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RESEARCH

Employment–output elasticity and employment determinants in the Northern Region of Mexico

Elasticidad empleo-producto y determinantes del empleo en la Región Norte, México

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Abstract

This study examines the effect of economic growth on job creation by calculating the employment–output elasticity coefficient, followed by a multiple regression model to identify the determinants of employment. The results show that employment increases by 0.75% in the region and 0.80% nationwide for every 1% increase in gross domestic product (GDP), suggesting that the crisis context does not appear to affect employment at the regional or national level. However, the sub-period analysis clearly reveals an adverse impact on job creation at the regional scale, in the states comprising the region, and at the national level. According to the econometric model, job creation is explained by economic growth, foreign investment, and public spending, but not by domestic investment.

Keywords: economic growth, employment, employment–output elasticity.

JEL code: J2,O1 y O4

Resumen

Se estudia el efecto del crecimiento económico en la creación de empleo, por ello se calcula el coeficiente de elasticidad o intensidad empleo-producto y, luego, un modelo de regresión múltiple para identificar factores determinantes del empleo. Los resultados muestran que el empleo crece 0.75% en la región y 0.80% en el país por cada 1% de aumento en el producto interno bruto (PIB), por lo que aparentemente el contexto de crisis no afecta el empleo regional ni nacional; sin embargo, el análisis por sub-periodos muestra claramente un impacto adverso en la creación de empleos a escala regional, en los estados que conforman la región y también en el país. De acuerdo al modelo econométrico, la generación de empleos se explica por el crecimiento económico, la inversión extranjera y el gasto público, pero no por la inversión doméstica.

Palabras clave: crecimiento económico, empleo, elasticidad empleo-producto.

Código JEL: J2,O1 y O4

1. Introduction

Globally, the average economic growth rate was 3.6% during the period 2011–2018, lower than the 3.9% recorded between 2001 and 2010 (IMF, 2018). In Latin America, economic growth was interrupted by the 2008 crisis, resulting in a -1.9% growth rate and an unemployment rate of 8.1% in 2009 (ILO,

2011). In Mexico, the early years of the century saw a modest annual average GDP growth of 2.8%, but in 2009 the growth rate turned negative at -6.7% (INEGI, 2010a), and the unemployment rate reached 6.4% (INEGI, 2010b).

The relationship between economic growth, employment, and productivity is increasingly relevant, as reflected in the 2030 Agenda for Sustainable Development, specifically Goal 8: Decent Work and Economic Growth (UN, 2016). In the short term, economic growth can i nfluence employment and/or unemployment; whereas long-term GDP expansion at a pace faster than employment and labor force growth may result in increased labor productivity (ILO, 2019).

Thus, the lack of employment remains a central global concern and a major challenge for governments, particularly in the context of the COVID-19 pandemic. In 2014, over 200 million people were unemployed 31 million more than before the global financial crisis and in 2015 a further increase of 3 million unemployed persons was expected worldwide (ILO, 2015). By 2018, there were 172 million unemployed people worldwide, corresponding to an unemployment rate of 5% (ILO, 2019).

Even before the emergence of COVID-19, with a global unemployment rate around 5% and a growing labor force, an annual increase of 1 million unemployed persons was projected, reaching 174 million in 2020 (ILO, 2019; Table 1.5, p. 20). In Mexico, with the arrival of the pandemic, the unemployment rate was estimated at 11.7% by the end of 2020, equating to approximately 6 million people (ILO, 2020). So far this century, the Mexican economy has shown slow growth, impacting employment levels, as job creation has not kept pace with the growth of the working-age population. In this context, the research problem involves examining the impact of economic growth on employment levels in the northern region[1] and the country before the global crisis (2005–2007), during the crisis (2008–2010), and after the crisis (2011–2013).

This study seeks to answer the following questions: What are the levels of investment, economic growth, and employment in the northern region? What effect has economic growth had on job creation in the region and the country? What other factors influence or determine job creation? The working hypothesis posits that despite the crisis, economic growth in the northern region positively affects employment, due to its proximity to the U.S. economy and the benefits from trade liberalization, which fosters productive investment not only the exchange of goods and services.

Therefore, the general objective of this research is to determine the impact of economic growth on job creation in the northern region, its constituent states, and the country as a whole. Two specific objectives are proposed: 1) To calculate the employment–output elasticity coefficient to capture the impact of economic growth on job creation; and 2) To identify the main factors that influence or determine the creation of new jobs.

Following this introduction, the second section presents the conceptual aspects of the relationship between economic growth and employment, along with recent empirical evidence. The third section details the methodology and data used. The fourth section provides a brief characterization of the study region, followed by an analysis of employment–output elasticity in the region, its states, and the country, as well as the factors promoting job creation. The final section presents the conclusions.

2. Theoretical framework and evidence on the subject

Economic theory posits a positive relationship between output variations and the level of employment; that is, an increase in output implies an increase in the number of employed persons, thereby reducing the unemployment rate (Tangarife, 2013, p. 40). Thus, economic performance is a fundamental determinant of job creation in any country, as higher output requires more labor and increases people's purchasing power.

According to Keynesian theory, the economy does not operate at full employment, and labor market equilibrium is based on effective demand. The market is quite slow to reach such equilibrium, making state intervention necessary as a regulator, promoter, and driver of investment and employment.

Keynes clarified the relationship between income–output growth and employment, showing that

[1] The Northern Region is one of the four major regions defined by the National Population Council (Conapo 2004, cited in Zúñiga and Leite, 2006), which group the federal entities based on geographic proximity and their tradition of high migration intensity: Northern Region: Baja California, Baja California Sur, Coahuila, Chihuahua, Nuevo León, Sinaloa, Sonora, and Tamaulipas; Traditional Region: Aguascalientes, Colima, Durango, Guanajuato, Jalisco, Michoacán, Nayarit, San Luis Potosí, and Zacatecas; Central Region: Mexico City, Hidalgo, State of Mexico, Morelos, Puebla, Querétaro, and Tlaxcala; Southern-Southeastern Region: Campeche, Chiapas, Guerrero, Oaxaca, Quintana Roo, Tabasco, Veracruz, and Yucatán.

changes in output (Y) are driven by changes in employment (N) through aggregate demand (Keynes, 1936) a basic production function already expressed by classical Ricardian economics as Y = f(N), with dy/dn > 0, assuming land (another factor) is constant, which led to the law of diminishing returns.

The relationship between output and employment is evident when Y is replaced by the modern concept of GDP (Dornbusch et al., 2002). Although modern growth theory identifies other factors influencing GDP growth such as physical capital investment (Solow, 1957), human capital (Mankiw et al., 1992), research and development (Romer, 1990), public spending, work environment, labor organization, and skill level these factors are ultimately absorbed into employment (OECD, 2001).

However, according to Skidelsky (2011), economic growth and existing employment levels are also the result of a combination of short-term expectations, reflected in corporate profitability, and long-term expectations, reflected in capital accumulation. Nevertheless, in times of crisis, expectations in both directions are clearly reversed.

It is worth noting that while the Keynesian approach explains economic fluctuations through effective demand in the short term, the existence of effective demand fosters optimistic investment expectations, which increase investment levels and, in turn, production. This dynamic leads to higher economic growth and consequently, job creation.

