Sobre México. Temas de Economía. Nueva Época, año 1, núm. 1, enero-junio 2020, pp. 127-166

Internal Migration and Convergence in Mexico 2000-2010

Migración interna y convergencia en México 2000-2010

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We thank Felix Módrego, Isidro Soloaga, Leonardo Iacovone, Alan Hernández and two anonymous referees for their useful comments and suggestions. All errors are naturally our own.
This paper was prepared as part of the Territorial Cohesion for Development Program coordinated by Rimisp – Latin American Centre for Rural Development-and funded by the International Development Research Centre (IDRC, Canada).

Abstract

This paper investigates whether internal migration has long-term effects on conditional convergence across functional territories in Mexico. Using an instrumental variable approach, we find that controlling for net migration inflows increases the convergence term, which indicates that migration flows reduce convergence among functional territories. Furthermore, when we interact migration inflows with initial income in our growth equations, appropriately instrumenting migration, our results show that migration flows lead to lower growth on average, and they also have a divergent effect, since growth is faster in territories that exhibit higher migration inflows along with a higher initial income. Moreover, there appears to be heterogeneity across the territory growth distribution, which could be an indicator of clubs convergence.

Keywords: Convergence, migration, growth.

Resumen

Este artículo examina los efectos a largo plazo de la migración interna sobre la convergencia condicional entre territorios funcionales en México. Utilizando un enfoque de variables instrumentales, los resultados indican que la migración interna reduce la convergencia condicional. El análisis de la interacción entre los flujos migratorios y el nivel inicial de ingreso muestra que los flujos migratorios reducen el crecimiento promedio e impulsan la divergencia entre territorios, porque el crecimiento es más rápido en los territorios con mayores niveles de ingreso iniciales y que reciben mayores flujos de migrantes. Además, parece haber heterogeneidad en la tasa de crecimiento entre territorios, lo que podría indicar la presencia de clubes de convergencia.

Palabras clave: Convergencia; migración; crecimiento.

JEL: O15, O4, R1

Fecha de recepción: 26 de julio de 2019

Fecha de aceptación: 02 de noviembre de 2019

1. Introduction

Regional inequalities are a concern for policy-makers, because they affect the well-being and opportunities of dwellers of marginalized territories, and may also hinder the aggregate economic growth of a country (Cerina and Mureddu, 2014). Internal migration is sometimes considered as a mechanism of adjustment towards regional convergence in incomes and wellbeing (World Bank Group, 2009). If migration is induced by income differentials, it can be expected, other things being equal, to reduce those differentials by mitigating the relative labor scarcity that caused the differentials in the first place, thereby accelerating regional income convergence (Barro and Sala-i Martin, 1992a). This may not occur, however, if an economy is characterized by increasing returns and positive externalities from skill accumulation, and if migrants are predominantly drawn from the more skilled population of the sending region (defined by Borjas (1987) as positive selection). In this case, migration has a size and composition effect on sending and receiving regions that may lead to a process of interregional divergence, and not convergence: an inflow of skilled labor to a richer region increases real wage at destination by making everyone more productive, and reduces real wages at the origin.

Internal migration is an important phenomenon in Mexico. According to the Population Census, almost twenty million people (17.6 percent of the population) were living in 2010 in a different state from where they were born, versus about 12 percent of the population who migrated internationally (UN-DESA and OECD, 2013). Trends in internal migration and regional growth have been intertwined in Mexico, especially since its access to the General Agreement on Tariffs and Trade (GATT) in 1986 and the signing of the North American Free Trade Agreement (NAFTA) in 1994. The implementation of these free-trade agreements with very large economies, and the substantial inflows of foreign direct investment towards the northern part of the country, reshaped Mexico's economic geography. In particular, the increase in economic activities and wages in the states of the north attracted a large inflow of labor from southern states (Flores, Zey, & Hoque, 2013; Pérez Campuzano & Santos Cerquera, 2013; Chiquiar, 2008; Sánchez-Reaza & Rodríguez-Pose, 2002).

Indeed, regional inequalities in the country are severe and appear to have widened over the last three decades, after a period of regional convergence between 1940 and 1985 (Esquivel, 1999; Esquivel and Messmacher, 2002; Rodríguez-Oreggia, 2007). The most notable difference is between the North and Capital regions, with high growth rates since the 1990s, and the South, which consistently lags behind. At a lower level of spatial aggregation, spatial inequalities remain striking: between 2005 and 2010, national growth averaged 1.7 percent, but only two percent of municipalities increased their levels of consumption, and only three percent reduced poverty (Yunez Naude , 2013).

This paper investigates whether internal migration has any long-term effects on conditional convergence across regions in Mexico. The spatial unit of analysis is functional territories, that is, relatively self-contained spaces in which people live and work, and where there is a high frequency of economic and social interaction among inhabitants, organizations or businesses. We estimate a conditional regional convergence equation, measuring the impact of internal migration on income growth in a panel of functional territories for the period 2000-2010. The critical identification problem complicating the analysis of the impact of internal migration and regional convergence is posed by the two-way causality between growth and migration rates: the decision on whether and where to migrate is based, at least in part, on expectations about future regional growth, which can be self-fulfilling in the case of selective migration (e.g. if the destination grows faster because more skilled migrants moved there). We address this simultaneity bias by using an instrumental variable approach.

Studies of internal migration in Mexico are scarce compared to the vast literature on international migration, and most of them focus on characterizing migration flows and their determinants (Soloaga & Lara, 2006; Wendelspiess Chávez Juárez & Wanner, 2012; Soloaga et al., 2010, among others). Analyses of the effects of internal migration typically focus on inter-state migration, but this level of aggregation may hide intra-state patterns of internal migration, spatial inequality, and convergence.

The main contributions of this study are threefold. First, conducting the analysis at the level of functional territories instead of administrative areas allows exploring the role of labor flows between meaningful economic areas, which are masked in the inter-state and inter-municipal migration analysis available in Mexico to date. Second, the paper analyzes convergence in aspects that reflect more directly the wellbeing of households and communities compared to aggregated output: it uses Small Area Estimates (SAEs) of average income per capita combining the geographical detail of Census data, with the measurement accuracy of surveys; and data on the intensity of night lights which, according to recent literature, have proven to be good proxies of local economic activity and welfare (Berdegué et al., 2019; Henderson et al., 2012). Third, the paper provides estimates of the impact of internal migration on regional convergence controlling for the endogeneity of the relationship. We find no evidence that internal migration has contributed to regional convergence in Mexico over the period between 2000 and 2010. Indeed, our results suggest that richer places that receive large migration inflows have experienced the largest growth over the period.

The rest of the paper is organized as follows: Section 2 reviews the different strands of literature related to this study, section 3 details the methodology, and section 4 presents the data and descriptive statistics. The results are discussed in section 5, and section 6 concludes.

2. The debate on the relationship between internal migration and regional convergence

Different theoretical growth models lead to different theoretical predictions for the relationship between migration and regional convergence. In neoclassical growth models, which assume homogeneous technology and labor characteristics, diminishing returns to capital and labor, no barriers to labor and capital mobility, and migration from poorer to richer regions, internal migration is an adjustment mechanism which can lead to an equalization of the capital to labor ratio, labor productivity and income per capita across regions, thereby accelerating regional income convergence (Barro and Sala-i Martin, 1992a). From this perspective, long-run persistent real income differentials across regions simply reflect frictions to factor mobility, differential costs of migration, and (spatial) transaction costs, whether natural or policy-induced.

Endogenous growth models, on the other hand, allow for increasing returns and positive externalities from skill accumulation (Romer, 1990). In the context of agglomeration economies (among others, Glaeser & Gottlieb, 2009; Venables, 2005; Henderson, 2003), this opens the possibility that migration induces inter-regional divergence and self-sustaining underdevelopment traps (Bénassy & Brezis, 2013). If a positive selection of emigrants prevails, the skill composition in sending and receiving regions after migration will not be the same as before (Kanbur & Rapoport, 2005). An inflow of skilled labor to a richer region increases, rather than decreasing, the real wage at the destination, due to positive externalities that make everyone more productive. In contrast, in places where the skilled population is low , skilled wage is also low, pushing the emigration of higher human capital. This reduces productivity and wages further in the sending regions, leading to further emigration, and so on (Bénassy and Brezis, 2013).

The effect of migration on the skill composition of sending regions is the subject of theoretical and empirical debate on the competing hypotheses of "brain drain" versus "brain gain" (See for example, Beine et al., 2008; Docquier and Rapoport, 2012). In a brain drain scenario, any depletion of a place's human capital stock is detrimental to its current and future economic performance (Bhagwati and Hamada, 1974; Miyagiwa, 1991; Reichlin and Rustichini, 1998). In contrast, the brain gain hypothesis suggests that the possibility of emigrating and earning higher incomes in another region provides an incentive to acquire human capital, thereby promoting growth in the sending region (Mountford, 1997; Stark et al., 1997). Beine et al. (2001) argue that migration can have an ex-ante gain effect and an ex-post drain effect, with a positive net effect only if the first dominates the second. In the model developed by Bénassy and Brezis (2013), brain drain prevails, unless the government intervenes in human capital formation.

Empirical results on the relationship between migration and convergence are not conclusive, partly due to differences in the measurement of migration (net versus gross migration, homogeneous versus heterogeneous labor). A positive but negligible effect of internal migration on the speed of regional convergence is found, among others, by Barro and Sala-i Martin (1992a) for Japan and the US, Cárdenas and Pontón (1995) for Colombia, and Shioji (2001) for Japan. Stronger evidence that internal migration contributes to regional convergence is found by Maza (2006) for Spain, Østbye and Westerlund (2007) for Sweden, and DiCecio and Gascon (2010) for the US. In contrast, studies finding evidence that internal migration leads to increasing regional divergence, most of which take into account the heterogeneity of labor, include Østbye and Westerlund (2007) for Norway, Kirdar and Saracoğlu (2008) for Turkey, Peeters (2008) for Belgium, and Fratesi and Percoco (2014) for Italy.

For the case of Mexico, Guajardo (1997) concludes that internal labor mobility, even when adjusted for human capital differences, does not contribute to decreasing regional inequality in the long run. Esquivel (1999) suggests that historically low regional convergence rates can be explained, in part, by the low sensitivity of inter-state migration to inter-state income differentials. Mendoza and Calderon (2013) find that, although remittances have increased as a share of GDP in lower-income regions, they are not contributing to regional convergence. Aguilar-Ortega (2011) argues that, although remittances have been useful in integrating traditionally marginalized areas into the national economy, they did not translate into the generation of a more dynamic regional economy that decreases its dependence from remittances.

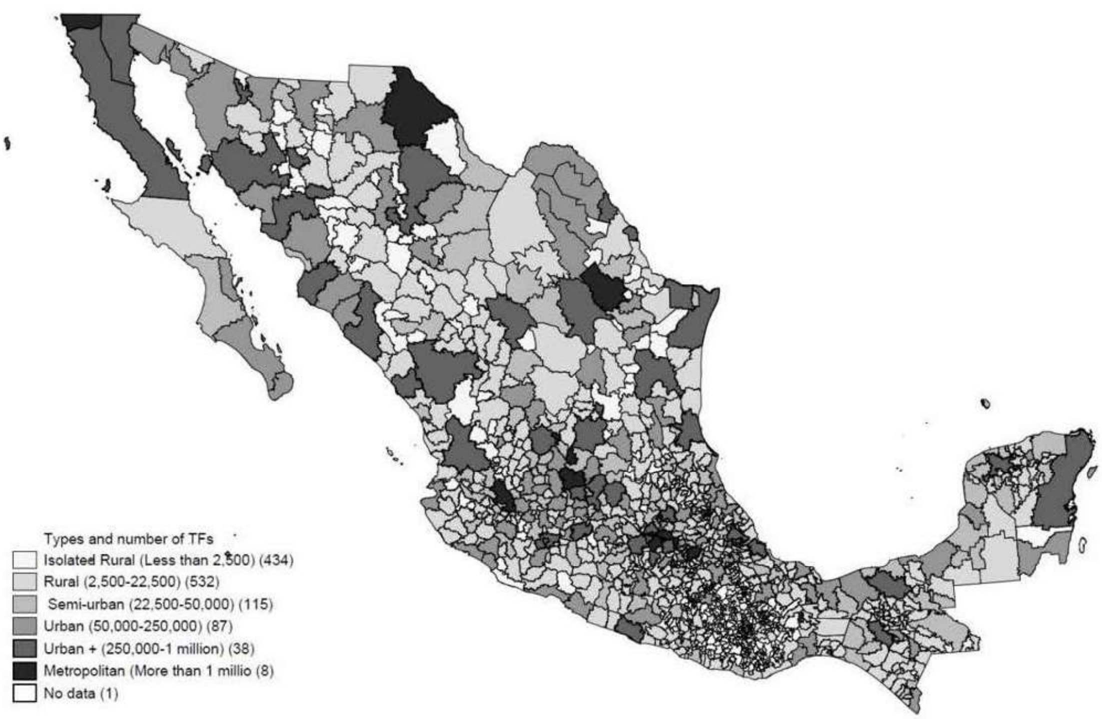
3. Data and methods

3.1. Data

3.1.1. Spatial unit

Following Soloaga and Yunez Naude (2013), our unit of analysis are 1,215 functional territories instead of the 2,456 municipalities of the country. These functional territories are defined using commuting flows between municipalities and applying cluster analysis. In this sense, the use of these units will allow us to avoid problems related to commuting as an individual could move from one municipality to another without really changing his economic environment or migrating. Figure 1 shows the functional territories by type (metropolitan, urban, rural, etc.). More than half of the territories are classified as rural. Therefore, it is important to consider a conditional convergence framework instead of an absolute one, considering that it is not expected that all the functional territories converge to the same steady-state given the considerable differences in their initial characteristics.

