# Generation and distribution of income in Mexico, 1990-2015

**Francisco Javier Ayvar Campos[1*], José César Lenin Navarro Chávez[1] y Víctor Manuel Giménez García [2]**

[1]Instituto de Investigaciones Económicas y Empresariales, Universidad Michoacana de San Nicolás de Hidalgo, Morelia, Michoacán (Mexico)
[2] Department of Business. Universitat Autònoma de Barcelona (Spain)

## Abstract

**Purpose** - The following article reviews the efficient use of economic and social resources to generate income, and at the same time reduce the concentration of wealth in the 32 states of the Mexican Republic during the period 2000-2010.

**Design/methodology/approach -** Human development in the entities of the country is characterized by low performance of the income factor. Therefore, it is necessary to develop mechanisms that will increase and improve income distribution. To diagnose the efficiency of Mexican entities the Data Envelopment Analysis (DEA) with the inclusion of a bad output was used and the Malmquist-Luenberger index to know its evolution.

**Findings -** Of the results, it is clear that only three of the 32 units studied were efficient in the generation and distribution of wealth, while the rest must increase their level of income and its distribution.

**Keywords:** Income, Human development, Concentration of wealth, Efficiency, Mexico.

* Corresponding author. Calle Santiago Tapia 403, Col. Centro, C.P. 58000, Morelia, Michoacán. Tel. +52 (443) 3 16 51 31, ext. 102. E-mail: fayvar@umich.mx

## 1. Introduction

In Mexico the Human Development Index (HDI) during the period 1990-2015 increased in 17.6%. However, this indicator of welfare is still lower than that of other Latin American economies; being one of the main causes the low level of *per capita* income in the economy (UNDP, 2018b). At the level of federal entities, Mexico City, Nuevo León, Chihuahua, Baja California, Sonora and Aguascalientes stand out as the states with the highest levels of human development. While Hidalgo, Michoacán, Chiapas, Oaxaca and Guerrero have the lowest HDI levels, thus, presenting a strong state and regional disparity in social welfare (UNDP, 2011, 2016). The dynamics of variables such as public expenditure, level of education and employed personnel, despite the positive trends throughout the study period, reveal the need for higher levels of investment, employment and education; since its impact on the income dimension of the national and state HDI has been low (INEGI, 2018a-h). In turn, the income concentration data in Mexico indicates that a significant percentage of the states have an asymmetric distribution of wealth, affecting negatively the level of welfare of the society (Tello, 2010; Quiroz & Salgado, 2016; Ortiz, Marroquín & Ríos, 2017). For this reason, it is relevant to establish as a research question, how efficient were the 32 entities of the Mexican Republic in the use of their economic and social resources to generate and distribute income, during the period 1990-2015. The results of this study allow to quantify the efficiency in the management of the resources during the analyzed period and, therefore, contribute to the design of strategies and policies that energize the behavior of the income dimension of the IDH.

Harttgen and Klasen (2012) conceive human development as the process that expands the opportunities of the persons for lives the life that they value and, therefore, reach a higher level of well-being. Understanding as opportunities the possibility to have a long and healthy life; being literate and possess knowledge; access to economic resources that allow a decent standard of living; and be involved in community life. If we don't own them, many other options and opportunities of life are inaccessible (UNDP, 2018a). Determining the level of human development of an economy is key to establish public policies; since it allows to evaluate the evolution of the living conditions of the population; diagnose the problems; and enrich the design of government objectives and strategies (López-Calva, Rodríguez-Chamussy & Székely, 2004).

In the measurement of human development highlights the HDI, proposed by the United Nations Development Program (UNDP). This index combines three elements to evaluate the progress of countries in terms of human development: the Gross Domestic Product (GDP) *per capita*, health and education; each one is included with the same weight in the index (Griffin, 2011; Harttgen & Klasen, 2012). It is due to its simplicity and easy access to the statistical information that is required for its calculation that the HDI has become the most used mechanism to measure human development and social welfare (León, 2002; Ordóñez, 2014). Under the vision of human development, and consequently of the HDI, the individual must be the center of the design of public policies, and at the same time the fundamental instrument of their own development (Griffin, 2011).

The distribution of income is the way in which the national product is distributed among those who have contributed to its production, grouping them into homogeneous categories according to the function exercised or according to the nature of the contribution made (Salinas, 1977; Medina, 2001). The concentration of income is caused by multiple factors. The way in which this asymmetry is measured is through inequality indices, which are measures that summarize the distribution of a variable among a set of individuals. Consequently, the inequality in the distribution of wealth is given by the degree of dispersion of income with respect to a reference value (Ruza, 1978; Carrillo & Vázquez, 2005; Ospina & Giraldo, 2005). The indicators of inequality are usually classified as positive and normative measures (Carrillo & Vázquez, 2005; Ospina & Giraldo, 2005; Mazaira, Becerra & Hernández, 2008). This research employs positive measures, since the normative depend on ethical judgments that are reflected in the values chosen for the parameters of the social welfare function (Acevedo, 1986). Of the divers positive inequality measures, this research uses the Gini Coefficient (Cg), because it allows a simple interpretation of the degree of income concentration and meets the four basic properties of an inequality indicator: is sensitive to the effect of socioeconomic factors of inequality, considers the influence of any social hierarchy on changes of the composition of the population, is consistent with the argument of the Lorenz curve, and shows invariance in the face of proportional increases in income (Gradín & del Rio, 2001; Medina, 2001; Yáñez, 2010).

The income dimension of human development apart of the GDP *per capita* includes other indicators such as the concentration of income to determine in a more inclusive way the economic well-being of society (Hicks, 1997; Alkire & Foster, 2011). Thus, it reaffirms the fact that there can be no economic well-being if the income generated by a society is not properly distributed among the population that generated it (Mazaira *et al.*, 2008; Yáñez, 2010). Hence, an excessive concentration of income can be considered as negative and, therefore, its decrease is recommended (Quiroz & Salgado, 2016). For it, is possible to point out that the variables that measure the concentration of income have a behavior similar to an unwanted output or bad output, while income itself would behave as a desired output, and whose improvement would increase its level.

Given that income generation involves the use of resources, it is important, prior to any manipulation of factors, to determine under which combination of socioeconomic inputs an economy is achieving the highest level of income *per capita* with the lowest concentration of it. In other words, it is relevant to analyze the efficiency in the generation of income. Several studies point the importance of the efficient use of resources to increase the economic well-being of an economy. Arguing that the welfare of society depends on the application of public policies aimed at the efficient use of resources and the promotion of greater equity in the distribution of wealth (Martić & Savić, 2001; Cortés, 2003; Stimson, Stough & Roberts, 2006; Vargas, 2009; Halkos & Tzeremes, 2010; Tello, 2010; Poveda, 2011; Torres & Rojas, 2015; Quiroz & Salgado, 2016; Ortiz *et al.*, 2017). Thus, the hypothesis of the research is that very few entities of the Mexican Republic were efficient in the usage of their economic and social resources to generate and distribute income, during the period 1990-2015. This has important repercussions on the economic and social well-being of the Mexican population.

For the analysis of the efficiency the literature offers different methodologies. Data Envelopment Analysis (DEA), developed initially by Charnes, Cooper and Rhodes (1978), is a methodology widely used as an alternative to parametric methods (Banker, Charnes & Cooper, 1984; Bemowski, 1991). In essence, DEA compares an observed production unit with a virtual unit, which obtains the same or more product with the same or lesser number of factors. However, unwanted outputs often are produced together with desirable results. In this sense, Pittman (1983) introduces unwanted outputs in the calculation of productivity indexes, adapting the methodology of Caves, Christensen and Diewert (1982), and determines the shadow prices of these. The result of this new approach allows to deduce an efficiency measure that, while maximizing the good outputs, minimizes the undesired outputs from a benchmarking process (Serra, 2004). Although the applications of DEA have been mostly in productive units, it is also applied in studies of quality of life, economic well-being, human development and social welfare (Mahlberg & Obersteiner, 2001; Despotis, 2005; Yago, Lafuente & Losa*,* 2010;

Giménez, Ayvar-Campos & Navarro-Chávez, 2017). Mariano, Sobreiro and Rebelatto (2015) perform an extensive review of the literature that use DEA for the analysis of human development. According to our knowledge, this work is the first that analyze the efficiency in the generation of income considering bad outputs from a temporal perspective. For it, the Malmquist-Luenberger index is used to measure changes in the efficiency, technological change and productivity over time, taking into consideration the undesirable outputs of the productive process (Chung, Färe & Grosskopf, 1997).