In other words, the Keynesian principle holds that productivity growth stimulates wage increases, which boost demand and employment. As demand grows, investment tends to rise, restarting the cycle of greater productivity (Camargo, 2013). This implies that employment is a function of output level, and not solely of wage levels, as assumed in the labor market framework (Kato, 2004).

The output–employment relationship is often measured using the output–employment elasticity of the economy, which quantifies the relative response of employment levels to changes in output. However, as noted earlier, other factors besides labor are involved in the production process, so employment levels may not solely depend on GDP (Tangarife, 2013).

This means that economic growth may be a necessary but not sufficient condition for job creation. Therefore, employment elasticity values should be analyzed in the context of the business cycle and other macroeconomic variables such as labor productivity, labor costs, investment, labor demand, etc. (Tangarife, 2013; Pattanaik & Nayak, 2011; Kapsos, 2005; Islam & Nazara, 2000).

Despite criticisms[2] mainly that it ignores the supply side the concept of employment output elasticity remains a convenient way to summarize the effect of economic growth on employment. It aligns with Okun's Law, which has been useful in industrialized countries to identify growth thresholds at which job creation becomes significant (Islam & Nazara, 2000).

Specifically, Okun's Law examines the empirical relationship between cyclical changes in GDP and unemployment (Dornbusch et al., 2002), supporting the idea that a 1% loss in employment corresponds to a 2-percentage-point loss in GDP. However, a simplistic market analysis often places GDP growth as the main driver of employment increases hence the common expression that economic growth is necessary for job creation.

Within this analytical framework, the key issue remains: By what percentage does employment increase for every 1% increase in GDP? This is the research question to be addressed in the following sections, focusing on the states that make up the Northern Region and the country as a whole.

Regarding international studies analyzing the effect of economic growth on employment, Morén and Wändal (2019) calculated employment elasticity of economic growth for 168 countries and found that higher elasticity corresponds to more labor-intensive growth. The results vary widely by country, with elasticity ranging from -0.32 to 2.61. At the regional level, the most employment-intensive growth was seen in the Caribbean, Central America, and Southern Europe. Elasticity was higher in developing countries compared to developed ones,

[2] For a detailed review of these criticisms, see Islam and Nazara, 2000:4–7.

and for most regions, the highest elasticity was recorded for adult women, followed by adult men. Finally, they demonstrated that labor force growth, the share of employment in services and industry, foreign direct investment (FDI), and trade all influence employment elasticity.

Meanwhile, Görg et al. (2018) studied 20 OECD countries over the period 1960–2014 and found that the long-term employment–output elasticity averaged around 0.80. They note that this indicates a significant increase in employment responsiveness to output fluctuations in recent decades, with labor market policies playing a crucial role. Flexible short-term contracts may also affect employment dynamics.

For the South African economy, Mkhize (2019) investigates the evolution of employment intensity across eight non-agricultural sectors from the first quarter of 2000 to the fourth quarter of 2012, aiming to identify key growth sectors that are labor-intensive. The empirical findings suggest that total non-agricultural employment and GDP do not move together in the long term, implying that unemployment growth occurred in South Africa during the analyzed period. This supports the idea that South Africa has become less labor-intensive and more capital-intensive. Accordingly, branches within the tertiary sector show better performance in terms of employment intensity, reflecting the changing structure of the economy, with employment shifting from the primary to the tertiary sector. Therefore, investment in the tertiary sector is necessary to promote new jobs and could help improve overall employment intensity in southern Africa.

In Latin America, Kapsos (2005) found an employment–output elasticity of 0.65 for the period 1991–1995, 0.70 for 1995–1999, and 0.45 for 1999–2003. These figures are similar to those published by ECLAC for 20 countries in the region, reporting an average employment elasticity of 0.60 for Latin America during the 1990s (ECLAC, 2000, cited in Kato, 2004:89). In both studies, the method used to estimate employment–output elasticity consisted of dividing the employment growth rate by the output growth rate. Stallings and Weller (2001) also estimated an employment–output elasticity of 0.60 for Latin America, but for the longer period of 1950–1999.

In the case of Mexico, Cruz and Ríos (2014) analyzed employment–output elasticity by occupation, highlighting the ten most dynamic and the ten least dynamic occupations. They pointed out that occupations with high elasticity are likely to involve labor-intensive or low-productivity production methods, whereas those with low elasticity may indicate high productivity and potential unemployment if productive capacity does not expand progressively. The results show that workers are concentrated in activities where earnings are low (between one and three minimum wages), and that in the main occupational groups, workers typically have only primary or secondary education. Only those with upper secondary or higher education are able to earn more than three minimum wages.

Ríos and Carrillo (2014) studied the impact of output changes on employment across Mexico's manufacturing subsectors in the aftermath of the 2009 crisis. Using data from the National Accounts System and the National Survey of Occupation and Employment (ENOE) by INEGI, they applied a fixed-effects panel model and found that the subsectors with the highest elasticity were 2 (textiles, apparel, and leather industries), 4 (paper, printing, and publishing), and 8 (metal products, machinery, and equipment). This indicates that high-tech subsectors are not the only ones with high elasticity and, therefore, may be more affected by employment reductions during economic downturns. In subsectors with a high relative demand for unskilled labor such as subsector 2 (apparel manufacturing) and subsector 8 (furniture manufacturing) layoffs are the preferred measure during periods of low product demand, with maquiladoras and traditional labor-intensive industries being the most affected.

Carbajal and Almonte (2017) analyzed, at the level of major manufacturing divisions, the performance of production and its effects on formal job creation in the Central region of Mexico. They identified the most dynamic divisions of manufacturing activity and, by estimating an employment function with panel data for each of the nine major manufacturing divisions, reported that the following divisions show high income elasticity

of employment: I. Food products, beverages, and tobacco; II. Textiles, apparel, and leather; III. Wood and wood products; and IX. Other manufacturing industries, with elasticities of 0.716, 1.035, 0.781, and 0.94, respectively. Meanwhile, divisions comprising the most technologically advanced, innovative, and export-oriented branches such as Division VIII. Metal products, machinery, and equipment showed lower elasticity.

Also focusing on the manufacturing sector and using data from the Monthly Industrial Survey, Kato (2004) found that social benefits have been more important than wages in absorbing employment in response to production changes. This may be due to average worker compensation not increasing in real terms, while social benefits have maintained a negative relationship with employment. Consequently, reducing labor costs through this component has promoted greater job creation at the expense of social benefits. These two effects enabled a higher employment–output elasticity when comparing the periods 1987–1993 and 1995–2001, which showed employment–output elasticities of 1.17 and 1.86, respectively demonstrating that elasticity is higher in the manufacturing sector than in the Mexican economy overall.

Ríos and Cruz (2019) calculated the impact of economic growth on employment for the group "transport and mobile machinery drivers" during the period 1996–2012, using data from the National Survey of Household Income and Expenditure (ENIGH) published by INEGI. For the main group "Transport and mobile machinery drivers," they found that the states with the most positive elasticities were Campeche, Jalisco, Michoacán, Morelos, Sonora, Veracruz, and Yucatán. Among the 14 unit occupational groups within group 83: transport and mobile machinery drivers, eight showed positive employment–output elasticity, particularly the following unit groups: Bicycle transport drivers (9321), Mobile machinery operators for cargo movement in factories, ports, commerce, etc. (8352), Deck officers, sailors, and pilots (8322), Mobile machinery operators for construction and mining (8351), and Drivers of buses, trucks, vans, taxis, and passenger cars (8342).