FIGURE 1
Type of functional territories



Source: Soloaga and Yunez Naude (2013).

While most studies of convergence use GDP or value-added as the outcome variables, this information is not available for Mexico at spatial disaggregations smaller than state level. Therefore, we use a different set of outcome variables, that are also more closely related to household and community wellbeing.

3.1.2. Outcome variables

Small Area Estimates

First, we use real total income per capita by functional territory[1], calculated with Small Area Estimates (SAEs), a methodology developed by Elbers et al. (2002, 2003) that improves the accuracy of survey estimates, by combining them with other sources such as population censuses through non-linear econometric models. SAEs estimates were obtained from the World Bank at the municipality level, and we used a weighted average, taking the municipality population as the weight, to aggregate the data into functional territories. The SAE methodology, first, identifies common variables between the survey (National Survey of Household Income and Expenditure-ENIGH), and the Population and Housing Censuses. Considering that income is better measured in the survey, as its main objective is to have accurate measures of income and expenditure, the second step is to estimate highly predictive models of household income (including household and local characteristics) separating regions, to account for regional heterogeneity. After evaluating how predictive are the models, income is predicted using data from the Population and Housing Census.

Night lights

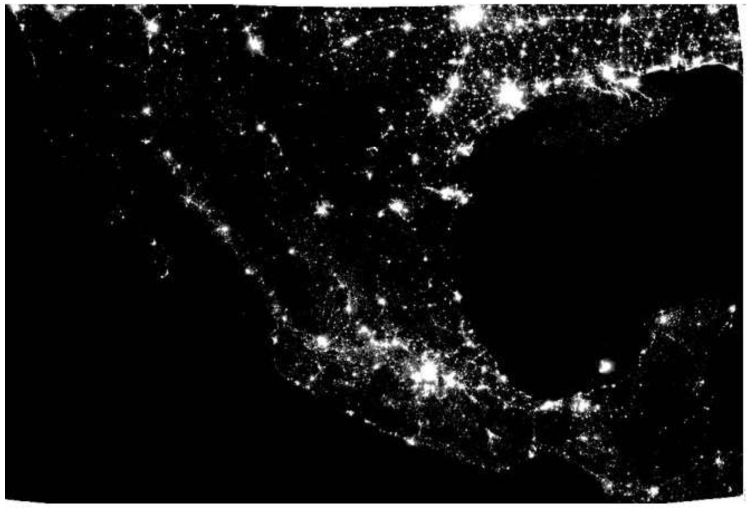
As an alternative outcome variable, we use the intensity of night lights measured through satellite images and aggregated at the level of functional territory. Recent studies have found that this variable is a very good proxy for economic activity and welfare, yielding only small differences against national accounts and providing a robust way to measure growth at disaggregated geographical units of analysis (Henderson et al., 2011; 2012). Figure 2 shows the images that we used to construct this outcome variable following the steps suggested by Lowe (2014).

According to Henderson et al. (2011), the brightness of visible lights is clearly associated with both income per capita and population density. The later is observed through the visibility of urban agglomerations.

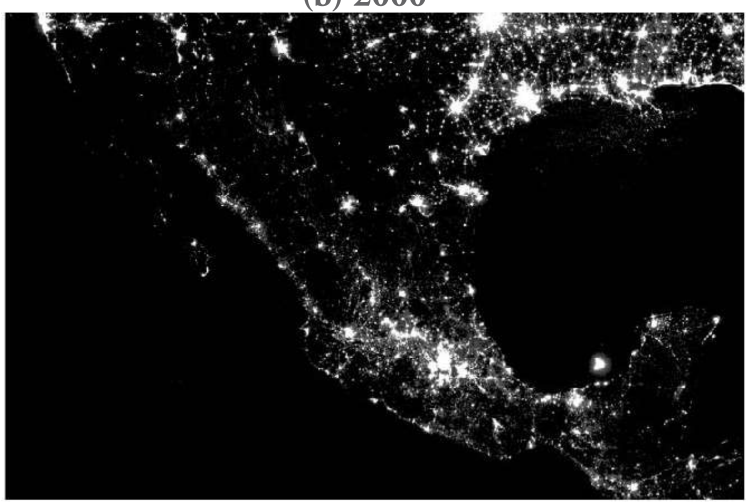
[1] The income variable is in constant prices of 2010 and it was deflated using the Consumer Price Indices at the regional level.

FIGURE 2
Night lights

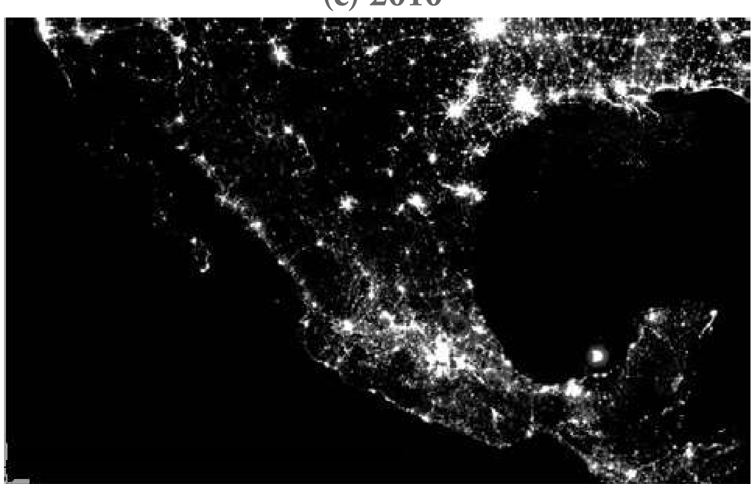
(a) 1992



(b) 2000



(c) 2010



Source: U. S. National Oceanic and Atmospheric Administration.

3.1.3. Migration and control variables

To characterize migration flows, we use the information regarding where the individual was living five years before (state and municipality), using the 2000 and 2010 samples of Mexico's Population and Housing Censuses. This data allows us to analyze migration flows that occurred between 1995 and 2000 and between 2005 and 2010.[2]

To condition on human capital following the convergence literature (Mankiw, Romer & Weil; 1992), we use average years of schooling for the population aged 25 and more. We calculate this at the municipality level and then use a weighted mean using population as weight, to obtain figures at the functional territory level.

As controls for local characteristics, we use the rate of urbanization measured as the ratio of urban population over total population. The urban population is defined as people from a locality of more than 15,000 inhabitants, which is the definition that the National Council of Population, and Enamorado, López-Calva, and Rodríguez-Castelán (2014) use. We also control by total population and type of functional territories, as defined in Figure 1.

4. Empirical strategy

To analyze if migration has effects on growth at the same time as on how convergence changes once we control for migration, we start by estimating a standard growth equation that analyzes β convergence (See for example Mankiw et al., 1992). We then develop this baseline model to account for the potential endogeneity of growth and migration. We measure growth as the difference of logarithms of our outcome variables (SAEs estimates and night lights) between and for two ten-year periods (1990-2000 and 2000-2010). Internal migration data refer to the periods 1995-2000 and 2005-2010, as they rely on a question from the Census asking where the individual lived five years before.[3]

$$\Delta lny_{it} = \beta_0 + \beta_1 lny_{it-1} + \delta migration_{it} + \gamma X_{i,t-1} + \psi_t + u_{it} \quad (1)$$

Where:

Δlny_{it} = Functional territory growth rate

[2] Even though INEGI conducted Population Counts for 1995 and 2005, this information was not used considering that it includes only a subset of relevant variables and that these Counts do not include all the information needed for our analysis.

[3] This question appears for the first time in the 2000 Census, which prevents us from using information from the 1990 Census.

lny_{it-1} = Income level at the initial period
$migration_{it}$ = ln(migration inflows functional territory i at time t)
$X_{i,t}$ = Control variables (education, urbanization rate, average population, type of territory, and region)
u_i = Stochastic shock

β_1 stands for the classic convergence term, where a negative term indicates that states with higher income or GDP levels experience a lower growth, which is an indicator of convergence. The coefficient of interest here is δ, which indicates the effect of migration on growth. This specification allows us to analyze convergence conditional on migration. As mentioned by Barro and Sala-i Martin (1992b), if once we include migration into the growth equation a lower value of β_1 is observed, it is an indicator that there is indeed a role for migration on convergence.

Additionally, considering that the main interest of this paper is the role that migration plays on regional convergence, we test whether the convergence term is higher for states that receive higher relative inflows of migrants using a split regression. That is, we estimate the growth equation separately for states that have high migration (above the median) and low migration (below the median).

Finally, we estimate an alternative specification, which includes an interaction between migration and initial income. This allows to test whether migration indeed enhances convergence:

$$\Delta lny_{it} = \beta_0 + \beta_1 lny_{it-1} + \delta migration_i + \beta_2 lny_i \; migration_i + \gamma X_i + u_i \quad (2)$$

An important threat to the identification of this kind of models is the endogeneity and selectivity that characterize migration decisions (McKenzie & Sasin, 2007), as it is not clear whether migration enhances growth and convergence, or if growth generates incentives for migration. Economic conditions at both origin and destination can affect migration. Economic growth may attract immigrants; if immigration is higher in places that grow faster, then the impact of migration on growth would be overestimated.

To address this threat, we use an Instrumental Variable approach. Previous literature has relied on lagged values of previous migration rates (McKenzie & Rapoport, 2007), distances (McKenzie et al., 2010), city densities, natural shocks, communications, distances to railway stations in the 1900s, etc. (Woodruff and Zenteno, 2007). In some of these cases, the validity of the instruments is questionable as the variable can be directly related to economic activity.

We use two alternative instrumental variables. The first is based on a gravity model for migration following Soloaga and Lara (2006). We estimate migration inflows at the level of functional territory by aggregating the predicted values of a gravity model that analyzes bilateral migration flows. This approach is similar to what Frankel and Romer (1999) and Dollar and Kraay (2003) do to construct an instrument for trade.

The second instrument has been used in previous work regarding international migration and is related to networks (see, for example, McKenzie & Rapoport, 2007). It is based on the idea that people are more prone to migrating to a different country or region where they have a group of people they already know. We use the information on people's state of origin included in the Population Census, and we construct the instrumental variable by interacting the stock of migrants in a functional territory that comes from each of the other functional territories with the distance between the two of them.

$$IV2migration_{st} = \sum_{i=1}^{R} Stockmigrants_{st-1}^{-R} * Distance_{sR} \quad (3)$$

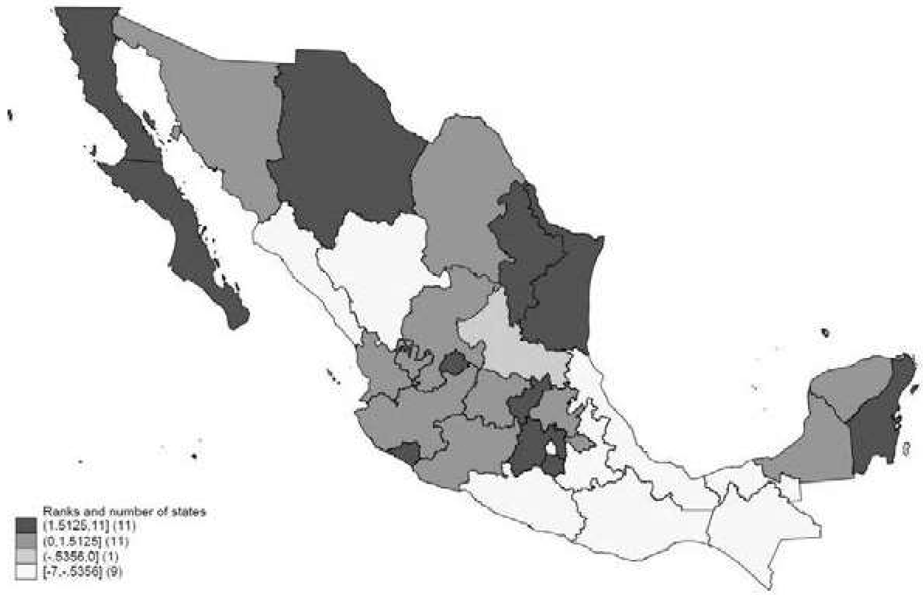
5. Descriptive Statistics

5.1 State-level

First of all, we used state data from the 2000 and 2010 Population and Housing Census to characterize the migration flows and how they are related to growth. Between 1995 and 2000, 4.2 million people changed their state of residence. However, this figure reduced for the period of 2005-2010 with around 3.5 million people migrating, which represents three percent of Mexico's total population in 2010. From these, 52 percent were aged 25-65, which means that are individuals that are not likely to change their schooling level and are in the labor force.

