Cities' Productivity and High-Skilled Workers' Segregation

Preprint · January 2020

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Abstract

The goal of this investigation is to study, empirically, the effect of high-skilled workers —workers with a university degree— segregation on cities' labor productivity. Using data for USA Metropolitan Areas we find evidence of a positive impact. Exploring possible mechanisms, we find that clusters of high-skilled workers produce positive spillovers on high-skilled workers productivity that more than compensate for the low-skilled workers' productivity loss due to their exclusion. The latter is particularly valid in cities specialized in industries where the complementary between these two kinds of workers in the city production function is low, like technology or sciences. We use panel data and IV approach as identification strategy. Results are robust to different specifications.

1 Introduction

What is the effect of high-skilled workers segregation on cities production? The aim of this investigation is to find an answer to this question. High-Skilled Workers are understood as workers with a college degree. Using census data for USA's Metropolitan Areas and cities ruggedness as an instrument, we found a positive impact of this kind of segregation on cities' labor productivity. Additionally we found evidence on the fact that this result if driven by the positive impact of High Skilled workers segregation on productivity of cities specialized in technological industry. We argue that the underlying mechanism is the relationship between human capital's complementarities at local level and the global labor market complementarities. If High and Low skilled workers complementarities at global level are less important than High Skilled workers local positive feedbacks on human capital acquisition, we should observe that labor productivity is increasing with segregation, but if the city production function needs both type of workers then segregation will harm productivity because Low Skilled workers can not take advantage of the positive spillovers that High Skilled workers agglomeration produces.

The vast majority of research on residential segregation has been focused on its negative effects on individuals well-being, which arise in the presence of the spatial concentration of vulnerables households, such as low income families or minorities. Good examples of these investigations are Cutler and Glaeser (1997), Bayer et al. (2004), Ananat (2011) and Chetty et al. (2016). The latter is particularly interesting because, focusing on Moving to Opportunity experiment[1] recipient households' children outcomes, found that after a threshold of 11 years living in a segregated neighbourhood, segregation effects are irreversibles, what explains why some articles about this subject using Moving to Opportunity experiment's data for teenagers and adults conclude that segregation has just minor effects, mainly on mental health —see for instance Kling and Liebman (2004), Kling et al. (2005) and Kling et al. (2007)—.

However, segregation has positive consequences as well, particularly when better-offs are the one that live segregated, whom look for sort themselves out. Reasons for acting this way are, for example, sharing similar problems or needs, or taking advantages of peer effects and social interactions: a good neighbourhood provides not just nice houses but a good provision of public goods, good schools and good neighbours for building social networks as well. Literature talks about specialized neighbourhoods which are places where individuals of a similar characteristic tend to be concentrated. These households gain from locating in specialized neighbourhoods with other complementary families, enriching social interaction and cultural opportunities, providing useful support networks and improving labour market access, i.e. agglomeration economies —benefits to households which arise from close proximity— appear to manifest themselves in specialized neighbourhoods.

Blau and Robins (1992) investigate on the role that informal networks play in the job

[1]The Moving to Opportunity Program was a randomized social experiment sponsored by the United States Department of Housing and Urban Development. Families who participate in the program were randomly assigned to 3 groups. One group received housing vouchers that could be used only in low-poverty areas for the first year. After a year, they could use their vouchers anywhere. One group received vouchers that could be used anywhere. A third group did not receive vouchers but remained eligible for any other government assistance. The program was implemented by public housing authorities in Baltimore, Boston, Chicago, Los Angeles, and New York City.

search process, finding that this method is the most successful way of getting a job. Additionally Ioannides and Loury (2004) point out that jobs that were found using personal contacts last longer. Bayer et al. (2008) show that people sharing neighbourhood tend to work in the same census block, besides they find that local social interactions have a significant impact on job locations and this impact is greater for neighbours of similar age, education and number of children.[2] Ananat (2011) studies the effects of racial segregation on inequality and she finds that segregation reduces inequality amongst white households. Coniglio (2003) works on the relationship between language and job opportunities and concludes that for those immigrants that are not able to talk the local language the fact of living in neighbourhoods where people of the same nationality or ethnic background live increases their productivity and income. Bayer et al. (2004) research about segregation drivers using San Francisco's bay census data, finding that in the case of Chinese individuals once they are able to speak english the propensity of neighbouring Chinese households is reduced, which means that meanwhile Chinese cannot speak english they use Chinese communities to get job opportunities.

Another source of benefits are human capital spillovers at local level. Benabou (1993) presents examples supporting this assumption. The first one has to do with fiscal externalities: if schools are financed using local resources, and if they provide a complementary input to individual effort, the return to studying will be higher in a richer community. The second example is related to peer effects in education: as long more students work hard in order to get into college, lower effort will be needed for generating a studious atmosphere and consequently easier will be for students to achieve their goal. The third example is related to role models: people with a good job in the neighbourhood teach to younger ones the value of education.[3]

All these positive effects make people willing to pay in order to segregate themselves. Bayer et al. (2016) found that an income increase of five-fold raises the willing to pay for one percent of white neighbours eight times.[4]

[2]Cheshire (2007) presents a literature review about these segregation's aspects.

[3]Following Manski (1993) taxonomy, the second example corresponds to endogenous peer effect, which arises when individuals imitate their peers behaviour, meanwhile the second one corresponds to the exogenous peer effect, which arise when peers' characteristics influence individuals behaviour.

[4]Forerunners of models that give a explanation of the precess that generates segregation when a sector of the population wants to live among peers and they are willing to pay in order to do it are border models due to Bailey (1959) and Rose-Ackerman (1975), local externalities models by Yinger (1976) and Schnare (1976) and global

As households able to choose their neighbourhood will enjoy segregation benefits for themselves and households that are not able to choose their place of living will suffer segregation negative consequences, it is a valid question if private location equilibria are socially efficient. One answer to this question is provided by Benabou (1993). This work proposes a model assuming as a key element of segregation aggregated consequences the interaction between local and global complementarities. In this model there are two groups of individuals which are assumed to be ex ante equal but that in the end differ in the level of education they choose, hence there will be high and low skilled workers (depending on the level of education). Local complementarities then have to do with the educational spillovers that arise at neighbourhood level: when high-skilled workers live concentrated education's costs are reduced —examples of situations where this could be the case were already given early on—.

Considering that the city's labor market is global, and its production function takes the constant returns to scale form, global complentarity implies that the city production function uses as inputs both High and Low skilled workers and independently of where workers lives, they will receive the same wage depending on their skill level. As High-skilled workers salary is higher than the one that Low-skilled workers receive and taking into account the fact the High-skilled workers benefit more from the neighbourhood effects that they produce than Low-skilled workers do, the former can crowd out Low-skilled workers paying a higher price.

The problem is that there is a missing market, because the price payed in the housing market is the same for High and Low skilled workers, meanwhile in a complete market High-skilled workers should pay a lower price due to the positive externalities that they produce on other workers. Consequently efficiency is not guaranteed. To explain how the latter can be to be the case Benabou (1993) consideres a situation where a benevolent social planner search to maximize total output minus education costs, which is split into a two parts problem, one is an output maximization problem and the other one is a cost minimization problem. In the former the planner chooses the aggregate amount of High-skilled workers and in the latter the location of them amongst two neighbourhood —the city in this model is made out of two neighbourhoods—. It turns out that the key element of this analysis is the convexity of the education cost. When the education cost is concave is efficient to have integrated neighbourhoods because this can happen because High skilled workers concentration in a given neighbourhood benefit not just High-skilled workers but it benefit Low-skilled workers

externalities models attributed to Yellin (1974), Papageorgiou (1978), Kanemoto (1980) and Ando (1981).

living in the same neighbourhood as well. As this externality is not internalized, it would became a source of inefficiency.[5]

The case where integration maximizes the total surplus of the city economy implies that both High and Low skilled workers are complements in a global sense i.e. this is the case no just in city production function but once education costs have been taken into account as well. However if this is not the case, and the education cost function is concave. the High skilled workers segregation will be efficient.