Lastly, Bracamontes and Camberos (2016) investigated the impact of growth on employment during the first decade of the 21st century for the state of Sonora and its regions. They found that by the end of the decade, the Costa region had the highest employment–output elasticity coefficient (0.421), surpassing the employment intensity observed for the state of Sonora as a whole (0.362) implying that in the Costa region, employment increased by 0.42% for every 1% increase in output, while in the state overall it only rose by 0.36% per 1% growth in GDP. The next highest were the Frontera region (0.304) and the Sierra region (0.072). The Costa region showed a clear predominance in terms of investment share, value-added generation, and employment. However, employment–output elasticity coefficients were relatively low for all three regions and for the state as a whole.

3. Methodology and data used

Employment–output elasticity helps assess the intensity of economic growth in relation to job creation. Equation (1) measures arc elasticity, which is the calculation of elasticity between two different time points. This descriptive method has been used by the ILO and ECLAC (Islam & Nazara, 2000). Where Ɛ represents employment elasticity, L is the employed population, and Y is the Gross Domestic Product (GDP) of the country, region, and constituent states.

$$Ɛ = (\Delta L / L) / (\Delta Y / Y)$$

(Ec. 1)

The numerator simply provides the percentage change in employment in an economy (L_i) between periods t_0 and t_1, while the denominator gives the corresponding percentage change in output (Y_i). In this sense, employment elasticity (Ɛ) measures the percentage change in job creation for every one percent increase in GDP.

The Economic Commission for Latin America and the Caribbean (ECLAC, 2000, cited in Cruz & Ríos, 2014) notes that it is not easy to prescribe whether high or low employment–output elasticity values are desirable. In the first case, the economy would be characterized by labor-intensive or low-productivity

production methods, while in the second case, high productivity may exist, potentially accompanied by unemployment if there is no progressive expansion of productive capacity.

Changes in employment have implications in terms of productivity, which complicates the interpretation of elasticity values. To address this challenge, and in line with Kapsos (2005), this study assumes that employment and productivity growth should be pursued jointly in order to maximize the potential for achieving economic development goals, such as poverty reduction.

Table 1. Interpretation of Employment–Output Elasticities

Employment Elasticity	GDP Growth	
	Positive GDP Growth	Negative GDP Growth
$\varepsilon<0$	(-) Employment growth (+) Productivity growth	(+) Employment growth (-) Productivity growth
$0\leq\varepsilon\leq1$	(+) Employment growth (+) Productivity growth	(-) Employment growth (-) Productivity growth
$\varepsilon>1$	(+) Employment growth (-) Productivity growth	(-) Employment growth (+) Productivity growth

Source: Adapted from Kapsos (2005:4)

To clarify the relationship between employment–output elasticities, real employment growth, and productivity increases, the author establishes a summary of this relationship under different scenarios of GDP growth. This framework is used in the present research to analyze elasticities. In Table 1, the cells can be interpreted as follows (Kapsos, 2005:4):

1. When the economic growth rate is positive and the employment elasticity is negative (less than zero), the employment growth rate is negative and the productivity growth rate is positive (labor productivity increases but employment does not).

2. When the economic growth rate is positive and employment elasticity is between zero and one, both employment and productivity growth rates are positive (both labor productivity and employment increase). This scenario is often considered ideal, as employment growth goes hand in hand with productivity gains. However, within this range, higher elasticities (0.6 to 1.0) imply greater employment intensity but lower productivity growth.

3. The lower left cell of the table shows that in economies with positive GDP growth, elasticities greater than one correspond to positive employment growth but negative productivity growth (employment increases, but productivity deteriorates).

4. The right-hand columns indicate that the interpretation of employment elasticities vis-à-vis employment and productivity growth is exactly the opposite in cases where GDP is experiencing negative growth.

Furthermore, various studies use macroeconomic variables to examine employment generation in both developed and developing countries (Sodipe & Ogunrinola, 2011; Fofana, 2001). According to data availability, to test the research hypothesis, a multiple linear regression model will be estimated in which the main determinants of employment generation are economic growth, investment, and public spending on infrastructure. The model will be estimated for average values during the study period 2005–2013, as well as for the sub-periods: 2005–2007, 2008–2010, and 2011–2013, and is specified as follows:

$$LgPOi = \beta 0 + \beta 1LgPIBi + \beta\ 2LgIEDi + \beta 3LgFBKi + \beta 4LgGP$$

(Ec. 2)

Where:

LgPO= The natural logarithm of the employed population;

LgPIB= The logarithm of Gross Domestic Product (GDP);

LgIED = The logarithm of foreign direct investment (FDI);

LgFBK= The logarithm of domestic investment;

LgGP= The logarithm of public spending on infrastructure.

The employment data are obtained from the National Survey of Occupation and Employment (ENOE), which is conducted and published annually by INEGI. Economic growth is measured using the average GDP value for the period and sub-periods, with data obtained from the National Accounts System of INEGI. Foreign direct investment data are provided by the Economic Information Bank of INEGI. Data on Gross Fixed Capital Formation are also taken from INEGI[3], as reported in the Economic Censuses, since gross fixed capital formation represents the direct investment observed in the production process in the form of means of production. These censuses are published every five years, so the values published in 2004 and 2014 are used as approximate initial and final values for the period, respectively.

Similarly, public spending on infrastructure is obtained from the INEGI website, specifically from the state and municipal public finance[4] section under Administrative Records. Public investment is used as a proxy variable for public spending on infrastructure, as it represents government expenditure that encourages third-party investment, anticipating general potentialities where applied, rather than benefiting only a specific group.

For data processing and management, the statistical software Excel version 14.0 and STATA version 12.1 are used.

4. Employment elasticities and determinants

Before analyzing the effects of economic growth on job creation, a brief characterization of the study region is presented. In 2010, the Northern Region had a population of 23.2 million people (Table 2, 2nd column), representing 20.74% of the total national population. The most populous states were Nuevo León, Chihuahua, Tamaulipas, and Baja California, followed in smaller numbers by Sinaloa, Coahuila, and Sonora. Baja California Sur was the least populated.

The Region accounted for 23.27% of the national GDP, which amounted to 12 trillion pesos in 2010. The state of Nuevo León, with 6.7%, had the largest share in generating regional wealth, followed at an intermediate level by Coahuila, Tamaulipas, Baja California, Sonora, and Chihuahua. The states of Sinaloa and Baja California Sur had the smallest shares in the wealth generation of the Northern region.

[3] It is the value of fixed assets purchased by economic units (domestic or imported, new or used), minus the value of fixed asset sales. It includes, as part of the fixed asset purchases, the value of renovations, improvements, and major overhauls made to fixed assets that extended their useful life by more than one year or increased their productivity, as well as fixed assets produced by the economic activity for its own use (INEGI, 2009).

