Regional economic growth in Mexico; Analysis of the convergence process over the last 40 years

Crecimiento económico regional en México; análisis del proceso de convergencia en los últimos 40 años

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Abstract

After overcoming the import substitution policies of the 1970s following the change in international economic conditions, the Mexican government began a strong process of productive adjustment and restructuring based on trade liberalization and the application of the recipes of the Washington Consensus in the years 1982-1988. According to the neoclassical theory of growth, the less developed economies would tend to close the per capita income gap with the more developed ones in a process of economic convergence. This article offers a broad vision of the evolution of economic growth in the Mexican states in a context of economic convergence. Thus, the problem of state convergence in Mexico between 1980-2018 is analyzed. For this, a panel data model is applied that includes the main variables selected by the international literature. In particular, the analysis supports the view that trade openness, institutional variables, level of education, and population variables such as fertility rate and life expectancy are key explanatory variables of differentiated growth trajectories for the states. Thus, a convergence process is observed, surely conditional to different stationary states by groups of states in the country in the past four decades.

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Resumen

Después de la superación de las políticas de sustitución de importaciones de los años 70 tras el cambio de las condiciones de la economía internacional, el gobierno mexicano iniciaba un fuerte proceso de ajuste y reestructuración productiva basado en la apertura comercial y la aplicación de las recetas del Consenso de Washington en los años 1982-1988. De acuerdo con la teoría neoclásica del crecimiento, las economías menos desarrolladas tenderían a cerrar la brecha de ingreso per cápita con las más desarrolladas en un proceso de convergencia económica. El presente artículo ofrece una visión amplia de la evolución del crecimiento económico en los estados mexicanos en un contexto de convergencia económica. Se analiza así la problemática de la convergencia estatal en México entre 1980-2018. Para ello se aplica un modelo de datos de panel que incluye las principales variables seleccionadas por la literatura internacional. En particular, el análisis respalda la opinión de que la apertura comercial, variables de corte institucionales, el nivel de educación y variables de población, como la tasa de fertilidad y la esperanza de vida, son variables explicativas clave de las trayectorias de crecimiento diferenciadas para los estados. Se observa así un proceso de convergencia seguramente condicional a distintos estados estacionarios por grupos de estados del país en las pasadas cuatro décadas.

Código JEL: C23, O47, P48
Palabras clave: crecimiento económico; convergencia condicional; educación; demografía; panel cointegrado

Introduction

Economic science has expended considerable effort to understand economic growth, from classical authors such as Adam Smith and David Ricardo to contemporary currents. Nevertheless, it was Robert Solow in 1956 who formalized the theory of growth in which the stock of productive factors and total productivity in an economy were the determinants of growth, as well as its potential steady state.

Mexico is a region with a very unequal distribution of income within states. In particular, growth studies about Mexico have pointed out that the country has no consensus regarding convergence. Given the relevance of this recent period for Mexican development, this paper proposes to identify, within the framework of the prolific theory of economic growth, the relevance that various economic, social, and political factors have had in this new regional landscape. The contribution of those that the literature has been considered as most relevant will be analyzed, such as trade openness (Lucas, 2002), education (Sala-i-Martin & Barro, 1995), institutions (Barro, 1996b; Hall & Jones, 1999), life expectancy (Barro, 2016) and the unemployment rate (Blanchard et al., 1992). The period of analysis covers the last 40 years, as this is where there is less empirical evidence of this type. With this objective, a quantitative analysis based on panel techniques is adopted to identify the relative contribution of each set of factors to regional economic growth in this theoretical framework. Likewise, evidence is presented on whether or not there have been economic convergence processes among the 32 Mexican states using absolute and conditional β-convergence indicators. This second exercise makes it possible to identify significant differences

between groups of states in the speed of convergence to the steady state and to observe the role that various explanatory variables play in the growth process, including demographic aspects, and institutional and educational variables. Finally, the empirical results obtained for the Mexican states are compared with the existing evidence for other Latin American countries and regions, discussing their main economic policy implications.

After this brief introduction, the paper is structured as follows: the second section briefly reviews the most relevant economic growth literature. The third section shows the evolution of per-capita income in Mexico's states. The fourth section presents the methodology. The next section describes the data, and the sixth section presents the econometric results. The results are compared with those found in other countries, and finally, the eighth section presents the main conclusions and economic policy recommendations derived from the research.

