NÚMERO 591

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Does Trade Imply Convergence? Analyzing The Effect of NAFTA on The Local Convergence in Mexico

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MARZO 2015

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Abstract

Regional Economics and Economic Growth focus on the question of whether trade leads to a greater concentration of economic activity. Yet little empirical work has assessed the regional convergence impacts of trade. Therefore this paper studies the regional convergence from trade in Mexico after NAFTA. Unlike previous papers, working with municipal-level data allows to observe more clearly the convergence patterns across space and to identify the effect of NAFTA, respectively. Result shows that after NAFTA, convergence in regions near the U.S. border grew faster than those further away. However, there is a significant reduction of the β coefficient after NAFTA indicating a slowdown in the convergence rate. Additional, we find that those municipalities in the south have not been integrated in the world markets, and have, instead, lagged behind their counterparts after NAFTA.

Keywords: Convergence, clusters, international trade, NAFTA and Mexico
JEL codes: R11 and R15

Resumen

La Economía Regional y el Crecimiento Económico se enfocan en la pregunta sobre si el comercio conlleva a una mayor concentración en la actividad económica. No obstante, pocos trabajos empíricos han evaluado los impactos del comercio en la convergencia regional. Por tanto, este trabajo estudia la convergencia de México después del TLCAN. Contrario a trabajos previos, el trabajar con datos a nivel municipal nos han permitido observar de forma más clara los patrones de convergencia en el espacio e identificar el efecto del TLCAN, en cada caso. Los resultados muestran que, después del TLCAN, la convergencia entre regiones cerca de la frontera con los Estados Unidos creció más rápido que aquellos cuya posición geográfica es más lejana. Sin embargo, hay una reducción significativa de los coeficientes β después del TLCAN, indicando una reducción en la tasa de convegencia. Asimismo, encontramos que los municipios del sur no han sido integrados a la economía de mercado, y se han quedado detrás de sus similares después del NAFTA.

Palabras clave: Convergencia, Clusters, Comercio Internacional, TLCAN y México
Codigos JEL: R11 y R15

Introduction

Economists generally agree that trade has a positive effect on overall economic growth in a country. However, it is not necessary that this positive effect happen in all the territory. Actually, some areas could obtain great benefits but others be even substantially damaged. So, it is possible to accept that trade generate growth and global international convergence but with higher internal divergences.

Mexico is probably the best case to study the trade effects over convergence. In 1994 this country enters in the North American Free Trade Agreement (NAFTA). Overall, Mexico has been expected to benefit from its lower labor costs (Musik, 2004). Also, the physical proximity of its border regions implies that northern Mexico has a geographic advantage in production for the U.S. market, and may benefit more than other countries from NAFTA. However, empirical studies regarding the internal spatial effects of NAFTA have had mixed results (see Aroca, et al., 2005; Krugman & Livas-Elizondo, 1996; Hanson, 2001; Rodríguez-Pose & Sánchez-Reaza, 2005; Smith, 1990; among others).

This paper evaluates the NAFTA effects on regional convergence throughout Mexico at a local level of desegregation. There are many previous analysis of convergence for Mexico but many of them are limited, as they use state level data, which masks the spatial distribution of economic activity and severely restricts the number of their observations. This paper offers the following contributions:

(i) We use municipal panel data to identify more clearly the relationship between trade and regional convergence. Using municipal data also provides new observations that could help improve the precision of the estimated impact, since as the sample size grows the estimators converge in probability to the quantity being estimated.

(ii) We include the 2009 economic census to observe if, after fifteen years of NAFTA, the economy has decentralized away from Mexico City to the U.S. border regions.

Work with the local dimension in convergence analysis gives to our results an additional value. Agglomeration economies are positive externalities that evolve due to the spatial concentration of economic activity. Urban economic theory expects that firms obtain productive advantages from locating themselves in close proximity to other firms, and that these benefits can explain the formation and growth of cities and industrial locations (Marshall, 1920). The main sources of agglomeration externalities arise from improved opportunities for labor market pooling, knowledge interactions, specialization, the sharing of inputs and outputs, and from the existence of public goods. As the scale and density of urban and industrial agglomerations grows, an increase in the external benefits available to firms is also expected (Graham, 2006). New Economic Geography (NEG) theory argues that some of the most important determinants in the concentration of economic activity are market size, transportation