[4] The variable Public Investment, formerly known as "Public Works and Social Actions," is divided into Public Works on Public Domain Assets and Productive Projects and Promotion Actions. Public Works on Public Domain Assets includes the construction of schools, hospitals, public buildings, roads and highways, infrastructure for the supply of water, oil, gas, electricity, and telecommunications, as well as civil engineering works such as land division and urban development projects. As for Productive Projects and Promotion Actions, these include investments in public security, agricultural development, industrial development, administrative development, tourism promotion, and educational promotion.

Table 2. Mexico and Northern Region. Population, Gross Domestic Product (GDP), Investment and GDP Per Capita, 2010.

Entities	Total Population	%	GDP1	%	Investment2	%	GDP per Capita
Mexico	112,336,538	100	12,756,947.64	100	464,390.60	100	113,560.09
Northern Region	23,299,205	20.74	2,968,513.55	23.27	108,814.70	23.27	127,408.36
Baja California	3,155,070	2.81	348,466.63	2.73	9,918.60	2.73	110,446.56
Baja California Sur	637,026	0.57	89,603.56	0.7	3,835.00	0.7	140,659.19
Chihuahua	3,406,465	3.03	326,658.13	2.56	11,784.00	2.56	95,893.58
Coahuila	2,748,391	2.45	380,884.16	2.99	12,184.60	2.99	138,584.42
Nuevo León	4,653,458	4.14	855,024.82	6.7	28,455.70	6.7	183,739.67
Sinaloa	2,767,761	2.46	255,621.38	2.0	6,825.60	2	92,356.74
Sonora	2,662,480	2.37	331,009.28	2.59	11,967.40	2.59	124,323.67
Tamaulipas	3,268,554	2.91	381,245.58	2.99	23,843.50	2.99	116,640.44

The POB figures are expressed in millions of pesos, and GDP per capita is reported in 2008 current pesos.
This represents Gross Fixed Capital Formation in millions of pesos for the year 2010.
Source: Adapted from Millán L. Christian (2017:37)

Total investment in the region amounted to 108,814.7 million pesos (Table 2, 6th column), equivalent to 23.4% of the national investment, which totaled 464,390.6 million pesos. The states of Nuevo León and Tamaulipas stood out with the highest investment levels, followed to a lesser extent by Coahuila, Sonora, Chihuahua, and Baja California. The lowest investment levels were observed in Sinaloa and Baja California Sur.

It is important to note that despite the crisis, the relative share of the Northern region in the national GDP has remained approximately stable at 23.0% during 2004-2014 (Millán, 2017:51, Table 11). However, the regional investment's share of total national investment fell from 35.05% to 18.19% during the same period; in other words, in the context of the crisis, investment amounts in the Northern region were nearly halved. This decline is observed in all states of the region, particularly in Tamaulipas, whose share dropped from 5.48% to 0.91% over the period (Millán 2017:42, Table 5).

The last column of Table 2 shows that the Northern region had a GDP per capita of 127,408 pesos, surpassing the national GDP per capita of 113,560 pesos per year. The states of Nuevo León, Baja California Sur, and Coahuila have GDP per capita figures above those observed in both the region and the country, followed by Sonora, Tamaulipas, and Baja California. Chihuahua and Sinaloa recorded the lowest GDP per capita in the Northern region.

4.1. Analysis of Employment-Output Elasticities

It is important to consider that employment-output elasticity trends only show employment's response to economic growth and, although this is an important indicator, it does not provide information regarding the number of employed persons, employment quality, or job types (Kapsos, 2005). Furthermore, while the computational estimation of arc elasticity is simple, Islam and Nazara (2000) caution that elasticity values calculated year after year using this method may exhibit considerable instability and may be unsuitable for comparative purposes. This, however, is not the case here as the analysis presented is short-term.

The last column of Table 3 shows relatively high employment-output elasticities, although these are higher nationwide than for the Northern region during the 2005–2013 period. At the national level, employment grows by 0.80%, while in the Northern region, employment grows by only 0.75% for every 1% increase in GDP. In both cases, GDP growth rates are positive (Tables A and B in Annex I), and according to Kapsos' (2005) classification, this represents the ideal scenario, as employment growth goes hand in hand with productivity increases. However, this reflects a labor-intensive economic growth that is becoming increasingly less productive, both in the Northern region and nationally[5].

In the states of Baja California (1.58%), Tamaulipas (1.38%), Baja California Sur (1.14%), and Coahuila (1.02%), the highest employment elasticities were

[5] According to Kahn (2000, cited in Kapsos 2005), developing economies should ideally have employment-output elasticities of 0.70, and as they achieve upper-middle-income status, these employment elasticities will gradually decline as a country becomes more developed and labor becomes scarce. In this way, Kahn argues that labor-abundant economies especially those with a relatively high incidence of poverty need to achieve a relatively higher employment intensity than economies that are less labor-abundant.

Table 3. Northern Region. Employment-Output Elasticity by Sub-Periods and for the Total Period, 2005–2013.

Region	Sub-period 2005-2007	Sub-period 2008-2010	Sub-period 2011-2013	Period 2005-2013
Mexico	0.79	0.6	0.65	0.8
Región norte	0.7	-0.38	0.7	0.75
Baja California	0.92	-0.24	1.06	1.58
Baja California Sur	0.82	-1.07	0.61	1.14
Chihuahua	0.7	1.43	0.72	0.44
Coahuila	1.7	-2.22	0.77	1.02
Nuevo León	0.52	4.31	0.37	0.52
Sinaloa	0.01	-3.1	0.33	0.45
Sonora	0.64	0.62	0.64	0.81
Tamaulipas	1.14	0.12	1.59	1.38

Source: Own elaboration based on Sistema de Cuentas Nacional of Mexico and the National Survey of Occupation and Employment by INEGI

recorded, exceeding both the employment elasticity of the Northern region and that of the country. Meanwhile, the state of Sonora (0.81%) shows an employment elasticity similar to that of the country. The fact that GDP growth rates are positive (see Tables C–J in Annex I), along with an employment-output elasticity greater than 1, implies that in these states employment increased, but productivity did not during the 2005–2013 period. Conversely, Nuevo León (0.52%), Sinaloa (0.45%), and Chihuahua (0.44%) had the lowest employment-output elasticities, indicating productivity increases but not employment growth in those states.

When analyzing employment elasticities by sub-periods (Table 3, columns 2, 3, and 4), it can be seen that at the national level (0.60) and in the Northern region (-0.38), employment generation declined in the context of the crisis (2008–2010). However, the drop in job creation was steeper in the Northern region, which recorded a negative employment elasticity, meaning not only was job creation halted, but previously generated jobs were also lost. Similarly, the states of Sinaloa, Coahuila, Baja California Sur, and Baja California recorded negative employment elasticities, except for Nuevo Leónand Chihuahua, where the impact of the crisis is reflected in the post-crisis period (2011–2013), with a significant decline in their employment elasticities: Nuevo León (0.37) and Chihuahua (0.72). In Sonora (0.62), there was a slight decline in elasticity, indicating the crisis had milder effects; the opposite occurred in Tamaulipas, where the employment-output elasticity fell to 0.12 during the crisis.