The research is structured in five sections, the first one analysis the socioeconomic aspects of economic well-being. In the second, the theoretical elements of human development and income distribution are addressed. In the third, the methodological features of the generation and distribution of income DEA model are presented. In the fourth, the main results of the DEA model are exposed, indicating the entities that efficiently used their resources. Finally, the conclusions are established, where the fundamental aspects of the research are highlighted.

## 2. **The income dimension of human development in the entities of Mexico**

The study of the dynamics of the income dimension of the HDI shows that, during the period 1990-2010, the highest income indices were held by the states of Nuevo León, Mexico City, Chihuahua, Campeche and Sonora. On the other hand, the entities with the lowest income indices were Chiapas, Oaxaca, Guerrero, Tlaxcala and Hidalgo, which is directly related to the behavior of the GDP *per capita* (UNDP, 2011, 2016). Table 1 a-d of the annex shows that GDP *per capita* had an increase of 58% during the period 1990-2015, as a result of increases in public spending and investment attraction policies. The states of the country with the highest GDP *per capita* levels are Campeche, Mexico City, Jalisco, Nuevo Leon, Queretaro, Quintana Roo and Tabasco.

[Insert Table 1 a-d]

The public spending had a major expansion from 33,938 million pesos in 1990 to 1,955,597 million pesos in 2015. The educational level of the society presented an increase of 45.5%, this is, in 1990 the average level of education was 6.3 years and in 2015 it was 9.1 years. The employed population grew 116%, excelling Mexico City, State of Mexico, Nuevo León, Jalisco, Puebla and Veracruz (see Table 1 a-d). The establishment of companies during this stage was incentivized since they went from 736,860 in 1990 to 5,654,014 in 2015, factor that had a direct impact on the generation of jobs and on the remunerations of the population. An element that also presented development was the Gross Capital Formation, being, the Foreign Direct Investment the variable that showed the highest growth during the years studied. Specifically, the states of Baja California, Chihuahua, Guanajuato, Jalisco, State of Mexico, Mexico City, Nuevo León, Puebla and Veracruz were the more benefited (INEGI, 2018a-h). Despite the positive behavior of these indicators, the low impact of the income dimension on the national and state HDI reflects the importance of increasing *per capita* income levels, since this would lead to higher levels of well-being in the entities of the country.

[Insert Table 2]

The concentration of income in Mexico decreased during the period 1990-2015, going from 0.519 in 1990 to 0.469 in 2015. When carrying out the analysis by states, it was observed that Baja California Sur, Tlaxcala, Colima, Baja California and State of Mexico presented the highest levels of income distribution, while Oaxaca, Guerrero, Hidalgo, Querétaro and Campeche were the ones that had the highest concentration of income. These results have as a background the poor performance of these last entities in terms of generation and distribution of GDP (see Table 2).

## 3. Methodology

The idea of Farrell (1957), who explains that to measure the efficiency of a set of productive units it´s necessary to know the function of production and the frontier of efficiency, has been applied empirically through two methodologies: stochastic frontiers estimation and DEA measurements. The first involves the use of econometrics and the second involves linear programming algorithms and benchmarking. DEA is a technique used to measure the comparative efficiency of homogeneous units. Starting from the inputs and outputs, this method provides a classification of the DMU (Decision Making Unit), giving them a relative efficiency score. A DMU is efficient when there is no other (or combination of them) that produces more output, without generating less of the rest, and without consuming more inputs. In this case we speak of an output-oriented model while in the opposite case it is called an input-oriented model. DEA models take advantage of the know-how of the DMUs and once determined who is efficient and who is not, set improvement goals for the inefficient, and based on the achievements of the efficient (Bemowski, 1991; Navarro & Torres, 2003; Serra, 2004). In our case, the model was oriented to the output because the ultimate goal of economic well-being is to maximize income and minimize the concentration of it.

Due to the existence of undesirable outputs, for the calculation of the annual efficiency levels, a model based on a directional distance function (DDF) was used (Färe, Grosskopf & Lovell, 1994), precisely with the objective to maximize income while minimizing the concentration of it, given the amount of available resources. The DDF models has been widely used in efficiency studies (Sueyoshi & Goto, 2010; Färe, Grosskopf, Noh & Weber, 2005; Watanabe & Tanaka, 2007). The mathematical expression of it is as follows:

$$
\begin{aligned}
& Max\ \beta \\
& s.t \\
& \sum_{k=1}^{K} \lambda_k y^t{}_{km} \geq y_m^{ot}(1+\beta) \quad m = 1 \ldots M \\
& \sum_{k=1}^{K} \lambda_k b^t{}_{kh} \leq b_h^{ot}(1-\beta) \quad h = 1 \ldots H \\
& \sum_{k=1}^{K} \lambda_k x^t{}_{kn} \leq x_n^{ot} \quad n = 1 \ldots N \\
& \beta \geq 0\ ;\ \lambda_k \geq 0 \quad k = 1 \ldots K
\end{aligned} \tag{1}
$$

where $\beta$ is the maximum increase and reduction achievable simultaneously in the good and bad outputs respectively. $y_{km}^t$ represents the output *m* of the unit *k* in the year t, $b_{kh}^t$ the bad output *h* of the unit or country *k* in the year t, and $x_{kn}^t$ the input *n* used by the country *k* in the year *t*. $y_m^{ot}$, $b_h^{ot}$, $x_{kn}^{ot}$ denote the observed levels of good and bad outputs and inputs for the country evaluated in the year *t*. The linear mathematic program (1) is solved for each unit analyzed.

For determined the evolution of efficiency and productivity over time, the Malmquist-Luenberger (ML) index is used, which has its origins in the Malmquist index (MI) (Caves *et al*., 1982; Chung *et al*., 1997). The MI can explain the change in the total productivity of the factors as a product of the efficiency change or catching up and technological change. Chung *et al.* (1997) modified the MI to apply it to the case of DDF. The new index called ML was decided to use in this investigation since undesirable variables were considered in the income dimension of the HDI. The mathematical expression of the index is as follows (Chung *et al.,* 1997):

$$ML^{t,t+1} = \left( \frac{\left(1 + D^{t}\left(x^{t}, y^{t}, b^{t}\right)\right)}{\left(1 + D^{t}\left(x^{t+1}, y^{t+1}, b^{t+1}\right)\right)} \times \frac{\left(1 + D^{t+1}\left(x^{t}, y^{t}, b^{t}\right)\right)}{\left(1 + D^{t+1}\left(x^{t+1}, y^{t+1}, b^{t+1}\right)\right)} \right)^{\frac{1}{2}} \tag{2}$$

where $D^{t}\left(x^{t}, y^{t}, b^{t}\right) = \max\left(\beta \mid \left(y^{t} + \beta g_{y}^{t}, b^{t} - \beta g_{b}^{t}\right) \in P\ (x^{t})\right)$ is the DDF defined for each unit analyzed taking its data for year *t* $\left(x^{t}, y^{t}, b^{t}\right)$ and as a reference the set of production possibilities for the same year $P\left(x^{t}\right)$. In an analogous way, it could be defined, for example, $D^{t+1}\left(x^{t}, y^{t}, b^{t}\right) = \max\left(\beta \mid \left(y^{t} + \beta g_{y}^{t}, b^{t} - \beta g_{b}^{t}\right) \in P\ (x^{t+1})\right)$. In this case, the DDF would take the data for year t $\left(x^{t}, y^{t}, b^{t}\right)$ for each unit analyzed and, as a reference, the set of production possibilities for year *t + 1*, that is, $P\left(x^{t+1}\right)$. In the latter case, the DDF is crossed in the sense that it uses the data of one year for the analyzed units and projects them on the production possibility frontier of a different year. A value of $ML^{t,t+1}$ greater than one would mean that there has been an improvement in productivity between years *t* and *t + 1*, while a value less than one would be interpreted in the opposite way. Any of the DDF needed for calculating the ML index can be calculated from (1).

The expression (2) can be decomposed, by simple algebraic manipulation, such as:

$$ML^{t,t+1} = MLEFF^{t,t+1}\ x\ MLTECH^{t,t+1} \tag{3}$$

Where:

$$MLEFF^{t,t+1} = \frac{1 + D^{t}\ (x^{t}, y^{t}, b^{t})}{1 + D^{t+1}(x^{t+1}, y^{t+1}, b^{t+1})} \tag{4}$$

represents the efficiency change or catch up, that is, if the unit analyzed has approached or moved away in the period with respect to the frontier. If it has been approximated, the expression (4) takes a value greater than one and less than one otherwise. While:

$$MLTECH^{t,t+1} = \left[\frac{[1+D^{t+1}(x^{t},y^{t},b^{t})]\ x\ [1+D^{t+1}(x^{t+1},y^{t+1},b^{t+1})]}{[1+D^{t}\ (x^{t},y^{t},b^{t})]\ x\ [1+D^{t}\ (x^{t+1},y^{t+1},b^{t+1})]}\right]^{1/2} \tag{5}$$

represents technological change, that is, if the frontier has improved or worsened over the period. In case of improvement (positive technological change), the expression (5) takes a value greater than one, and less than one otherwise.