Review of the literature

This section reviews the main contributions of recent economic growth literature to identify the most relevant determinants present in this literature. The neoclassical Solow-Swan growth model (Solow, 1956) is the original contribution to this literature, constituting the initial theoretical framework of the so-called "economic growth accounting." Following this pioneering contribution, numerous studies have continued to expand the framework of analysis, including new explanatory factors of the economic dynamics of countries[1].

The central hypothesis of this theory is to assume that economies (national or regional) converge to the same steady state. The literature defines ß-convergence as the process where economies differ only in the initial level of wealth per capita while the fundamentals of the model are the same. Thus, in a given time, the lower-income economies should show higher growth rates than the richer economies and thus reach the wealth per capita levels of the rich in the same final steady state. Other concepts have been absolute convergence and conditional convergence. The former means that the income level converges even when each foundation's absolute value is considered. The latter means that income converges, but not absolutely, and was applied to economies with comparable characteristics (Mankiw et al., 1992; Sala-i-Martin & Barro, 1995).

The initial capital stock and the characteristics of the economy under analysis were the most relevant aspects defining the processes of economic convergence in the basic neoclassical model. Technological progress, represented by external shocks to the economy, was the main engine of growth

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[1] See Barro and Sala-i-Martin (2003) for an overview.

that disappeared once this source of initial impulse was exhausted. Factors such as the population growth rate or the replacement capacity of other productive factors determined the path of each economy toward its steady state, which marked a point where existing production only allowed for the replacement of assets depreciated in the previous period. As expected, this analysis framework is very limited for studying such a relevant topic as international economic growth, with the appearance of several authors whose contributions will expand it. In this regard, each author will emphasize those aspects of the model that they consider most relevant in this process of economic change in the countries.

For example, after the Asian miracle of the 1990s, from a theoretical point of view, several studies point to the relevance of having a context of trade openness conducive to growth (Frankel & Romer, 1999; Lucas, 2002). Through different measures of openness, empirical studies demonstrate the positive effects of trade on growth (Dollar & Kraay, 2003; Wacziarg & Welch, 2008). Authors such as Baier and Bergstrand (2007) point out that the signing of a free trade agreement doubles bilateral trade relations between member countries after 10 years, while Awokuse (2008) concludes that exports, both in the short run and in the long run, boost economic growth. The relevance of education and its effect on the improvement of factor productivity and therefore on growth was already recognized early on by Arrow (1962) and would later be taken up by Lucas (1993). Barro (2000; 2001) and De la Fuente and Domenech (2001) evaluate the importance of education and human capital in a growth model, finding positive evidence of the effects of educational investment in countries on their economic performance. In this regard, it is worth mentioning the relevance of the contributions of the Barro and Lee (1993; 2013) database, which would lead to many papers on the relation between education and growth.

The role of institutions in promoting economic growth began to capture the attention of economists in the 1990s (Barro, 1996a; Hall & Jones, 1999). Subsequently, a group of authors has focused their attention on the role of institutions in a broad sense (democracy, voice, political stability, social rights, free elections, and citizen representation, among others) as a source of economic growth, especially in developing countries and transition economies (Easterly & Levine, 2003; Acemoglu et al., 2001, 2005; Rodrik, 2000). In addition, more social variables such as life expectancy have recently been incorporated (Barro, 2016; Royuela & García, 2015).

Blanchard et al. (1992) found that workers' movement between different regions reduces unemployment and leads to the convergence of local labor markets. Similarly, several studies have addressed the issue of convergence in other variables, such as the unemployment rate (Llorente, 2004; Román & Moral de Blas, 2000; Avilés et al., 1997).

Other studies identify additional factors responsible for the economic growth of nations. Nonetheless, the factors mentioned above include the most relevant determinants, which are important for Latin America, so these additional factors will not be included in this review to avoid distracting attention

from what is truly relevant. Next, the study of economic convergence between countries or regions of a country will be discussed, as it is one of the main topics of study in the recent literature on growth.

