Impact of public and private investment on the economic growth of the north-central region of Mexico

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Abstract

This article analyzes the impact of public and private investment on economic growth in the north-central region of Mexico during the periods 2013-2018 and 2019-2024. It uses the theoretical foundations of an endogenous growth model, which have proven to be substantial for economic growth. It also presents a literature review and analyzes the evolution of regional growth and investment over time. A panel data methodology is used. The empirical results show that in the estimated models, private investment has a slightly greater impact than public investment on the region's economic growth. Remittances do not play a predominant role in the growth rate. Secondary education contributes more to growth than basic or higher education.

JEL Classification: E62, F21, O45, R11
Keywords: regional growth, north-central region, public and private investment.

Impacto de la inversión pública y privada en el crecimiento económico de la región centro-norte de México

Resumen

Este artículo analiza el impacto de la inversiones pública y privada en el crecimiento económico de la región centro-norte de México durante los periodos 2013-2018 y 2019-2024. Para lo cual se utilizan fundamentos teóricos de un modelo de crecimiento endógeno que demostraron ser sustanciales para el crecimiento económico. Asimismo, se expone una revisión de la literatura y se analiza la evolución del crecimiento regional, así como de las inversiones en el tiempo. Se sigue una metodología de datos panel. Los resultados empíricos muestran que en los modelos estimados la inversión privada tiene un impacto ligeramente mayor que la pública en el crecimiento económico de la región. Las remesas no juegan un papel preponderante en la tasa de crecimiento. La educación media contribuye más al crecimiento que la educación básica o superior.

Clasificación JEL: E62, F21, O45, R11
Palabras clave: crecimiento regional, región centro-norte, inversión pública y privada.

1. Introduction

Throughout history, economic growth has been studied extensively, resulting in a wealth of definitions and perspectives on how to approach its analysis. For the purposes of this study, we will understand economic growth as a process in which levels of economic activity increase steadily over time (Redondo et al., 2018). Furthermore, another dimension of economic growth is that increased per capita output leads to higher real wages and the opportunity for citizens of a country to improve their standard of living (Samuelson, 2006). It is also important to mention that for a country to experience economic growth, a series of changes must occur in production techniques, social attitudes, and institutions, as the authors point out. Undoubtedly, the implementation of economic policies is fundamental to creating this environment conducive to growth, and their effectiveness can be measured by their impact on increasing per capita output. For example, in Latin America, the implementation of public policies focused on economic growth has shown mixed results. While countries like Chile and Brazil have achieved stability and economic expansion through structural reforms and trade liberalization, other countries with similar situations have faced difficulties. In this sense, in the case of Mexico, which has implemented various strategies to promote regional growth, disparate results have been obtained among its different geographic areas. Let's examine the case of northern Mexico, which has historically been characterized by its industrial dynamism and its close relationship with the U.S. market.

Given this scenario, the need arises to answer the following research question: How have the public policies implemented between 2007 and 2024 influenced the economic growth of northern Mexico? To this end, key indicators such as regional Gross Domestic Product (GDP), public and private investment, job creation, and exports will be analyzed. This study contributes to the debate on the impact of economic policies on regional development and aims to help generate recommendations to improve the effectiveness of strategies that lead to sustained growth in Northern Mexico. The findings of this research can contribute to the design of more efficient policies to strengthen regional economic development and reduce inequalities in the country. Thus, the aim of this paper is to analyze the impact of public and private investment on economic growth in the north-central region of Mexico. To this end, it uses theoretical foundations, presents a literature review, and analyzes the evolution of regional growth and investment over time. This study contributes to the existing literature that specifically analyzes the states that comprise the north-central region of Mexico.

The document presents a clear and coherent organization that allows for a gradual understanding of the topic addressed. Part two presents a critical analysis of previous studies that underpin the current work, identifying relevant theories and gaps in existing research. Part three provides a summary of the basic characteristics of the variables used in the study, including graphical analysis, which lays the groundwork for subsequent analysis. Part four describes the data source and methodology used, including data processing techniques and the analysis procedure. Part five then presents the results derived from estimating the proposed model, along with a detailed analysis of these results, discussing their relevance and potential implications. Finally, the most important results and proposals of the study are presented in the conclusions, where the practical and theoretical implications are detailed, and future lines of research are suggested.