Benabou (1996) studies the dynamic aspect of socioeconomic segregation and concludes that integration slow down economic growth in the short run, but in the long run increases growth because it leads to a less unequal distribution of skills.

Despite the importance of these results little has been done in literature for testing them empirically. As it was previously discussed the relationship between segregation and productivity can be both positive and negative depending on what kind of complementarity prevails. So the first question that this investigation try to answer is: Does High-skilled workers residential segregation have a positive or negative effect on cities labor productivity? High-skilled workers are individuals with a college degree. For answering it we use census data samples for 144 Metropolitan Areas for years 2005 and 2015 obtained from IPUMS. As identification strategy we use instrumental variables. Specifically we use Mets' ruggedness for instrumenting segregation. There are some works pointing out that there is a direct relationship between production and development and ruggedness trough direct contemporaneous effects or past interaction with relevant historical events (see Kamarck (1976) and Rappaport and Sachs (2003) as examples of the first group on investigations, and Acemoglu et al. (2002) for the second one). Hence ruggedness would not be valid as an instrument because it fails the exogeneity condition.

Nunn and Puga (2012) show that the historic effect between geography and economic outcomes is statistically significant and economically meaningful just in Africa, and in rest of the world this relationship is contemporaneous. Regarding the latter, the underlying mechanism are cultivation, building and transportation costs. Therefore we include as a control the construction costs obtained from The Value of Construction Put in Place Survey for taking into account the possible direct contemporaneous effect of ruggedness on cities

[5]All this analysis is made assuming that local human capital externalities are less important than global complementarities in production.One reason for working under this assumption is to avoid the possibility of multiple equilibria.

economic outcomes.

Following the procedure just described, we found a positive effect of High-skilled workers segregation on Met's labour productivity. A result like this implies that local complementarities dominates global ones. This could be the case when High and Low skilled workers are not complement in the city's production function. So the second question that we try to answer is: Does High-skilled workers segregation effect on productivity change depending on the type of industry cities are specialized in? We identified the main industry in every Met —or Met's industrial specialization— and then we test the extent of complementarity between High and Low skilled workers. We found that Met specialized in industry with a high degree of complementarity suffer a negative impact of High-skilled workers segregation on their labor productivity, meanwhile in cities where this complementarity is not relevant, mainly industries related to technology and scientific research, segregation has a positive impact on productivity, therefore must be a u-shaped relationship between complementarity and segregation.

These finding are in the same line of those that indicate that more productive cities are more unequal, which is one of the contradiction that urban development must deal with: the clustering of knowledge that is behind growth and prosperity is, at the same time, one of the drivers of spatial inequality. This contradiction presents a challenge for urban public policies than must find a way to foster knowledge economy and technological industries, and mitigate the negative effects that they generate like spatial exclusion.

2 Data

2.1 Segregation Data

We consider as a high-skilled worker, households head with a college degree. The segregation indices were calculated (they are explained later on) using census data from IPUMS for USA Metropolitan Statistical Areas (MSA). The sub geographical area used are the Public Use Microdata Area (PUMA). We built a panel from 2005 to 2015 for 144 MSA with 1,584 observations.

2.2 Cities' Labor Productivity and Controls Data

Cities' labor productivity was obtained using data from the U.S. Bureau of Economics Analysis (BEA) and the Bureau of Labor Statistics (BLS). Controls used here are share of Mets' population with a college degree, Mets' population density and Mets' rate of employment. The idea that spatial concentration of human capital, population or employment boost productivity is in the core of the agglomeration literature (Rosenthal and Strange, 2004). Additionally we include year and state fixed effect.

Table 1 presents variables definition and Table 2 shows the descriptive statistics of these variables. As it can be appreciated all variables average has increased between 2005 and 2015 with the exception of employment.

Table 1: Variables

Variables	Description
logprod	Logarithm of labor productivity, where labor productivity is defined as GDP divided by the number of employments
logdensity	Logarithm of population's density
semp	Is the number of employments divided by Met's population
educ	Share of Met's population older than 25 years with a college degree
Gini	Segregation measured using either Gini or Duncan index Duncan

Table 2: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
2005					
logprod	143	11.68221	.1942413	11.26695	12.62802
logdensity	144	5.75046	.7975259	2.562662	7.917295
semp	143	.4018067	.0719728	.2133146	.5404644
educ_	144	.2697292	.0660683	.126	.46
2015					
logprod	144	11.7095	.1829541	11.30346	12.30441
logdensity	144	5.881881	.780436	2.70956	8.002335
semp	144	.375002	.0685555	.2073748	.5249867
educ_	144	.2911319	.0700383	.138	.489

Figure 1 shows the correlation between segregation and controls. As it can be observed in all these cases correlation is positive as previous literature has pointed out.

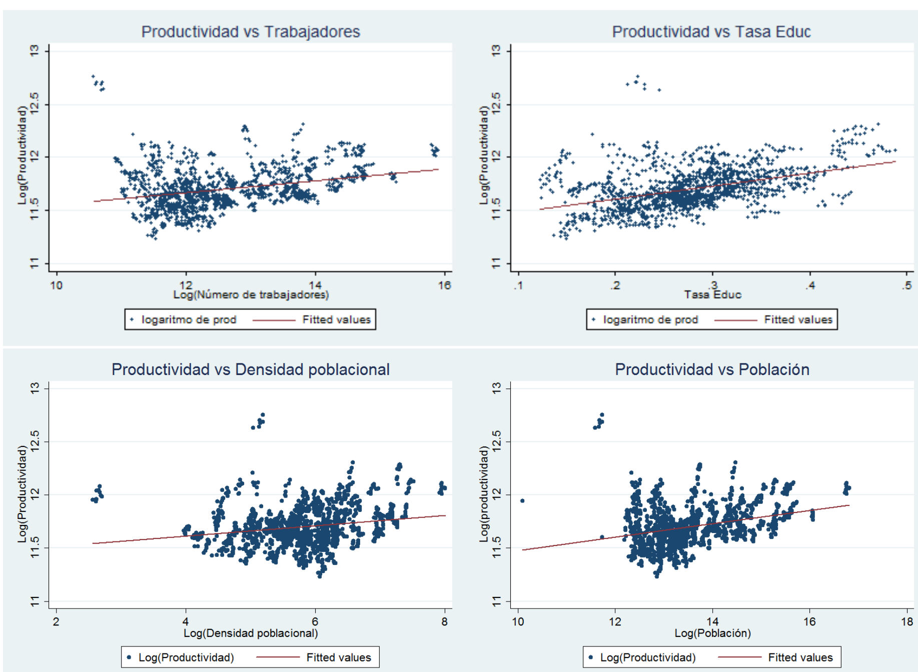

Figure 1: Correlation between Productivity and Controls

3 Segregation and Productivity

In this section we presents some concepts that are used throughout this article. First we review what has been done in theoretical terms regarding well-off people segregation. In particular our focus is on High-Skilled Workers segregation. Because of that, in order to understand the potential mechanisms that are behind this phenomenon, we use the model developed in Benabou (1993) which is, thus far, the most important theoretical work on this issue. After that we describe the segregation indices used.