For the application of the model to this empirical case, it was used as output the GDP *per capita* and as a bad output the concentration of the income, measured by the Cg, this due to the theoretical representativeness that has the level of income and the distribution of it to explain the economic well-being of a economy. The selection of inputs was based on the theoretical pillars that explain the behavior of the components of the HDI income dimension. In this sense, the postulates of the UNDP (2011, 2016, 2018a), Mahlberg and Obersteiner (2001), Arcelus, Sharma and Srinivasan (2006), Despotis (2005), Yago *et al.* (2010), Emrouznejad, Osman and Anouze (2010), Blancas and Domínguez-Serrano (2010), Jahanshahloo, Hosseinzadeh, Noora and Parchikolaei (2011), and Blancard and Hoarau (2011, 2013) were analyzed, arriving at the conclusion that the indicators that explain the behavior of the income dimension of human development are: the average annual change in the consumer price index, inequality index, exports, imports, foreign direct investment, total debt service, development assistance, public spending, electricity consumption *per capita*, proportion of the population that uses the internet, degree of schooling, economically active population, employed personnel, economic units, gross capital formation, remunerations and salary.

Given the availability of statistical information for the states of the Mexican Republic, the number of indicators was reduced. With these data, a statistical analysis was carried out determined fist a matrix of correlations. Subsequently, factorial analysis was carried out, which are very useful for depurate the correlation matrix. The factorial analysis, under the concept of main components, passed the tests of Kaiser-Meyer-Olkin (KMO), with values higher than 0.70, and the test of sphericity of Bartlett, with a high result and with a small level of significance. Due to the positive results in the tests, we proceeded with the factorial analysis and a matrix of communalities was obtained, which showed that the inputs that best explain the HDI income dimension are: Public Expenditure, Degree of Schooling and Employed Personnel (see Table 3 to 6).

[Insert Tables 3, 4, 5 and 6]

The statistical information of these variables was possible to obtain it through the databases of the Instituto Nacional de Estadística, Geografía e Informática de México, the Secretaría de Educación Pública de México, the Consejo Nacional de Población, the Consejo Nacional de Evaluación de la Política de Desarrollo Social, the Banco de México, and the Human Development Reports of UNDP.

## 4. **Analysis and discussion of results**

The states considered efficient in the use of their resources to generate income and at the same time reduce the concentration of income, during the period 1990-2015, were Baja California Sur, Campeche and Mexico City. On the other hand, Quintana Roo and Nuevo León stand out as entities that approach efficiency (see Table 7). These results are related to the endowment of factors that these states have and the level of life of their population. Specifically, it can be seen in Tables 1 and 2 that Baja California Sur, Campeche and Mexico City were characterized for occupying the first positions in terms of GDP *per capita*, Public Expenditure, Employed Personnel and Average Degree of Schooling; as well as having the lowest levels of income concentration. Behavior that directly affected the position that they occupied in the national ranking of HDI (UNDP, 2011, 2016, 2018b). Emphasizing with this the preponderant position that they occupy within the regional dynamics of Mexico, being the entities that historically stand out in the country for their socioeconomic dynamism (Garza & Schteingart, 2010; Tello, 2010; Quiroz & Salgado, 2016; Ortiz *et al.*, 2017). Thus, in this case, the efficient use of resources corresponds with the behavior of the main socioeconomic indicators and to the level of human development displayed by these entities during the study period.

[Insert Table 7]

The results of Table 7 also show that entities such as Oaxaca, Chiapas, Michoacán, Guerrero and Veracruz were the most inefficient in generating economic well-being. These states didn´t use efficiently their resources to increase their GDP *per capita* and at the same time reduce the concentration of income in the period 1990-2015. Performance that is linked to the allocation of public expenditure, employed personnel and average grade of schooling that in comparison these states have with other entities of the Mexican Republic (INEGI 2018a-h); since historically they have been characterized as being the most lagging in economic and social terms (Garza & Schteingart, 2010; Tello, 2010; Quiroz & Salgado, 2016; Ortiz *et al.*, 2017). Behavior that has been reflected in the health, education and income indicators of the HDI (UNDP, 2011, 2016, 2018b).

Table 8 shows that the entities rated as efficient in the generation of economic well-being (Baja California Sur, Campeche and Mexico City) didn´t have a similar performance in terms of productivity, during the period 1990-2015. In the case of Baja California Sur, Campeche and Mexico City the Malmquist-Luenberger (ML) index worsened. That is, these states, despite being efficient, didn´t present substantial improvements in the efficient use of their resources. In general, Table 8 shows that during the period 1990-2015, the 32 entities worsened the use of their resources to generate and distribute income. This deterioration is consistent with the low levels of economic well-being that place Mexico in the ranking of countries with medium degree of HDI (UNDP, 2018b).

These results show that the states of the country that received the most resources in the period 1990-2015 (Campeche, Jalisco, Nuevo Leon, Queretaro, Quintana Roo, Tabasco and Mexico City) were not always the most efficient in the generation and distribution of income. Similarly, it is observed that, despite the general increase in the efficient use of resources in the country, it is necessary to promote public policies that encourage this type of management and promote investment, employment and education in each of the entities of the Mexican Republic. This is because the efficient use of economic and social resources would generate economic well-being and, therefore, contribute to a higher level of human development in Mexico. Causal relationship that had already been exposed by authors such as Martić and Savić (2001), Arcelus *et al.* (2006), Stimson, Stough and Roberts (2006), Halkos and Tzeremes (2010), Emrouznejad *et al.* (2010), Blancas and Domínguez-Serrano (2010), Jahanshahloo *et al.* (2011), Blancard and Hoarau (2011, 2013) and Poveda (2011). Thus, the efficiency results of this study match with the theoretical arguments that indicate that the efficient use of resources contributes significantly to the human development of the countries (Mahlberg & Obersteiner, 2001;

Despotis, 2005; Yago *et al.*, 2010; Giménez *et al.*, 2017). As with the empirical evidence that highlights that the lack of economic growth and the presence of income concentration in Mexico; as a consequence of the cheapening of the labor force, the absence of employment for the trained personnel, the little social mobility, the deficient public services, and the absence of a social and labor policy that benefits the most disadvantaged social classes; perpetuate poverty and marginalization (Cortés, 2003; Vargas, 2009; Tello, 2010; Torres & Rojas, 2015; Quiroz & Salgado, 2016; Ortiz *et al.*, 2017).

**Conclusions**

Human development in Mexico as a goal of economic development models has been partial since, on one hand, it exists a positive evolution in terms of health and education, coupled with positive, but not sufficient, growth rates of employed personnel, public expenditure and GDP *per capita*. While, on other hand, there are important lags in social matters such as marginalization and concentration of income. In regional terms, there is an uneven development of the entities in Mexico. States such as Campeche, Jalisco, Nuevo Leon, Queretaro, Quintana Roo, Tabasco, Puebla and Mexico City have high levels of well-being. While, others like Oaxaca, Guerrero, Michoacán and Chiapas are distinguished by their economic backwardness.

Human development seeks to expand the capabilities of the human being, adding to the economic factor the health and education dimensions to have a holistic vision of social welfare. The concentration of income, understood as the unequal distribution of the product generated by a society among its members, is directly related to the concept of human development from the income dimension, since economic well-being is not only the generation of income it is also the way in which it is distributed among the population.

Based on the DEA methodology, it was determined how efficient were Mexican entities in the use of the resources to generate income and at the same time reduce the concentration of it during the period 1990-2015. The model was elaborated with constant returns to scale, oriented to the output and including a bad output. The outputs of the model was the GDP *per capita*, the bad output the concentration of income and the inputs were the public spending, the degree of schooling and the personnel employed.

Oaxaca, Chiapas, Michoacán, Guerrero and Veracruz were the most inefficient entities in the generation of economic well-being. While, Baja California Sur, Campeche and Mexico City had the highest efficiencies, that is, with the resources they possess were efficient in the generation of income and in the reduction of the concentration of it. The Malmquist-Luenberger Index in this case reflected that all the states presented a negative evolution in their efficiency and productivity over the period studied.

The results obtained in this study show that the states that received the most economic resources (Campeche, Jalisco, Nuevo León, Querétaro, Quintana Roo, Tabasco and Mexico City) were not always the most efficient in the generation and distribution of income. Making evident the need for a more adequate use of resources, through the establishment of public policies focused by entity for the promotion of investment, employment, education and the reduction of inequity.

