

15. Recent Regional Change and Productivity in Mexico

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1. Introduction

It has been acknowledged that the recent regional change in Mexico can be described as one where economic activity increases in the northern states and decreases in the largest cities but, to my best knowledge, there has been no solid empirical analysis and evaluation of this regional change on the national and regional productivity growth. In this chapter, after the author identifies and analyzes the growth patterns of the regional manufacturing for the period 1970-1993, the author explores the implications of this regional change on the manufacturing productivity growth in Mexico. In particular, this article concludes that if the regional change can be considered efficient in static, short run economics because it reflects minimizing of transport costs and exploitation of increasing internal returns to scale (see Livas and Krugman, 1992), this spatial reallocation of economic activity could not be considered efficient in a dynamic, long run economics; regions that have shown higher growth rates in terms of employment are not those that have shown higher growth rates in productivity.

The analysis developed in this chapter is particularly relevant since most of productivity analyses are at firms or sector levels but no at spatial level. This is even more significant if we take in account that new economic growth theories have noted that spatial dispersion of technological externalities are relevant in explaining economic growth. In particular, these theories have concluded that economic externalities generated by endogenous growth factors, such as education, public infrastructure, learning by doing, and knowledge spillover, among others factors, are relevant as economic growth factors. In this way, this research can be seen as a preliminary approach to the analysis of economic growth that suggests endogenous growth factors in Mexican regional economic growth.

In this chapter, using the Mexican manufacturing census, the author firstly presents an analysis of employment and output by regions for the period 1970-1993. In this part, the author follows an 'ad hoc' regionalization that reflects the industrialization patterns rather than other spatial characteristics. Secondly, the author presents an analysis of productivity growth by regions, based on two productivity indicators, output per worker and total factor productivity (TFP). To my best knowledge, this is the first time an analysis of productivity sources by regions is presented. Finally, in the conclusion, the author evaluates the implications on the productivity performance of the recent regional change in the Mexican manufacturing productivity growth and present some explications for the observed pattern of regional productivity growth.

2. Recent Regional Change in Mexico

In this part, first, the author presents a regionalization that illustrates the dramatic changes in output and labor growth among regions in the recent period in order to show more clearly the characteristics of the recent regional change. And, in a second part, based on my 'ad hoc' regionalization, the author identifies the characteristics of the recent regional change in the manufacture.

A. Regionalization Proposal

It has been acknowledged that the recent regional change in Mexico, since 1980, can be described as one where economic activity increases in northern states and decreases in the largest cities. A long list of researchers¹ have documented this trend that has become common knowledge among regional specialists in Mexico. In this article, because analysis based on conventional regionalizations has been made (see my footnote 1), the author proposes an 'ad hoc' regionalization that features dramatically the regional change of economic activity. This regionalization presents, on one hand, the participation of the three largest cities in the national output and employment, and, on the another hand, the participation of the northern states. Both 'regions' let us observe the relevant locational change in economic activity since they cover about 60 or 70 percent of the total employment and about 80 or 90 percent of the output. The rest of the states are classified as Central, West-Central, and Rest of the Country regions, according to industrialization and location patterns that, as we will see later, also present clear differences in economic performance. In particular, states are classified as follow:

a) The states of Distrito Federal, Jalisco, Mexico State, and Nuevo Leon are classified as the Largest Cities Region. These states are characterized by manufacturing activity that is consolidated under the import substitution industrialization and that features the highest levels of output per worker in the national manufacture. They also concentrated the economic growth rates since 1950 and are the locus of the three largest industrialized cities in the country, Ciudad de Mexico, Guadalajara and Monterrey.

b) Northern Region includes the states of Baja California, Coahuila, Chihuahua, Sonora, and Tamaulipas. Manufacturing in this region was promoted by the Export Maquiladora Program since the 1960's and has been specially encouraged under the trade liberalization strategy. Tax subsidies, transport cost advantage and agglomeration economies with the American southern states are the growth base for this region.

c) A third and fourth region identify the performance of two regions of accelerated industrialization outside the Largest Cities and Northern regions. They are states that have steadily increasing their participation in the national manufactures since the 60's (see Vleugels, 1990). In this 'newly industrialized periphery', the author includes as Central Region, the states of Hidalgo, Morelos, Puebla, Queretaro y Tlaxcala; and as West-Central Region, the states of

Aguascalientes, Guanajuato, Michoacan and San Luis Potosi. The Central and West Central regions let us, in my opinion, identify states that, besides their geographic location, take their industrialization off under different initiatives, with the Mexico City decentralization program for the Central region and for West Central region under a spontaneous initiative, that is not related to a particular government or business initiative.