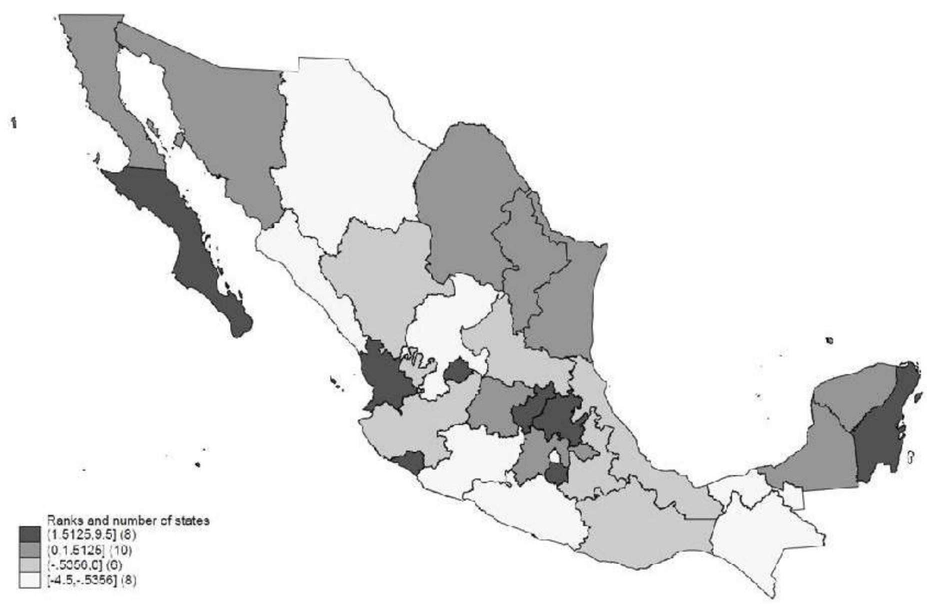
Considering the geographical dimension of this phenomenon, if we analyze net migration between 1995 and 2000, ten states had net migration outflows, and the highest relative levels were observed in the case of Puebla, Distrito Federal, Veracruz, and Guerrero, while the states with the highest levels of net inflows during this period were Quintana Roo, Baja California, Baja California Sur, and Chihuahua (See Figure 3). It is worth noting that these patterns are very different from the ones observed in 2005-2010. For this last period, we find that 14 states exhibited net outflows, and the highest levels of outflows relative to their population are observed in Distrito Federal, Guerrero, and Chiapas. On the other hand, the states with the highest relative inflows are Baja California Sur, Quintana Roo, Colima, Nayarit, and Queretaro (See Figure 4).

FIGURE 3
Net migration flows 1995-2000



Source: Authors' calculations using data from the 2000 Population and Housing Census, INEGI.

FIGURE 4
Net migration flows 2005-2010

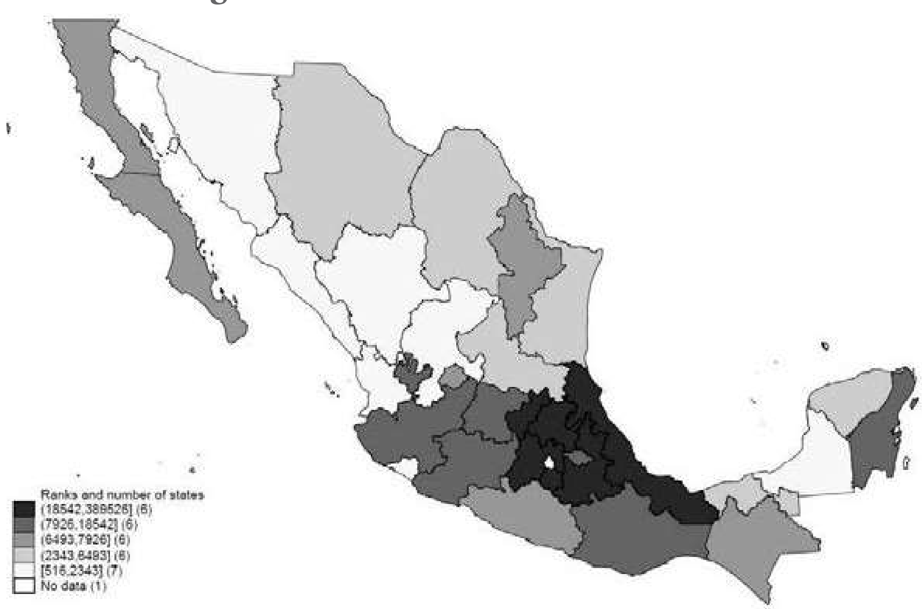


Source: Authors' calculations using data from the 2010 Population and Housing Census, INEGI.

The case of Distrito Federal, which concentrates eight percent of the national population, is particularly interesting as it is the state with the highest level of migration outflows. This is partly driven by policies implemented between 1970 and 1982, which aimed at decentralizing the industrial activity, and which offered subsidies for firms to move out of the main Metropolitan Area of the country (Casalet, 1999). Therefore, it is not surprising that it is surrounded by states with high inflows. Furthermore, if we analyze the destination of its outflows, most of the migrants move to neighbor states (Figure 5). This indicates that the spatial dimension is an important factor to take into consideration in the estimations. Additionally, agglomeration forces could be playing a role in migration flows, generating incentives for people to move to the periphery.

As Figure 6 shows, those states that received larger inflows of internal migration experienced a higher growth rate. Thus, there appears to be indeed a strong correlation between internal migration and GDP growth without controlling for any other characteristic.

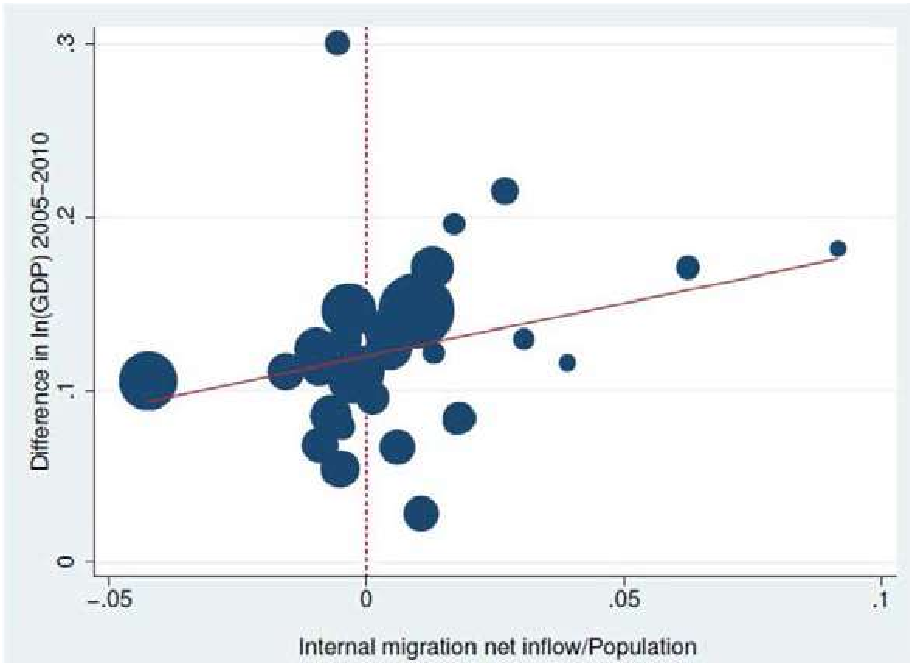
FIGURE 5
Migration outflows from Distrito Federal



Source: Authors' calculations using data from the 2010 Population and Housing Census, INEGI.

FIGURE 6

GDP growth vs. Share of migration inflows



*Marker's sizes indicate the population level of the states.
Source: Authors' calculations using data from the 2010 Population and Housing Census and the National Accounts System, INEGI.
Note: Following Chiquiar (2005), Campeche and Tabasco are excluded from the sample.

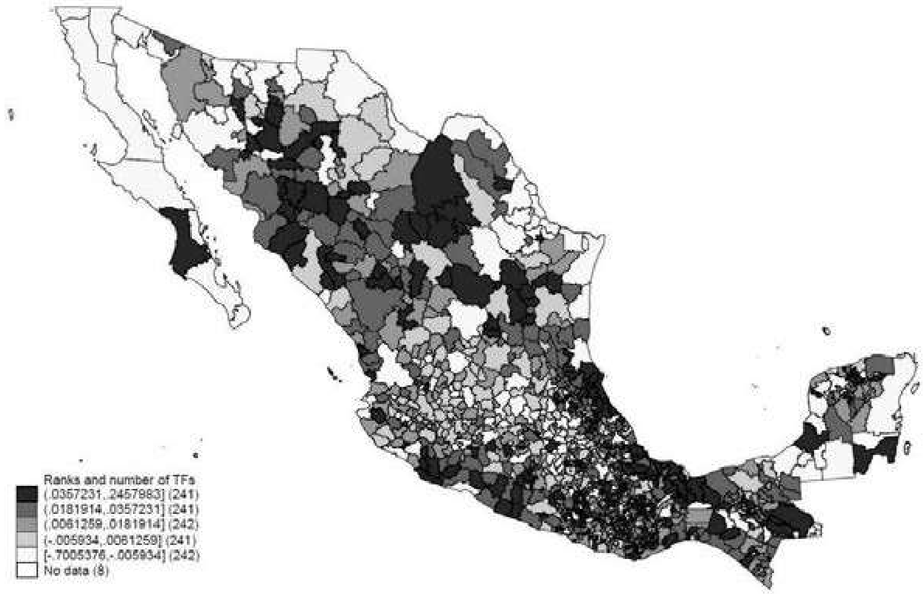
5.2 Functional territory level

Once we consider functional territories, the number of migrants between 1995 and 2000 increases to 4.3 million. This figure is similar for 2005 and 2010. To analyze these flows geographically, we divided the functional territories in quintiles according to the net flows relative to the population for 1995-2000. As Figure 7 shows, territories located in the Northern region, but not the ones in the border exhibit the highest relative net inflows, along with some coastal territories. On the contrary, there is a region in the Center of the country where net outflows are observed.

Using the same thresholds for the 2005-2010 period, we observe a totally different distribution as now there are some territories in the border that exhibit net inflows, there are fewer territories that exhibit high net inflows and they are no longer in the coast, but there is still a region in the Center of the country with net outflows (See Figure 8).

