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Intergenerational Social Mobility in Mexico and its Regions
Results from Rank-Rank Regressions

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Abstract

With data from the ESRU Social Mobility Survey (EMOVI) 2011 we run rank-rank regressions to estimate relative and absolute upward intergenerational social mobility in the dimensions of wealth, education, and occupational status in Mexico at national and regional levels. For the case of wealth, the estimations yield a clear regional pattern: the degree of social mobility is higher than the national average in the North and North-Central regions, similar to the national average in the Central region, and lower than average in the South region. In particular, it is estimated that the children of poor parents (i.e. parents in the 25th percentile rank in the national distribution of wealth of their generation) achieved greater than average progress if they grew up in the North region, and smaller than average progress if they grew up in the South region. The same results are found for the case of education and occupational status. However, in general, the differences between regional estimates of absolute educational mobility are not statistically significant; and the estimates of occupational mobility are not robust.

JEL Codes: J62, E23, R10, N96, N36

Resumen

Con los datos de la Encuesta de Movilidad Social ESRU (EMOVI) 2011 realizamos regresiones de rango para estimar la movilidad social intergeneracional, relativa y absoluta ascendente, en las dimensiones de riqueza, educación y estatus ocupacional en México a nivel nacional y regional. Para el caso de la riqueza, las estimaciones arrojan un patrón regional claro: el grado de movilidad social es más alto que el promedio nacional en las regiones Norte y Centro-Norte; similar al promedio nacional en la región Centro y más bajo que el promedio en la región Sur. En particular, se estima que los hijos de padres pobres (es decir, padres en el percentil 25 de la distribución nacional de la riqueza de su generación) lograron un progreso mayor que el promedio si crecieron en la región Norte, y un progreso menor que el promedio si crecieron en la región Sur. Los mismos resultados se encuentran para el caso de la educación y el estado ocupacional. Sin embargo, en general, las estimaciones de la movilidad social absoluta en educación no difieren estadísticamente entre las regiones, y las estimaciones de la movilidad ocupacional no son robustas.

Códigos JEL: J62, E23, R10, N96, N36

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1. Introduction

This paper presents estimates of intergenerational social mobility in wealth, education, and occupational status for the case of Mexico, at the national level and by region.[1] The data used in this study are indices of household assets, years of schooling, and occupational status first calculated by Behrman and Vélez-Grajales (2015) with information from the ESRU Social Mobility Survey (EMOVI) of 2011, and recalculated by the authors of this document. The regionalization of Mexico corresponds to that defined by the Bank of Mexico. Both relative and absolute upward intergenerational social mobility are estimated in a consistent way from rank-rank regressions as in Chetty *et al.* (2014).

There are very few studies of intergenerational social mobility using regression analysis for the case of Mexico, and even fewer studies have estimated social mobility at the regional level. This is partly due to a limitation of CEEY's "ESRU Social Mobility Survey" (EMOVI, 2006 and 2011), which does not provide data on household income, the main variable that has been used in regression analysis. EMOVI provides data which are representative of the socioeconomic status of head-of-households aged 25-64 years by gender at the national level.

EMOVI's indicators of socioeconomic status are categorical variables for education and occupation of head of household, and for household's ownership of durable goods and access to services and utilities, for both the current and the past generation. Therefore, the analysis of EMOVI data has mostly involved the estimation of intergenerational transition matrices for education and occupation (i.e. across levels of education and types of occupation). Indices for "wealth" were estimated from information on households' assets, home characteristics, appliances, and access to services, and this allowed for the estimation of transition matrices for measures of wealth as well (Vélez-Grajales and Stabridis, 2014). More general indices of socioeconomic status were also estimated, based on all of these factors: education, occupation, and wealth components (Torche, 2012).

Transition matrices provide an estimate of "absolute" social *immobility*; namely, the degree of persistence in low socioeconomic status over the generations. Vélez-Grajales et al. (2013) report, among the main results of this literature for Mexico, that persistence in the lowest quintile is as high as 48% for general socioeconomic status measured by household assets and head-of-households' occupation and education (with additional 22% moving from quintile 1 to quintile 2 across generations). The degree of persistence in quintile 1 is 35% for a wealth index based on household's assets, access to services and home appliances only. Other results are: 28% of adults with unschooled parents are also unschooled or have incomplete

[1] Intergenerational social mobility is defined, in theory, by the degree to which the social and economic opportunities of the children depend on the social status of the parents. The greater the dependence (correlation) between the opportunities of the children and the status of their parents the lower social mobility is, and the children tend to occupy in the "social scale" a place similar to the one which was occupied by their parents (Chetty et al., 2014). Empirical studies of intergenerational social mobility generally seek to establish a relationship between the achievement of children in adulthood and the past achievement of their parents in terms of income, occupation, education or wealth; this is mainly due to the lack of data on opportunities or social status, conditions which are more difficult to measure. For a thorough discussion of the theory and empirics of social mobility see Mulligan (1997) and Jäntti and Jenkins (2015).

elementary education (an additional 33% have completed elementary education only). And 52% of adults with a father in the agricultural sector now work in the agricultural sector or have become low-skilled manual laborers. These findings illustrate the low degree of social mobility across generations in Mexico.

Jere Behrman and Viviana Vélez-Grajales (2015) is the first study in which, using EMOVI 2011 data, indices for wealth, education and occupational status are computed in order to estimate relative intergenerational social mobility with regression analysis. These authors transformed educational levels into years of education, and estimated an index of occupational status from occupational categories and job titles based on the ISEI (Socio-Economic Index of Occupational Status), to compute continuous variables useable in regression analysis of intergenerational social mobility. *Relative* intergenerational social mobility is computed using the value of the (slope) coefficient of the log-log regression of the indices in the current generation on those of the past generation. The coefficient measures the degree of persistence of inequality across generations. For the case of the wealth index, they found a coefficient of around 0.60; for education it was 0.33; and for occupational status 0.21 (these coefficients were higher for rural and indigenous populations and somewhat higher for males than for females). Therefore, and in accordance with much of the literature, they found that intergenerational social mobility in Mexico is higher in terms of occupational status and education than it is in terms of wealth.