B. Regional Change in the Manufacture

Based on my 'ad hoc' regionalization, the author identifies the characteristics of the recent regional change in the manufacture in tables 1 and 2. These tables are presented in terms of regional participation of each region in relation to the national total whereas the objective of the presentation is to identify the comparative performance of each region. In that way, the author 'isolates' the effects that can be attributed to the changes in national performance that is common to greater or less degree to all regions.

In terms of employment, in table 1 the author observes a significant loss in the share of Largest Cities in national employment. Since 1970, this share goes from 59.73 to 43.34 percent in 1993. Because the author is talking about changes in percent share, the author observes that a decrement (increment) in their participation out of the national level is implying a growth rate under (above) the national average rate. In the same table 1, the author observes that my North region has notably increased its participation, going from 11.25 to 22.23 percent for the analyzed period. For the "newly industrialized periphery", the Central and Central-West regions, have also increased their participation but at a lower rate than the North. 'The Rest of the Country' region have also increased its participation. In this and further analysis, the author omits data referent to 1980 whereas this data show changes due more to oil boom in the Mexican economy than 'structural' trends.

In the table 2, the author shows the relative performance of the output, measured by the added value, by region. This table show a performance similar to that in our analysis for the employment in table 1.

This reallocation of economic activity in the Mexican geography has been explained as result of the interaction of internal economies of scale, agglomeration economies, transport costs, and a moving of the central market from the largest cities to the northern states due to economic and trade liberalization policies. (See Livas and Krugman, 1992; Hanson, 1994). The implications of these analyses can be better understood if it is thought in terms of a change in economic strategy, from one based on import substitution to one based on trade liberalization. Under import substitution industrialization, because the trade protection of the national manufacturing, the central market² was the internal market, that is where the population is located, the largest cities in the country. During the industrialization process there was created a feedback between population and industrial location that resulted in concentration of the industry in the largest cities. This situation which is widely documented in the literature on economic development is recently explained

by Livas and Krugman (1992) in terms of internal economies of scale whereas firms look for producing for the internal market and taking advantage of minimization of transport cost and agglomeration economies.

But, what will be the regional location pattern under trade liberalization?. Livas and Krugman (1992) suggest a moving of the firms from the old central market, the largest cities, to the new central market, the United States as they are the main trade partner to Mexico. The implications in terms of industrial locations are a moving of firms towards the cities geographically closed to the United States where these firms will take advantage of economies of scale whereas firms produce for both countries from one location. Then, in the northern cities, firms minimize transport cost and after a while, they will create agglomeration economies which will encourage even more the attraction of economic activity towards the northern region.

If, in terms of short term economic efficiency, this reallocation of the economic activity can be explained as a result of the optimizing decisions by firms, in the next part of this article the author describes what is the impact of this reallocation on economic growth and, in particular, on the productivity growth that, in the long run, determines the possibility of economic and social development for regions.

3. Patterns of Productivity Growth in Regional Manufacture

In this part, the author describes the performance of the manufacture productivity in a regional perspective based on two productivity indicators: output per worker and as total factor productivity (TFP³). In particular, the author analyzes the level and rate of growth in productivity measured in both indicator for the Mexican regions, as they were classified in my 'ad hoc' regionalization.

A. The Regional Productivity Growth: Output per Worker

In table 3, the author presents the dynamics of the levels of regional productivity in relation to a national average following my later regional analysis in order to 'isolate' the effects that can be attributed to the changes in national performance that can be common in greater or less degree to all regions. In this table, we can observe that the region where the largest cities are located still maintain the highest level of productivity for all the period. In contrast, the North region show a decrement in its level productivity in relation to national average that goes from 0.98, in 1970, to 0.73, in 1993. The Central region maintains its level of 0.84 during the same period. For West-Central and 'Rest of the Country' regions there are increments in the level of productivity in relation to the national average.

Table 4 shows the productivity performance (output per worker) by regions for periods, 1970-85, 1985-88, and 1970-93. The regional growth rates are expressed in relation to the national productivity growth rate. That is, for instance, a growth rate of 1.33 means that the growth rate for that region is 33 percent higher than the national growth rate for the same period. In that way, in table 4, the author observes that the output per worker growth for the Largest Cities region is relatively similar to the national, 1.07 out of national growth rate. The North region has grown for all

periods below the national average rate of growth. In contrast, West-Central and Rest of the Country regions show a significant rate of growth higher than the national average.