2. Literature Review

This section presents a review of the literature on research conducted on the link between private and public investment and economic growth. The link between private and public investment and its effects on economic growth have gained significant relevance in the economic literature in recent years. Despite the historical significance of public investment, there is broad consensus that private investment tends to be a more efficient engine for promoting economic growth. This is reflected in various empirical studies over the decades.

Within the economic literature, a variety of studies can help us understand the effects of public spending on economic growth. In their article, Bandrés and Gadea-Rivas (2019) examine the dynamics of the long-term interaction between the size of public spending and growth rates for a sample of 25 European countries.

They find that the relationship between these two variables is not linear, as countries with comparatively lower public spending than the average negatively impact growth rates, while others with much higher public spending do not experience negative impacts on their long-term growth dynamics. They conclude that the effects of public spending on growth depend on the composition of the spending, the efficiency with which it is managed, and its financing.

Ortiz and Ruiz (2024) analyzed the impact of public spending on Peru's economic growth from 1980 to 2021. Using the Barro model and an econometric approach, they confirmed a positive correlation between the two. They emphasize that efficient management of public spending is crucial for maximizing sustainable economic growth and achieving optimal tax rates.

Salazar (2023) evaluated the influence of public spending on economic growth, based on the premise that public spending can only have long-term effects on economic growth when it positively influences factor productivity. To this end, he developed a cointegration model and error correction mechanism for the Mexican economy, using quarterly data from 1995 to 2018. The results indicate that total public spending, and its components, have a positive and significant impact on economic growth in both the short and long term.

Similarly, Ramírez and Sanabria (2023) aimed to identify the impact of foreign direct investment (FDI) on gross domestic product (GDP), gross fixed capital formation (GFCF), and the labor force participation rate (LFR) as determinants of Mexico's economic growth during the period 1960–2021. They employed a descriptive quantitative methodology to determine the degrees of association and evaluate their behavior over time. Their results indicate that increases in FDI flows lead to increases in GDP and GFCF. However, no significant relationship was found between FDI and LFR, as increases in FDI do not generate impacts on employability. This work is relevant to the ongoing research because it provides useful information for implementing policies aimed at eradicating existing biases in sectors of the Mexican economy, with the goal of boosting FDI flows.

Rivas and Puebla (2016), through an empirical analysis of sectoral panel data, identifies spillovers between Foreign Direct Investment (FDI) and macroeconomic performance indicators for the Mexican economy. His results show that: a) FDI exhibits two distinct concentration patterns, one by state and the other by economic sector; b) FDI flows to Mexico primarily seek production efficiencies; and c) these flows are explained by economic growth, labor productivity, and international competitiveness.

Erwinsyah (2025) studies economic growth in Indonesia, evaluating the trade-offs associated with economic development. The study uses econometric data processing in Eviews to analyze the balance between economic and environmental factors and examines the effects of industrialization and economic development in Indonesia. It emphasizes emissions reduction and sustainable economic growth. Recommendations from the study include clean technologies, renewable energy, international cooperation, and public awareness campaigns.

Ayala and Ibarra (2025) analyze investment and job creation in Mexico, using time series data and estimating a model to determine the effects of interest rate reductions on investment in Mexico. They state that a one percentage point reduction in the real interest rate would increase investment by 23.9 billion pesos. They also find that modifying tax regulations for multinational corporations can promote economic growth and job creation.

Regarding the relationship between economic growth and changes in poverty across Mexico's states, Campos and Monroy-Gómez-Franco (2016) found no correlation between average annual growth and changes in food or asset poverty at the state level during the period 2000–2012: the gains from economic growth did not translate into significant reductions in poverty. However, for the period 2005–2014, economic growth did reduce poverty, although only in some states. This leads to a unitary elasticity of poverty with respect to growth at the national level. They also found that economic growth is associated with a greater number of formal jobs, but not with better wages in those jobs.

As will be discussed later, the northern border region of Mexico has been characterized by its economic dynamism for several decades. Using data from 1993 to 2008, Sánchez and Campos (2010) assert that it is a winning region based on the growth rate of per capita GDP. Through a theoretical framework alternative to the neoclassical model of growth, they demonstrate that the increase in manufacturing industries located there is the primary cause behind the virtuous cycle of cumulative causality experienced.