cost, and economies of scale (Krugman & Livas-Elizondo, 1996). Krugman's (1991) model shows that the interaction between the economies of scale, transportation and congestion costs can explain the formation of cities. He develops a two-region economy where there is tension between agglomeration (or "centripetal" force) arising from economies of scale plus transport costs, while pressures for dispersion (or "centrifugal" force) arise from the transport costs to dispersed immobile farmers. He argues that manufacturing firms will try to locate themselves in or near a region with large demand for their products, but that cities' growth will be limited by congestion costs. In a later paper, Krugman and Livas-Elizondo (1996) consider the effect of trade on the location of economic activity, and replace the immobile, dispersed farmers with congestion costs as the cause of the centrifugal force. In this case, increased trade can lead to dispersion. The intuition is that as a new market arises from trade, the pull of the existent domestic market diminishes. The domestic center loses the consumers who can now consume from abroad. They apply this model to Mexico, and show that Mexico City has lost relevance as a determinant of regional economic growth over time. Thus, Krugman and Livas-Elizondo predict that the removal of trade barriers will have a larger effect for those regions close to the new market: in this case, those regions closer to the U.S. border. Second, they imply that trade will cause economic dispersion. In contrast, Paluzie (2001) and Montfort and Nicolini (2000) extend the original Krugman model assuming that labor is not internally mobile, and show that trade agreements can increase agglomeration within the country. Paluzie argues that while Krugman and Livas-Elizondo's model may describe economic distribution within a single country like Mexico, the model is more appropriate for the kind of regional inequalities that European integration might generate. Also, Paluzie's and Montfort and Nicolini's models remain closer to the basic Krugman Core-Periphery model and, therefore, their conclusions are more consistent with the general predictions of the literature of new economic geography (Paluzie, 2001).

Two papers explicitly test for convergence in Mexico, but their empirical findings are mixed. Rodríguez-Pose and Sánchez-Reaza (2005) find that states closer to the U.S. border grew faster than others, and there was no significant change in this pattern after NAFTA. They do find evidence that the draw of Mexico City lessened after NAFTA, giving support to the Krugman and Livas-Elizondo hypothesis that trade has decreased agglomeration in Mexico. In contrast, Aroca et al. (2005) do not find that NAFTA substantially changed growth patterns in Mexico, and instead argue that agglomeration has emerged in the form of several income clusters.

Using the output per worker—Gross Value Added (GVA) per employee—across regions of Mexico, this paper examines whether or not trade openness and distance to the U.S. border have an effect on the regional convergence and, if this effect exists, has it clustered or dispersed within the country.

The β-convergence approach: a brief reappraisal

The reduction or persistence of the inequalities among territories is one of the main subjects in Regional Economics and Economic Growth literature. There exists many ways of measuring if the poorest territories catch up to the richest ones. However, among the great variety of measurements, the β-convergence approach stands out (Baumol, 1986; Barro and Sala, 1991; Rey and Mountouri, 1999; Miller and Genc, 2005). The basic β-convergence idea consists on estimate the correlation between the growth of a territory and its initial situation:

$$\left(\frac{lny_i - Lny_{i0}}{T}\right) = g_i = \alpha + \beta lny_{i0} + u_i \qquad (1)$$
$$\lambda = -ln(T\beta + 1)/T$$

This is the simplest specification: unconditional β-convergence. T is the total period of time and i indexes municipalities. A negative β coefficient would indicate that the poor territories are reaching the richer ones. This coefficient can be transformed to a speed of convergence λ in order to compare results in different periods of time.

Obviously this approach is too simple because do not consider the differences among territories which could explain different levels of development. Usually a vector of variables (x_i) that describes the steady state of the economy is introduced extending equation (1) into a conditional β-convergence. Since the spatial econometrics develops, it is also assumed the relevance of the neighbors (Anselin 1988). Equation (2) contains a more precise approach that includes steady stay variables and a Spatial Lag specification:

$$g_i = \alpha + \beta lny_0 + \rho W g_i + \gamma x_i + u_i \qquad (2)$$

This model would allow us to see if the differences in terms of speed of convergence persist when the traditional variables are considered. As a result, it would allow us to discard that these variable are the cause of the difference. However, it should be noticed that there are different reasons for a stop in the process of convergence. As a result, this analysis would highlight a possible structural break that is not caused by the traditional factors. Several variables could be causing this break. But, from an economic point of view, a new period of openness could be one of the most important reasons. A change of pattern in the process of convergence could lead to a model of clusters. In order to explore this possibility, dummies and interactions terms for each cluster are introduced in the model. This extension of model (2) would indicate that the territories follow a different path of convergence depending on their cluster. The significance of the set of dummies is tested in both periods in order to compare the importance of this phenomenon.

