Wage inequality and economic growth in Mexican regions

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ABSTRACT: Only a few studies have analysed the relationship between intra-regional inequality and growth, although several studies have measured inequality at the regional level. The objective of this paper is to analyse the relationship between income (wage) inequality and economic growth in different regions of Mexico. We also try to identify factors that explain the variation of intra-regional inequality across Mexican regions and over time. Using macroeconomic databases and publicly available microdata, we apply techniques used in the fields of statistics and econometrics to obtain robust evidence on the relationship between growth and inequality. Our aim is to provide policy recommendations to support the design and implementation of growth-promoting measures thatavoid the exclusion of certain social groups. This paper provides reasons to use a spatial approach and an analysis of particular regions to avoid «one size fits all» policy recommendations.

JEL Classification: J24, J31.

Keywords: Regional inequality, economic growth, Mexican regions.

Desigualdad salarial y crecimiento económico en las regiones de México

RESUMEN: Sólo unos pocos estudios han analizado la relación entre la desigualdad intra-regional y el crecimiento, a pesar de que varios estudios han medido la desigualdad a nivel regional. El objetivo de este trabajo es analizar la relación entre la desigualdad del ingreso (salario) y el crecimiento económico en diferentes regiones de México. También tratamos de identificar los factores que explican la variación de la desigualdad intra-regional a lo largo del tiempo. Para ello, se utilizan bases de datos macroeconómicos y de microdatos a disposición del público

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y aplicamos técnicas estadísticas y econométricas para obtener evidencia robusta sobre la relación entre crecimiento y desigualdad. Nuestro objetivo es intentar ofrecer recomendaciones de política para apoyar el diseño y la implementación de medidas que promuevan el crecimiento y que eviten así la exclusión de ciertos grupos sociales. El artículo ofrece motivos para utilizar un enfoque espacial y el análisis de determinadas regiones para evitar recomendaciones de política del tipo *«one size fits all»*.

Clasificación JEL: J24, J31.

Palabras clave: Desigualdad regional, crecimiento económico, regiones de México.

1.   Introduction

There has been growing interest in analysing the relationship between inequality and growth since the pioneering work of Kuznets (1955) that found that inequality first increases and later decreases during the process of economic development, suggesting a non-linear relationship between these two variables. However, theoretical papers and empirical applications have produced conflicting results. While a considerable part of the literature has shown that inequality is detrimental to growth, more recent studies have challenged this result and found inequality to have had a positive effect on growth. The first group of authors argue that there is less demand for redistribution in more egalitarian societies and therefore less tax pressure, which creates greater accumulation of capital and higher growth (Persson and Tabellini, 1994). A second argument in this line of reasoning is related to political instability (Alesina and Perotti, 1996) and posits that greater levels of inequality imply a distortion in the functioning of markets, reducing labour productivity. By contrast, the authors who defend a positive relationship between inequality and growth base their arguments on the effects of inequality in the accumulation of factors of production. If the savings rate of the rich is higher than that of the poor, the reduction of inequality implies a reduction in aggregate savings and therefore of capital accumulation and growth (Fields, 1989; Campanale, 2007). Moreover, agglomeration economies produce higher returns to high-skilled workers and consequently produce simultaneously higher inequality and higher economic growth (Borjas *et al*., 1992; Wheaton and Lewis, 2002; Glaeser and Maré, 2001). If both variables are influenced by identical factors, it is likely that they are produced by the same causes.

The recent meta-analysis by de Dominicis *et al*. (2008) concluded that it would be misleading to simply speak of a positive or negative relationship between income inequality and economic growth when looking at the available studies, although policy conclusions clearly depend on the type of relationship. Differences in methodologies, data quality and sample coverage substantially affect the magnitude of the estimated effect of income inequality on economic growth. For this reason, these authors propose to focus their research on determining the effect of income inequality on economic growth using single-country data at the regional level because most of the

factors explaining the bulk of the differences between studies, data-related issues and structural or institutional issues, will thereby be eliminated. However, the international evidence for using this approach is scarce, see Partridge (2005), Frank (2009) and Fallah and Partridge (2007) for the US, Perugini and Martino (2008), Barrios and Strobl (2009) for the EU-15 countries, Castelló (2010) for OECD countries (focusing on groups of countries with distinct income levels), Herzer and Vollmer (2011) for a sample of 46 countries and Székely and Hilgert (1999) for 18 Latin American countries. To the best of our knowledge, there are only a few similar studies for a single country, including Rooth and Stenberg (2011) for Swedish regions and, for developing countries, we find studies of Argentina by Cañadas (2008) and Araujo, *et al*. (2009) and a study of Brazil by Azzoni (2001).

The objective of this paper is to provide evidence about the association of inequality and growth across 32 Mexican states (31 states and the Federal District) over a period of 10 years (1998-2008) by using several measures of inequality and different econometric specifications. Moreover, we would like to determine whether other factors simultaneously influence inequality and growth, such as previous growth rates, which have been found to influence both present inequality and subsequent growth in the regional convergence literature.

The Mexican case is particularly interesting in this context for several reasons. First, the labour structure of Mexico has undergone different political, economic and demographic changes affecting both inequality and regional economic growth over the past three decades. Second, inequality trends have been substantially different than those observed in other developing countries.

After a critical period of economic adjustment characterised by the debt crisis in the 1980's, Mexico enjoyed a period of economic growth. In the mid-1980s, Mexico was in the initial stages of implementing new trade liberalisation policies and export promotion that was expected to increase the country's productivity and competitiveness. During that period, trade barriers were reduced through various rounds of negotiations under the GATT and the WTO; Mexico also experienced a radical reduction in the size of its public sector and in the strength of its unions, while it sawa massive increase in the rate of underemployment and in workers moving into the informal sector (Gong *et al*., 2004; Meza, 2005). From 1989 to 1994, GDP grew at an average rate of approximately 3.9% per year [1], but growth ended abruptly in 1995, when GDP fell by 6.2% in the aftermath of the so-called «Peso Crisis». After the crisis of 1995, the GDP contracted by approximately 8%; thereafter, the economy quickly recovered but not with significant levels of growth, and Mexico's per capita GDP grew at an annual rate of 4% from 1996 to 2000, falling to an annual rate of 1% between 2001 and 2006 [2].

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[1] World Bank (1997).

[2] The introduction of trade liberalisation has generated important changes in the Mexican economy. However, the research has shown that there are heterogeneous (positive and negative) outcomes. For instance, apparently NAFTA did not break down the divergent pattern in regional per-capita output observed after the initial stages of the reforms; the degree to which trade will reduce regional inequality in a given country is mediated by the geographic distribution of its endowments, and trade openness has increased

Under this macroeconomic framework, there is overwhelming evidence that Mexico has faced increasing inequality not only in economic but also in social terms since the mid-1980s, although it seems to have decreased from 2000 onwards. The inequality increase observed during the 1990s was a common feature of several OECD industrialised countries [3], but was not common in most developing countries (Autor *et al.*, 2005 and 2008; Arellano *et al.*, 2001; Acemoglu, 2003; Morley, 2000; Bandeira and García, 2002; Ferreira, *et al*., 2008 and Cornia, 2010) [4].

The remainder of this paper is structured as follows. Section 2 discusses data sources. Section 3 focuses on methodology and the econometric model to be estimated. Section 4 shows the results about the influence of wage inequality on economic growth from a regional perspective. Finally, Section 5 concludes.

2.   Data sources

The dataset used in this paper comes from the National Survey of Labour and Employment (ENOE) and the National Urban Employment Survey (ENEU), conducted by the National Institute of Statistics and Geography of Mexico (INEGI), from 1987 to 2008.

In the rest of the analysis, we use ENEU-ENOE microdata covering the period from 1998 to 2008to describe the evolution of inequality in Mexico. The size of the sample is 1,391,438 observations in an urban aggregate of 32 metropolitan areas. Our basic sample consists of workers between 15 and 65 years of age who are working full-time, and hours are measured against the hours customarily worked in the principal job. Wefocused on the formal or mains tream labour market and chose not to consider self-employed, seasonal or unpaid workers to avoid problems addressing retained earnings.

The scarce availability of sub-national data in Mexico hasthusfar strongly influenced the research on the causes and effects of regional inequality in Mexico. This suggests that analyses covering all 32 states [5] may be conducted, providing a

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regional inequality in Mexico, favouring states located in the north of Mexico in particular. While it appears that human capital policies might have a great effect in closing disparities among regions in the Mexican context, some policies cannot be dismissed because building local capacities requires a great deal of time and a coordinated and well-focused regional policy. In all cases, the findings show that there is increasing polarisation between the Mexican states. See, in particular, Jordaan and Rodriguez (2012), González (2007), Rodríguez-Oreggia (2005) and Chiquiar (2005) for a review of these arguments and Rodríguez-Oreggia (2007) for a review of the polarisation between the Mexican states, where rich states are becoming richer and experiencing higher growth.

[3] For evidence that inequality measures are sensitive to the sample of workers examined and the earnings measure, see Handcock, *et al*. (2000) and Lemieux (2002, 2006).

[4] This contrasts with the slight increases or even declines in other countries such as the Netherlands, Sweden or Belgium, US, UK, Germany, Canada and some countries in Latin America.

[5] Aguascalientes, Baja California, Baja California Sur, Campeche, Coahuila de Zaragoza, Colima, Chiapas, Chihuahua, Distrito Federal, Durango, Guanajuato, Guerrero, Hidalgo, Jalisco, México Federal District, Michoacán de Ocampo, Morelos, Nayarit, Nuevo León, Oaxaca, Puebla, Querétaro Arteaga,

number of observations (in our case, regions) sufficient to allow econometric analysis. We built regional measures of wage inequality using hourly wages (derived from monthly earnings and weekly hours multiplied by 4.3)[6]. For individuals who report their wages as a multiple of the minimum wage, we assigned the mean of the interval[7]. Wages were deflated by the consumer price index (CPI) to the second quarter, using 2002 as the base year. The regional CPI disaggregates indices covering six geographical regions that include 46 cities classified by size (small, medium and big). This structure allows for at least one representative city in each state[8].

In view of the high variability of outcomes highlighted by the literature with respect to the measures employed and the geographical scope, wealso considered regional population, regional GDP (current)[9], population density, sectoral employment structure, level of qualification (as a proxy of human capital), educational inequality and measures of labour market performances (labour force participation, unemployment and informal labour rates). Geographical information, such as the coastal strip and the distance in kilometres from the capital of each state to Mexico City, are used to represent proximity among markets. Distance to important markets is an important variable in the new economic geography. This strand of the literature assumes that a shift in the relevant market occurs once trade is introduced[10]. The data sources for each of the variables are shown in table A1.1 (see Annex 1).

3. Methodology

3.1. Measuring inequality

A substantial and growing literature has developed different measures or indices as proxies for economic inequality. Several authors have used the Gini coefficient and other measures or relationships drawn from Lorenz curves, other authors have chosen to use different indicators of dispersion, such as an entropy index or axiomatic deriva-

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Quintana Roo, San Luis Potosí, Sinaloa, Sonora, Tabasco Tamaulipas, Tlaxcala, Veracruz, Yucatán, Zacatecas.

[6] The definition of earnings in the publicly available version of the surveys refers to monthly «equivalent» earnings from the main job after taxes and Social Security contributions, including overtime premiums and bonuses. For those paid by the week, the survey transforms weekly earnings into monthly. Similar adjustments are used for workers paid by the day or every two weeks.

[7] During the period, the population that does not declare income was less than one percent.

[8] The NCPI has been calculated since 1969 and it has changed its base year four times to 1978, 1980, 1994 and 2002. For this study, we used the base year 2002 that corresponds to a weighting of the consumer population structure in 2000. The NCPI is calculated and published on a monthly basis by the Central Bank (Bank of Mexico). The index gathers the prices of a family shopping basket, using prices of goods and services found at *www.banxico.org.mx*.

