REGIONAL CONVERGENCE OF INCOME AND LABOR PRODUCTIVITY IN MEXICO

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Abstract

Economic growth continues to be a major objective of state governments in Mexico. What role do firm location, openness, education, and wage rates play in determining the ability of a state to increase the growth of its economy? This study examines the economic competitiveness of the Mexican states using location coefficients. This paper tries to bridge the gap between the macroeconomic issue of convergence on the aggregate income level and the microeconomic issue of labor productivity convergence on the industry and sectorial level.

Resumen

El crecimiento económico continua siendo uno de los objetivos más importantes para los gobiernos estatales en México ¿Cuál es el papel de la localización de las empresas, la apertura, la educación y los salarios en determinar la habilidad de los estados para fomentar el crecimiento de la economía? El estudio examina la competitividad de los estados en México mediante el uso de índices de localización. El estudio trata de cerrar la brecha entre el tema de la convergencia macroeconómica en el nivel agregado del ingreso y los temas microeconómicos de la convergencia de la productividad laboral a nivel sectorial e industrial.

JEL classification: L1, L6, R1
Keywords: Economic Convergence, Labor Productivity, Location Coefficients

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1. Introduction

The recent empirical evidence in Mexico demonstrates that over the last few years important changes have taken place. Certain states, which are not always the most developed ones, show high rates of growth and a very positive dynamics of development. However, others, which are not necessarily the less-developed or peripheral ones, show at the same time a more negative dynamics of development with rates of economic growth clearly below the mean. All of this reflects processes of convergence and divergence, which take place at the state level in Mexico in a more competitive and globalized context. Therefore, different traditional methods are necessary to capture, at least in a partial way, the complexity of these processes. A possible approach is to study the impact of the important economic transformations of the last few years on the productivity of the Mexican state regions using an alternative model.

Productivity plays a key role in the evolution of regional economies in Mexico, as evidenced in a great number of studies. The gains in productivity are the result of a complex process of technical and structural changes that include, from the incorporation of technological progress or the introduction of new methods of production and new products, to the intra and intersectorial reassignment of resources in Mexico.

The motivation for this paper came from the fact that productivity levels in Mexico differ significantly across sectors and industries. These industry differences suggest that it is worthwhile to analyze the causes of the productivity gap in more detail, and that industry specifics should be highlighted. The paper is organized as follows: The first part gives an overview on research already undertaken concerning the development of industry productivity levels across countries. One major finding of these analyses is that productivity convergence can be documented for some sectors while for other sectors the parameters signaling productivity convergence are not significant. Krugman (1987) suggests that the manufacturing sector, for instance, can be described by growth models based on the new growth theory, while other sectors can be well described by traditional growth models.

A weakness of the research done so far is that the sources for labor productivity growth and convergence have not been analyzed. An analysis of the mechanisms that might lead to convergence or divergence of income and labor productivity on the industry level is also conducted. The next sections presents the literature review and the empirical results by sector. The final section sets forth some conclusions.

2. Industry Convergence in Regional Productivity

Regional economics is concerned with the spatial allocation of economic activity. It is more concerned with the allocation among regions of a country rather than with urban areas, this is typically the preview of urban economics. Regional economics is also useful in that it provides more basic questions in economics. For example, examining economic trends within and among regions can shed light on theories of aggregate economic activity. This is the case in regard to the relatively new and growing literature on economic growth, regional convergence and labor productivity. Several studies have been made at the industry level analyzing labor productivity.

Dollar and Wolff (1988, 1993) analyzed international data for the manufacturing sector provided by the UN Yearbook of Industry Statistics for the years 1963, 1979, 1982 and 1986 covering 13 OECD countries. The authors aggregated 28 industries into four groups (heavy industries, medium industries, light industries, other industries). For the period from 1963 to 1982, convergence for overall manufacturing as well as for the four different groups was identified. Dollar and Wolff (1988, 1993) argue that levels of productivity are more similar between industries than between the aggregate levels. Hence, increases of productivity are mainly fueled through shifts in employment structures towards capital and technology intensive industries. However, Dollar and Wolff (1988, 1993) could not identify a significant effect through shifts of employment, nor could they find an equalization of productivity levels on the industry level. In the end, they conclude that other factors such as the accumulation of capital and technological progress have to be considered to explain differences in productivity levels.

Cuadrado-Roura *et al.* (1999) analyze the evolution of regional differences in Spain and emphasize the importance of a disaggregate analysis at an industry level. They find convergence in regional productivity at the aggregate regional level but not at the sectorial level.

