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AL OTRO LADO DEL RÍO:
THE PERSISTENCE OF COLONIAL SPATIAL ETHNIC SEGREGATION ON ECONOMIC DEVELOPMENT AND CULTURE

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PRESENTA

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Para los tapatíos que me enseñaron
a apreciar y querer mi ciudad:
Claudia y Guillermo;
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Enrique y Guillermo, que la tierra les sea leve.

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Sobre todo, creo que no todo está perdido [...]

Jorge Drexler, *Al otro lado del río*

Abstract

Historical events have persistent effects on contemporary economic development. This paper studies a natural experiment of ethnic segregation. In its colonial foundation, the city of Guadalajara, Mexico, was divided into two kinds of settlements: one for the Spaniards and one for the Indigenous population. The divide was enforced by the institution of República de Indios. Using a census from 1821, the paper shows that colonial neighborhoods with a previous República de Indios status had higher ethnic fractionalization. Using a Fuzzy Regression Discontinuity, the paper provides evidence that the ethnic fractionalization of 1821 explains contemporary wealth at the neighborhood level. Mechanisms of persistence are subprovision of public goods and cultural traits. The historical development hypothesis holds within a spatially compact area.

Palabras clave: Historical development, colonial institutions, ethnic fractionalization, culture, segregation, spatial inequality, Guadalajara.
Clasificación JEL: H2, H7, N96, O18, Z13

Contents

Chapter 1

Introduction

History is a strong determinant of contemporary economic development. Economics has extensive literature studying the long-lasting effects of historical events over economic development (Nunn, 2009, 2014, 2020; Spolaore and Wacziarg, 2013). The historical development hypothesis argues that historical events persist through different channels such as formal institutions, technology, public goods, and culture, among others, affecting contemporary economic development dimensions (Nunn, 2020).

In addition, cities are also relevant to explain economic development. As the urban economic literature argues, cities gather agents, economic activity, and ideas, promoting growth and economic development (Duranton, Henderson, and Strange, 2015; Glaeser and Gottlieb, 2009; Moretti, 2015). Historical events can also explain the persistence of spatial patterns in cities, and, consequently, economic development and social status differences within them (Rosenthal and Ross, 2015). Nonetheless, the literature of the historical persistence focuses mostly on broader spatial units, such as countries or regions. This paper studies the persistence of a historical institution on economic development within a small spacial unit, the city of Guadalajara, Mexico.

Guadalajara's metropolitan area is the second most populated in Mexico at more than 4 million inhabitants.[1] The city is the capital of the western state of Jalisco and characterizes as a commercial and industrial urban area. Compared to other Mexican cities, the metropolitan area of Guadalajara exhibits a sharp division in economic development levels within its neighborhoods. The western section of the Guadalajara Metropolitan Area has high-income levels compared to the national average and low urban marginalization indexes. The eastern part of the city concentrates most of the more disadvantaged neighborhoods: households with low income and unmet social needs, such as human capital and public goods provision.

Spatial inequality and differences in neighborhood status are common patterns in cities during different periods (Kanbur and Venables, 2005; Rosenthal and Ross, 2015). For instance, Latin American cities depict high levels of spatial inequality (Bilal et al., 2019; Rubalcava and Schteingart, 2012). Notwithstanding, Guadalajara's sharp segregation seems to be an outlier even for Mexican urban areas (Ariza and Solís, 2009; Jaramillo and Saucedo, 2016; Rubalcava and Schteingart, 2012). Figure 1.1 shows the spatial inequality within Guadalajara's municipality by urban blocks, AGEB (*Area Geostadística Básica*), in terms of a calculated wealth index. As Figure 1.1 illustrates, there is a sharp division in household wealth between the western and eastern neighborhoods of the city.

Besides development dimensions, there is also a cultural divide between west and east Guadalajara. Broadly, the city is dived by *Calzada Independencia*, an avenue that runs from northeast to southwest. Jaramillo and Saucedo (2016) argues there is a normalization in signaling inhabitants of the city as those who live 'from *la Calzada* til here,' the west, and 'from *la Calzada* til there,' the east. Jaramillo and Saucedo (2016) continue: "It is impossible to ignore how this division goes along with subjective anchors with meaning among the citizens: 'It is far away: on the other side of the Calzada'; 'There is nothing there'; 'It is people who do not pay taxes. How do they want to be taken into account by the government?'". Often these stigmatizing

[1] Population of the municipalities of Guadalajara, San Pedro Tlaquepaque, Tlajomulco de Zúñiga, Tonalá, and Zapopan.

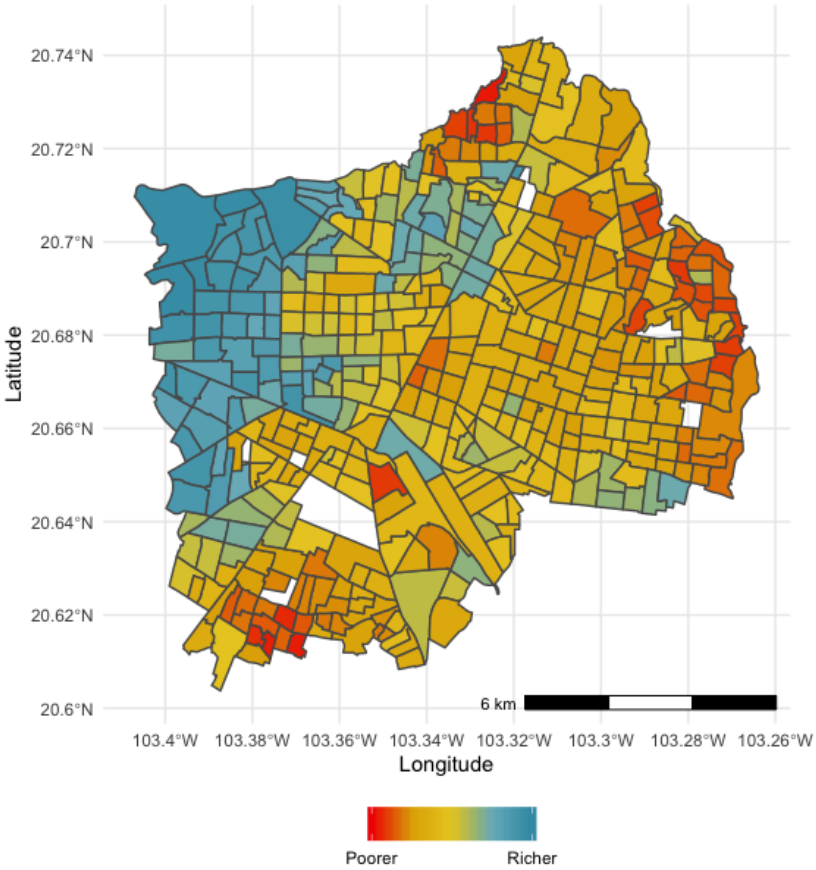

Figure 1.1: Guadalajara's municipality spatial inequality: Wealth index (PCA) by AGEB (Own elaboration).

representations "are justified through dissimilar cultural roots and justify the different results between individuals who live in both cardinal points of the city regarding well-being, poverty, [...], as well as differentiated investment and public spending levels" (Jaramillo and Saucedo, 2016). The discrimination just described is common in other Latin American cities with high spatial inequality, such as Bogota, Colombia (Bogliacino, Jimmnez, and Reyes Galvis, 2015).

A popular narrative supported by some scholars argues that the inequality within Guadalajara, as well as the cultural divide, is the result of the colonial ethnic segregation dated to the city foundation in 1542. After a chaotic process of conquest, the city was divided by a river into two neighborhoods: a *República de Indios* and a *República de Españoles*. The *República de Indios* and *República de Españoles* statuses were legal institutions or corporations enacted by

the Spanish Crown and enforced in colonial cities in Latin America to segregate indigenous communities from Spanish settlements. Each *República* counted with different administrative authorities, rights, and obligations.

Political theorists argue that the segregated indigenous neighborhoods served as "infrastructures of race": an urban element of the colonial cities that enforced a 'biopolitical' narrative by the Spaniards to control the indigenous and other ethnic groups (Nemser, 2017). The fact is that the *Repúblicas de Indios* neighborhoods had a lower social status than the *Repúblicas de Españoles* neighborhoods. As Anderson (1988) explains, colonial social status was intimately related to ethnicity and economic activity. So, during the colonial era, the *Repúblicas de Indios* became populated by many ethnic groups, such as *indios*, *mestizos*, *mulatos*, other castes, and Spaniards with low social status. The indigenous neighborhoods also were populated by low-skilled workers, like journeymen, artisans, and laborers; they also had a lower share of the female population and had a higher population.

My research hypothesis is that Guadalajara's initial ethnic segregation has persistent effects on the economic development of the city and the cultural traits of its inhabitants. Firstly, the *República de Indios* status affected the neighborhood ethnic fractionalization by the end of the colonial era. Then, the ethnic fractionalization of the colonial neighborhoods in 1821 has persistent effects on contemporary economic development. Ethnic segregation and fractionalization are related to sub-provision of public goods (Alesina and La Ferrara, 2005; Alesina and Zhuravskaya, 2011), while the persistence of the economic status of neighborhoods is related to self-reinforcing spillovers from agglomeration (Rosenthal and Ross, 2015). As well, ethnic fractionalization by the end of the colonial era explains differences in cultural traits, related to the transmission and socialization of culture through historical events (Bisin and Verdier, 2011; Nunn, 2012).

With a rich city census of 1821, this paper provides evidence that even when the legal status of *República de Indios* and *República de Españoles* were not enforced by the end of the

colonial period, the neighborhoods that once were a *República de Indios* have higher ethnic diversity.[2] Moreover, the status of *Repúblicas de Indios* of Guadalajara's colonial neighborhoods is a good instrument to estimate colonial ethnic diversity's effect on contemporary economic development. Instrumenting by the *Repúblicas de Indios* status, this work uses a fuzzy regression discontinuity to show that the contemporary neighborhoods closer to a colonial neighborhood with higher ethnic fractionalization are less wealthy.

The effects of colonial demographics persisted through a differentiated provision of public goods and different cultural traits. Contemporary neighborhoods closer to the colonial ones with higher ethnic fractionalization have fewer schools per student and less share of the population with access to social security. Consistently, those neighborhoods have lower years of education. Moreover, the housing prices of these neighborhoods are lower. In terms of cultural persistence, individuals living in the previously mentioned neighborhoods have less trust in government and other institutions, have less satisfaction with their neighborhood, and report to feel more discrimination. Lastly, there is also an effect on neighborhood voting.

The findings are consistent with the literature on ethnic fractionalization as a driver of underdevelopment through the provision of public goods. Alesina and La Ferrara (2005) model how ethnically diverse communities can foster development as long as there are complementarities in production due to the diversity of skills. The prediction is right as long as the production process is sufficiently diversified, and institutional setting allows to sort out conflicts regarding public goods and public policies. The evidence provided below shows that it was not the case of Guadalajara's urban history: colonial ethnic fractionalization is related to less labor diversification during the colonial period and to a sub-provision of public goods.

Guadalajara's urban history is a good natural experiment to test whether the ethnic characteristics of the colonial era cause differences in contemporary economic development and cultural traits within the city for various reasons. First, Guadalajara's pre-hispanic area lacked a po-

[2]Mexico declared its independence formally from Spain in 1821.

litical, social, and economic indigenous structure, such as the Mexicas or other present in the Center and South of the country. Second, Guadalajara was founded quite arbitrarily after four attempts to settle in different geographic locations because of the constant threat of semi-nomad indigenous groups. Third, as explained previously, the spatial ethnic segregation was enforced by a formal institution independent of the colonial conquerors' interests. Fourth, Guadalajara's last settlement was settled in a valley that is geographically homogeneous. Lastly, the status of *República de Indios* and *República de Españoles* were not enforced by the end of the colonial era. Therefore, the spatial ethnic segregation treatment was assigned 'as good as randomly' in this case study, and the legal status is potentially a valid instrument.

This work contributes to different economics literature, such as historical development economics, social economics, and urban economics literature. First, the paper provides evidence of the persistent effects of colonial institutions over contemporary economic development. The most studied mechanism of historical persistence is formal institutions. The argument broadly states historical events, or ancient institutions, shaped actual formal institutions that, at the same time, determine contemporary economic development. Engerman and Sokoloff (1997), Acemoglu, Johnson, and Robinson (2001), La Porta, Lopez-De-Silanes, Shleifer, and Vishny (1997), and La Porta, Lopez-de Silanes, Shleifer, and Vishny (1998), contributed firstly with more convincing evidence. After these seminal studies, and thanks to the historiographical work and data collection, new stages in the economics literature have used novel identification strategies to show causal links between history and economic development, focusing on analyzing the mechanisms of persistence (Nunn, 2009, 2020). Some examples are L. M. Arias and Dirod (2014); Banerjee and Iyer (2005); Nunn (2008); Dell (2010); Dell and Olken (2020); Valencia Caicedo (2019); Waldinger (2017). This work shows that the *República de Indios* and *República de Españoles* legal status affect segregation and fractionalization patterns in colonial Guadalajara and have long-lasting effects on economic development. First, the *República de Indios* status is correlated with higher colonial ethnic fractionalization. Contemporary neighborhoods closer to the *cuarteles* with high ethnic fractionalization are poorer, less educated,

have a higher share of the population without public services, and its dwelling prices are lower.

Second, the paper also shows evidence that culture is a mechanism of persistence. There is a vast empirical literature providing evidence that culture is relevant to explain decision-making related to economic and social choices (Ajzenman, 2018; Fernández, 2013; Fisman and Miguel, 2007; Guiso, Sapienza, and Zingales, 2006; Henrich et al., 2005; Hoff and Pandey, 2006; Tabellini, 2010).[3] An economic definition of culture is "decision-making heuristics or 'rules of thumb' that have evolved given [the human] need to make decisions in complex and uncertain environments" (Nunn, 2012).[4] Nunn (2012) argues that culture is a slow-moving variable that can be affected by historical events. Therefore, historical events can have long-term effects on economic development through culture. It is also true that culture and formal institutions are strongly correlated (Alesina and Glaeser, 2004; Alesina and Angeletos, 2005), and formal institutions need the know-how of culture to have effects over economic development (Nunn, 2012). Only relatively recent studies have paid attention to culture as a mechanism of persistence, such as Alesina, Giuliano, and Nunn (2013); Bazzi, Fiszbein, and Gebresilasse (2017); Greif (1994); Lowes, Nunn, Robinson, and Weigel (2017); Nunn and Wantchekon (2011). The paper shows that some cultural traits evolved differently between the west and the east of the city. With the use of survey data, the results show that there is less satisfaction with government, less trust in institutions –such as political parties, church, media, among others– and more self-reported cases of suffering discriminated. Moreover, with electoral data, the paper also shows there are differences in political preferences through voting behavior.