[9] The regional GDP in constant prices is only available for 2005-2009.

[10] In the Mexican case, the relevant market should be Mexico City during ISI (Import Substitution Industrialisation) and the border with the US during the GATT (General Agreement on Tariffs and Trade), particularly since the implementation of NAFTA (North American Free Trade Agreement) (Hanson, 1997; Hanson and Harrison, 1999; Krugman and Livas, 1996).

tions of inequality indices, and still others advocate the use of normative measures derived from social welfare functions [11].

The most commonly used inequality index remains the Gini coefficient (G), which ranges from 0 (perfect equality) to 1 (perfect inequality). As the ratio of the area enclosed by the Lorenz curve (L) and the perfect equality line to the total area below that line, the Gini coefficient is twice the area defined between p and $\theta(p)$, where $\theta(p)$ is the Lorenz curve and shows the income value (Y) below a fraction $0 \leq p \leq 1$ [12]:

$$G(Y) = 1 - 2\int_0^1 L(p_i Y)dp \qquad (1)$$

When compared to other measures, the Gini coefficient is the most sensitive to income differences in the middle of the distribution (more precisely, around the mode). This index is usually completed by using other Lorenz-based measures such as the Mehranindex and the Piesch index, which are more sensitive to differences between the lowest and the highest income individuals.

A different family of inequality indices can be derived utilising the considerations summarised by Cowell and Kuga (1981). This family of indices is known as Generalised Entropy indices (E_α); given an appropriate normalisation and using the standard population principle (Dalton, 1920), they can be calculated as follows [13]:

$$E_\alpha(Y) = \frac{1}{\alpha^2 - \alpha}\int\left(\left(\frac{y_i}{\mu Y}\right)^\alpha - 1\right)f(y_i)dy \qquad (2)$$

where α is the order of the index, y_i is the income share that is individual *i's* total income share as a proportion of total income for the entire regional population and μY is the mean income. The more positive or negative α is, the more sensitive (E_α) is to income differences at the top or bottom of the distribution, respectively; E_0 is equivalent to the mean logarithmic deviation [14], E_1 corresponds to the Theil index [15] and E_2 is half the square of the coefficient of variation [16].

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[11]   The extent of this work is indicated by the recent publication of two handbooks, the *Handbook of Income Distribution* edited by Atkinson and Bourguignon (2000), much of which addresses measurement problems, and the *Handbook on Income Inequality Measurement* edited by Silber (1999), devoted entirely to the subject. See also, Cowell (2000) and Lambert (2001) for an excellent survey.

[12]   Yitzhaki (1998) reviews other alternative formulae.

[13]   Using an analogy with the entropy concept in information theory, Theil (1967) opened and explored a new area in inequality measurement and for the axiomatic approach to inequality measurement. The entropy concept is the expected information in the distribution. Theil's application of this to income distribution replaced the concept of event probabilities by income share.

[14]   This inequality index is an example of the concept of conditional entropy that allows the comparison distribution and has been applied to the measurement of distributional change (see Cowell, 1980).

[15]   The most commonly used values of α, are 0, 1 and 2. When $\alpha = 0$, more weight is given to distances between wages in the lower range, when $\alpha = 1$, equal weights are applied across the distribution, while a value of $\alpha = 2$ gives more weight proportionately to gaps in the upper range (see Litchfield, 2003).

[16]   For more details of these measures, see Tello (2012).

The Atkinson index explicitly manifests value judgements in a parameter, ε, that represents the degree of inequality aversion. The Atkinson class of measures has the general formula:

$$A_\varepsilon = 1 - \left[\frac{1}{n} \sum_{i=1}^{n} \left[\frac{y_i}{y} \right]^{1-\varepsilon} \right]^{\frac{1}{1-\varepsilon}} \tag{3}$$

where ε is an inequality aversion parameter, $0 < \varepsilon < \infty$, and the higher the value of ε, the more society is concerned about inequality (Atkinson, 1970). The Atkinson class of measures ranges from 0 to 1, with zero representing no inequality. Setting $\alpha = 1 - \varepsilon$, the GE class becomes ordinally equivalent to the Atkinson class, for values of $\alpha < 1$ (Cowell and Jenkins, 1995) [17]. The more that $\varepsilon > 0$ (the «inequality aversion parameter»), the more sensitive the index is in different parts of the income distribution. Thus, the most commonly used values of ε are the following: A(0.5), A(1) and A(2).

3.2. Methodology

The standard procedure for estimating the effect of inequality on growth is to assume a simple linear relationship in which the logarithmic difference of per capita income at the beginning and at the end of the time period is regressed on a number of explanatory variables that potentially explain differences in the growth rates of countries, including a measure of income inequality. Specifically,

$$\ln y_{i,t} - \ln y_{i,t-1} = \alpha + \beta \cdot \ln y_{i,t-1} + \gamma \cdot Ineq_{i,t-1} + \upsilon_{i,t} \quad t = 1998,...,2008 \tag{4}$$

where $lny_{i,t}$ is the logarithm of real GDP per capita in region i at time t, $Ineq_{i,t}$ represents an inequality measure (Gini index, Mehran and Piesch measures, Generalised Entropy index and Atkinson class), and $\upsilon_{i,t}$ is an error term that varies across regions and periods. In this model, the coefficient β will be related to the convergence rate across economies while the coefficient γ will permit the assessment of the effect of regional inequality on growth. As previously mentioned, studies based on cross-national regressions typically report a negative and significant relationship between initial income inequality and growth. The negative coefficient usually holds for different measures of inequality, different country samples, and different time periods.

One of the main critiques of this type of regression is that cross-national estimates may be biased because variables may be omitted. Country-specific factors such as technology, climate and institutional structures may be important determinants of growth rates and may correlate with explanatory variables in the model. Although

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[17] Atkinson proposes to define the index not according to the difference between actual social welfare and the social welfare that would ensue with equally distributed income, but in terms of the difference between mean actual income and *equally distributed equivalent income*, *i. e.,* income which, being equal for everyone, would provide the same level of actual social welfare.

control variables may be included in the model, many factors are typically unobservable. Assuming that those factors are constant over time and using longitudinal rather than cross-sectional data, the suggested specification results in a modified panel data version of the previous equation that can be used to control for unobservable factors using a fixed effects model. The modified model will adopt the following form:

$$\ln y_{i,08} - \ln y_{i,98} = \alpha + \beta \cdot \ln y_{i,98} + \gamma \cdot Ineq_{i,98} + \varphi X_{i,98} + \eta_{08} + \mu_i + \varepsilon_{t,08} \qquad (5)$$

where $lny_{i,t}$ is the logarithm of real GDP per capita in region i at time t, $Ineq_{i,t-1}$ represents the different inequality measures in region i lagged 1 year, $X_{i,t-1}$ includes k explanatory variables suggested in the literature as important determinants of the growth rates [18]; β, γ and φ represent the parameters of interest that are estimated, η_t is a time specific effect, μ_i is a region specific effect, and $\varepsilon_{i,t}$ is an error term that varies across regions and periods.

However, panel data estimations have a list of drawbacks; if most of the variation in the key variables is cross-sectional rather than within regions, fixed effect approaches may produce misleading results (Barro, 2000). In other words, if the underlying causal factors in the growth process are persistent, the long-run cross-sectional effects will be subsumed into the country-fixed effects, and the explanatory variable coefficients would be much less informative (Rodríguez-Pose and Tselios, 2010). Consequently, OLS cross-sectional models capture how persistent cross-sectional differences in inequality affect long-term growth rates, which is relevant to understanding growth disparities, while panel techniques capture how time-series changes in inequality within a region affect changes in its growth rate over the short term. Therefore, the two methods are complementary and may reflect different responses.

Consequently, both cross-sectional and panel data models will be considered. The econometric estimation of panel data systems must address similar problems, such as the measurement error of the endogenous variable, the inclusion of the lagged endogenous variable as a regressor, the potential endogeneity of growth and, lastly, the potential existence of spatial spillovers. The inclusion of additional explanatory variables at the regional level will permit an assessment of our second research hypothesis. However, the choice between various techniques to estimate the panel data model is governed by assumptions about the error term and its correlation with the explanatory variables. Most panel data growth studies use the fixed effects estimator, as opposed to the random effects estimator. However, as Temple (1999) stressed, this approach does not correctly analyse the effect of variables that are fairly constant over time or that will have only a long-term effect on growth, as could be the case for inequality. An additional problem with both the fixed and random effects estimators is that our specification contains a lagged regressor undermining the strict exogeneity assumption of the explanatory variables, so we recommend the exclusive use of the

[18] These variables are the logarithm of GDP per capita, educational attainment, educational inequality, the labour force, unemployment and informal labour rates, the coastal localisation of the region, the distance to DF and occupation by economic sector. A more detailed description of each variable and its sources is included in Table A1.1 in the Annex 1.

GMM estimator initially developed by Arellano and Bond (1991) and improved by more recent contributions that takes into account problems related to panel dimensions. This estimator first takes differences to eliminate the source of inconsistency and uses the levels of the explanatory variable lagged as instruments.

4.   Empirical results

4.1.   The evolution of wage inequality in Mexican regions

Mexico has experienced significant increasesin wage disparity across regions since the mid-1980s. During the nineties, NAFTA had heterogeneous effects in several regions because not all regions within Mexico are equally linked to the international (global) economy. While the degree of regional exposure to globalisation appears to be an important determinant of the differences in the evolution of state-specific wage profiles, it is important to note that Mexico's regions exhibit large differences in natural resource endowments, infrastructure, regional policies and historically determined agglomerations of population.

Figure 1 shows the evolution of the different inequality measures considered in this paper. From this figure, we can conclude that there is a general trend of inequality in Mexico that follows an inverted «U» pattern, with a sharp decline since 1997. If we focus on the Gini index, it shows that a major increase in inequality has taken place since 1994 (when the value of the Gini index was 0.52). After the Mexico crisis, the level of inequality declined slightly. Finally, the General Entropy indices show that the volatility of the index is higher for extreme values of the sensitivity parameter (most likely because of top coding problems); however, focusing on levels shows that GE(–1), GE(0) and GE(1) follow a pattern close to the Gini index.

Table 1 shows different measures of inequality for 32 states in Mexico for the period from 1998 to 2008. Important differences in the inequality indices can be

Figure 1.   Inequality measures in Mexico, 1987-2008
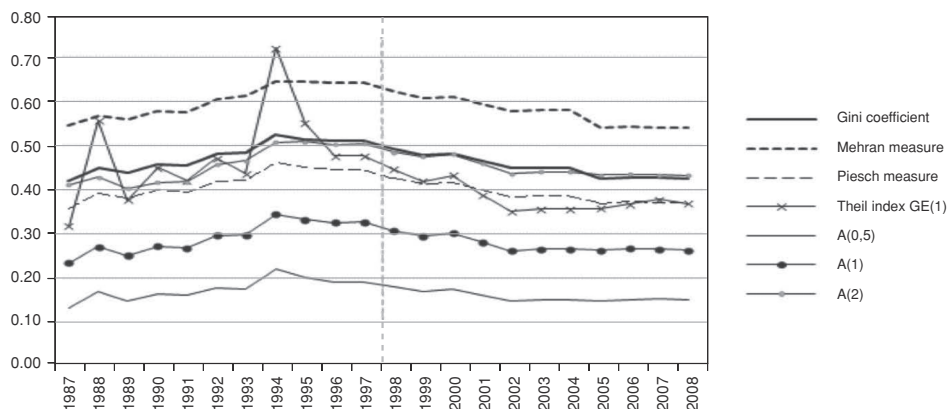
Source: Our elaboration from ENEU-ENOE 1987-2008.