In this paper we extend the regression analysis of the EMOVI data of Behrman and Vélez-Grajales (2015) for Mexico in two important dimensions: firstly, we estimate relative and *absolute upward* intergenerational social mobility in a consistent way and, secondly, we compute these social mobility indicators at the national and regional levels.

Rank-rank regressions are used. That is, rather than regressing the indices of socioeconomic status of children on that of their parents, it's the percentile rank of children in the national distribution of socioeconomic status that is regressed on the percentile rank of their parents' in the corresponding distribution. Rank-rank regressions have many advantages over log-log regressions (see Dahl & Deleire, 2008, and Chetty *et al.*, 2014). In particular, one can get fully comparable estimates of intergenerational social mobility across regions of a country; relative intergenerational social mobility is actually an estimate of the correlation between levels of socioeconomic status across generations; and, finally, absolute upward and relative intergenerational social mobility are estimated consistently.

The regionalization of Mexico corresponds to that defined by the Bank of Mexico (2016). In the context of the EMOVI, whose representativeness is national and not regional, this regionalization has the advantage that the country is divided in only four but very different regions (North, North-Central, Central and South). This makes it possible to estimate the degree of intergenerational social mobility with a large enough number of observations in each region. As it is discussed below, our results are consistent with intergenerational transition matrices which have been estimated by region using regionally representative data.

The main result of the estimation is that the three measures of socioeconomic status show a similar regional pattern: the degree of intergenerational social mobility is higher than the national average both in the North and North-Central regions; close to the national average in the Central regional; and lower than average in the South region. In particular, it is estimated that the children of poor parents (i.e. parents in the 25th percentile rank in the national wealth distribution of their generation) achieved greater progress if they grew up in the North region; their average percentile rank is 41 in the national wealth distribution of the current generation. On the other hand, the expected improvement is lower in the South region, where the children of poor parents are on average in the 28th percentile rank, that is, they hardly improved their situation compared to that of their parents. In the North-Central and Central regions the corresponding figures are the 37th percentile and the 33th percentile.

The results presented here are consistent and complementary to those reported in Vélez-Grajales et al. (2017), where matrices of intergenerational wealth transition are estimated for the 32 states of Mexico. The estimation at the state level is possible because the data of the EMOVI 2011, whose representativeness is at national level, are combined with those of the National Nutrition and Health Survey (ENSANUT) of 2012, whose representativeness is at the state level. Both surveys provide enough information to compute a household wealth index for the interviewed adult, but in the ENSANUT that information is representative at the state level. On the other hand, the EMOVI has the retrospective information that allows estimating an index of wealth for the parents of the interviewee.

Thus, this information from the EMOVI is used to impute the wealth of the household of origin for those who were surveyed by the ENSANUT. The imputation is made by matching the respondents in both surveys by their percentile rank in the distribution of the wealth index of the current generation, their year of birth, and their gender.

The findings in Vélez-Grajales et al. (2017) and the ones presented here are consistent with each other because they show the same regional gradient for social mobility in wealth: South-Central-North-Central-North. This is so despite the fact that the wealth index used in the analysis was estimated by a different method in each case. The results from both studies are complementary because, while Vélez-Grajales *et al.* (2017) estimate transition matrices, and obtain information, for example, on the degree of child persistence in the father's wealth quintile, the results presented here allow direct estimation of well-known and easily comparable measures of relative and absolute upward intergenerational social mobility. Together, both studies allow greater possibilities of comparison between the degree of intergenerational social mobility in Mexico and in other countries.

From the perspective of macroeconomists, social mobility is important because it is related to inequality and economic growth. Various authors have found a negative relation between inequality and social mobility [Krueger (2012), Corak (2013a)] and a positive one between social mobility and economic growth (Hassler and Rodríguez Mora, 2000). On the other hand, there is evidence of a negative relation between inequality and economic growth (OECD, 2015). Thus, economic theory predicts multiple equilibria in which different combinations of these variables are generated [Galor and Zeira (1993), Hassler and Rodríguez Mora (2000), Hassler *et al.* (2007)]. These multiple equilibria would generate combinations in which low (high) social mobility is associated with a high (low) degree of inequality and a low (high) rate of economic growth.[2]

[2] Intergenerational social mobility analyzed in terms of progress relative to the family of origin in measures such as wealth, education or occupational status presents a more restricted characterization of the impact of "family background" than the equal opportunities approach [Corak (2013b), Brunori *et al.* (2013), Ferreira and Peragine (2015)]. However, both concepts are closely related and this allows linking social mobility with public policies. Social mobility is related to equal opportunities in the access to education, health and the labor market, and these in turn are related to factors such as the nature and quality of public policies in these areas, as well as other factors, such as social discrimination (especially by skin color or appearance, and by gender). In this way, differences in public policies on education, health and labor between regions of a country (social discrimination is perhaps less variable among them) generate differences in the degree of social mobility. These policies also explain the relationship between social mobility, inequality, and economic growth.

The results presented in this paper are effectively consistent with a negative association between intergenerational social mobility and income inequality by region, and a positive association with the rate of economic growth. That is, the highest degrees of social mobility are observed in the regions that have grown the most and where the inequality is lowest. This indicates the desirability of analyzing in more detail in further research the mechanism that has been operating in the regions of Mexico, by which inequality and economic growth might have been factors associated with social mobility.

The article is organized as follows. Section 2 presents a brief and simple discussion on rank-rank regressions and their main advantage: to allow for a simultaneous estimation of relative and absolute upward intergenerational social mobility; the discussion is actually a summary of the presentation of this topic in Chetty *et al.* (2014). Section 3 contains a presentation of the data used in this study; it discusses the main characteristics of the indices of wealth, education and occupational status which were estimated for this study. This section also presents the regionalization of Mexico that will be used in the analysis, its advantages and disadvantages. The results are presented in section 4, and are discussed in section 5. Section 6 is a brief conclusion.

