



Regional convergence, road infrastructure, and industrial diversity in Mexico



Roberto Duran-Fernandez ^{a, *}, Georgina Santos ^{a, b, 1}

^a Transport Studies Unit, University of Oxford, UK

^b School of Planning and Geography, Cardiff University, UK

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ABSTRACT

This paper presents a convergence analysis of productivity growth in the manufacturing sector in Mexico using regional data from the National Economic Census 1999 and 2004. The absolute convergence analysis indicates that regional productivity growth follows a slow convergence trajectory. However, a conditional convergence analysis indicates that current productivity gaps can be directly attributed to divergences in the industrial profile of the regional economy as well as to differences in infrastructure endowments. The results of the paper suggest that the productivity gaps which originated from the liberalisation reforms of the 1980s and 1990s will be exhausted in 25 years approximately. The innovation of this paper is the extension of a convergence analysis to the industrial sector. The use of regional data improves the details of the analysis and allows the identification of growth patterns that had not been previously identified. Finally, it applies innovative metrics to model the industrial profile of a region and the value of transport infrastructure.

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1. Introduction

The North American Free Trade Agreement (NAFTA), signed in 1994, was the peak of a liberalisation reform in the Mexican economy, which started in the mid 1980s and dramatically transformed the country. In the first five years after the NAFTA took effect –between 1995 and 2000– Mexico underwent an average growth rate of 7.8 percent, fostered by an incredible growth of its export sector. However, the development process that NAFTA triggered was far from even across Mexican regions. Between 1995 and 2000 the border states² experienced a growth rate of seven percent, considerably higher than that experienced by the southern states,³ where the growth rate was on average three percent. This behaviour generated a geographic polarisation of the Mexican economy, which had and still has consequences on the social and demographic development of the country as a whole.

In order to investigate the roots of this process this paper presents a convergence analysis of productivity in the manufacturing

sector, using regional data from the National Economic Census (NEC) 1999 and 2004. The analysis attempts to investigate whether productivity is converging or diverging in growth rates or levels across regions in Mexico for this sector. We estimate an absolute and a conditional convergence model using four different econometric approaches, including a spatial autocorrelation model.

The most important result of the analysis is that manufacturing productivity follows a slow conditional convergence trajectory. There are two main factors for this long-run productivity convergence. The first one is a change in the industrial profile of industrially specialised regions to a more diverse composition. The second factor is that the productivity gains originally generated by the 1980s and 1990s liberalisation reforms will be eventually exhausted in the long term.

In particular, our analysis identifies industrial specialisation and accessibility to international markets as significant determinants in a conditional convergence model. This implies that the present gaps in manufacturing productivity can be directly associated to differences in industrial profiles at regional level as well as divergences on accessibility endowments. Finally, the analysis suggests that road infrastructure does generate positive spillovers on productivity as long as it is complementary to the liberalisation reforms. These results highlight the importance of infrastructure policy as a tool for achieving an even development process at regional level.

* Corresponding author. Tel.: +52 (55) 5249 5060.

E-mail addresses: r.duran.fernandez@gmail.com (R. Duran-Fernandez), SantosG@Cardiff.ac.uk (G. Santos).

¹ Tel.: +44 (0) 29 208 74462.

² Baja California, Chihuahua, Coahuila, Nuevo Leon, Sonora, and Tamaulipas.

³ Chiapas, Guerrero, and Oaxaca.

2. Literature review

One of the most important predictions of neo-classical economic growth theory is convergence. This concept implies that if two economies have the same technology, and their economic agents have the same preferences, the initially poorer economy will grow faster in per capita terms.

Barro and Sala-i-Martin (1992) propose a simple empirical framework to test the validity of this prediction. Starting from a standard neo-classical growth model, the authors derive the expression presented in Equation (1).

$$\log\left(\frac{y_{i,t+T}}{y_{i,t}}\right) = \alpha - \frac{1 - e^{-\beta T}}{T} \log(y_{i,t}) + \varepsilon_{i,t+T} \quad (1)$$

In Equation (1), $y_{i,t}$ is the initial per capita income for economy i , $y_{i,t+T}$ is per capita income when T years have elapsed, $\varepsilon_{i,t+T}$ is a random variable, and α is a constant. In this expression, β is the speed of convergence to a long-run steady state common to all the economies. A positive value for this parameter implies absolute convergence, and a negative value suggests that the per capita income diverges across different economies.