Table 1.   Descriptive statistics of main variable by region

| | lgdppc | | Gini coefficient | | Mehran | | Piesch | | Inequality measures Generalized Entropy Index | | | | | | | | Atkinson class | | | | | |
| | | | | | | | | | GE(−1) | | GE(0) | | GE(1) | | GE(2) | | A(0.5) | | A(1) | | A(2) | |
	1998	2008	1998	2008	1998	2008	1998	2008	1998	2008	1998	2008	1998	2008	1998	2008	1998	2008	1998	2008	1998	2008
Aguascalientes	4,16	4,45	0,48	0,40	0,61	0,51	0,41	0,35	0,43	0,33	0,34	0,27	0,41	0,31	0,95	0,48	0,17	0,13	0,29	0,24	0,46	0,40
Baja California	4,32	4,40	0,42	0,37	0,53	0,47	0,37	0,32	0,29	0,26	0,27	0,23	0,33	0,28	0,62	0,57	0,14	0,12	0,24	0,21	0,37	0,34
Baja California Sur	4,29	4,55	0,47	0,45	0,59	0,55	0,40	0,39	0,43	0,41	0,35	0,34	0,40	0,46	0,79	1,39	0,17	0,17	0,29	0,29	0,46	0,45
Campeche	4,39	5,17	0,49	0,44	0,62	0,56	0,43	0,38	0,49	0,44	0,39	0,33	0,43	0,38	0,74	0,66	0,19	0,16	0,32	0,28	0,50	0,47
Coahuila	4,34	4,57	0,49	0,43	0,62	0,53	0,43	0,37	0,48	0,38	0,37	0,30	0,45	0,36	0,99	0,70	0,18	0,15	0,31	0,26	0,49	0,43
Colima	3,99	4,20	0,49	0,42	0,62	0,53	0,42	0,36	0,45	0,37	0,36	0,29	0,45	0,32	1,38	0,48	0,18	0,14	0,30	0,25	0,47	0,42
Chiapas	3,08	3,32	0,53	0,47	0,67	0,59	0,46	0,40	0,67	0,51	0,46	0,37	0,47	0,44	0,78	1,47	0,21	0,18	0,37	0,31	0,57	0,50
Chihuahua	4,35	4,59	0,43	0,41	0,54	0,50	0,37	0,36	0,30	0,29	0,28	0,28	0,34	0,40	0,58	1,21	0,14	0,15	0,25	0,24	0,38	0,37
Distrito Federal	4,87	5,25	0,51	0,44	0,63	0,55	0,44	0,38	0,48	0,39	0,39	0,32	0,47	0,37	0,90	0,67	0,19	0,16	0,33	0,27	0,49	0,44
Durango	3,80	4,11	0,50	0,42	0,63	0,53	0,43	0,36	0,46	0,36	0,37	0,29	0,46	0,32	1,40	0,52	0,18	0,14	0,31	0,25	0,48	0,42
Guanajuato	3,61	3,98	0,45	0,35	0,57	0,44	0,39	0,30	0,32	0,22	0,29	0,21	0,36	0,27	0,88	0,58	0,15	0,11	0,25	0,19	0,39	0,31
Guerrero	3,32	3,65	0,51	0,43	0,63	0,55	0,44	0,38	0,45	0,43	0,37	0,33	0,48	0,42	1,50	1,33	0,19	0,17	0,31	0,28	0,47	0,46
Hidalgo	3,44	3,82	0,49	0,45	0,64	0,57	0,42	0,39	0,48	0,44	0,36	0,34	0,38	0,37	0,57	0,59	0,17	0,16	0,30	0,29	0,49	0,47
Jalisco	3,94	4,22	0,50	0,40	0,64	0,50	0,43	0,35	0,42	0,31	0,34	0,27	0,41	0,32	0,86	0,56	0,17	0,13	0,29	0,23	0,45	0,39
México	3,72	3,94	0,48	0,38	0,61	0,49	0,41	0,33	0,39	0,31	0,33	0,25	0,39	0,32	0,75	0,94	0,16	0,13	0,28	0,22	0,44	0,38
Michoacán	3,35	3,76	0,44	0,42	0,58	0,54	0,37	0,37	0,32	0,37	0,26	0,30	0,30	0,36	0,57	0,74	0,13	0,15	0,23	0,26	0,39	0,43
Morelos	3,82	4,04	0,46	0,38	0,58	0,49	0,39	0,33	0,34	0,29	0,30	0,25	0,36	0,29	0,66	0,50	0,15	0,12	0,26	0,22	0,40	0,36
Nayarit	3,45	3,80	0,49	0,41	0,64	0,54	0,42	0,35	0,48	0,39	0,34	0,29	0,41	0,31	1,25	0,48	0,17	0,14	0,29	0,25	0,49	0,44
Nuevo León	4,58	4,97	0,50	0,42	0,62	0,52	0,44	0,37	0,45	0,35	0,39	0,29	0,47	0,35	0,93	0,64	0,19	0,15	0,32	0,25	0,48	0,41
Oaxaca	3,04	3,53	0,54	0,43	0,68	0,55	0,46	0,37	0,65	0,44	0,42	0,32	0,51	0,34	1,70	0,52	0,20	0,15	0,35	0,27	0,56	0,47
Puebla	3,66	3,90	0,44	0,40	0,58	0,51	0,37	0,34	0,35	0,33	0,28	0,27	0,31	0,30	0,47	0,47	0,14	0,13	0,25	0,23	0,41	0,40
Querétaro	4,20	4,44	0,49	0,39	0,62	0,50	0,43	0,34	0,48	0,29	0,37	0,25	0,43	0,30	0,82	0,48	0,18	0,13	0,31	0,22	0,49	0,36

Quintana Roo	4,47	4,65	0,46	0,43	0,57	0,53	0,40	0,38	0,36	0,34	0,33	0,31	0,49	0,42	2,20	1,20	0,18	0,16	0,28	0,27	0,42	0,40
San Luis Potosí	3,64	4,05	0,55	0,42	0,66	0,53	0,49	0,36	0,58	0,36	0,50	0,29	1,07	0,33	31,21	0,53	0,28	0,14	0,39	0,25	0,54	0,42
Sinaloa	3,67	4,03	0,49	0,41	0,62	0,53	0,42	0,36	0,46	0,34	0,36	0,28	0,42	0,33	0,81	0,58	0,18	0,14	0,30	0,25	0,48	0,40
Sonora	4,11	4,48	0,48	0,42	0,60	0,52	0,42	0,36	0,43	0,35	0,36	0,29	0,44	0,37	0,90	0,91	0,18	0,15	0,30	0,25	0,46	0,41
Tabasco	3,51	4,31	0,49	0,44	0,64	0,57	0,42	0,38	0,52	0,42	0,38	0,33	0,39	0,35	0,55	0,53	0,18	0,16	0,32	0,28	0,51	0,46
Tamaulipas	4,04	4,46	0,48	0,48	0,60	0,59	0,42	0,42	0,45	0,48	0,36	0,39	0,43	0,51	0,97	1,75	0,18	0,20	0,30	0,32	0,48	0,49
Tlaxcala	3,32	3,52	0,51	0,42	0,65	0,53	0,44	0,36	0,56	0,39	0,36	0,30	0,39	0,34	0,67	0,61	0,17	0,14	0,30	0,26	0,53	0,44
Veracruz	3,49	3,82	0,51	0,40	0,64	0,51	0,44	0,34	0,52	0,33	0,40	0,27	0,46	0,31	0,93	0,50	0,19	0,13	0,33	0,24	0,51	0,40
Yucatán	3,73	4,09	0,51	0,45	0,64	0,56	0,45	0,39	0,52	0,39	0,41	0,33	0,47	0,39	0,94	0,68	0,20	0,16	0,33	0,28	0,51	0,44
Zacatecas	3,36	3,83	0,51	0,47	0,65	0,59	0,44	0,42	0,50	0,48	0,39	0,39	0,45	0,53	1,04	2,59	0,19	0,20	0,32	0,32	0,50	0,49

Source: Our calculations. For full definition of the variables, see Table A1.1 in Annex 1.
Notes: lgdppc: Natural logarithm of real GDP per capita.
Inequality measures: Gini index (Gini), Mehran and Piesch measures, Generalised Entropy GE (–1, 0, 1, 2), Atkinson class A (0.5, 1, 2).

identified among regions over the period. In 1998, the Gini coefficient was 0.49 and this coefficient ranges between 0.42 and 0.54 by region. Chiapas, D. F., Guerrero, Jalisco, Nuevo León, Oaxaca, San Luis Potosí, Tlaxcala, Veracruz Yucatán and Zacatecas showed Gini coefficient values of 0.50 or over. Maps 1a and 1b (in Annex 2) show the changes among regions between 1998 and 2008. The evolution of disparities among regions during this period shows a clear downward trend, with the average measure of the Mehran index decreasing from 0.62 to 0.53, the Piesch from 0.42 to 0.36 and the Generalised Entropy indices in values (–1, 0, 1 and 2) declining from 0.45 to 0.37, 0.36 to 0.30, 0.44 to 0.36 and 1.89 to 0.81, respectively.

The Atkinson class with three different values of the inequality aversion (0.5, 1 and 2) fell significantly over the period, from 0.18 to 0.15, 0.30 to 0.26 and 0.47 to 0.42, respectively. However, the magnitude of the drop clearly increases with aversion to inequality, indicating that inequalities reduce mostly through movements in the lower end of the distribution. In other words, the poorest regions are becoming richer rather than the richest regions becoming poorer. The fact that regional disparities decline when considering the regions as a whole does not prevent disparities from increasing within an important number of regions, such as those regions at the border).

The trends in the average of the distribution of earnings in Mexico differ from the trends in the distribution at the upper and lower ends of the spectrum. For example, on the one hand, the Mehran and the Piesch measures, which are more sensitive to the differences between low income and high income individuals, respectively, andthe Generalised Entropy indices and the Atkinson class, on the other hand, show important differences in values of inequality among regions (see table 1 and also maps 2a-8b in the Annex 2).

We have drawn box plots for three inequality measures to highlight regional differences in the levels and dispersion of wage inequality, *w* (figures 2a, 2b and 2c). From these figures, time period differences are clear-cut in terms of both levels and intra-regional inequality.

Figure 3 shows economic fluctuations over two decades in which economic instability (with volatility and negative growth rates) characterised the Mexican economy. After the severe recession in 1995, the economy recovered quickly in 1996, maintaining relatively high growth rates for the rest of the decade. From 2000 to 2003, Mexico experienced another recession and slightly positive growth rates thereafter until 2006. Finally, in 2007-2008, there was an economic slowdown; the graph shows here that the average rate of growth from 1998 to 2008 was 3.1%, which, according to INEGI's official figures [19], continued and worsened during the next years. In this paper, we review the changes in economic growth and inequality measures at the regional level.
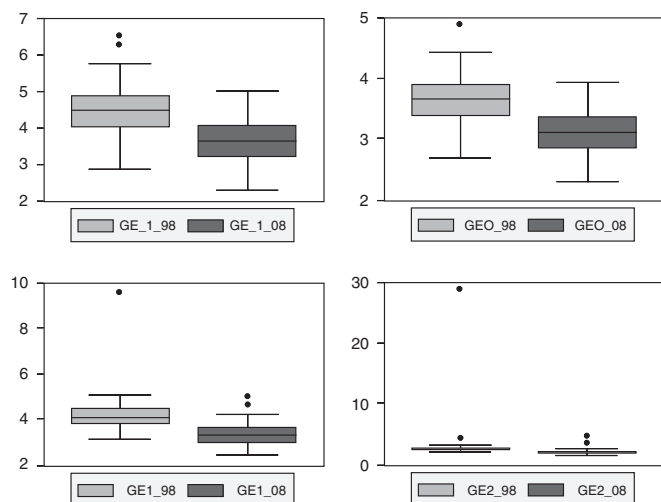
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[19] Mexican National Accounts are available through INEGI's webpage at *http://dgcnesyp.inegi.org.mx/bdiesi/bdie.html*.