## References


Acevedo, M. (1986). La pobreza en Colombia: una medida estadística. *El Trimestre Económico 53*(2): 315-340.

Alkire, S. and J. Foster. (2011). Counting and multidimensional poverty measurement. *Journal of Public Economics 95*(7-8): 476-487.

Arcelus, F., Sharma, B. and Srinivasan, G. (2006). The human development index adjusted for efficient resource utilization. In UNU-WIDER (ed.), *Inequality, poverty and well-being,* (177-193). Finland: Palgrave Macmillan UK.

Banker, R., Charnes, A. and Cooper, W. (1984). Some models for estimating technical and scale inefficiencies in data envelopment analysis. *Management Science 30*(9): 1078-1092.

Banco de México (BANXICO) (2018). Índice nacional de precios al consumidor y sus componentes mensuales. http://www.banxico.org.mx/SieInternet/consultarDirectorioInternetAction.do?sector=8&accion=consultarCuadro&idCuadro=CP154&locale=es (March 26, 2018).

Banco Mundial (2018). Indicadores del desarrollo mundial. http://databank.bancomundial.org/data/reports.aspx?source=2&series=NE.EXP.GNFS.ZS&country= (March 26, 2018).

Bemowski, K. (1991). The benchmarking bandwagon. *Quality Progress 24*(1): 19-24.

Blancard, S. and Hoarau, J. F. (2011). Optimizing the new formulation of the United Nations human development index: an empirical view from data envelopment analysis. *Economics Bulletin 31*(1): 989-1003.

Blancard, S. and Hoarau, J. F. (2013). A new sustainable human development indicator for small island developing states: a reappraisal from data envelopment analysis. *Economic Modelling 30*: 623-635.

Blancas, F. J. and Domínguez-Serrano, M. (2010). Un indicador sintético DEA para la medición de bienestar desde una perspectiva de género. *Revista Investigación Operacional*, *31*(3): 225-239.

Carrillo, M. and Vázquez, H. (2005). Desigualdad y polarización en la distribución del ingreso salarial en México. Problemas del desarrollo. *Revista Latinoamericana de Economía 36*(141): 109-130.

Caves, D., Christensen L. and Diewert, E. (1982). The economic theory of index numbers and the measurement of input, output, and productivity. *Econometrica 1*(50): 1393-1414.

Charnes, A., Cooper, W. and Rhodes, E. (1978). Measuring efficiency of decision making units. *European Journal of Operational Research 2*(6): 429-444.

Chung, Y., Färe, R. and Grosskopf, S. (1997). Productivity and undesirable outputs: a directional distance function approach. *Journal of Environmental Management 51*(3): 229-240.

Consejo Nacional de Evaluación de la Política de Desarrollo Social (CONEVAL) (2018a). Evolución de las dimensiones de la pobreza 1990-2012. https://www.coneval.org.mx/Medicion/Paginas/Evolucion-de-las-dimensiones-de-la-pobreza-1990-2010-.aspx (Jun 9, 2018).

CONEVAL (2018b). Medición de la pobreza. https://www.coneval.org.mx/Medicion/MP/Paginas/AE_pobreza_2016.aspx (Jun 9, 2018).

Cortés, F. (2003). El ingreso y la desigualdad en su distribución. México: 1970-2000. *Papeles de Población, 9*(35): 137-152.

Despotis, D. (2005). A reassessment of the human development index via data envelopment analysis. *Journal of the Operational Research Society 56*: 969-980.

Emrouznejad, A., Osman, I. and Anouze, A. (2010). Performance management and measurement with data envelopment analysis. Proceedings of the 8th International Conference of DEA, Lebanon: American University of Beirut.

Färe, R., Grosskopf, S. and Lovell, C. A. K. (1994). *Production frontiers.* Cambridge University Press.

Färe, R., Grosskopf, S., Noh, D. and Weber, W. (2005). Characteristics of a polluting technology: theory and practice. *Journal of Econometrics 126*(2): 469-492.

Farrell, M. (1957). The measurement of productive efficiency. *Journal of the Royal Statistical Society 120*(3): 253-290.

Garza, G. and Schteingart, M. (2010). *Los grandes problemas de México. Desarrollo urbano y regional* (1a ed.). México: El Colegio de México.

Giménez, V., Ayvar-Campos, F. and Navarro-Chávez, J. C. L. (2017). Efficiency in the generation of social welfare in Mexico: a proposal in the presence of bad outputs. *Omega 69*: 43-52.

Gradín, C. and del Río C. (2001). *Desigualdad, pobreza y polarización en la distribución de la renta en Galicia*. Spain: Instituto de Estudios Económicos de Galicia.

Griffin, K. (2011). Desarrollo humano: origen, evolución e impacto, coordinated by P. Ibarra y K. Unceta, Ensayos sobre el desarrollo humano, 25-40. Spain: Icaria.

Halkos, G. and Tzeremes, N. G. (2010). Measuring regional economic efficiency: the case of Greek prefectures. *The Annals of Regional Science, 45*(3): 603-632.

Harttgen, K. and Klasen, S. (2012). Household-based human development index. *World Development 40*(5): 878-899.

Hicks, D. (1997). The inequality-adjusted human development index: a constructive proposal. *World Development 25*(8): 1283-1298.

Instituto Nacional de Estadística y Geografía (INEGI) (2018a). Banco de Información Económica. http://www.inegi.org.mx/sistemas/bie/ (March 26, 2018).

INEGI (2018b). Censos y conteos de población y vivienda. http://www.inegi.org.mx/est/contenidos/Proyectos/ccpv/default.aspx (March 26, 2018).

INEGI (2018c). Encuesta intercensal 2015. http://www.beta.inegi.org.mx/proyectos/enchogares/especiales/intercensal/default.html (March 26, 2018).

INEGI (2018d). Ingresos y egresos públicos. http://www.inegi.org.mx/sistemas/olap/Proyectos/bd/continuas/finanzaspublicas/FPEst.asp?s=est&c=11288&proy=efipem_fest (March 26, 2018).

INEGI (2018e). Ingresos y egresos públicos. http://www.inegi.org.mx/sistemas/olap/Proyectos/bd/continuas/finanzaspublicas/FinanzasEstDF.asp?s=est&c=11290&proy=efipem_festdf (March 26, 2018).

INEGI (2018f). Población ocupada. http://www.inegi.org.mx/est/lista_cubos/consulta.aspx?p=encue&c=4 (March 26, 2018).

INEGI (2018g). Grado promedio de escolaridad de la población de 15 años y más años por entidad federativa según sexo. http://www.beta.inegi.org.mx/temas/educacion/ (March 26, 2018).

INEGI (2018h). Establecimientos. http://www.beta.inegi.org.mx/proyectos/ce/2014/ (March 26, 2018).

Jahanshahloo, G. R., Hosseinzadeh, L., Noora, A. and Parchikolaei, B. (2011). Measuring human development index based on Malmquist productivity index. *Applied Mathematical Sciences 5*(62): 3057-3064.

León, M. (2002). Desarrollo humano y desigualdad en el Ecuador. *Gestión, 102*: 1-7.

López-Calva, L., Rodríguez-Chamussy, L. and Székely, M. (2004). Medición del desarrollo humano en México. Estudios sobre Desarrollo Humano 2003-6. http://sic.conaculta.gob.mx/documentos/1006.pdf (July 13, 2017).

Mahlberg, D. and Obersteiner, M. (2001). Remeasuring the HDI by data envelopment analysis. Interim Report IR-01-069. Austria: International Institute for Applied Systems Analysis (IIASA). http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1999372 (July 13, 2017).

Mariano, E. B., Sobreiro, V. A. and Rebelatto, D. A. N. (2015). Human development and data envelopment analysis: a structured literature review. *Omega, 54*: 33-49.

Martić, M. and Savić, G. (2001). An application of DEA for comparative analysis and ranking of regions in Serbia with regards to social-economic development. *European Journal of Operational Research, 132*(2): 343-356.

Mazaira, Z., Becerra, F. and Hernández, I. (2008). Bienestar social y desigualdad del ingreso: diferentes enfoques para su medición. *Revista OIDLES 2*(5). http://www.eumed.net/rev/oidles/05/rlh.htm (July 13, 2017).

Medina, F. (2001). Consideraciones sobre el índice de Gini para medir la concentración del ingreso. Estudios estadísticos y prospectivos. Chile: CEPAL. http://repositorio.cepal.org/bitstream/handle/11362/4788/S01020119_es.pdf?sequence=1 (July 13, 2017).

Navarro, J. and Torres, Z. (2003). La evaluación de la frontera de eficiencia en el sector eléctrico: un análisis de la frontera de datos (DEA). *Ciencia Nicolaita 35*: 39-58.