FIGURE 7

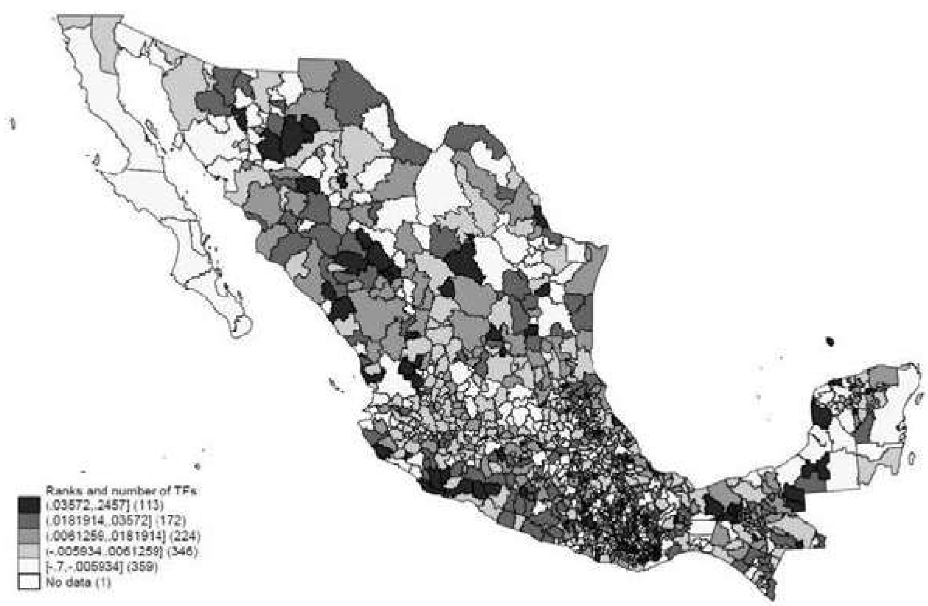
Net migration flows 1995-2000: Functional territories



Source: Authors' calculations using data from the 2000 Population and Housing Census and the National Accounts System, INEGI.

FIGURE 8

Net migration flows 2005-2010: Functional territories



Source: Authors' calculations using data from the 2010 Population and Housing Census and the National Accounts System, INEGI.

5.3 Characteristics of migrants

Regarding the personal characteristics of migrants, we find that they are relatively younger than non-migrants and that these differences are statistically significant. The evidence, as shown in Table 1, points towards positive selection as migrants have a higher level of education. Non-migrants are on average below junior high-school, while migrants have on average finished this level. Analyzing this at the state level allows us to study if this only applies to inflows. In most of the cases, people who left the state between 2005 and 2010 were more highly educated that the ones who stayed in the state. A similar pattern is observed when we compare migrants with non-migrants in the same state. That is, on average, migrants have more years of schooling than both people who stayed in their state of origin and people in the recipient state (See Appendix A, Table A1).[4]

Considering the educational dynamics of migrants, as we observe in Appendix A, Figure A1, migrants became more highly educated in the period between 2000 and 2010, which is an expected outcome since from 1993 junior-high-school is mandatory, so the level increased for the whole population.

Finally, considering the occupational distribution of migrants, we observe that in activities such as agriculture, and artisans, there is a much higher proportion of non-migrants regardless of the period considered and the geographical definition (See Appendix A, Figures A2 and A3). On the contrary, there is a higher proportion of migrants among professionals and technicians, fixed machinery operators, support activities, and protective services as well as managers and directors.

Table 1. Characteristics of internal migrants 2000 and 2010

	Non-migrants	Migrants	Diff
2000			
Age	40.14	36.19	-3.94***
Schooling	7.49	9.13	1.69***
% male	0.47	0.52	0.05***
2010			
Age	41.39	37.4	-3.99***
Schooling	8.72	10.64	1.92***
% male	0.47	0.51	0.03***

Source: Authors' calculations using data from the Population and Housing Census 2000, INEGI.

[4] Further information on the characteristics of migrants is provided in Appendix A.

5.4 Characteristics of the sample

Table 2 shows descriptive statistics for the functional territories included in the sample. As the table shows, and as mentioned before, even though both measures are used in logarithms and their magnitude should be comparable, the growth rates have different characteristics depending on the outcome measure selected (SAEs or night lights). The SAEs measure for the 1990-2000 period has a negative mean, indicating that on average, the incomes of the territories have decreased, while in the case of night lights, the mean is positive indicating an increase in economic activity. On the other hand, for 2000-2010, both measures have positive means, but they differ in the magnitudes of the growth rate.

In the case of the average years of schooling, the means are really low, even though we are calculating this measure for individuals between 25 and 66, for whom education should not change. This could be because our unit of observation is functional territories, and we are calculating a simple mean, and some of the functional territories are rural, and their education level is low.

Table 2. Descriptive statistics Functional Territories 1990-2010

Variable	mean	p5	p10	p50	p90	p95	sd	N
2000								
$\ln(Y_t) - \ln(Y_{t-1})$	-0.52	-1.19	-1.02	-0.52	-0.02	0.13	0.42	1,141
$\ln(Lights_t) - \ln(Lights_{t-1})$	0.69	0.09	0.19	0.59	1.35	1.59	0.47	1,141
$\ln(Y_{t-1})$	7.52	6.78	6.94	7.54	8.09	8.2	0.46	1,141
$\ln(Lights_{t-1})$	0.98	0	0	0.66	2.48	2.9	0.99	1,141
Average $Schooling_{t-1}$	3.35	1.22	1.61	3.2	5.37	6.06	1.43	1,141
Urbanization $rate_{t-1}$	0.08	0	0	0	0.33	0.5	0.18	1,141
Average $Population_{t-1}$	70,908.26	1,280.00	1,990.00	15,920.00	124,910.00	243,420.00	343,866.60	1,141
Migration $inflows_{t-1}$	1,721.60	5	9	154	2,458.00	6,477.00	8,377.82	1,141
2010								
$\ln(Y_t) - \ln(Y_{t-1})$	0.09	-0.45	-0.31	0.08	0.52	0.63	0.35	1,180
$\ln(Lights_t) - \ln(Lights_{t-1})$	0.22	-0.12	-0.01	0.2	0.51	0.67	0.25	1,180
$\ln(Y_{t-1})$	6.97	6.01	6.17	6.99	7.71	7.93	0.58	1,180
$\ln(Lights_{t-1})$	1.65	0.12	0.3	1.69	2.87	3.28	1	1,180
Average $Schooling_{t-1}$	4.72	2.2	2.71	4.62	6.96	7.79	1.63	1,180
Urbanization $rate_{t-1}$	0.09	0	0	0	0.36	0.55	0.19	1,180
Average $Population_{t-1}$	81,993.72	1,199.00	1,940.00	16,340.00	136,595.50	288,011.50	382,382.39	1,180
Migration $inflows_{t-1}$	1,883.45	9	17	177.5	2,908.00	7,791.50	8,498.82	1,180

Source: Authors' calculations using data from the 1990, 2000 and 2010 Population and Housing Censuses, INEGI, World Bank SAE Estimates and the U. S. National Oceanic and Atmospheric Administration.

6. Results

As the focus of this paper is on convergence, first of all, we estimate a simple absolute convergence equation following the growth literature in which the dependent variable is growth, and the independent variable is the lagged value of income. As the first column of Table 3 shows, the results indicate that there is absolute convergence as the coefficient of this regression is negative regardless of the outcome measure used. Once we analyze conditional convergence, by including the lagged value of schooling, the convergence term gets larger.

As columns (3) and (4) of Table 3 show, when we include migration inflows in the equation, the convergence term gets slightly higher in absolute terms, which could be an indicator of migration contributing to increasing divergence. Once we include the interaction between migration and the lag of income, we find that its coefficient is positive. This suggests that migration inflows to richer functional territories reduce the convergence rate. Furthermore, the coefficient of migration inflows becomes negative, suggesting that, overall, migration is negatively associated with per capita growth.

When we instrument for migration using the results of the gravity model (Table 4), we observe similar results.[5] As expected, in the OLS specification (Table 3), we were slightly overestimating the effect of migration inflows, but the bias is very small. In the case of the SAEs outcome, migration has a divergent effect, since the magnitude of the convergence coefficient increases, and the logarithm of migration flows by itself has a negative effect on growth. However, when we analyze night lights, migration flows have a positive effect on growth, but they slow down the rate of convergence. These differences are statistically significant, as shown in Figure 9. Our results hold in the case of the instrument based on networks (Table 5) and in an overidentified model (Table 6) in which we instrument migration using the two instrumental variables constructed.

It is important to note that for migration flows alone, mixed results are observed as in some specifications using night lights, it has a positive and significant sign while in other specifications its coefficient is negative. The differences observed using different outcome variables could due to the fact that night lights are a proxy not only of income but also of agglomeration and population density. Therefore, in the specification where we control for the type of functional territory, we always observe a negative sign, similar to the case of the SAE incomes. Additionally, as Christiaensen and Todo (2014) argue, poverty tends to reduce more with the growth of small or medium-size

[5] Further details on the construction of this instrument is provided in Appendix B.

cities than with the growth of largest cities (i.e., increasing agglomeration), and city size is better captured by night lights. As shown in Figure 10, this difference in the sign of migration inflows generates very different predictions for growth, keeping all other variables constant. While for SAE incomes the highest estimates of growth are obtained when both initial growth and migration inflows are low, for night lights, high migration, and low initial levels of lights lead to higher predicted growth.

In summary, what is robust across all of our estimates and regardless of the specification is that migration slows down convergence.

Table 3. Pooled regression OLS estimates of the Convergence equation

	-1	-2	-3	-4	-5	-6	-7
	Outcome: SAEs income estimates						
$\ln y_{it-1}$	-0.431***	-0.666***	-0.716***	-0.708***	-0.777***	-0.790***	-0.903***
	-0.0134	-0.0117	-0.0127	-0.0233	-0.0324	-0.033	-0.0374
ln(migration inflows$_t$)			0.0539***	0.0541***	-0.0722*	-0.0637*	-0.230***
			-0.00472	-0.00476	-0.0369	-0.038	-0.0452
$\ln y_{it-1}$* ln(migration inflows$_t$)					0.0171***	0.0193***	0.0419***
					-0.00506	-0.00524	-0.00626
R^2	0.27	0.59	0.619	0.619	0.621	0.623	0.636
	Outome: Night lights						
ln (Lights$_{t-1}$)	-0.123***	-0.0561***	-0.0861***	-0.0411***	-0.0945***	-0.0838***	-0.107***
	-0.00783	-0.00723	-0.0075	-0.00694	-0.0196	-0.0193	-0.0207
ln(migration inflows$_t$)			0.0594***	0.0249***	0.0130*	-0.019	-0.0237*
			-0.00494	-0.00514	-0.0073	-0.0122	-0.0127
$\ln y_{it-1}$* ln(migration inflows$_t$)					0.00946***	0.00696**	0.0112***
					-0.00303	-0.003	-0.00323
R^2	0.0865	0.198	0.243	0.344	0.347	0.352	0.354
Controls							
Schooling$_{t-1}$	No	Yes	Yes	Yes	Yes	Yes	Yes
Time effect	No	No	No	Yes	Yes	Yes	Yes
Urbanization rate$_{t-1}$	No	No	No	No	No	Yes	Yes
Average Population$_{t-1}$	No	No	No	No	No	Yes	Yes
Type of FT dummies	No	No	No	No	No	No	Yes
Observations	2,321	2,321	2,321	2,321	2,321	2,321	2,321

Source: Authors' calculations using data from the 1990, 2000 and 2010 Population and Housing Censuses, INEGI, World Bank SAE Estimates and the U. S. National Oceanic and Atmospheric Administration.

Table 4. IV estimates of the Convergence equation IV gravity model

	-1	-2	-3	-4	-5
$\ln y_{it-1}$	-0.707***	-0.703***	-0.787***	-0.774***	-0.909***
	-0.013	-0.0233	-0.029	-0.0309	-0.0346
ln(migration inflows$_t$)	0.0445***	0.0448***	-0.111***	-0.110**	-0.300***
	-0.00532	-0.00539	-0.0399	-0.0432	-0.0514
$\ln y_{it-1}$* ln(migration inflows$_t$)			0.0211***	0.0186***	0.0458***
			-0.00535	-0.0058	-0.00691
F- first stages					
ln(migration inflows$_t$)	9,133.98	10,030.18	6,187.12	640.93	650.88
$\ln y_{it-1}$* ln(migration inflows$_t$)				701.74	707.73
ln (Lights$_{t-1}$)	-0.0984***	-0.0524***	-0.0912***	-0.105***	-0.129***
	-0.00788	-0.00734	-0.02	-0.0212	-0.0231
ln(migration inflows$_t$)	0.0838***	0.0434***	0.0346***	0.0706***	0.0732***
	-0.00566	-0.00597	-0.008	-0.021	-0.0208
$\ln y_{it-1}$* ln(migration inflows$_t$)			0.00690*	0.00916**	0.0137***
			-0.00311	-0.00325	-0.00359
F- first stages					
ln(migration inflows$_t$)	9,368.46	6,968.77	3,534.08	356.78	372.25
$\ln y_{it-1}$* ln(migration inflows$_t$)			3,302.38	2,059.61	1,441.91
Controls					
Schooling$_{t-1}$	Yes	Yes	Yes	Yes	Yes
Time effect	No	Yes	Yes	Yes	Yes
Urbanization rate$_{t-1}$	No	No	No	Yes	Yes
Average Population$_{t-1}$	No	No	No	Yes	Yes
Type of FT dummies	No	No	No	No	Yes
Observations	2,321	2,321	2,321	2,321	2,321

Source: Authors' calculations using data from the 1990, 2000 and 2010 Population and Housing Censuses, INEGI, World Bank SAE Estimates and the U. S. National Oceanic and Atmospheric Administration.

