82%	-0.63%
Tlaxcala	-2.94%	6.35%	-12.42%	29.13%	-3.79%	19.28%	-32.06%	10.14%	-31.69%
Veracruz	39.93%	-10.60%	30.95%	32.85%	-11.46%	12.33%	7.08%	0.86%	18.62%
Yucatán	10.30%	2.40%	9.23%	-14.41%	-3.55%	-19.70%	24.71%	5.95%	28.93%
Zacatecas	41.01%	95.47%	182.69%	26.94%	31.21%	40.02%	14.07%	64.26%	142.67%

Annex 2. Percentage changes in variances (**Δ%** VQ)) due to changes in final demand levels (**Δ%** VQ FD) and changes in trade quotients (**Δ%** VQ TQ). Periods: 2003-2008, 2008-2012, 2003-2012.
Source: Regional input-output models. Developed by the authors based on the methodology described in this document with information from INEGI (2003, 2008 and 2012 Input-Output Tables and statistics of the Gross Domestic Product of the Federal Entities)

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