Figure 2. Box plots of inequality measures
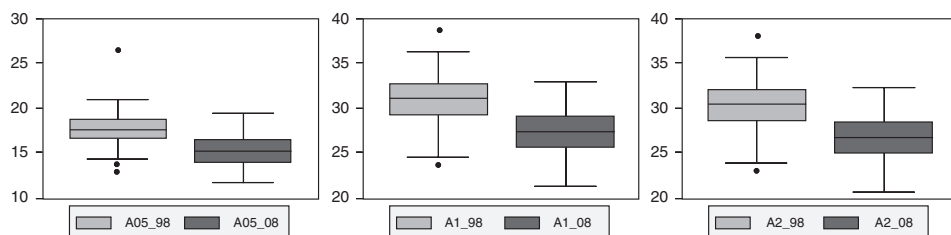(Intra-regional inequality evolution in Mexico)

a) Gini index 1998-2008
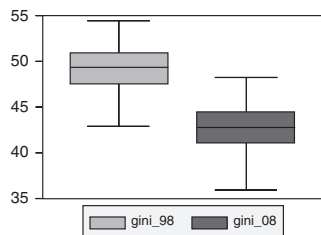
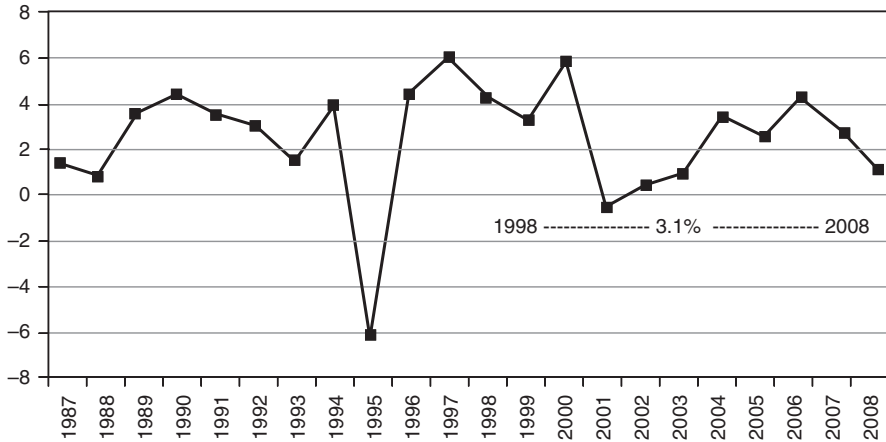*b)* Generalised entropy 1998-2008

c) Atkinson class 1998-2008

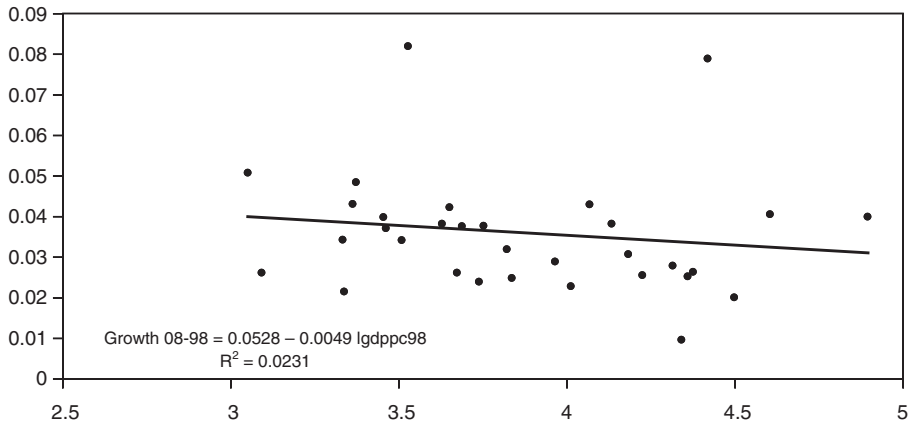*Source*: Our elaboration from ENEU-ENOE 1987-2008.

Figure 3.   Annual rate of growth GDP for Mexico, 1987-2008 (percentages)

Source: Our elaboration from System of National Accounts: Mexico 1987-2008.

In the initial assessment, Figure 4 plots the real per capita growth rate from 1998 to 2008 against the initial level of per capita income in Mexican regions. The regression results show that the rate of convergence is equal to –0.0049, representing a slow cross-regional convergence process for the entire period (at approximately 0.5% per year) [20]. The low explanatory power of the estimate suggests that additional structural variables can influence the growth performance of regions.

**Figure 4.**   Beta-convergence in real GDPpc between 1998 and 2008

Growth 08-98 = 0.0528 − 0.0049 lgdppc98
R^2 = 0.0231

Source: Our elaboration from System of National Accounts: Mexico 1987-2008.

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[20]   A negative sign of the beta coefficient indicates that regions with a lower initial level of per capita income grew faster than regions with a higher initial level of per capita income.

Figure 5 shows the relationship between average real per capita growth rate between 1998 and 2008 with the 1998 Gini coefficient. A positive relationship between inequality and growth is found. Over 15% of the variation in growth over the 10-year span can be explained by the 1998 Gini coefficient. However, although outliers seem to produce this pattern, the results should be cautiously interpreted because omitted variables could also explain this relationship.

Figure 5.   Cross-state scatter plot of inequality.
Gini coefficient and Growth, 1998-2008
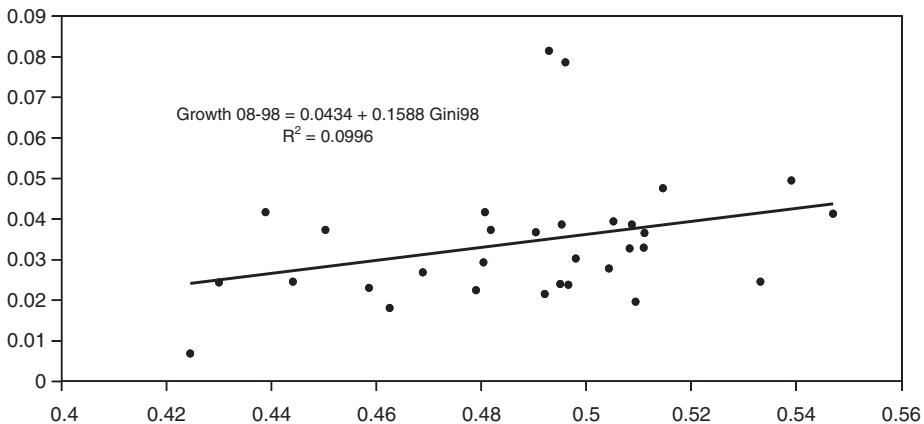
Source: Our elaboration from ENEU-ENOE 1987-2008 and System of National Accounts: Mexico 1987-2008.

4.2.   The relationship between inequality and growth

To assess whether inequality matters for regional growth in Mexico and to determine whether inequality is more relevant for growth than other control variables, we use cross-sectional and panel data analyses to capture different responses to the growth model and to better justify the results. We estimate pooled OLS, Fixed Effects (FEs) and Fixed Effects with instrumental variables models. First, OLS models assume that there is no correlation between the explanatory variables and the composite error. Second, we gauge the relationship between inequality and growth without control variables and, in a further step, with control variables.

Following the work of Forbes (2000) and Partridge (2005), we estimate the FEs model in which the coefficients can be interpreted as short-run, medium-run or time series effects because they reflect within-region time-series variation (in our case, over a period of ten years). FEs models with instrumental variables eliminate any omitted-variable bias that may occur in the event of unobserved regional characteristics that affect growth and are correlated with the explanatory variables included. We use one lag in the income per capita (explanatory variable) and one lag in the rest of the explanatory variables. Table 2 displays the cross-sectional regression results for

Table 2.   Cross-sectional analysis: OLS results

Without controls variables

dlgdpc9808	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
lgdppc_98	-0.00175 [0.00638]	0.000882 [0.00672]	-0.00311 [0.00624]	-0.0001 [0.00658]	-0.00292 [0.0061]	-0.0047 [0.00627]	-0.00475 [0.00632]	-0.0042 [0.00613]	-0.00299 [0.00609]	-0.0004 [0.00649]
Gini_98	0.150** [0.0726]									
Mehran_98		0.159** [0.071]								
Piesch_98			0.134* [0.071]							
GE(−1)_98				0.0584* [0.033]						
GE(0)_98					0.0971* [0.0479]					
GE(1)_98						0.0142 [0.00966]				
GE(2)_98							0.000177 [0.000118]			
A(0.5)_98								0.138* [0.072]		
A(1)_98									0.141* [0.0691]	
A(2)_98										0.110* [0.0573]
Constant	-0.0323 [0.0509]	-0.0675 [0.0612]	-0.0106 [0.0446]	0.00779 [0.0335]	0.0102 [0.0315]	0.0457* [0.0252]	0.0518** [0.024]	0.0255 [0.0287]	0.00283 [0.0341]	-0.0163 [0.043]
R-squared	0.102	0.131	0.084	0.128	0.128	0.038	0.027	0.081	0.131	0.143
Observations	32	32	32	32	32	32	32	32	32	32

With controls variables

dlgdpc9808	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
lgdppc_98	0.00158 [0.00750]	0.00355 [0.00766]	0.00062 [0.00749]	0.0035 [0.00769]	0.001 [0.00737]	-4.74E-05 [0.00778]	0.000192 [0.00790]	7.800E-05 [0.00755]	0.000898 [0.00735]	0.00309 [0.00758]
Gini_98	0.134* [0.0692]									
Mehran_98		0.144* [0.0713]								
Piesch_98			0.119* [0.0655]							
GE(−1)_98				0.0532* [0.0307]						
GE(0)_98					0.0898** [0.0430]					
GE(1)_98						0.0156* [0.00785]				
GE(2)_98							0.000308** [0.000132]			
A(0.5)_98								0.130** [0.0575]		
A(1)_98									0.130** [0.0622]	
A(2)_98										0.100* [0.0533]
Constant	-0.0391 [0.0494]	-0.0703 [0.0613]	-0.0204 [0.0432]	-0.00478 [0.0361]	-0.00346 [0.0339]	0.0258 [0.0317]	0.031 [0.0310]	0.00918 [0.0325]	-0.00998 [0.0358]	-0.0263 [0.0435]
R-squared	0.159	0.181	0.145	0.184	0.188	0.116	0.11	0.15	0.189	0.196
Observations	32	32	32	32	32	32	32	32	32	32

Source: Our calculations. For a full definition of the variables, see Table A1.1 in the Annex 1.

Notes: lgdppc: Natural logarithm of real GDP per capita

Inequality measures: Gini index (Gini), Mehran and Piesch measures, Generalised Entropy GE (−1, 0, 1, 2), Atkinson class A (0.5, 1, 2)

Including the following controls: coast, distance to DF, agriculture, manufacturing, construction, trade, transportation and communications, services, qualified and no qualified workers, education inequality (Theil index), part time share, unemployment rate and the share of informality

Robust standard errors in brackets: *** p<0.01, ** p<0.05, * p<0.1

models (1 to 10) using income per capita and different inequality measures for the entire population as independent variables. This table reports OLS estimations with and without control variables, which reflect unconditional and conditional responses to the growth model, respectively. Positive coefficients are found for the inequality measures at the beginning of the period for all regressions. When estimates are made without controls, the coefficients of GE(1) and GE(2) are not significant; using some controls, the coefficients of inequality measures are still statistically significant in most cases. Following this approach, inequality at the beginning of the period positively affects average regional economic growth over the period. This implies that states with greater overall economic inequality subsequently experience greater economic growth, which is inconsistent with results from cross-national studies (*e. g.,* Guerrero, *et al.,* 2009). However, these results may be caused by omitted factors that are correlated with both economic growth and initial-period inequality. Thus, regional dummy variables are added in table 3 to capture omitted regional fixed effects; additional control variables related to human capital, such as employment by economic sector and unemployment rate, are also introduced here to capture missed effects. In this case, the other coefficients reflect the influence of the within-regional variation of the independent variables on per capita income growth, whereas cross-regional effects are reflected in the regional dummy coefficients. These results suggest the elasticity coefficient on the lagged income per capita is negative, indicating convergence. The findings also show positive, significant, and robust to the inclusion of control variables (qualified workers, construction employment and the unemployment rate) on regional economic growth. Thus, the current educational endowment of a region in Mexico seems to matter more for economic growth than its relative wealth. However, the magnitude and statistical significance of the different inequality coefficients are not relevant in this model.