Table 5. IV estimates of the Convergence equation IV2

	-1	-2	-3	-4	-5
Iny_{it-1}	-0.720***	-0.711***	-0.807***	-0.841***	-0.960***
	-0.0132	-0.0236	-0.0375	-0.0379	-0.0453
In(migration inflows$_t$)	0.0587***	0.0586***	-0.116**	-0.132**	-0.301***
	-0.00647	-0.00647	-0.0517	-0.0518	-0.0642
Iny_{it-1}* In(migration inflows$_t$)			0.0238***	0.0310***	0.0545***
			-0.00677	-0.00657	-0.00833
		F- first stages			
In(migration inflows$_t$)	1,200.95	1,233.62	733.98	237.55	241.11
Iny_{it-1}* In(migration inflows$_t$)			765.17	262.22	257.88
In (Lights$_{t-1}$)	-0.0762***	-0.0324***	-0.110***	-0.0886***	-0.118***
	-0.00782	-0.0078	-0.0232	-0.0213	-0.0237
In(migration inflows$_t$)	0.0399***	0.0105	-0.00309	-0.0536*	-0.0549*
	-0.00776	-0.00832	-0.0114	-0.0236	-0.0238
Iny_{it-1}* In(migration inflows$_t$)			0.0134***	0.00838*	0.0138***
			-0.00404	-0.00347	-0.00394
		F- first stages			
In(migration inflows$_t$)	1,229.88	1,143.79	638.59	238.55	239.42
Iny_{it-1}* In(migration inflows$_t$)			684.19	952.29	605.17
		Controls			
Schooling$_{t-1}$	Yes	Yes	Yes	Yes	Yes
Time effect	No	Yes	Yes	Yes	Yes
Urbanization rate$_{t-1}$	No	No	No	Yes	Yes
Average Population$_{t-1}$	No	No	No	Yes	Yes
Type of FT dummies	No	No	No	No	Yes
Observations	2,321	2,321	2,321	2,321	2,321

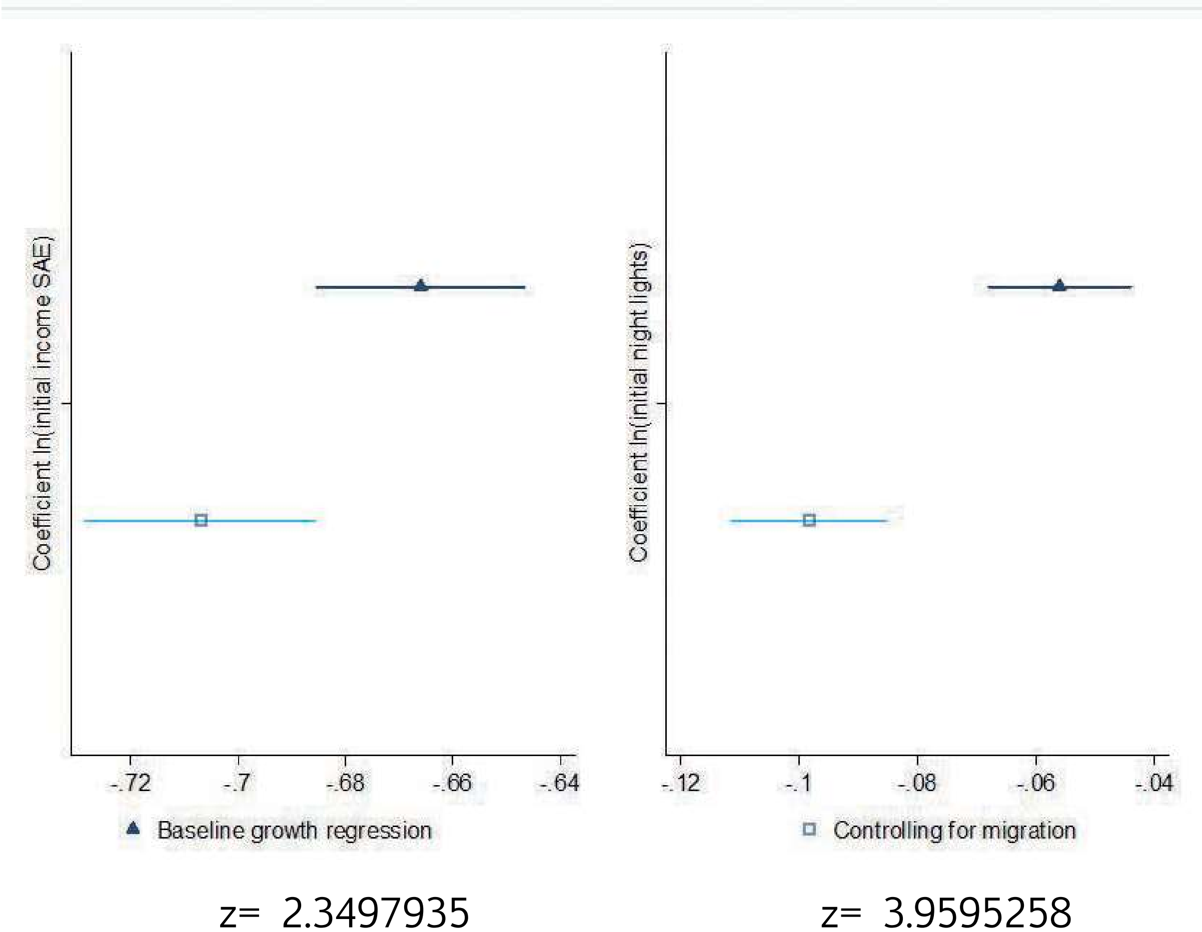
Source: Authors' calculations using data from the 1990, 2000 and 2010 Population and Housing Censuses, INEGI, World Bank SAE Estimates and the U. S. National Oceanic and Atmospheric Administration.

Table 6. IV estimates of the Convergence equation: Overidentified model					
	-1	-2	-3	-4	-5
$\ln y_{it-1}$	-0.707***	-0.703***	-0.795***	-0.802***	-0.942***
	-0.013	-0.0233	-0.0288	-0.0316	-0.0363
ln(migration inflows$_t$)	0.0445***	0.0448***	-0.119***	-0.114**	-0.318***
	-0.00532	-0.00539	-0.0392	-0.0449	-0.0545
$\ln y_{it-1}$* ln(migration inflows$_t$)			0.0225***	0.0236***	0.0520***
			-0.00526	-0.0061	-0.00743
F- first stages					
ln(migration inflows$_t$)	4,573.07	5,026.96	3,659.44	500.22	510.33
$\ln y_{it-1}$* ln(migration inflows$_t$)			3,978.55	531.45	538.65
Sargan	0.33	0.3326	0	0	0
ln (Lights$_{t-1}$)	-0.0984***	-0.0524***	-0.0913***	-0.105***	-0.135***
	-0.00788	-0.00734	-0.02	-0.0212	-0.0225
ln(migration inflows$_t$)	0.0838***	0.0434***	0.0346***	0.0706***	-0.0542*
	-0.00565	-0.00596	-0.00799	-0.0209	-0.0236
$\ln y_{it-1}$* ln(migration inflows$_t$)			0.00690*	0.00916**	0.0168***
			-0.00311	-0.00325	-0.00359
F- first stages					
ln(migration inflows$_t$)	4695.12	3493.71	1781.15	185.15	129.13
$\ln y_{it-1}$* ln(migration inflows$_t$)			1834.48	1125.19	708.86
Sargan	0.3762	0.4681	0.3688	0.3957	0.295
Controls					
Schooling$_{t-1}$	Yes	Yes	Yes	Yes	Yes
Time effect	No	Yes	Yes	Yes	Yes
Urbanization rate$_{t-1}$	No	No	No	Yes	Yes
Average Population$_{t-1}$	No	No	No	Yes	Yes
Type of FT dummies	No	No	No	No	Yes
Observations	2,321	2,321	2,321	2,321	2,321

Source: Authors' calculations using data from the 1990, 2000 and 2010 Population and Housing Censuses, INEGI, World Bank SAE Estimates and the U. S. National Oceanic and Atmospheric Administration.

FIGURE 9

Coefficients of Baseline growth regression vs. controlling for migration[6]

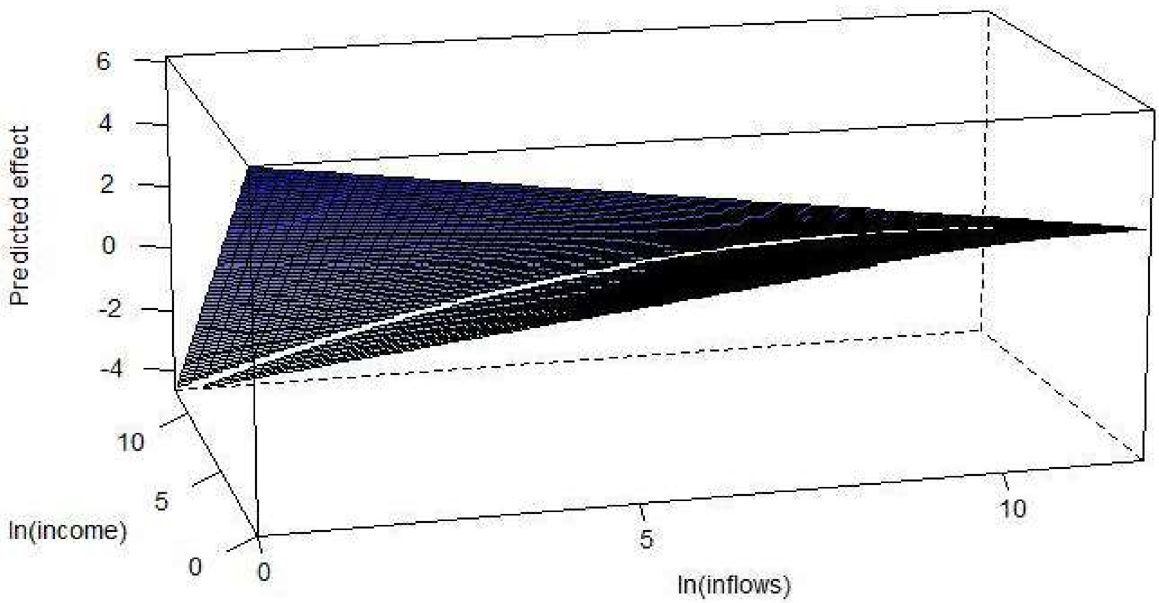


*Calculations use the coefficients from an OLS regression of growth controlling for schooling, and an estimation controlling for schooling and instrumenting migration inflows using the results from the gravity model and the instrument based on networks. Source: Authors' calculations with data from the 1990, 2000 and 2010 Population and Housing Censuses, INEGI, World Bank SAE Estimates, and the U. S. National Oceanic and Atmospheric Administration.

