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Foreign Direct Investment and Regional Economic Growth considering the Distance to the Northern Border of Mexico

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Abstract

The study reviews the different theories that explain the tendencies of FDI at the regional level in Mexico. The effects of the NAFTA agreement in regional FDI are also analyzed. An empirical econometric model is used to analyze the relation between the FDI and economic growth at the regional level in Mexico, with an approach of the new economic geography and endogenous economic growth. The results show that distance to the Mexico-U.S. Border is an important variable that explains regional economic growth. The results support the new economic geography theories.

Key words: FDI, Regional Economic Growth, Northern Border, Regional Econometric Models, Mexico.
JEL codes: F12, F15, F21, R11, R15.

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Introduction

Foreign Direct Investment (FDI) is often thought of as one of the determinants of economic growth, due to its complementing domestic investment. FDI is the investment decision of profit-maximizing agents facing worldwide competition and where significant differences in cost structures due to factor productivity or wage differentials justify cross-border investment and production.

In 1989, Mexico received a large amount of FDI, right at the start of the financial deregulation in Mexico. In 1993, FDI increased to 36,184 million dollars. The largest effect of FDI howerer was thought to be indirect, caused by productive linkages affecting national production; FDI was also thought to be an important vehicle of technological transmission, contributing more to economic growth than domestic investment, due to a minimum threshold stock of human capital in Mexico. FDI also favored the expansion and creation of domestic firms (crowding in) by the complementarity in production and spillovers of technology in Mexico.

The impulse caused by the opening of the economy and the signing of the NAFTA in 1994 had a positive effect in the growth of regional and municipal northern border economies of Mexico, where the maquilador sector is one of the main motors of economic growth on the Northern Mexican Border. In almost all the regions of the Northern Border, a process of economic growth is observed, and the impulse due to the commercial opening is apparent. The exporting sector being one of the most dynamic sectors of the Mexican economy. Since the signing of NAFTA, the growth of exports has contributed to at least half of the growth of Mexico's national product, and more than half of the 3.5 million jobs created in Mexico since August 1995 are related to the exporting sector and to activities linked with FDI. By the year 2000, the companies that exported more than 80% of their production, paid 62% higher wages than other types of companies. In that same year, the maquiladora sector had wages 5 times greater than the average national minimum wage.

Similarly, Mexico has diversified its export base. In 1987, petroleum and related products represented 30% of the national exports, but by the year 2000, companies producing manufactured goods accounted for 87 % of Mexico's export sales. In one decade, the liberalization of trade and the macroeconomic policies in Mexico have increased exports from 41 trillion USD, in 1990, to 166 trillion USD in 2000. Similarly, Mexico increased its imports by 310% between 1990 and 2000. From the creation of NAFTA in 1994 to 2004, the North American region is seen as one of the most integrated commercial regions in the world. The regional proximity of the NAFTA partners is a factor that increases the dynamic performance of North

America in terms of economic growth. By the year 2000, the members of NAFTA carried out one third of the total trade of the region. Similarly, NAFTA has increased the trade flows between Mexico, Canada and the United States. During the last few years, Mexico's trade with its NAFTA partners tripled, accounting for almost $275 trillion USD in 2000.

Trilateral trade between all NAFTA's members reached 659 trillion USD in 2000, or 128.2 % more than in 1993. From 1994 on, commercial trade between the member countries of NAFTA increased at an annual average rate of 11.8%, whereas the worldwide annual average rate of growth in trade was around 7%. The opportunities of trade for both Mexico and Canada within NAFTA have increased in the last few years. Mexico became the fourth most important commercial partner for Canada, whereas the bilateral commerce between Mexico and Canada tripled, reaching 12 trillions USD in 2000, and Mexico is now the third most important buyer of Canadian products. The integration of the intra industry trade is extremely high within NAFTA and shows how the region integrated not only in commercial terms but also in terms of the region's productive systems.