3.1 High-Skilled Workers Segregation

Benabou (1993) develops a theoretical model which studies High-Skilled Workers' segregation consequences on city production. In this model agents must choose their level of education: low, high or none and the place of residence. The neighbourhood educational cost depends on the percentage of high educated workers living in the neighbourhood, i.e. there is local complementarities in education. Costs of acquiring high and low level of education are $c_H(x)$ y $c_L(x)$. Both costs are decreasing in x, which corresponds to the share of High-Skilled workers in the neighbourhood population. This mechanism works based on human capital externalities, such as peer effects in education or .social networks. It is possible as well to consider education as local public good which needs to be financed at local level, therefore well-off neighbors will be able to finance a better education.

Wages depend on the level of education but they do not depend on the place where workers live. However the cost of acquiring education, as mentioned, depends on x, consequently High-Skilled workers will be willing to live in neighbourhoods where x is high. The latter will increase dwelling prices in the neighborhood with a high concentration of High-Skille Workers, crowding out Los-Skilled Workers. As a consequence, educational cost will relative low in neighborhoods with a high concentration of High-Skilled Workers and high in neighborhood with a high concentration of Low-Skilled Workers, generating ghettos of workers with low productivity which are not going to choose high levels of education due to the fact that in this kind of neighborhood to reach higher levels of education is too expensive or difficult. It is even possible that under these circumstances workers choose not to have any kind of education and therefore they will be outside the labor market and they will just live out of their reservation income.

How this will affect the whole city productivity? The answer to this question depends on the global complementarities in the city's production function. As explained, there are local externalities in education, hence the educational cost is determined by the concentration of High-Skilled Workers in the neighbourhood. In the case of production complementarities are global, which means that they do not depend on where workers live but in the technological characteristics of the city's production function. According to Benabou (1993) in the long run full segregation will generate that workers living in neighborhood without High-Skilled Workers will choose not to have any level education, hence they will be outside the labor market and because of that city's production function will collapse as it needs both High-Skilled and Low-Skilled workers.

Based on this concept, we conjecture that High-Skilled Workers segregation effect will depend on the global complementarities. If the MSA's production function is characterized by a technology that needs both type of workers as input, then High-Skilled Workers segregation will have a negative effect on MSA's productivity. However, in the case that these complementarities are low, like it would be the case of technological industry, the productivity gains, due to agglomeration economies, that High-Skilled Workers enjoy because of segregation would more than compensate Low-Skilled Workers productivity loss and, consequently, the High-Skilled Workers segregation will have a positive effect on MSA's productivity.

3.2 Segregation Indices

3.2.1 Duncan Index

Duncan or dissimilarity index is by far the most used segregation measure. It varies between [0,1] and it represents the proportion of a region's inhabitants that must move out in order to have no segregation. For instance, this index reaches the value 1 when neighbourhoods within a city are populated just by one group, and it reaches the value 0 when each neighborhood is populated by all groups in the exact proportion they have in the city as whole population (Massey and Denton, 1988). The Duncan index's formula is:

$$D = \sum_{i=1}^{n} \left[\frac{t_i}{p_i} - \frac{P}{2TP(1-P)} \right]$$

Where t_i and p_i are total population and the minority group population in neighborhood i. T and P are the total population and the minority population in the city as whole.

3.2.2 Gini Index

This very well known index derived from the Lorenz's curve, it is an inequality measure than can be applied to spatial distribution as well (Massey and Denton, 1988). Alike Duncan index, it varies between [0,1]. The Gini index formula is the following:

$$G = \frac{\sum_{i=1}^{n} \sum_{j=1}^{n} t_i t_j |p_i - p_j|}{2T^2 P(1-p)}$$

As before t_i and p_i are total population and the minority group population in neighborhood i. T and P are the total population and the minority population in the city as whole. Table 3.2.2 shows segregation's descriptive statistics.

Table 3: Estadísticas descriptivas

Variable	Obs	Mean	Std. Dev.	Min	Max
2005					
Duncan	144	.1443621	.0698175	.0025177	.2926655
Gini	144	.1774074	.0926983	.0025177	.3631155
2015					
Duncan	144	.1410873	.0694666	.001491	.2901204
Gini	144	.1788099	.0934433	.0015903	.3503264

4 Exploring the Relationship Between Productivity and Segregation

Following Glaeser and Resseger (2010), we graphically show the relationship between productivity and MSA inhabitants conditioning by the rate of High-Skilled Workers. The left panel of Figure 2 presents the relationship between these two variables for the 50 more educated MSA meanwhile the right panel do the same but for the 50 least educated MSA.

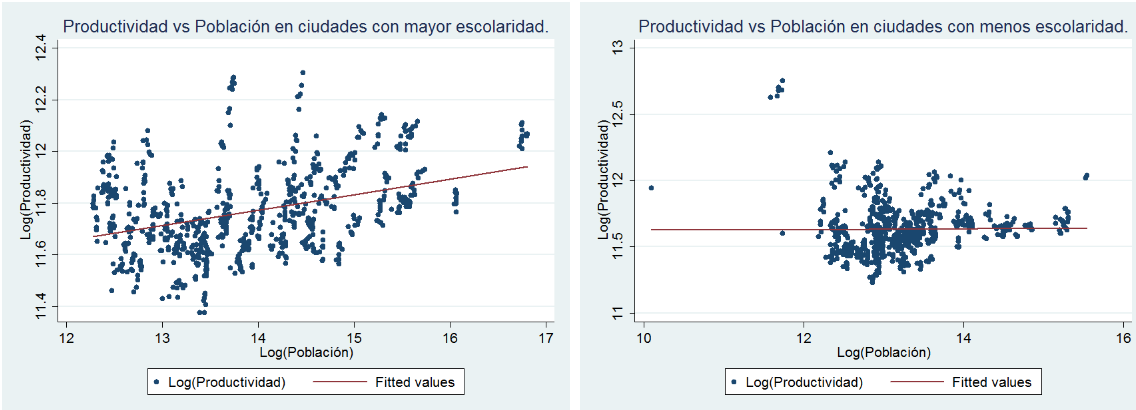

Figure 2: Productivity v/s Population

As it can be aprecieted in the first case the relationship is positive and significative, which suggests the presence of strong agglomeration economies for High-Skilled Workers, however in the case of the least educated cities this relationship is flat. This preliminary analysis gives support to the conjecture that the High-Skilled Workers segregation effect will be strongly related to city specialization and the level of education of their population.

Figure 3 shows the relationship between productivity and High-Skilled Workers segregation. Then again the relationship is significative and positive. Consequently it seems to be that there is evidence about the fact that High-Skilled Workers segregation boosts High-Skilled Workers productivity and this gain in productivity more than compensates the productivity loss experienced by Low-Skilled Workers.

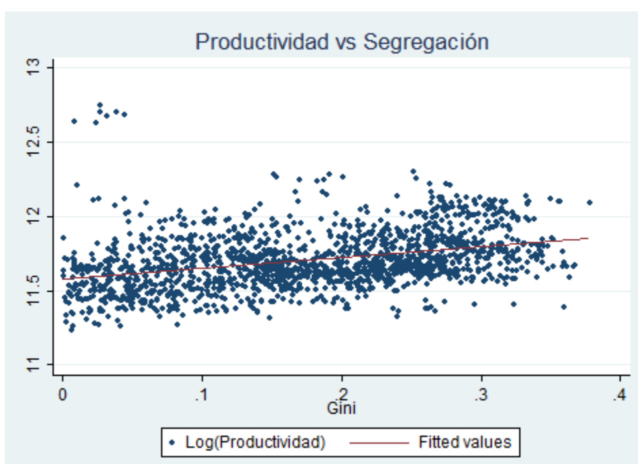

Figure 3: Productivity vs Segregation

In Figure 4 it is possible to watch MSA's High-Skilled Workers' segregation measured using the Gini index. Bigger MSA exhibit greater levels of segregation. Additionally, the most productive MSA of the country present greater levels of segregation, as in both coasts. The fact that bigger cities and more productive cities are more segregated is something that has been widely documente in the literature (Cutler et al., 1999).