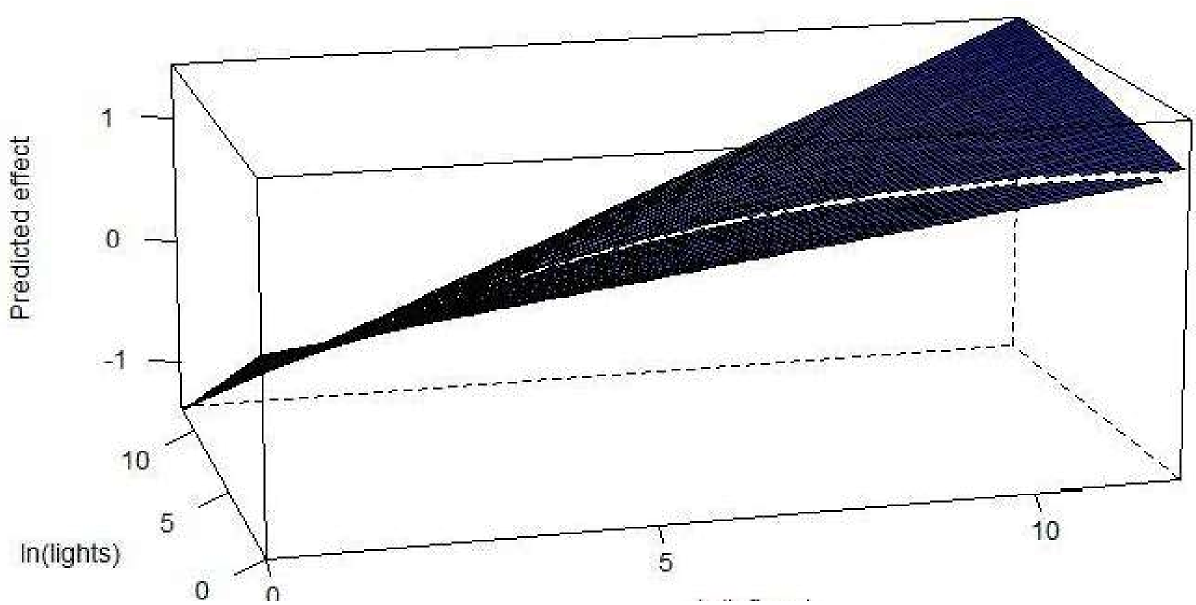
[6] We test the difference between coefficients of the convergence terms using a z-test $z = \frac{\widehat{\beta_1} - \widehat{\beta_2}}{\sqrt{se(\widehat{\beta_1})^2 + se(\widehat{\beta_2})^2}}$

FIGURE 10
Predicted growth from IV estimates (interacted model)

(a) Predicted growth (SAEs)



(b) Predicted growth (Night lights)

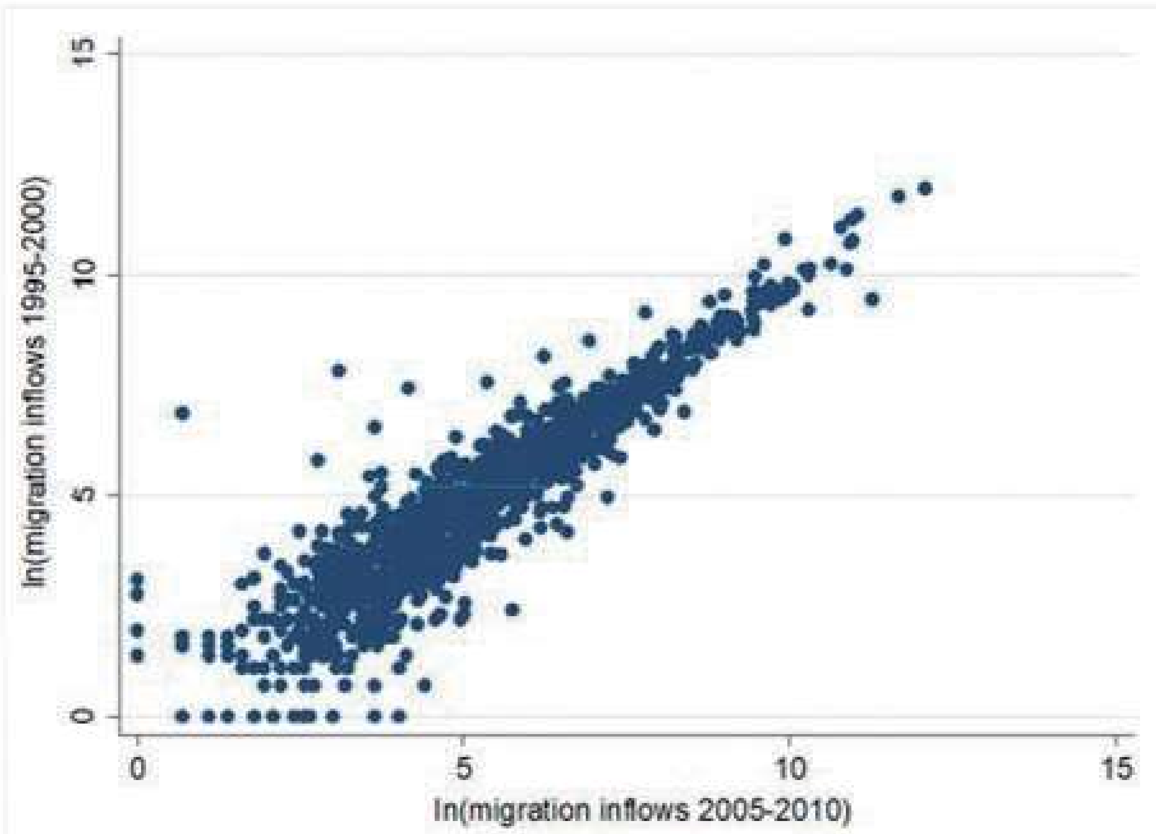


Source: Authors' calculations with data from the 1990, 2000 and 2010 Population and Housing Censuses, INEGI, World Bank SAE Estimates and the U. S. National Oceanic and Atmospheric Administration.

It is important to note that even though we have a panel, none of the regressions shown include fixed effects. The main reason behind this, following Barro (2012), is that we aim at estimating a coefficient over the migration variable with precision and, as mentioned by this author when there is little within variation in the explanatory variable, coefficients cannot be estimated with precision. As Figure 11 shows, this is the case of migration inflows, which are the main interest of this paper.

FIGURE 11

Relation between migration inflows 1995-2000 and 2005-2010



Source: Authors' calculations with data from the 2000 and 2010 Population and Housing Censuses.

6.1. Robustness tests

Considering the mixed results observed regarding migration inflows in the case of the night lights outcome, we estimated quantile regressions to analyze if the effects vary across the growth distribution.[7] The quantile regression estimates indicate heterogeneity, depending on the distribution of growth, as the coefficients associated with migration inflows are positive in the left tail of the distribution and end up being negative on the right tail of the growth distribution (See Figure 12). In the case of the interaction, it starts around zero, and the positive coefficient increases across the growth quantiles. That is, the divergent effect of migration is higher for high-growth functional territories. Finally, the convergence term appears to be almost constant in the case of the SAE income, while it increases in absolute terms (indicating a higher level of convergence) for the night-lights outcome variable.

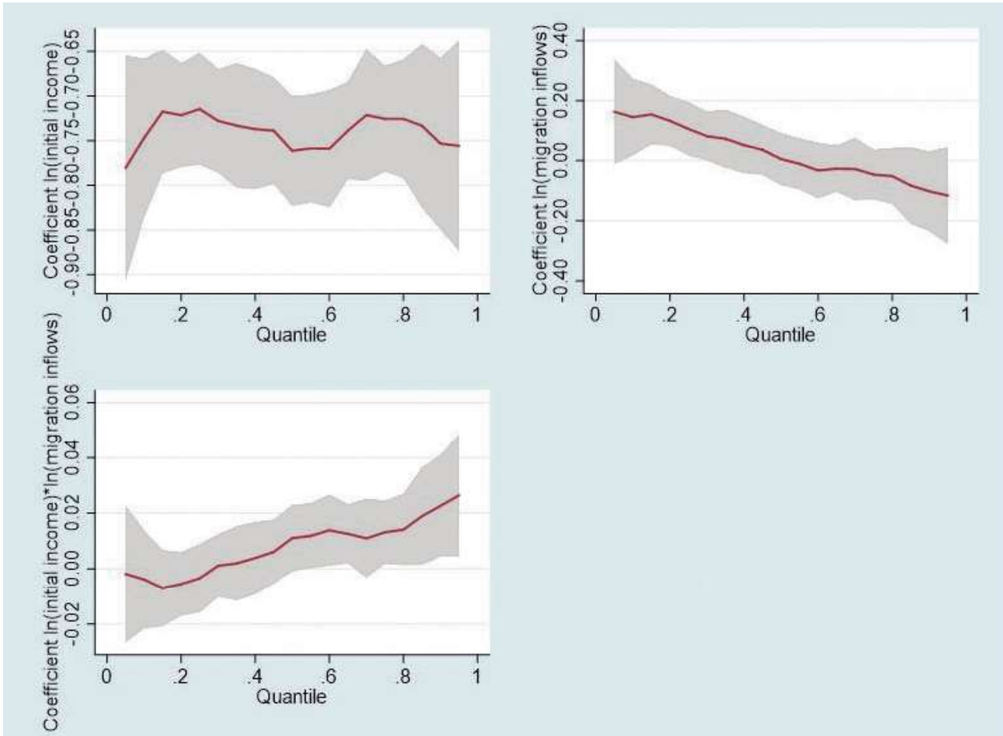
As an additional robustness test, we estimated similar specifications but splitting the sample between territories with high and low migration (defined as functional territories with migration above and below the median, respectively). First, as shown in Appendix C, Table C1, we find that convergence is higher among territories with low migration. Secondly, the divergent effect of migration (captured by the interaction) is higher for territories with low migration. In the case where the SAE income is the outcome variable, migration inflows, by themselves, have a negative and robust effect in the interacted model for low-migration territories, while for high-migration territories, the coefficient is much lower and even non-significant in some specifications. Similar to the results for the whole sample, migration inflows have positive coefficients when the outcome is night lights and they don't differ much between the two groups.

[7] Results of this estimates are not shown here, but are available upon request.

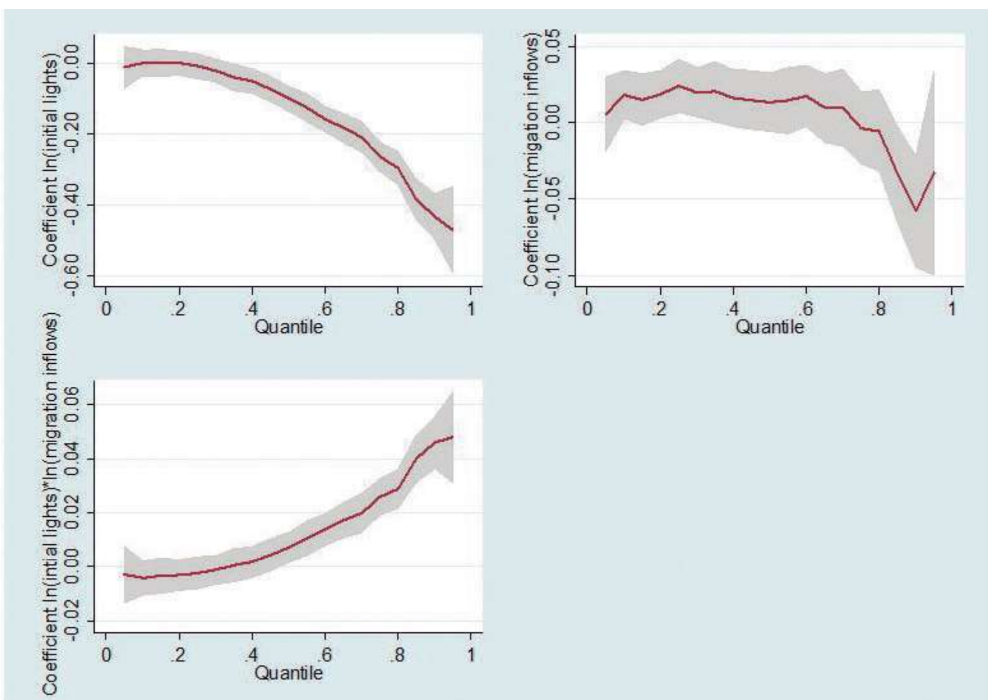
FIGURE 12

Coefficients of quantile regressions including interaction

(a) Income (Small Area Estimates)



(b) Night lights



Source: Authors' calculations using data from the 2000 and 2010 Population and Housing Censuses, INEGI.
*Note: Results from quantile regression controlling for education, urbanization rate, and initial population.

7. Concluding remarks

Regional inequalities are a concern for policy-makers, because they affect the well-being and opportunities of dwellers of marginalized territories, and may also hinder the aggregate economic growth of a country. Internal migration is primarily induced by differences in living standards across space, but also has an impact on those differences over time. In neoclassical growth models, internal migration is an adjustment mechanism towards regional convergence in incomes and wellbeing. In endogenous growth and new economic geography models, on the other hand, which allow for increasing returns and positive externalities from skill accumulation, internal migration can be a mechanism of regional divergence instead of convergence. This is reinforced if, as is typically found, positive selection of migrants prevails, because an inflow of skilled labor to a richer region increases, rather than decreasing, the real wage at the destination, and reduces real wages at the origin.

This paper investigated whether internal migration has any long-term effects on conditional convergence across regions in Mexico. Internal migration is an important phenomenon in Mexico, as in 2010 almost twenty million people (18 percent of the population) were living in a different state from where they were born, versus about 12 percent of the population who migrated internationally. Mexico is also characterized by severe regional inequalities, which appear to have widened over the last three decades, after a period of regional convergence between 1940 and 1985. We estimated a conditional regional convergence equation, measuring the impact of internal migration on income growth in a panel of functional territories for the period 2000-2010 instrumenting migration by estimating a gravity model of internal migration between pairs of territories and aggregating these data to construct a predicted migration inflow for each territory. As an alternative instrument, we used networks interacted with the distance between territories as an exogenous estimate of internal migration inflows. The results suggest that, over the period between 2000 and 2010, internal migration has not contributed to regional convergence in Mexico. Instead, we find that growth is faster in richer places that receive larger migration inflows.