Ordóñez, J. A. (2014). Teorías del desarrollo y el papel del Estado. Desarrollo humano y bienestar, propuesta de un indicador complementario al Índice de Desarrollo Humano en México. *Política y Gobierno, 21*(2), 409-441.

Ortiz, J., Marroquín, J. and Ríos, H. (2017). Factores macroeconómicos vinculados a la pobreza en México. *Análisis Económico*, 22(79): 26-51.

Ospina, R. and Giraldo, O. (2005). Aproximación a los conceptos de pobreza y distribución del ingreso. *Semestre Económico 8*(15): 47-61.

Pittman, R. (1983). Multilateral productivity comparisons with undesirable outputs. *The Economic Journal 93*: 883-891.

Poveda, A. C. (2011). Economic development and growth in Colombia: an empirical analysis with super-efficiency DEA and panel data models. *Socio-Economic Planning Sciences, 45*(4): 154-164.

Quiroz, S. and Salgado, M. C. (2016). La desigualdad en México por entidad federativa. Un análisis del índice de Gini: 1990-2014. *Tiempo Económico, 11*(32): 57-80.

Ruza, J. (1978). Génesis y evolución histórica de la teoría de la distribución funcional de la renta. *Revista de Economía Política 80*: 187-206.

Salinas, J. (1977). La estructura de la distribución del ingreso como obstáculo al desarrollo económico de América Latina. *Revista de Economía Política 75*: 81-132.

Serra, D. (2004). *Métodos cuantitativos para la toma de decisiones*. España: Ediciones Gestión 2000.

Secretaría de Educación Pública (SEP) 2018. Sistema de indicadores y pronóstico. http://www.sep.gob.mx/es/sep1/sep1_Estadisticas (March 26, 2018).

Stimson, R. J., Stough, R. R. and Roberts, B. H. (2006). *Regional economic development: analysis and planning strategy*. Springer.

Sueyoshi, T. and Goto, M. (2010). Should the US clean air act include CO2 emission control? Examination by data envelopment analysis. *Energy Policy 38*(10): 5902-5911.

Tello, C. (2010). Estancamiento económico, desigualdad y pobreza: 1982-2009. *Economía UNAM, 7*(19): 5-44.

Torres, F. and Rojas, A. (2015). Política económica y política social en México: desequilibrio y saldos. *Revista Problemas del Desarrollo, 182*(46):41-65.

United Nations Development Programme (UNDP) (2011). Informe sobre desarrollo humano, México 2011. http://hdr.undp.org/sites/default/files/nhdr_mexico_2011.pdf (July 13, 2017).

UNDP (2016). Informe sobre desarrollo humano, México 2016. http://www.mx.undp.org/content/dam/mexico/docs/Publicaciones/PublicacionesReduccionPobreza/InformesDesarrolloHumano/idhmovilidadsocial2016/PNUD%20IDH2016.pdf (January 30, 2018).

UNDP (2018a). Desarrollo humano. Concepto. http://desarrollohumano.org.gt/desarrollo-humano/concepto/ (January 30, 2018).

UNDP (2018b). Human development trends by indicator. http://hdr.undp.org/en/data (January 30, 2018).

Vargas, C. O. (2009). Veinte años de estancamiento en la distribución del ingreso de las familias mexicanas. Un enfoque de microdatos. *Ensayos Revista de Economía, 28*(1): 81-106.

Watanabe, M. and Tanaka, K. (2007). Efficiency analysis of Chinese industry: a directional distance function approach. *Energy Policy 35*(12): 6323-6331.

Yago, M., Lafuente, M. and Losa, A. (2010). Una aplicación del análisis envolvente de datos a la evaluación del desarrollo. El caso de las entidades federativas de México, coordinated by L. Aceves, J. Estay, P. Noguera y E. Sánchez, Realidades y Debates sobre el Desarrollo, 119-142. Spain: Universidad de Murcia.

Yáñez, J. (2010). *La distribución del ingreso en México 1984-2008: una evaluación de la hipótesis de Kunznets*. Spain: Universidad Autónoma de Barcelona. http://www.ecap.uab.es/secretaria/docrecerca/jyanez.pdf (July 13, 2017).

## Tables

| TABLE 1 a | | | | | | |
|---|---|---|---|---|---|---|
| **DATA OF THE INCOME FACTOR IN MEXICO, 1990 - 2015** | | | | | | |
| **GDP per capita** | | | | | | |
| **(Pesos)** | | | | | | |
| **State** | **1990** | **1995** | **2000** | **2005** | **2010** | **2015** |
| Aguascalientes | 7,272 | 9,145 | 11,724 | 14,270 | 17,368 | 14,332 |
| Baja California | 8,612 | 10,825 | 13,053 | 15,492 | 17,445 | 14,972 |
| Baja California Sur | 10,744 | 10,256 | 11,412 | 14,864 | 14,823 | 17,201 |
| Campeche | 10,571 | 15,308 | 15,477 | 20,276 | 20,819 | 41,776 |
| Chiapas | 3,641 | 3,566 | 3,717 | 4,760 | 4,585 | 5,043 |
| Chihuahua | 9,253 | 10,677 | 13,437 | 17,149 | 21,009 | 14,125 |
| Colima | 8,990 | 7,683 | 9,013 | 11,668 | 12,433 | 12,355 |
| Ciudad de México | 19,999 | 19,291 | 23,400 | 30,911 | 34,413 | 28,689 |
| Coahuila | 7,319 | 11,004 | 12,159 | 16,377 | 17,306 | 18,356 |
| Durango | 6,211 | 6,528 | 7,425 | 10,833 | 10,907 | 10,419 |
| Estado de México | 7,209 | 6,150 | 6,895 | 8,557 | 9,453 | 8,289 |
| Guanajuato | 5,453 | 5,473 | 6,577 | 8,671 | 9,311 | 10,727 |
| Guerrero | 4,990 | 4,386 | 4,994 | 6,574 | 5,942 | 6,090 |
| Hidalgo | 6,285 | 4,519 | 5,216 | 6,929 | 6,611 | 8,562 |
| Jalisco | 8,633 | 7,497 | 9,120 | 11,581 | 11,612 | 13,338 |
| Michoacán | 4,248 | 4,358 | 4,996 | 6,649 | 7,121 | 7,823 |
| Morelos | 9,411 | 6,706 | 7,676 | 10,811 | 9,074 | 9,015 |
| Nayarit | 6,457 | 4,495 | 5,146 | 7,014 | 8,578 | 9,028 |
| Nuevo León | 12,677 | 13,449 | 16,522 | 22,185 | 23,730 | 22,112 |
| Oaxaca | 3,756 | 3,593 | 3,856 | 5,420 | 5,614 | 6,260 |
| Puebla | 4,933 | 5,177 | 6,626 | 8,459 | 9,387 | 8,133 |
| Querétaro | 6,743 | 9,208 | 11,035 | 13,878 | 15,690 | 16,872 |
| Quintana Roo | 18,111 | 12,516 | 14,313 | 17,913 | 15,093 | 15,231 |
| San Luis Potosí | 5,583 | 5,883 | 6,696 | 9,532 | 11,641 | 11,598 |
| Sinaloa | 7,988 | 6,116 | 6,833 | 9,184 | 9,040 | 11,211 |
| Sonora | 7,728 | 10,004 | 10,789 | 14,237 | 17,607 | 17,580 |
| Tabasco | 5,461 | 5,311 | 5,718 | 7,938 | 8,244 | 16,639 |
| Tamaulipas | 7,161 | 8,491 | 10,060 | 13,840 | 12,181 | 13,540 |
| Tlaxcala | 4,310 | 4,116 | 4,943 | 6,223 | 6,034 | 7,086 |
| Veracruz | 4,390 | 5,093 | 5,150 | 7,366 | 8,343 | 8,982 |
| Yucatán | 6,662 | 5,740 | 7,494 | 9,854 | 9,644 | 10,334 |
| Zacatecas | 4,120 | 4,559 | 4,755 | 6,610 | 7,799 | 9,172 |
| Source: Own elaboration based on the INEGI (2018a-h), Banxico (2018), Banco Mundial (2018) and SEP (2018). | | | | | | |