One important concern in this analysis is the existence of endogeneity in the determination of inequality measures and per capita GDP. To assess the relationship between income distribution and growth in per capita income, instrumental variable (IV) regressions are used to address the endogeneity problem. The results of the OLS regressions may also be biased because of reverse causation and simultaneity bias. We extract the exogenous component of income distribution using the lagged inequality measure (one period) in each model (1 to 10) [21]. The results in Table 4 show that the coefficient of the lagged income per capita is negative and significant, indicating convergence, as in previous models. Moreover, our results clearly show a negative and statistically significant effect of inequality measures on the per capita income growth rates, except when the GE(1) and GE(2) inequality indices are used. On the one hand, the evidence shows that inequality measures have different effects on growth depending on which part of the distribution or sensitivity of each index is affected; on the other hand, the results suggest that the mechanisms at work differ among regions. Similarly, Castelló (2010) finds that using different inequality mea-

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[21] Finding the correct structure of time lags for estimating this model is also a problem. Banerjee and Duflo (2003) show that using long lags substantially reduces the number of changes in inequality, and therefore they use short lag periods in their study (5 year lag periods).

Table 3. Fixed-effects (within) regression

dlgdppc9808	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*
lag1lgdppc	−0.0609* [0.0335]	−0.0651* [0.0348]	−0.0601* [0.0327]	−0.0707** [0.0308]	−0.0669** [0.031]	−0.0735** [0.03]	−0.0794*** [0.0294]	−0.0683** [0.0306]	−0.0667** [0.0309]	−0.0688** [0.0308]
Gini	0,125 [0.114]									
Mehran		0,0741 [0.102]								
Piesch			0,152 [0.119]							
GE (−1)				0,0429 [0.0508]						
GE (0)					0,0919 [0.0794]					
GE (1)						0,0303 [0.0386]				
GE (2)							−0,0003 [0.00149]			
A (0.5)								0,173 [0.149]		
A (1)									0,132 [0.11]	
A (2)										0,0917 [0.0875]
Qualified workers	0.308** [0.124]	0.306** [0.124]	0.309** [0.124]	0.312** [0.124]	0.312** [0.124]	0.307** [0.124]	0.307** [0.124]	0.310** [0.124]	0.311** [0.124]	0.310** [0.124]
Employment (sector)	0.543** [0.22]	0.539** [0.222]	0.540** [0.219]	0.510** [0.217]	0.511** [0.217]	0.504** [0.217]	0.506** [0.218]	0.510** [0.217]	0.513** [0.217]	0.515** [0.217]
Unemployment rate	0.0241** [0.00959]	0.0246** [0.00958]	0.0238** [0.0096]	0.0240** [0.00963]	0.0234** [0.00965]	0.0245** [0.00959]	0.0250*** [0.00957]	0.0236** [0.00962]	0.0233** [0.00965]	0.0236** [0.00965]
Constant	0,0297 [0.152]	0,0609 [0.166]	0,0237 [0.143]	0,108 [0.113]	0,0817 [0.117]	0,127 [0.104]	0,162* [0.0965]	0,0901 [0.112]	0,0744 [0.119]	0,0784 [0.123]
R–within	0,063	0,062	0,065	0,062	0,064	0,062	0,06	0,064	0,064	0,063
Observations	352	352	352	352	352	352	352	352	352	352

Source: Our calculations. For a full definition of the variables, see Table A1.1 in the Annex 1.
Notes: lgdppc: Natural logarithm of real GDP per capita
Inequality measures: Gini index (Gini), Mehran and Piesch measures, Generalised Entropy GE (–1, 0, 1, 2), Atkinson class A (0.5, 1, 2)
Standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1

sures (such as the Gini coefficient and income percentiles ratios) on income inequality has a negative influence on the per capita income growth rates in less developed countries [22]. The results of the education variable show a positive and significant effect on growth in models 1-4 and 7 of table 4. The unemployment rate also has a positive coefficient, but the magnitude of the effect is small [23].

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[22] For example, the negative effect of income inequality on growth in low- and middle-income countries, and in high-income countries not belonging to the OECD, is identified with five countries in the sample (Mexico, Hungary, Poland, Israel and Taiwan).

[23] As for the unemployment rate, the theoretical work of Hall (1991) and Caballero and Hammour (1994) note that unemployment and inactivity during recessions may stimulate growth in the short run.

Table 4. Fixed–effects (within) IV regression

dlgdppc9808	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
lag1lgdppc	–0.260*** [0.0645]	–0.257*** [0.0592]	–0.256*** [0.068]	–0.169*** [0.0459]	–0.219*** [0.0616]	–2,268 [16.4]	–0,0492 [0.0439]	–0.241*** [0.0844]	–0.208*** [0.0577]	–0.167*** [0.0449]
Gini	–1.263*** [0.375]									
Mehran		–0.971*** [0.263]								
Piesch			–1.440*** [0.465]							
GE (–1)				–0.477*** [0.163]						
GE (0)					–1.086*** [0.372]					
GE (1)						–12,45 [93.18]				
GE (2)							0,0141 [0.0139]			
A (0.5)								–2.680** [1.195]		
A (1)									–1.407*** [0.478]	
A (2)										–0.812*** [0.269]
Qualified workers	0.302** [0.151]	0.321** [0.144]	0.288* [0.156]	0.251* [0.145]	0,25 [0.163]	0,135 [2.635]	0.300** [0.142]	0,264 [0.184]	0,261 [0.159]	0.281* [0.144]
Employment (sector)	0,108 [0.288]	0,05 [0.28]	0,163 [0.293]	0.435* [0.252]	0,422 [0.284]	0,622 [4.067]	0,402 [0.267]	0,413 [0.323]	0,406 [0.278]	0,406 [0.253]
Unemployment rate	0.0340*** [0.012]	0.0302*** [0.0113]	0.0366*** [0.0127]	0.0358*** [0.0118]	0.0440*** [0.0143]	0,277 [1.898]	0.0249** [0.011]	0.0466*** [0.0174]	0.0427*** [0.0138]	0.0369*** [0.0119]
Constant	1.463*** [0.406]	1.442*** [0.366]	1.439*** [0.432]	0.723*** [0.224]	1.071*** [0.339]	13,36 [98.84]	0,0391 [0.158]	1.226** [0.499]	1.061*** [0.331]	0.870*** [0.262]
Observations	351	351	351	351	351	351	351	351	351	351
Hausman (IV) test	15,12 (0.009)	18,63 (0.002)	12,58 (0.027)	11,26 (0.046)	10,5 (0.062)	0,02 (0.900)	1,12 (0.952)	5,8 (0.326)	10,96 (0.052)	12,65 (0.026)

Source: Our calculations. For a full definition of the variables, see Table A1.1 in the Annex 1.
Notes: lgdppc: Natural logarithm of real GDP per capita
Inequality measures: Gini index (Gini), Mehran and Piesch measures, Generalised Entropy GE (–1, 0, 1, 2), Atkinson class A (0.5, 1, 2)
Instruments: L. Gini, L. Mehran, L. Piesch, L. GE(–1) L.GE(0) L. GE(1) L.GE(2) L.A(0.5) L.A(1) L.A(2)
Standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1

Table 5 reports estimates obtained using Arellano and Bond's GMM technique. All inequalities measured have a positive effect on growth and some are also significant, except under the Mehran measure. However, these inequality measures show differences in magnitude, indicating that inequality in different parts of the income distribution has different effects on growth and therefore that the profile of the inequality matters for economic growth. On the basis of the data and the instrument set, it therefore seems that the Theil index GE(1), GE(2) and Atkinson class A(0.5) are the most efficient at capturing the effects of inequality on per capita income growth over a ten year period.

Table 5.   Instrumental variables (3SLS-GMM) regression

dlgdppc9808	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
lpibpc_98	0,0136 [–0.0101]	0,0162 [–0.0119]	0,00986 [–0.00919]	0,0155 [–0.0108]	0,00712 [–0.00827]	0,00275 [–0.0111]	0,00314 [–0.0101]	0,00432 [–0.00898]	0,00686 [–0.0083]	0,0139 [–0.0105]
Gini_98	0.610** [–0.3]									
Mehran_98		0,404 [–0.249]								
Piesch_98			0.706** [–0.317]							
GE (–1)_98				0.174** [–0.0857]						
GE (0)_98					0.338** [–0.139]					
GE (1)_98						0.283*** [–0.0848]				
GE (2)_98							0.00547*** [–0.00155]			
A (0.5)_98								0.895*** [–0.313]		
A (1)_98									0.481** [–0.205]	
A (2)_98										0.307* [–0.155]
Qualified workers_98	0,0353 [–0.0692]	0,0405 [–0.0743]	0,0386 [–0.0643]	0,0357 [–0.0669]	0,0313 [–0.0616]	0,0573 [–0.0522]	0,102* [–0.0505]	0,0329 [–0.0574]	0,0302 [–0.0631]	0,0305 [–0.0693]
Employment (sector)_98	0,141 [–0.185]	0,151 [–0.183]	0,132 [–0.185]	0,123 [–0.196]	0,129 [–0.182]	0,182 [–0.184]	0,212 [–0.187]	0,132 [–0.18]	0,13 [–0.183]	0,127 [–0.194]
Unemployment rate_98	–0,0066 [–0.00852]	–0,0073 [–0.00903]	–0,0057 [–0.00824]	–0,0073 [–0.00876]	–0,005 [–0.00796]	0,00585 [–0.0111]	0,00616 [–0.0115]	–0,0025 [–0.00824]	–0,0051 [–0.00798]	–0,0075 [–0.00905]
Constant_98	–0.330** [–0.151]	–0.293* [–0.165]	–0.318** [–0.134]	–0.117** [–0.0559]	–0.128** [–0.0546]	–0.139** [–0.0638]	–0,0458 [–0.0479]	–0.158** [–0.0619]	–0.150** [–0.0628]	–0.174** [–0.0804]
R-≠squared	–0,69	–0,105	–1,103	–0,29	–0,583	–5,306	–3,475	–1,789	–0,551	–0,232
lpibpc_93	–0,0194 [–0.0125]	–0.0318** [–0.0133]	–0,0127 [–0.0124]	–0.0720** [–0.0333]	–0,0211 [–0.0212]	–0,0245 [–0.0574]	–1,03 [–2.408]	–0,0062 [–0.0115]	–0,014 [–0.0148]	–0.0352* [–0.0189]
Gini_93	0.195* [–0.112]									
Mehran_93		0.284** [–0.125]								
Piesch_93			0,16 [–0.107]							
GE (–1)_93				0.468*** [–0.161]						
GE (0)_93					0.299** [–0.132]					
GE (1)_93						0,175 [–0.19]				
GE (2)_93							2,093 [–2.106]			
A (0.5)_93								0,203 [–0.131]		

Table 5. *(cont.)*

dlgdppc9808	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
A (1)_93									0.282** [–0.124]	
A (2)_93										0.400*** [–0.136]
Constant_93	0.469*** [–0.0671]	0.568*** [–0.0894]	0.406*** [–0.0592]	0.535*** [–0.144]	0.339*** [–0.0866]	0.461** [–0.227]	3,9 [–9.344]	0.167*** [–0.0464]	0.274*** [–0.0622]	0.426*** [–0.0941]
R-squared	0,154	0,284	0,096	0,351	0,192	0,03	0,049	0,096	0,19	0,328
No. of States	28	28	28	28	28	28	28	28	28	28
No. of observations	351	351	351	351	351	351	351	351	351	351
AR(1)	(0.788)	(0.487)	(0.944)	(0.393)	(0.944)	(0.534)	(0.5439)	(0.598)	(0.918)	(0.406)
AR(2)	(0.351)	(0.343)	(0.355)	(0.585)	(0.447)	(0.446)	(0.415)	(0.419)	(0.439)	(0.459)
Hansen test	0,061	0,006	0,098	0,251	0,014	0,122	0,007	0,017	0,009	0,184
(p-value)	(0.804)	(0.936)	(0.753)	(0.616)	(0.905)	(0.726)	(0.93)	(0.894)	(0.921)	(0.667)
Diff-in–Sargan	2,914	1,786	3,464	3,871	4,503	5,544	6,173	5,084	4,423	3,549
(p-value)	(0.087)	(0.181)	(0.062)	(0.049)	(0.033)	(0.018)	(0.013)	(0.024)	(0.035)	(0.059)

Source: Our calculations. For a full definition of the variables, see Table A1.1 in the Annex 1.
Notes: lgdpc: Natural logarithm of real GDP per capita.
Inequality measures: Gini index (Gini), Mehran and Piesch measures, Generalised Entropy GE (–1, 0, 1, 2), Atkinson class A (0.5, 1, 2). Endogenous variables: dlpibpc9808 and Inequality measures (1998). Exogenous variables: lpibpc_98, qualif_98, oc_con_98, ltparo_98, lpibpc_93 and Inequality measures (1993). The standard errors were computed using weight matrix, robust. SEs in brackets *** p<0.01, ** p<0.05, * p<0.1.