This work also provides evidence in favor of the hypothesis of ethnic fractionalization as a driver of underdevelopment previously mentioned. There is a vast literature studying ethnic fractional-

[3]There is also a vast literature in theory linking culture and economics. See Akerlof and Kranton (2000); Alesina and Angeletos (2005); Bénabou and Tirole (2006); Bisin and Verdier (1998, 2011); Tabellini (2008).

[4]A narrower definition by Guiso et al. (2006) is "those customary beliefs and values that ethnic, religious, and social groups transmit fairly unchanged from generation to generation". Fernández (2011) has a similar definition but argues that culture shows a "systematic variation," so it can change in shorter periods rather than the slow pace previously argued.

ization and its relationship with economic development.[5] Alesina and La Ferrara (2005) review the relationship between economic development and ethnic fractionalization. The authors argue that there are two main arguments of the relationship between ethnic diversity and economic development. The first one is that ethnic fractionalization fosters innovation and competition and then economic development. The second one argues that ethnic diversity is related to conflict, weak political institutions, and sub-provision of public goods, which is detrimental to economic development. More recently, Alesina, Michalopoulos, and Papaioannou (2016) argue that ethnic inequality, namely inequality between ethnic groups, is the driver of differences in economic development. This work shows that, for Guadalajara, colonial ethnic segregation and fractionalization are related to contemporary underdevelopment through sub-provision of public goods (Alesina and Zhuravskaya, 2011; Easterly and Levine, 1997), rather than the ethnic conflict-prone in some African regions (Esteban and Ray, 2008; Michalopoulos and Papaioannou, 2016; Montalvo and Reynal-Querol, 2005). Even when we cannot provide evidence of class-conflict or local capture by the elites, the results are consistent with (Alesina and La Ferrara, 2005) model predictions.

Fourth, since the paper uses the case study of Guadalajara, it is one of the few works linking the historical development hypothesis with the analysis of spatial persistence within cities. Few studies in the historical development literature use a spatial 'mezzo' approach (Michalopoulos and Papaioannou, 2018). Rosenthal and Ross (2015) review the literature studying the dynamics of reversal, persistence, and change of social status of city neighborhoods. Some examples of studies analyzing spatial persistence patterns on the economic development of smaller units are Bleakley and Lin (2012), Falck, Heblich, Lameli, and Südekum (2012), Heblich, Trew, and Zylberberg (2016) and Jedwab, Kerby, and Moradi (2017).

Lastly, the paper contributes to the literature on agglomeration economies. Urban economics argue that spatial patterns of economic development respond to the spatial structure of economic

[5]Besides the studies cited above, see also Alesina, Devleeschauwer, Easterly, Kurlat, and Wacziarg (2003); Michalopoulos and Papaioannou (2013).

activities (Benabou, 1993; Glaeser and Gottlieb, 2009; Krugman, 1991; Moretti, 2004). More specifically, agglomeration economies argue that "extreme persistence of a city's economic status is based on self-reinforcing spillovers from agglomeration" (Rosenthal and Ross, 2015). This work shows that the segregation in the foundation of the city induced ethnic fractionalization, which simultaneously had agglomeration effects on the accumulation of human capital.

The paper is structured as follows. The next section provides a historical overview of Guadalajara. Section 3 describes the historical and contemporary data. Section 4 discusses the identification strategy. Section 5 presents the results, and Section 6, the mechanisms of persistence. The last section concludes.

Chapter 2

Historical background

This section provides a brief overview of Guadalajara's foundation and the origins of ethnic segregation. It is based mainly on the historical work by Anderson (1988); Becerra Jiménez and Regalado Pinedo (2016); Castro Gutiérrez (2010); Rivière D'Arc (1973); Solís Matías (1986, 1992); Van Young (2018).

2.1 Guadalajara's arbitrary foundation

Guadalajara was the capital of the New Galicia, the kingdom corresponding to the west-central territories of New Spain. It became a central urban center during the colonial era due to the presence of political and religious institutions, such as the Real Audiencia and the Bishopric of the kingdom; because of its geographic location in the middle of the silver mines of Zacatecas and Mexico City; as well due to the region's hinterland commercial and agricultural activities. Nonetheless, Guadalajara's foundation responds to a series of arbitrary events during the conquest of the New Galicia rather than a previous historical settlement. Then, unlike Mexico City, Guadalajara was founded from scratch by the Spaniards.

Contrary to the territories in central Mexico, the northern pre-Hispanic territories were "a con-

geries of stateless or, more dramatically, acephalic societies (often chiefdoms)" (Knight, 2002). Accurately, historians describe the region of Chimalhaucan, New Galicia's pre-Hispanic region, as a low-density area, with low-integration among small independent state-cities, and few sedentary communities with irrigation systems (Van Young, 2018; Rivière D'Arc, 1973). The geographic characteristics of the region were also quite different from central Mexico (Álvarez, 2016). However, the above-enlisted facts not implied that a smooth conquest. The Chichimecas, the derogatory noun to the northern Indian communities coined by the Mexica empire, were hostile warriors that face the Spaniards decades before surrendering. Since there was no unified political structure, the conquest of the New Galicia territories implied state-building from scratch by the Spanish, something that did not happen in central Mexico where they seized and took advantage of the political and religious structure of the Mexica empire (Knight, 2002; L. M. Arias and Dirod, 2014).

Another relevant issue to mention is that the process of the conquest of New Galicia did not respond to the interest of the Spanish Crown, but mainly to the interest of its most relevant conqueror: Nuño de Guzmán (Álvarez, 2016). Guzmán was president of the Real Audiencia of Mexico, making him one of the most powerful men in New Spain, along with Hernán Cortés. Guzmán departed Mexico City in 1529 with a military expedition toward the west-center of the New World, all the way until the Pacific coast.[1] Guzmán's interest was not to settle but rather keep exploring the northern hinterland seeking prosperous Indian settlements, which did not exist (Calvo, 2016).

Since it was not in Guzmán's best interest to establish a single settlement that could foster as a political hub for the new kingdom, he founded five settlements during the expedition, most of them along the coastal line of the actual states of Sinaloa, Nayarit, and Jalisco, to assure the dominance of the new territories (Becerra Jiménez, 2016).[2] Among the first towns of New

[1]The expedition was extremely violent due to Guzmán's methods and the fierce resistance of the Chichimecas (Regalado Pinedo, 2016).

[2]Culiacán, Espíritu Santo, Purificación, Compostela –the first location of the Audiencia and Bishopric of the New Galicia–, and, lastly, Guadalajara –the name of the Spanish hometown of Guzmán– (Álvarez, 2016).

Galicia, Guadalajara had a particular fate. It was not founded once, nor twice, nor thrice. There was a total of four foundations of the settlement in different locations. It is essential to mention that the four settlements established on both sides but always along the Santiago River, which mainly runs through Huentitán canyon. Becerra Jiménez (2016) describes the complete process until the last foundation, which is briefly summarized here.

Fuente: Inegi conjunto de datos vectoriales, marco geoestadístico 2009. **Autor:** Celina G. Becerra Jiménez. **Elabora:** Geo. Judith Navarro Flores, ced. 8288383.

Figure 2.1: Guadalajara's foundation (Becerra Jiménez, 2016)

The first foundation was in 1532 in Nochistlán, in the actual south of the state of Zacatecas, a considerably distant location from the actual one. Due to constant threats of the Cascans –a Chichimeca semi-nomad indigenous community– and the shortage of water, the settlement lasted a bit more than a year. Afterward, in a short absence of Guzmán, the settlers of Guadala-

jara crossed the Huentintán canyon in 1533 and installed in Tonalá, which was a village of Indians where Guzmán had his *encomienda* –a colonial institution of indigenous forced labor–. When Guzmán returned, he forced to move again across the canyon to settle next to the smaller indigenous village of Tlacotlán in 1535. The problem with Tlacotlán was the same as Nochistlán: the constant threat of insurgency by the Cascans.

The violent situation aggravated, and in 1541 there was the Mixtón war. The viceroy Mendoza had to personally lead a military expedition from Mexico City to appease the situation. The last event helped the viceroy gain control over Guzmán, which was later sent to Spain to face trials against the Crown (Knight, 2002; Becerra Jiménez, 2016). In this context, led by Beatriz Hernández, Guadalajara's settlers decided that the location to ensure their safety was south of the Huentitán canyon: the Atemajac valley. Thus, in mid-February of 1542, Guadalajara was founded in its definitive location. So, the final location where the city established, as argued by Rivière D'Arc (1973), was entirely arbitrary. Figure 2.1 shows the location of the four settlements.

2.2 *Repúblicas de Indios*: colonial spatial ethnic segregation

Apart from the arbitrary location of the settlement, the ethnic spatial segregation within the city of it was also exogenous. Guadalajara established on the west side of San Juan de Dios river in the Atemajac valley. Nonetheless, the new settlers had as neighbors two *República de Indios* (Becerra Jiménez, 2016; Van Young, 2018; Rivière D'Arc, 1973; Anderson, 2006a). A part of the indigenous fraction brought by Mendoza's military aid during the Mixtón war settled in another small community in the south, named Mexicaltzingo (Castro Gutiérrez, 2010).[3] Then, in 1543, the Franciscans founded Analco, a convent on the east side of the San Juan de Dios river, which means "on the other side of the river" (Solís Matías, 1986, 1992). Therefore, taking

[3]Some indigenous *barrios*, composed by tlaxcaltecas and other indigenous groups participating along with Spaniards in the conquest, enjoyed some privileges since they argue they "were not conquered but conquerors" (Castro Gutiérrez, 2010).

into account the arbitrary location of Guadalajara, the root of the ethnic spatial division within the city is a natural experiment that originated in the 1542 foundation.[4]

The latter narrative argument is robust when analyzing the formal institutions behind the ethnic segregation. In 1538, the Spanish Crown ordered the creation of *Repúblicas de Indios*, namely indigenous settlements separated from Spanish ones, "differing in institutions, rights, and obligations from its members" (Nemser, 2017). The *Repúblicas de Indios*, hereafter indigenous *barrios*, were instituted by the enactment of the XIX law in the *Leyes de Los Reinos de las Indias* (*Recopilación de Leyes de los Reinos de las Indias*, 1841, Volume II, Book 6, Tittle I, Law XIX). Thus, every Spaniard settlement was set strictly apart from the indigenous *barrios*. Then, *Repúblicas de Indios* were independent settlements of indigenous populations with their small political structure: they had the right to choose its *cabildo* and possess communal land (Becerra Jiménez, 2016; Solís Matías, 1986). Castro Gutiérrez (2010) argues that beyond an institution or spatial unit, the indigenous *barrios* were a network of communications, kindships, friendships, and rivalry.

Two main arguments explain the creation of *Repúblicas de Indios*. The first one responds to the interest of the clerics, meanwhile the second one to 'biopolitical' reasons. Hillerkuss (1995) argues that, contrary to popular belief, the separation of the Spaniard settlers and the indigenous communities did not respond to the ethnic motivations or discrimination from the colonizers. Hillerkuss argues that the Spaniards wanted to have the indigenous population living with them in serfdom. Nevertheless, the interests of another important colonial actor prevailed: the ecclesiastic orders. The Franciscans, Dominican, Augustinians, and Jesuits argued that the Spaniards corrupted with immoral acts the indigenous population, for instance, drinking alcohol. Following the evangelization crusade, these religious congregations lobbied for the creation of *Repúblicas de Indios* (Hillerkuss, 1995). On the other hand, Nemser (2017) argues that urban spatial segregation by ethnicity was one of the many 'infrastructures of race' used by the

[4]There was also one small indigenous community in the north of the Spanish settlement, named Mezquitán. However, Mezquitán was not incorporated into the city until the end of the XIX century as Figure 2.2 illustrates.

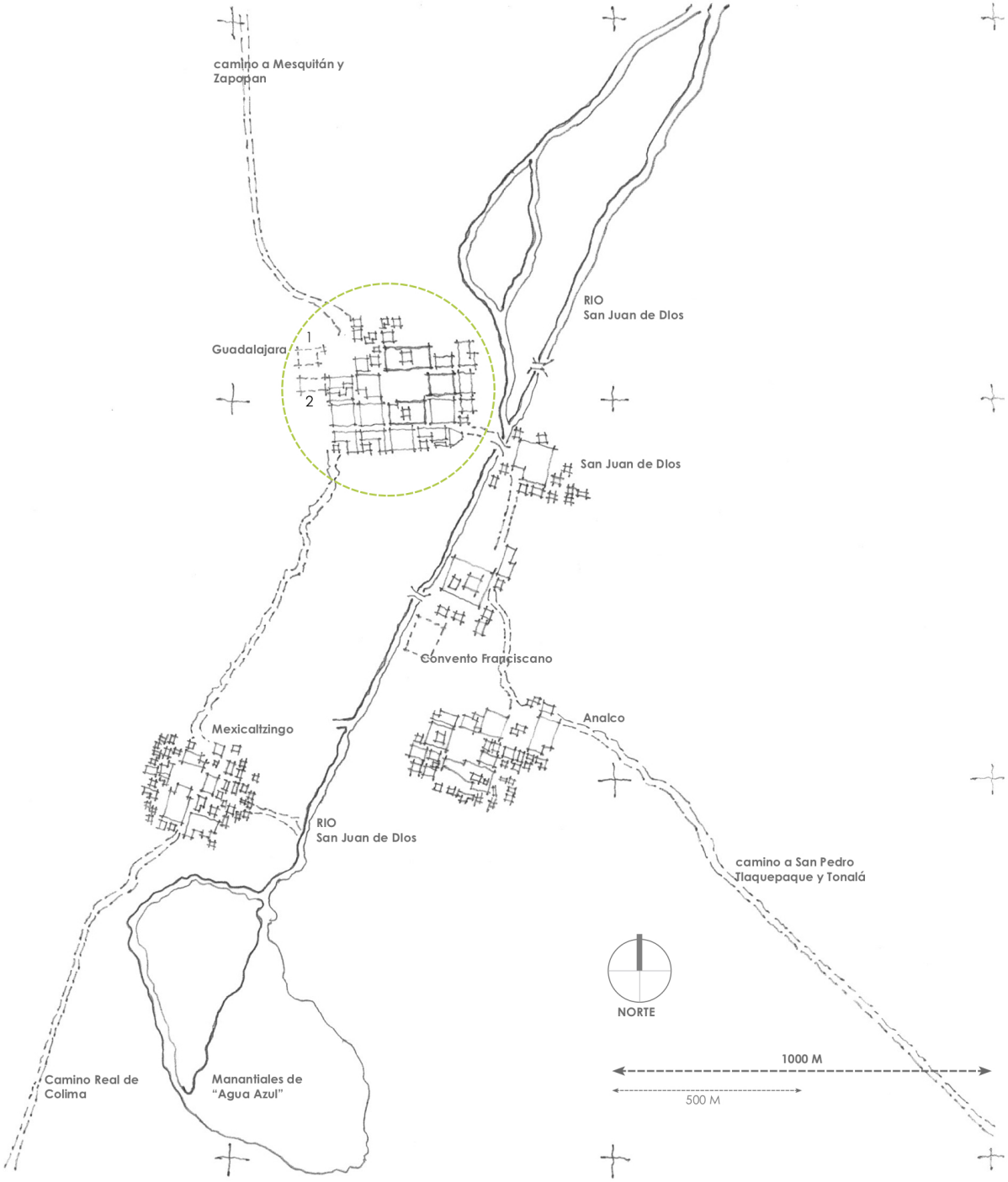

Figure 2.2: Guadalajara City circa 1542 (Mendoza Ramírez, 2004)

Crown, namely policies intended to reaffirm the political power of the Spanish over the Indians and other castes.