Paci (1997) found convergence across 109 European regions from 1980 to 1990, not only for Manufacturing but also for Services. The speed of convergence was estimated at 1.7 percent annually for Manufacturing, while the estimate for Services was at 1.2 percent somewhat lower. Paci (1997) claims that most of the country dummies were significant. This means that the process of convergence is present at the overall European level as well as on the national level. In spite of this, no convergence was found for agriculture or for the per capita income level.

Bernhard and Jones (1996) tested the convergence hypothesis with the traditional approach suggested by Barro (1991). According to their results, the service sector is an important engine for international convergence. Bernhard and Jones found a negative relationship between the initial level of productivity and the subsequent rates of productivity growth for the Manufacturing sector. However, the estimated parameter was not significant. The results of their analysis of total factor productivity correspond to those of labor productivity. Van Ark (1996) is less interested in the question of convergence, as he tries to identify periods of growth and stagnation. Using the method of growth accounting, he estimates the importance of single components fueling the growth of productivity. Yet, his results concerning the convergence of productivity on the sectoral level are in line with the findings of Bernhard and Jones. Van Ark (1996) showed that countries like (France, West Germany, Netherlands, Great Britain) could catch-up to the USA on the aggregate level. There is also a continuous process of convergence for the agricultural sector, while for manufacturing, the process of convergence came to a halt during the eighties. Between the four European countries hardly any convergence was found.

Gouyette and Perelman (1997) could identify a clear process of convergence concerning the service sector while for manufacturing they could not. Gouyette and Perelman (1997) mention that there has been convergence of productivity in the service sector but not in the manufacturing sector. Countries with a high

level of productivity enjoy almost no increase in total factor productivity with regard to the service sector. This implies convergence across countries concerning the service sector. For manufacturing the picture is rather ambiguous. Countries with high efficiency levels can nevertheless experience high growth rates.

Broadberry (1993) already pointed out that, on the one hand, by looking at the USA, Great Britain, and Germany he could find no convergence for manufacturing within the period from 1870 to 1978. On the other hand, convergence for the whole economy was present. Broadberry (1993) concludes that the results for manufacturing are consistent with the results for the whole economy, the global convergence of GDP per Worker cannot be explained in terms of technology transfer in manufacturing. This in turn suggests the need for a more general view of the catching-up process. In addition to composition effects through structural change, productivity trends in sectors other than manufacturing have a role to play.

In the case of Mexican manufacturing when we exclude maquiladoras, we observe that labor productivity rose rapidly between 1988 and 1996, over 7% a year compared to 1% a year between 1981 and 1987. However, most of the recent productivity gains occurred in large and export-oriented firms. Maquiladoras and small manufacturing operations had little or no productivity gains between 1988 and 1993. When we compare to US manufacturing productivity, we observe that labor productivity increased an average of about 3.2% a year since 1981; while the Mexican rate for manufacturing productivity increased only 1.7% a year. Gerber (2002) estimates labor productivity in constant (1985 dollars) purchasing power parity terms. From the output per worker perspective, the productivity differences between a worker in Tijuana, and one in the Imperial Valley California, is almost insignificant. Indeed, comparisons along the entire US-Mexico border show that a number of US counties have lower productivity than a number of Mexican cities, or municipios. In 1999, Tijuana had an output per worker of $30,487 dollars, while Imperial County, California had an almost similar output per worker of $31,016 dollars. The results indicate that even at the state border level, the productivity gap is closing between Mexico and the United States. The finding motivates the question how the productivity gap is behaving at the state level in Mexico.

3. Theoretical background on Labor Productivity Convergence

Different growth theories explain the productivity convergence (or divergence) in different ways. The traditional growth theory explains (conditional) productivity convergence via the accumulation of capital, which leads to decreasing factor returns and hence towards a slowdown of productivity growth. The traditional trade theory predicts an equalization of factor prices through international trade or factor movements.

The equalization of factor prices is what brings about an equalization of factor productivity. The new models of endogenous growth or the new trade theory explain divergence and convergence of productivity. Models including a catching-up effect caused by the absorption of foreign knowledge, for example, may very well explain convergence. While models that implicitly have a coefficient of productivity for the accumulated production factor of one (AK models)

explain the absence of convergence.

Solow (1956) and Swan (1956) predict a catching-up process via the accumulation of capital if in one region the stock of capital is not optimal. In the Cass (1965) and Koopmans (1965) model, this implies that the time preference rate is lower than the interest rate. When all the regions have reached their steady state, the force promoting convergence will vanish. Productivity growth is subsequently determined only by technological progress. Hence, one would expect an initial convergence process driven by the convergence of the capital stock per employee.