The NAFTA region has created new opportunities of investment and trade for the companies of all 3 countries, and 50 % of FDI in NAFTA is between trade partners. For Mexico, the United States is the main source of FDI. From 1994 to 2000, U.S. companies invested 40.3 trillion dollars in Mexico, whereas Canada invested nearly 2.8 trillion dollars. FDI is of great importance the Northern Border Mexican Region, and by the year 2004, FDI in the Northern Border States of Mexico represented 18.7% of total FDI at the national level. The Northern Border States that are considered in this study are Baja California, Sonora, Chihuahua, Coahuila, Nuevo Leon and Tamaulipas. The following table shows the importance of FDI in the Mexican Northern Border area.

Table 1
FDI by state in Mexico fron 1995 to 2004 in million dollars

States	*1995*	*1996*	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*
Total	8,345.0	7,836.3	12,199.7	8,359.3	13,336.9	16,909.6	27,720.8	15,325.2	11,663.6	16,115.1
Northern Border	2,440.5	1,906.7	4,110.4	2,667.5	4,080.2	5,518.5	4,205.8	3,595.5	2,992.1	3,013.6
Aguascalientes	27.1	34.8	18.1	69.1	91.2	82.6	103.4	-12.5	20.2	28.7
Baja California	538.1	427.6	677.7	726.0	1,167.0	971.7	839.4	916.3	682.2	918.3
Baja California Sur	20.9	34.6	42.4	46.7	99.1	80.6	154.1	235.9	101.8	122.1
Campeche	0.5	0.0	1.8	0.1	4.6	11.4	-21.4	55.0	11.1	10.6
Coahuila	120.4	147.6	114.4	134.6	213.4	293.3	177.7	188.6	110.6	128.1
Colima	3.0	4.0	3.5	4.1	4.2	9.5	1.3	6.7	11.9	6.3
Chiapas	0.4	1.0	0.4	0.4	4.3	2.2	-0.9	2.2	1.4	3.2
Chihuahua	528.7	534.3	503.8	620.0	603.8	1,074.8	740.1	608.5	710.5	708.4
Distrito Federal	4,483.0	4,776.7	6,740.8	4,017.5	6,008.2	8,192.2	20,335.9	9,501.5	7,016.8	11,051.7
Durango	40.5	20.2	41.6	45.3	15.6	5.0	43.5	69.4	9.1	8.6
Guanajuato	6.3	9.8	41.0	7.1	136.8	71.8	221.2	129.7	214.4	26.6
Guerrero	45.2	9.6	2.4	4.2	32.4	10.4	21.7	15.4	15.7	13.0
Hidalgo	48.3	60.2	2.4	0.7	0.7	-22.0	76.5	4.9	-0.5	0.6
Jalisco	114.4	185.6	202.3	361.5	523.4	1,144.0	498.2	218.0	225.3	401.5
Estado de México	607.9	407.9	290.3	747.0	1,392.4	434.6	769.2	687.3	410.9	672.2
Michoacán	48.8	1.2	4.0	4.3	6.3	28.3	5.8	8.1	4.8	-7.4
Morelos	67.6	51.2	27.4	60.8	147.9	65.9	18.5	5.3	47.1	142.4
Nayarit	2.0	3.6	7.6	6.0	27.5	44.4	37.8	18.0	89.3	30.5
Nuevo León	704.2	354.6	2,371.2	671.6	1,431.0	2,288.0	1,924.1	1,374.2	1,058.5	713.4
Oaxaca	-2.0	0.3	6.1	0.4	1.1	-1.7	-1.7	2.4	0.4	1.9
Puebla	25.3	39.2	379.3	37.9	200.5	549.1	444.6	478.1	262.6	340.4
Querétaro	42.0	69.8	73.2	125.1	138.9	156.7	187.2	103.2	35.2	54.4
Quintana Roo	20.5	25.4	124.6	41.9	96.4	94.1	96.8	20.4	56.8	62.6
San Luis Potosí	135.3	89.1	1.1	6.1	207.7	284.5	181.3	2.8	38.1	28.7
Sinaloa	94.1	28.7	36.0	13.6	40.9	12.5	61.4	19.8	17.1	16.7
Sonora	155.4	108.3	159.6	169.6	203.2	402.0	179.1	185.9	125.4	251.0
Tabasco	1.2	0.0	7.6	0.4	52.8	38.4	4.2	2.3	0.3	2.1
Tamaulipas	393.7	334.3	283.7	345.7	461.8	488.7	345.4	322.0	304.9	294.4
Tlaxcala	11.2	7.3	3.9	8.8	44.5	4.5	13.2	-17.6	31.1	57.8
Veracruz	29.0	10.4	3.7	38.2	-73.1	24.3	119.7	165.2	26.8	11.3
Yucatán	19.8	47.9	14.2	31.0	41.3	55.5	138.0	3.4	22.6	9.9
Zacatecas	12.2	11.1	13.6	13.6	11.1	12.3	5.5	4.8	1.2	5.1