Among the relevant research applied to the case of Mexico, Chiquiar (2005) concludes that NAFTA has led to divergence. Esquivel and Messmacher (2002) analyze the effects of the opening processes and the states' convergence speed. Cabral and Mollick (2012) point out that the northern regions converge more slowly than the central and southern regions. Furthermore, Sakikawa (2012) finds conditional convergence for the period 1970-2005, even after economic liberalization, but at a slower rate than before. Notable more recent studies include that of German-Soto et al. (2020), who find regional convergence at rates between 1.2% and 4.6% for the years 1940-2015, while Castellanos-Sosa (2020) shows convergence conditioned by the evolution of labor productivity. Thus, existing studies for Mexico show, in general, that per capita income seems to converge among Mexican states, although moderated by their structural conditions and at different rates according to the period analyzed.

This study has followed the most recent literature of key authors, such as Barro (2016), who provides new contributions to studying economic convergence. The study will focus on a synthesis of explanatory variables following those authors already reviewed in this section, seeking to identify the speed of convergence and the role of central factors in this literature, such as demographic, institutional, educational, and specific factors of each economic juncture.

Evolution of GDP per capita in the Mexican states 1980-2018

Figure 1 shows the evolution of GDP per capita of Mexico's states grouped into quartiles. In general, high-income states are concentrated in the northern part of the country (Baja California, Sonora, Chihuahua, Coahuila, Nuevo León, and Tamaulipas). In contrast, the lowest-income states are concentrated in the south (Guerrero, Oaxaca, and Chiapas), except for Campeche, which has extraordinary oil revenues. Despite the changes in income levels noted for the states in this figure between 1980 and 2018, the large difference in income between the northern and southern states is clear, with certain nuances among those located in the central zone, which could be considered intermediate income states.
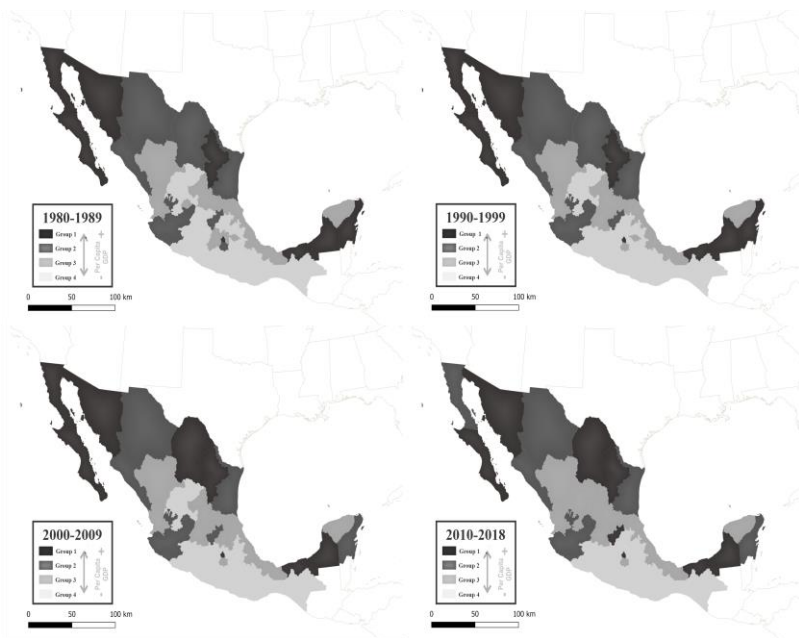
Figure 1. Geographical distribution of state GDP per capita, 1980-2018 (in quartiles)
Source: created by the authors with data from INEGI. Annual GDP per capita at constant 2013 prices.

Continuing along the same lines, Table 1 shows some statistical indicators of GDP per capita by state. Excluding Campeche, the states with the highest per capita income were Mexico City, Tabasco, Nuevo Leon, and Quintana Roo, which had an average annual income of MXN 201 498 for the period under study. Those with the lowest per capita incomes were Michoacán, Guerrero, Chiapas, and Oaxaca, with an annual average of MXN 61 562.

Columns 3 and 4 show the skewness and kurtosis for each state's annual distribution of per capita income. This makes it possible to compare the data distribution with a reference distribution, such as the normal distribution. In the case of skewness, positive values show that the distribution has a longer right tail and, therefore, a higher concentration of low values. This can be seen in the case of Baja California and Baja California Sur. On the contrary, negative values—as in the case of Morelos—indicate that the left tail is longer and generally in a greater number of years where high incomes were observed. On the other hand, kurtosis shows the degree of skewness in the income distribution, where values greater than three indicate that the distribution is leptokurtic (high concentration of data in the center of the distribution) and less than three is platykurtic (low concentration of data around the central value).