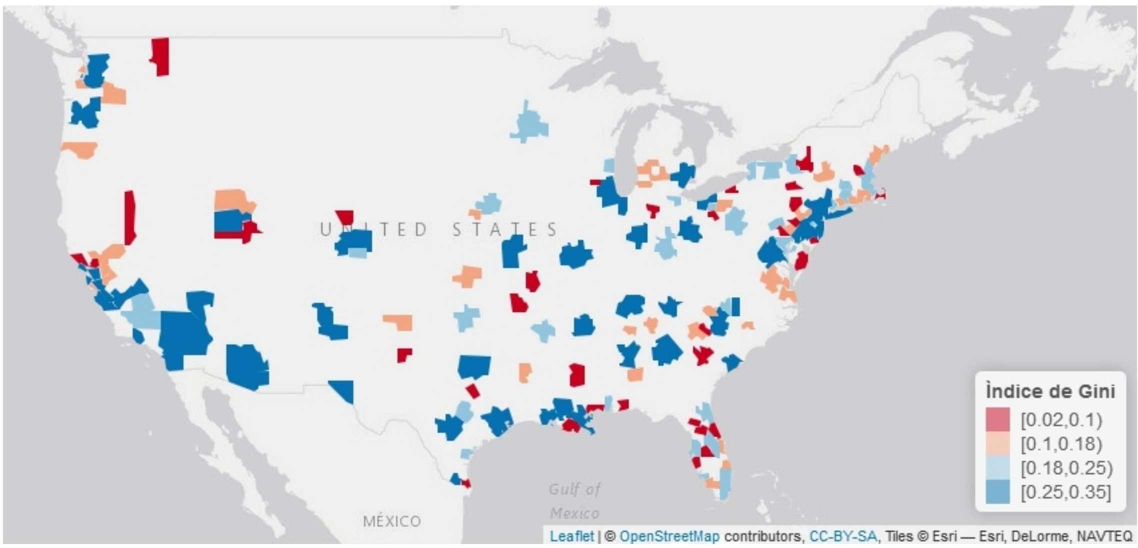

Figure 4: MSA Segregation

What we have presente here are just correlation, however they give us a first impression about what would be the relationship between High-Skilled Workers segregation and MSA's labor productivity. In the next section we explain our identification strategy.

5 Identification Strategy

There are two main problems that we need to deal with. First there are MSA's characteristics that would be omitted and that may affect segregation. Second, cities MSA with a higher income attract more educated people, and probably they will choose to live in neighbourhoods with a high concentration of High-Skilled Workers, so it will not be clear the causality direction. Because of that, we implement an identification strategy using instrumental variables.

5.1 Instrument

The instrument used here is the MSA ruggedness. Topographic irregularities can be used as physical barriers to exclude others. Therefore they may be used as a segregation device. The strategy of considering physical barrieres as an instrument to segregation is not new. Cutler and Glaeser (1997) uses the number of rivers between and within counties to study the effect of racial segregation on afro americans education, employment and single parenthood. The same approach is implemented by Hoxby (2000) for studying the competion btween public and private schools on educational achievements. Ananat (2011) studies the causal effect of racial segregation on poverty and inequality exploiting the arrangements of railroad tracks in the nineteenth century combined with historic data from the Great Migration.

Similarly, this investigation considers geographic barriers in order to study the causal effect of segregation on MSA's productivity. Specifically, we use a MSA's ruggedness index as instrument.[6] We measure the MSA's topographic height every 10.000 meters using ArcGIS. The ruggedness index (TRI hereafter) is the standard deviation of the all heights obtained in this way.

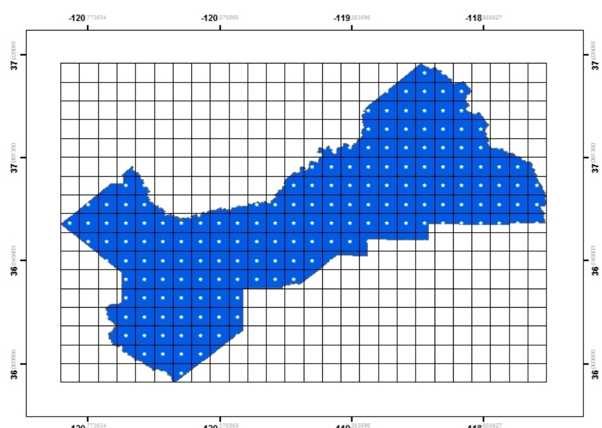

Figure 5: Fresno Ruggedness

Figure 5 presents an example of this procedure for the MSA of Fresno CA. Figure 6 shows a map with MSA ruggedness index. Comparing Figure 6 to Figure 4, it is possible to observe a certain degree of positive correlation between TRI and segregation. Figure 7 shows in a clearer way that correlation, which has a calculated value of 0.20. The latter is evidence that

[6]We are aware about the relationship between ruggedness and productivity, something that is addressed later on in this article.

the instrument would fulfil the validity requirement which is key to avoid a biased instrument (Bound, 1995). So we run the first stage regression in order to test if this condition is really fulfilled.