Heckscher, E. (1919) and Ohlin, B. (1933) used the traditional models of trade to compare two situations of equilibrium, but descriptions of dynamic changes are hardly possible. In the traditional model, when a small labor abundant country is integrated into the global trade regime, trade theory would predict that this country has a comparative advantage in producing labor-intensive goods. Global demand will lead to an increase of the price for labor-intensive goods in the home country and consequently wages will increase. Therefore, time series should reflect a convergence of wages especially in those industries producing tradable goods. For the non-tradable goods producing industries, only the sectorial mobility of workers will result in wage equalization.

Recent convergence models presented in Barro and Sala-i-Martin (1995) contrast whether or not a situation of relative lag in a given moment tends to decrease in time. In other words, whether or not the regions with low levels of labor productivity have higher rates of growth than regions with high levels of labor productivity, in such a way that catching-up effect takes place. Convergence can appear either in a conditional or a non-conditional way. In the latter case only when the variables that determine the stationary state of the regional economies are controlled. The former case addresses the absolute convergence that includes a series of implicit assumptions based on the notion that the regional economies do not differ significantly in their economic fundamentals. This fact reflects a capacity of the regional or state economies to converge to the same long-run equilibrium value and at the same speed. This implicit assumption of the absolute convergence does not necessarily have to appear in reality. The regional economies can differ quite significantly in the economic structures, providing that the process of economic convergence would neither have to evolve to the same point, nor should it conduce to the same long-term levels of equilibrium. These assumptions can be tested by using models in which the variables appear in such an explicit way that they are considered determinants of the stationary state of each economy. In other words, equations of conditional convergence could be estimated where all the parameters considered could differ for each of the considered regions. The presence of absolute or conditional convergence is not only a question of methodological or econometric discussion. The policy implications that are derived from both are completely different. If we admit the existence of different regional realities that determine different long-run trends, we are providing a wide field of action for public policies than if the non-conditional economic convergence is verified.

Gerschenkron (1962), Abramovitz (1979) and Verspagen (1991) developed alternative models with technological spillovers assuming that one country holds the technological leadership in a certain industry while those countries lag-

ging behind are able to reduce the productivity gap by absorbing technological knowledge from the leading country. Not only labor productivity but also total factor productivity should converge, as the countries lagging behind are catching-up.

Newer models include the AK models of the so called, new growth theory such as Romer (1986, 1990) and Lucas (1988) which include cumulative factors for the production of goods that become relevant, making the tendency of convergence weaker or completely disappearing. This finding not only applies to the whole economy but also to single industries.

4. Industry Specialization and Concentration

The location quotient (LQ) technique is the most commonly utilized economic base analysis method. It was developed in part to offer a slightly more complex model to the variety of analytical tools available to economic base analysts. This technique compares the regional economy to a reference national economy, in the process attempting to identify specializations in the local economy. The location quotient technique is based upon a calculated ratio between the local economy and the economy of some reference unit.

Industry specialization or concentration is also measured by location quotients. Location quotients measure the industry's share of the regional state total employment divided by the national share of that industry. An LQ greater than 1 indicates that an industry is more concentrated locally than it is nationally and generally indicates that the industry is exporting its product. When a state has a basic sector or more than national average employment in a sector, we might conclude that the extra employment is involved in production for export.

The approach taken to analyze labor productivity convergence is to use the LQ shares by industry in order to explain the state differentiated catching up process in Mexico for the period 1970-2000. The data used in the present study comes from the INEGI databases for income per capita by state and for the number of jobs in the industry at the state and national level. We compute fictive labor productivity series under the assumption that for each region, the initial labor input industry mix does not change. The basic method of regional analysis is the location quotient (LQ) for each sector. The LQ is computed as the share of the region's jobs in an industry divided by the share of the nation's jobs in the industry.

The aggregate productivities growths are then solely assumed to be within sector dynamics. Once the series are constructed for each state in Mexico, we appraise the convergence properties of the aggregate productivity with the unchanged employment structure in order to compare them to the convergence properties for actual productivity data and income per capita. The LQ describes the importance of the ith industry in each state. If LQ is greater than one, we would think that the sector is a basic sector in the state economy. If less than or equal to one, it's assumed to be a non-basic sector. Suppose an industry has a LQ of 1, then we observe that there is just enough employment in that industry to satisfy local demand. If an industry has a LQ of less than one, then there is not enough employment to satisfy local demand. All local employment is for local consumption, and in fact we probably import some additional units

of that good. If we observe an industry that has a LQ of more than one, then we satisfy local consumption and the state industry exports the good. The overpowering advantages of using location quotients are that the method is inexpensive and the exercise of computing excess employment may give the analyst an opportunity to gain insights of interest in themselves. Furthermore, in free open market state economies in Mexico, the region basic industries are known as the comparative advantage regions.