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Table 1
GDP per capita, 1980-2018

State	Mean	Skewness	Kurtosis	Min.	Max.
National	145 189	5.139	30.130	45 955	1 405 058
Aguascalientes	113 034	0.602	2.338	84 678	161 061
Baja California	158 169	1.134	4.371	130 253	209 722
Baja California Sur	167 954	1.132	5.003	139 810	224 360
Campeche	1 116 472	-1.109	3.071	547 476	1 405 058
Coahuila	159 223	-0.116	1.458	121 348	194 868
Colima	122 116	0.421	2.027	110 791	137 407
Chiapas	59 559	0.915	4.004	48 819	74 990
Chihuahua	111 360	0.492	2.165	86 513	150 913
CDMX	233 107	0.277	2.028	153 945	345 992
Durango	91 124	-0.002	1.440	72 105	111 357
Guanajuato	84 775	0.577	2.320	65 392	116 541
Guerrero	60 630	0.327	2.072	55 699	66 392
Hidalgo	76 889	0.614	3.091	64 958	92 005
Jalisco	120 375	0.539	2.648	103 515	146 608
México	78 508	0.496	2.712	66 528	94 147
Michoacán	68 835	0.282	1.807	56 139	89 202
Morelos	95 077	-0.799	4.011	79 205	104 187
Nayarit	83 141	0.173	1.730	71 327	98 362
Nuevo León	186 151	0.243	1.588	141 268	248 197
Oaxaca	57 222	0.034	2.129	50 621	64 842
Puebla	71 428	0.309	1.766	57 358	93 181
Querétaro	141 296	0.218	2.083	107 649	185 008
Quintana Roo	169 630	2.206	7.024	139 937	292 909
San Luis Potosí	91 604	0.603	2.268	70 001	130 998
Sinaloa	105 811	0.653	2.657	93 657	125 782
Sonora	160 704	0.212	2.022	130 130	198 088
Tabasco	217 104	0.200	2.718	186 297	253 884
Tamaulipas	123 147	-0.042	1.391	100 087	150 047
Tlaxcala	76 471	0.735	2.373	69 941	89 674
Veracruz	85 861	-0.116	1.698	74 053	97 990
Yucatán	90 102	0.485	2.170	73 398	117 930
Zacatecas	69 160	0.368	1.663	45 955	99 835

GDP per capita at constant 2013 prices
Source: created by the authors with data from INEGI.

Figure 2 shows the σ-convergence indicator, defined as the standard deviation of per capita income distribution from 1980-2018. It indicates the existence of a lower dispersion in the distribution of per capita income over time beyond the severe crisis of the late 1980s already discussed, with a change in the orientation of Mexican economic policy and with a clear reduction in the dispersion of per capita income among states since the beginning of the new century (except for the impact of the 2008-2009 financial crisis). This figure thus provides the first evidence of a possible process of economic

convergence between states, with income distribution becoming more equitable. It also shows that, during this long analysis period, the lower-income states in the sample grew more than the richer ones, reducing income dispersion. Nevertheless, the presence of crises in this time series of income dispersion is again highlighted, with recurrent episodes of increased dispersion in this indicator of σ-convergence since 1982, which are repeated throughout the 1980s due to the variability of oil prices, the default on foreign debt payments, and the abrupt opening of trade. This clearly reflects the main adverse circumstances the country has been going through during these forty years.
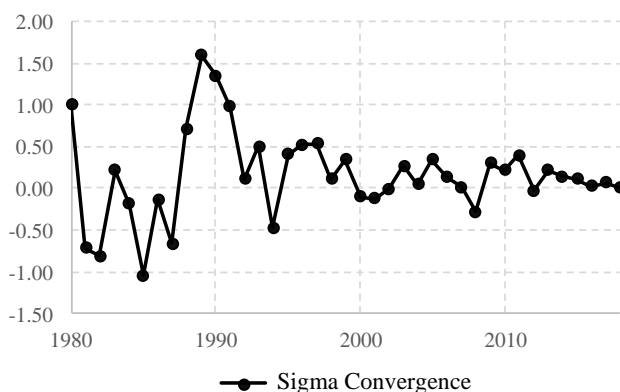

Figure 2. Sigma growth convergence
Source: created by the authors with data from INEGI.