Source: Secretaría de Economía (2004).

By the year 2004, Mexico received 16,000 million dollars of FDI, which shows the positive effect of the NAFTA agreement on FDI during its first decade.

Agglomerations play an important role in the globalization of the productive sectors of the economy. Agglomeration forces stem from the forward and backward linkages among producers from different regions in Mexico, and induced, industrial clustering after trade liberalization and the opening of the economy during the NAFTA era. The intuition is that the fall of trade barriers unleashes agglomeration forces because it is advantageous for firms operating in a given sector to cluster together (and to exploit proximity to input suppliers) and to serve distant consumers by exports. Models of the new economic geography generally abstract from factor endowment differences among regions, and hence they do not explicitly analyze the interplay between factor proportions and agglomeration economies after the opining up of an economy. Regardless of some of the positive effects of NAFTA in Mexico, it will not resolve all the structural reform problems that the country still faces.

1. Economic Growth in Mexico

Economic Growth can be measured by the amount of production in a particular region, during a period of time, in real terms. The central concern of growth economists in Mexico however, is what are the determinants of national economic growth and it is difficult to say much about that without a theory of growth. Another concern for economists in Mexico is regional economics. Regional economics in Mexico is concerned with the spatial allocation of economic activity. It is centered along the analysis within regions and states, or metropolitan areas of a country. Mexico as a country is now one of the steady-growing economies in Latin America and a model of financial and commercial integration. But these development and economic growth challenges lie ahead for the country in the next quarter century, as we observe the deep contrasts between Mexico's rich and poor states, growing urban centers and destitute rural areas, and between, Mexicans rich enough to be considered amongst the richest men in the world and owning companies that are able to compete with industrialized countries, and those Mexicans for whom the benefits of globalization have not yet materialized. In recent years, Mexico is among the best macroeconomic performers in the Latin American region, with private sector growth and competitiveness, improvements in infrastructure, environmental protection, and public governance. But in the coming years, Mexico faces many challenges in order to support economic growth. The pending reforms, including the fiscal reform, financial sector, labor, energy and decentralization, wich promise

to give the country a greater legitimacy, stronger sustainability and a higher rate of economic growth.

The economics of growth in Mexico has come a long way since it regained center stage for economists in the last few years. The early focus of economic growth in Mexico was based upon theoretical models that generated self-sustaining growth, but newer models of economic growth have been applied to Mexico, which have increasingly replaced older models, with an attempt to shed light on the factors affecting economic growth in Mexico. On the empirical front, the search for determinants of growth has gone from basic economic growth variables (such as physical and human capital) to newer determinants of economic performance such as trade and institutions. Our understanding of the economic growth process in Mexico has increased considerably as a result. The next table shows the annual growth of the GDP and the rate of inflation in Mexico.