The appendix presents the LQ estimates by state and sector for the year 2000. For sector 9, the other manufacturing sector, most states in Mexico have a LQ greater than one indicating that the sector is exporting manufactured goods. In contrast, for the Metals, Machinery and equipment sector also called sector 8, the LQ quotient is less than one for most states, indicating some sectorial imports in the region. Similar to the population employment ratio, the LQ is a measure of the ability of the local market to capture state economic activity. For our study of Mexico City, the LQ is significantly greater than one indicating that some sectors represent the strength of the Metropolitan Area.

The important basic sectors in Mexico City for the year 2000 are sector 4 (paper and printing), sector 5 (chemical and plastic), sector 7 (basic metals), sector 9 (other manufactures), sector GD6 (commercial, restaurants and hotels) and sector GD7 (telecommunications and transport). In the case of the state of Baja California Norte, the basic sectors include sector 3 (wood products), sector 4 (paper and printing), sector 5 (chemical and plastic), sector 7 (basic metals) and sector 9 (other manufactures). For the state of Baja California we think in terms of specialization of the local economy. The Baja California sectors with LQ greater than one are the other manufactures. It is no surprise that the state specializes in the manufacturing sector and is considered a strength.

Another interpretation focuses on the exporting potential of the basic sectors in Baja California. The LQs by state and sector in Mexican manufacturing over time have become more alike as manufacturing has distributed across the states. The LQs are relatively close to 1, similar to what has happened to the manufacturing sector in the United States. An exception for Mexico is sector 9 where the LQs are much greater than one. For sector 9, we could think of industry cluster or geographic concentration of interdependent companies with similar suppliers, products, labor pools, and institutions that together constitute an important competitive advantage for each regional state.

The rate of growth of income per capita at the state level can be explained by the sectorial growth of important sectors in each state. The northern Border States have rates of growth that are higher than the national average and are a major source of the regional differences between 1980 and 1999. The states of Chiapas and Tabasco were adversely affected due to the large dependency on energy exports in the last two decades of the century. The high growth advance states includes border states like Chihuahua, and new states, which are more open like Quintana Roo, Queretaro and Aguascalientes. Some states can be classified as dynamic intermediate regions, which show an important dynamism in terms of productivity and employment such as the states of Guanajuato and Puebla.

The dynamic intermediate regions reflect an adequate process of adaptation and a strategy of economic growth based on dynamic activities with some of

the branches of manufacturing and the third sector in general. We observe also declining regions which correspond to the southern periphery with a low level of industrialization, low human capital indicators and problems due to the lack of economic activity and openness.

The states of Guerrero and Chiapas are representative of the group below the national average growth rate. Finally, the data shows that states within the northern border have a higher growth rate in Mexico. Looking at labor productivity growth between 1985 and 1998, shows a quite diverse picture in Mexico. While some states (like B.C., Tamaulipas, Queretaro and Jalisco) showed an increase of labor productivity, others (as Campeche, Tabasco and Guerrero) experienced even a decline in labor productivity.

The mechanism for convergence can be explained by the traditional growth model for labor productivity. The analysis of the annual rate of growth of labor productivity by state in Mexico shows a states diverging in terms of labor productivity during the period between 1985 to 1998.

Table 1. Annual Rate of Growth of Labor Productivity by State in Mexico (1985-1998)

Aguascalientes	7.18	Morelos	2.13
B.C.	11.11	Nayarit	-0.22
BCS	-3.98	NL	2.26
Campeche	-10.78	Oaxaca	3.17
Coahuila	1.78	Puebla	3.39
Colima	-3.31	Querétaro	4.48
Chiapas	-0.09	Quintana Roo	-2.36
Chihuahua	5.91	San Luis Potosí	2.24
Distrito Federal	-1.55	Sinaloa	-0.75
Durango	0.29	Sonora	6.09
Guanajuato	3.99	Tabasco	-6.19
Guerrero	-4.27	Tamaulipas	6.44
Hidalgo	-1.87	Tlaxcala	4.48
Jalisco	4.15	Veracruz	-1.7
México	0.62	Yucatán	2.87
Michoacán	0.37	Zacatecas	0.85