| TABLE 1 b | | | | | | |
|---|---|---|---|---|---|---|
| **DATA OF THE INCOME FACTOR IN MEXICO, 1990 - 2015** | | | | | | |
| **Public spending** | | | | | | |
| **(Millions of Pesos)** | | | | | | |
| **State** | **1990** | **1995** | **2000** | **2005** | **2010** | **2015** |
| Aguascalientes | 268 | 1,126 | 4,634 | 8,403 | 13,441 | 22,524 |
| Baja California | 1,907 | 5,106 | 21,843 | 20,764 | 30,537 | 42,143 |
| Baja California Sur | 161 | 776 | 3,161 | 5,868 | 9,556 | 16,305 |
| Campeche | 276 | 1,727 | 6,082 | 10,186 | 15,138 | 23,169 |
| Chiapas | 944 | 4,927 | 18,554 | 34,424 | 57,418 | 87,811 |
| Chihuahua | 791 | 4,223 | 14,518 | 26,563 | 44,555 | 66,599 |
| Colima | 204 | 840 | 3,326 | 5,746 | 8,827 | 16,665 |
| Ciudad de México | 7,707 | 17,991 | 56,676 | 79,624 | 130,541 | 210,845 |
| Coahuila | 552 | 3,252 | 10,867 | 19,859 | 38,234 | 44,812 |
| Durango | 328 | 942 | 7,327 | 11,706 | 25,024 | 33,969 |
| Estado de México | 2,316 | 13,185 | 41,977 | 88,876 | 171,651 | 246,145 |
| Guanajuato | 718 | 3,676 | 15,484 | 28,192 | 48,465 | 81,367 |
| Guerrero | 602 | 1,691 | 14,382 | 23,673 | 39,798 | 55,580 |
| Hidalgo | 320 | 2,309 | 9,324 | 17,806 | 27,397 | 46,139 |
| Jalisco | 2,976 | 11,452 | 25,587 | 44,201 | 73,161 | 96,809 |
| Michoacán | 558 | 3,525 | 15,443 | 27,409 | 48,321 | 62,741 |
| Morelos | 378 | 1,389 | 6,793 | 11,724 | 19,544 | 28,242 |
| Nayarit | 272 | 1,309 | 5,596 | 8,920 | 16,517 | 21,198 |
| Nuevo León | 3,325 | 9,149 | 21,315 | 34,393 | 59,417 | 86,631 |
| Oaxaca | 1,495 | 7,631 | 14,733 | 25,974 | 51,711 | 70,202 |
| Puebla | 671 | 4,298 | 19,301 | 31,532 | 54,491 | 84,600 |
| Querétaro | 299 | 2,221 | 6,823 | 12,398 | 20,841 | 30,789 |
| Quintana Roo | 212 | 1,021 | 5,105 | 10,176 | 23,018 | 31,485 |
| San Luis Potosí | 367 | 2,356 | 9,761 | 18,318 | 27,761 | 42,795 |
| Sinaloa | 679 | 3,128 | 10,654 | 18,249 | 35,340 | 47,721 |
| Sonora | 981 | 3,464 | 11,631 | 21,530 | 44,105 | 57,500 |
| Tabasco | 1,256 | 3,423 | 14,023 | 28,068 | 35,013 | 47,262 |
| Tamaulipas | 766 | 3,302 | 13,517 | 22,976 | 43,696 | 52,599 |
| Tlaxcala | 292 | 681 | 4,820 | 7,689 | 16,458 | 21,523 |
| Veracruz | 1,664 | 6,368 | 28,088 | 47,807 | 98,322 | 114,417 |
| Yucatán | 337 | 1,080 | 3,617 | 12,846 | 21,768 | 34,548 |
| Zacatecas | 314 | 1,459 | 6,310 | 11,241 | 24,748 | 30,462 |
| Source: Own elaboration based on the INEGI (2018a-h), Banxico (2018), Banco Mundial (2018) and SEP (2018). | | | | | | |

| TABLE 1 c | | | | | | |
|---|---|---|---|---|---|---|
| **DATA OF THE INCOME FACTOR IN MEXICO, 1990 - 2015** | | | | | | |
| **Degree of schooling** | | | | | | |
| **(Years)** | | | | | | |
| **State** | **1990** | **1995** | **2000** | **2005** | **2010** | **2015** |
| Aguascalientes | 6.7 | 7.3 | 7.9 | 8.7 | 9.46 | 9.7 |
| Baja California | 7.5 | 7.9 | 8.2 | 8.9 | 9.54 | 9.8 |
| Baja California Sur | 7.4 | 7.9 | 8.4 | 8.9 | 9.69 | 9.9 |
| Campeche | 5.8 | 6.5 | 7.2 | 7.9 | 8.53 | 9.1 |
| Chiapas | 4.2 | 4.8 | 5.6 | 6.1 | 6.73 | 7.3 |
| Chihuahua | 6.8 | 7.3 | 7.8 | 8.3 | 9.01 | 9.5 |
| Colima | 6.6 | 7.1 | 7.7 | 8.4 | 9.12 | 9.5 |
| Ciudad de México | 8.8 | 9.2 | 9.7 | 10.2 | 10.81 | 11.1 |
| Coahuila | 7.3 | 7.8 | 8.5 | 9 | 9.79 | 9.9 |
| Durango | 6.2 | 6.8 | 7.4 | 8 | 8.74 | 9.1 |
| Estado de México | 7.1 | 7.6 | 8.2 | 8.7 | 9.48 | 9.5 |
| Guanajuato | 5.2 | 5.8 | 6.4 | 7.2 | 7.9 | 8.4 |
| Guerrero | 5 | 5.6 | 6.3 | 6.8 | 7.55 | 7.8 |
| Hidalgo | 5.5 | 6 | 6.7 | 7.4 | 8.21 | 8.7 |
| Jalisco | 6.5 | 7 | 7.6 | 8.2 | 8.98 | 9.2 |
| Michoacán | 5.2 | 5.8 | 6.4 | 6.9 | 7.62 | 7.9 |
| Morelos | 6.8 | 7.3 | 7.8 | 8.4 | 9.17 | 9.3 |
| Nayarit | 6.1 | 6.7 | 7.3 | 8 | 8.72 | 9.2 |
| Nuevo León | 8 | 8.4 | 8.9 | 9.5 | 10.17 | 10.3 |
| Oaxaca | 4.5 | 5.1 | 5.8 | 6.4 | 7.08 | 7.5 |
| Puebla | 5.6 | 6.2 | 6.9 | 7.4 | 8.14 | 8.5 |
| Querétaro | 6.1 | 6.8 | 7.7 | 8.3 | 9.26 | 9.6 |
| Quintana Roo | 6.3 | 7.1 | 7.9 | 8.5 | 9.3 | 9.6 |
| San Luis Potosí | 5.8 | 6.4 | 7 | 7.7 | 8.51 | 8.8 |
| Sinaloa | 6.7 | 7.1 | 7.6 | 8.5 | 9.28 | 9.6 |
| Sonora | 7.3 | 7.8 | 8.2 | 8.9 | 9.6 | 10 |
| Tabasco | 5.9 | 6.5 | 7.2 | 8 | 8.78 | 9.3 |
| Tamaulipas | 7 | 7.5 | 8.1 | 8.7 | 9.48 | 9.5 |
| Tlaxcala | 6.5 | 7.1 | 7.7 | 8.3 | 9.13 | 9.3 |
| Veracruz | 5.5 | 6 | 6.6 | 7.2 | 7.84 | 8.2 |
| Yucatán | 5.7 | 6.3 | 6.9 | 7.6 | 8.26 | 8.8 |
| Zacatecas | 5.4 | 5.9 | 6.5 | 7.2 | 7.89 | 8.6 |
| Source: Own elaboration based on the INEGI (2018a-h), Banxico (2018), Banco Mundial (2018) and SEP (2018). | | | | | | |