2. Methods

There are two main measures of intergenerational social mobility: "absolute" and "relative" mobility. The first is a measure that answers the question: how are children from families of a given income level doing, better or worse than their parents? For example, in this paper we estimate the expected percentile rank in the distribution of wealth of adult children whose parents were in the 25th percentile rank in the distribution of wealth of the previous generation. On the other hand, relative mobility is a measure that responds to the question: how are the adult children of high-income families doing (in terms of wealth, education, etc.) relative to the adult children of low-income families? In the context of the present work, we estimate the difference between the expected rank position in the distribution of wealth of the present generation of the children of rich parents and the children of poor parents.

For the case of income, the usual measure of relative intergenerational social mobility is the so-called intertemporal income elasticity; obtained by estimating thecoe

ficient β in the linear regression $log(Y_{i1}) = \alpha + \beta log(Y_{i0}) + \varepsilon_{it}$ where Y_{i1} and Y_{i0} are the (permanent) income of family i members in the present and past generation, respectively; with $i = 1, \cdots, N$. In this way, for any two different families, i and j, we have $E[log(Y_{j1}) - log(Y_{i1})] = \beta[log(Y_{j0}) - log(Y_{i0})]$; i.e. the expected percentage difference between the incomes of the two families in the current generation is a proportion β of the percentage difference in the previous generation; so relative social mobility is lower the higher the estimated coefficient of the regression. In others words, relative social mobility is a measure of the persistence of inequality over the generations.

Relative social mobility measures estimated by log-log regression have biases and limitations that can be addressed by improving income data and sample representativeness [see Solon (1992) and Chetty et al. (2014)]. On the other hand, some authors have proposed replacing, in the regression, the income of parents and children by the position of these parents and children in the distribution of income in each generation. These regressions, called rank-rank, solve additional linearity and zero income problems, and yield more stable estimates [Dahl and Deleire (2008)]. Another advantage of rank-rank regressions over log-log regressions is that β, the slope of the regression, is in general an estimate of the correlation coefficient between the variables analyzed. The coefficient of correlation, rather than elasticity, is the primary object in the study of social mobility.

More important for the present study, in the context of a regional analysis, rank-rank regressions allow us to obtain absolute upward social mobility estimates that are not only comparable across regions, but also clarify and give precision to results on relative mobility (Chetty *et al.*, 2014). For this reason, we use rank-rank regressions to study intergenerational social mobility in the regions of Mexico. In this way, for the variable of interest (education, occupation, wealth, etc.), we estimate the relationship between the percentile rank that the adult children occupy in the distribution of the present generation and the corresponding one that their parents occupied in the distribution of the previous generation.

For region c and family i, we define (following the notation in Chetty et al. 2014) the linear relation $R_{ic} = \alpha_c + \beta_c P_{ic} + \varepsilon_{ic}$, where R_{ic} is the percentile rank occupied by the son of that family and region in the national distribution of the current generation, and P_{ic} is the percentile rank occupied by the father of that family and region in the national distribution of the previous generation. The intercept and the slope of the regression vary by region.

In this context, the degree of relative intergenerational social mobility is the difference between the expected percentile rank (in the national distribution of the present generation) of the children born to parents at the top and at the bottom in the national distribution of the previous generation; namely, $\overline{R_{100,c}} - \overline{R_{0,c}} = 100\beta_c$. So to estimate relative mobility, it is enough to estimate the regression parameter β_c. On the other hand, absolute mobility in the percentile p of origin refers to the average rank in the national distribution of the current generation occupied by adult children whose parents were in the percentile p in the national distribution of the previous generation, and it is given by $\overline{R_{p,c}} = \alpha_c + \beta_c p$. In particular, "absolute upward mobility" is the expected rank in the distribution of the current generation of those children whose parents were on average below the median in the distribution of the previous generation. This is equivalent to estimating the expected rank in the distribution of the present generation of children with parents in the 25th percentile in the national distribution of the previous generation, or $\overline{R_{25,c}} = \alpha_c + \beta_c 25$.

In conclusion, rank-rank regressions allow us to obtain estimates of absolute upward intergenerational social mobility comparable across geographic areas of a country.[3] It also makes it possible to determine the source of the advantage of one geographical area relative to another in terms of relative mobility: whether it is improvements among the children of poor households or a worsening condition among the children of wealthy households.

3. Data

The estimation of the measures of social mobility that we propose for Mexico and its regions is carried out with data from the ESRU Social Mobility Survey for Mexico (EMOVI) of 2011. The survey reports representative data at national

[3] The economic significance of the estimates, however, relies on the assumption that the values of the variable–whichever one is used to rank children and their parents–in a given area have little effect on the national distribution of the values of that variable (Chetty et al. 2014, page 1562). Given that we study social mobility across large regions of the country, the analysis presented here could be subject to that limitation and, therefore, should be taken up again in future research; for example, if data representative at the regional level became available.

level on education, occupation, and access to goods and services in the household of the population between 25 and 64 years of age, masculine and feminine, and also of their parents. Retrospective information on the personal and household characteristics of their parents is provided by the interviewees at the time of the survey.[4]

The survey reports the place of residence of the interviewess at 14 years of age. Thus, the variable "region" in the present study refers to the geographic zone of Mexico where the state in which the interviewee lived at the age of 14 years is located. Note that this state may differ from the one in which the interviewee had his residence at the time of the survey. The reason for this choice is the assumption that the regional dimension is important to understand social mobility to the extent that it potentially reflects differences in the degree of equality of opportunity in different parts of the country. And the impact of these differences is more likely to be greater during the period of accumulation of human capital than in adult life. Thus, estimated differences between regions in social mobility will be interpreted as reflecting differences existing between regions at the time the interviewees were 14 years-old.

For the definition of the regions we adopt the one used by the Bank of Mexico (2016). In this regionalization, the states of Mexico are grouped into 4 regions (Figure 1). North: Tamaulipas, Nuevo León, Chihuahua, Coahuila, Sonora, and Baja California. South: Guerrero, Oaxaca, Chiapas, Quintana Roo, Yucatán, Campeche, Tabasco, and Veracruz. Central: Morelos, Puebla, Tlaxcala, Hidalgo, Guanajuato, Querétaro, State of Mexico and Mexico City. North-Central: Michoacán, Colima, Jalisco, Baja California Sur, Nayarit, Aguascalientes, Zacatecas, San Luis Potosí, Sinaloa, and Durango.