After determining the economic and labor productivity strength of each state of Mexico, the question arises: Why are some states competitive and growing, while others are not? Many studies have analyzed state economic growth within a country, but, thus far, there has been little consensus about the relevance of specific factors in explaining relative economic performance. Most studies have considered the effects of funds, wages, and education. Due (1961) and Wheat (1986) mention that state and local funds were thought to play a minor to insignificant role. However, a more recent study like Munnell (1990) indicates that state and local funds do have a significant negative effect. Munnell (1990), Bauer and Cromwell (1989), and Carlton (1979) suggest that wages have a significant effect on business activity and growth. Higher labor costs are likely to reduce the rate of employment growth. Many believe that human capital also enhances a region's ability to grow, but a recent study by Duffy (1994) indicates that it plays a marginal role at best.

5. Empirical Results

A cross-sectional model of the states in Mexico was estimated with the competitive position of each of the states being the dependent variable and the location quotient, local banking credit and funds, education, urbanization, wages and state openness being the independent variables. The location quotient was obtained by the previous equation described. Banking credit is a variable by state in constant millions of dollars of September 2000. The educational variables are the average age of schooling for people 15 years or older, while the urban variable is the percentage of the population that lives in city in each state. The minimum wage is given by state in pesos. The wage is introduced in the model to avoid the constant labor productivity assumption. Its impact can be ameliorated slightly through using income data, which can be assumed to reflect regional productivity variation through differences in wage rates. The assumption that local demands are met first by local production in LQ analysis, presents the need for an openness variable. The openness variable is constructed by using the sum of imports and exports over total production in each state.

In accordance with previous studies, the data used for income growth was the change in the logarithm of income from 1970 to 2000. For labor productivity growth, the annual rate of growth is used from 1985 to 1998. All the necessary data were obtained from INEGI and Bank of Mexico. The next two tables show the important disparities in income and labor sectorial convergence that are present at the sector level in Mexico. The model was estimated using TSLS with instrumental variables. TSLS was used to avoid the endogeneity problem that may be present in the model. TSLS refers to a stage in which new endogenous variables are created to substitute for the original ones, and a stage in which the regression is computed using the newly created variables. The purpose of the first stage is to create new dependent variables, which do not violate OLS regression's recursivity assumption.

Table 2. The Mexican Sectorial Convergence 1970-2000

Dependent Variable: Income per capita growth TSLS regressions by Sector								
Division	SECTORS	Level	LQ	Bank	Education	Urban	Wage	Openness
1	FOOD PRODUCTS	-0.42	-0.06	0.001	0.05	0.001	-001	-0.013
		(1.89)	(1.44)	(0.762)	(1.02)	(0.58)	(-0.83)	(-0.14)
2	TEXTILES	-0.50	-0.005	0.001	0.066	0.001	-0.01	0.065
		(1.97)	(0.24)	(0.83)	(1.26)	(0.46)	(-0.96)	(0.83)
3	WOOD	-0.47*	0.003	0.001	0.065	0.001	-0.01	0.05
		(2.07)	(0.21)	(0.83)	(1.24)	(0.43)	(-0.94)	(0.75)
4	PAPER	-0.44	-0.05	0.002	0.064	0.001	-0.014	0.060
		(1.92)	(0.63)	(1.05)	(1.23)	(0.42)	(-0.93)	(0.81)
5	CHEMICAL and Plastic	-0.38	-0.08*	0.003	0.041	0.001	-0.016	0.082
		(-1.80)	(2.21)	(1.52)	(0.64)	(0.76)	(-1.16)	(1.19)
6	NON METALS Chemicals	-0.60*	-0.04	0.001	0.069	0.02	-0.016	0.061
		(2.44)	(1.18)	(0.74)	(1.35)	(0.88)	(1.07)	(0.843)

* 95% significance level. T stats in parenthesis. LQ are the LQ shares calculated by sector.