3. Variable Analysis

This section analyzes the evolution of the variables used in this study, such as economic growth of each entity, its public and private investment, and remittances received. Economic growth in the north-central region of Mexico is highly dynamic. To better understand this dynamic, it is essential to observe the percentage variation in GDP during different government periods. During Enrique Peña Nieto's administration (2012-2018), the country experienced moderate growth, driven by various structural reforms. However, it also faced economic challenges, such as oil price volatility and political uncertainty. During Andrés Manuel López Obrador's administration (2019-2024), economic growth had to contend with the COVID-19 pandemic, which significantly impacted the national and global economy. Austerity policies and a focus on social programs also influenced the country's economic dynamics and, consequently, the states' GDP. Table 1 provides specific data on the percentage change in GDP during these two periods, allowing for a comparative analysis that better illustrates the growth trends and factors that have influenced the economy of north-central Mexico.

Table 1. GDP growth in the periods 2013-2018 and 2019-2023
(data in billions of pesos)

Entity	2013 - 2018		2019 - 2023	
	PIB	% Variation	PIB	% Variation
Aguascalientes	2,016.15	35.08%	1,595.29	-0.15%
Baja California Sur	1,114.67	25.36%	861.97	2.92%
Colima	990.32	13.43%	759.87	-3.96%
Durango	2,112.91	8.01%	1,509.46	0.35%
Jalisco	11,335.83	17.84%	8,754.17	4.81%
Michoacán	4,034.76	19.17%	3,193.21	6.21%
Nayarit	1,044.75	9.00%	788.58	8.22%
San Luis Potosí	3,431.81	27.47%	2,665.84	8.91%
Sinaloa	3,437.28	13.05%	2,556.72	0.93%
Zacatecas	1,488.88	13.46%	1,103.14	2.91%
Total	31,007.36	18.43%	23,788.26	4.07%

Source: own elaboration based on data from INEGI.

As can be seen in Table 1, during the 2013-2018 period, Aguascalientes, Baja California Sur, and San Luis Potosí had the highest growth rates, while Durango and Nayarit were the states that grew the least. Meanwhile, for the 2020-2023 period, San Luis Potosí and Nayarit recovered, achieving growth rates of 8 percent, while Aguascalientes, Colima, and Sinaloa were the states that achieved the lowest growth. Public investment is a crucial component of a country's economic and social development, enabling the construction and maintenance of infrastructure, as well as the provision of basic services that benefit the population. In Mexico, a comparison between the two administrations of Enrique Peña Nieto and Andrés Manuel López Obrador reveals significant differences in public investment policies and their outcomes. During Peña Nieto's administration, public investment was marked by large infrastructure projects, such as the construction of new roads, hospitals, and schools, as well as the modernization of airports and ports. However, a lack of transparency and perceptions of corruption in some of these projects were also criticized. On the other hand, López Obrador's administration was characterized by a focus on strengthening social programs and prioritizing flagship projects such as the Mayan Train and the Dos Bocas refinery. Graph 1 illustrates these changes in public investment.

Graph 1. Public Investment in the North-Central Region
(millions of pesos)
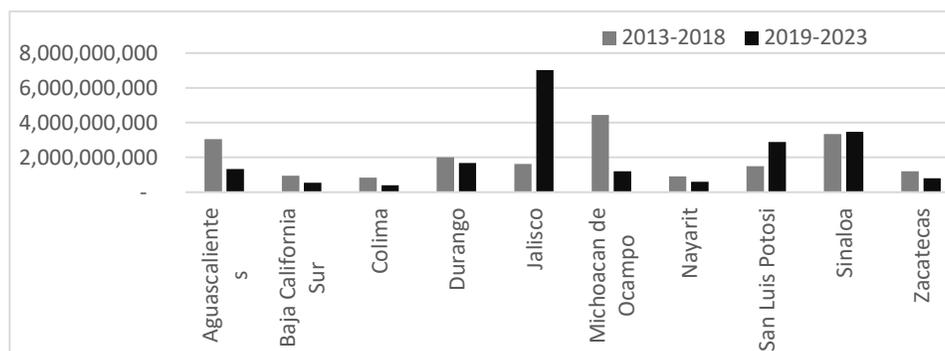
Source: own elaboration based on data from INEGI.