Methodology; convergence assessment in the Mexican states

This section estimates a β-convergence model with panel data, which makes it possible to exploit both the cross-section and time-series dimensions of the data, thus providing a more comprehensive view of the growth process than traditional cross-sectional estimates (see, for example, Cuadrado-Roura et al., 1999). Variables relating to life expectancy, fertility, trade openness, violence, education, governance, and other labor market-related variables are included. This way of estimating the convergence parameter is also called conditional convergence. Thus, the following conditional convergence equation is proposed:

$$\Delta \, 1ny_{it} = \alpha + \beta 1ny_{i,t-1} + \delta X_{it} + \gamma_i + \gamma_t + \xi_{it}$$

(1)

Where $\Delta \, 1ny_{it}$ represents the change in the average annual growth rate using as a proxy variable the real per capita product of state i at time t, α is the intercept, γ_i is the specific individual effect that

seeks to capture other components of the growth rate common to the states, γ_t is the specific time effect, $1ny_{i,t-1}$ is the base year economic growth as a convergence factor, X_{it} is a matrix of variables mentioned above, and ξ_{it} is the model's residual that in some estimation includes an autoregressive process AR(1).

Regarding the econometric estimation of the model, it should be noted that a model with fixed effects has been chosen over another with random effects following the results of the Hausman test (1978) applied, which rejects the null hypothesis of random effects. According to Hausman (1978), the fixed effects model ensures the consistency of the estimated model parameters. [1] Furthermore, robust standard errors are used to correct potential heteroscedasticity problems in the variance-covariance matrix estimated for Equation (1). Thus, in addition to ensuring the robustness of the computed errors, this can be controlled by intra-class correlation, or intra-state in this case, in line with the spirit of panel data econometrics. Finally, and to limit possible serial autocorrelation in the time dimension of the model, an AR(1) component is incorporated in the residuals of the model in column 4, which yields a parameter r= 0.19 significant at 95%, indicating temporal serial correlation in the panel (see Table 2) and the importance of correcting for autocorrelation.

Data

The present research tests the convergence hypothesis for the 32 Mexican states using a panel data model with fixed effects in line with the relevant literature (Hurwicz, 1950; Nickell, 1981; Baltagi, 2005; Barro, 2016). The model employed to estimate convergence follows the standard specification of Baumol (1986), including an initial effect of GDP per capita by state, which is expected to be negative, given that states with higher initial GDP pc should grow more slowly, hence this expected sign in any convergence model. A panel of annual data for 1980-2018 is used for the 32 states of Mexico. This database is constructed from information provided by the National Institute of Statistics and Geography (INEGI; Spanish: Instituto Nacional de Estadística y Geografía) for state GDP per capita. Three groups of variables identified by the economic growth literature are included as explanatory factors of the model. Trade openness variables are specified to capture the new orientation of economic policy in the context of globalization after the 1980s[2]. An educational variable is included as a basic factor of growth based on human capital, as indicated by endogenous growth models. This variable is approximated by an index of population with higher education studies calculated by the National Population Council (CONAPO;

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[2] Trade openness was approximated in the study as the percentage of exports in each state's GDP.

Spanish: Consejo Nacional de Población). Unemployment rate, government effectiveness[3], and a violence index (approximating vehicle theft per 10 000 inhabitants) are also included as proxies for institutional factors indicated by the literature. Finally, a life expectancy variable is also included, in line with the initial approach to the growth equation defined by the original Solow-Swan contributions.

Econometric results of the growth model for Mexico 1980-2018

The results of estimating the model proposed in Equation (1) are shown in Table 2. First, a unit root test is performed for the model's variables, which makes it possible to identify the stationarity of the series to ensure a stationary panel (see Table A1 in the Annex).

As a first result, the presence of β-convergence effects in the four selected regressions is worth mentioning, with convergence speeds around 12%-23% depending on the equation. These results are in line with previous studies by Diaz-Bautista and Cota (2004), Sakikawa (2012), and German-Soto et al. (2020), although the coefficients are high.