Database description: Mexico´s Economic Census

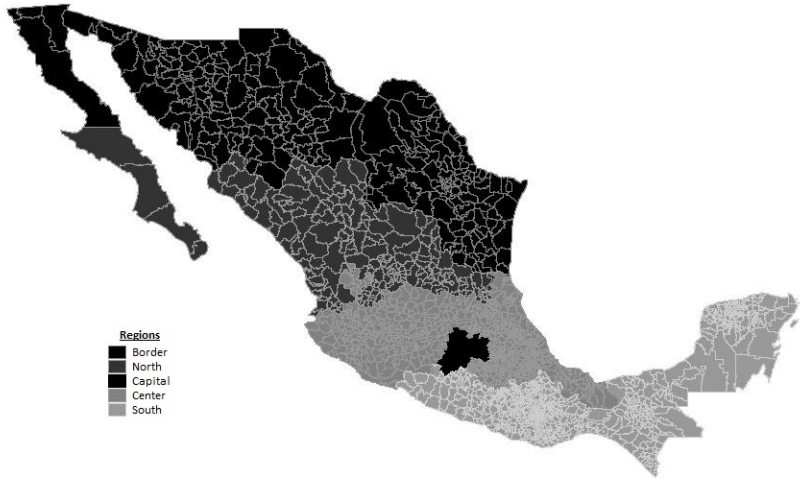
The dataset used in our analysis comes from Mexico´s Economic Census. This database provides both demographic and economic information, and is used to generate a panel data for a convergence analysis. From a spatial point of view, there are 2,377 locations (municipalities) ; and from a temporal perspective, there is quinquennial information from 1980 to 2010.

There are information about Gross Value Added (GVA) in real terms of the different sectors, except for the primary sector. The omission of that sector implies that the GVA could be negative in small and rural areas. In order to avoid this problem, municipalities with a negative value in GVA in any year were eliminated and, therefore, the number of municipalities in this research is 1,902. With this information and the employment of all sectors, our dependent variable can be built. In our model, it is the growth of the GVA per worker (y) in a continuous context $(\frac{lny_i - Lny_{i0}}{T}) = g_i$.

Standard variables that represent the Solow's steady state are also included in this database, following Rodriguez-Pose and Sanchez-Reaza (2005). These variables are: the growth of the population in the previous five years (n), the percentage of people that lived in other municipality five years ago, the distance of the municipality to the closest US border point in kilometers by road (dist) and the human capital is represented by the percentage of people with college five years ago. This variable is a lag in order to avoid endogenity problems.

Finally, following the classification of convergence clubs of Chiquiar (2008), we divide the Mexican territory in 5 groups: (i) the Border Region, states that border the United States, (ii) the north, (iii) the Center; (iv) the South and (v) the Capital, as Figure 1 shows.

FIGURE 1: CONVERGENCE CLUBS IN MEXICO (CHIQUIAR, 2008)



Results

First basic approach: unconditional β-convergence[1]

In order to observe the general process, basic equation (1) is estimated. This result provides a first impression of the process of convergence in Mexico. The estimation of unconditional β-convergence should not be considered as the definitive model. Other variables are also important in the growth of GDP per capita of the territories. However, it is an important instrument in order to see if the poor locations have a bigger growth rate. The results obtained with OLS are summarized in Table 1.

TABLE 1: UNCONDITIONAL B-CONVERGENCE FOR MUNICIPALITIES IN MEXICO (1980-2010)

	Coefficient	Std.Err.	P-value
Lny_{t-30}	-0.016	0.001	~0
Constant	0.054	0.002	~0
R^2		31.58%	
λ		2.17%	

The convergence result in Table 1 highlights a significant process of convergence in the Mexican economy for the full sample. The 2.17% in speed of unconditional β-convergence is also similar to the results of previous researches. There is also a positive and significant convergence rate when we split the panel in two periods, before and after NAFTA (see Table 2). However, the coefficient changes from -0.033 to -0.015, for the before and after NAFTA, respectively. This reduction is significant if we take into account the standard deviations. So, this process seems to be slower during the last period.

TABLE 2: UNCONDITIONAL B-CONVERGENCE IN TWO SEPARATE PERIODS FOR THE MUNICIPALITIES IN MEXICO (1980-1995 AND 1995-2010)

	1980-1995			1995-2010		
	Coefficient	Std.Err.	P-value	Coefficient	Std.Err.	P-value
Lny_{t-15}	-0.033	0.001	~0	-0.015	0.001	~0
Constant	0.094	0.004	~0	0.066	0.004	~0
R^2		36.16%			8.91%	
λ		4.5%			1.7%	

[1] Between the 1989 and 2004 censuses, 48 new municipalities were created by splitting some of the old municipalities. To analyze the same municipalities through the years, we merged the new municipalities back to their 1988 boundaries (INEGI, 2006).