The advantage of this classification with only 4 regions is that it yields a higher number of observations per region; which is a condition for the estimation of the regressions because the EMOVI is representative at the national level. Other regionalizations that have been proposed for Mexico yield a greater number of regions. On the other hand, this regionalization allows for a sufficient regional differentiation in terms of several dimensions: per capita GDP, productive structure, educational levels, poverty, etc.

[4] For a discussion of the questionnaire, sample design and general results of the survey see Vélez Grajales et al (2013).

Figure 1. Regions of Mexico

Source: Banco de México.

The original data reported by the EMOVI in the dimensions of education, occupational status, and household wealth are not suitable for the analysis of social mobility using regression analysis. This type of analysis requires continuous variables, while the EMOVI reports: for the case of education, years of schooling associated with levels of education achieved; for the case of occupation, information on the task, job or job position of the interviewees; and for the case of wealth, assets of the household and goods and services to which it has access.

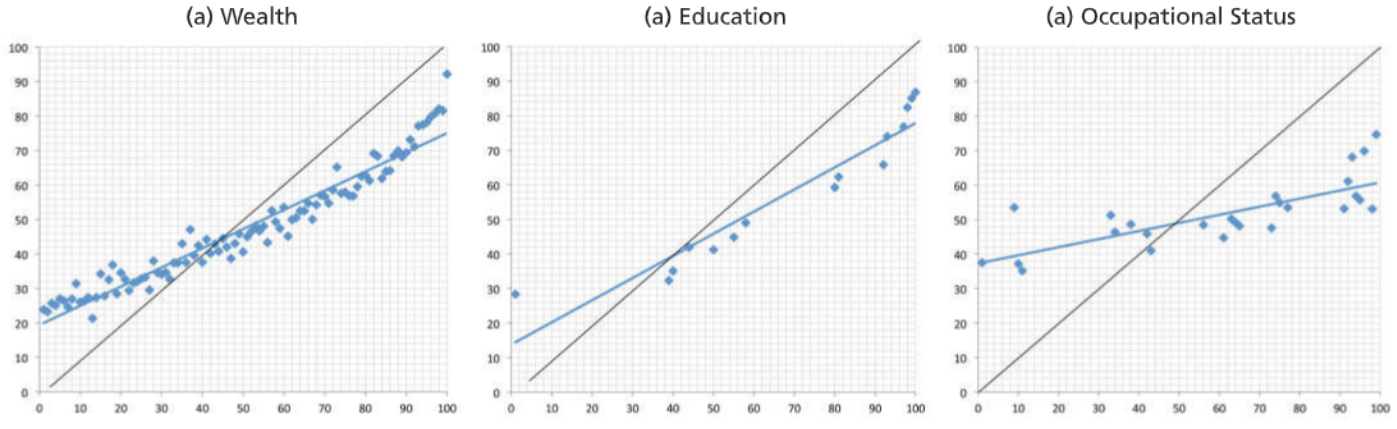
The same problem confronted Behrman and Vélez Grajales (2015) when analyzing social mobility in Mexico with a regression model. These authors transformed these "discrete" variables into "continuous" ones by constructing indices with the necessary characteristics. For a justification, design and construction of the indices please see the referred document.

In this paper we follow the methodology of Behrman and Vélez-Grajales (2015). The indices obtained by these authors were replicated for the purpose of this paper using the original EMOVI data; their findings were also fully replicated. In this way, it is verified that the data used in the present work are exactly the same as those used by them. The indices obtained we simply refer to as "wealth", "education" and "occupational status". Subsequently, for the interviewees in the EMOVI and for their parents, we determined the percentile rank they occupy in the national distribution of each generation. In the case of "occupational status", the indices were only calculated for the male population because the labor participation rate among the Mexican female population is very low (this was also the case in previous research).

A graphical analysis of the national distribution of these indices provides a preliminary result of the degree of intergenerational social mobility at the national level. Figure 2 (panel a) depicts the average percentile rank of the children in the national distribution of wealth (vertical axis) against the percentile rank of the parents in the national distribution of wealth of the previous generation (horizontal axis). The relationship between the rank of children and parents approaches the linear form postulated by the theory, with deviations in the queues of the distribution. A regression line (in blue) was added to simplify the discussion that follows. The slope of the regression line is less than 1 (the slope of the 45° degree line, in black), which indicates that there is social mobility in relative terms: the smaller the slope of the regression line, the greater the relative intergenerational mobility. An intercept greater than zero indicates that there is absolute upward social mobility: the larger the intercept, the greater the absolute upward mobility among the children of poor parents.

In Figure 2, in the panels b and c respectively, the information corresponding to the schooling index and the occupational status index is presented. The relation between children's and parents' percentile rank is linear; however, there are gaps in the data that indicate that the indices computed from the original data show important discontinuities or jumps in their values. Relative intergenerational social mobility in occupational status is

Figure 2
Average Percentile Rank of Children vs Percentile Rank of Parents



greater than social mobility in education, and both are higher compared to that observed for wealth. These results and those concerning absolute mobility will be discussed in more detail in the next section.

4. Results

Table 1 presents the estimates of relative and absolute upward social mobility in wealth and education for men and women, while Table 4 presents the estimates for the case of occupational status of men (as already mentioned, no indices of occupational status were estimated for women).