Figure 2.2 shows the location of Guadalajara's settlement, as well as the initial *Repúblicas de Indios* of Analco and Mexicaltzingo. As the map elaborated by Mendoza Ramirez (2004) shows, the Spaniard settlement was strictly set apart from Analco by San Juan de Dios River. Also, Guadalajara was at least a kilometer north-east away from Mexicaltzingo. Then, the ethnic spatial segregation in Guadalajara responds to a formal institution enacted by the Crown, exogenous to Spaniard settlers' interest.

It was not until the end of the XVIII century that Analco and Mexicaltzingo indigenous barrios were "physically absorbed by the city, however not in legal terms" (Rivière D'Arc, 1973; Solís Matías, 1986, 1992; Van Young, 2018). The barrios were considered *arrabales*, marginal, and poor neighborhoods mostly populated by non-Spaniard ethnic groups and low social status individuals (Becerra Jiménez and Regalado Pinedo, 2016). Historical evidence suggests the indigenous barrios had lower development than the western neighborhoods of the city. For instance, during different episodes of typhus and smallpox, 1814 and 1830, respectively, the highest mortality rates were in the indigenous barrios of Analco and Mexicaltzingo due to the low salubrity and the closeness to the San Juan de Dios river (Oliver Sánchez, 2008, 2016). It is also true that by the end of the colonial period, there was a clear social and economic stratification between Spaniards and Mestizos, and indigenous and other castes without nobility titles (Anderson, 1988), which reflects the inequality in economic activities within the city neighborhoods. Thus, the historical evidence shows that the neighborhoods that once had the status of *República de Indios*, or indigenous *barrio*, had higher ethnic diversity, lower diversification of economic activities, and lower economic development.

In summary, the *República de Indios* or indigenous *barrio* was a complex institutional, geographical, and social unit. Castro Gutiérrez (2010) argues that even when the indigenous communities living in these institutions lived in harsh living conditions, paid multiple taxes, and

were often humiliated, they had the opportunity to decide their affairs and participate actively in political activities. Besides, this institutional arrangement facilitated the administrative and ecclesiastic duties of the colonial authorities. So, rather than classifying the historical institution as an 'extractive' or 'inclusive' institution, this work exploits the fact that it induced ethnic segregation and fractionalization. Moreover, as Castro Gutiérrez (2010) suggests, the *República de Indios* or indigenous *barrio* identity persisted. It is then plausible to test whether spatial ethnic segregation of the foundation has persistent effects on the demographics at the end of the colonial era and the last on contemporary economic development.

Chapter 3

Data

3.1 Historical data

To test whether the ethnic segregation originated in the foundation of the city had effects on the ethnic fractionalization by the end of the colonial period and the latter has effects on contemporary economic development, this paper exploits the Guadalajara Census Project (GCP) data. The GCP data comprises the 1821 and 1822 city censuses, recompiled by Rodney D. Anderson (Anderson and Spike, 2007).

After the Independence War, the Trigarante Army ordered local authorities of the Intendencias of Guadalajara and Zacatecas to conduct "a precise and exact census with all the particulars of all the population in its province, men and women by equal, young and old [...] without repair in its age, *calidad* or occupation" (Anderson, 2006a). Anderson (1988) explains that *calidad* was related to ethnicity, "but implied a social definition of one's 'color, occupation, and wealth."

The censuses were complied at the individual level by the local authorities of the Guadalajara *cuarteles*. By the end of the colonial period, Guadalajara had twenty-four *cuarteles*, which was "a system imposed in the late colonial era as a Bourbon administrative reform" (Anderson,

2006b). Anderson explains that by 1790 the Intendent of Nueva Galicia ordered the division of Guadalajara into *cuarteles* and the *cuarteles* to be further divided into *barrios*. Anderson argues that "the purpose was to create a system that was large enough to administer policy efficiently but which was small enough to allow each citizen to be registered with, and responsible to, a specifically appointed official of the state."

Figure 3.1: Guadalajara *Cuarteles* in 1821 (Own elaboration).

Figure 3.1 shows the division of Guadalajara by *cuarteles* in 1821.[1] The indigenous *barrios* of Analco and Mexicalztingo were already included in the administrative division of the city. It is clear that the Río San Juan was a natural trace used to divide Analco, which comprises *cuarteles* 8 and 9. Meanwhile Mexicaltzingo comprises *cuarteles* 10, 11 and 24. Therefore, by 1821,

[1]The division of *cuarteles* by *República de Indios* and *República de Españoles* is based on Anderson (2006a); Becerra Jiménez (2016); Mendoza Ramirez (2004). Figure 3 in the appendix shows the map of Guadalajara *distritos* by 1821, an administrative level above *cuarteles*. From Figure 9 the study based the division of *cuarteles* between *República de Indios* and *República de Españoles* through GIS.

there was still a sharp physical division between the ancient indigenous *barrios* and the rest of the city's *cuarteles*.

The 1821 and 1822 censuses contain information about ethnicity, economic activity, social status, and location within the city at the individual level. Table 3.1 depicts the descriptive statistics of the GCP data. As Table 3.1 shows, the total population of Guadalajara by 1821 was 35,287 inhabitants, which represent more than 60% of the registered individuals of the GCP database. Almost 53% of the population was male. The mean age was 25 years old, with a standard deviation of 17 years. The median age was 23.

Table 3.1: Guadalajara's 1821 and 1822 censuses descriptive statistics

Variable	N	Percentage	Percentage with available info.
Registered Individuals	57,091	–	–
Registered in 1821	35,287	61.80%	–
Females	25,843	45.26%	46.24%
Males	30,038	52.61%	53.75%
Hidalguía	13,450	23.55%	25.46%
Without *Hidalguía*	39,375	68.96%	74.53%
Español	8,960	15.69%	48.21%
Indio	7,119	12.47%	38.30%
Mestizo	1,842	3.22%	9.91%
Mulato	431	0.75%	2.32%
Other castes	231	0.4%	1.24%
Elite	1,138	1.99%	6.42%
Merchant or master	2,288	4%	12.9%
Journeyman Artisans	6,794	11.9%	38.33%
Laborers	5,170	9.05%	29.16%
Servants	2,335	4.08%	13.17%
Born in Guadalajara	24,571	43.03%	73.90 %
Born elsewhere	8,674	15.19%	26.09%

Notes: Own elaboration with GCP data (Anderson and Spike, 2007).

As Table 3.1 illustrates, the censuses did not register information on every variable. For instance, only 32.5% of the individuals have information regarding ethnicity, while only 31% of the total

observations have information on economic activity. Nevertheless, it is relevant to note that the percentage with available information on the variables regarding sex and *hidalguía* –social status– are close to the percentage of the total sample. Therefore, a strong assumption of this work is that the available information on ethnicity and economic activity is representative of the city's real population parameters by 1821 and 1822.

It is possible to aggregate the census data by *cuartel*. Nonetheless, several issues arise in the aggregation of the information. First, there is no available information of *cuartel* 16. Secondly, when aggregating by *cuartel* it is possible to appreciate that the missing information at the individual levels happened at certain *cuarteles*, especially regarding ethnic information. As, well each *cuartel* registered information on the economic activity of about 30% of its population. Lastly, when aggregating information for the 1822 census, the data has more missing values than the 1821 census. Table 1 in the appendix depicts the main interest variables aggregated by *cuartel* by 1821.[2]

With the 1821 census data aggregated by *cuartel*, we calculate the Ethnic Fractionalization Index. In the development literature, fractionalization measures indicate the diversity of a spatial unit regarding one dimension. The most used measure of ethnic fractionalization is the Herfindahl-Hirschman index, given by

$$HHI = \sum_{i}^{N} \pi_i(1 - \pi_i) \tag{3.1}$$

Where N is the number of ethnic groups within a spatial unit, and π is the percentage of the group i in the spatial unit population. Alesina and La Ferrara (2005) explain that this index measures the probability that in a random draw of two individuals, both will belong to different ethnic groups. Then, the Ethnic Fractionalization Index (EFI hereafter) measures the diversity of ethnic groups in a given *cuartel*. The GCP data set broadly distinguished between four ethnic

[2]As a methodological note it is worth pointing out that the study will work only with the percentage rates regarding the available information.

groups: *Españoles*, *Indios*, *Mestizos* and other *castas*, including *Mulatos* among others.[3] With these ethnic groups and the available information on ethnicity by *cuartel* we calculate the EFI.[4]

We also calculate a Labor Fractionalization Index. In industrial organization literature, the Herfindahl-Hirschman index is a measure of market power. In this study, the Labor Fractionalization Index (LFI hereafter) measures the diversity of economic activities in a given *cuartel*. Regarding economic activities or labor occupation, the GCP classifies the occupations in five groups: elite, merchants and masters, journeyman, laborers, and servants.[5] As the GCP data explains,[6] the elite groups *hacendados* and similar landowners, clerics, government officials, professionals and non-commercial clerical positions.[7] The second category includes merchants and artisans with *hidalguía*, *maestros*. The third category is for those artisans without *hidalguía*. Laborers include bakers, brick masons, street merchants and other occupations considered "casual" .[8] With the categories enlisted above, we calculate the fractionalization indexes. Table 3.2 shows the descriptive statistics of these indexes.

Table 3.2: Fractionalization and polarization indexes

Dimension	Index	Abbreviation	Mean	Std. Deviation
Ethnicity	HHI	EFI	0.403	0.194
Labor Occupation	HHI	LFI	0.283	0.0748

Notes: Own elaboration with GCP data (Anderson and Spike, 2007).

[3]Codebook 1821 file of GCP data set.

[4]Only 14 *cuarteles* out of the 23 with available information registered ethnicity.

[5]In contrast, every *cuartel* registered information on labor occupation.

[6]Code-book of the 1821 Census file.

[7]Military occupations of officers and all individuals with hidalguía were placed in the elite category. Those without hidalguía were listed as Laborers. Code-book of the 1821 Census.

[8]The Code-book of the 1821 Census explains: "Those with no occupation given were excluded, although for a more accurate labor structure, one should include a significant portion of those adults and older youth who were not given occupation as Laborers."

3.2 Contemporary economic development and public goods

The main source of contemporary economic development variables is the 2010 *Censo de Población y Vivienda* by *Instituto Nacional de Estadística, Geografía e Informática* (INEGI). The 2010 Census registered information at household level and its most disaggregated level of available information is by urban block and *Área Geoestadística Básica* (AGEB). We also use data of dwelling prices and public infrastructure from *Instituto de Información Estadística y Geográfica del Estado de Jalisco* (IIEG),[9] and industry and services locations from *Directorio Estadístico Nacional de Unidades Económicas* (DENUE) from INEGI.[10]

Table 3.3 depict the descriptive statistics of the main variables of interest of the 2010 National Census and other data sources for the Guadalajara Municipality.[11] The wealth index illustrated in Figure 1.1 is constructed with Principal Component Analysis including variables such as people per room in the household, access to piped water, and possession of a car, among others, and, by construction, it is standardized.[12]

3.3 Cultural traits

To measure cultural traits, beliefs, and preferences, we use the 2016 and 2018 survey *Encuesta de percepción ciudadana sobre calidad de vida* elaborated by the local NGO *Jalisco Cómo Vamos* (JCV).[13] The JCV survey is registered at the individual level and is representative of the Guadalajara Metropolitan Area. The survey includes several questions, such as trust in government and institutions –political parties, church, media, police, businessman–; beliefs in individualism, collectivism, and luck; and the satisfaction with income and wealth distribution.

[9] https://datos.jalisco.gob.mx/instituciones/iieg.

[10] https://www.inegi.org.mx/app/mapa/denue/.

[11] The greater Guadalajara's Metropolitan Area includes the municipalities of Guadalajara, El Salto, Ixtlahuacán de los Membrillos, Juanacatlán, San Pedro Tlaquepaque, Tlajomulco de Zúñiga, Tonalá, Zapopan and Zapotlanejo. The study only focuses in Guadalajara municipality AGEBs, all within a ratio around eight squared kilometers

[12] The complete set of variables for the PCA index are: people per room in the household; access to piped water; possession of fridge, washing machine, car, radio, computer, cellphone, telephone; and access to the internet.

[13] Available at http://www.jaliscocomovamos.org/datos-abiertos.

Table 3.3: 2010 Census: Descriptive statistics for Guadalajara municipality by AGEB

Variable	Mean	Std. Deviation
Population	3382.765	1778.21
Density (population / km^2)	1268.59	688.18
Women (%)	52.15 %	1.86 %
Median age	29.68	4.07
Indigenous households (%) (2010)	0.80 %	1.01 %
Years of schooling	10.382	1.85
Occupied population (%)	96.41 %	1.3 %
People per room	0.868	0.2
Households with car (%)	59.86 %	15.17 %
Dwellings mean price	3,093,537 MXN	2,296,762 MXN
Dwellings median price	2,786,095 MXN	1,999,158 MXN

Notes: Own elaboration with 2010 National Census Data (INEGI); Dwellings price map (IIEG).

Table 3.4 depicts the descriptive statistics of the JCV survey. It is worth noting that the sample for the Guadalajara municipality is 800 individuals spread across 51 different AGEBs.

Table 3.4: JCV Survey Descriptive statistics

Variable	Mean	Std. Deviation
Women	0.484	–
Age	48.553	18.345
Subjective well-being	8.545	1.767
Individualism	8.75	1.728
'Governmentalism'	4.005	2.711
Satisfaction w/ neighborhood	7.796	2.21
Satisfaction w/ public services	6.109	1.557
Satisfaction w/ local government	3.791	1.836
Satisfaction w/ income/wealth distribution	4.127	2.69
Trust in institutions	4.712	1.67
Discirmination	0.054	0.125

Notes: Own elaboration with 2016 and 2018 *Encuesta de percepción ciudadana sobre calidad de vida* (JCV). Preferences, trust, satisfaction, and perception variables are measured in a Likert scale from 1 to 10. Discrimination is the mean of the total count of discrimination attitudes that the individual responded she has suffered.