Table 2
GDP Growth and Annual Inflation in Mexico (1960-1995)

Period	*Annual Average Rate of Growth*	*Annual Average Inflation Rate*
1960-1969	7.1	2.6
1970-1979	5.8	16.0
1980-1989	1.9	69.7
1990-1995	1.3	21.3

Sources: Banco de Mexico and INEGI.

During the 2001 recession and after the reactivation of the economy in 2002, the Mexican economy has a moderate economic growth following closely the cyclical movements of the U.S. economy. The synchronicity of both economies has been analyzed, and it differs from the behavior of the European Union with Mexico, and the asymmetry of the economies of Japan and Mexico. The following table shows the annual growth rate of Mexico compared with other countries.

Table 3
Annual Rate of Growth of GDP (%) during 2000-2004

Conuntry	*2000*	*2001*	*2002*	*2003*	*2004*
United States	3.7	0.8	1.9	3.0	4.4
Mexico	6.6	-0.1	0.7	1.3	4.3
European Union	3.5	1.6	0.8	0.5	1.8
Japan	2.8	0.4	-0.3	2.5	3.0

Sources: Banco de Mexico and INEGI.

2. Literature Review

Most growth analysts would date the birth of the modern theory of economic growth to the 1950's, but the growth economists in Mexico would say that the classical economists, such as Adam Smith, David Ricardo, and Thomas Malthus were the first to discuss many of the basic ingredients of modern growth theory. In particular, their emphasis on competitive behavior, equilibrium dynamics, and the impact of diminishing returns on the accumulation of labor and capital are integral elements of what is called the neoclassical approach to growth theory. In the case of Mexico, the neoclassical tradition has had a big impact in the way the theory of growth has been developed. During the 1950s, the neoclassical approach to understanding growth was formalized by Solow and Swan. The basic assumptions underlying the neoclassical growth model, with a productive capacity that can be adequately characterized by a constant-returns-to-scale production function, with diminishing returns to capital and labor, has been the basis of the empirical work being done in Mexico at research centers and Universities in the last twenty years. Growth economists in Mexico also accept the other assumptions, in which firms are price-takers in a competitive market place, which means that no individual firm has any influence over market prices and individual firms are assumed to possess no market power. The assumption that technological change or productivity growth is entirely exogenous and independent of the actions of the consumers and producers and is available to all countries at no cost, has always been taken with some reservation.

The implications of the neoclassical model of growth are straightforward for a middle-income country. The first major implication is that sustained increases in per-capita income can be supported only by sustained increases in total factor productivity. In such a model, the output per worker can only rise if the ratio of capital per worker increases or total factor productivity increases. The assumption of diminishing returns to capital showed that there is a limit to how much capital accumulation can add to output per capita. Hence, the only way to increase output per worker in the long run is to have sustained productivity growth. This major weakness of the neoclassical growth model has been detected by economists around the world and has not been overlooked in Mexico. Long-run growth in the model is exogenous. Recent empirical studies have found a correlation between the rate of growth of FDI and economic growth. The direction of causality between the rate of growth of investment and the rate of economic growth has been analyzed by Carrol and Weil (1994), Blomström, Lipsey and Zedjan (1996) and Barro (1997), and found that the causality was from FDI to economic growth. In the Solow growth model the causality between the rate of economic growth and FDI is negative. In the

endogenous growth models the increases in investment during a period of time, increases the rate of economic growth in the long run. In the endogenous growth models, FDI can affect growth endogenously if it generates increasing returns in production via externalities and productivity spillovers. Moreover, policy changes might induce permanent increases in output growth by providing incentives to host FDI. Specifically, FDI is thought to be an important source of human capital accumulation and technological change. The models of Helpman (1984) and Helpman and Krugman (1985) are also an important part of the analysis of FDI in the new growth theory. In those models, distance to the export market is an important determinant of economic growth and FDI.