| TABLE 1 d | | | | | | |
|---|---|---|---|---|---|---|
| **DATA OF THE INCOME FACTOR IN MEXICO, 1990 - 2015** | | | | | | |
| **Employed Personnel** | | | | | | |
| **(Persons)** | | | | | | |
| **State** | **1990** | **1995** | **2000** | **2005** | **2010** | **2015** |
| Aguascalientes | 212,365 | 292,184 | 331,083 | 406,782 | 460,428 | 518,514 |
| Baja California | 565,471 | 785,060 | 906,369 | 1,181,866 | 1,318,160 | 1,512,261 |
| Baja California Sur | 102,763 | 142,847 | 169,014 | 225,302 | 258,651 | 357,412 |
| Campeche | 149,983 | 214,141 | 243,323 | 326,946 | 345,981 | 394,634 |
| Chiapas | 854,159 | 1,101,341 | 1,206,621 | 1,552,418 | 1,722,617 | 1,898,952 |
| Chihuahua | 773,100 | 1,041,766 | 1,117,747 | 1,328,974 | 1,276,383 | 1,539,769 |
| Colima | 133,474 | 178,907 | 199,692 | 256,986 | 289,025 | 340,008 |
| Ciudad de México | 2,884,807 | 3,449,206 | 3,582,781 | 3,957,832 | 3,985,184 | 4,147,971 |
| Coahuila | 586,165 | 724,729 | 822,686 | 965,240 | 1,040,436 | 1,247,782 |
| Durango | 347,275 | 402,351 | 443,611 | 556,402 | 576,977 | 724,360 |
| Estado de México | 2,860,976 | 3,908,623 | 4,462,361 | 5,553,048 | 6,195,622 | 7,065,112 |
| Guanajuato | 1,030,160 | 1,304,041 | 1,460,194 | 1,887,033 | 1,961,002 | 2,381,939 |
| Guerrero | 611,755 | 776,577 | 888,078 | 1,164,045 | 1,301,453 | 1,390,303 |
| Hidalgo | 493,315 | 690,874 | 728,726 | 926,353 | 932,139 | 1,208,638 |
| Jalisco | 1,553,202 | 2,180,447 | 2,362,396 | 2,870,720 | 3,073,650 | 3,424,781 |
| Michoacán | 891,873 | 1,105,816 | 1,226,606 | 1,595,979 | 1,602,495 | 1,903,548 |
| Morelos | 348,357 | 504,109 | 550,831 | 663,781 | 719,727 | 778,745 |
| Nayarit | 233,000 | 286,693 | 318,837 | 408,313 | 430,055 | 544,513 |
| Nuevo León | 1,009,584 | 1,317,418 | 1,477,687 | 1,832,395 | 1,975,245 | 2,225,108 |
| Oaxaca | 754,305 | 955,626 | 1,066,558 | 1,408,055 | 1,450,587 | 1,621,204 |
| Puebla | 1,084,316 | 1,446,039 | 1,665,521 | 2,161,852 | 2,358,045 | 2,564,998 |
| Querétaro | 288,994 | 428,651 | 479,980 | 651,557 | 683,693 | 766,182 |
| Quintana Roo | 163,190 | 259,071 | 348,750 | 518,040 | 655,226 | 738,156 |
| San Luis Potosí | 529,016 | 616,679 | 715,731 | 935,462 | 979,539 | 1,116,158 |
| Sinaloa | 660,905 | 818,932 | 880,295 | 1,139,861 | 1,110,501 | 1,290,410 |
| Sonora | 562,386 | 751,405 | 810,424 | 957,211 | 972,978 | 1,309,197 |
| Tabasco | 393,434 | 546,794 | 600,310 | 731,237 | 762,850 | 907,599 |
| Tamaulipas | 684,550 | 903,894 | 1,013,220 | 1,271,428 | 1,308,505 | 1,491,450 |
| Tlaxcala | 196,609 | 290,914 | 328,585 | 430,958 | 439,084 | 531,163 |
| Veracruz | 1,742,129 | 2,145,521 | 2,350,117 | 2,701,735 | 2,852,644 | 3,092,678 |
| Yucatán | 407,337 | 531,197 | 618,448 | 788,841 | 899,766 | 977,644 |
| Zacatecas | 294,458 | 267,925 | 353,628 | 524,128 | 541,914 | 600,148 |
| Source: Own elaboration based on the INEGI (2018a-h), Banxico (2018), Banco Mundial (2018) and SEP (2018). | | | | | | |

| TABLE 2 | | | | | | |
|---|---|---|---|---|---|---|
| **THE COEFFICIENT OF GINI IN MEXICO, 1990 -2015** | | | | | | |
| **Sate** | **1990** | **1995** | **2000** | **2005** | **2010** | **2015** |
| **National** | 0.519 | 0.518 | 0.516 | 0.499 | 0.482 | 0.469 |
| Aguascalientes | 0.488 | 0.471 | 0.454 | 0.481 | 0.507 | 0.451 |
| Baja California | 0.476 | 0.461 | 0.446 | 0.476 | 0.506 | 0.432 |
| Baja California Sur | 0.458 | 0.475 | 0.493 | 0.489 | 0.485 | 0.447 |
| Campeche | 0.504 | 0.512 | 0.520 | 0.517 | 0.514 | 0.484 |
| Chiapas | 0.543 | 0.542 | 0.542 | 0.541 | 0.541 | 0.512 |
| Chihuahua | 0.509 | 0.508 | 0.507 | 0.490 | 0.473 | 0.465 |
| Colima | 0.536 | 0.520 | 0.505 | 0.511 | 0.517 | 0.507 |
| Ciudad de México | 0.510 | 0.487 | 0.465 | 0.470 | 0.476 | 0.460 |
| Coahuila | 0.500 | 0.506 | 0.511 | 0.465 | 0.420 | 0.440 |
| Durango | 0.486 | 0.482 | 0.478 | 0.474 | 0.470 | 0.431 |
| Estado de México | 0.520 | 0.509 | 0.498 | 0.483 | 0.468 | 0.438 |
| Guanajuato | 0.519 | 0.522 | 0.525 | 0.479 | 0.433 | 0.513 |
| Guerrero | 0.542 | 0.545 | 0.549 | 0.532 | 0.516 | 0.480 |
| Hidalgo | 0.528 | 0.530 | 0.531 | 0.498 | 0.465 | 0.467 |
| Jalisco | 0.560 | 0.542 | 0.523 | 0.492 | 0.461 | 0.445 |
| Michoacán | 0.543 | 0.523 | 0.502 | 0.496 | 0.489 | 0.438 |
| Morelos | 0.532 | 0.547 | 0.561 | 0.491 | 0.420 | 0.452 |
| Nayarit | 0.501 | 0.497 | 0.493 | 0.490 | 0.488 | 0.471 |
| Nuevo León | 0.499 | 0.484 | 0.469 | 0.483 | 0.498 | 0.515 |
| Oaxaca | 0.517 | 0.541 | 0.565 | 0.537 | 0.509 | 0.503 |
| Puebla | 0.563 | 0.559 | 0.554 | 0.518 | 0.481 | 0.505 |
| Querétaro | 0.583 | 0.556 | 0.529 | 0.508 | 0.487 | 0.484 |
| Quintana Roo | 0.538 | 0.554 | 0.571 | 0.524 | 0.477 | 0.464 |
| San Luis Potosí | 0.551 | 0.548 | 0.545 | 0.526 | 0.507 | 0.463 |
| Sinaloa | 0.515 | 0.498 | 0.481 | 0.474 | 0.466 | 0.457 |
| Sonora | 0.497 | 0.496 | 0.495 | 0.487 | 0.479 | 0.487 |
| Tabasco | 0.540 | 0.530 | 0.520 | 0.499 | 0.478 | 0.457 |
| Tamaulipas | 0.522 | 0.511 | 0.500 | 0.474 | 0.449 | 0.476 |
| Tlaxcala | 0.485 | 0.501 | 0.518 | 0.471 | 0.425 | 0.395 |
| Veracruz | 0.538 | 0.548 | 0.558 | 0.546 | 0.533 | 0.489 |
| Yucatán | 0.526 | 0.558 | 0.590 | 0.526 | 0.462 | 0.481 |
| Zacatecas | 0.492 | 0.508 | 0.523 | 0.522 | 0.521 | 0.499 |
| Source: Own elaboration based on data published by the CONEVAL (2018a-b). | | | | | | |

| TABLE 3 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **MATRIX OF CORRELATIONS** | | | | | | | | |
| | | GP_I | GraEsc_I | EP_I | EU_I | MW_I | Rem_I | GDP_O |
| Correlations | GP_I | 1 | 0.53 | 0.78 | 0.83 | 0.63 | 0.8 | 0.23 |
| | GraEsc_I | 0.53 | 1 | 0.3 | 0.33 | 0.75 | 0.57 | 0.7 |
| | EP_I | 0.78 | 0.3 | 1 | 0.93 | 0.26 | 0.82 | 0.06 |
| | EU_I | 0.83 | 0.33 | 0.93 | 1 | 0.41 | 0.8 | 0.03 |
| | MW_I | 0.63 | 0.75 | 0.26 | 0.41 | 1 | 0.41 | 0.36 |
| | Rem_I | 0.8 | 0.57 | 0.82 | 0.8 | 0.41 | 1 | 0.43 |
| | GDP_O | 0.23 | 0.7 | 0.06 | 0.03 | 0.36 | 0.43 | 1 |

Note: GDP *per capita* (GDP), Total public expenditure (GP), Average grade of schooling (GraEsc), Employed Personnel (EP), Economic Units (EU), Minimum Wage (MW), Remuneration (Rem).