Here it is possible to notice that Jalisco invested more than the other entities in the 2019-2023 period, having a significant difference with respect to the other entities. It is also possible to notice that there are entities that reduced public investment such as Aguascalientes from 3 billion to 1 billion; Baja California Sur from 947 million to 551 million; Colima from 843 million to 398 million; Durango from 2 billion to 1.678 billion; Michoacán suffering the largest reduction from 4 billion 449 million to 1.206 billion; Nayarit from 900 million to 600 million and; Zacatecas from 1.198 billion to 799 million pesos. Something interesting occurs, since it could and should be thought that poverty reduction is due to public investment, in these entities it seems that this is not the case, as it was in Jalisco, which increased its investment from 1.622 billion to 7.20 billion; San Luis Potosí from 1.492 billion to 2.892 billion; Sinaloa from 3.337 billion to 3.477 billion pesos.

Foreign direct investment increased during the 2019-2023 period compared to the 2013-2018 period, so at first glance, one might think that private investment had a positive effect on the economic growth of the country's north-central region. This historically makes sense given the companies that have moved to the area and have been able to create more jobs and a different way of life. The evolution of FDI during the two periods mentioned can be seen in graph 2.

Graph 2. Foreign Direct Investment in the North-Central Region
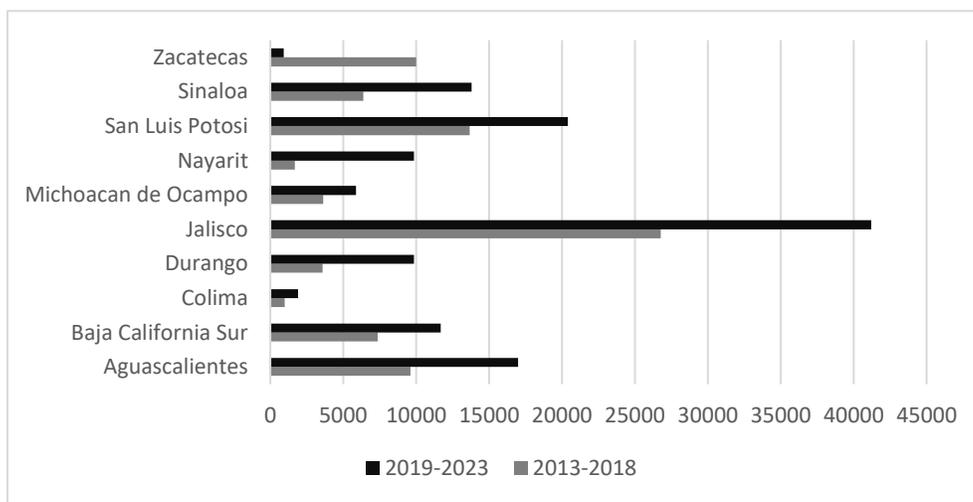
Source: own elaboration based on data from the Ministry of Economy.

As can be seen in graph 2, foreign investment increased in almost all states compared to the previous six-year term, except for Zacatecas. Private investment in Aguascalientes increased by 77%; Baja California Sur by 59%; Colima by 92%; Durango by 174%; Jalisco by 53%; Michoacán by 62%; Nayarit by 481%, the highest in this region; San Luis Potosí by 49%; and Sinaloa by 116%.

4. Data and Methodology

The estimation methodology presented is based on an econometric panel data analysis using a large database spanning nearly two six-year periods, from 2013 to 2023, with biennial data collection intervals. This approach captures trends and variations over time in the 10 states of north-central Mexico, which include Aguascalientes, Baja California Sur, Colima, Durango, Jalisco, Michoacán de Ocampo, Nayarit, San Luis Potosí, Sinaloa, and Zacatecas.