Relative intergenerational social mobility in wealth is 54.1 points at the national level; that is the expected difference in percentile rank between the children of the richest and the poorest families in the national distribution of wealth of the current generation. The results indicate that in the South region the lowest degree of relative social mobility is estimated (59.6), while in the North-Central region the highest degree of social mobility is estimated (44.2). The estimates for the North-Central and the North region (46.3) are not statistically different (Table 2, upper panel). The Central region's estimate, at 55.0, is only slightly above the national average.[5]

Regarding the intergenerational social mobility of those who grew up in poor households (whose parents were in the 25th percentile rank in the distribution of wealth of their generation), at the national level the degree of absolute mobility is 33.5 –i.e. the children of poor parents, thus defined, are expected to have advanced to the 33.5th percentile rank in the distribution of wealth of the current generation. That is, they advanced 8.5 percentiles in relation to the position that their parents had. Progress is greater than average in the North (41.1) and North-Central (36.6) regions, and similar to the average in the Central region (33.1); the lowest progress is observed in the South region (28.2).[6]

Differences in the results by region relative to the national average are graphically shown for the two polar cases: the North region (in Figure 3,a) and the South region (in Figure 3,b). The relative and absolute advantages in intergenerational social mobility of the North region over that of the South are observed in the slope and in the intercept, respectively, of the regression line. In the case of the North (South) the slope is lower (higher) than that of the national data, indicating that the difference in the expected rank between the children of the rich and the poor in the distribution of wealth is smaller (larger) in that region than at the national level (Figure 3). Regarding the intercept of the line of regression, in the North (South) it has a larger (smaller) magnitude with respect to the intercept of the line estimated with national data. Thus, adults in the EMOVI 2011 sample whose parents were poor (25th percentile in the distribution of wealth of their generation) and who grew up in the North (South) achieved a higher (lower) rank in the wealth distribution of the current generation compared to the national average of those born in equally poor households.

Relative intergenerational social mobility in education is somewhat larger than in the case of wealth, but it shows the same regional pattern (Table 1, lower panel). Relative social mobility in education is 44.0 at the national level: this is the expected difference between the rank of the children of the richest and the poorest families in the national distribution of years of schooling (the figure for the case of wealth is 54.1). Estimates indicate that the South region has the lowest degree of relative social mobility in education, at 48.0, while education mobility is highest in the North-Central and North regions, at 39.9 and 40.8, respectively (these last two estimates are not statistically different–see Table 3, upper panel). The Central region has an intermediate level of educational mobility, at 44.5, only slightly above the national average.

[5] The data in Figure 2, panel a, admit an alternative regression analysis that includes a quadratic term. In this case the expected increase in the percentile rank of children due to an increase in the percentile rank of the parent is not constant, and of course depends on the percentile rank of the parent. The coefficients for the linear and quadratic terms in the regression equations, and the standard errors in parentheses, are: 0.214 (0.04) and 0.003 (0.0004). This means that relative intergenerational social mobility decreases with the wealth of parents. These results suggest that other methods and specifications could be used to study the degree of intergenerational mobility in these data, a task that is left for future research.

[6] This ranking of regions in terms of the degree of upward absolute social mobility is warranted by the results of the tests of equal coefficients between regressions shown in Table 2 and Table 3. The null hypothesis of equal coefficients between regions is rejected both for the slope and the constant terms in all regressions; except for the slope coefficient in the North-Central and North regions, as was already mentioned -in this last case the ranking of absolute social mobility estimates is established in terms of the difference in constant terms of the regression. Additionally, the standard error of the estimate of upward absolute social mobility at the 25th percentile of parental wealth distribution was computed, and the results are [region, absolute mobility estimate, standard error, number of observations]: North [41.1, 0.98, 8]; North-Central [36.6, 0.72, 24]; Central [33.1, 0.65, 24]; and South [28.2, 0.61, 19].

Absolute upward social mobility in education at the national level is also slightly higher than that estimated for wealth: 36.9 against 33.5. As for the regional pattern, the results for years of schooling show two differences in relation to the estimates for wealth. First, the differences between regions in the degree of mobility are smaller in the case of education, and these regional differences are in general not statistically significant (Table 3, lower panel). Second, it is in the North-Central region, and not in the South region, where upward social mobility is lowest (35.3). For the rest of the regions, the following pattern, from lowest to highest, is observed in absolute upward social mobility in education: South (36.7), Central (37.6), and North (38.0). The estimate of the constant term in the regression for the South region is significantly different to those estimated for the Central and North region (Table 3, lower panel). Therefore, in terms of upward social mobility in education across generations, it can only be determined that the South region has the lowest degree of mobility, but a clear ranking for the rest of the regions cannot be determined.

TABLE 1

Intergenerational Social Mobility in Mexico and its Regions
Linear Relation between Child and Parents Ranks
Population Aged 25-65, 2011

	Wealth								*R^2*
	α		β		R^2	$r_{100} - r_0$	r_{25}	Obs.	
México	*19.9*	*(0.52)*	*0.54*	*(0.01)*	*0.31*	***54.1***	***33.5***	*6,626*	
North	29.6	(1.50)	0.46	(0.02)	0.24	**46.3**	**41.1**	1,059	
North-Central	25.5	(1.06)	0.44	(0.02)	0.24	**44.2**	**36.6**	1,439	
Central	19.3	(0.96)	0.55	(0.02)	0.30	**55.0**	**33.1**	2,446	
South	13.3	(0.87)	0.60	(0.02)	0.35	**59.6**	**28.2**	1,558	
	Education								
	α		β		R^2	$r_{100} - r_0$	r_{25}	Obs.	
México	*25.9*	*(0.39)*	*0.44*	*(0.01)*	*0.26*	***44.0***	***36.9***	*9,421*	
North	27.7	(1.04)	0.41	(0.02)	0.24	**40.8**	**38.0**	1,587	
North-Central	25.3	(0.75)	0.40	(0.02)	0.24	**39.9**	**35.3**	1,958	
Central	26.5	(0.68)	0.44	(0.01)	0.27	**44.5**	**37.6**	3,366	
South	24.7	(0.80)	0.48	(0.02)	0.28	**48.0**	**36.7**	2,325	

Note: These are the results of the regression $R_{ic} = \alpha_c + \beta_c P_{ic} + \varepsilon_{ic}$ (see Section 2). The expressions $r_{100} - r_0$ and $r25$ refer to the estimates of relative and absolute upward social mobility, respectively. Results in panel (a) are for the whole sample, while those in panel (b) are for the North region restricted sample. Standard errors in parentheses, rounded to the nearest hundredth. All regression coefficients are statistically significant at 1 %.