Inspired in Toral (2018), this work also evaluates whether the colonial ethnic fractionalization also has persistent effects on local voting behavior. Rather than testing general theories of neighborhood effects on voting behavior, we seek to test if the division in terms of cultural traits of

Guadalajara's inhabitants also extends to political preferences. For this purpose, we use electoral data for the 2018 elections for the senate.

The 2018 Senate election is of particular interest in terms of political preferences. It was a local representative election where Wikipolítica, a grassroots independent local political movement, contended against the incumbent party of the senate and the Jalisco governor seat, PRI, as well as Morena and Movimiento Ciudadano parties, heading the presidential and governor election polls, respectively.[14] Besides, if voting behavior reflects political preferences, we would expect to see a differentiated voting pattern as expected with the cultural traits, such as in Bazzi et al. (2017).

Table 3.5: 2018 Senate election by electoral section

Variable	Mean	Std. Deviation
Turnout	63.5 %	14.8
Wikipolítica	28.969 %	9.019
Movimiento Ciudadano (MC)	17.011 %	4.637
PRI - PVEM	11.126 %	3.676
Morena	19.746 %	5.5
PAN	11.256 %	4.758

Notes: Own elaboration based on Toral (2018).

Table 3.5 shows the descriptive statistics for the 2018 Senate election at the electoral section level for the Guadalajara municipality. As argued before, the 2018 Senate seat is of particular interest. For instance, the turnout was high. Moreover, Wikipolítica won the Guadalajara municipality, but, as Toral (2018) describes, thanks to the vote of some geographic regions. It is worth testing if the city's cultural divide also extends to political preferences, reflected by voting behavior.

[14] Wikipolítica, with Pedro Kumamoto as a candidate, won a local congress seat in the 2015 local elections (*Pedro Kumamoto makes history with shoestring campaign and win in Mexico*, 2015). For the 2018 election, Wikipolítica participated in the process with Kumamoto and Juanita Delgado, a local political activist, as candidates for the Jalisco senate seat (Villegas, 2018)

Chapter 4

Empirical strategy

4.1 Identification strategy

The goal of the paper is to assess whether the *República de Indios* status has persistent effects on economic development. For estimating the persistence of the colonial institution, first on ethnic fractionalization and then on contemporary economic development, the paper uses a Fuzzy Regression Discontinuity design (Fuzzy RD), which is an instrumental variable approach (Angrist and Pischke, 2008, Chapter 6.2).

The argument is that the *República de Indios* status effects on contemporary economic development persisted through the ethnic fractionalization by the end of the colonial period. Specifically, the *República de Indios* status has effects in the fractionalization index of ethnicity: colonial *cuarteles* with previous *República de Indios* status have higher ethnic fractionalization. As noted previously, the fractionalization indexes denote the probability that in a random draw, two individuals within a spacial unit belong to different groups. As Angrist and Pischke (2008) explain, Fuzzy RD approach exploits discontinuities in the probability or expected value of treatment conditional on a covariate. Then the study case of this paper fits the criterion for a Fuzzy

RD specification.

In the first stage we instrument ethnic fractionalization on a dummy indicating whether the *cuartel* had a previous *República de Indios* status. Equation 4.1 depict the first stage of the Fuzzy RD specification.

$$EFI_{ac}^{1821} = \alpha_1 + \beta_1 \textit{República de Indios}_{ac} + \delta_1 f(\textit{Dist. to barrio boundary}_a) + \gamma_1 \textit{Dist. to nearest cuartel}_{ac} + Z_c'\eta_1 + e_a \quad (4.1)$$

Where *República de Indios*$_{ac}$ is a dummy indicating if the nearest *cuartel* c of AGEB a had a *República de Indios* status. Since we are analyzing a geographical discontinuity, the running or score variable is a polynomial of the distance from AGEB a to the boundary dividing *Repúblicas de Indios* and *Repúblicas de Españoles*, centered in zero, whose effect is captured by δ_1. Note that, since EFI_{ac}^{1821} is strictly between zero and one, the Fuzzy RD criteria is fulfilled. Equation 4.1 also controls for the distance of AGEB a to the nearest *cuartel* c, and a vector Z_a with controls of *cuartel* c, such as elevation, distance to roads, distance to rivers and population density.[1]

With the fitted values of Equation 4.1, we run the regression on the reduced form or second stage regression, depicted in Equation 4.2.

$$y_a^{2010} = \alpha_2 + \beta_2 \hat{EFI}_{ac}^{1821} + \delta_2 \textit{Dist. to nearest cuartel}_{ac} + Z_c'\theta_2 + u_a \quad (4.2)$$

Where y_a^{2010} represents a variable of contemporary economic development in AGEB a, such as the constructed wealth index, years of schooling, number of schools per AGEB, among others. Then, $\hat{EFI}_{ac}^{1821}$ are the fitted values of the ethnic fractionalization indexes of the nearest *cuartel* c, corresponding to AGEB a. The next term is the distance between AGEB a and the closest *cuartel* c. The specification includes the vector Z_a with controls of *cuartel* c.[2]

[1] In some specifications, we control by LHI_{ac}^{1821}, which represents the labor diversity of the nearest *cuartel* c corresponding to AGEB a. The advantage of including the labor diversity index is to control the ethnic fractionalization effect. However, since the labor fractionalization index is also endogenous, it may be a bad control.

[2] Same as the previous specification, in some specifications I control by LHI_{ac}^{1821}.

The *República de Indios* status is a good instrument for ethnic fractionalization in 1821. As the first relation of interest argues, the ethnicity and economic activity in 1821 were strongly correlated with the *República de Indios* status. Therefore, the relevance restriction holds. Also, as argued previously, the *República de Indios* status was not enforced by the end of the colonial period. Then, the ethnic diversity by *cuartel* at the end of the colonial period is a result of a path dependence process of the neighborhoods' social status. So, ethnic fractionalization by the end of the colonial period is one of the possible channels through which *República de Indios* status persisted, fulfilling the exclusion restriction.[3]

The estimates of the Fuzzy RD specifications should be interpreted as the Local Average Treatment Effect of increasing the probability that at a given draw in a spatial unit, two individuals belong to different ethnic groups. Namely, the LATE represents the intensity of the ethnic fractionalization in 1821 on the contemporary variables of interest.[4]

4.2 Spatial analysis

To estimate the persistent effects of the *Republica de Indios* on 1821's ethnic fractionalization by *cuartel*, and later on contemporary development, with the use of Geographic Information Systems (GIS), each AGEB is linked with the nearest *cuartel* of 1821.[5] Even if the area of interest is small, the analysis uses the chordal distance rather than Euclidean distance (Keele and Titiunik, 2015). Thus, we calculate the chordal distance from each AGEB centroid to the nearest *cuartel* centroid.[6] Then we link the nearest *cuartel* demographics and fractionalization indexes by AGEB. We also calculate the chordal distance of 1) the *cuartel* distance to the nearest point in the geographical boundary of the *República de Indios* status, and 2) the AGEB distance to the nearest point in the same boundary. Figure 5 in the Appendix depicts the size of the urban

[3]Note that there is only information on ethnic fractionalization on 14 out of the 23 *cuarteles* with available information. Therefore, with the criterion used for matching *cuarteles* to contemporary AGEBs, the sample is reduced from 430 to 320.

[4]The EFI is standardized to allow comparability along with the different regressions.

[5]All the GIS analysis was realized in QGIS and R.

[6]Chordal distance is calculated with `pointDistance()` command from `raster` package.

trace of 1821, colored in red, regarding the size of the Guadalajara municipality in 2010. The 1821 urban trace is the contemporary *Centro Histórico* or city's downtown. Meanwhile, Figure 6, also in the Appendix, illustrates with red the AGEBs that are closer to an 1821 *cuartel* which had a previous status of *República de Indios*.

Since our geographical area of study is within a radio of 8 kilometers, a potential problem for the identification strategy is spatial autocorrelation. Moreover, as Kelly (2019) points out: "persistence regressions are spatial regressions." It means that, as every analysis using spatial data, for a given spatial unit, either the dependent variables, the independent variables, the error term, or a combination of them, is correlated with its spatial neighbors (Gibbons, Overman, and Patacchini, 2015). Nonetheless, this issue is barely taken into account in most of the historical persistence literature, even when spatial autocorrelation in the error term produces inflated t-statistics (Kelly, 2019), and spatial autocorrelation of dependent variable causes bias in estimation (Betz, Cook, and Hollenbach, 2019).

To address this concern, firstly, the paper test for spatial autocorrelation of the main interest variables with a Moran I test. Table 4.1 shows the Moran I statistics for our variables of interest. The results confirm there is spatial autocorrelation of the main variables of interest. So we expect the fuzzy regression discontinuity approach will produce biased estimators and high inflated t-statistics.

Spatial econometrics models are an alternative to asses the problem. As Gibbons et al. (2015) explain observations on variables at a given location are typically linear combinations of the observations in neighboring locations. These linear combinations are aggregated with a sequence of scalar spatial or group weights. Then, spatial econometrics include a spatial neighbor weight matrix, W, that represents spatial lags of the variables of interest. Then a generalized spatial econometrics model is

$$y = \rho W y + X\beta + WX\theta + u, u = \lambda W u + \varepsilon$$

Table 4.1: Moran I test

Variable	Moran I Statistic	p-value
Dependent variables		
Wealth index	0.737	0.01
Years of schooling	0.784	0.01
Share without access to social security	0.574	0.01
Log(Mean price of dwellings)	0.612	0.01
Independent variables		
EFI	0.885	0.01
LFI	0.670	0.01

Notes: Own elaboration with GCP and INEGI data. W matrix is based on contiguous neighbors. Elaborated with `moran.mc()` command of `spdep` package in R.

Where the spatial lags effects are given by the parameters ρ, θ, and λ. Several specifications can arise imposing restrictions from the generalized model.[7] Since we are interested in assessing the effect of a few EFI values on contemporary household wealth, controlling by distance to the nearest *cuartel* and other historical variables, the model that fits better our question of interest is a SARAR ($\theta = 0$). The SARAR model includes both global spillover effects through ρ, which in our case study might capture the urban growth process, and local spillover effects through λ, which might capture the unobserved interactions from each location and its neighbors.[8]

This work uses both the standard econometric and spatial econometrics toolkit. Firstly, we estimate the Fuzzy RD specification with robust standard errors correcting by heteroscedasticity and autocorrelation (HAC). Following Keele and Titiunik (2015), we also estimate the Fuzzy RD with `rdrobust` package to correct for bandwidth selection (Calonico, Cattaneo, and Titiunik, 2015).[9] These alternatives may correct the inference, but not necessarily the spatial endogeneity bias. Then, the analysis estimates spatial models to correct the spatial endogeneity bias. More-

[7] Spatial Autoregressive Model SAR ($\theta = \lambda = 0$); Spatial Lagged SLX ($\rho = \lambda = 0$); Spatial Error SEM ($\rho = \theta = 0$); and a combination of the previously listed, such as Spatial Durbin ($\lambda = 0$), Spatial Durbin Error ($\rho = 0$), and SARAR ($\theta = 0$) also known as Kelejian-Prucha, Cliff-Ord, or SAC (Burkey, 2018; Gibbons et al., 2015).

[8] For guidance for choosing a specific spatial econometric specification see Burkey (2018); LeSage (2014).

[9] It is relevant to mention that the package has trouble estimating with covariates. Therefore, some specifications include some covariates while others do not.

over, following Betz et al. (2019), we use a Spatial 2SLS approach to estimate the Fuzzy RD correcting for the non-spatial endogeneity. We use `spatialreg` and `spreg` packages following Betz et al. (2019); Bivand, Pebesma, and Gómez-Rubio (2013); Burkey (2018); Kelejian and Piras (2017); Piras (2010).

Chapter 5

Results

5.1 Main results

Colonial ethnic fractionalization has a persistent negative effect on economic development. Column (3) of Table 5.1 estimates that an increase in a standard deviation in ethnic fractionalization by 1821 decreases household wealth by more than 0.6 standard deviations. Along with the different specifications, the point estimate is a decrease ranging between 0.92 and 0.42 standard deviations and is highly statistically significant, as expected.

When correcting the optimal bandwidth of the first stage with `rdrobust`, the effective number of observations reduces to 45, and the point estimator lower bound is a decrease in 0.95 standard deviations, statistically significant at 10 percent. With the robust estimation, the coefficient is a decrease in one standard deviation, not statistically different from zero. It is worth noting that this is the point estimate at the boundary, not the LATE on the sample.

The instrument of *República de Indios* status fulfills the relevance restriction. Table 5.1 also shows the diagnostics for the Fuzzy RD first stage. The weak instruments test is high and statistically significant, rejecting the null hypothesis that the instrument is not relevant. Figure

Table 5.1: Colonial ethnic segregation and fractionalization on contemporary wealth (I)

	Dependent variable:					
	Wealth index					
	OLS		*2SLS*			
	(1)	(2)	(3)	(4)	(5)	(6)
EFI	-0.421^{***}	-0.753^{***}	-0.611^{***}	-0.924^{***}	-0.953^{*}	-1.000
	(0.106)	(0.147)	(0.162)	(0.227)	(0.555)	(0.671)
LFI		0.487^{***}		0.676^{***}		
		(0.151)		(0.226)		
Distance to nearest cuartel	-0.145^{***}	-0.136^{***}	-0.149^{***}	-0.134^{***}		
	(0.027)	(0.029)	(0.026)	(0.029)		
Observations	320	320	320	320	45	45
Historical controls	✓	✓	✓	✓	✗	✗
R^2	0.377	0.385	0.368	0.384		
F / Wald statistic	31.511^{***}	27.959^{***}	22.99^{***}	23.22^{***}		
Weak instruments			303.282^{***}	1011.79^{***}		
Wu-Haumsan			8.725^{***}	5.985^{**}		
Sargan			1.030	0.016		
Moran I for residuals	0.457	0.523	0.451	0.473		

Notes: Own elaboration. Robust standard errors in parenthesis from Columns (1)-(4). Columns (5) and (6) show the results for the `rdrobust` estimation. Column (5) is for the conventional estimation. Column (6) is for the robust estimation. All variables but distance to nearest cuartel are standardised. Historical controls include log of density, distance to roads, distance to rivers, and log of elevation, each by cuartel in 1821. *p<0.1; **p<0.05; ***p<0.01

5.1 illustrates the first stage of the Fuzzy RD graphically. It is clear that, even with a polynomial of fourth order, the EFI jumps at the geographical boundary. Then, the Fuzzy RD identification strategy is consistent.