Table 2
Conditional convergence (v.dep.: GDP per capita growth rate)

	(1)	(2)	(3)	(4)
Lagging GDP per capita	-0.122**	-0.124**	-0.152**	-0.235***
	(0.049)	(0.054)	(0.056)	(0.034)
Life expectancy	1.919***	1.956***	1.309**	1.494*
	(0.523)	(0.606)	(0.508)	(0.877)
Fertility	-0.198*	-0.191*	-0.143	-0.16
	(0.107)	(0.109)	(0.119)	(0.105)
Commercial openness	0.013***	0.013***	0.009***	0.007
	(0.004)	(0.004)	(0.003)	(0.006)
Violence	-0.006*	-0.006	-0.004	-0.002
	(0.004)	(0.004)	(0.004)	(0.004)
Education	0.113***	0.118***	0.086**	0.121***
	(0.031)	(0.035)	(0.034)	(0.042)
Governance	0.014*	0.014*	0.013*	0.013***
	(0.007)	(0.007)	(0.007)	(0.004)
Salary 1 quartile		0.021	-0.041*	-0.049
		(0.022)	(0.023)	(0.031)
Salary 4 quartile		0.012	0.016	0.028
		(0.039)	(0.037)	(0.038)
Unemployment rate			-1.359***	-1.749***
			(0.336)	(0.327)
N	378	378	378	346

[3] Government effectiveness seeks to measure the government's capacity to foster local development. This is approximated by the urban growth rate, which measures the annual growth rate of an urban area relative to the population growth rate (IMCO, 2021).

R^2-Adjusted	0.589	0.588	0.616	0.675
Hausman's test (Chi-sq)	54.73	61.38	67.35	69.83
(p-value)	0.000	0.000	0.000	0.000
Heteroscedasticity Test (Chi-sq)	1582.91	1716.31	1008.01	1008.01
(p-value)	0.000	0.000	0.000	0.000
Contemporaneous correlation (Chi-sq)	687.137	677.329	640.430	640.430
(p-value)	0.000	0.000	0.000	0.000
Rho-autocorrelation (AR(1))				0.19
(p-value)				0.000

Notes: * $p<0.10$, ** $p<0.05$, *** $p<0.010$. Robust standard errors. Variables expressed in logarithms. GDP per capita in constant 2013 prices. The null hypothesis of Hausman's test if random effects and fixed effects estimators do not differ substantially. Wald's test for heteroscedasticity shows that there are no problems with heteroscedasticity. Breusch and Pagan's contemporaneous correlation test shows that the errors among the units of analysis are independent of each other.
Source: created by the authors with data from OECD, INEGI, and CONAPO.

The variables that contribute to the explanation of the per capita GDP growth rate are, in the first place, demographic variables (life expectancy and fertility) that are significant in the different specifications of the model. Therefore, there is a common problem, which is usually contextualized in the debates of classical authors, such as Robert Malthus, Adam Smith, and David Ricardo, who discussed the problem of the production of wealth and its distribution among the population. As can be seen, the variables are significant and relevant to the specified model, especially life expectancy.

For the neoclassical school, from the seminal works of Ramsey and Solow to the endogenous growth models (Romer and Lucas), the analysis between economic and demographic variables has evolved, particularly Malthus' population principle. Their study provides both a quantitative approach and a qualitative one as a result of the process that required endogenizing the population (Ramírez & Morelos, 2002). For Malthus, population growth and per capita income remained almost constant, which is why when per capita income increased, so did population growth. For Galor and Weill (2000) this relation is positive and equal to population dynamics.

Based on the above, the values of life expectancy and fertility rate summarize the relevance of the population theory. The results indicate that if life expectancy is increased by 10%, the effect on growth would be between 13%-19% for life expectancy, indicating the relevance of population as a national productive factor. For its part, an increase in the fertility rate of 10% reduces economic growth by 1.9%, similar to the result obtained by Barro (2016).

It should also be mentioned that trade openness is significant and positive (1.3%-0.9%), so this variable may reflect the effect of NAFTA in each of the states, i.e., those that managed to get on the globalization train show greater growth through trade. The education variable, measured by the educational attendance index at the higher education level, is statistically significant, with a coefficient of

11%, which indicates the importance of education in the growth of a country and the importance of human capital in growth, as pointed out in the studies by Lucas and Romer (Lucas, 2002).