Barro and Sala-i-Martin (1992) applied this framework to the analysis of historic USA data at state level, finding strong evidence of income convergence. However, when the analysis is extended to an international context it is not possible to get the same result. This puzzle has been tackled with the introduction of conditional convergence. The idea is that the intrinsic parameters that determine the long-run steady state of per capita income – i.e. technology and preferences – vary across different economies. Therefore, conditional convergence predicts that income per capita will converge given these parameters. In practice, economies that exhibit similar characteristics are expected to converge in their income levels. In fact, this is the case for the developed countries in the Organisation for Economic Cooperation and Development (Barro & Sala-i-Martin, 1992).

Some of the authors that have analysed convergences for the Mexican case are Chiquiar (2004), Esquivel (1999), Esquivel and Mesmacher (2002), García-Verdu (2005), Juan-Ramon and Rivera-Batiz (1996), Mallick and Carayannis (1994), Messmacher (2000), Rodríguez-Oreggia (2001), Rodríguez-Pose and Sánchez-Reza (2002a, 2002b). These studies have shown that, in general terms, per capita income seemed to converge across states until the mid 1980s, when this pattern was broken.

The divergences in the geographical distribution of income the literature has identified may be directly associated with trade liberalisation (Rodríguez-Pose and Sánchez-Reza 2002b). In the mid 1980s the Mexican economy started a deep structural transformation, driven by a change in international trade policy. It started precisely in 1986, when the country entered into the General Agreement on Tariffs and Trade (GATT) and culminated in 1994, with the signature of the NAFTA. Some of the research that has analysed growth patterns after the mid 1990s has shown that after NAFTA the convergence process was never restored. In fact, there is robust evidence showing that trade liberalisation and membership of NAFTA is connected to a greater geographic polarisation.

Immediately after Mexico entered into the NAFTA the domestic economy experienced an outstanding boost of its export sector. For example, between 1993 and 2000, the share of non-oil exports in the gross domestic product increased from 13 to 38 percent (INEGI, 2008). This improvement was driven by the export-oriented manufacturing sector. However, the distribution of these improvements was not even across the country. In fact, the empirical literature shows that the states that are closer to the USA market have experienced greater benefits from the structural changes in

comparison to the states in the south (Rodríguez-Pose and Sánchez-Reza 2002a).

An illustration of this point is one of the most successful export programmes in Mexico: the *maquila* industry. This programme gives tax exceptions to intermediate goods imported from the USA and Canada, which are also the main destinations of the *maquila* industry exports. The gross product of the *maquila* sector in 2003 represented 59 percent of the total manufacturing product in the country and up to 99 percent of the product was exported (INEGI, 2008). The importance of the *maquila* industry in Mexican exports, its weight in manufactures' product, and the peculiarities of its spatial distribution suggest that the polarisation of income levels has been driven by an asymmetric growth of the manufacturing sector.

Physical proximity to international markets is only part of the explanation of the uneven process of growth. Infrastructure endowments, human capital, and the industrial composition of the economy have been identified as some of the key variables that explain the divergences in growth rates across Mexico. For example, the empirical literature has shown that the states that had sufficient availability of communications and transport infrastructure, an important presence of large firms with export capabilities, and a relatively well educated labour force, have been more likely to take advantage of the liberalisation reforms that started in the mid 1980s (Chiquiar, 2004). Moreover, within a country, the differences in the institutional framework are not as significant as at international level, given that a country shares these features as a whole political unit. This is an additional argument that supports the hypothesis that the differences in socio-economic determinants, rather than the divergences in institutions, are the cause of the interregional gaps in income levels.

3. Regional convergence in the manufacturing sector

The analysis presented in this paper applies the methodology of the convergence literature to the analysis of the recent evolution of the manufacturing sector in Mexico. We use data from the NEC in 1999 and 2004 to study the growth pattern of the productivity, measured as the gross value added per worker during this period. The objective is to verify whether the present regional productivity gaps across the country are widening or closing. The dataset is the most updated information on production in the manufacturing sector in the country at local level. It covers a period that has not been analysed previously at this geographic level.

Following the limited availability of data, the existing literature has relied on the analysis of state economies. The state-level approach has an important limitation because it cannot analyse in detail any kind of intra-state divergences. This can be particularly troublesome in the analysis of conditional convergences. The geographic scale effects of variables such as infrastructure might be limited to a local context and not apply to the whole state. Under this scenario, if the weight of a region in a state is not large enough to be captured by aggregate state data, an analysis might underestimate the real effects of infrastructure.

The NEC provides an exceptional opportunity to analyse growth patterns at local level given that it presents information on production at municipal level. However, the direct analysis of municipal data might not be as useful for the study of conditional convergence because of the potential interaction between a municipality and neighbouring locations. In this case, the industrial composition of a region might be a more relevant piece of information. A middle point to tackle this geographic scale trade-off is the use of regional data. We use the NEC to build-up a dataset on manufacturing production at regional level following the regionalisation proposed by Bassols-Batalla (1993, 2002).

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