A conclusion of this set of tables is the persistent patterns of regional productivity in Mexico, since 1970 to 1993. That is, steady economic growth in the largest cities region, negative growth in the northern border, and accelerated growth for our West-Central and Rest of the Country regions.

In this article, so far, the analysis on economic growth has been based on terms of output per worker, but as it is known, the growth of output per worker is mainly determined by the growth of capital goods available per worker. Then, an analysis based only on output per worker is limited, in the next part of the article, the author analyzes the economic growth and its sources by region by means of the analysis of TFP. In my best knowledge, this analysis have not been done for Mexican regions.

B. The Sources of Economic Growth: A Regional Perspective.

In this part of this article, the author presents an analysis of the sources of economic growth by regions. In particular, the author presents estimates of TFP for each region, as defined in my 'ad hoc' regionalization, for the periods, 1970-85, 1985-1988, and for both periods, 1970-93. The author follows the conventional methodology in growth accounting that let us identify the productivity growth as residual out of output growth minus the weighted change in use of productive factors. In this way, TFP is identified as the change in output that cannot be attributed to change in use of productive factors, and that define the 'make more with less', the basic characteristic of the economic growth. It is acknowledged that this methodology has multiple restrictions, however, its use as conventional measure of productivity make particularly attractive its application.

Following this methodology⁴, let assume that the manufacturing output (added value) in each state is a function of capital, labor⁵ and time, that are combined by means of a state production function. Then, the necessary conditions for the optimization equilibrium for the state as a representative agent, and assuming constant returns to scale at state level, imply that the output elasticities with relation to capital and labor are equals to the participation of the each productive factor in the total cost. Therefore, the share of capital and labor in relation to total cost are equal to one. In that way, the growth rate of the output is expressed as the addition of the growth rates in the amount of capital and labor, each one weighted by their share in the total cost, and total factor productivity. This model is developed using data from the manufacturing census for the years 1970, 1985, and 1993. The author identifies the 'total de activos fijos' as data for capital, 'valor agregado censal bruto' (added value) as data for output, and 'empleo promedio anual' (annual average number of workers) as data for labor⁵. In relation to prices at regional level, the information in nominal prices has been deflated with the implicit price index for the GNP in base of 1980 prices. Therefore, it is assumed that there are no significant differences in inflation among regions.

Tables 5, 6, 7, show my estimates of sources of growth by region for the

periods 1970-85, 1985-88, and 1970-93. In relation to the regional variations, in table 7 that shows the period from 1970-93 we can observe that regions that have shown a positive rate of TFP growth are the Largest cities and Rest of the Country, our Largest cities regions is the only that persistently along the period showed a growth rate above the national average, see table 5 and 6. In contrast, the North region shows TFP growth rates that persistently were under the national average. The rest of regions show a mix performance, for instance, West-Central region showed a negative growth of rate in TFP before 1985 and a amazing positive rate of growth in TFP after 1985. Different performance was shown by the 'Rest of the Country' region that obtained a TFP growth rate above of national average before 1985, but one under the national average for later 1985, see table 5 and 6. All these changes in productivity performance confirm in general, our previous conclusions on regional economic performance. That is, there exists a stagnation in the productivity growth in our Largest cities region. A negative performance in the North and a positive performance in the 'Rest of the Country' region. A mixed performance in West-Central and Central regions. The table 5, 6, and 7 show this trend and let us observe that in the case of the North region, its growth is based on capital and employment growth but not on productivity.

3. Conclusions

So far, with the limitations of the data, the author expects to have showed the broader trends in regional performance, but what are the implications of the regional change and productivity for the Mexican economic growth? And what explains the persistent regional dynamic in terms of productivity? In the next part of this article, as conclusion, the author offers some preliminary answers to these questions. In particular, in relation to the first question, the author evaluates the implications of the regional change on the economic growth extending the Reynolds (1979)'s analysis to evaluate the recent change until 1988.

The performance of regional economic growth previous to 1970's, according to Reynolds(1979) and Reynolds and Alejo (1987), was characterized by a highest level of Gross State Product (GSP) per capita in the Mexico City region⁶, medium level in North Pacific region⁷, and North⁸ with the lowest level in the rest of the country, but the South region⁹ in the 1970's due to oil boom concentrated in this region during these years. Whereas Mexico City region was able to absorb population and maintain its productivity level, it was observed that labor migration from the low to high productivity regions contributed to the productivity growth at national level, even when this contribution was decreasing over years. Reynolds (1979), using the shift-share accounting, identify the regional change component in 16 percent in 1940's, 11 percent in 1950's, 14 percent in 1960's, and 1 percent in 1970's. That is, at the best a sixth or 10th out of the output per capita growth at national level can be explained by the labor migration.