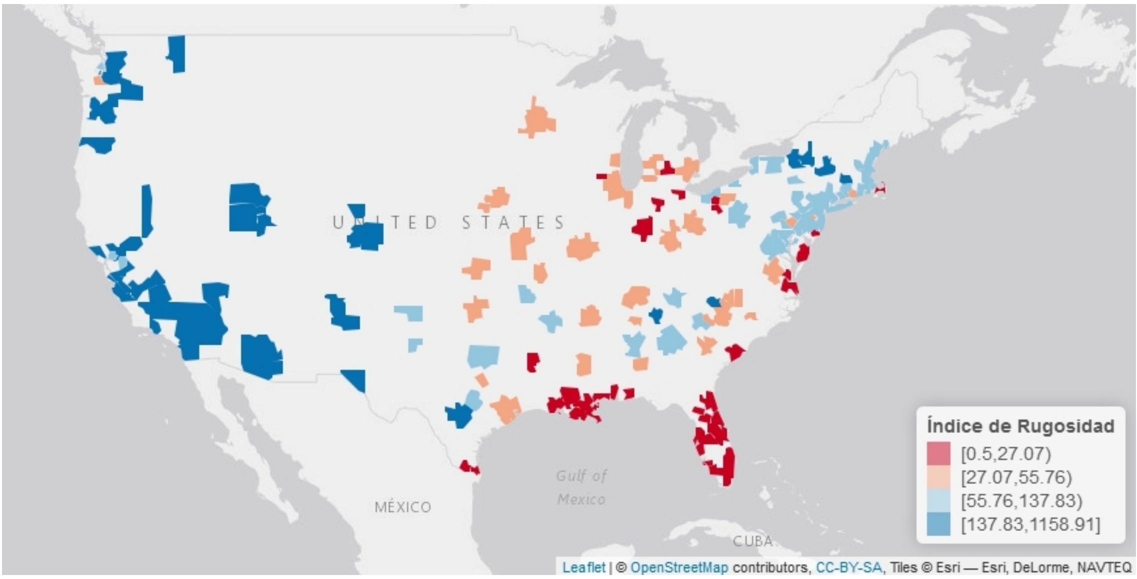

Figure 6: MSA Ruggedness Index

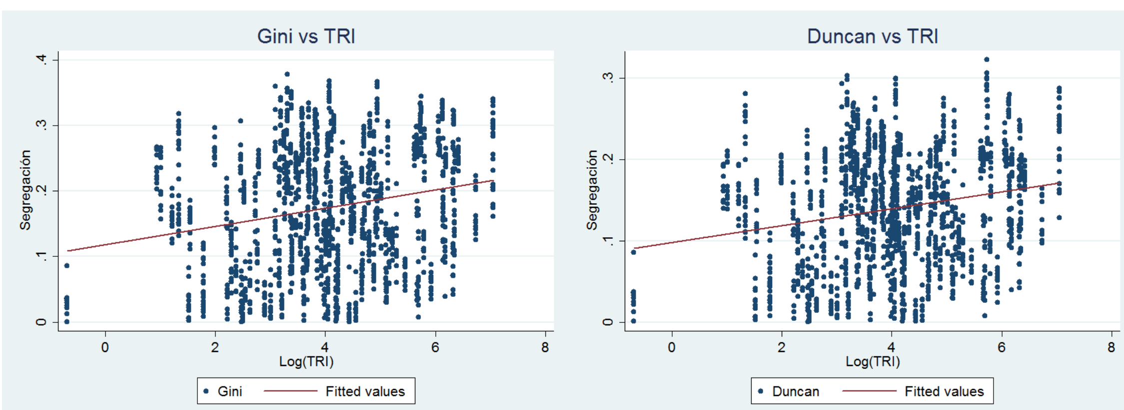

Figure 7: Segregation vs Ruggedness

The specification of the first stage regression is the following:

$$\widehat{Segregation}_{it} = TRI_i + Log(Dens)_{it} + Educ_{it} + Semp_{it} + \eta_i$$

Where TRI_i is the ruggedness index of the MSA i, $Dens_{it}$ is the population density of the MSA i at period t, $Educ$ is the percentage of the population with a college degree in the MSA

i at period t, $Semp$ is the percentage of the population with an employment in the MSA i at period t and η_i are the errors at MSA level.

Table 4 presents the results of this first stage regression. In column (2) there is fixed effect by year, in te column (3) fixed effect by state and in column (4) both by year and state. TRI is significant hence is satisfied the relevance condition. In oder to analyze the weakness of this instrument we use the test proposed by Stock and Yogo (2005). Results of this test are shown in Table 6. Results indicate that TRI is not a weak instrument.

Table 4: First Stage

	Gini			
	(1)	(2)	(3)	(4)
tri	0.000169***	0.000171***	0.000230***	0.000228***
	(18.12)	(18.29)	(15.07)	(14.78)
logdensity	0.0407***	0.0408***	0.0625***	0.0623***
	(14.57)	(14.62)	(15.33)	(15.18)
semp	0.312***	0.333***	0.328***	0.361***
	(7.74)	(7.60)	(6.52)	(5.87)
educ	0.0568	0.0391	0.157***	0.131*
	(1.45)	(0.95)	(3.32)	(2.44)
cons	-0.219***	-0.224***	-0.326***	-0.331***
	(-11.86)	(-11.04)	(-12.47)	(-12.22)
Obs	1583	1583	1583	1583

T statistic in parenthesis, * p< .05; ** p< .01; *** p< .001

Table 5: Underidentification test

(Kleibergen-Paap rk LM statistic):	90.776
Chi-sq(1) P-val =	0.0000

Table 6: Weak identification test

(Cragg-Donald Wald F statistic):	236.400
(Kleibergen-Paap rk Wald F statistic):	218.322
Stock-Yogo weak ID test critical values: 10% maximal IV size	16.38
15% maximal IV size	8.96
20% maximal IV size	6.66
25% maximal IV size	5.53

Even tough the validity condition is fulfilled, the discussion regarding the exclusion condition is more tricky. Albeit there is a clear correlation between segregation and ruggedness, in the literature there are several works indicating that there is negative relationship between ruggedness and cities productivity because ruggedness makes agriculture more difficult and less efficient and increases construction and transport costs. Probably the most important investigation regarding this issue is (Nunn and Puga, 2012). The latter introduces doubts about our identification strategy. However, in the next section we argue why this instrument still would satisfy the exclusion condition.

5.2 Ruggedness and Productividad

As mentioned, construction costs and transportation —we left out agriculture because our focus is on urban settlements— may affect the exclusion condition of the ruggedness index. To deal with this problem we include MSA's construction costs as control. This variable is obtained from The Value of Construction Put in Place Survey (VIP). This survey considers public and private construction costs on a monthly basis, and includes transportation costs, manpower, building inputs, architecture, engineering, general costs, interests and taxes payed during the construction period and contractors profits. Data is not available at MSA level but at state level. So we assign the state information to MSA according the proportion of employment in construction sector of each MSA within the state. The cost fo construction of MSA i is:

$$C_{i,s} = \sum_{n=1}^{N} S_{n,s} \left(\frac{e_{i,s}}{e_s} \right)$$

Where $e_{i,s}$ is the construction employment of MSA i in state s and e_s is the total construction employment in state s. Finally we sum over the different type of costs considered from $n = 1...N$. Behind the construction of this variable is the assumption that there are not significant differences between the extent that ruggedness affects construction costs in each MSA. In order to reduce the uncertainty about this assumption we verify how variable is TRI for MSAs within the same state. Figure 5.2 presents MSA's TRI dispersion across states. Left panel shows this relationship for 27 states, and the right one the full sample. As it can appreciated, MSA of a same state present similar TRI values.

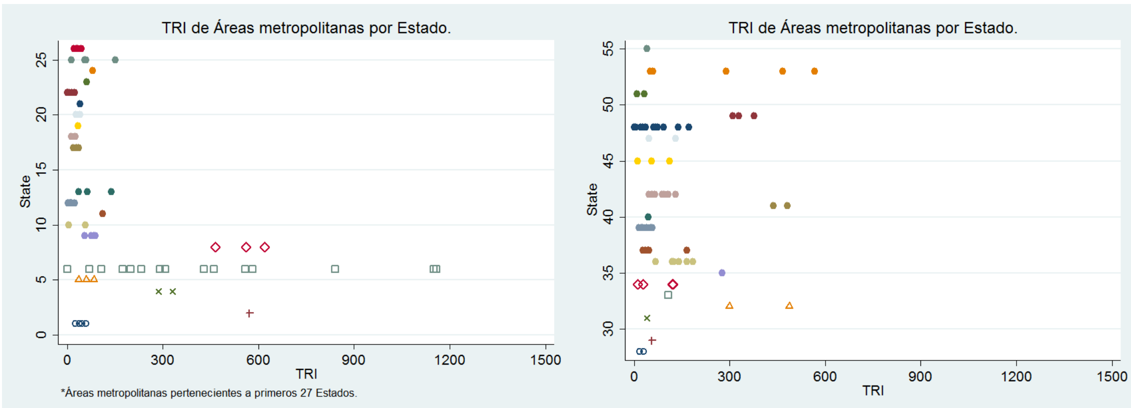

Figure 8: Figura 10: TRI de Áreas metropolitanas por Estado.