In the post-crisis period (2011–2013), the Northern region increased its employment elasticity (0.70), recovering the level observed before the crisis and exceeding the national employment elasticity (0.65), which also showed a slight recovery. The states of Baja California (1.06) and Tamaulipas (1.59) achieved significant recovery in employment generation during the post-crisis period, surpassing both regional and national employment elasticities. These were followed by Coahuila (0.77), Chihuahua (0.72), Sonora (0.64), and Baja California Sur (0.61). Meanwhile, Nuevo León (0.37) and Sinaloa (0.33) experienced the lowest employment elasticities in the post-crisis period.

So far, it can be confirmed that the employment-output elasticities calculated for the total period at the national, regional, and state levels are high. According to the literature, this is to be expected when comparing the employment elasticities of developed and developing economies (Morén & Wändal, 2019; Kahn, 2000). In this sense, the elasticities obtained in this study for the country and the Northern region align with the findings of Görg et al. (2018), who estimated an employment-output elasticity of 0.80 for the OECD during 1960–2014, as well as the estimates of Kapsos (2005) and ECLAC (2000), who estimated an average elasticity of 0.70 and 0.60 respectively for Latin America. However, it is important to note that the sub-period analysis clearly highlights the adverse impact of the crisis on employment creation at the national, regional, and state levels.

In terms of sectoral contribution to employment creation in the Northern region and the country (Table 4), it is evident that the primary sector presents the lowest employment-output elasticities: regional (0.40) and national (0.38), and therefore is the sector that generates the fewest jobs in both the region and the country. This result can be interpreted based on three possible arguments: a) a high capital coefficient in the sector, which leads to productivity growth but not employment growth (ILO, 2013; ECLAC 2000, cited in Cruz & Ríos, 2014), b) the ongoing rural exodus in the country, and c) a combination of both (a and b).

On the other hand, in the secondary sector, the Northern Region (0.86) shows a high employment elasticity, although lower than the country (1.11), which has a very high employment-output elasticity. In the tertiary sector, the highest employment elasticities are observed: Northern Region (2.41) and Mexico (2.36), which confirms a process of tertiarization of the regional and national economy. This means that both the region and the country base job creation on the secondary and tertiary sectors, although to a greater extent in the tertiary sector, as shown by the employment-output elasticities in 7 of the 8 states that make up the region.

In summary, when the elasticity analysis is conducted for the entire period (2005–2013), a high employment elasticity is observed in the Northern Region (0.75), although lower than the national level (0.80), which is also high. This would mean that the global crisis context apparently did not have harmful effects in terms of job creation for the Northern Region, nor for the country.

Table 4. Northern Region. Employment-Output Elasticity by Sector and in the Total Period, 2005–2013

Region	Sectoral Elasticities 2005-2013			Total period 2005-2013
	Primary	Secondary	Tertiary	
Mexico	0.38	1.11	2.36	0.80
Región norte	0.4	0.86	2.41	0.75
Baja California	-1.31	5.16	5.17	1.58
Baja California Sur	5.32	1.04	3.87	1.14
Chihuahua	0.35	1.56	0.11	0.44
Coahuila	-0.86	1.02	3.29	1.02
Nuevo León	-4.6	0.64	1.54	0.52
Sinaloa	1.9	1.86	1.52	0.45
Sonora	1.31	0.46	3.68	0.81
Tamaulipas	-0.76	1.67	3.65	1.38

Source: Own elaboration based on Sistema de Cuentas Nacional of Mexico and the National Survey of Occupation and Employment by INEGI

However, the sub-period analysis shows that in the context of the crisis (2008–2010), there was a clear drop in job creation at the national level (0.60), followed by a slight recovery in the post-crisis period (0.65), although this employment-output elasticity is still far from that observed before the crisis in the country (0.79). In other words, in the post-crisis period, the country did not manage to recover the employment levels that existed before the crisis.

On the other hand, in the context of the crisis, a negative employment elasticity is observed in the Northern Region (-0.38), which implies that not only did job creation stop, but jobs created before the crisis were lost. However, for the post-crisis period, the Northern Region (0.70) recorded an employment elasticity equal to that observed before the crisis, which means that at least in the Northern Region, the jobs lost due to the global crisis were recovered.

Among the states, during the crisis and with negative employment-output elasticities, Sinaloa, Coahuila, Baja California Sur, and Baja California were the most affected, followed by Tamaulipas, whose elasticity fell to 0.12 during the crisis. In Sonora (0.62), there was only a slight drop in elasticity, reflecting the least damage from the crisis. In contrast, in Nuevo León and Chihuahua, the impact of the crisis was reflected in the post-crisis period (2011–2013), when they recorded a noticeable drop in employment elasticity: Nuevo León (0.37) and Chihuahua (0.72). In the post-crisis period (2011–2013), the states that achieved a significant recovery in employment elasticity were Baja California (1.06) and Tamaulipas (1.59), followed by Coahuila (0.77), Chihuahua (0.72), Sonora (0.64), and Baja California Sur (0.61).

Finally, the sectoral employment-output elasticities show that in the Northern Region and in the country, job creation relies more on the secondary and tertiary sectors. Throughout the period, the Northern Region (0.86) recorded a high employment elasticity in the secondary sector, but lower than that observed in the country (1.11). In the tertiary sector, the Northern Region (2.41) also recorded a high employment elasticity, slightly higher than the country (2.36), which indicates the tertiarization of economic activity at both regional and national levels.

4.2. On the determinants of employment

Various studies use macroeconomic variables to examine job creation in both developed and developing countries (Sodipe & Ogunrinola, 2011; Fofana, 2001). In Equation 1, the factors that stimulate job creation beyond economic growth are explored. By considering the average values of annual data for the states during the period 2005–2013, a coefficient of determination of $R^2 = 0.90$ is obtained, indicating a high explanatory power of the model in terms of employment generation, due to changes in GDP growth, foreign direct investment, gross capital formation, and public infrastructure spending.

Likewise, the probability of the F-statistic being < 0.05 indicates a 95% confidence level in the model, meaning that overall the model shows statistical significance between the independent variables

and employment. However, when looking at the probabilities associated with the t-statistic, we can see that all the coefficients are statistically significant, except for gross capital formation, which does not show the expected sign[6]. This implies that domestic investment is inhibited, leading to a decline in job creation in the region and the country during the crisis context.

Equation 1. $LgPOi = \beta 0 + \beta 1 LgPIBi + \beta\ 2LgIEDi + \beta 3 LgFBKi + \beta 4 LgGP$

```
. regress lgMPO0513 lgMPIB0513 lgMIED0513 lgMFBK0513 lgMGP0513

      Source |       SS       df       MS              Number of obs =      37
-------------+------------------------------           F(  4,    32) =   72.31
       Model |  7.84265781     4  1.96066445            Prob > F      =  0.0000
    Residual |  .855892449    32  .026746639           R-squared     =  0.9016
-------------+------------------------------           Adj R-squared =  0.8893
       Total |  8.69855026    36  .241626396           Root MSE      =  .16354

------------------------------------------------------------------------------
    lgMPO0513 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
--------------+---------------------------------------------------------------
  lgMPIB0513 |   .9260183   .1152729     8.03   0.000     .6912151    1.160821
  lgMIED0513 |   .1600255   .0857338     1.87   0.071    -.0146086    .3346596
  lgMFBK0513 |  -.3849062   .1146519    -3.36   0.002    -.6184444   -.1513679
   lgMGP0513 |    .252944   .0947128     2.67   0.012     .0600203    .4458676
       _cons |   1.089508   .3305343     3.30   0.002     .4162313    1.762784
------------------------------------------------------------------------------
```

The Breusch-Pagan test is applied to check for evidence of heteroskedasticity[7], for which a null hypothesis of constant variance is established (H_0 = constant variance). A chi-squared value of 1.63 and a p-value of 0.2012 (Prob > chi^2 = 0.2012) are obtained. Since the p-value is greater than 0.05, we cannot reject the null hypothesis our model has constant variance, and therefore, there is no heteroskedasticity.