As well, table 2 in the Results Appendix show the results for the first stage of the Fuzzy RD approach. We estimate the first stage with OLS corrected by robust standard errors and with `rdrobust`. The estimate ranges between 1.18 and 1.29 standard deviations. The estimate in standard deviations is equivalent to an increase in between 0.089 and 0.097 percentage points in the ethnic fractionalization index. Since the assignment of *República de Indios* status was given from the foundation of the city, besides some geographical covariates, we cannot prove balance on the status treatment. Then, we do not claim causality in the estimated first stage RD.

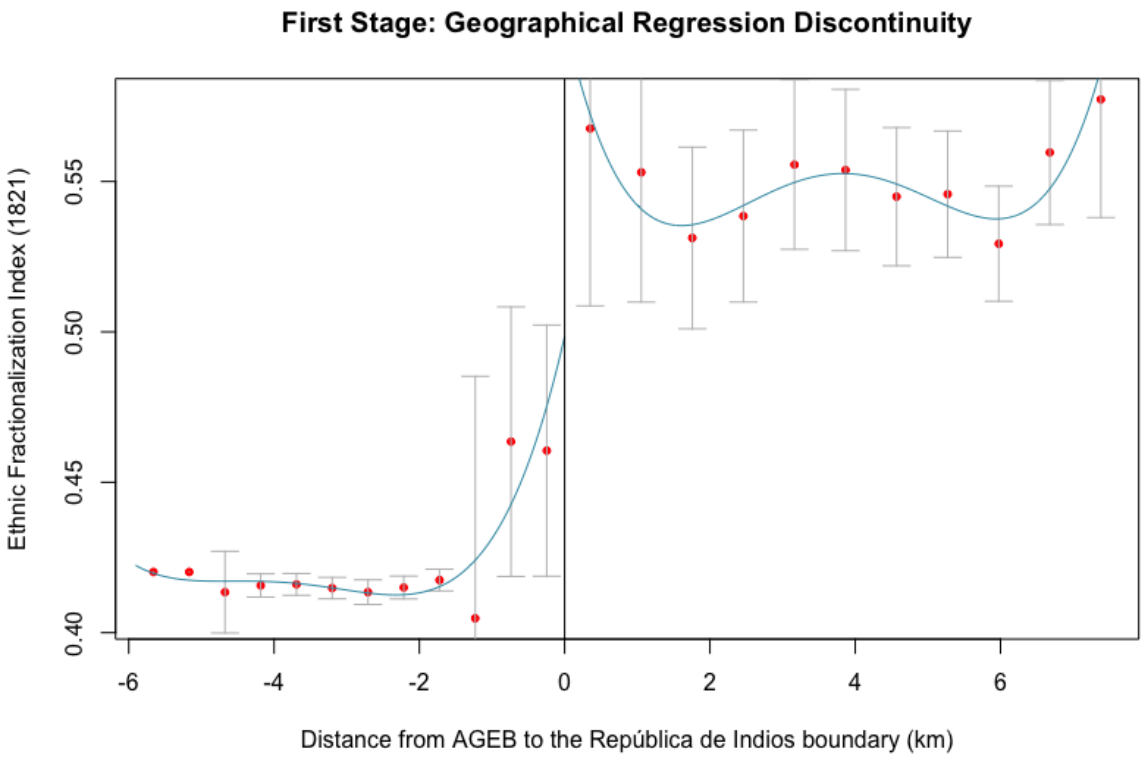

Figure 5.1: First stage GRD (Own elaboration).

However, the estimate is consistent with the historical evidence and convincing enough that the effect of segregation persisted through the colonial period.

Table 5.1 also shows that the labor fractionalization index has the opposite sign of the same index for ethnicity: so higher labor diversification by *cuartel* in 1821 is associated with higher contemporary wealth. As expected, adding the LFI to the regression inflates the EFI estimate. Since our variable of interest is the ethnic fractionalization, we do not include the LFI in the regressions hereafter. Also, Table 5.1 shows that distance to the nearest *cuartel* has a negative impact on household wealth: one kilometer further away from the nearest *cuartel* is associated with a decrease of almost 0.15 standard deviations. The effect of the distance to the nearest *cuartel* is consistent, along with the different specifications. It is also consistent with the urban economics literature: economic status declines with distance from the spatial areas with a higher density of economic activity, for instance, Guadalajara's downtown, even the mechanism is

different from the one proposed for US cities (Glaeser, Kahn, and Rappaport, 2008).

5.2 Robustness

5.2.1 Spatial endogeneity

The last row of Table 5.1 shows the Moran I Statistics for the residuals spatial autocorrelation. Besides the autocorrelation in the independent and dependent variables depicted in Table 4.1, it is clear that there is spatial autocorrelation in the error term along the different specifications. Then, we have a problem of spatial endogeneity and the inference of the standard econometrics it is not valid. Nevertheless, spatial econometrics models support the previous results. Table 5.2 present the spatial models' results.[1]

Table 5.2 show the results for the SARAR and Spatial 2SLS specifications. Columns (1) to (3) in Panel B show that the SARAR direct impact estimator of EFI over the household wealth is a decrease between 0.18 and 0.12 standard deviations, statistically significant at least at the 10 percent. Columns (4) to (6) presents the equivalent of LATE for the S2SLS. Columns (4) and (5) show that the effect of ethnic fractionalization over household wealth remains negative and statistically significant: an increase in a standard deviation on EFI causes a decrease in 0.215 in household wealth. Thus, the coefficients from spatial econometrics are smaller in magnitude but consistent with the standard econometrics results in expected sign and statistical significance.

The results above confirm the research hypothesis. Colonial ethnic fractionalization, instrumented by the *República de Indios* status, drives underdevelopment. An increase in a standard deviation in the ethnic fractionalization, equivalently an increase in 0.078 percentage points in the EFI, causes a decrease of at least 0.215 standard deviations in household wealth in terms of local average treatment effect. As Figure 7 in the result appendix shows, there could be high

[1] Due to both SARAR and S2SLS are highly sensitive to the type of weight matrix, we estimate these two models for different weight matrices.

Table 5.2: Colonial ethnic segregation and fractionalization on contemporary wealth (II)

	Dependent variable:					
	Wealth index					
	SARAR			S2SLS		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Coefficients						
EFI	-0.093^{*}	-0.184^{*}	-0.108	-0.215^{**}	-0.079	-0.215^{**}
	(0.054)	(0.100)	(0.066)	(0.103)	(0.064)	(0.103)
ρ	0.846^{***}	0.069	0.756^{***}	0.409^{***}	0.822^{***}	0.915^{***}
λ	-0.320^{***}	0.666^{*}	-0.104	0.352^{*}	-0.257	0.7266^{*}
Panel B. Impacts of EFI						
Direct impact	-0.123^{*}	-0.184^{*}	-0.132^{***}			
	(0.074)	(0.099)	(0.077)			
Indirect impact	-0.481	-0.013	-0.384			
	(1.253)	(0.043)	(0.459)			
Total impact	-0.605	-0.198^{*}	-0.517			
	(1.288)	(0.116)	(0.500)			
Observations	320	320	320	320	320	320
Historical controls	✓	✓	✓	✓	✓	✓
Nagelkerke R^2	0.630	0.593	0.614			
LR test	167.04^{***}	136.55^{***}	154.09^{***}	153.46^{***}	11.79^{***}	138.28^{***}

Notes: Own elaboration. Asymptotic standard errors in parenthesis. W weight matrix for spatial models based on contiguous neighbors. Column (1) W is row standardised. Columns (2) and (4) W is globally standardised. Column (3) W is variance-stabilizing coding scheme. Column (6) W follows Kelejian and Prucha (2010). Historical controls include log of density, distance to roads, distance to rivers, and log of elevation, each by cuartel in 1821. Each specification also controls for distance to the nearest cuartel. *p<0.1; **p<0.05; ***p<0.01

heterogeneity of the effect regarding the distance to the *República de Indios* boundary. Then, it is plausible that the effects range between minus 0.95 standard deviations at the boundary, until the S2SLS estimate, including the IV estimate of minus 0.61 standard deviations.

5.2.2 Robustness checks

Besides ethnic fractionalization, the *República de Indios* status might have had effects on other variables during the colonial period. For instance, as mentioned before, ethnicity was intimately related to economic activity and social status (Anderson, 1988). To test the specifications previ-

ously presented, we use other available variables at the *cuartel* level to analyze their relationship with ethnic fractionalization.

Figures 8, 9, 10, and 11 in the results appendix show that ethnic fractionalization is not statistically correlated with the labor fractionalization index, the share of population with *hidalguía*, the share of female population, nor the population at the *cuartel* level. The lack of statistical significance is due to the shortage of information at the *cuartel* level. Nonetheless, the same Figures depict that the two *cuarteles* with available information that had a previous *República de Indios* status have high ethnic fractionalization, at the same time with relatively low labor fractionalization, low share of the population with *hidalguía*, low share of female population, and relatively high population.

Then we use the Fuzzy RD specification using the wealth index as the dependent variable to test if any of the previously mentioned variables have a similar effect to the ethnic fractionalization index. If so, we would have evidence that the *República de Indios* status effect through ethnic fractionalization is consistent. Results are at Table 5.3.

Differing from the estimate in Table 5.1, the labor fractionalization index is not statistically correlated with the dependent variable in any specification. Column (10) shows that the point estimate of the population share with *hidalguía* is positively correlated with the wealth index at a 10 percent level of statistical significance. Then, neither economic activity nor social status at the *cuartel* level explains contemporary underdevelopment as the ethnic fractionalization index does.

Figures 10 and 11 show that *cuarteles* with a previous *República de Indios* status have high ethnic fractionalization and a low share of females and a relatively bigger population, respectively. The specifications for the share of the female population in Table 5.3 show that it is positively correlated with contemporary household wealth, with a significance level of at least 5 percent. Moreover, the log of the population at the *cuartel* by 1821 is negatively correlated with the con-

temporary wealth index, and it is statistically significant. Then, it might be the case that the ethnic fractionalization effect is also capturing a gender and demographic effect. The gender effect is consistent with the literature studying women empowerment and social capital (Duflo, 2012; Janssens, 2010). Nevertheless, the effect of *República de Indios* status is consistent.

Table 5.3: Specification tests

	Dependent variable:											
	Wealth index											
	OLS				*2SLS*							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
LFI	−0.085				0.233				0.791			
	(0.079)				(0.675)				(1.464)			
Share of Hidalguía		0.173				0.197				0.360*		
		(0.108)				(0.176)				(0.213)		
Share of females			0.243***				0.348**				0.679	
			(0.094)				(0.151)				(0.456)	
log(Population)				−0.292**				−0.565**				−1.035***
				(0.135)				(0.258)				(0.447)
Observations	430	339	430	430	430	339	430	430	163	118	91	151
Historical controls	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✗	✗
R^2	0.416	0.500	0.434	0.424	0.383	0.500	0.431	0.415				
F / Wald Statistic	50.253***	55.263***	54.159***	51.797***	21.48***	31.94***	34.03***	30.47***				
Weak instruments					5.309***	117.948***	127.855***	133.586***				
Wu-Hausman					0.606	0.069	1.760	3.995**				
Sargan					12.096***	0.063	1.353	2.682				

Notes: Own elaboration. All variables but log(Population) standardised. Robust standard errors in parenthesis. Columns (8) to (12) estimated with `rdrobust` robust estimation. Historical controls include log of density, distance to roads, distance to rivers, and log of elevation, each by cuartel in 1821. *p<0.1; **p<0.05; ***p<0.01

As an additional robustness check, we use probit regressions at the individual level with the censuses of 1821 and 1822 to estimate the probability to being registered in a certain category of ethnicity or economic activity, given if the individual was registered in a *cuartel* with previous *República de Indios* status. As, Tables 3 and 4 in the results appendix show, the *República de Indios* does correlate positively to the probability of being registered as *Indio*, journeyman and as a laborer. These results are consistent with the historical evidence presented.

Tables 3 and 4 also show the positive correlation of certain categories of ethnic and economic activity. For instance, being registered as *Indio* is positively correlated with being a laborer and vice versa. As well, not having *hidalguía* is positively correlated with being registered as *Indio*, *Mestizo*, or one of the other castes; it is also positively correlated with being a journeyman, laborer or servant. Lastly, Table 3 provides evidence that gender was also related to ethnicity: it was more probable to be a woman being a Spaniard than any other caste. Therefore, there

is evidence in favor of Anderson (1988) hypothesis of the close relation of ethnicity, economic activity, and social status at the individual level, even when the last two do not have effects on contemporary development aggregating them onto the *cuartel* level.

Chapter 6

Mechanisms of persistence

One of the main challenges of the study is to shed light on the mechanisms that caused the persistence of the colonial ethnic segregation and fractionalization for two centuries. This section aims to disentangle some mechanisms of persistence consistent with Guadalajara's urban history. Specifically, we test for public goods, housing prices, and cultural traits as drivers of the effect previously found. Since the previous results prove the causal relation of interest, the channels of persistence are estimated through 2SLS.

6.1 Public Goods

Following Dell (2010), first, we study whether education is a mechanism of persistence. Table 6.1 presents the results for the Fuzzy RD specification with years of schooling as the dependent variable. Column (2) shows that the point estimate for LATE in the whole sample is minus 0.56 standard deviations on years of schooling. Therefore, contemporary neighborhoods closer to a colonial *cuartel* with high ethnic fractionalization have, on average, a year less in years of schooling. The point estimate for the discontinuity is minus 0.48 standard deviations, statistically significant at 10 percent, and statistically not different from zero with robust estimation.