TABLE 2

Chi-squared Test of Equal Coefficients (Wealth)			
	β		
	Central	North-Central	North
Central	-	-	-
North-Central	16.8	-	-
North	9.0	0.42***	-
South	3.1**	27.7	17.7
	α		
	Central	North-Central	North
Central	-	-	-
North-Central	18.8	-	-
North	33.2	4.9*	-
South	21.4	78.8	88.0

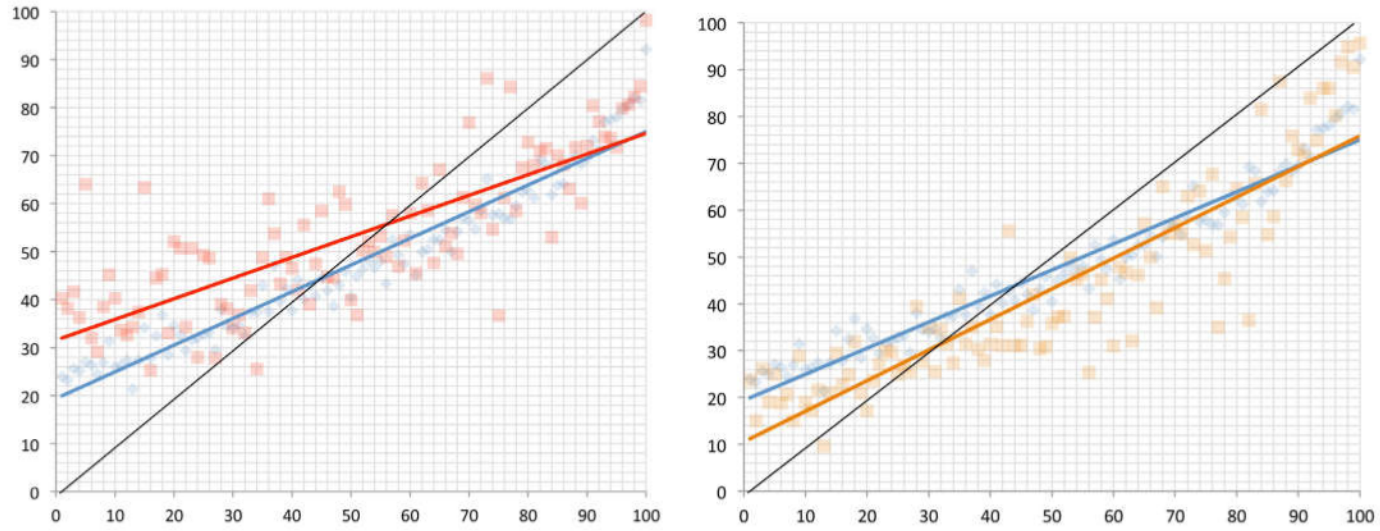
Note: The null hypothesis of equal coefficients is rejected at a statistical significance level of 1%, except when indicated: * rejected at 5% significance, ** rejected at 10% significance, and *** the null hypothesis is not rejected.

TABLE 3

Chi-squared Test of Equal Coefficients (Education)			
	β		
	Central	North-Central	North
Central	-	-	-
North-Central	5.2*	-	-
North	2.8**	0.15***	-
South	3.1**	13.1	8.9
	α		
	Central	North-Central	North
Central	-	-	-
North-Central	1.4***	-	-
North	0.9***	3.4**	-
South	2.9**	0.3***	5.0*

Note: The null hypothesis of equal coefficients is rejected at a statistical significance level of 1%, except when indicated: * rejected at 5% significance, ** rejected at 10% significance, and *** the null hypothesis is not rejected.

Figure 3
Average Percentile Rank of Children vs Percentile Rank of Parents: Wealth



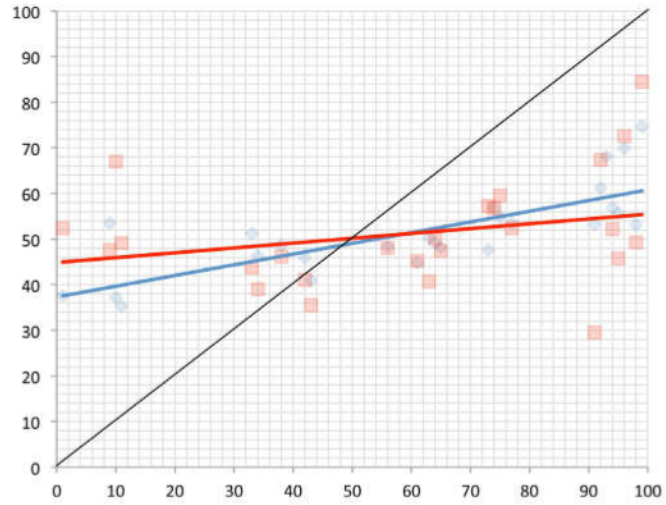
The EMOVI 2011 data on occupational status present a greater challenge for the measurement of social mobility. In addition to the lack of data for the women interviewed (the analysis is only representative for the male national population), in the North region the relationship between the average percentile rank of the children and the percentile rank of the parents deviates from the linear pattern (Figure 4). This may be due to the method by which data on occupations in Mexico are translated into the occupational status index. This method is based on the ISEI.[7]

The result is that the average percentile rank of the children does not increase with the percentile of the parents for low values of the latter variable. Rank-rank regressions assume a linear relationship between children's occupational rank and parental occupational rank; so a way to recover the linearity would be to eliminate the observations corresponding to these low values of the percentile rank of the parents (those under the 20th percentile). However, as shown below, the results of the estimation change noticeably.