Alternatively we can run a regression of TRI versus a set of state dummies. If all MSA within the same state have the same TRI then the R-squared of this regression should be 1. The R-squared obtained is 0.6087 hence the extent of similarity of TRI values for MSA within the same state is high enough to justify our assumption.

$$TRI_i = \sum_{n=1}^{N} State_n + \mu_i$$

N=1584 Adj R-squared=.6087

6 Results

Table 7 presents results for a set of pooled regressions. In this case $COV(x_{it}, u_{it}) \neq 0$ therefore estimation are biased. However they allows to have a first flavour about what the effect of High-Killed Workers on MSA labor productivity segregation would be. Columns from (1) to (4) consider as a segregation measure the Gini index meanwhile columns from (5) to (8) the Duncan index. Columns (2) and (6) present estimation using a year fixed effect, columns (3) and (7) an state fixed effect and columns (4) and (8) both year and state fixed effects. In all these specifications segregation has a positive a highly significant effect. The percentage of people with a college degree is always significant with a positive impact on productivity. The percentage of the population with an employment is always significant but with a negative impact. The intuition in this case is that given a level of production, MSA with a greater labor productivity need less workers to produce the same. Density is only significant in specifications (7) and (8). Regressions with a better adjustment are those that include both year and state fixed effect. These results suggest that High-Skilled Workers Segregation generates, on average, agglomeration economies between High-Skilled Workers which are able to boost the MSA economy as whole, and therefor it would be the case that they more than compensate the potential Low-Skilled Workers productivity loss. Tables iv and 9 presents results for IV regressions. Table 9 considers construction costs in order to provide robustness to the exclusion assumption of our instrument. Columns (2) and (6) consider year fixed effect, (3) and (7) state fixed effect and columns (4) and (8) both.

Table 7: Pooled Regressions

	"Productividad"							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Gini	0.59***	0.59***	0.47***	0.46***				
	(0.05)	(0.05)	(0.04)	(0.04)				
logdensity	0.00	0.00	0.01	0.01	0.00	0.00	0.02**	0.02**
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
semp	-0.62***	-0.61***	-0.35***	-0.29***	-0.60***	-0.59***	-0.33***	-0.26**
	(0.07)	(0.08)	(0.07)	(0.08)	(0.07)	(0.08)	(0.07)	(0.09)
educ_	1.32***	1.33***	1.28***	1.26***	1.34***	1.35***	1.28***	1.25***
	(0.08)	(0.08)	(0.06)	(0.07)	(0.08)	(0.08)	(0.06)	(0.07)
Duncan					0.78***	0.78***	0.58***	0.57***
					(0.07)	(0.07)	(0.05)	(0.05)
Constant	11.47***	11.46***	11.29***	11.27***	11.42***	11.42***	11.24***	11.22***
	(0.04)	(0.04)	(0.04)	(0.05)	(0.04)	(0.04)	(0.04)	(0.05)
R^2	0.29	0.29	0.63	0.63	0.29	0.30	0.62	0.63
Obs	1583	1583	1583	1583	1583	1583	1583	1583

* p< .05; ** p< .01; *** p< .001

The IV approach confirm the positive and significant impact of High-Skilled Workers segregation on MSA labor productivity. In columns (1) and (5) the estimated coefficients are te double that those estimated by OLS. Including the construction costs as controls the coefficients obtained are very similar and the same happens when year fixed effects are included. Using as a control the state fixed effect segregation estimated coefficients remain positive and significant. The remaining controls exhibit similar results that those found using OLS. Therefore, all in all, our results are robust to the IV approach and the inclusion of construction costs. These results provide new insights to the discussion about the segregation effects, in particular the well-off people segregation, High-Skilled Workers in this case, which has not been studied as deep as the worse-off segregation has been. In the next section we explore possible mechanism that can explain the results that have been presented here.

Table 8: Instrumental variables estimation

	"Productividad"							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Gini	1.19***	1.19***	0.42***	0.41***				
	(0.13)	(0.13)	(0.09)	(0.09)				
logdensity	-0.01*	-0.01*	0.02**	0.02**	-0.01	-0.01	0.02***	0.02***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
semp	-0.72***	-0.72***	-0.33***	-0.27***	-0.70***	-0.69***	-0.32***	-0.26***
	(0.08)	(0.08)	(0.08)	(0.09)	(0.08)	(0.08)	(0.08)	(0.09)
educ_	1.21***	1.22***	1.28***	1.26***	1.24***	1.25***	1.28***	1.25***
	(0.08)	(0.08)	(0.06)	(0.07)	(0.08)	(0.08)	(0.06)	(0.07)
Duncan					1.63***	1.64***	0.57***	0.56***
					(0.18)	(0.18)	(0.12)	(0.12)
Constant	11.52***	11.51***	11.28***	11.26***	11.42***	11.42***	11.24***	11.21***
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Observaciones	1583.00	1583.00	1583.00	1583.00	1583.00	1583.00	1583.00	1583.00

* p< .05; ** p< .01; *** p< .001

Table 9: IV controlando por costo en construcción

	"Productividad"							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Gini	1.26***	1.27***	0.22 *	0.22*				
	(0.21)	(0.21)	(0.12)	(0.13)				
logdensity	-0.02**	-0.02**	0.00	0.00	-0.01*	-0.01	0.00	0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
semp	-0.69***	-0.69***	-0.47***	-0.41***	-0.67***	-0.66***	-0.46***	-0.40***
	(0.09)	(0.09)	(0.12)	(0.14)	(0.08)	(0.09)	(0.12)	(0.14)
educ_	1.22***	1.23***	1.27***	1.24***	1.23***	1.23***	1.26***	1.24***
	(0.09)	(0.09)	(0.07)	(0.09)	(0.09)	(0.09)	(0.07)	(0.09)
cost_mas	-0.00	-0.00	0.00***	0.00***	-0.00	-0.00	0.00***	0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Duncan					1.64***	1.66***	0.29*	0.29*
					(0.28)	(0.28)	(0.16)	(0.16)
Constant	11.53***	11.52***	11.43***	11.41***	11.46***	11.45***	11.41***	11.39***
	(0.05)	(0.06)	(0.05)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
Observaciones	1583.00	1583.00	1583.00	1583.00	1583.00	1583.00	1583.00	1583.00

* p< .05; ** p< .01; *** p< .001

7 Segregation and Cities Productive Specialization

Benabou(1993) indicates that the effect of segregation on city productivity depends on the educational complementarities at local level and global complementarities in the city's production function. In the case that High-Skilled Workers segregation prevent the correct functioning of the city production function, its effect will be negative. The latter would happen when the city is specialized in a productive sector which needs both High-Skilled and Low-Skilled workers, like the extractive sector, construction or the manufacturing sector, because all of them need both white and blue collar workers. However, if the global complementarities between these two type of workers are weak the High-Skilled Workers segregation may have a positive impact on city productivity, like it would be the case of financial or technological sectors. In order to test this mechanism we run the same set of regression but adding the

MSA productive specialization as a control.[7] In what follow in this section we explain the methodology used in more detail and we present the results.

7.1 The Specialization Index

Following Duranton and Puga (2000) we use as a measure of the MSA specialization the productive sector that employs the greatest part of the MSA working force. The exact calculation of this measure is given by the following formula: En concreto, denotaremos S_{ij} como la participación de la industria j en la metro área i. De esta manera, el índice de especialización estaría dado por:

$$ZI_i = \max_j (S_{ij}) \tag{1}$$

Where ZI denotes the MSA specialization and S_{ij} the sector share on the total MSA employment. However, this calculation is probably biased due to the fact that there are some industrial sectors that have a greater share of the employment at country level. In order to correct this problem we use the MSA relative specialization which is obtained dividing each MSA sector share by its share at country level.

$$RZI_i = \max_j (S_{ij}/S_j) \tag{2}$$

Where S_j is the share of the industrial sector j at country level. Once we have obtained the relative specialization index RZI for each MSA, we introduce dummies variables to identify those MSA that are specialized in construction and extractive sector and MSA that are specialized in computation and mathematics, biological sciences, physics and social science. The former dummy is called prim and the latter phd.