In order to evaluate how important the regional change has been in explaining the recent manufacture growth at national level, the author uses the same approach as

Reynolds (1979). If we take in account that the employment has grown more in the regions with the lowest level in output per worker, the 'transference' of interregional employment has negatively contributed to increase the national level of productivity. According my estimates for manufacturing, if the employment growth would have increased in same proportion in all regions, the output per worker would have been 16 percent higher than the observed one for 1985-1988. If this trend continues, as data for 1993 shows, the persistent dynamic of the productivity disassociated from the regions with highest employment growth rate, imply that as much as the employment grows in the regions of lowest productivity growth rate, the productivity in manufacture is negatively affected. Therefore, the recent employment growth is limited in terms of productivity and also limited the role of the manufacture in the regional economic development. Even more, the significant increment in Mexican manufacture productivity since 1984, that have been noted by Brown and Dominguez (1994), Elias (1992), and Weiss (1992), seems not be encouraged by the regional change.

In relation with our initial second question, whereas the regions with highest productivity growth maintain this performance along the period, before and under a freer trade regimen, what seems to explain this performance? Two hypothesis seems to be attractive in explaining the persistence of the regional productivity patterns despite the recent regional change.

One of these two hypothesis is related to the new activities that are promoted under trade liberalization. In particular, that the new activities do not promoted the use of knowledge. Rivera-Batiz and Xie (1993) have suggested than in the case of economic integration between countries with unequal endowment of human capital that is applied to the production of knowledge, the integration can induce to the non-innovating country to be a chronically non-innovating country. If the endowment of human capital is lower, in relation to the partner, the non-innovating country is maintained in that condition after the integration. They suggest that whereas Mexico is the non-innovating country in the NAFTA case, such results are applicable to the new activities to be promoted. However, it interesting to note that if we observe the productivity in the maquiladora industry, we also note differences in productivity among regions. Maquiladoras in Guadalajara or Monterrey present higher productivity growth than in the Northern border cities (Wilson, 1994).

The another hypothesis about the explaining of differences in productivity growth among regions is about the regional characteristics that promote the productivity in each case. This hypothesis take us to a series of economic growth factors identified in the new growth theory, or endogenous growth theories, such as education, learning by doing, public infrastructure, and knowledge spillovers, among others, that are identified as externalities that promote growth, by means of avoiding the decreasing returns to physical capital. In this way, these endogenous growth models suggest that if endogenous growth factors are relevant, regions that have promoted, intentionally or not, these factors should show a better performance in economic growth. This explanation is extended if we see the effects of this

endogenous growth factors as technological externalities and therefore, not identified by the firms in their investment decisions, and by the same token, not having motives for promoting those externalities. From this hypothesis, it can be inferred that the disassociation between productivity and regional change of economic activity does not necessarily means regional change imply lower productivity growth, but productivity growth is not 'automatic' and related to economic activity growth. Productivity growth is a phenomena related to specific characteristics historically created in the regions and once identified can be subject of public policies. In this stage of the research, the empirical evaluation of this and the another hypothesis seem particularly attractive for further research.

Table 1. Employment Share By Regions Mexican Manufacturing : 1970-1993

| Regions | 1970 | 1980 | 1985 | 1988 | 1993 |
|----------------|--------|--------|--------|--------|--------|
| Largest C. | 59.73 | 59.48 | 53.90 | 47.78 | 43.34 |
| North | 11.25 | 8.11 | 15.07 | 19.87 | 22.23 |
| Central | 7.98 | 8.26 | 9.97 | 9.69 | 10.80 |
| West-C. | 7.82 | 6.23 | 8.89 | 9.91 | 10.42 |
| Rest of the C. | 13.20 | 17.91 | 12.16 | 12.74 | 13.19 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

Source: Industrial census, Mexico.

Table 2. Output Share By Regions Mexican Manufacturing: 1970-1993

| Regions | 1970 | 1980 | 1985 | 1988 | 1993 |
|----------------|-------|-------|-------|-------|-------|
| Largest C | 68.6 | 50.3 | 55.1 | 54.2 | 52.12 |
| North | 11.1 | 8.7 | 13.6 | 15.9 | 16.29 |
| Central | 6.7 | 6.6 | 11.2 | 11.1 | 9.09 |
| West-C | 4.5 | 3.1 | 6.1 | 8.5 | 8.96 |
| Rest of the C. | 8.9 | 30.9 | 13.8 | 10.2 | 13.52 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

Source: Same TABLE 1.