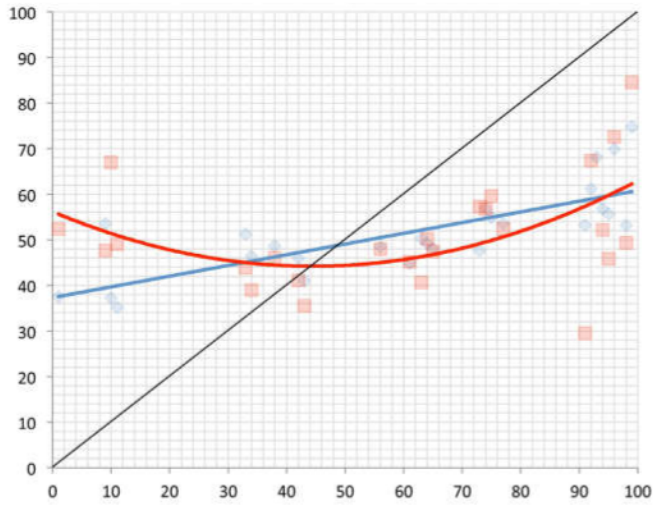
7 The International Socioeconomic Index of Occupational Status (ISEI) allows the stratification of occupations using a continuous scale. Occupations are classified based on the skills and abilities to perform certain jobs, ordered in a linear fashion. The continuous dimension of the index facilitates its analysis through different statistical models. However, as it is an international index, it may be that stratification does not reflect the particularities of the occupations in Mexico and may underestimate the status of certain occupations (Behrman and Velez-Grajales, 2015). For details regarding this index see Ganzeboom et al (1992).

Figure 4
Average Percentile Rank of Children vs Percentile Rank of Parents: Occupational Status, National (in blue) and North Region (in red)

(a) Linear fit



(b) Non-linear fit



When all the observations in the North region are used in the estimation, the results concerning relative intergenerational mobility in occupational status are, in general, similar to those found for wealth and education (Table 4, upper panel). Mobility in occupational status reaches its highest value in the North region (7.6) and the lowest in the South region (35.3); the Central and North-Central regions have intermediate values (25.9 and 27.6, respectively; these estimates are not statistically different–see Table 5, upper panel). Absolute upward occupational mobility is also higher in the North region, and has very similar values in the rest of the regions (Table 4, upper panel).

However, if we restrict data from the North region to those interviewees whose parents were at a percentile rank equal to or greater than 20 in the national distribution of occupational status of the previous generation, the results change significantly (Table 4, bottom panel). The North region now has the lowest intergenerational mobility, both relative and absolute, in the national ranking. This contrasts with the results presented above.

These results indicate that the effects of the non-linearity in the occupational status data of the North region cannot be easily controlled for if the group of observations with less linearity is eliminated. Thus, the low stability of the estimated coefficient of regression leads us to discard for the moment the estimates of social mobility in occupational status for the case of the North region using rank-rank regressions, and to recommend that the definition and construction of occupational status indexes calculated using EMOVI data and the ISEI methodology be revised for the case of Mexico.

TABLE 4

Intergenerational Social Mobility in Mexico and its Regions
Linear Relation between Child and Parents Ranks
Male Population Aged 25-65, 2011

Ocupation(a)								
	α		β		R^2	$r_{100} - r_0$	r_{25}	Obs.
México	*33.8*	*(0.74)*	*0.26*	*(0.01)*	*0.08*	***26.4***	***40.4***	*3,822*
North	44.8	(1.97)	0.08	(0.04)	0.01	**7.6**	**46.7**	631
North-Central	32.9	(1.47)	0.28	(0.03)	0.10	**27.6**	**39.8**	827
Central	34.0	(1.42)	0.26	(0.03)	0.07	**25.9**	**40.4**	1,316
South	30.3	(1.33)	0.35	(0.03)	0.14	**35.3**	**39.1**	963
Ocupation (b)								
	α		β		R^2	$r_{100} - r_0$	r_{25}	Obs.
México	*33.8*	*(0.74)*	*0.26*	*(0.01)*	*0.08*	***26.4***	***40.4***	*3,822*
North	24.9	(3.91)	0.37	(0.06)	0.07	**36.8**	**34.1**	458
North-Central	32.9	(1.47)	0.28	(0.03)	0.10	**27.6**	**39.8**	827
Central	34.0	(1.42)	0.26	(0.03)	0.07	**25.9**	**40.4**	1,316
South	30.3	(1.33)	0.35	(0.03)	0.14	**35.3**	**39.1**	963

Note: These are the results of the regression $R_{ik} = \alpha_c + \beta_c P_{ik} + \varepsilon_{ik}$ (see Section 2). The expressions $r_{100} - r_0$ and *r25* refer to the estimates of relative and absolute upward social mobility, respectively. Results in panel (a) are for the whole sample, while those in panel (b) are for the North region restricted sample. Standard errors in parentheses, rounded to the nearest hundredth. All regression coefficients are statistically significant at 1 %.

TABLE 5

Chi-squared Test of Equal Coefficients (Occupation -a-)			
β			
	Central	North-Central	North
Central	-	-	-
North-Central	0.2***	-	-
North	15.0	16.8	-
South	5.8*	3.6**	32.9
α			
	Central	North-Central	North
Central	-	-	-
North-Central	17.9	-	-
North	0.23***	20.9	-
South	3.4**	1.7***	33.8

Note: The null hypothesis of equal coefficients is rejected at a statistical significance level of 1%, except when indicated: * rejected at 5% significance, ** rejected at 10% significance, and *** the null hypothesis is not rejected.

5. Discussion

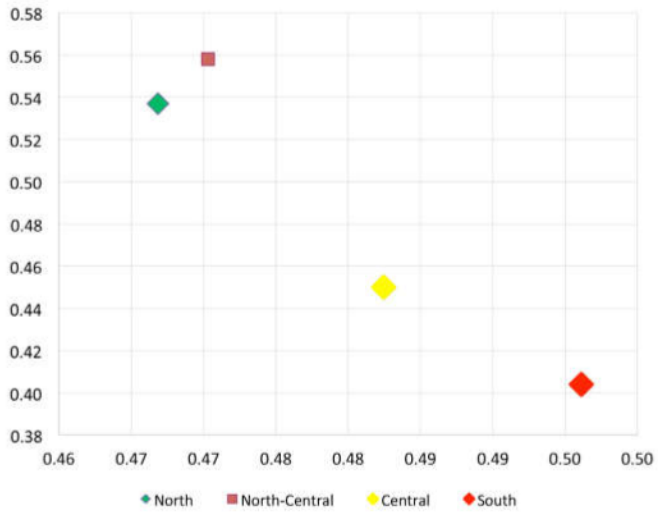
The South-Central-North-Central-North regional gradient in intergenerational social mobility in wealth found in this work is consistent with the estimates presented in Vélez-Grajales et al. (2017). In that paper, as it was already mentioned in the Introduction, an intergenerational transition matrix in wealth for each of Mexico's 32 states is estimated as a result of an exercise of imputation of a household wealth index using data at the national level of the EMOVI 2011 and at state level of ENSANUT 2012.