To test this potential mechanism we regress productivity the complementarity between High-Skilled and Low-Skilled as follow:

$$Log(Prod)_i = \beta_1 \text{Comp}_i + \beta_2 \text{Comp*Prim}_i + \beta_3 \text{Comp*Phd}_i + \mu_i$$

Where $Comp_i = \Delta H_i^H * \Delta H_i^L$, H_i^H is the percentage of the MSA population older than 25 years with a college degree and H_i^L is the percentage of the MSA population older than 25 years without a college degree. We use $Comp_i$ as a proxy of the cross derivative of the MSA production function. Hence this regression searches to capture the effect of global

[7] The information regarding MSA employment by industry sector is provided by the U.S. Bureau of Labor Statistics.

complementarities on the productivity: β_2 measures the relationship between productivity and global complementarities in MSA specialized in extractive and construction sectors, β_3 makes the same for the case of MSA specialized in Computations and Maths or in Physics, Biology or Social Sciences and β_1 for MSA specialized in all the remaining sectors. Table 10 presents the results of this regressions. Columns (2) and (3) include year dummies.

Table 10: Complementarities and Productivity

	"Productividad"			
	(1)	(2)	(3)	(4)
comp	98.83*	73.77		
	(55.39)	(49.60)		
com*prim	418.09**	352.35*	478.51**	384.99**
	(199.36)	(197.66)	(194.88)	(194.51)
com*phd	-134.10*	-138.30*	-45.61	-75.14
	(79.31)	(77.19)	(61.62)	(62.48)
Constant	11.71***	11.69***	11.71***	11.68***

* p< .1; ** p< .05; *** p< .01

As it can be appreciated complementarities between High-Killed and Low-Skilled workers have a positive and significant impact on productivity in those MSA specialized in Construction and Extractive sectors. However this is not the case when MSA are specialized in Computations and Maths or in Physics, Biology or Social Sciences, with a negative coefficient. Given this results we should expect a negative impact of segregation in those MSA specialized in Construction and Extractive sectors and a positive one in those MSA specializaed in Computations and Maths or in Physics, Biology or Social Sciences.

7.2 Results

We run now the same set of regressions that in Section 5 but controlling by MSA specialization. Table 11 shows the results of these regressions when MSA are specialized in Construction and Extractive sectors and Table 12 shows the regressions for the same groups of MSA but including construction costs as a control. The effect of High-Skilled Workers segregation in this case is always negative. The negative coefficients' sign gives support to the hypothesis that the effect of High-Skilled Workers segregation on productivity depends on the MSA specialization. Therefore in this case where global complementarities between both High-Skilled and Low-Skilled workers matter, the High-Skilled Workers gain in productivity due to agglomeration economies are not able to compensate the Low-Skilled Workers loss in productivity due to their spatial exclusion in the MSA.

Table 11: IV MSA Specialized in Construction and Extraction

	Productivity							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Gini_prim	-14.97**	-15.82**	-3.85***	-3.45***				
	(5.89)	(6.54)	(1.38)	(1.21)				
logdensity	-0.01	-0.02	0.07***	0.07***	-0.01	-0.01	0.07***	0.07***
	(0.04)	(0.04)	(0.02)	(0.02)	(0.03)	(0.03)	(0.02)	(0.02)
semp	0.15	0.30	0.55*	0.69**	0.12	0.24	0.51*	0.65**
	(0.47)	(0.56)	(0.29)	(0.31)	(0.41)	(0.47)	(0.28)	(0.29)
educ_	0.52	0.38	0.69***	0.60**	0.51	0.39	0.69***	0.62**
	(0.38)	(0.44)	(0.25)	(0.25)	(0.34)	(0.38)	(0.24)	(0.25)
Duncan_prim					-16.39***	-17.17***	-4.62***	-4.18***
					(5.69)	(6.20)	(1.64)	(1.46)
Constant	11.81***	11.78***	11.08***	11.02***	11.78***	11.75***	11.12***	11.06***
	(0.19)	(0.19)	(0.09)	(0.10)	(0.15)	(0.16)	(0.08)	(0.09)
Observaciones	1583.00	1583.00	1583.00	1583.00	1583.00	1583.00	1583.00	1583.00

* p< .05; ** p< .01; *** p< .001

Table 12: IV MSA Specialized in Construction and Extraction Controlling by Construction Costs

	Productivity							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Gini_prim	-6.05***	-6.27***	-1.29	-1.16				
	(1.59)	(1.66)	(0.86)	(0.78)				
logdensity	-0.03*	-0.03*	0.02	0.02	-0.03*	-0.03*	0.02	0.02
	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)
semp	-0.41**	-0.34*	-0.18	-0.10	-0.39**	-0.33*	-0.19	-0.11
	(0.16)	(0.18)	(0.21)	(0.23)	(0.16)	(0.17)	(0.20)	(0.22)
educ_	0.76***	0.70***	1.04***	0.99***	0.74***	0.68***	1.04***	0.99***
	(0.16)	(0.17)	(0.17)	(0.18)	(0.16)	(0.16)	(0.17)	(0.18)
cost_mas	0.00***	0.00***	0.00***	0.00***	0.00***	0.00***	0.00***	0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Duncan_prim					-7.21***	-7.46***	-1.56	-1.42
					(1.87)	(1.94)	(1.04)	(0.95)
Constant	11.84***	11.83***	11.41***	11.38***	11.82***	11.82***	11.42***	11.39***
Observaciones	1583.00	1583.00	1583.00	1583.00	1583.00	1583.00	1583.00	1583.00

* p< .05; ** p< .01; *** p< .001

Now we repeat the exercise but for those MSA specialized in Computations and Maths or in Physics, Biology or Social Sciences. Table 13 shows the results of these regressions and Table 14 presents the results controlling by construction costs. As in this case we expect that global complementarities are not important, High-Skilled Workers segregation should have a positive impact on MSA productivity. Results confirm this expectation. In the full set of regressions, including those that control by construction costs, the coefficient estimated for the impact of High-Skilled Workers segregation on MSA productivity have a positive sign and they are highly statistically significant.

Consequently we have found evidence supporting the mechanism proposed. The effect of High-Skilled workers segregation depend on the cities type of industry specialization, because this specialization will tell us how global complementarities will work between these two kind of labor force.

Table 13: IV Computations and Maths or in Physics, Biology or Social Sciences

	Productivity							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Gini_phd*	7.90**	8.02**	4.08***	3.92***				
	(3.28)	(3.33)	(1.48)	(1.41)				
logdensity	0.07**	0.07**	0.04***	0.04***	0.08**	0.08**	0.05***	0.05***
	(0.03)	(0.03)	(0.01)	(0.01)	(0.04)	(0.04)	(0.02)	(0.02)
semp	-0.76***	-0.74***	-0.16	-0.06	-0.76***	-0.74***	-0.12	-0.01
	(0.21)	(0.22)	(0.13)	(0.14)	(0.24)	(0.25)	(0.15)	(0.17)
educ_	-1.40	-1.46	0.15	0.13	-1.86	-1.95	-0.12	-0.13
	(1.11)	(1.13)	(0.42)	(0.40)	(1.46)	(1.49)	(0.60)	(0.57)
Duncan_phd*					11.36**	11.57**	5.97**	5.69**
					(5.24)	(5.35)	(2.53)	(2.35)
Constant	11.78***	11.82***	11.44***	11.42***	11.83***	11.87***	11.47***	11.44***
Observaciones	1583.00	1583.00	1583.00	1583.00	1583.00	1583.00	1583.00	1583.00

* p< .05; ** p< .01; *** p< .001

Table 14: IV Computations and Maths or in Physics, Biology or Social Sciences Controlling by Construction Costs