5. Conclusions

This study examines the impact of economic growth on job creation in the Northern Region, its constituent states, and the country before the global crisis (2005–2007), during the crisis (2008–2010), and after the crisis (2011–2013). To this end, the employment-output elasticity coefficient is first calculated, and then a multiple regression model is used to explore the macroeconomic factors that influence job creation.

The first finding is that for the entire period, employment elasticity is high in the Northern Region (0.75), although lower than that recorded for the country (0.80). This suggests that the crisis did not affect job creation at the regional or national level. However, the sub-period analysis shows a clear drop in job creation during the crisis in both the Northern Region and the country. This decline was more abrupt in the region, where elasticity was negative, implying that not only did job creation stop, but previously created jobs were destroyed.

A second finding is that the states most affected during the crisis were Sinaloa, Coahuila, Baja California Sur, and Baja California, since they, like the Northern Region, had negative employment-output elasticities. They were followed by Tamaulipas, whose employment elasticity suddenly dropped to 0.12 during the crisis. The state of Sonora (0.62) experienced less severe effects on job creation, with only a slight drop in employment elasticity during the crisis. In contrast, in Nuevo León and Chihuahua, the impact of the crisis was reflected in the post-crisis period.

Another finding is that in the post-crisis period, the region recorded an employment elasticity equal to that observed before the crisis. This implies that the region recovered the jobs lost due to the global crisis, something that did not occur at the national level. The states that achieved a significant recovery in elasticity after the crisis were Baja California and Tamaulipas, followed by Coahuila, Chihuahua, and Baja California Sur. Additionally, the sectoral employment elasticities in both the region and the country show that job creation relies on the secondary and tertiary sectors, as confirmed by the very high sectoral employment elasticities of the states.

Therefore, the empirical evidence confirms a clear link between economic growth and job creation. Moreover, the working hypothesis of this study must be accepted, since the results of the econometric model show that job creation is explained by GDP growth, foreign direct investment, and public spending but paradoxically, not by domestic investment.

The results reveal the labor market's insufficiency in restoring equilibrium between labor supply and demand, highlighting the indispensable role of the State in restoring business confidence and encouraging entrepreneurs to invest a greater share of the value generated, thereby stimulating labor demand. In this sense, amid the pandemic context, a partnership between the State and the business sector undoubtedly becomes imperative for the region and the country in order to reverse the undeniable damage caused by COVID-19 in terms of economic

[6] Similar results were found in the analysis by sub-periods; see Equations 2, 3, and 4 in Appendix II.

[7] Tests for normality, multicollinearity, and the functional form of the model were also verified; see Annex III.

growth, job creation, and overall well-being.

In this regard, the current approach of the Fourth Transformation (4T) government in engaging with all business groups including its critics becomes highly relevant as a strategy to promote the necessary short- and medium-term investment across all sectors and branches of the economy. This aims to boost job creation in a context where domestic investment must play an increasingly central role, which may help improve the overall employment intensity in both the country and its regions.

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Appendix I

Table A. Mexico. GDP Growth Rates, Employment, and elasticities by period, subperiods, and sector

Entity	Period	GDP Growth Rate	Employment Growth Rate	Elasticity
Mexico	2005-2007	2.57	2.02	0.79
	2008-2010	1.15	0.69	0.60
	2011-2013	1.55	1.02	0.65
	2005-2013	2.11	1.68	0.80
Primary Sector	2005-2007	4.38	0.20	0.05
	2008-2010	-2.08	1.23	-0.60
	2011-2013	3.39	0.87	0.26
	2005-2013	2.48	0.94	0.38
Secondary Sector	2005-2007	1.60	2.06	1.29
	2008-2010	0.58	-0.40	-0.69
	2011-2013	0.37	1.96	5.29
	2005-2013	0.98	1.09	1.11
Tertiary Sector	2005-2007	3.07	2.41	0.78
	2008-2010	1.69	1.08	0.64
	2011-2013	2.12	0.77	0.36
	2005-2013	2.76	6.53	2.36

Source. Own estimates based on the Sistema de Cuentas Nacionales and the Encuesta Nacional de Ocupación y Empleo (INEGI).

Table B. Northern Region. GDP Growth Rates, Employment, and elasticities by period, subperiods, and sector

Entity	Period	GDP Growth Rate	Employment Growth Rate	Elasticity
Northern Region	2005-2007	3.57	2.51	0.70
	2008-2010	-0.41	0.16	-0.38
	2011-2013	2.25	1.57	0.70
	2005-2013	2.52	1.89	0.75
Primary Sector	2005-2007	4.12	0.24	0.06
	2008-2010	0.95	3.06	3.22
	2011-2013	3.86	0.63	0.16
	2005-2013	1.25	0.50	0.40
Secondary Sector	2005-2007	3.61	1.55	0.43
	2008-2010	-1.22	-1.00	0.81
	2011-2013	1.69	4.54	2.69
	2005-2013	2.20	1.89	0.86
Tertiary Sector	2005-2007	3.51	3.24	0.92
	2008-2010	0.03	0.52	15.08
	2011-2013	2.52	0.74	0.29
	2005-2013	2.81	6.79	2.41

Source. Own estimates based on the Sistema de Cuentas Nacionales and the Encuesta Nacional de Ocupación y Empleo (INEGI).

Table C. Baja California. GDP Growth Rates, Employment, and Elasticities by Period, Subperiods, and Sector

Entity	Period	GDP Growth Rate	Employment Growth Rate	Elasticity
Baja California	2005-2007	3.12	2.87	0.92
	2008-2010	-2.11	0.52	-0.24
	2011-2013	1.63	1.73	1.06
	2005-2013	1.38	2.19	1.58
Primary Sector	2005-2007	1.89	-3.21	-1.69
	2008-2010	3.35	3.54	1.06
	2011-2013	1.42	-9.87	-6.93
	2005-2013	1.31	-1.71	-1.31
Secondary Sector	2005-2007	3.59	3.39	0.94
	2008-2010	-4.77	-3.22	0.67
	2011-2013	0.93	7.37	7.92
	2005-2013	0.33	1.69	5.16
Tertiary Sector	2005-2007	2.86	3.63	1.27
	2008-2010	-0.68	2.11	-3.10
	2011-2013	2.04	1.00	0.49
	2005-2013	2.03	10.52	5.17

Source. Own estimates based on the Sistema de Cuentas Nacionales and the Encuesta Nacional de Ocupación y Empleo (INEGI).