Table 2. (continued)

Dependent Variable: Income per capita growth TSLS regressions by Sector								
Division	SECTORS	Level	LQ	Bank	Education	Urban	Wage	Openness
7	BASIC METALS	-0.44	0.001	0.0002	0.047	0.001	-0.01	0.04
		(1.99)	(1.18)	(0.095)	(0.89)	(0.73)	(0.90)	(0.63)
8	MACHINERY metals and equipment	-0.58*	0.08	0.0001	0.075	0.001	-0.01	0.09
		(2.42)	(1.20)	(0.743)	(1.464)	(0.45)	(0.96)	(1.21)
9	OTHER Manufactures	-0.46	-0.00	0.001	0.062	0.001	-0.01	0.05
		(1.94)	(0.11)	(0.94)	(1.10)	(0.43)	(0.93)	(0.605)
GD6	RESTAURANTS and Hotels	-0.46	-0.00	0.001	0.06	0.001	-0.01	0.05
		(1.94)	(0.11)	(0.84)	(1.10)	(0.43)	(0.93)	(0.60)
GD7	TELECOM and Transport	-0.47*	0.004	0.001	0.06	0.001	-0.014	0.06
		(2.03)	(0.18)	(0.78)	(1.16)	(0.45)	(-0.96)	(0.81)

* 95% significance level. T stats in parenthesis. LQ are the LQ shares calculated by sector.

Table 3. The Mexican Sectorial Convergence (1985-1998)

Dependent Variable: Labor Productivity Growth TSLS regressions by Sector								
Division	SECTORS	Level	LQ	Bank	Education	Urban	Wage	Openness
1	FOOD PRODUCTS	-11.02	-0.75	-0.007	0.40	0.013	-0.04	10.07*
		(-1.41)	(-0.45)	(1.00)	(0.22)	(1.57)	(0.08)	(3.27)
2	TEXTILES	-7.17	0.92	0.007	-0.057	0.11	-0.01	9.98*
		(0.85)	(1.17)	(0.96)	(0.33)	(1.28)	(0.02)	(3.87)
3	WOOD	-11.57	0.25	0.007	-0.22	0.13	-0.06	10.72*
		(1.50)	(0.41)	(0.97)	(0.12)	(1.56)	(0.12)	(4.20)
4	PAPER	-13.63	3.64	-0.001	-0.24	0.13	-0.09	10.77*
		(1.79)	(1.34)	(-1.62)	(-0.14)	(1.58)	(-0.18)	(4.408)
5	CHEMICAL and Plastic	-14.01	-2.12	-0.001	0.349	0.11	-0.02	10.26
		(1.87)	(1.65)	(1.46)	(0.20)	(1.36)	(0.04)	(4.22)
6	NON METALS Chemicals	-8.37	1.01	-6.71	-0.38	0.09	-0.02	10.81*
		(-0.98)	(0.87)	(0.90)	(0.21)	(1.05)	(0.05)	(4.33)

* 95% significance level. T stats in parenthesis. LQ are the LQ shares calculated by sector.

Table 3. (continued)

Dependent Variable: Labor Productivity Growth TSLS regressions by Sector								
Division	SECTORS	Level	LQ	Bank	Education	Urban	Wage	Openness
7	BASIC METALS	-10.68	0.03	-6.64	-0.082	0.15	-0.03	10.46*
		(1.40)	(1.12)	(0.09)	(0.46)	(1.81)	(0.07)	(4.19)
8	MACHINERY metals and equipment	-4.96	-5.42	-5.70	-0.97	0.12	-0.07	8.57*
		(0.67)	(2.49)	(0.84)	(0.60)	(1.66)	(0.16)	(3.15)
9	OTHER Manufactures	-7.47	-0.23	0.001	-1.45	0.16	0.02	8.10*
		(0.98)	(1.83)	(0.90)	(0.81)	(1.96)	(0.04)	(2.88)
GD6	RESTAURANTS and Hotels	-7.47	-3.19	-6.41	-1.45	0.16	0.02	8.10*
		(0.98)	(1.83)	(0.90)	(0.81)	(1.96)	(0.04)	(2.87)
GD7	TELECOM	-11.62	-0.001	0.001	-0.262	0.132	-0.06	10.86*
	and Transport							
		(1.48)	(0.00)	(0.951)	(-0.145)	(1.464)	(0.13)	(4.21)

* 95% significance level. T stats in parenthesis. LQ are the LQ shares calculated by sector.

The analysis of Mexican regions performances tends to show that a small income convergence process by sector took place during the last three decades. It appears that income convergence is significant and rather strong for wood, non metals, machinery and the telecom and transport sectors.

The wage coefficients are negative and non significant. The LQ coefficient for the chemical and plastic sector industry is negative and significant which gives a profile of the industry's location pattern in relation to the state as an important determinant of state growth.