Possible extensions for this analysis include generating a regression-adjusted measure of income based on wages, which could be more correlated with the labor market as well as analyzing further the heterogeneity found with quantile regressions.

In terms of policy recommendations, our results indicate that migration is not going to be a mechanism of adjustment that will reduce regional inequality by itself, but on the contrary, it can enhance already divergent paths. Therefore, it is important to design policies at the regional level to foster growth in lagged regions.

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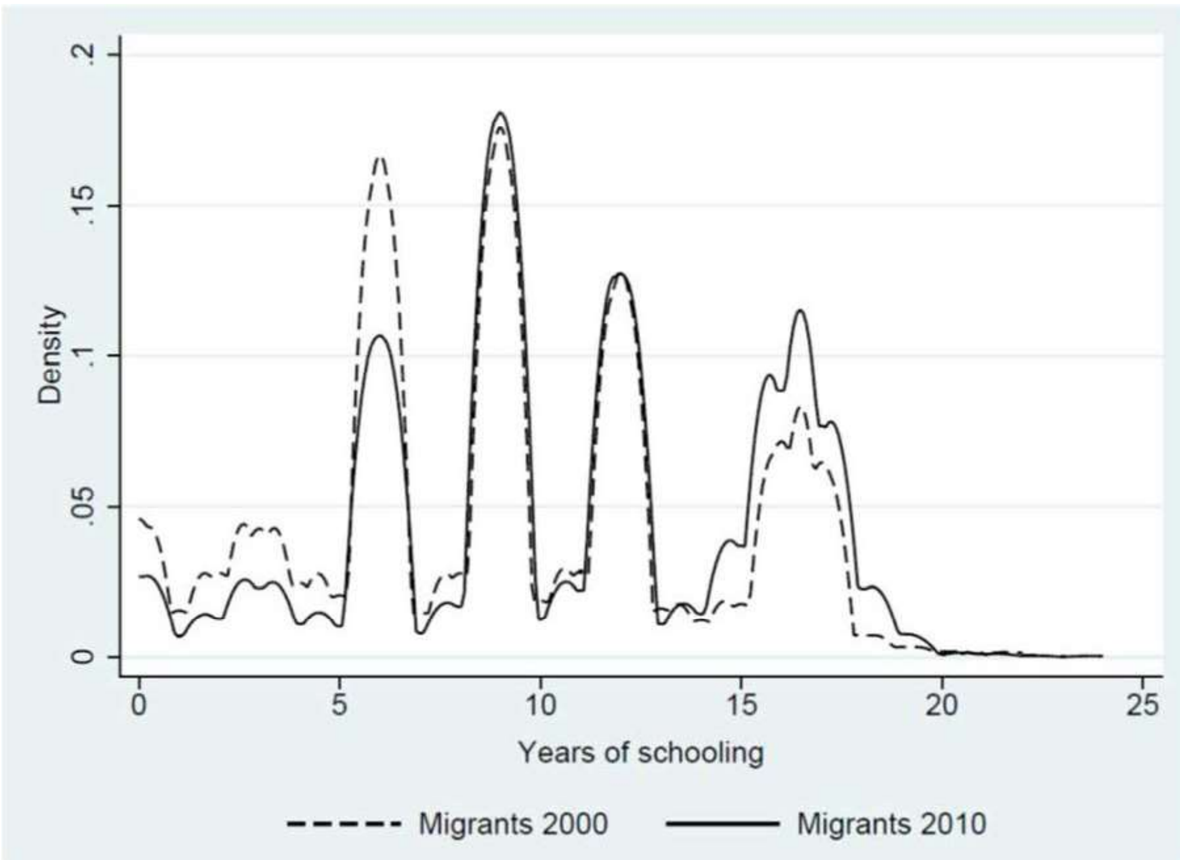
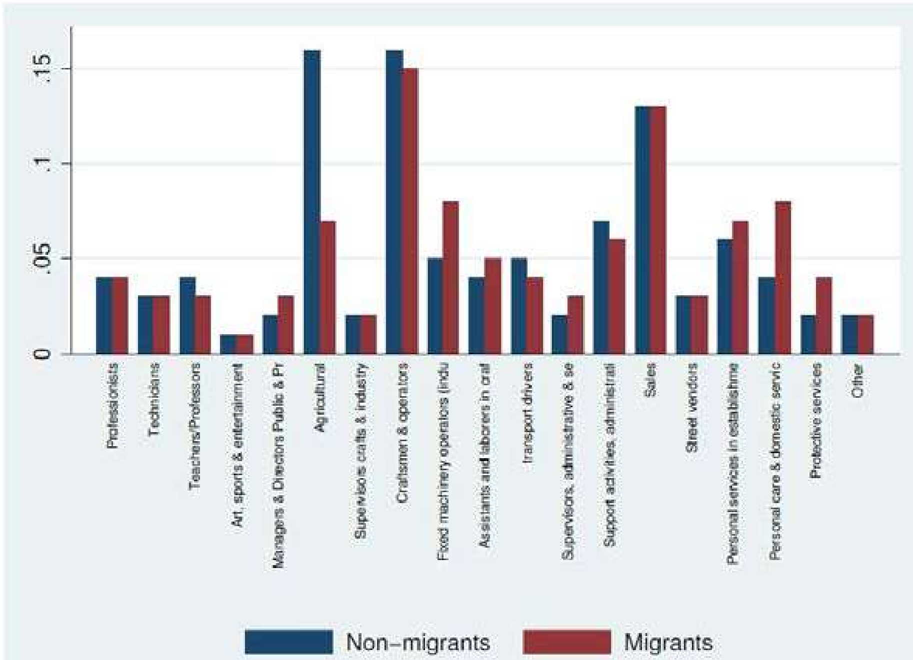
APPENDIX A
CHARACTERISTICS OF MIGRANTS

FIGURE A1
Kernel density schooling of migrants aged 25-66

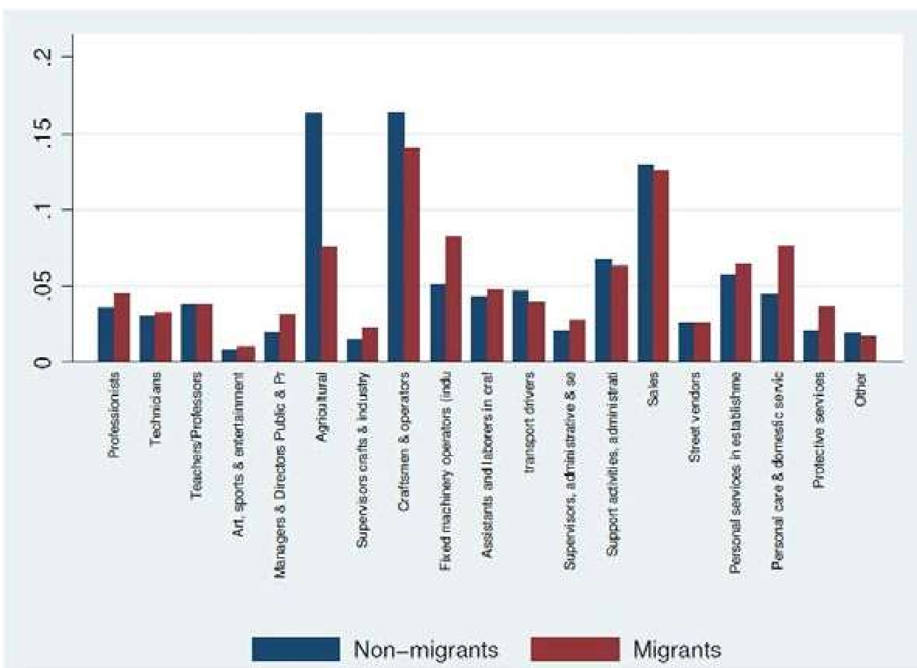


Source: Authors' calculations using data from the 2010 Population and Housing Census, INEGI.

FIGURE A2
Occupations distribution: 1995-2000
(a)State



(b) Functional territory

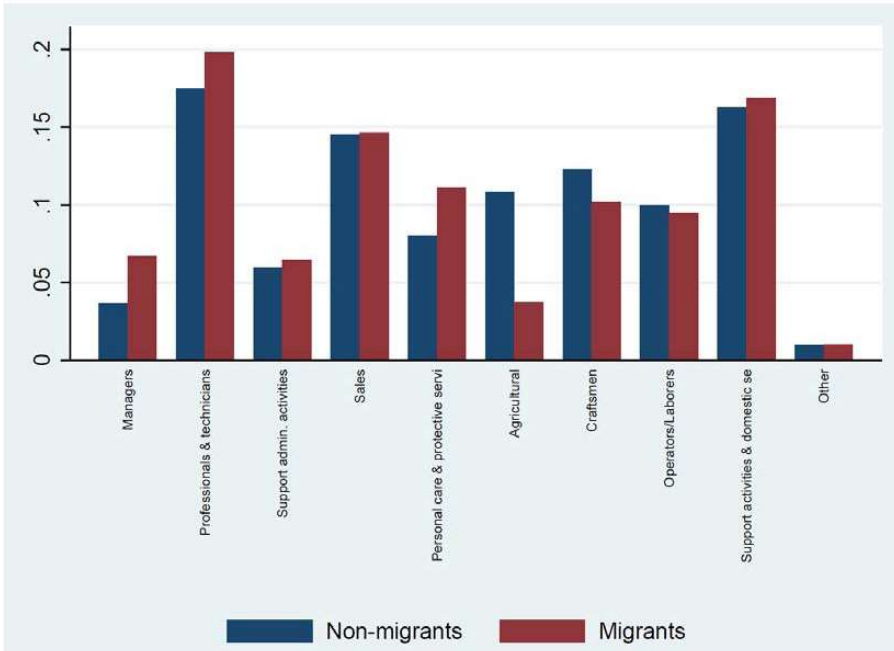


Source: Authors' calculations using data from the 2010 Population and Housing Censuses, INEGI.

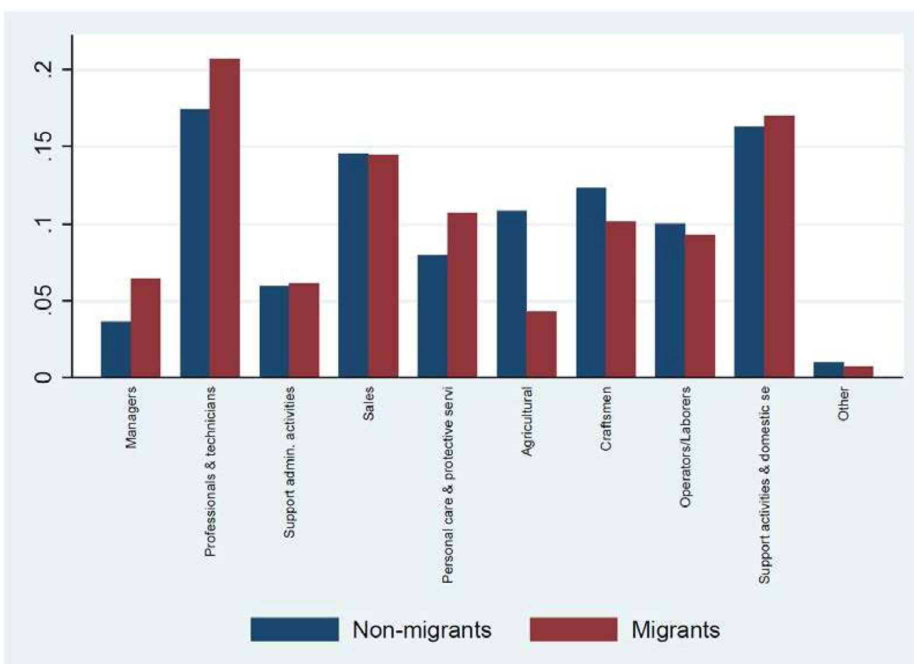
FIGURE A3

Occupations distribution: 2005-2010

(a) State



(b) Functional territory



Source: Authors' calculations using data from the 2010 Population and Housing Censuses, INEGI.