Table D. Sonora. GDP Growth Rates, Employment, and elasticities by period, subperiods, and sector

Entity	Period	GDP Growth Rate	Employment Growth Rate	Elasticity
Sonora	2005-2007	3.64	2.32	0.64
	2008-2010	1.04	0.65	0.62
	2011-2013	3.77	2.41	0.64
	2005-2013	3.55	2.86	0.81
Primary Sector	2005-2007	5.04	3.74	0.74
	2008-2010	1.81	2.71	1.50
	2011-2013	3.88	2.67	0.69
	2005-2013	2.63	3.46	1.31
Secondary Sector	2005-2007	4.21	1.03	0.24
	2008-2010	1.21	0.10	0.08
	2011-2013	4.80	0.70	0.15
	2005-2013	4.43	2.04	0.46
Tertiary Sector	2005-2007	2.99	3.36	1.12
	2008-2010	0.79	0.72	0.91
	2011-2013	2.87	3.65	1.27
	2005-2013	2.94	10.82	3.68

Source. Own estimates based on the Sistema de Cuentas Nacionales and the Encuesta Nacional de Ocupación y Empleo (INEGI).

Table E. Chihuahua. GDP Growth Rates, Employment, and Elasticities by Period, Subperiods, and Sector

Entity	Period	GDP Growth Rate	Employment Growth Rate	Elasticity
Chihuahua	2005-2007	3.62	2.54	0.70
	2008-2010	-1.97	-2.82	1.43
	2011-2013	3.78	2.72	0.72
	2005-2013	2.31	1.03	0.44
Primary Sector	2005-2007	4.40	3.72	0.85
	2008-2010	2.36	2.74	1.16
	2011-2013	7.64	2.92	0.38
	2005-2013	3.97	1.40	0.35
Secondary Sector	2005-2007	3.69	1.57	0.42
	2008-2010	-4.69	0.08	-0.02
	2011-2013	5.18	8.28	1.60
	2005-2013	1.68	2.62	1.56
Tertiary Sector	2005-2007	3.50	1.70	0.49
	2008-2010	-0.77	-4.48	5.80
	2011-2013	2.59	1.10	0.42
	2005-2013	2.51	0.26	0.11

Source. Own estimates based on the Sistema de Cuentas Nacionales and the Encuesta Nacional de Ocupación y Empleo (INEGI).

Table F. Coahuila. GDP Growth Rates, Employment, and Elasticities by Period, Subperiods, and Sector

Entity	Period	GDP Growth Rate	Employment Growth Rate	Elasticity
Coahuila	2005-2007	2.84	4.83	1.70
	2008-2010	-0.05	0.11	-2.22
	2011-2013	1.77	1.37	0.77
	2005-2013	2.63	2.70	1.02
Primary Sector	2005-2007	1.82	4.61	2.53
	2008-2010	0.68	3.70	5.46
	2011-2013	-0.46	-9.04	19.75
	2005-2013	0.55	-0.47	-0.86
Secondary Sector	2005-2007	2.45	1.82	0.74
	2008-2010	-0.50	-0.30	0.59
	2011-2013	1.65	4.03	2.44
	2005-2013	2.65	2.71	1.02
Tertiary Sector	2005-2007	3.32	6.09	1.84
	2008-2010	0.39	0.24	0.62
	2011-2013	2.02	0.87	0.43
	2005-2013	2.73	8.98	3.29

Source. Own estimates based on the Sistema de Cuentas Nacionales and the Encuesta Nacional de Ocupación y Empleo (INEGI).

Table G. Nuevo León. GDP Growth Rates, Employment, and Elasticities by Period, Subperiods, and Sector

Entity	Period	GDP Growth Rate	Employment Growth Rate	Elasticity
Nuevo León	2005-2007	4.87	2.56	0.52
	2008-2010	0.34	1.45	4.31
	2011-2013	2.04	0.75	0.37
	2005-2013	3.29	1.72	0.52
Primary Sector	2005-2007	4.07	-12.34	-3.04
	2008-2010	3.17	16.59	5.23
	2011-2013	-0.33	-0.96	2.93
	2005-2013	0.47	-2.18	-4.60
Secondary Sector	2005-2007	5.60	1.80	0.32
	2008-2010	0.36	-0.56	-1.54
	2011-2013	0.73	2.33	3.22
	2005-2013	2.93	1.87	0.64
Tertiary Sector	2005-2007	4.41	3.48	0.79
	2008-2010	0.29	2.04	7.09
	2011-2013	2.90	0.07	0.02
	2005-2013	3.54	5.44	1.54

Source. Own estimates based on the Sistema de Cuentas Nacionales and the Encuesta Nacional de Ocupación y Empleo (INEGI).

Table H. Tamaulipas. GDP Growth Rates, Employment, and Elasticities by Period, Subperiods, and Sector

Entity	Period	GDP Growth Rate	Employment Growth Rate	Elasticity
Tamaulipas	2005-2007	1.94	2.21	1.14
	2008-2010	-0.78	-0.09	0.12
	2011-2013	1.13	1.79	1.59
	2005-2013	1.35	1.85	1.38
Primary Sector	2005-2007	2.02	1.35	0.67
	2008-2010	1.40	5.20	3.73
	2011-2013	-2.58	3.69	-1.43
	2005-2013	-1.59	1.21	-0.76
Secondary Sector	2005-2007	1.03	-0.51	-0.49
	2008-2010	-1.46	0.21	-0.15
	2011-2013	-0.32	5.7440	-17.90
	2005-2013	0.44	0.73	1.67
Tertiary Sector	2005-2007	2.60	3.83	1.47
	2008-2010	-0.42	-0.73	1.74
	2011-2013	2.30	0.15	0.06
	2005-2013	2.15	7.85	3.65

Source. Own estimates based on the Sistema de Cuentas Nacionales and the Encuesta Nacional de Ocupación y Empleo (INEGI).

Table I. Sinaloa. GDP Growth Rates, Employment, and Elasticities by Period, Subperiods, and Sector

Entity	Period	GDP Growth Rate	Employment Growth Rate	Elasticity
Sinaloa	2005-2007	2.87	0.04	0.01
	2008-2010	-0.23	0.70	-3.10
	2011-2013	2.24	0.74	0.33
	2005-2013	1.83	0.83	0.45
Primary Sector	2005-2007	6.36	-0.85	-0.13
	2008-2010	-1.86	0.47	-0.25
	2011-2013	7.65	3.12	0.41
	2005-2013	-0.21	-0.40	1.90
Secondary Sector	2005-2007	2.01	0.15	0.08
	2008-2010	-0.83	-5.05	6.08
	2011-2013	-1.44	3.9	-2.69
	2005-2013	0.41	0.77	1.86
Tertiary Sector	2005-2007	2.48	0.39	0.16
	2008-2010	0.34	2.57	7.46
	2011-2013	2.74	-0.69	-0.25
	2005-2013	2.68	4.07	1.52

Source. Own estimates based on the Sistema de Cuentas Nacionales and the Encuesta Nacional de Ocupación y Empleo (INEGI).