This pattern of results follows what has previously been found in the literature, i.e., the overall effect of inequality on growth is sensitive to the econometric technique used (see *e. g.,* Panizza, 2002; Banerjee and Duflo, 2003). Methods that rely on time-series variation in the data tend to indicate a positive effect of inequality on growth (*e. g.,* Li and Zou, 1998; Forbes, 2000), whereas methods that rely on cross-sectional information tend to indicate a negative effect (*e. g.,* Persson and Tabellini, 1994). Partridge (1997) argues that the positive effects found in different parts of the distribution could affect economic growth through other channels besides the political process. He considers that, in the context of an ambiguous government policy, this type of economic growth relationship would be consistent with this explanation. He also stresses that the differences found in the middle quintile suggest that a strong middle class could favour economic growth because it may indicate a more stable economic or social environment.

5. Final remarks

In this paper, we have examined the link between different inequality measures and economic growth in Mexican regions using data from 1998 to 2008. Contrary to the findings of several studies in developing countries, we have found evidence of a positive relationship between changes in inequality and changes in growth. We estimated different models, including OLS, FEs, FE-IV and IV-GMM, and obtained mixed evidence on the relationship between inequality and growth. In this sense,

it seems that the combined effect of both income and educational distribution on growth is far from being well understood and is indeed complex. Overall, existing income and human capital inequality are likely to increase growth, but the magnitude of their effect is relatively small.

The differences among the results shown in this paper are in line with those found in Partridge (1997) for the United States. First, the positive or negative effect can be attributed to differences in the estimation techniques, the variables used in the analysis, the source of the data used to measure inequality, the level of regional analysis and the differences within regions. Second, the positive and negative influences of inequality on growth are mostly associated with inequality in different parts of the income distribution. Many of the positive mechanisms can be linked to inequality at the upper end of the income distribution, while many of the negative mechanisms are associated with inequality further down the distribution. Third, the results support that Mexico has experimented with changes in the bottom and the middle part of the distribution of incomes; however, if growth is facilitated by an income distribution that is compressed only in the lower part of the distribution and not in the top end, we must consider reviewing redistributive policies and their relation with mobility incomes. Consequently, future research is required to examine the relationship of the three elements, *inequality, redistribution and growth,* and pro-equality policies.

To generate additional policy implications from the empirical relationship between inequality and income growth, a better understanding of this issue is warranted. It would merit further examination to determine whether advanced post-industrial economies have recently undergone a change in their inequality-economic growth relationship across countries rather than within countries, perhaps by using subnational data from other nations. There should also be further study of whether the relative welfare of the middle class or the median voter plays a special role.

6.   References

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Annex 1.   Description of variables

**Table A1.1.**   List and abbreviation of variables used in Econometric Estimates

Variables	Description	Source	Variable
Regions	States: Aguascalientes, Baja California, Baja California Sur, Campeche, Coahuila de Zaragoza, Colima, Chiapas, Chihuahua, Distrito Federal, Durango, Guanajuato, Guerrero, Hidalgo, Jalisco, México, Michoacán de Ocampo, Morelos, Nayarit, Nuevo León, Oaxaca, Puebla, Querétaro Arteaga, Quintana Roo, San Luis Potosí, Sinaloa, Sonora, Tabasco Tamaulipas, Tlaxcala, Veracruz, Yucatán, Zacatecas.		reg
GDP	GDP per capita by region data are in 2002 Mexican pesos	System of National Accounts (SCN-INEGI).	
Logarithm of GDP per capita	Represents the natural logarithm of real regional GDP per capita		lgdppc
Consumer Price Index (CPI)	CPI by region Base year 2002. Campeche, Durango, Morelos, Oaxaca, Querétaro and Tlaxcala information are available since 1995. National average values of the corresponding group were assigned to these states.	Bank of Mexico	
Population	Population density	Conteo de Población y Vivienda, INEGI. Estimaciones de CONAPO. Encuesta Nacional de Dinámica Demográfica.	
Educational attainment	No qualified (No schooling or primary incomplete, primary and secondary levels) Qualified (Upper secondary and higher or tertiary levels)	Microdatos ENEU-ENOE	qualif No qualified
Educational inequality	Inequality in education (Theil index)	Microdatos ENEU-ENOE	
Labour force participation rate	Average rate by region	ENEU-ENOE	ltpart
Unemployment rate	Open unemployment (average rate) by region	ENEU-ENOE	ltparo
Informal labour rate	Average rate by region	ENEU-ENOE	ltoc_informal

Table A1.1.   *(cont.)*

Variables	Description	Source	Variable
Coastal localisation of the region	Dummy variable that takes the value of 1 when a region has a coastal strip and value 0 if not. Regions with coastal strip: Baja California, Baja California Sur, Campeche, Colima, Chiapas, Guerrero, Jalisco, Michoacán, Nayarit, Quintana Roo, Oaxaca, Sinaloa, Sonora, Tabasco, Tamaulipas, Veracruz. Yucatán.	Marco Geoestadístico INEGI	coast
Distance to DF	The distance in kilometers (Km) by road from the capital of each region to Mexico City.	Seccretaría de Comunicaciones y Transasporte	Dist_DF
Employment by economic sector	Employment in: (1) Agriculture, Forestry, Fishing and Mining Sector, (2) Industry and Manufacturing (including Electricity, Gas, Steam, Air conditioning and Water supply), (3) Construction, (4) Trade, (5) Transport, Storage and Communication Sector, (6) Services Sector (including Financial Services)	Microdatos ENEU-ENOE	OC_AGR OC_IND OC_CON OC_COM OC_TRA OC_SER
Inequality measures	Own calculations using real hourly wage. Inequality measures: Gini index, Mehran and Piesch measures, Entropy Generalized GE (-1, 0, 1, 2), Atkinson class A (0.5, 1, 2)	Microdatos ENEU-ENOE	Gini, Mehran, Piesch, GE(-1), GE(0), GE(1), GE(2), A(0.5), A(1), A(2)

Annex 2.   Maps of inequality measures

Map 1a.   Mexican states Gini index: 1998

Gini 1998

[0.42,0.47]
(0.47,0.49]
(0.49,0.51]
(0.51,0.55]
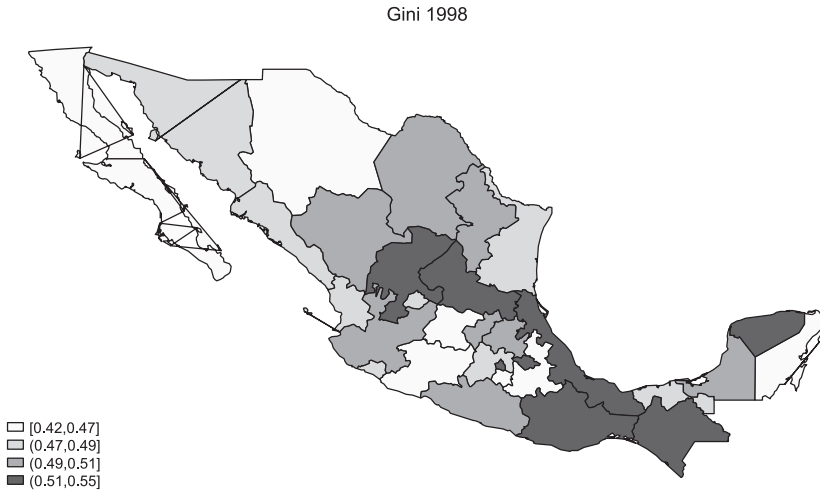
Map 1b.   Mexican states Gini index: 2008

Gini 2008

[0.35,0.40]
(0.40,0.42]
(0.42,0.44]
(0.44,0.48]

Source: Own elaboration from ENEU-ENOE 1998-2008.

Map 2a. Mexican states Mehran measure: 1998

Mehran measure 1998

[0.53,0.60]
(0.60,0.62]
(0.62,0.64]
(0.64,0.68]
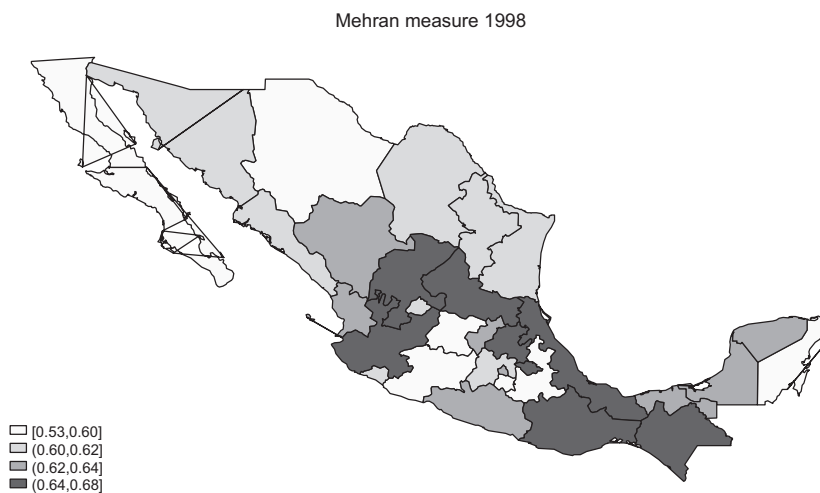
Map 2b. Mexican states Mehran measure: 2008

Mehran measure 2008

[0.44,0.51]
(0.51,0.53]
(0.53,0.55]
(0.55,0.59]
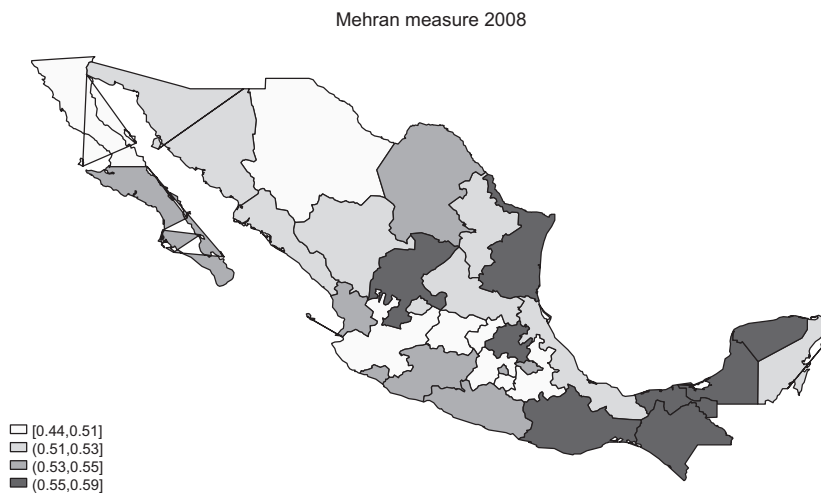
Source: Own elaboration from ENEU-ENOE 1998-2008.