Table A1: Characteristics of migrants: State level 2020						
		Non-migrants (A)	Inflow (B)	Diff (B-A)	Outflow (C)	Diff (C-A)
Aguascalientes	Age	40.93	37.28	-3.64	36.80	-4.13
	Schooling	9.25	11.51	2.26	11.41	2.16
	% Male	0.47	0.51	0.03	0.48	0.00
Baja Califormia	Age	40.78	36.68	-4.1	37.36	-3.42
	Schooling	9.44	9.11	-0.33	9.41	-0.03
	% Male	0.50	0.51	0.01	0.55	0.05
Baja California Sur	Age	41.35	36.75	-4.59	37.28	-4.07
	Schooling	9.77	10.78	1.01	10.39	0.62
	% Male	0.50	0.57	0.07	0.59	0.08
Campeche	Age	41.02	36.13	-4.89	36.84	-4.18
	Schooling	8.58	11.23	2.65	10.68	2.1
	% Male	0.48	0.55	0.07	0.52	0.04
Coahuila	Age	41.32	37.63	-3.69	37.39	-3.93
	Schooling	9.56	11.41	1.85	10.89	1.33
	% Male	0.49	0.52	0.03	0.55	0.06
Colima	Age	41.43	38.32	-3.11	36.96	-4.48
	Schooling	9.15	10.14	0.99	10.98	1.83
	% Male	0.49	0.51	0.02	0.53	0.04
Chiapas	Age	40.58	35.95	-4.63	35.33	-5.25
	Schooling	6.17	10.44	4.27	8.88	2.7
	% Male	0.48	0.54	0.06	0.5	0.02
Chihuahua	Age	41.32	37.88	-3.44	37.12	-4.2
	Schooling	8.93	10.41	1.49	9.77	0.85
	% Male	0.48	0.53	0.05	0.55	0.07
Distrito Federal	Age	42.4	36.8	-5.6	39.08	-3.32
	Schooling	11.03	12.4	1.36	11.31	0.28
	% Male	0.46	0.49	0.03	0.5	0.04
Durango	Age	41.58	37.25	-4.34	36.6	-4.98
	Schooling	8.7	9.24	0.54	9.69	0.99
	% Male	0.48	0.55	0.07	0.47	0
Guanajuato	Age	40.99	37.97	-3.02	37.08	-3.91
	Schooling	7.71	11.3	3.59	10.85	3.15
	% Male	0.46	0.53	0.07	0.49	0.02
Guerrero	Age	41.5	37.34	-4.16	36.44	-5.06
	Schooling	7.26	9.58	2.31	9.72	2.45
	% Male	0.47	0.54	0.07	0.49	0.03
Hidalgo	Age	41.56	37.77	-3.79	36.48	-5.07
	Schooling	8.01	10.12	2.11	10.23	2.22
	% Male	0.46	0.49	0.03	0.5	0.03
Jalisco	Age	41.23	37.32	-3.92	36.81	-4.42
	Schooling	8.87	10.96	2.08	11.23	2.36
	% Male	0.47	0.51	0.04	0.52	0.05
México	Age	41.03	37.96	-3.08	37.9	-3.14
	Schooling	9.06	10.64	1.58	10.82	1.75
	% Male	0.47	0.49	0.02	0.5	0.02
Michoacán	Age	41.51	39.11	-2.4	36.61	-4.89
	Schooling	7.37	10.01	2.64	10.01	2.65
	% Male	0.47	0.51	0.04	0.52	0.05

Table A1: Characteristics of migrants: State level 2020							
		Non-migrants (A)	Inflow (B)	Diff (B-A)	Outflow (C)	Diff (C-A)
Morelos	Age	42.2	40.63	-1.57	37.72	-4.49
	Schooling	9.19	11	1.81	11.08	1.89
	% Male	0.46	0.5	0.04	0.48	0.02
Nayarit	Age	41.8	36.95	-4.85	37.11	-4.69
	Schooling	8.72	9.83	1.11	10.02	1.3
	% Male	0.48	0.52	0.04	0.5	0.02
Nuevo León	Age	41.17	36.02	-5.15	36.27	-4.9
	Schooling	10.09	11.17	1.08	12.1	2.01
	% Male	0.5	0.49	0	0.55	0.06
Oaxaca	Age	41.75	37.41	-4.35	36.42	-5.34
	Schooling	6.77	9.04	2.27	9.04	2.27
	% Male	0.46	0.51	0.05	0.48	0.02
Puebla	Age	41.15	37.69	-3.46	35.61	-5.54
	Schooling	7.86	9.93	2.06	10.49	2.63
	% Male	0.46	0.49	0.03	0.51	0.05
Queretero	Age	40.48	38.21	-2.27	36.68	-3.8
	Schooling	9	12.24	3.25	12.36	3.36
	% Male	0.47	0.47	0	0.51	0.03
Quintana Roo	Age	39.59	35.84	-3.75	36.88	-2.71
	Schooling	9	10.66	1.66	10.53	1.54
	% Male	0.5	0.52	0.02	0.56	0.05
San Luis Potosí	Age	41.62	37.15	-4.47	36.32	-5.3
	Schooling	8.36	10.74	2.38	10.22	1.86
	% Male	0.47	0.49	0.02	0.48	0.01
Sinaloa	Age	41.9	37.06	-4.84	36.9	-5
	Schooling	9.17	10.09	0.92	10.19	1.02
	% Male	0.49	0.53	0.04	0.5	0.02
Sonora	Age	41.55	37.57	-3.97	37.64	-3.91
	Schooling	9.55	10.35	0.8	10.59	1.04
	% Male	0.49	0.56	0.06	0.52	0.03
Tabasco	Age	40.86	36.2	-4.66	36.28	-4.58
	Schooling	8.77	11.28	2.51	10.59	1.83
	% Male	0.48	0.51	0.03	0.54	0.06
Tamaulipas	Age	41.38	36.93	-4.45	36.59	-4.78
	Schooling	9.35	9.8	0.46	10.63	1.29
	% Male	0.48	0.51	0.03	0.52	0.04
Tlaxcala	Age	40.68	37.5	-3.18	36.89	-3.78
	Schooling	8.84	10.3	1.46	10.46	1.62
	% Male	0.46	0.5	0.04	0.46	0
Veracruz	Age	42.17	37.2	-4.97	36.58	-5.59
	Schooling	7.67	9.74	2.07	9.92	2.25
	% Male	0.46	0.52	0.06	0.49	0.03
Yucatan	Age	41.42	37.91	-3.51	36.32	-5.09
	Schooling	8.1	11.24	3.13	11.1	3
	% Male	0.48	0.53	0.05	0.51	0.03
Zacatecas	Age	41.42	37.02	-4.39	37	-4.41
	Schooling	8.05	9.88	1.83	9.95	1.9
	% Male	0.47	0.51	0.04	0.5	0.02

Source: Authors' calculations using data from the Population and Housing Census 2010, INEGI.
*p<0.10, **p<0.05 ***p<0.1

APPENDIX B
RESULTS OF THE GRAVITY MODEL OF MIGRATION FLOWS

Table B1: Gravity model migration flows 2000-2010

Dependent variable: migration flows	2000	2010
ln(distance)	-0.905***	-0.947***
	-0.0374	-0.0473
$ln(distance)^2$	0.0397***	0.0430***
	-0.00345	-0.00429
$ln(per-capita\ income\ destination_{t-1})$	-0.527***	-0.495***
	-0.00517	-0.00624
$ln(per-capita\ income\ origin_{t-1})$	0.274***	0.132***
	-0.0195	-0.0235
ln(stock of migrants)	0.0244***	0.0168***
	-0.00221	-0.00254
Neighbors dummy	0.299***	0.231***
	-0.0498	-0.0607
Schooling destination	0.223***	0.234***
	-0.00444	-0.00614
Income real growth destination	0.0778***	-0.0246***
	-0.0047	-0.00577
Income real growth origin	-0.0381***	0.00587
	-0.00608	-0.00652
Mexico city is the origin	-0.0404*	0.0907***
	-0.0231	-0.0271
Mexico city is the destination	-0.283***	-0.339***
	-0.0284	-0.028
Dummy U.S. border destination	0.418***	0.455***
	-0.0229	-0.024
Dummy U.S. border origin	0.205***	0.0430*
	-0.0214	-0.025
$ln(Population_{t-1}\ origin)$	0.603***	0.491***
	-0.0163	-0.0199
Temperature destination	0.0292***	0.0353***
	-0.00218	-0.0026
Temperature origin	0.0252***	0.0441***
	-0.00226	-0.00267
ln(precipitations destination)	-0.327***	-0.271***
	-0.0177	-0.0187
ln(precipitations origin)	-0.158***	-0.159***
	-0.0157	-0.0183
R^2	0.476	0.371
N	47739	39166

Source: Authors' calculations using data from the 1990, 2000 and 2010 Population and Housing Censuses, SIMBAD, INEGI, World Bank SAE Estimates and the U. S. National Oceanic and Atmospheric Administration.

As Table B1 shows, the gravity model has the expected signs in the case of distance as when the distance increases, migration reduces but at an increasing rate, but at an increasing rate. On the other hand, the effects of initial income are counter-intuitive as a higher income in the functional territory of origin increases migration flows while the opposite occurs with the income of the territory of destination. This result could be due to our unit of observation as individuals could prefer moving to the periphery instead of living in territories where economic activity is high.

The rest of the variables have the expected effects over migration flows. An interesting result is the one observed for the Mexico City dummy as results change from the 2000 regression to the 2010 regression. This could be because there are incentives to decentralize activity from the Capital of the country to other cities.

APPENDIX C

RESULTS OF SPLIT REGRESSION OF MIGRATION ABOVE AND BELOW THE MEDIAN

Appendix C: Results of split regression of Migration above and below the median

Table C1: Migration above and below the median

	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10
	Migration below the median					Migration above the median				
Iny_{it-1}	-0.764***	-0.731***	-1.100***	-1.088***	-1.081***	-0.605***	-0.625***	-0.740***	-0.738***	-0.870***
	-0.0177	-0.0318	-0.0724	-0.0737	-0.0732	-0.0157	-0.0302	-0.0785	-0.0806	-0.1
In(migration inflows$_t$)	0.0257**	0.0273**	-0.729***	-0.740***	-0.682***	-0.000922	-0.0041	-0.145	-0.154	-0.330**
	-0.0129	-0.0127	-0.137	-0.138	-0.138	-0.00871	-0.00848	-0.0917	-0.105	-0.13
Iny_{it-1}* In(migration inflows$_t$)			0.108***	0.107***	0.0997***			0.018	0.0162	0.0364**
			-0.0196	-0.0198	-0.0198			-0.0116	-0.0119	-0.0153
F- first stages										
In(migration inflows$_t$)	1617.94	1809.32	1094.45	343.78	353.19	3651.53	3526.38	2045.15	202.13	159.15
Iny_{it-1}* In(migration inflows$_t$)			1104.55	342.88	352.54			2275.86	278.14	202.41
In(Lights$_{t-1}$)	-0.139***	-0.0717***	-0.131*	-0.152**	-0.156**	-0.0665***	-0.0331***	0.0224	0.0429	0.0219
	-0.014	-0.0126	-0.053	-0.0563	-0.0566	-0.00815	-0.00791	-0.0368	-0.0395	-0.0412
In(migration inflows$_t$)	0.104***	0.0819***	0.0702**	0.0930**	0.0964**	0.107***	0.0389***	0.0556***	0.133***	0.164***
	-0.0168	-0.0158	-0.0223	-0.0317	-0.0314	-0.00792	-0.00895	-0.0143	-0.0351	-0.0387
In(Lights$_{t-1}$)* In(migration			0.0163	0.0219	0.0219			-0.00786	-0.0113*	-0.00859
			-0.014	-0.0147	-0.0147			-0.00485	-0.00536	-0.00567
F- first stages										
In(migration inflows$_t$)	1464.06	1445.58	726.27	217.52	225.61	3694.42	2263.26	1174.9	148.79	122.51
Iny_{it-1}* In(migration inflows$_t$)			262.27	136.91	144.09			1017.69	625.18	520.91
Controls										
Schooling$_{t-1}$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time effect	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Urbanization rate$_{t-1}$	No	No	No	Yes	Yes	No	No	No	Yes	Yes
Average population$_{t-1}$	No	No	No	Yes	Yes	No	No	No	Yes	Yes
Type of FT dummies	No	No	No	No	Yes	No	No	No	No	Yes
Observations	1151	1151	1151	1151	1151	1170	1170	1170	1170	1170

Source: Authors' calculations using data from the 1990, 2000 and 2010 Population and Housing Censuses, SIMBAD, INEGI, World Bank SAE Estimates and the U. S. National Oceanic and Atmospheric Administration.