It is interesting to note that the chemical and plastic sector industry (concentrated in the states with an exporting base) appear also in the list of external-economy industries highly concentrated in places such as Mexico City. The following table shows the labor productivity growth convergence analysis. The table provides evidence in support of the low growth dynamics of the industrial labor productivity for the Mexican regions. The analysis gives no indication of convergence in labor productivity, due to the non significant coefficients.

Neither convergence nor an increase of average productivity are present in the restaurant and hotel industry. The results for Mexico follow the previous results obtained for Norway, Sweden and the USA which show a declining labor productivity. Labor productivity seems to depend on national attributes like consumer preferences. Moreover, differences may be partly due to different data definitions, for example the number of employees. Manufacturing exhibits little and non significant convergence across states.

The coefficient on openness was positive and significant at the 1 percent level, while the coefficient on wages is negative and non significant. The F-statistic of 5.2 indicates the labor productivity model is significant at the one percent level. The adjusted R-squared ranges from 0.55 to 0.57, which is unexpectedly high given that the competitive position is similar to a residual effect in that two major determinants of state employment growth, income growth and industrial structure with LQ's, were already taken into account.

6. Conclusions

A location quotient measures an industry's concentration or specialization in a state geographic area relative to the national economy geographic area. In this study, we are using location quotients to compare the share of an industry's employment in the state to the same industry's share of national employment. The different approach to convergence using regional income per capita and labor productivities show the industry and regional differentiated catching up process inside the Mexican regional economic space. During the period 1970-2000, Mexican regional convergence processes were rather weak at both aggregate and industry sectorial levels, which prevents us from giving a single conclusion for all sectors. Looking at individual sectors or industries is very informative when it comes to the questions about income and labor productivity convergence across regions in Mexico. The non metallic, machinery and equipment, and telecom and transport sectors show significant convergence results in terms of income per capita.

Apparently, convergence is not present by sectors when doing the labor productivity growth analysis. If anything, divergence seems to be present when examining state labor productivity growth between 1985 and 1998 in Mexico.

Although the location quotient used in the study is not a perfect measure of the export activity, it does quickly identify unusually large industries within a geographic area. Division 9 shows large LQ coefficients with respect to other divisions. The location quotient technique usually requires the assumption that the two areas being compared, such as the State and the nation, share uniform consumption patterns and labor productivity. In the study we control for wages, education and state openness. The openness variable is significant when explaining labor productivity growth. If we do not control with the openness variables, a high location quotient, indicating a higher share of regional employment in a given industry, would be the result of a less productive labor force or unusual local consumption patterns, not export-producing employment. The positive and significant effects of the openness variable on labor productivity growth supports the view of export demand as the prime mover in regional state growth in Mexico. If most Mexican states grow, then the whole country or must also be growing, despite the fact that it may not export at all. It appears, then, that internal trade and demand in a state can generate regional growth, although convergence may not be present. We identify two primary barriers to continued sectorial economic growth in states of Mexico. The two primary factors are access to capital and access to high-skilled and experienced workforce, which are not significant in the study. Finally, there is no evidence that convergence of income in a sector will result in a convergence of labor productivity in the same sector. Specific policy recommendations could include getting the investment community aligned with local basic industries, involve people that work in the basic industry in lecturing/teaching at local universities, especially teaching with the latest technologies. Another policy recommendation is to have wages that are more in accord to labor productivity by sector and state.

Appendix A

LQ Shares by Industrial Sectors 2000
(Gran División y División Industrial 2000)

Sector	Div. I	Div. 2	Div. 3	Div. 4	Div. 5
State					
Aguascalientes	0.9867	2.2991	0.7540	0.5360	0.3974
B.C.	0.3011	0.7338	2.4463	1.0768	1.1107
B.C.Sur	2.0126	0.6090	0.3406	0.6272	0.1352
Campeche	1.4287	0.1163	0.7796	0.6954	0.2094
Chiapas	0.9665	0.1582	1.2069	0.5539	0.2503
Chihuahua	0.5180	0.9249	1.0599	0.4675	0.4512
Coahuila	0.7399	1.7771	0.5710	0.5387	0.4104
Colima	1.7677	0.0800	0.9278	0.4748	0.2118
D.F.	0.7821	0.5111	0.4752	1.9984	1.4263
Durango	0.9374	2.5190	5.3818	0.6719	0.1775
Guanajuato	1.0659	2.4827	0.4042	0.8414	1.3341
Guerrero	0.9455	0.7215	0.8816	0.4033	0.0929
Hidalgo	1.0011	2.4571	0.8177	0.4666	1.0049
Jalisco	1.5600	0.7494	1.4505	0.8442	1.3425