	Productivity							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Gini_phd*	6.07**	6.31**	1.20*	1.13*				
	(2.94)	(3.09)	(0.70)	(0.66)				
logdensity	0.02	0.02	0.01	0.01	0.02	0.02	0.01	0.01
	(0.02)	(0.02)	(0.01)	(0.01)	(0.03)	(0.03)	(0.01)	(0.01)
semp	-0.73***	-0.68***	-0.40***	-0.31**	-0.73***	-0.67***	-0.39***	-0.30**
	(0.18)	(0.19)	(0.12)	(0.15)	(0.19)	(0.20)	(0.13)	(0.15)
educ_	-1.06	-1.20	0.90***	0.88***	-1.28	-1.45	0.86***	0.83***
	(1.06)	(1.13)	(0.21)	(0.21)	(1.22)	(1.31)	(0.24)	(0.24)
cost_mas	0.00**	0.00*	0.00***	0.00***	0.00***	0.00***	0.00***	0.00***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Duncan_phd*					8.11**	8.47**	1.57*	1.47*
					(4.08)	(4.31)	(0.93)	(0.87)
Constant	11.98***	11.97***	11.52***	11.49***	12.02***	12.01***	11.53***	11.50***
Observaciones	1583.00	1583.00	1583.00	1583.00	1583.00	1583.00	1583.00	1583.00

* p< .05; ** p< .01; *** p< .001

8 Conclusions

We have studied the effect of High-Skilled Workers segregation on cities productivities. Traditionally the focus of the literature has been on worse-off segregation and there are just few works that have researched in this particular type of segregation. We have found evidence that High-Skilled Workers segregation has a positive impact on cities productivity. We have explored one potential mechanism behind this result. Based on Benabou (1993) we proposed that the key element is the type of global complementarities in the city's production function and the local educational complementarities at neighborhood level. If global complementarities at city level are weak or not important and local educational complementarities generate agglomeration economies, High-Skilled workers will take advantage of them, but Low-Skilled workers will not because they live in a different neighborhood where this agglomeration economies are not present. As global complementarities in this case are not important, the productivity gain of High-Skilled Workers boost city productivity. Notwithstanding, when global complementarities are significant, then the High-Skilled workers productivity gain will not able to compensate the Low-Skilled Workers productivity loss because now the city production function needs both type of workers as inputs, and if one of them exhibits an importante productivity loss, the city as whole will face a productivity loss as well. We test this mechanism and the main finding is that segregation has a negative effect on productivity in cities specialized in Construction and Extractive sectors, meanwhile it has a positive effect on prodcutivity in cities specialized in Computation and Maths, and Biology, Physics and Social Sciences. This result is in line with investigations regarding creative cities which have exhibited high level of segregation and open a question about how public policy should face segregation. On one hand there are plenty of evidence about the negative effects that segregation has on society but on the other hand it would boost productivity. Therefore to balance cost and benefits of segregation in order to select the best possible policy is a difficult task that should addressed in future investigations.

References

Acemoglu, D., Johnson, S., and Robinson, A. (2002). Reversal of fortune: Geography and institutions in the making of the modern world income distribution. *Quartely Journal of Economics*, 117(4):1231–1294.

Ananat, E. (2011). The wrong side(s) of the tracks: The causal effects of racial segregation on urban poverty and inequality. *American Economic Journal: Applied Economics*, 3(2):34–66.

Ando, A. (1981). *Development of a unified theory of urban land use*. PhD thesis, University of Pennsylvania.

Bailey, M. (1959). Note on the economics of residential zoning and urban renewal. *Land Economics*, 35:288–292.

Bayer, P., McMillan, R., Murphy, A., and Timmins, C. (2016). A dynamic model of demand for houses and neighborhoods. *Econometrica*, 84(3):893–942.

Bayer, P., McMillan, R., and Rueben, K. (2004). What drives racial segregation. *Journal of Urban Economics*, 56:514–535.

Bayer, P., Ross, S., and Topa, G. (2008). Place of work and place of residence: Informal hiring networks and labor market outcomes. *Journal of Political Economy*, 116(6):1150–1196.

Benabou, R. (1993). Working of a city: Location, education and production. *The Quarterly Journal of Economics*, 108(3):619–652.

Benabou, R. (1996). Equity and efficiency in human capital investment: The local connection. *The Review of Economics Studies*, 63(2):237–264.

Blau, D. and Robins, P. (1992). Job search outcomes for the employed and unemployed. *Journal of Political Economy*, 98:637–55.

Bound, J. Jaeger, D. A. . B. R. M. (1995). Problems with instrumental variables estimation when the correlation between the instruments and the endogenous explanatory variable is weak. *Journal of the American statistical association, 90(430)*, pages 443–450.

Cheshire, P. (2007). *Segregated neighbourhoods and mixed communities: a critical analysis.* Joseph Rowntree Foundation.

Chetty, R., Hendren, N., and Katz, L. (2016). The effects of exposure to better neighborhoods on children: New evidence from the moving to opportunity experimen. *American Economic Review*, 106(4):855–902.

Coniglio, N. (2003). Migration networks and ethnic cluster formation in cities. *SNF Working Papers*, (46).

Cutler, D. and Glaeser, E. (1997). Are ghettos good or bad? *Quarterly Journal of Economics*, 112 (3):826–872.

Cutler, D. M., Glaeser, E. L., and Vigdor, J. L. (1999). The rise and decline of the american ghetto. *Journal of political economy*, 107(3):455–506.

Duranton, G. and Puga, D. (2000). Diversity and specialisation in cities: why, where and when does it matter? *Urban studies*, 37(3):533–555.

Glaeser, E. L. and Resseger, M. G. (2010). The complementarity between cities and skills. *Journal of Regional Science*, 50(1):221–244.

Hoxby, C. M. (2000). Does competition among public schools benefit students and taxpayers? *American Economic Review*, 90(5):1209–1238.

Ioannides, Y. and Loury, L. (2004). Job information networks, neighborhood effects and inequality. *Journal of Economic Literature*, 42(4):1056–93.

Kamarck, A. (1976). *The Tropics and Economic Developmen*. John Hopkins University Press.

Kanemoto, Y. (1980). *Theories of Urban Externalities*. North Holland.

Kling, J. and Liebman, J. (2004). Experimental analysis of neighborhood effects on youth. *Princeton IRS Working Paper*.

Kling, J., Liebman, J., and Katz, L. (2007). Experimental analysis of neighborhood effects. *Econometrica*, 75(1):83–119.

Kling, J., Ludwig, J., and Katz, L. (2005). Neighborhood effects on crime for female and male youth: evidence from a randomized voucher experiment. *Quarterly Journal of Economics*, 120(1):87–130.

Manski, C. (1993). Identification of endogenous social effects: The reflection problem. *Review of Economic Studies*, 60:531–542.

Massey, D. S. and Denton, N. A. (1988). The dimensions of residential segregation. *Social forces*, 67(2):281–315.

Nunn, N. and Puga, D. (2012). Ruggedness: The blessing of bad geography in africa. *Review of Economics and Statistics*, 94(1):20–36.

Papageorgiou, J. (1978). Spatial externalities. i: theory. *Annals of the Association of American Geographers*, 68:465–476.

Rappaport, J. and Sachs, J. (2003). The united states as a coastal nation. *Journal of Economic Growth*, 8(1):5–46.

Rose-Ackerman, S. (1975). Racism and urban structure. *Journal of Urban Economics*, 7:233–250.

Rosenthal, S. S. and Strange, W. C. (2004). Evidence on the nature and sources of agglomeration economies. *Handbook of regional and urban economics*, 4:2119–2171.

Schnare, A. (1976). Racial and ethnic price differentials in an urban housing market. *Urban Studies*, 13:107–120.

Stock, J. and Yogo, M. (2005). *Asymptotic distributions of instrumental variables statistics with many instruments*, volume 6. Chapter.

Yellin, J. (1974). Urban population distribution, family income, and social prejudice. *Journal of Urban Economics*, 1:21–47.

Yinger, J. (1976). Racial prejudice and racial residential segregation in an urban model. *Journal of Urban Economics*, 3:383–396.