The breakdown of the variables selected for the econometric model shows careful attention to the factors that influence the economic development of the states. Public investment by state is obtained from INEGI (National Institute of Statistics and Geography), a variable crucial for regional development. Public investment not only improves infrastructure and public services but can also stimulate local economic activity, generate employment, and attract additional investment. Foreign direct investment, provided by the Ministry of Economy, is essential for understanding investor confidence in the local economy. A healthy flow of FDI can indicate a favorable business environment and can be an engine of economic growth, creating jobs and promoting technology transfer. Remittances, often from migrant workers, are an important source of income for many families and regions. Data on remittances, obtained from the Bank of Mexico, allow for analysis of their impact on income and consumption, as well as their effect on poverty reduction and promoting social development in host communities. School enrollment by state is collected from the Ministry of Public Education (SEP); this variable is an indicator of the educational level in each state. Education is a key determinant of human capital, and higher levels of schooling are often associated with better job opportunities and greater economic development. Analyzing this variable is essential for assessing not only economic development but also social development in the regions studied. Together, these variables provide a comprehensive framework for understanding the factors that affect economic growth in the states, allowing for the identification of patterns and the promotion of policies that can improve the region's economic and social conditions.

The model used is a panel data model developed using the econometric software Stata. Data from ten states across several years are included. The advantage of this model is that it provides a broad data set that exhibits greater variability and less collinearity. Panel data also allows for individual heterogeneity to be controlled to avoid bias in the estimates. Similarly, this model is unique in that it has a greater capacity for identifying and estimating effects than would be possible with other models such as pure series data (Baltagi, 1995).

5. Model and Results Analysis

The model developed by Sims and Wolff (2018) is a significant contribution to understanding the interaction between public spending and the economy. By considering public consumption as inseparable from private consumption, the authors highlight the importance of complementarity between the two types of consumption. This means that an increase in public spending not only directly affects production and employment but also has positive implications for individual well-being by improving overall consumption.

The multiplier effect of public spending translates into an increase in production, employment, and individual consumption, which in turn can lead to a virtuous cycle of economic

growth. While it is true that an increase in public spending can result in higher tax rates, the model suggests that the benefits derived from increased public consumption and general well-being outweigh the costs associated with taxation.

This approach provides a more nuanced perspective on the role of public spending in the economy, suggesting that expansionary fiscal policies can be justified not only by their immediate impact on output, but also by their ability to improve long-term welfare. In this sense, the work of Sims and Wolff contributes to the discussion on the effectiveness of fiscal policies in contexts of recession or low economic growth, highlighting the importance of a comprehensive approach that considers both the direct and indirect effects of public spending.

To analyze economic growth in the north-central region of Mexico, the variables used are: state GDP, state public investment, state foreign direct investment, remittances from each state, and the educational level of each state. A panel data model is used to estimate the model. The estimated model has the following form:

$$pib_{it} = \beta_1 + \beta_2 invpub_{it} + \beta_3 ied_{it} + \beta_4 rem_{it} + \beta_5 edu_{it} + u_{it} \quad (1)$$

where:

pib_{it} is the Gross Domestic Product of state i at time t

$invpub_{it}$ is the public investment of state i at time t

ied_{it} is the foreign direct investment of state i at time t

rem_{it} are the remittances from state i at time t

edu_{it} is the educational level of state i at time t

u_{it}: is the stochastic disturbance term

It is important to mention that for the variable edu, the levels of basic, upper secondary, and higher education will be considered, so models will be estimated separately for each educational level: basic education (edubas), upper secondary education (edumed), and higher education (edusup). The results of the model of equation (11) are observed in Table 2.

Table 2. Results of the Economic Growth Model for the North-Central Region

Dependent variable: GDP growth			
Independent Variables	**Model 1** MEF	**Model 2** MEF	**Model 3** MEA
invpub	0.285305 (0.0415)	0.399607 (0.0183)	0.216524 (0.0252)
ied	0.644365 (0.0312)	0.730583 (0.0214)	0.611519 (0.0446)
rem	0.182363 (0.0081)	0.224847 (0.0034)	0.193842 (0.0002)
edubas	0.110064 (0.0009)	-	-
edumed	-	0.486563 (0.0000)	-

edusup	-	-	-0.274741
			(0.0158)
Constant	14.23397	16.19443	17.99775
	(0.0000)	(0.0000)	(0.0000)
F (p-value)	0.000	0.000	0.000
LM (p-value)	0.000	0.000	0.000
Hausman (p-value)	0.011	0.021	0.15
R^2	0.53	0.79	0.68
Observations	120	120	120

Source: own elaboration.