Table 6.1: Education

	Dependent variable:			
	Years of schooling			
	OLS	*2SLS*		
	(1)	(2)	(3)	(4)
EFI	-0.385^{***}	-0.560^{***}	-0.483^{*}	-0.332
	(0.107)	(0.162)	(0.283)	(0.350)
Observations	320	320	34	34
Historical controls	✓	✓	1/2	1/2
R^2	0.459	0.451		
F / Wald statistic	44.192^{***}	29.98^{***}		
Weak instruments		303.282^{***}		
Wu-Haumsan		8.557^{***}		
Sargan		1.496		

Notes: Own elaboration. Robust standard errors in parenthesis from Columns (1)-(3). Columns (4) and (5) show the results for the `rdrobust` estimation. Column (4) is for the conventional estimation. Column (5) is for the robust estimation. All variables but distance to nearest cuartel are standardised. Historical controls include log of density, distance to roads, distance to rivers, and log of elevation, each by cuartel in 1821, and the distance to the nearest cuartel. 1/2 only controls for density and distance to nearest cuartel. *p<0.1; **p<0.05; ***p<0.01

To deepen in the analysis of the mechanism of persistence, we run a regression of the number of schools per AGEB with the Fuzzy RD specification. Column (6) of Table 6.2 shows that there is actually a higher number of schools in AGEBs closer to a *cuartel* with high ethnic fractionalization. Then, the provision of schooling infrastructure does not explain why those same AGEBs have fewer years of education. What about the capacity within a school? We run two complementary specifications through OLS and the Fuzzy RD with the ratio of students per school and students per teacher at the AGEB level. Consistent with the result of fewer years of education, Columns (2) and (4) of Table 6.2 shows that higher ethnic fractionalization is also associated with more students per school and per teacher. An increase in a standard deviation in the fractionalization index is associated with an increase of almost 0.4 standard deviations of students per school, nearly 125 children more, and an increase of 0.3 standard deviations of students per teacher at a given school, at least two more children per teacher. Consistent with

the previous results, there is a problem of rivalry in the provision of services and infrastructure per child in education. The point estimates of the discontinuity for the last three regressions are not statistically significant.

Table 6.2: School capacity

	Dependent variable:					
	Students per school		**Students per teachers**		**Schools per AGEB**	
	OLS	*2SLS*	*OLS*	*2SLS*	*OLS*	*2SLS*
	(1)	(2)	(3)	(4)	(5)	(6)
EFI	−0.032	0.398*	0.306***	0.301***	0.367*	0.490**
	(0.201)	(0.236)	(0.077)	(0.114)	(0.215)	(0.217)
Observations	200	200	199	199	320	320
Historical controls	✓	✓	✓	✓	✓	✓
R^2	0.094	0.047	0.099	0.099	0.231	0.227
F / Wald statistic	2.463**	5.017***	3.535***	5.322***	15.638***	7.374***
Weak instruments		234.137***		231.637***		303.282***
Wu-Haumsan		27.303***		0.003		2.835*
Sargan		1.644		0.333		0.326

Notes: Own elaboration. Robust standard errors in parenthesis. All variables but distance to nearest cuartel are standardised. Historical controls include log of density, distance to roads, distance to rivers, and log of elevation, each by cuartel in 1821, and distance to the nearest cuartel. *p<0.1; **p<0.05; ***p<0.01

To asses, if there is also a shortage of public goods provision besides the education dimension, we run another set of regressions with the share of the population without access to social security. Results are depicted in Table 6.3. Column (2) shows that ethnic fractionalization is associated positively with 0.54 standard deviations on the share of the population without access to social security. Then, the neighborhoods closer to a *cuartel* with high EFI also are deprived of access to health services. When analyzing other available information on health at the AGEB level, we do not find significant differences in the ethnic fractionalization effect.

The effect of ethnic fractionalization on years of schooling and share of the population without access to social security is consistent with the causal effect of the first on the wealth index. The R^2 for a linear regression of years of schooling on the wealth index is 0.923. While the

Table 6.3: Health

	Dependent variable:			
	Share without access to social security			
	OLS	*2SLS*		
	(1)	(2)	(3)	(4)
EFI	0.393***	0.514***	2.857	3.060
	(0.113)	(0.162)	(3.336)	(3.696)
Observations	320	320	34	34
Historical controls	✓	✓	1/2	1/2
R^2	0.377	0.368		
F / Wald statistic	30.086***	22.83***		
Weak instruments		303.282***		
Wu-Haumsan		2.837***		
Sargan		1.172		

Notes: Own elaboration. Robust standard errors in parenthesis in Columns (1) and (2). Columns (3) and (4) show the results for the `rdrobust` estimation. Column (3) is for the conventional estimation. Column (4) is for the robust estimation. All variables but distance to nearest cuartel are standardised. Historical controls include log of density, distance to roads, distance to rivers, and log of elevation, each by cuartel in 1821, and the distance to the nearest cuartel. 1/2 only controls for density and distance to nearest cuartel. *p<0.1; **p<0.05; ***p<0.01

R^2 for a linear regression of share of the population on the wealth index is 0.465. Then, since ethnic fractionalization causes a decrease on wealth, education and social protection, it might also have a significant economic effect in poverty indexes.[1] The results above are also consistent with economic literature regarding residential choice and human capital investment (Benabou, 1993; Moretti, 2004).

6.2 Housing

The last subsection presented evidence that households in the contemporary neighborhoods near to a *cuartel* with high ethnic fractionalization, which by history and our identification strategy we know were initially segregated by the *República de Indios* status, are poorer and have less

[1] Due to poverty indexes are in categories rather than a continuous scale, we do not run a regression to test this point.

access to public goods. If the social status of a neighborhood in a city is persistent through time we would also expect that housing prices represent the willingness to locate in one of such neighborhoods (Ioannides, 2011; Rosenthal and Ross, 2015). Table 6.4 shows the results for specifications with the log of the mean and median housing prices in Guadalajara municipality as dependent variables.

Table 6.4: Housing prices

	Dependent variable:							
	log(Mean price)				**log(Median price)**			
	OLS	*2SLS*			*OLS*	*2SLS*		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
EFI	−0.069	−0.177	−0.629***	−0.608**	−0.091	−0.178*	−0.454***	−0.404*
	(0.068)	(0.112)	(0.200)	(0.247)	(0.062)	(0.092)	(0.116)	(0.149)
Observations	247	247	34	34	247	247	32	32
Historical controls	✓	✓	1/2	1/2	✓	✓	1/2	1/2
R^2	0.206	0.197			0.148	0.142		
F / Wald Statistic	10.376***	7.259***			6.942***	4.695***		
Weak instruments		213.81***				213.81***		
Wu-Hausman		4.764**				3.049*		
Sargan		0.075				0.185		

Notes: Own elaboration. Robust standard errors in parenthesis from in Columns (1), (2), (5), (6). Columns (3), (4), (7) and (8) show the results for the `rdrobust` estimation. Columns (3) and (7) is for the conventional estimation. Columns (4) and (8) is for the robust estimation. All variables but distance to nearest cuartel are standardised. Historical controls include log of density, distance to roads, distance to rivers, and log of elevation, each by cuartel in 1821, and the distance to the nearest cuartel. 1/2 only controls for density and distance to nearest cuartel. *p<0.1; **p<0.05; ***p<0.01

Regarding the mean price of houses, Column (2) shows that ethnic fractionalization has no persistent effect on the LATE estimate. However, there is a relevant discontinuity at the boundary. The point estimates of the Fuzzy RD near the boundary indicate that neighborhoods closer to a *cuartel* with higher ethnic fractionalization have a decrease in their mean prices of at least 0.6 percent, statistically significant with both the conventional and robust estimations.

Meanwhile, Column (5) shows that the LATE estimate for the median price is barely significant statistically: a standard deviation in EFI decreases the median price by 0.17 percent. The point estimates near the boundary indicate a decrease between 0.45 and 0.4 percent in the median prices. Then, colonial ethnic fractionalization also has persistent effects in neighborhood status and, thus, in neighborhood house prices.

6.3 Mobility infrastructure: Tramway lines of XIX century

The most challenging issue to assure the persistent effects of the colonial ethnic segregation and fractionalization is to illustrate mechanisms of persistence besides contemporary variables of economic development. For instance, to show that the effect persisted through other historical events throughout the period. Unfortunately, we have not found another rich set of data at a fine level of disaggregation for the time between the colonial period and the present time.

However, the GCP database includes a map of the tramway system of Guadalajara by the end of the XIX century. Figure 4 in the Data Appendix shows the map of the tramway system. By 1888, the whole tramway line system of the city consisted of approximately 23,904 meters. With the use of GIS, we mapped the tramway lines of the city into the Guadalajara urban trace of 1821. Then, we run a simple regression discontinuity with meters of tramway line per *cuartel* square kilometer of the Guadalajara urban trace by 1821 as the dependent variable, and the distance to the *República de Indios* boundary and the *República de Indios* dummy as the independent variables. Figure 6.1 illustrates the results.

We do not claim causality in the result. Nevertheless, the plot is convincing that there was less investment in tramway infrastructure on *cuarteles*, which were previously a *República de Indios*. Moreover, the result is consistent with the previous findings of lower levels of public goods provision and can be related to the observed housing prices differentials.

6.4 Culture

Finally, we evaluate whether cultural traits and political preferences are correlated with ethnic fractionalization by the end of the colonial period.

Table 6.5 shows the results for several linear regressions at the individual level with EFI as the independent variable regarding self-reported answers to the 2016 and 2018 JCV surveys. Re-

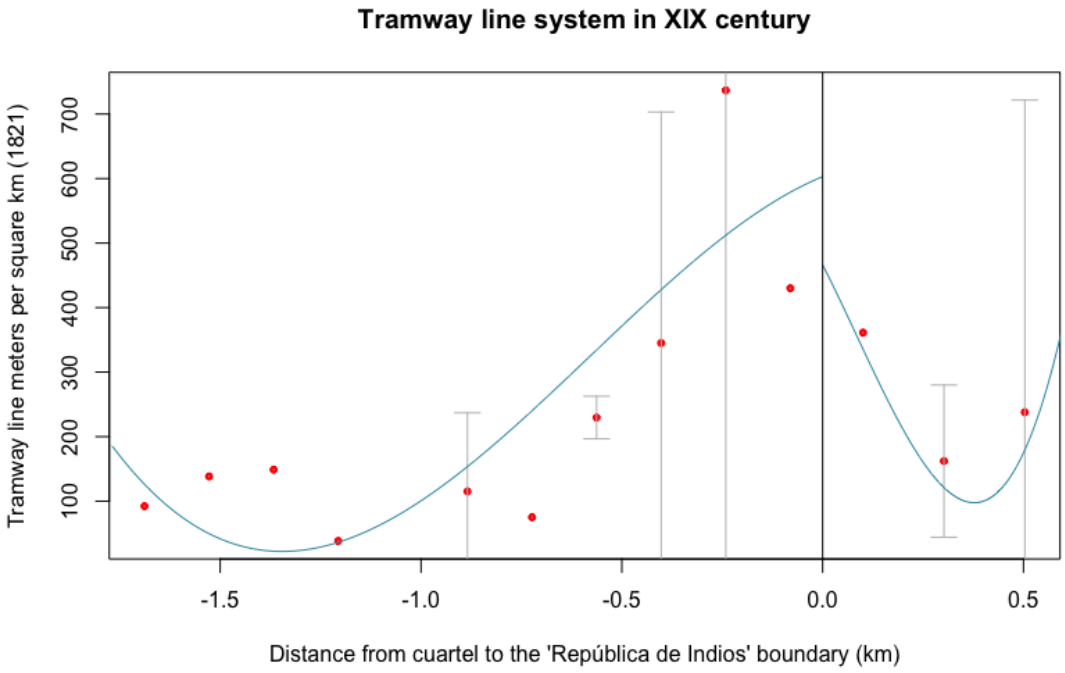

Figure 6.1: Tramway system RD (Own elaboration).

gressions control by sex, age, age squared, years of schooling, and year of the survey. Finally, we estimate robust standard errors clustering by AGEB and year.[2] People living in neighborhoods nearer to colonial *cuarteles* with high ethnic fractionalization, have less satisfaction of with their neighborhood and public services; declare to have suffered more discrimination attitudes towards them; beliefs less that government should be responsible for solving social problems. The same individuals declare higher subjective well-being and believe more that luck determines outcomes.

Thus, the results confirm part of the argument of Jaramillo and Saucedo (2016) and the individual experiences of Guadalajara inhabitants they share. The results are also consistent with our argument of persistence: ethnic segregation in the foundation increased ethnic fractionalization during the colonial period; ethnic fractionalization by the end of the colonial era explains differences in wealth; the channel of the persistence of the ethnic fractionalization effects is a

[2]We ran 2SLS regressions for each of them, and the Wu-Hausman test in seven out of eight did not reject the null hypothesis. So we decided to use OLS to descriptive the relation rather seek causation.

Table 6.5: Cultural traits

	Dependent variable:						
	Subjective well-being	Satisfaction w/ public services	Satisfaction w/ neighborhood	Satisfaction w/ government	Suffered discrimination	Believes in government	Believes in luck
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
EFI	0.042***	−0.080***	−0.150***	−0.071*	0.053***	−0.111**	0.082**
	(0.015)	(0.014)	(0.042)	(0.042)	(0.019)	(0.050)	(0.037)
Observations	595	595	595	595	595	288	277
Controls	✓	✓	✓	✓	✓	✓	✓
R^2	0.035	0.316	0.025	0.064	0.011	0.024	0.016
F Statistic	3.580***	45.284***	2.547**	6.720***	1.124	1.381	0.868

Notes: Own elaboration. Robust standard errors clustering by AGEB and year in parenthesis. Columns (6) and (7) do not control or cluster for year since the questions only belong to 2018 JCV survey. Controls include sex, age, age squared, years of schooling, and year of survey. *p<0.1; **p<0.05; ***p<0.01

differentiated provision of public goods and public infrastructure within the city; lastly, people living near the area of influence of high ethnic inequality show less trust and satisfaction for government and reports feeling more discriminated.

Following Bazzi et al. (2017), we also test if there is a effect on political preferences. Table 6.6 shows the result for a Fuzzy RD estimation of the shares of votes for each candidacy for the 2018 senate seat election. Each specification is at the electoral section level, and we control by distance to the nearest cuartel and mean years of schooling by AGEB. Lastly, since many electoral sections belong to a same AGEB, we estimate robust standard errors clustering by AGEB.

Firstly, Column (1) shows that there is no effect of colonial ethnic fractionalization on turnout. Column (2) shows that the electoral sections nearer to a colonial *cuartel* with high ethnic fractionalization had fewer votes for the Wikipolítica independent candidacy. This result is consistent with Toral (2018) analysis. Column (3) shows that the share of votes for Movimiento Ciudadano, the header in the governor polls, and the ruling party at the Guadalajara municipality, an increase in 0.3 standard deviations in electoral sections closer to colonial *cuarteles* with high ethnic fractionalization. Columns (4) to (6) show a little or null voting effect of colonial ethnic fractionalization on other political parties suggest shares. Strikingly, the political prefer-

Table 6.6: 2018 Senate seat elections

	Dependent variable:					
	Turnout	Wikipolítica	MC	PRI-PVEM	Morena	PAN
	(1)	(2)	(3)	(4)	(5)	(6)
EFI	0.085	-0.064^{**}	0.306^{***}	-0.069	-0.068^{*}	0.015
	(0.058)	(0.030)	(0.052)	(0.057)	(0.040)	(0.040)
Observations	796	796	796	796	796	796
R^2	0.116	0.725	0.312	0.116	0.490	0.439
Wald Statistic	144.6^{***}	502.3^{***}	81.51^{***}	28.79^{***}	145.4^{***}	92.76^{***}
Weak instruments	406.294^{***}	406.294^{***}	406.294^{***}	406.294^{***}	406.294^{***}	406.294^{***}
Wu-Hausman	3.694^{*}	14.697^{***}	26.052^{***}	79.51^{***}	7.070^{***}	1.618
Sargan	1.390	1.733	1.783	10.23^{***}	0.032	21.051^{***}

Notes: Own elaboration. Robust standard errors clustering by AGEB in parenthesis. Controls include distance to nearest cuartel and mean years of education by AGEB. *p<0.1; **p<0.05; ***p<0.01

ences analysis provides evidence that, even when individuals living nearer to colonial *cuarteles* with high ethnic fractionalization have less satisfaction with the local government, they vote in favor of the local incumbent.