Table J. Baja California Sur. GDP Growth Rates, Employment, and Elasticities by Period, Subperiods, and Sector

Entity	Period	GDP Growth Rate	Employment Growth Rate	Elasticity
BCS	2005-2007	5.60	4.60	0.82
	2008-2010	-0.52	0.56	-1.07
	2011-2013	1.95	1.20	0.61
	2005-2013	3.30	3.75	1.14
Primary Sector	2005-2007	-2.48	-2.96	1.19
	2008-2010	2.33	-0.92	-0.39
	2011-2013	1.27	1.74	1.36
	2005-2013	0.28	1.49	5.32
Secondary Sector	2005-2007	4.46	7.93	1.78
	2008-2010	-4.21	-0.97	0.23
	2011-2013	3.65	3.84	1.05
	2005-2013	4.17	4.33	1.04
Tertiary Sector	2005-2007	6.40	4.88	0.76
	2008-2010	0.65	1.40	2.17
	2011-2013	1.40	0.39	0.28
	2005-2013	3.16	12.22	3.87

Source. Own estimates based on the Sistema de Cuentas Nacionales and the Encuesta Nacional de Ocupación y Empleo (INEGI).

Appendix II

Equation 2. LgPOi = β0 + β1LgPIBi + β 2LgIEDi + β3LgFBKi + β4LgGP

```
. regress lgMPO0507 lgMPIB0507 lgMIED0507 lgMFBK0409 lgMGP0507
```

Source	SS	df	MS	Number of obs =	37
				F(4, 32) =	54.61
Model	7.70205829	4	1.92551457	Prob > F =	0.0000
Residual	1.12839218	32	.035262256	R-squared =	0.8722
				Adj R-squared =	0.8562
Total	8.83045047	36	.245290291	Root MSE =	.18778

lgMPO0507	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lgMPIB0507	.9476868	.1390216	6.82	0.000	.664509	1.230865
lgMIED0507	.1551452	.0991617	1.56	0.128	-.0468405	.3571309
lgMFBK0409	-.4381021	.1794236	-2.44	0.020	-.803576	-.0726282
lgMGP0507	.2624237	.0991625	2.65	0.013	.0604363	.4644112

Equation 3. LgPOi = β0 + β1LgPIBi + β 2LgIEDi + β3LgFBKi + β4LgGP

```
. regress lgMPO0810 lgMPIB0810 lgMIED0810 lgMFBK09 lgMGP0810
```

Source	SS	df	MS	Number of obs =	37
				F(4, 32) =	64.12
Model	7.71195099	4	1.92798775	Prob > F =	0.0000
Residual	.962205304	32	.030068916	R-squared =	0.8891
				Adj R-squared =	0.8752
Total	8.67415629	36	.240948786	Root MSE =	.1734

lgMPO0810	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lgMPIB0810	.9622479	.1277972	7.53	0.000	.7019335	1.222562
lgMIED0810	.1207066	.0805372	1.50	0.144	-.0433424	.2847555
lgMFBK09	-.3559651	.1223212	-2.91	0.007	-.6051253	-.1068049
lgMGP0810	.2068423	.0818103	2.53	0.017	.0402001	.3734845
_cons	.8619368	.3629113	2.38	0.024	.1227107	1.601163

Equation 4. LgPOi = β0 + β1LgPIBi + β 2LgIEDi + β3LgFBKi + β4LgGP

```
. regress lgMPO1113 lgMPIB1113 lgMIED1113 lgMFBK0914 lgMGP1113
```

Source	SS	df	MS	Number of obs =	37
				F(4, 32) =	85.27
Model	7.87767942	4	1.96941986	Prob > F =	0.0000
Residual	.739064609	32	.023095769	R-squared =	0.9142
				Adj R-squared =	0.9035
Total	8.61674403	36	.239354001	Root MSE =	.15197

lgMPO1113	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lgMPIB1113	.9169663	.1057687	8.67	0.000	.7015226	1.13241
lgMIED1113	.2302106	.0757837	3.04	0.005	.0758442	.3845769
lgMFBK0914	-.3076541	.0865426	-3.55	0.001	-.4839356	-.1313727
lgMGP1113	.1215058	.0727158	1.67	0.104	-.0266116	.2696231
_cons	.7615838	.3152752	2.42	0.022	.1193892	1.403778

Appendix III

*Model Specification: Ramsey Test (ovtest)

```
Ramsey RESET test using powers of the fitted values of lgMPO0513
       Ho:  model has no omitted variables
                  F(3, 29) =      0.08
                  Prob > F =      0.9718
```

The null hypothesis (H_0) is that there are no omitted variables. The p-value is greater than 0.05 (Prob > F = 0.9718). Therefore, the null hypothesis is not rejected. This means that there are no omitted variables in the model.

*Heteroscedasticity in the model: Breusch-Pagan Test (estat hettest)

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of lgMPO0513

         chi2(1)      =     1.54
         Prob > chi2  =   0.2149
```

The null hypothesis (H_0) is that the variance is constant. The p-value is greater than 0.05 (Prob > F = 0.2149). Therefore, the null hypothesis is not rejected. The model does not present heteroscedasticity.

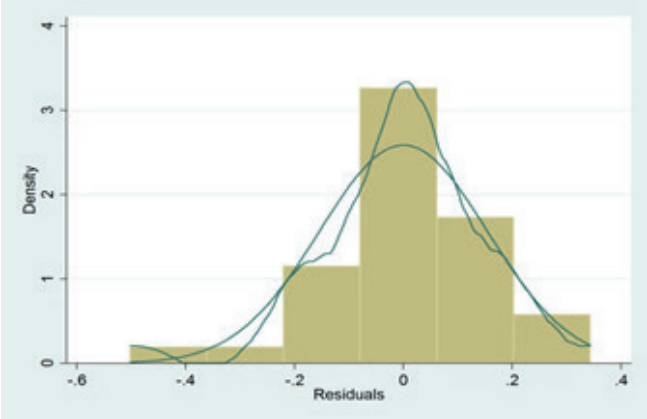
*Normality in the model: Jarque-Bera normality test (predict resid, residuals; then: jb resid)

```
. jb resid
Jarque-Bera normality test:  .9788 Chi(2)    .613
Jarque-Bera test for Ho: normality:
```

The null hypothesis (H_0) is that the residuals are normally distributed. The p-value is greater than 0.05 (Prob = 0.613).

The null hypothesis is not rejected. In the model, the residuals follow a normal distribution, as also shown by the graphical method:

Histogram of the residuals:



*Multicollinearity in the model: Variance Inflation Factor (VIF)

Variable	VIF	1/VIF
lgMFBK0513	6.40	0.156305
lgMPIB0513	5.04	0.198370
lgMIED0513	3.48	0.287703
lgMGP0513	3.22	0.310878
Mean VIF	4.53	

*There are two metrics to determine whether a variable shows correlation:

1st: VIF > 5 = Correlation; VIF > 10 = Strong correlation

2nd: VIF > 4 = Correlation; VIF > 8 = Strong correlation

The second is stricter than the first. The average of the VIF values and the highest of these factors are both below 10; therefore, the variables are significant at the 10% level and can be jointly included in the model specification, as they do not generate multicollinearity.