Concerning the institutional variables, for example the violence indicator, the impact is negative and significant throughout the model, with an elasticity of around 0.6%. This variable shows the impact of the crime rate on growth in Mexico. Similarly, the government effectiveness variable in quality of regulation shows a positive and significant effect, where a 10% increase in the actions taken by governments to influence the economic development of their cities has an effect of 1.3%-1.4% in terms of growth.

Finally, variables related to the labor market are incorporated to analyze the impact of states' labor market changes on their economic growth. The wage variables for the 1st and 4th quartiles seek to capture the impact of wage increases between two different population groups (high-income and low-income). It can be seen that the results are not significant in either case. Similarly, the unemployment rate is incorporated in Equations 3 and 4. It can be seen that the effect is negative and significant; that is, a 10% increase in the unemployment rate reduces the growth of the states by 14-17%.

By including time and state-fixed effects in the estimation, it is possible to control through idiosyncratic shocks[4] relevant to the country's economic history. The results are statistically significant, and the largest effect appears for the years 1983, 1985, 1995, and 2009. Starting in December 1982, with the external debt crisis, the country began the transition toward adopting a new economic model that would, in turn, allow it to relate to the rest of the world. A set of reforms was implemented that would cover many interrelated areas to improve the efficiency of the economic system, thereby modifying institutions and redefining the relation between the factors of production and society. In addition, the years 1995 and 2009 show other relevant economic shocks for the country, with national and international crises, which is well reflected in the model.

In summary, the model is statistically significant and explains about 60% of the variance of state growth, identifying key variables in the country's growth and its states in the last forty years. Moreover, Figure 3 makes it possible to identify the resulting heterogeneity for the country's different states, which makes it necessary to mention conditional convergence since it seems plausible that groups of states converge to different stationary states given their own structural socio-economic conditions. In particular, it can be observed that the lower-income states in the south converge at higher rates than the richer ones, although the significant social inequality of the country does not avoid talking about absolute convergence, with conditional convergence being more likely.

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[4] For Martínez *et al.* (2013), an idiosyncratic shock refers to an alteration of the economy that is due to local causes of that particular economy, and not to structural or exogenous alterations.

In addition, the following section will compare results from other Latin American countries for the economic growth literature.
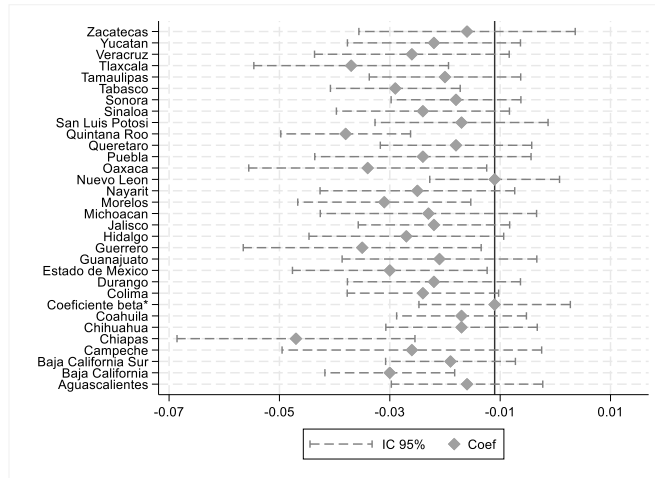

Figure 3. Beta convergence in GDP per capita and fixed effects, 1980-2018
Source: created by the authors with data from INEGI.

Notes: Results correspond to a regression where the dependent variable is the annual rate of change of state GDP per capita (in logarithms), and the dependent variables include the one-period lagged average annual growth rate and state and time fixed effects. Annual GDP per capita at constant 2013 prices. N= 1.216. The vertical line marks the value of beta convergence. Mexico City and 1981 are considered as reference categories for the calculations.