One of the main results in Vélez-Grajales et al (2017) refers to the percentage of the adult population that remains in the same wealth quintile of their parents. The greater the persistence in the lowest quintile in a given state, the lower social mobility is in that state. If, as a regional measure, the simple average of the estimates by state is used, the South-Central-North-Central-North gradient reported in this paper is also found there. For example, in the South region 55.2% of the children who grew up in households of the first quintile remained in that quintile when they reached adult age; but only 34.3% did so in the Central region, 24.0% in the North-Central region, and 22.1% in the North region. The national figure is 34%.

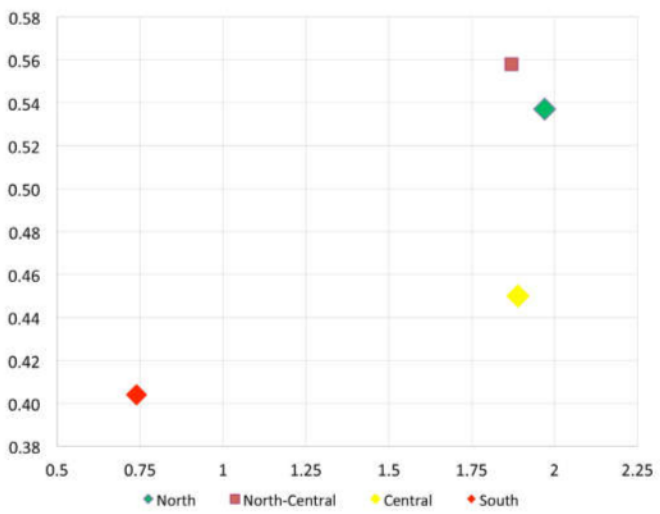
Therefore, the results in Vélez-Grajales *et al.* (2017) not only show the same regional profile of intergenerational social mobility in wealth we find here, but the differences in the degree of mobility between regions, the proximity of the estimates in the Central region and at National level, and the similarity that exists in the degree of mobility in the North and North-Central regions, are also present in both sets of results.

Figure 5
Social Mobility in Wealth, Income Inequality and Economic Growth
across Mexican Regions

(a) Relative Social Mobility vs Gini



(b) Relative SM vs Growth Rate



The South-Central–North-Central-North regional gradient in intergenerational social mobility in wealth reported in this paper is also consistent with the existence of a "Great Gatsby Curve" (Corak, 2013a) for the regions of Mexico. That is, social mobility and economic inequality are negatively associated across regions (Figure 5, a). Economic inequality here is measured by the GINI coefficient of household income calculated by Coneval from the INEGI Socioeconomic Conditions Module at the state level in 2014; the regional GINI is the simple average of the measures per state.

Estimates of social mobility in wealth by region are positively related to the GDP per capita growth rate; but the relationship appears non-linear (Figure 5, b). The

region stands out from the rest of the regions as it presents both the lowest rate of economic growth and the lowest degree of intergenerational social mobility in wealth. The rest of the regions do not present differences in the average economic growth rate among themselves, in comparison with those they present in terms of social mobility. The growth rate of GDP per capita of each region was calculated from INEGI data on GDP and population by state in 1995 and 2010, and corresponds to the annual average of the percentage change in the logarithm of GDP per capita during that period.

These *associations* between the estimates of relative social mobility and measures of inequality and economic growth by region are not meant to provide any concluding evidence about the actual relationship among these variables; they only show that the estimates of social mobility reported here yield a regional pattern of mobility that seems consistent and plausible, in as much they relate to other macroeconomic data in ways that have been highlighted in the economic literature elsewhere [Corak, 2013a; Hassler and Rodriguez Mora, 2000].

6. Conclusion

The analysis of the data from the ESRU Social Mobility Survey in Mexico (EMOVI) 2011 using rank-rank regressions reveals, in general, significant statistical and economic differences in intergenerational social mobility in terms of wealth, education, and occupation across the regions of the country. The main result is that social mobility in Mexico can be characterized by the regional gradient (from lowest to highest degree of mobility): South-Central–North Central-North. These results are consistent with the degree of social mobility by region that can be inferred from the matrices of intergenerational transition in wealth estimated by Vélez-Grajales *et al.* (2017) for the states of Mexico.

Relative intergenerational social mobility in wealth, in particular, is highest in the North-Central and North regions; the differences found between these two regions in the estimate of relative social mobility are not significant statistically. Absolute upward social mobility is highest in the North region. The Central and South region come second and third in the raking of both measures of social mobility.

Relative intergenerational social mobility in education can be characterized by the same regional pattern estimated for mobility in wealth. On the other hand, for absolute upward social mobility in education, it can only be established that it is lower in the South region than in the rest of the country. In general, the differences in the degree of absolute social mobility in education between the Central, North Central and North regions are small and statistically insignificant.

Regarding intergenerational social mobility in occupational status, the analysis seems to suggest that the degree of occupational mobility is highest in the North region. However, in this case the estimation has got important limitations: 1) The results are only valid for men; 2) The indices used in the estimation capture the occupational status with inaccuracies; which is reflected in problems of nonlinearity in the percentile rank relation between children and parents, especially in the North region. Therefore, the results related to mobility in occupational status are not conclusive.

The findings reported in this paper suggest future lines of research. The extension of EMOVI's representation at the regional level would be advisable and would allow for more precise results. Similarly, the methodology for constructing the indices of wealth, education and occupation can be improved in order to obtain greater linearity and continuity between parents' and children's percentile ranks. This is particularly important in the case of occupational status.

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