Source: Own elaboration based on the INEGI (2018a-h), Banxico (2018), Banco Mundial (2018) and SEP (2018).

| TABLE 4 | | |
|---|---|---|
| **KMO AND BARTLETT TEST** | | |
| Sampling adaptation measure of KMO. | | 0.72667374 |
| Bartlett's sphericity test | Approximate Chi-square | 1227.8515 |
| | Gl. | 21 |
| | Sig. | 6.531E-247 |

Source: Own elaboration based on the INEGI (2018a-h), Banxico (2018), Banco Mundial (2018) and SEP (2018).

| TABLE 5 | | | | | | |
|---|---|---|---|---|---|---|
| **ANTI-IMAGE MATRIX** | | | | | | |
| | | GP_I | GraEsc_I | EP_I | MW_I | GDP_O |
| Covariance anti-image | GP_I | 0.199 | 0.023 | -0.196 | -0.129 | -0.039 |
| | GraEsc_I | 0.023 | 0.204 | -0.062 | -0.151 | -0.210 |
| | EP_I | -0.196 | -0.062 | 0.290 | 0.132 | 0.083 |
| | MW_I | -0.129 | -0.151 | 0.132 | 0.256 | 0.118 |
| Correlation anti-image | GP_I | -0.039 | -0.210 | 0.083 | 0.118 | 0.418 |
| | GraEsc_I | 0.566 | 0.116 | -0.814 | -0.573 | -0.134 |
| | EP_I | 0.116 | 0.582 | -0.254 | -0.660 | -0.718 |
| | MW_I | -0.814 | -0.254 | 0.428 | 0.483 | 0.238 |
| a | Sample adaptation measure | | | | | |
| Source: Own elaboration based on the INEGI (2018a-h), Banxico (2018), Banco Mundial (2018) and SEP (2018). | | | | | | |

| TABLE 6 | | |
|---|---|---|
| **MATRIX OF COMPONENTS** | | |
| | Component | |
| | 1 | 2 |
| GP_I | 0.34 | 0.9 |
| GraEsc_I | 0.9 | 0.3 |
| EP_I | 0.01 | 0.93 |
| MW_I | 0.71 | 0.43 |
| Extraction method: Analysis of main components. | | |
| Rotation method: Varimax standardization with Kaiser. | | |
| a | The rotation converged in 3 iterations. | |
| Source: Own elaboration based on the INEGI (2018a-h), Banxico (2018), Banco Mundial (2018) and SEP (2018). | | |

| TABLE 7 | | | | | | |
|---|---|---|---|---|---|---|
| **EFFICIENCY IN MEXICO WITH OUTPUT ORIENTATION AND CONSTANT SCALE RETURNS, 1990 - 2015** | | | | | | |
| **DMU** | **1990** | **1995** | **2000** | **2005** | **2010** | **2015** |
| Aguascalientes | 0.720 | 0.852 | 0.952 | 0.877 | 0.932 | 0.684 |
| Baja California | 0.757 | 0.864 | 0.921 | 0.862 | 0.876 | 0.701 |
| Baja California Sur | 0.942 | 1.000 | 1.000 | 1.000 | 1.000 | 0.723 |
| Campeche | 0.811 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| Chiapas | 0.594 | 0.587 | 0.568 | 0.567 | 0.559 | 0.557 |
| Chihuahua | 0.765 | 0.829 | 0.894 | 0.872 | 0.949 | 0.676 |
| Ciudad de México | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 0.861 |
| Coahuila | 0.714 | 0.849 | 0.869 | 0.898 | 0.921 | 0.741 |
| Colima | 0.749 | 0.809 | 0.857 | 0.855 | 0.908 | 0.641 |
| Durango | 0.688 | 0.741 | 0.743 | 0.773 | 0.757 | 0.640 |
| Estado de México | 0.690 | 0.653 | 0.637 | 0.635 | 0.640 | 0.610 |
| Guanajuato | 0.652 | 0.658 | 0.661 | 0.657 | 0.662 | 0.621 |
| Guerrero | 0.633 | 0.629 | 0.611 | 0.606 | 0.580 | 0.573 |
| Hidalgo | 0.675 | 0.634 | 0.640 | 0.638 | 0.628 | 0.606 |
| Jalisco | 0.709 | 0.675 | 0.700 | 0.679 | 0.674 | 0.674 |
| Michoacán | 0.613 | 0.623 | 0.616 | 0.605 | 0.601 | 0.603 |
| Morelos | 0.761 | 0.703 | 0.719 | 0.763 | 0.734 | 0.615 |
| Nayarit | 0.690 | 0.648 | 0.664 | 0.670 | 0.699 | 0.611 |
| Nuevo León | 0.854 | 0.913 | 0.987 | 0.971 | 0.949 | 0.748 |
| Oaxaca | 0.599 | 0.588 | 0.573 | 0.577 | 0.576 | 0.572 |
| Puebla | 0.627 | 0.636 | 0.641 | 0.633 | 0.638 | 0.593 |
| Querétaro | 0.671 | 0.771 | 0.842 | 0.832 | 0.873 | 0.702 |
| Quintana Roo | 1.000 | 1.000 | 0.999 | 0.934 | 0.858 | 0.690 |
| San Luis Potosí | 0.649 | 0.671 | 0.682 | 0.694 | 0.741 | 0.645 |
| Sinaloa | 0.726 | 0.691 | 0.705 | 0.704 | 0.674 | 0.642 |
| Sonora | 0.724 | 0.820 | 0.829 | 0.820 | 0.889 | 0.709 |
| Tabasco | 0.644 | 0.654 | 0.656 | 0.670 | 0.670 | 0.711 |
| Tamaulipas | 0.699 | 0.763 | 0.792 | 0.811 | 0.742 | 0.665 |
| Tlaxcala | 0.631 | 0.646 | 0.653 | 0.658 | 0.651 | 0.604 |
| Veracruz | 0.611 | 0.624 | 0.592 | 0.603 | 0.608 | 0.606 |
| Yucatán | 0.686 | 0.671 | 0.734 | 0.719 | 0.724 | 0.624 |
| Zacatecas | 0.623 | 0.646 | 0.639 | 0.643 | 0.661 | 0.606 |
| Source: Own elaboration based on the data of Tables 1 and 2. | | | | | | |

| TABLE 8 | | | | |
|---|---|---|---|---|
| MALMQUIST LUENBERGER INDEX IN MEXICO, 2000 - 2010 | | | | |
| **DMU** | **Catch up** | **Technological Change** | **Malmquist - Luenberger Index** | **Type** |
| Aguascalientes | 0.949 | 0.259 | 0.246 | Worsened |
| Baja California | 0.925 | 0.646 | 0.598 | Worsened |
| Baja California Sur | 0.767 | 0.194 | 0.149 | Worsened |
| Campeche | 1.233 | 0.260 | 0.321 | Worsened |
| Chiapas | 0.937 | 0.559 | 0.524 | Worsened |
| Chihuahua | 0.884 | 0.398 | 0.352 | Worsened |
| Ciudad de México | 0.861 | 1.022 | 0.880 | Worsened |
| Coahuila | 1.039 | 0.376 | 0.390 | Worsened |
| Colima | 0.856 | 0.202 | 0.173 | Worsened |
| Durango | 0.930 | 0.293 | 0.273 | Worsened |
| Estado de México | 0.884 | 0.697 | 0.616 | Worsened |
| Guanajuato | 0.953 | 0.437 | 0.417 | Worsened |
| Guerrero | 0.905 | 0.399 | 0.361 | Worsened |
| Hidalgo | 0.898 | 0.276 | 0.248 | Worsened |
| Jalisco | 0.950 | 0.760 | 0.722 | Worsened |
| Michoacán | 0.984 | 0.419 | 0.412 | Worsened |
| Morelos | 0.809 | 0.264 | 0.213 | Worsened |
| Nayarit | 0.885 | 0.258 | 0.228 | Worsened |
| Nuevo León | 0.876 | 0.760 | 0.666 | Worsened |
| Oaxaca | 0.956 | 0.703 | 0.672 | Worsened |
| Puebla | 0.947 | 0.428 | 0.405 | Worsened |
| Querétaro | 1.046 | 0.276 | 0.289 | Worsened |
| Quintana Roo | 0.690 | 0.172 | 0.119 | Worsened |
| San Luis Potosí | 0.994 | 0.317 | 0.315 | Worsened |
| Sinaloa | 0.884 | 0.380 | 0.336 | Worsened |
| Sonora | 0.979 | 0.483 | 0.473 | Worsened |
| Tabasco | 1.103 | 0.617 | 0.681 | Worsened |
| Tamaulipas | 0.951 | 0.423 | 0.402 | Worsened |
| Tlaxcala | 0.958 | 0.310 | 0.297 | Worsened |
| Veracruz | 0.992 | 0.711 | 0.705 | Worsened |
| Yucatán | 0.909 | 0.283 | 0.257 | Worsened |
| Zacatecas | 0.974 | 0.328 | 0.319 | Worsened |
| Source: Own elaboration based on the data of Tables 1 and 2. | | | | |