Table 2 shows the influence of various independent variables on economic growth using different estimation models. In the first two models, the FEM was determined to be the most appropriate, while in the third model, the MEA was chosen. This suggests that model selection depends on the nature of the data and the relationships between variables. In the first model, all independent variables are statistically significant and have a positive effect on economic growth. The difference in the impact of private investment versus public investment is notable. The coefficient on private investment indicates that a 1 percent increase in this variable results in a 0.64 percent increase in economic growth, highlighting its importance as a driver of economic development. In contrast, public investment has a more moderate effect, with a coefficient suggesting that a 1 percent increase generates 0.28 percent growth. Furthermore, remittances also contribute significantly to economic growth. Their positive coefficient suggests that increased remittance flows stimulate consumption, which in turn promotes overall economic growth. This is especially relevant in economies where remittances constitute an important source of income for many families. The coefficient associated with basic education is also positive, indicating that this educational level contributes to economic growth. This is consistent with the labor context of maquiladoras, which typically require personnel with basic education, which in turn reflects the importance of educational training in the productive capacity of the workforce. In summary, the results suggest that both private investment and remittances and basic education play crucial roles in economic growth, with private investment standing out as the most influential factor.

The results of model two show that public investment has a positive and statistically significant relationship: for every 1 percent increase in public investment, it contributes 0.39 percent to growth. The coefficient on private investment also shows a positive and statistically significant relationship: for every 1 percent increase in such investment, economic growth increases by 0.7 percent. The coefficients on remittances and upper secondary education also show that they contribute to economic growth in the region. The results of model three show that almost all variables are positive and statistically significant, except for higher education, which yielded a negative coefficient. This could indicate that highly educated personnel are not as in demand for productive activities in the region. Overall, the results of the three models show that private investment is contributing more than public investment to economic growth in the north-central region. These results are consistent with those conducted by Phetsavong and Ichihashi (2012), Hague (2013), Ponce and Navarro (2016), as well as Yovo (2017), as they found consistent results that reinforce the idea that private investment tends to be more productive. These studies suggest that

private investment is usually more aligned with innovation and efficiency in resource allocation, which in turn drives economic growth more dynamically.

6. Conclusions

The objective of this article was to analyze the impact of public and private investment on economic growth in north-central Mexico. The analysis conducted in this article highlights the importance of both public and private investment in economic growth in north-central Mexico, using an endogenous growth model as a basis. Throughout the study, the existing literature was reviewed and an analysis of the evolution of regional growth was conducted, allowing the findings to be contextualized within a solid theoretical framework.

The use of panel data for the states of the north-central region during the period 2013 to 2023 provided a broad and representative picture of the region's economic dynamics. The empirical results indicate that public investment not only has a positive effect but is also significant in determining the economic growth rate. This suggests that investment-oriented public policies can be a key driver of regional development. Furthermore, the finding that foreign direct investment (FDI) has a slightly greater impact than public investment highlights the importance of attracting external capital. This may imply that regional development strategies should focus on creating a favorable environment for FDI, in addition to complementing these actions with public investments that strengthen infrastructure and services.

The study provides empirical evidence on the crucial role that investments play in the economic growth of north-central Mexico, suggesting that a combination of robust public investment and a proactive strategy to attract foreign direct investment could further boost growth in this region. Future research is suggested to delve deeper into the mechanisms through which these investments impact economic growth, as well as to identify specific sectors that could benefit from them.

The model´s evidence suggests that states must improve public sector productivity and develop policies to facilitate private investment to ensure a stable macroeconomic environment and sustainable economic growth.

The availability of basic infrastructure reduces the costs faced by private-sector firms. This creates an enabling environment for greater new private-sector capital formation and higher output growth. The presence of well-developed public infrastructure would reduce the start-up costs of private firms. For example, the presence of a railway network can reduce the cost of transporting heavy equipment that may be required to establish a new factory.

Furthermore, facilitating geographic access through improved transportation infrastructure improves labor mobility, which can move surplus labor to locations where it is scarce. A well-developed communications infrastructure can help facilitate the flow of information and help disadvantaged people gain access to productive opportunities by connecting them with basic economic activities. While both public and private investment are important for the growth process, in this region, the results show that private investment has a greater impact than public investment on the region´s economic growth.

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