Comparison with other Latin American countries

This section points out the most relevant works that have been carried out on regional convergence in Latin America following the neoclassical theory of growth to establish the recent evolution of growth in other countries around Mexico. Many contributions on the topic were identified, which seem to focus on verifying whether less developed economies grow at higher rates than more developed ones in a process of economic convergence. Nevertheless, the results do not present a consensus since the results are very varied and heterogeneous, depending on the country and the historical period analyzed.

The main problem researchers face is access to data and thus the quality of the analysis, compared to international studies for developed economies with more robust conclusions. This limitation also leads to short-term studies and non-homogeneous results, as is the case mainly for Mexico and

Colombia. It is relevant to mention that research works do not exist for all countries. Studies were identified mainly for Mexico, Colombia, Peru, Chile, Argentina, and Brazil, and few at the regional level.

Most of the β-convergence coefficients show convergence rates higher than those identified in the seminal work of Barro and Sala-i-Martin (1992) of 2% and their golden rule. The heterogeneous conditions of Latin America with different steady states within the same country, with such different geography and terrain, and with its abrupt institutional changes, invite reflections more of the conditional rather than absolute type of convergence as in this case. Recent articles such as Royuela and García (2015) are novel in this context because they include social variables and a spatial econometric approach, making the values of the coefficients more robust and up to date. Finally, it is important to mention the regional economic disparities within each country, which makes it difficult to point to a common pattern that would allow general statements to be made for the region as a whole.

Conclusions

Since Solow's seminal contribution (1956) and the subsequent debate he opened in the theory of economic growth, there has been a proliferation of estimates of this so-called "economic growth accounting," with abundant empirical evidence and theoretical contributions. Mexico is a country that has undergone important economic reforms in the last three decades—trade liberalization model, the energy, labor, pension, and education reforms, just to mention the most relevant—that have allowed higher rates of national economic growth, but also an increase in intra-state divergence at certain times. Although conditioned economic convergence is observed in the long term, it does not allow for a general rapprochement between income levels throughout the country, given that each group of states seems to converge to its own steady state as indicated by the developed analysis framework. In this context, current research has been applying a set of convergence tests that have made it possible to prove more robustly the existence of such conditional convergence for the 32 federal entities of the country. After a first descriptive analysis, the results have been shown in an econometric estimation framework that includes the main variables pointed out by the initial and subsequent endogenous neoclassical growth literature. In addition, the panel approach and the goodness-of-fit tests included have identified unequivocal negative and significant coefficients as a sign of this conditional beta-convergence process initially pointed out.

Furthermore, it has been possible to identify that the process of conditional convergence takes place at a high rate of between 12% and 15% per year, although with different stationary states for each group of states. The variables of life expectancy, fertility, trade openness, education, violence, governance, and unemployment rate are some of the most relevant variables that explain the growth of the states in the last forty years. The variables of life expectancy and unemployment rate stand out, showing the

importance of the population theory, as well as the implications of the labor market in Mexico's growth. Education continues to be a key variable in any country's socio-economic development process, as observed in the Mexican case.

From this perspective, it is possible to draw more realistic conclusions about Mexico's regional dynamics: states in the center, north, and close to the U.S. border are distancing themselves from the southern states, mainly since trade liberalization took place and due to the inflow of FDI in these northern states. Moreover, this distancing seems to respond to both an increase in economic activity in the central and northern states, and a reduction in the economic performance of the southern states, historically isolated and with a different development process with issues specific to their history.

The results obtained from this research are useful for the government, economic policy planners, and society as a whole, as they suggest that it is necessary to design an economic policy that aims to reduce disparities in the states, with special attention to the most relevant variables found in the model over the past forty years, and following the idiosyncrasies of each group of states in the national geography.

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Annex

Table A1
Unit root tests for the panel model variables

Variable	llc test	p-value
GDP per capita growth rate	-13 435	0.0000
Lagging GDP per capita	-3.116	0.0000
Life expectancy	-14 108	0.0000
Fertility	-9 810	0.0000
Commercial openness	-3 653	0.0000
Violence	-3 913	0.0000
Education	-6 867	0.0000
Governance	-5 340	0.0000
Salary 1 quartile	-3 282	0.0000
Salary 4 quartile	-3 436	0.0000
Unemployment rate	-3 472	0.0000

H0: The panel contains unit roots
H1: The panel does not contain unit roots

Note: The llc test for unit roots in a panel is taken from Levin, Li, and Chu (2002).