Map 3a.   Mexican states Piesch measure: 1998

Piesch measure 1998

[0.37,0.41]
(0.41,0.42]
(0.42,0.44]
(0.44,0.49]
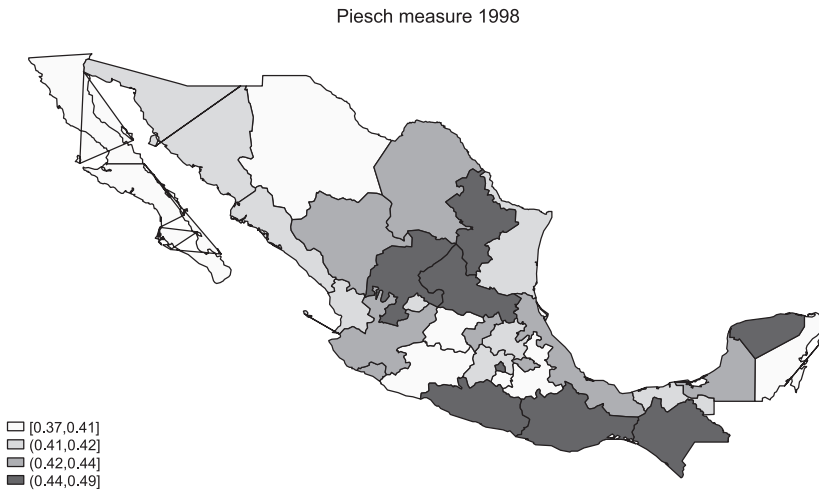
Map 3b.   Mexican states Piesch measure: 2008

Piesch measure 2008

[0.30,0.35]
(0.35,0.36]
(0.36,0.38]
(0.38,0.42]
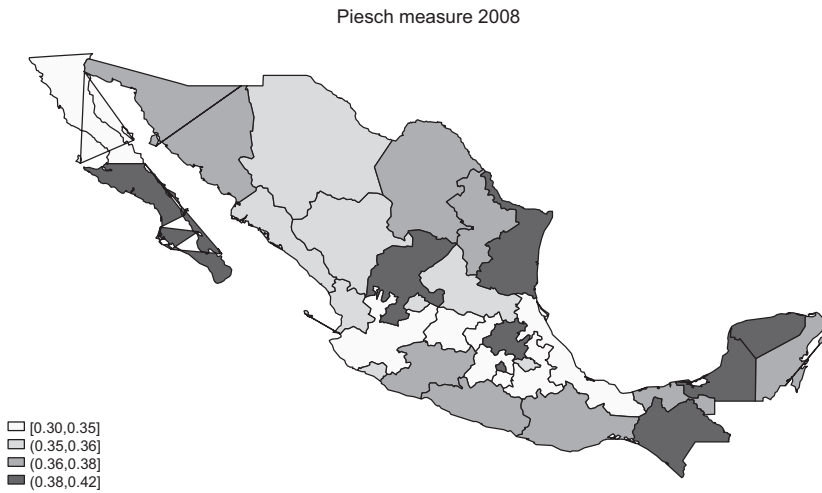
Source: Own elaboration from ENEU-ENOE 1998-2008.

Map 4a.   Mexican states Generalized entropy GE (–1): 1998
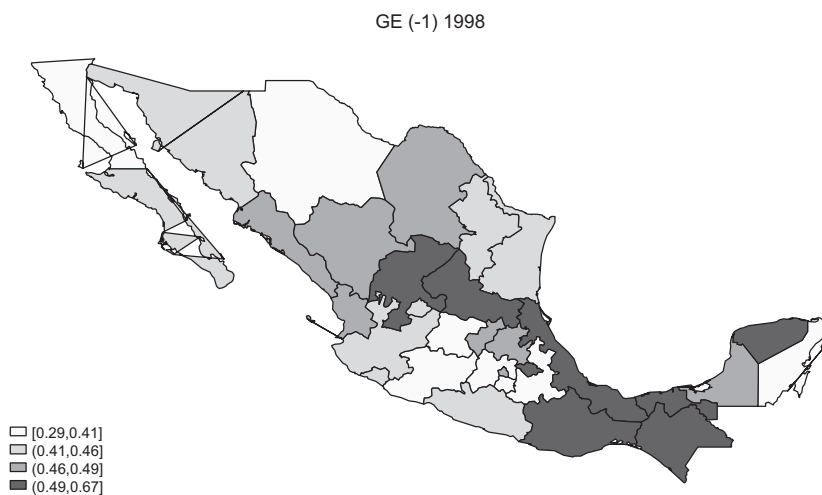
GE (-1) 1998

[0.29,0.41]
(0.41,0.46]
(0.46,0.49]
(0.49,0.67]

Map 4b.   Mexican states Generalized entropy GE (–1): 2008

GE (-1) 2008

[0.22,0.33]
(0.33,0.36]
(0.36,0.41]
(0.41,0.51]
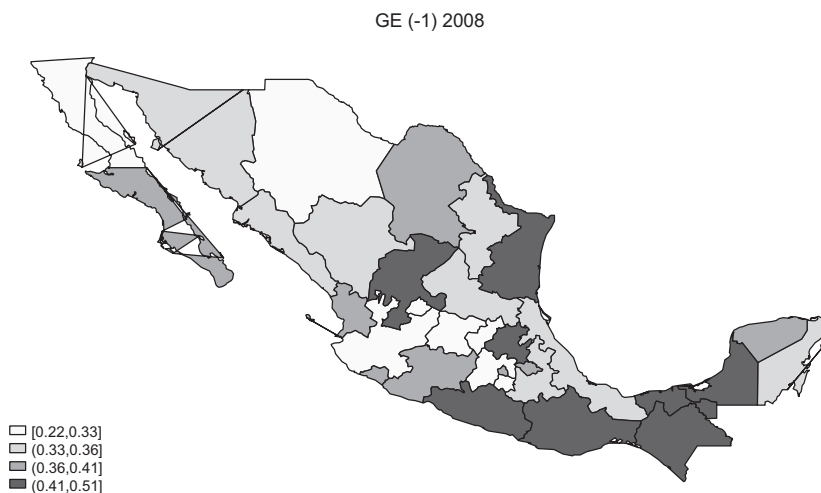
Source: Own elaboration from ENEU-ENOE 1998-2008.

Map 5a. Mexican states Generalized entropy GE (1): 1998
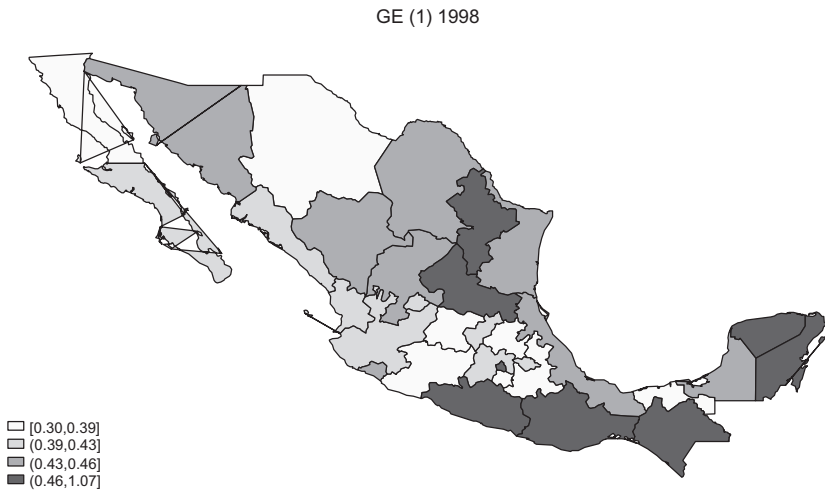
GE (1) 1998

[0.30,0.39]
(0.39,0.43]
(0.43,0.46]
(0.46,1.07]

Map 5b. Mexican states Generalized entropy GE (1): 2008

GE (1) 2008

[0.27,0.31]
(0.31,0.34]
(0.34,0.38]
(0.38,0.53]
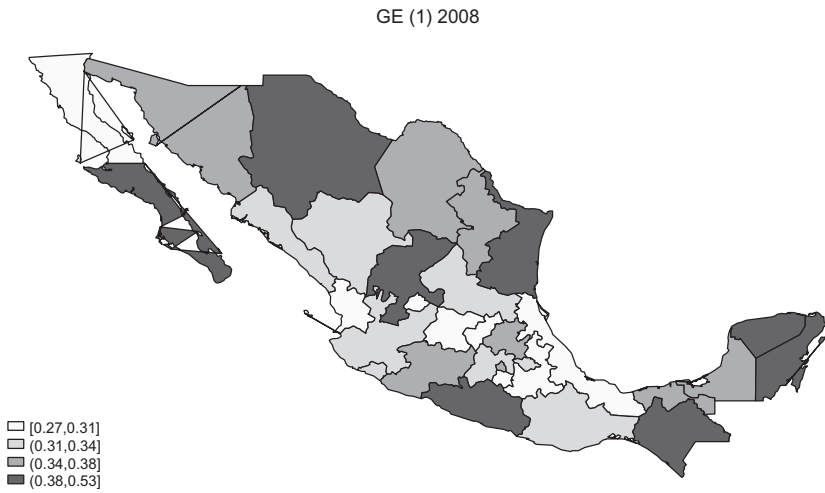
Source: Own elaboration from ENEU-ENOE 1998-2008.

Map 6a.   Mexican states Generalized entropy GE (2): 1998

GE (2) 1998

[0.47,0.71]
(0.71,0.89]
(0.89,1.02]
(1.02,2.20]
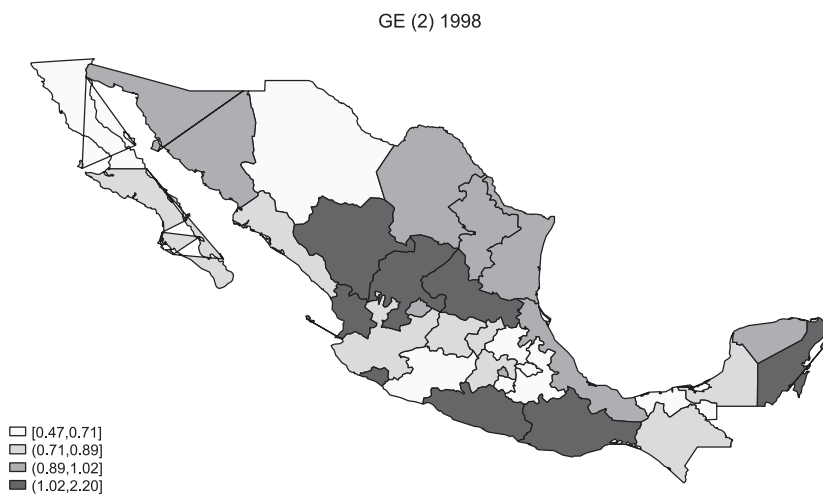
Map 6b.   Mexican states Generalized entropy GE (2): 2008

GE (2) 2008

[0.47,0.52]
(0.52,0.60]
(0.60,0.93]
(0.93,2.59]
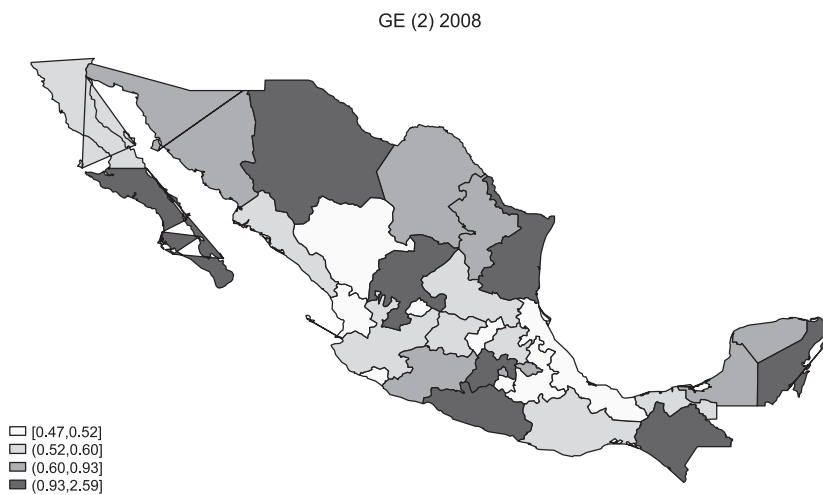
Source: Own elaboration from ENEU-ENOE 1998-2008.