(continued)

México	1.1288	0.9903	0.9225	1.2470	1.6299
Michoacán	1.3564	0.4267	2.8269	0.6629	0.4052
Morelos	1.0706	0.6156	0.5229	0.5901	0.9907
Nayarit	1.7398	0.1696	0.8943	0.4806	0.0472
Nuevo León	0.8148	0.4699	0.9467	1.3446	1.3743
Oaxaca	1.6932	0.5323	1.8492	0.4924	0.5317
Puebla	0.9954	2.6288	1.0186	0.4259	0.4466
Querétaro	0.4585	0.7361	0.2891	0.7563	0.7408
Quintana Roo	0.5462	0.1476	1.0168	0.7665	0.0740
San Luis Potosí	1.3935	0.5280	1.0848	1.3247	0.6219
Sinaloa	1.4766	0.0441	0.6562	0.7328	0.2072
Sonora	1.2045	0.9049	0.5391	0.7259	0.5700
Tabasco	1.5220	0.0773	0.6429	0.5515	0.6267
Tamaulipas	0.7267	1.1179	0.3493	1.0044	1.2370
Tlaxcala	1.1605	2.9440	0.4269	0.5825	0.6888
Veracruz-Llave	1.6938	0.4948	0.8970	0.7695	1.7546
Yucatán	1.4807	1.9636	0.7337	0.7156	0.5388
Zacatecas	0.2990	1.0829	2.2022	0.5912	0.2152

Own calculations with statistics obtained from INEGI.

LQ Shares by Industrial Sectors 2000
(Gran División y División Industrial 2000)

Sector	Div. 6	Div. 7	Div. 8	Div. 9	GD6	GD7
State						
Aguascaliente	0.7827	0.2774	0.3506	12.1108	0.884	0.493
B.C.	0.6749	8.2675	0.3137	9.5742	0.699	0.440
B.C.Sur	0.5285	0.1117	0.5920	18.9869	1.386	1.189
Campeche	0.4953	0.1564	1.1778	19.9882	1.459	1.009
Chiapas	0.6936	0.2856	0.5965	22.6064	1.651	1.180
Chihuahua	0.9311	1.4339	0.2212	8.7975	0.642	0.332
Coahuila	1.0105	1.0613	0.4772	10.6582	0.778	0.513
Colima	0.6309	0.2084	0.6160	20.3014	1.482	1.243
D.F.	0.2756	1.6852	0.6933	14.0406	1.025	1.874
Durango	1.1829	0.1710	0.3083	12.8615	0.939	0.482
Guanajuato	0.9168	0.5059	0.3279	14.0716	1.027	0.502
Guerrero	0.5419	7.6080	0.4235	18.5745	1.356	1.734
Hidalgo	1.3498	0.8372	0.2875	13.2606	0.968	0.871
Jalisco	1.6023	1.2346	0.4348	14.7093	1.074	0.612
México	1.0602	1.5035	0.1494	15.4092	1.125	0.775
Michoacán	1.6709	1.4975	0.3331	20.2174	1.476	0.733
Morelos	2.0384	0.8741	0.2360	18.6892	1.365	1.238
Nayarit	0.7105	0.1999	0.7355	20.2784	1.481	1.202
Nuevo León	2.4623	1.3862	0.4708	12.5859	0.919	0.557

(continued)

Oaxaca	1.2016	0.6361	0.3400	19.9586	1.457	0.916
Puebla	2.0121	0.8141	0.1757	13.0100	0.950	0.747
Querétaro	0.4995	105.14	0.0096	0.76164	0.055	2.569
Quintana Roo	0.6041	0.9410	0.7217	24.4606	1.786	0.967
San Luis Potosí	1.0234	1.0048	0.6993	14.9887	1.094	0.702
Sinaloa	0.4595	0.2127	0.7856	20.8790	1.525	1.057
Sonora	0.5539	3.0957	0.5614	13.0560	0.953	0.347
Tabasco	0.3224	0.0590	1.0156	18.5040	1.351	1.363
Tamaulipas	0.6872	1.4568	0.4753	11.8722	0.867	0.582
Tlaxcala	2.5601	1.4358	0.1969	11.2321	0.820	0.621
Veracruz-Llave	0.6071	0.3691	0.4099	18.6484	1.362	0.801
Yucatán	0.8772	1.9451	0.9973	13.8221	1.009	0.625
Zacatecas	0.1995	29.785	0.0053	0.3983	0.029	4.989

Own calculations with statistics obtained from INEGI.

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