The unconditional process of convergence is also calculated for the States through the aggregation of the information to the state level, in order to compare with other authors (see Tables 3 and 4). Although the coefficient is quite similar before 1995, there is no convergence among States within the other period. This result is also found by other authors as in Rodriguez-Pose (2002). These estimations indicate that our results are coherent with the previous literature. However, there is an important part of the convergence process that may not be seen at the aggregate level. So, in order to use all the information available the local level is used in the rest of the analysis.

TABLE 3: UNCONDITIONAL Β-CONVERGENCE FOR THE STATES IN MEXICO (1980-2010)

	Coefficient	Std.Err.	P-value
Lny_{t-30}	-0.009	0.003	0.003
Constant	0.042	0.016	0.011
R^2			25.37%
λ			1.09%

TABLE 4: UNCONDITIONAL Β-CONVERGENCE IN TWO SEPARATE PERIODS FOR THE STATES IN MEXICO (1980-1995 AND 1995-2010)

	1980-1995			1995-2010		
	Coefficient	**Std.Err.**	**P-value**	**Coefficient**	**Std.Err.**	**P-value**
Lny_{t-15}	-0.029	0.006	~0	0.006	0.006	0.279
Constant	0.111	0.030	0.001	0.001	0.027	0.984
R^2			48.14%			39%
λ			3.88%			0

Second approach: conditional β-convergence with spatial lag model

This simple analysis has already indicated that the speed of convergence is much slower in the last period. But this evidence of structural change in the convergence equation could be contaminated by changes in fundamental factors in the Mexican territories. The differences in the process of convergence could be caused by a significant change in the relevant factors of the economy. In that case, there should not be significant differences in a conditional convergence analysis. The empirical results of equation (2) are summarized in Table 5 and the estimation in two periods is reported

in Tables 6. This equation includes the traditional factors available in our data and the effect of the neighbor's territories.

TABLE 5: CONDITIONAL B-CONVERGENCE FOR THE STATES IN MEXICO
(1980-2010)

	Coefficient	Std.Err.	P-value
Lny_{t-30}	-0.02	0.001	~0
Population growth	0.278	0.041	~0
High education	0.263	0.037	~0
Immigration	0.105	0.017	~0
Constant	0.057	0.002	~0
ρ			0.133
λ			3.08%

TABLE 6: CONDITIONAL B-CONVERGENCE IN TWO SEPARATE PERIODS FOR THE MUNICIPALITIES IN MEXICO
(1980-1995 AND 1995-2010)

	1980-1995			1995-2010		
	Coefficient	**Std.Err.**	**P-value**	**Coefficient**	**Std.Err.**	**P-value**
Lny_{t-15}	-0.041	0.001	~0	-0.021	0.001	~0
Population growth	0.551	0.114	~0	0.76	0.151	~0
High education	0.451	0.069	~0	0.271	0.037	~0
Immigration	0.241	0.031	~0	0.081	0.05	0.101
Constant	0.103	0.004	~0	0.069	0.004	~0
ρ			0.15			0.107
λ			6.30%			2.53%

As in the unconditional convergence results, there is a significant reduction of the β coefficient in the second period: in this analysis, it falls from -0.042 to -0.022. The conclusion does not change with the inclusion of the standard determinants of the steady state . This confirms that there is a significant reduction in the process of convergence. This result has already pointed a first general problem of integration of the territories.

As a result, the convergence process is less intense than in the previous period. But a more complex structure is needed in order to test our hypothesis. Despite the integration that the trades could generate, a free-trade zone could not be enough to

eliminate a possible behavior of club convergence. This type of model will allow us to detect if the process of convergence is generated in different groups, and also to check their importance in both periods of time. Finally, it would generate the most complete model in order to measure the possible reduction in the speed of convergence.

$$H_0: \alpha_b = \alpha_{ce} = \alpha_{ca} = \alpha_s ; \beta_b = \beta_{ce} = \beta_{ca} = \beta_s \qquad (3)$$

Table 9 and table 10 summarize the results obtained of updating equation (2) using dummy and interaction variables for Chiquiar (2008) groups without any reference group. This evidence points to a possible behavior in groups. Using the hypothesis of equation (4) we can test this model against the OLS estimation without groups. It is expected that the evolution of Mexico to an open economy would have a significant effect on the importance of the groups.