Chapter 7

Conclusion

Historical events have long-lasting effects on economic development dimensions. For instance, historical institutions can explain differences in the economic development of neighborhoods within a city and the persistence of economic status in certain areas. This paper studied the persistence of spatial inequality across neighborhoods in Guadalajara, Mexico.

In Guadalajara's colonial foundation, the Spaniard conquerors settled on the west side of the San Juan de Dios River, while different Indigenous communities settled apart in two sites: one on the other side of the river, and the other south of the Spaniard settlement. The divide of the settlements was enforced by the *República de Indios* institution. The *República de Indios* was a legal status enacted by the Spanish Crown that segregated Indigenous communities from Spaniard settlements. With the particular history of Guadalajara's foundation, this paper exploits the exogenous variation on the assignment of the *República de Indios* status to test if it had persistent effects during the colonial period. With a city census of 1821, the paper showed that the colonial *cuarteles* or neighborhoods that had a previous *República de Indios* status had more ethnic fractionalization. Their inhabitants were mostly indigenous or belonged to other ethnic groups or castes, such as mulatos, mestizos, castizos, among others. They worked as laborers

and journeyman, and also had a low social status.

With the same data from the census of 1821, the paper uses a Fuzzy Regression Discontinuity design to show that contemporary neighborhoods closer to a colonial *cuartel* with high ethnic fractionalization are less wealthy. Since the Fuzzy RD is an instrumental variables approach, we instrument the ethnic fractionalization by the end of the colonial period with the *República de Indios* status. The first stage of the specification corroborates that *cuarteles*, which were a *República de Indios*, have higher ethnic fractionalization. Then, the second stage of the identification strategy shows that a neighborhood living nearer to a *cuartel* with high ethnic fractionalization has a decrease in between 0.95 and 0.215 standard deviations in household wealth at the AGEB level. The results prove a causal relation and are robust when implementing several spatial econometric models to account for spatial autocorrelation and spatial endogeneity.

The paper explores several mechanisms of persistence. We find that higher ethnic fractionalization is related to less public goods provision. Contemporary neighborhoods closer to the more ethnically diverse *cuarteles* have less school capacity: they have fewer schools and teachers per student. Then it is consistent with them also having fewer years of education. The same contemporary neighborhoods also have a higher share of the population without access to social security. Another mechanism of persistence is the provision of public infrastructure. With data on the tramway system of the XIX century, we show evidence that the meters of tramway line per square kilometer decrease in areas that were a *República de Indios*. With contemporary data, we also show that the housing prices decline for the neighborhoods closer to a *cuartel* with high ethnic fractionalization. Lastly, we show evidence that colonial ethnic fractionalization affects some cultural traits of Guadalajara's inhabitants. They declare to have less trust and satisfaction towards the government, to suffer some discrimination more frequently, and differ in political preferences through voting behavior.

The story here sketched is consistent with the urban history of the city (Doñan, 2001; Mendoza Ramirez, 2004; Rivière D'Arc, 1973). Note that the standard and spacial econometric

specifications are measuring the effect of *República de Indios* status through ethnic fractionalization. Then, we could be underestimating (overestimating) the ethnic fractionalization effect if there are other channels that could increase (decrease) the effect. The specification tests provide convincing evidence that the effect of *República de Indios* through other possible variables is consistent with the ethnic fractionalization estimate. Nonetheless, several other social phenomena could also serve as mechanisms of persistence not studied here. For instance, migration patterns from rural areas to the city by the end of the colonial period and beginning of the XIX century (Van Young, 2018), the structure of economic activities within the city during the XIX and XX century (P. Arias, 1985), or religion, a relevant issue in Guadalajara's history (De la Torre, 2006). There is also literature regarding the history of elite networks during the XIX century (Lizama Silva, 2014).

This work contributes to different topics of the economics literature. Firstly, the results present evidence in favor of the historical development hypothesis, specifically regarding the hypothesis of persistent effects of colonial institutions on economic development (Nunn, 2020, 2014). More interestingly, they provide an alternative explanation to an argument elaborated by Dell (2010) and Dell and Olken (2020), that some extractive institutions, such as haciendas in Peru or the sugar industry in Indonesia, have long term benefits over economic development. Rather than classifying the *República de Indios* as an extractive or non-extractive institution, we provide more evidence that it had persistent effects on the economic and social status of neighborhoods in the city, consistent with the arguments of Castro Gutiérrez (2010) and Nemser (2017). Then, some colonial institutional settings may differ according to the region, the colonial context, and the spatial unit of study. Thus, colonial institutions can also have detrimental effects on contemporary development and inequality.

Another relevant contribution is the result of ethnic fractionalization as a driver of underdevelopment, but through the provision of public goods rather than conflict (Alesina and La Ferrara, 2005; Alesina and Zhuravskaya, 2011). The ethnic fractionalization literature is mostly

on African countries and regions (Michalopoulos and Papaioannou, 2014, 2013; Montalvo and Reynal-Querol, 2005). Surprisingly, there are few studies studying ethnic fractionalization in Latin America. This fact could be due to a hiatus of discussion of the racial component in societies like Mexico (Solís, Güémez Graniel, and Lorenzo Holm, 2019). Nevertheless, the study of the effects of ethnic segregation and fractionalization in Latin American socieites, a region with high ethnic diversity, is important due to role played by ethnicity in economic development.

The results also support the hypothesis of culture as a mechanism of persistence of historical institutions (Bazzi et al., 2017; Fernández, 2013; Greif, 1993; Nunn, 2012). Nonetheless, future studies interested in the subject could exploit the historical experiment used here to get more precise or fine data regarding cultural traits, for instance, experiments between neighborhoods of a city (Bogliacino et al., 2015).

At last, the results are also consistent with the urban economic literature explaining differences in neighborhood status (Rosenthal and Ross, 2015), the reinforcing effects of agglomeration of human capital (Benabou, 1993; Moretti, 2004), and persistence of status in small spatial units (Falck et al., 2012; Heblich et al., 2016; Jedwab et al., 2017). Moreover, as Jedwab et al. (2017), point out, it is relevant to study the persistence of economic status in smaller spatial units, such as cities –specially in the case of many Latin American cities which are densely populated (only Guadalajara's municipality has nearly 1.5 million inhabitants) and are by rule the visual evidence of spatial inequality–.

Finally, it is worth noting that the results have clear implications for public policy. Since the main mechanism of persistence is the provision of public goods, both the state and municipal governments have to invest in schooling and public infrastructure in the western neighborhoods of the city, hoping to achieve a 'reversal' effect that equalizes the development levels of the neighborhoods. Alternatives to funding these investments are municipal property taxes –*predial*–, mostly written off,[1] and the state tax on vehicles –*tenencia*–, currently not levied by

[1](*Condonan ocho deudas de predial al día en la metrópoli*, 2019).

Jalisco. Both tax alternatives are progressive in terms of wealth and income. As Nunn (2020) argues, the historical development literature is no exempt from provide alternatives to improve development and well-being.

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.1 Data Appendix

Figure 1: Nueva Galicia Territories (Calvo and Regalado Pinedo, 2016)

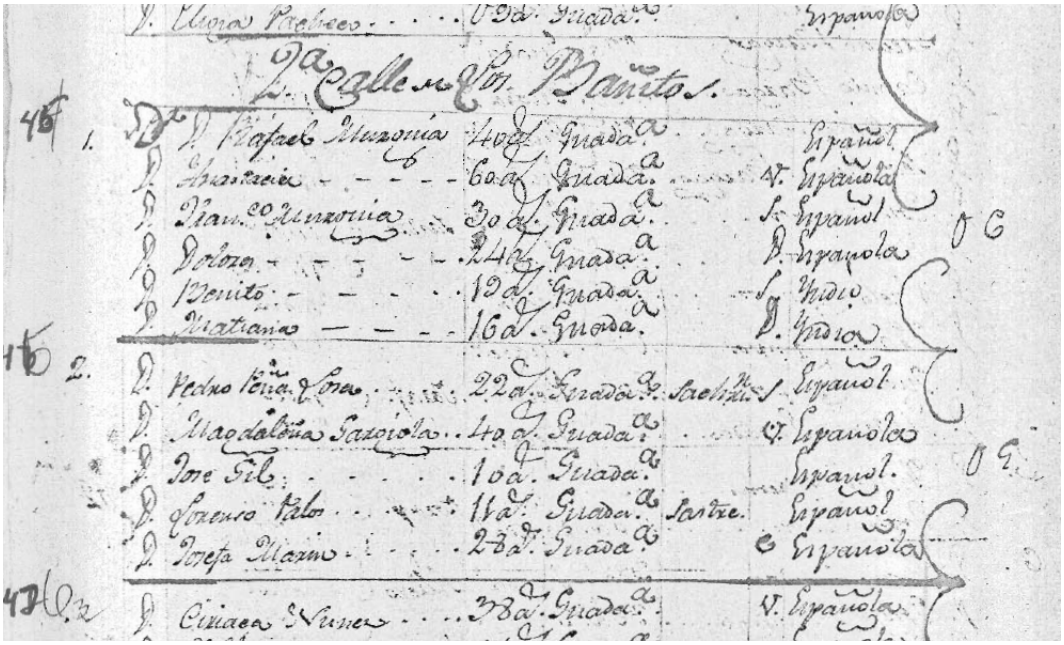

Figure 2: 1821 Census of Cuartel 10 (GCP) (Anderson and Spike, 2007)

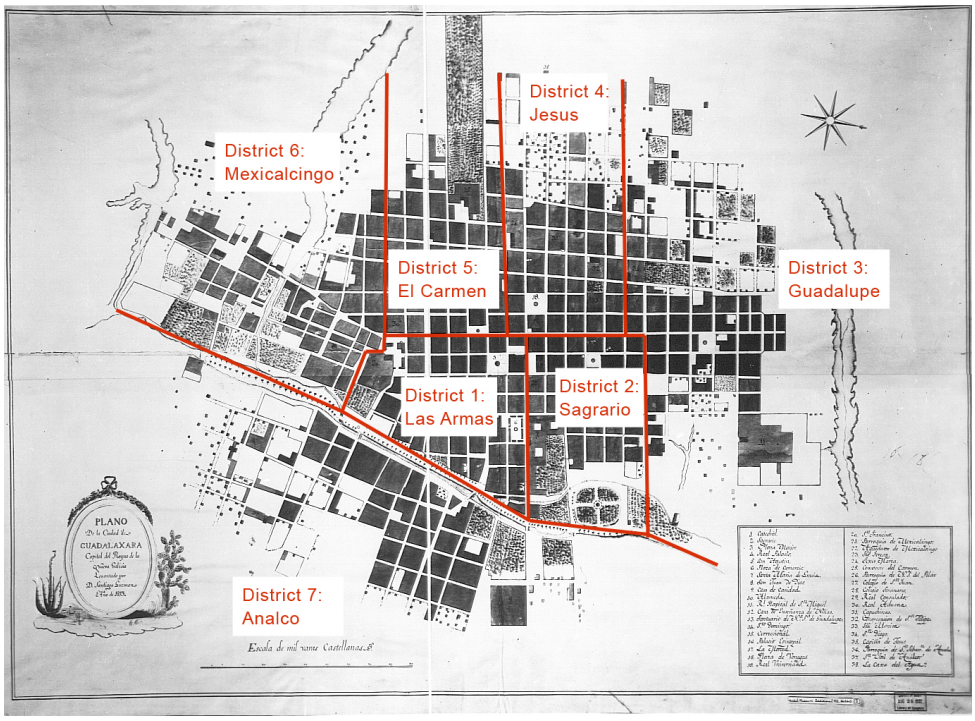

Figure 3: Colonial districts (GCP) (Anderson and Spike, 2007)

Figure 4: Guadalajara Tramway Lines in 1888 (GCP) (Anderson and Spike, 2007)

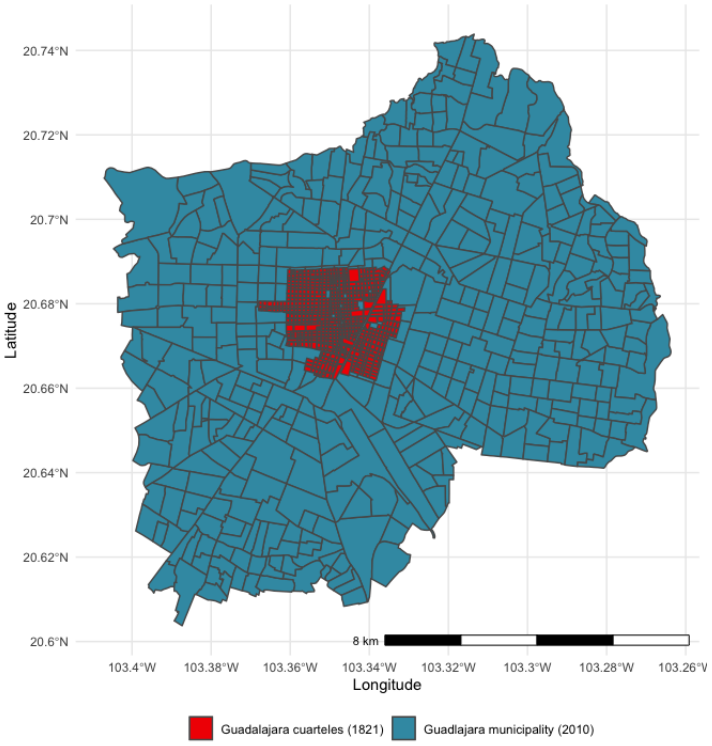

Figure 5: Guadalajara in 1821 and 2010 (Own elaboration).