3. Empirical Models of FDI and Regional Economic Growth

Early neoclassical growth models emphasized the role of capital accumulation. The Solow-Swan model output is produced by capital and labor. Economic growth is compatible with labor augmenting technical progress, which acts as if it were increasing the available amount of labor. In the long-term, output per capita and labor productivity grow at an exogenously given rate of technical progress. Technical progress is entirely exogenous to these models so that in reality economic growth is not entirely explained. In Solow's seminal study, growth in per capita income was almost entirely (88%) attributed to TFP growth; subsequent more careful measurement of factor inputs led to inputs explaining virtually all of output growth, thus reducing the residual to zero.

An important analytical development in the 1980's and 1990's was the significant improvement in the theory of endogenous growth by Romer (1986, 1990) and Lucas (1988). The new theories of growth, developed in the 80's, known as the endogenous growth theories give renewed importance to the ideas of imperfect competition between firms, appearance of multiple equilibria in the markets and the important role of history and accidents. The conceptual idea of the existence of increasing returns for explaining sustained growth is supported. These thesis are influenced by research progress made in other fields such as industrial organization and trade theory. The leading theorist defending endogenous economic growth and increasing returns to scale from location and knowledge accumulation is Romer (1990). Krugman (1997) uses the model developed by Dixit and Stiglitz (1977) to have a unified spatial economic structure which is described by the new economic geography. Fujita, Krugman and Venables (1999) assume that factors of production are less mobile between countries than between different regions of the same country, and analyzed the spatial order resulting from differing transport costs. They also

use a model to show how gradually declining transportation costs lead to a first spontaneous differentiation into a high-wage core and a low-wage periphery and eventually to a convergence of wages as the periphery industrializes. Economic geography offers the promise to combine globalization theories with a more rigorous theoretical foundation. Fujita, Krugman and Venables (1999) attempt to give some tangibles to the chaos of the new economic geography (NEG) in their recent book. They embrace computer modeling to help explain the interplay of diverse economic forces and cumulative processes.

3.1 Derivation of the Model with FDI and Regional Economic Growth

Suppose we assume a regional production function in the following form:

$$Y = F(K, L, F, X) \tag{1}$$

where Y is the product, K is capital, L is human capital, F is FDI and X denotes the vector of observable variables that can affect the regional economic growth and the FDI.

A Cobb Douglas function is used to obtain the logarithms in time that gives us the following expression:

$$g_y = \zeta g_k + \psi g_f + \gamma g_L + \theta g_x \tag{2}$$

The relation shows the empirical relationship between regional economic growth (g_y) and the presence of FDI (g_f), with other explicative factors (g_x).

From the conventional model of growth, the empirical model is developed using the economic growth Δy_{jt} in region j for time t, with the FDI represented by F, human capital represented by L, and other variables (X) like distance and urban agglomerations. The empirical model has the following form:

$$\Delta Yjt = \beta_0 + \beta_1 L_{jt} + \beta_2 F_{jt} + \beta_3 X_{jt} + u_{jt} \tag{3}$$

3.2 Sources of Information

The sources of information for the study are varied. Distance is measured by the number of kilometers on the road from the capital of a state to the nearest border crossing with the United States. Another distance variable is included and constructed by the number of kilometers on the road from the capital of a state to Mexico City.

The density per kilometer squared in each state of Mexico measures the level of cluster agglomeration in the economy. Another variable is constructed by the number of businesses in the commercial, services or manufacturing sector per state. The migration variable is measured by the net balance migration per state in Mexico provided by INEGI. The human capital variable is an indicator of the educational characteristics of the population in each state. It includes the percentage of the population 15 years of age or older that have more than elementary studies in each state of Mexico.

The regional economic growth is measured by the percentage annual increase in income per capita in the period 1994-2000. The initial level of income used in the study is the one provided by INEGI in 1994. Foreign direct investment is constructed from the data provided by the Ministry of Economy in Mexico from 1994 to 2000. The econometric technique must take into account the endogeneity argument suggesting that the relationship between cluster agglomerations and the economic growth rate is positive.