TABLE 7: CONDITIONAL CLUBS B-CONVERGENCE FOR THE MUNICIPALITIES IN MEXICO (1980-2010)

	Coefficient	Std.Err.	
Lny_{t-30}	0.302	0.042	~0
Population growth	0.041	0.041	0.31
High education	0.023	0.017	0.16
Immigration	0.086	0.008	~0
Dummy Border	0.083	0.009	~0
Dummy North	0.063	0.003	~0
Dummy Center	0.028	0.046	0.55
Dummy Capital	0.051	0.003	~0
Dummy South	-0.021	0.002	~0
Lny_{t-15} **Border**	-0.023	0.002	~0
Lny_{t-15} **North**	-0.019	0.001	~0
Lny_{t-15} **Center**	-0.003	0.008	0.69
Lny_{t-15} **Capital**	-0.019	0.001	~0
Lny_{t-15} **South**	0.137		
Constant	0.302	0.042	~0
ρ			0.041

TABLE 8: CONDITIONAL CLUBS B-CONVERGENCE IN TWO SEPARATE PERIODS FOR THE MUNICIPALITIES IN MEXICO
(1980-1995 AND 1995-2010)

	1980-1995			1995-2010		
	Coefficient	**Std.Err.**	**P-value**	**Coefficient**	**Std.Err.**	**P-value**
Population growth	0.664	0.116	~0	0.936	0.153	~0
High education	0.007	0.074	0.924	0.159	0.038	~0
Inmigration	0.068	0.031	0.028	0.009	0.049	0.85
Dummy border	0.198	0.014	~0	0.127	0.016	~0
Dummy north	0.179	0.016	~0	0.107	0.020	~0
Dummy center	0.115	0.006	~0	0.062	0.007	~0
Dummy capital	0.095	0.085	0.262	0.054	0.110	0.63
Dummy south	0.080	0.005	~0	0.074	0.005	~0
Lny_{t-15} **border**	-0.053	0.003	~0	-0.030	0.004	~0
Lny_{t-15} **north**	-0.052	0.004	~0	-0.027	0.005	~0
Lny_{t-15} **center**	-0.038	0.002	~0	-0.018	0.002	~0
Lny_{t-15} **capital**	-0.015	0.015	0.320	-0.008	0.025	0.73
Lny_{t-15} **south**	-0.038	0.002	~0	-0.024	0.002	~0
ρ	0.144			0.082		

Due to the different variables and the groups, the β-convergence of this equation is within really similar territories. However, as in the results without groups, the convergence rates within the clubs are lower in the period after NAFTA (1995-2010). On average, there is a reduction of 61.2% in all the groups in the β coefficient. But, using the LR test for equation (4), it can be seen that the p-value in the first period is 5.5%, while in the second one is almost 0. As a result, it seems that the groups are important in both periods, so the groups remain a significant factor in the convergence process in the period of openness and their importance could be even higher . Within these groups it seems that the group of the south has the lowest steady state (-α/β). This is a really important problem, because the territories of this region follow a worse growth path than the rest of the country. However, the introduction of liberalization policies has not been able to solve it. We also observed similar results Rodríguez-Pose and Sánchez-Reaza (2005) on the Capital region (Mexico City), which show that trade decreased agglomeration in it.

Conclusions

This paper studies the regional convergence from trade in Mexico after NAFTA. The analysis demonstrates that Mexico's trade liberalization, via NAFTA, has caused important changes in regional disparities, exacerbating those disparities which have existed in Mexico since industrialization began in the 1930s.

From the outset, we asked whether NAFTA increased the concentration of economic activity in Mexico, especially along the U.S. border, benefiting those regions more than their neighbors. Our results show NAFTA has indeed led to concentrations of economic growth in these border regions. One important finding we prove in the method is that the convergence process is lost at the aggregate level (State level). Therefore, the use of information available at the municipal level is imperative.

Trade liberalization has not reduced territorial disparities domestically, but rather has led to a greater polarization within Mexico. This paper confirms the idea that Mexican municipalities close to the U.S. market have profited from integration by increasing their β convergence, production and incomes. Regions further away from the U.S., such as the South, have not become as integrated into world markets, even losing from NAFTA. Thus, the introduction of liberalization policies has not been able to reduce this converging gap.

Even though centrifugal forces are starting to function, there is a significant reduction of the β coefficient after NAFTA. This indicates that better policies will be needed to control the increase of regional disparities. Industrial, educational, and regional development policies must be quickly developed to set up the foundations for growth in all regions. Further research is necessary to determine what other factors influence regional convergence in Mexico. Factors that were previously considered fundamental in growth theory are quickly giving way to different and less known factors that are likely to shape the next phase of Mexico's regional development.

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