Table 3. Comparative Output Per Worker By Regions (National Level = 1)
Mexico: 1970-1993

| Regions | 1970 | 1980 | 1985 | 1988 | 1993 |
|---------------------------|------|------|------|------|------|
| Largest C | 1.14 | 0.84 | 1.02 | 1.13 | 1.20 |
| North | 0.98 | 1.08 | 0.90 | 0.80 | .73 |
| Central | 0.84 | 0.80 | 1.12 | 1.14 | .84 |
| West-C. | 0.57 | 0.52 | 0.69 | 0.86 | .85 |
| Rest of the C. | 0.67 | 1.72 | 1.13 | 0.80 | 1.02 |
| Total | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Thousand Of Pesos of 1980 | 264 | 328 | 255 | 318 | 289 |

Source: Same TABLE 2.

Table 4. Comparative Growth Rate Of Output Per Worker By Regions
(National Growth Rates = 1) Mexico: 1970-1993

| | 1970-85 | 1985-88 | 1970-93 |
|----------------|---------|---------|---------|
| Largest C | 0.88 | 1.10 | 1.07 |
| North | 0.91 | 0.88 | 0.72 |
| Central | 1.33 | 1.01 | 1.03 |
| West-C. | 1.21 | 1.23 | 1.40 |
| Rest Of The C. | 1.69 | 0.70 | 1.51 |
| Total | 1.00 | 1.00 | 1.00 |

Source: Industrial census, various years.

Table 5. Sources Of Economic Growth By Region Mexico: 1970-1985 (Annual Average Growth Rates)

| | Largest C. | North | Central | West-C | R of the C. | Total |
|---------------|------------|-------|---------|--------|-------------|-------|
| Output (VACB) | 1.56 | 4.50 | 6.59 | 5.27 | 6.10 | 3.06 |
| Capital | 2.47 | 4.59 | 5.26 | 8.72 | 5.40 | 3.80 |
| Labor | 1.09 | 2.06 | 1.92 | 1.70 | 0.95 | 1.33 |
| TFP | -2.0 | -2.15 | -0.59 | -5.15 | -0.25 | -2.07 |

Source: My own calculations in base of industrial census.

Table 6. *Sources Of Economic Growth By Region Mexico: 1985-1988 (Annual Average Growth Rates)*

| | Largest C. | North | Central | West-C | R of the C. | Total |
|---------------|------------|-------|---------|--------|-------------|-------|
| Output (VACB) | 7.89 | 14.21 | 8.00 | 20.5 | -2.04 | 8.29 |
| Capital | -4.3 | 5.66 | -0.89 | -0.04 | 6.49 | -0.21 |
| Labor | -1.15 | 3.99 | 0.11 | 1.6 | 0.70 | 0.23 |
| TFP | 13.34 | 4.56 | 8.78 | 18.94 | -9.23 | 7.85 |

Source: Same table 5.

Table 7. *Sources Of Economic Growth By Region Mexico: 1970-1993 (Annual Mean Growth Rates)*

| | Largest C. | North | Central | West-C | R of the C. | Total |
|---------------|------------|-------|---------|--------|-------------|-------|
| Output (VACB) | 2.49 | 5.67 | 5.37 | 6.74 | 5.80 | 3.71 |
| Capital | 1.39 | 2.73 | 3.44 | 5.92 | 3.63 | 2.53 |
| Labor | 0.68 | 3.02 | 1.96 | 1.84 | 1.22 | 1.31 |
| TFP | 0.42 | -0.08 | -0.03 | -1.02 | 0.94 | -0.13 |

Source: Same table 5.

Notes

- 1 For a survey, see Scott (1982), Quintanilla (1987), Hanson (1994), and Polese and Pérez Mendoza (1995).
- 2 In this context, central market should be understood as the place where the principal sources of demand, final and intermediate, are located, that is where the most of the consumer and suppliers are located.
- 3 Total factor productivity (TFP) is conventionally defined as the residual out of the output growth minus the increment in the use and quality of labor and capital, both weighted by their share in the added value. Then, TFP is identified as the technological change.
- 4 For the applicability of this methodology at regional level, see Moomaw and Williams (1991).
- 5 The methodology in growth accounting suggests the use of data on worker-hour, but because these data is no available, I use a 'proxy' the number of workers. That is assumed that all workers works the same number of hours.
- 6 Distrito Federal and Mexico state.
- 7 Baja California Norte, Baja California Sur, Nayarit, Sinaloa, and Sonora.
- 8 Coahuila, Chihuahua, Durango, Nuevo León, San Luis Potosí, Tamaulipas, and Zacatecas.
- 9 South region includes the rest of the country.

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