3.3 Empirical Results of the Model

The econometric method of estimation is TSLS which considers that some of the variables are determined simultaneously in the model.

The econometric results are shown in Table 4.

Table 4
FDI and Regional Economic Growth Regression by States of Mexico during the period of 1994-2000.
Dependent Variable: Regional Income per Capita Growth
Method: TSLS with Instrumental Variables

Variable	*Coefficient*	*Std. error*	*t-stat*	*Prob.*
C	42.993	15.236	2.821*	0.010
Agglomeration	-0.0010	0.0073	-0.148	0.883
Urben population	0.3251	0.1879	1.729	0.098
Distance from D.F.	-0.0009	0.0020	-0.454	0.654
Distance from the border	-0.0079	0.0029	2.716*	0.012
FDI	-0.0001	0.0012	-0.091	0.927
Migration	1.9752	0.6377	3.097*	0.005
Human capital	-0.6105	0.3929	-1.553	0.135
Commerce	-0.0032	0.0026	-1.252	0.224
Services	0.0031	0.0032	0.988	0.334
Manufacturing	0.0009	0.0010	0.914	0.371
R-Squared	0.65	Mean dep. var.		25.30
R-Squared adjusted	0.49	S.D. depend var.		9.830

Note: **Statistically significant.*

The results of the econometric analysis of the regional economic growth with the new economic geography perspective shows that the agglomeration variables are non significant, while the distance from the border is statistically significant, which is evidence in favor of the agglomeration models and the NEG models.

The distance from the border shows the importance of transport costs and trade to the United States in explaining regional economic growth in Mexico. The migration variable is also important, showing the importance of migration in determining regional economic growth, due to repulsion and attraction forces that affect regions and agglomerations in Mexico. On the other hand, the human capital variable, which is one of the most important variables is the endogenous growth models is non significant. In endogenous growth models, FDI can affect growth endogenously if it generates increasing returns in production via externalities and productivity spillovers. Moreover, policy changes might induce permanent increases in output growth by providing incentives to host FDI. Specifically, FDI is thought to be an important source of human capital accumulation and technological change. However, the empirical results show that FDI is not statistically significant.

Conclusions

During the 1990's, the flows of FDI in Mexico increased, affecting the productive capacity of the country, contrary to the period prior to 1994-1995. FDI is determined by the institutional characteristics of Mexico: the degree of political stability and government intervention in the economy; the existence of property law legislation; the property and tax system, and adequate infrastructure. But FDI is also determined by economic factors, such as the degree of openness and trade of the economy. NAFTA had an effect on the amount of FDI that Mexico received after 1994-1995, but also the general macroeconomic performance of the economy in terms of inflation, monetary and fiscal policy. In the empirical study, the importance of the distance to the Northern Border of Mexico as a determinant of regional economic growth in Mexico is shown. The commercial trends in the agglomeration of industry in the Mexican Northern Border and the transportation technology costs to the border region (which are proxied by the distance to the border) are an important factor driving Mexico first to regional concentration and then to regional dispersion of economic activity. The production of manufactures is subject to increasing returns to scale if the production activities take place in a single site close to the border and the selling market.

The recent advances in the field of NEG have increased our understanding of spreading and agglomerating forces in the Mexican economy. Empirical testing,

however is difficult, due to the lack of specific regional data. The object of the study was in part successful, showing that migration, spatial location and distance to the northern border are important characteristics in the NEG of Mexico.

It is evident that the NAFTA agreement and the commercial policy of Mexico do not resolve the medium and long-term economic growth problems that are structural to Mexico. The regional model in Mexico is now focused more on the center-periphery model and the model of growth in the Northern Part of the Country. The Northern Border States of Mexico, accounts for almost 20% of the FDI in all of the country. Finally, migration and the distance to the most important export center, determine the NEG and regional economic growth in contemporary Mexico.

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