Map 7a.   Mexican states Atkinson class A(0.5): 1998

A(0.5) 1998

[0.13,0.17]
(0.17,0.18]
(0.18,0.19]
(0.19,0.28]
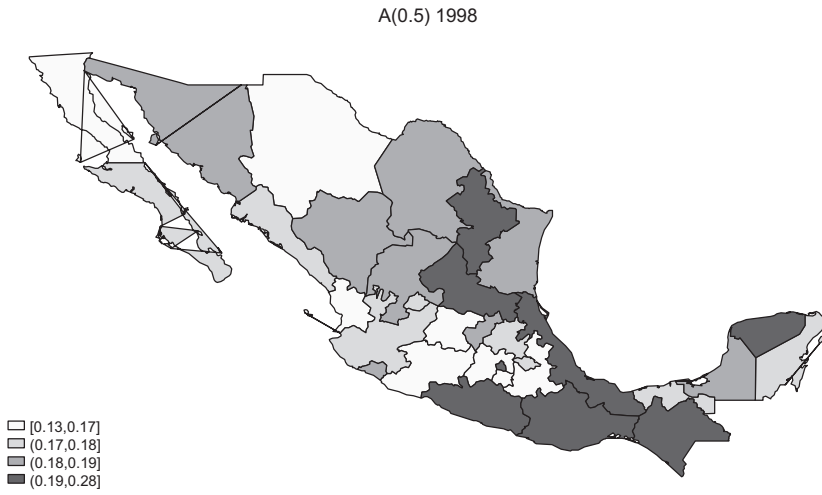
Map 7b.   Mexican states Atkinson class A(0.5): 2008

A(0.5) 2008

[0,11,0.13]
(0.13,0.15]
(0.15,0.16]
(0.16,0.20]
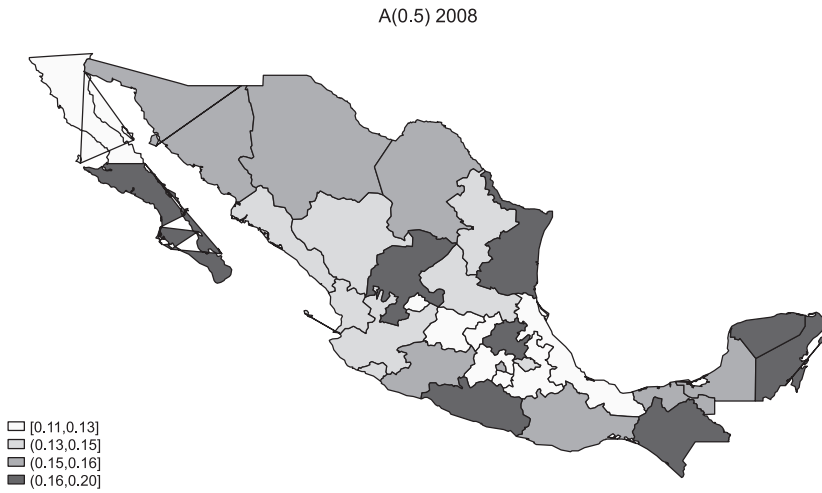
Source: Own elaboration from ENEU-ENOE 1998-2008.

Map 8a.   Mexican states Atkinson class A(2): 1998

A(2) 1998

[0.37,0.45]
(0.45,0.48]
(0.48,0.50]
(0.50,0.57]
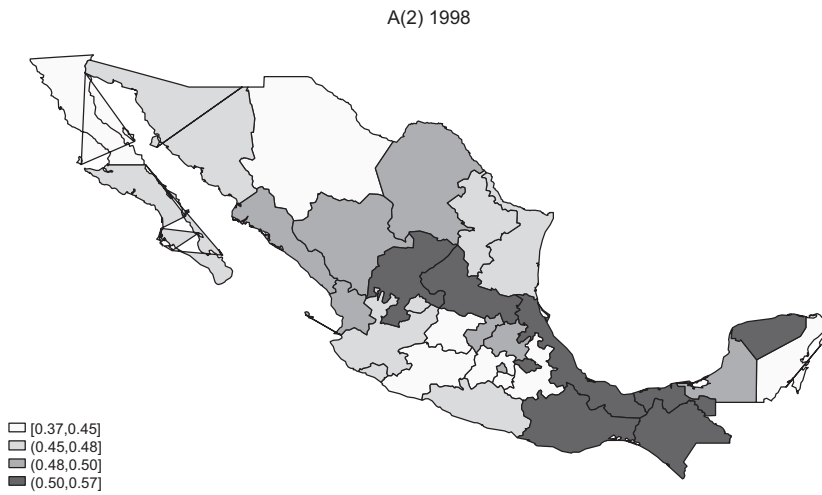
Map 8b.   Mexican states Atkinson class A(2): 2008

A(2) 2008

[0.31,0.40]
(0.40,0.42]
(0.42,0.45]
(0.45,0.50]
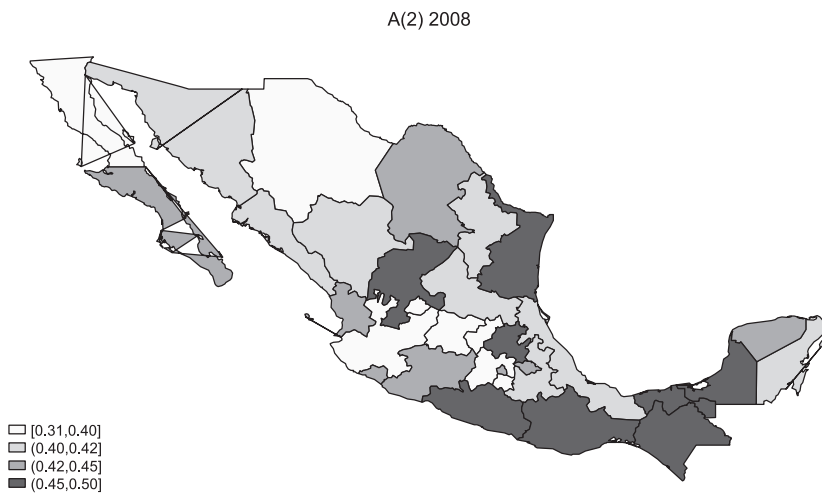
Source: Own elaboration from ENEU-ENOE 1998-2008.

Comment on «Wage Inequality and Economic Growth in Mexican regions», by Claudia Tello and Raúl Ramos

Antonio Di Paolo *

The paper «Wage Inequality and Economic Growth in Mexican Regions» investigates the effects of wage inequality on economic growth from a regional perspective, focusing on Mexico over the period from 1998 to 2008.

The relationship between economic growth and inequality has captured the attention of many economists during the past decades. The seminal papers by Lewis (1954), Kuznets (1955) and Kaldor (1956) analysed how economic development affects long-run income distribution, suggesting an inverted U-shaped relationship between growth and inequality. However, many subsequent studies from the economic growth and development literature were concerned with the investigation of the opposite causation between inequality and growth (*i. e.,* whether and how changes in income inequality affect economic growth). In general, it is of key importance to analyse this issue because of the need for a better understanding of whether pursuing more economic growth and a more equal distribution of economic resources are compatible goals.

From a theoretical perspective, arguments for the positive or negative impact of inequality on growth have been provided. For example, the traditional equity/efficiency trade-off hypothesis, which argues that a more redistributive policy that reduces inequality is detrimental to national income, predicts a positive relationship (see Okun, 1975). In contrast, the incomplete markets and credit constraint argument suggests that the presence of market failures increases income inequality and reduces economic growth, thus predicting a negative relationship (see Stiglitz, 1969). A negative impact of income inequality on growth also emerges from political economy theories, which claim that higher inequality leads to more electoral and political pressure for higher tax rates that end up cutting after-tax returns on capital, thereby reducing investment and causing less economic growth (Alesina and Rodrik, 1994; Persson and Tabellini, 1992 and 1994).

The extensive empirical evidence (well reviewed in the paper) concerning the impact of inequality on economic growth is far from conclusive. On the one hand, studies based on OLS cross-country regressions focusing on long-run relationships have often suggested a negative effect of income inequality on economic growth. On the other hand, panel data research aimed at capturing this relationship in the medium/short term and solving the typical omitted variable problems in this type of regression estimated by OLS has provided mixed evidence (usually positive or null relationships). It has also been argued (see Banerjee and Duflo, 2003) that the strong

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sensitivity of the results to the adopted econometric strategy is merely due to the implicit assumption of linearity in the relationship between income inequality and economic growth.

The main contribution of the discusses paper consists of providing additional evidence on wage inequality and economic growth from a regional perspective. Indeed, the author focuses on a single country —Mexico— and analyses the relationship between wage inequality and the economic growth generated by regional variations over the period from 1998 to 2008. This strategy, increasingly adopted in regional economics, helps to reduce the potential biases provoked by unobserved institutional characteristics in cross-country regressions and by measurement error issues. The use of homogeneous microdata for the construction of wage inequality measures represents another appealing feature of the paper, given that it also contributes to ensuring the internal validity of the information collected over several years. Moreover, the variety of considered inequality measures and the multiple econometric techniques employed to estimate long- and short-term relationships between inequality and growth constitute the additional richness of the paper, which is undoubtedly a valuable contribution to the literature of this field. In a nutshell, the paper confirms the sensitivity of the results to the adopted econometric techniques, given that OLS, Fixed Effects and IV-GMM provide a positive relationship, whereas the IV-Fixed Effect model yields negative coefficients.

In my opinion, the main weakness of the paper is the linear specification adopted in all the estimations, which constrains the impact of wage inequality on economic growth to a constant, although, as suggested above, other authors have found that the linear specification is rejected by the data (see Banerjee and Duflo, 2003; among others). Moreover, several variables that may confound the relationship between wage inequality and growth and may be especially relevant in the Mexican context are not considered in the estimations; these include the quality of the regional/local labour market and social institutions, political stability, corruption and criminality, among others, which are variables that are also likely to vary over time and across regions.

This paper can also be extended in at least two directions. First, the availability of a large and micro-dataset for such long time period (1998-2008) might be exploited to further disentangle the observed relationships between wage inequality and economic growth. For example, drawing on the idea developed by Bourguignon et al (2007), the inequality measure could be disaggregated in order to compute the share of inequality that is caused by inequality of opportunity, i.e., disparities related to factors that are beyond the control of the individual. This would enable to understand whether and how effort-related and circumstance-related inequalities are related to economic growth, which could also offer some additional insight into the role of institutions in mediating the relationship between inequality and growth. Second, the multiple inequality indexes considered in the paper provide only a partial picture of income distribution, which could be enhanced by considering the concept of polarisation introduced and formalised by Esteban and Ray (1994). This concept could be especially relevant in the case of Mexico. Indeed, both the deviation from the equal distribution of income (wage) and how distant the pools of income distribution are,

as considered by Ezcurra (2009) for the case of European regions, could be important for growth.

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