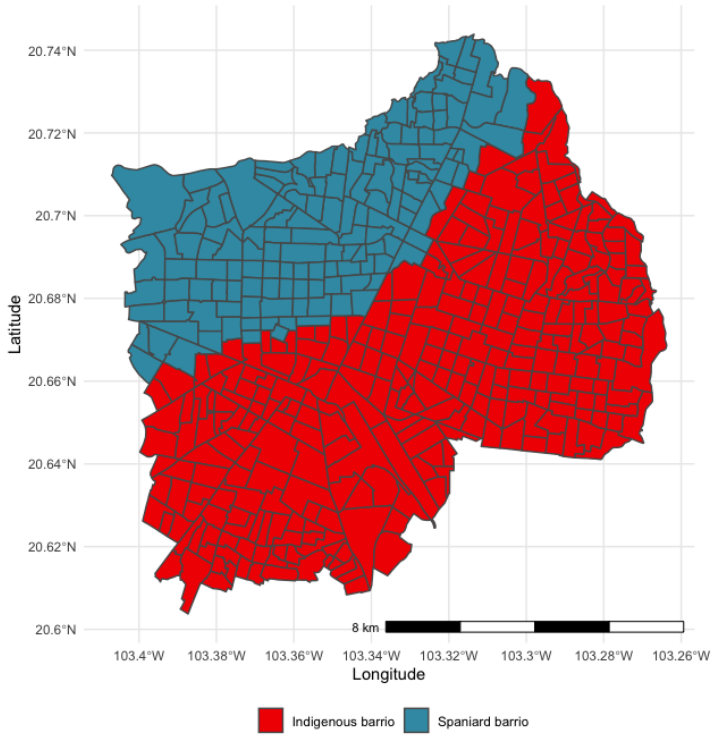

Figure 6: Nearest neighbor (Own elaboration).

Table 1: GCP by *cuartel* in 1821

Cuartel	Area (m^2)	Population	Density	Inf. on sex	Female (%)	Male (%)	Inf. on *Hidalguía*	*Don or Doña* (%)	*No Don or Doña* (%)	Inf. on migraton	Migrants (%)	No migrants (%)
1	1.63	1823	1120.17	1798	0.49	0.49	1812	0.64	0.35	853	0.16	0.31
2	1.33	910	681.81	884	0.54	0.43	908	0.41	0.59	908	0.01	0.99
3	1.87	1447	773.27	1444	0.55	0.44	1437	0.40	0.60			
4	1.45	1445	999.23	1414	0.56	0.42	1445	0.35	0.65	1439	0.03	0.96
5	2.13	825	386.66	819	0.54	0.45	825	0.25	0.75	824	0.32	0.68
6	2.67	743	277.99	742	0.56	0.44	743	0.08	0.92	743	0.22	0.78
7	5.19	944	181.95	929	0.53	0.45	933	0.08	0.90			
8	10.73	3892	362.65	3876	0.55	0.44	3892	0.11	0.89	3498	0.44	0.46
9	8.25	2981	361.44	2909	0.50	0.48	2981	0.11	0.89	2633	0.24	0.64
10	5.50	1894	344.25	1775	0.51	0.43				1773	0.02	0.91
11	2.45	1221	498.30	1212	0.53	0.46	1212	0.09	0.90	1210	0.35	0.64
12	1.04	1124	1081.27	1108	0.57	0.41	1108	0.43	0.56	1100	0.29	0.69
13	2.33	1277	548.16	1274	0.61	0.39	1277	0.51	0.49	872	0.20	0.49
14	1.76	1819	1033.15	1739	0.55	0.41	1740	0.28	0.67			
15	3.00	1273	423.83	1273	0.61	0.39	1273	0.66	0.34			
16												
17	2.58	1890	732.93	1862	0.55	0.43	1873	0.34	0.65			
18	3.85	2027	526.85	1937	0.56	0.39	1938	0.16	0.80	1933	0.12	0.83
19	2.45	823	335.35	820	0.56	0.44	823	0.29	0.71			
20	2.49	1570	629.87	1555	0.56	0.44	1555	0.09	0.90	1528	0.36	0.61
21	2.05	974	476.12	943	0.51	0.46	974	0.03	0.97	587	0.29	0.31
22	3.90	422	108.18	422	0.55	0.45	422	0.02	0.98			
23	2.23	2354	1056.18	2350	0.58	0.42	2354	0.47	0.53	2354	0.33	0.67
24	1.42	1542	1088.84	1515	0.57	0.41	33	0.01	0.02	1539	0.00	0.99

Cuartel	Inf. on ethnicity	*Español* (%)	*Indio* (%)	*Mestizo* (%)	*Mulato* (%)	*Castas* (%)	Inf. on economic activiy	Elite (%)	Merchant/Master (%)	Journeyman (%)	Laborer (%)	Servant (%)
1	11	0.00	0.00	0.00	0.00	0.00	871	0.05	0.19	0.07	0.06	0.12
2							245	0.04	0.06	0.05	0.02	0.11
3	1435	0.56	0.12	0.29	0.02	0.00	425	0.03	0.05	0.07	0.04	0.09
4							324	0.02	0.04	0.10	0.05	0.02
5	825	0.56	0.30	0.09	0.00	0.05	252	0.02	0.03	0.15	0.08	0.02
6							208	0.01	0.01	0.14	0.10	0.01
7	581	0.07	0.40	0.13	0.02	0.01	216	0.00	0.02	0.12	0.08	0.01
8							1242	0.01	0.02	0.17	0.11	0.01
9	2935	0.31	0.53	0.13	0.00	0.02	702	0.01	0.01	0.12	0.08	0.01
10	1772	0.58	0.35	0.01	0.00	0.00	531	0.01	0.04	0.13	0.11	0.00
11							387	0.01	0.02	0.15	0.12	0.03
12							310	0.04	0.05	0.09	0.05	0.04
13	227	0.14	0.02	0.01	0.00	0.00	387	0.02	0.08	0.08	0.03	0.09
14	1693	0.47	0.24	0.09	0.11	0.02	445	0.03	0.03	0.09	0.04	0.07
15	1273	0.68	0.25	0.05	0.02	0.00	608	0.06	0.10	0.12	0.04	0.16
16												
17	409	0.06	0.13	0.02	0.01	0.00	550	0.03	0.04	0.09	0.07	0.06
18	1937	0.40	0.49	0.04	0.02	0.01	985	0.02	0.02	0.17	0.21	0.07
19							181	0.01	0.03	0.08	0.09	0.01
20	1555	0.31	0.53	0.12	0.03	0.00	1028	0.01	0.02	0.22	0.37	0.04
21	179	0.03	0.15	0.00	0.00	0.00	287	0.00	0.01	0.13	0.16	0.00
22							102	0.00	0.00	0.14	0.09	0.00
23	2354	0.74	0.14	0.10	0.02	0.00	796	0.04	0.08	0.08	0.04	0.10
24							519	0.02	0.03	0.19	0.08	0.02

Notes: Own elaboration with GCP data (Anderson and Spike, 2007).

.2 Results Appendix

Table 2: Fuzzy RD: First stage

	Dependent variable:		
	EFI		
	(1)	(2)	(3)
República de Indios	1.293***	1.226**	1.188*
	(0.291)	(0.578)	(0.710)
Observations	320	43	43
Controls	✓	✗	✗
R^2	0.932		
F Statistic	612.964***		

Notes: Own elaboration. EFI is standardised. Column (1) is estimated with conventional OLS and robust standard errors. Columns (2) and (3) are estimated with `rdrobust`. Column (2) is the conventional estimation; Column (3) is robust estimation. Controls include log of density, distance to roads, distance to rivers, and log of elevation, each by cuartel in 1821. *p<0.1; **p<0.05; ***p<0.01

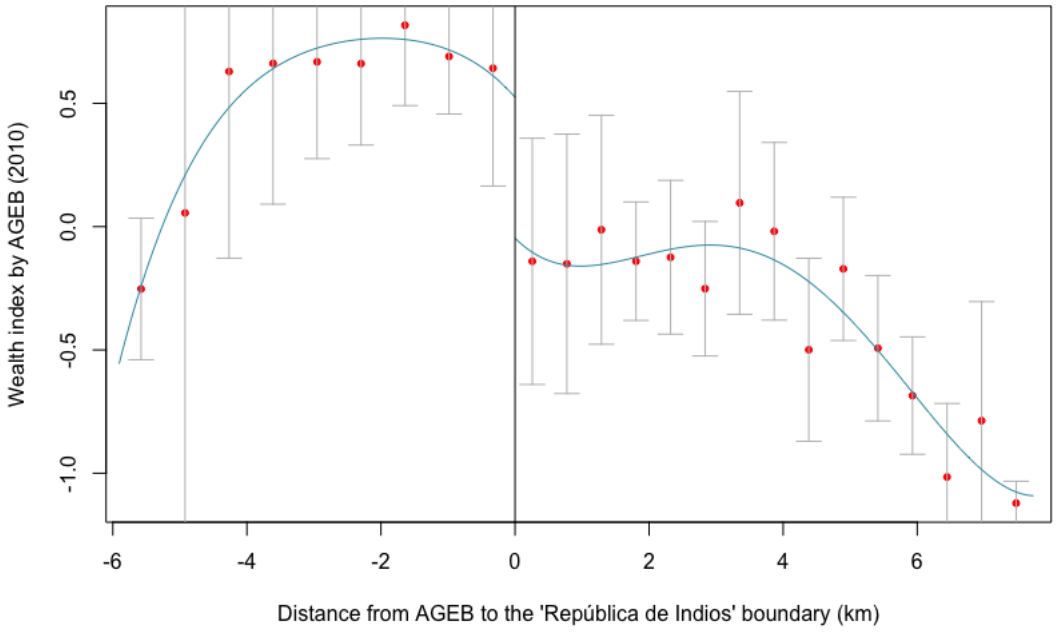

Figure 7: Point estimate at different distance to the *República de Indios* boundary (Own elaboration).

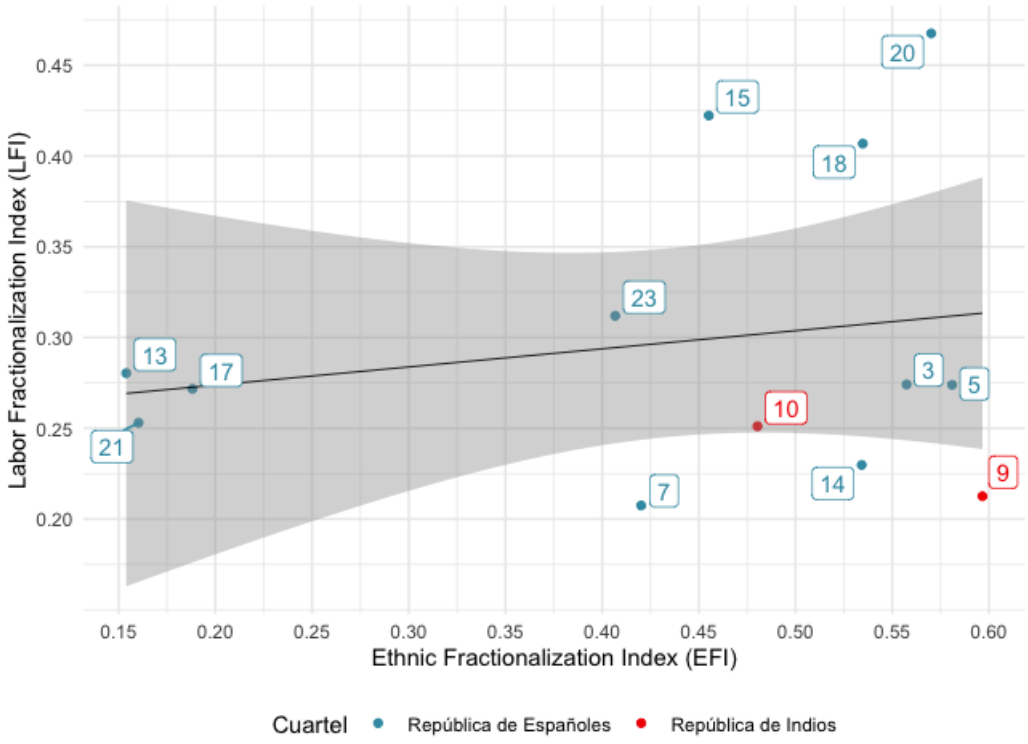

Figure 8: EFI and LFI (Own elaboration).

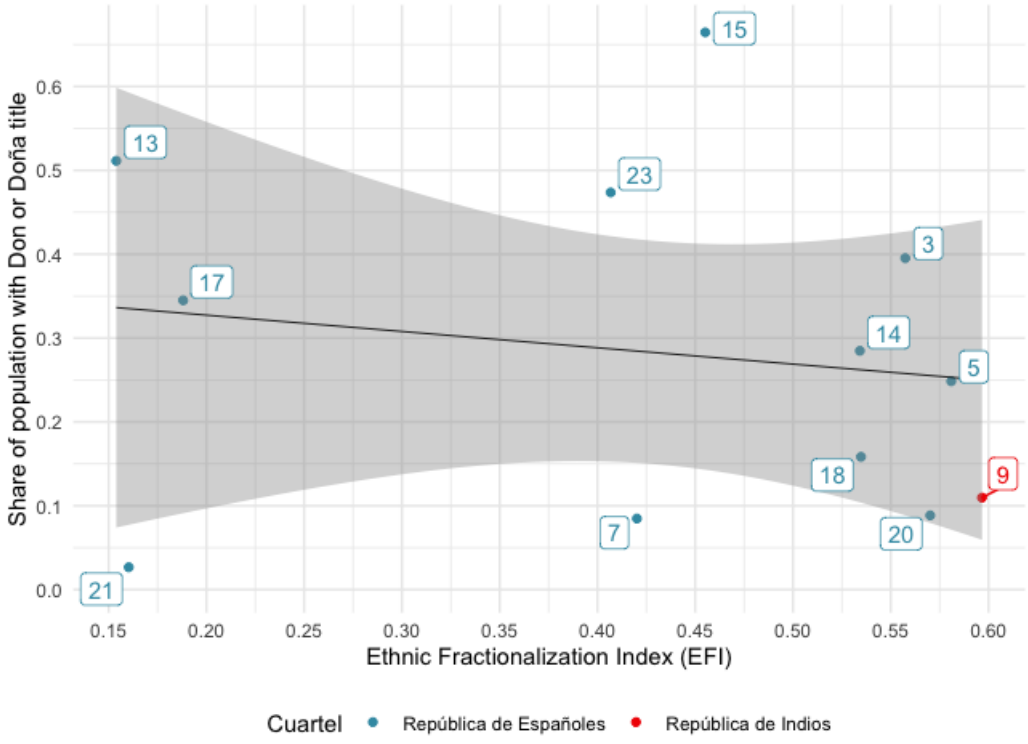

Figure 9: EFI and Hidalguía share (Own elaboration).

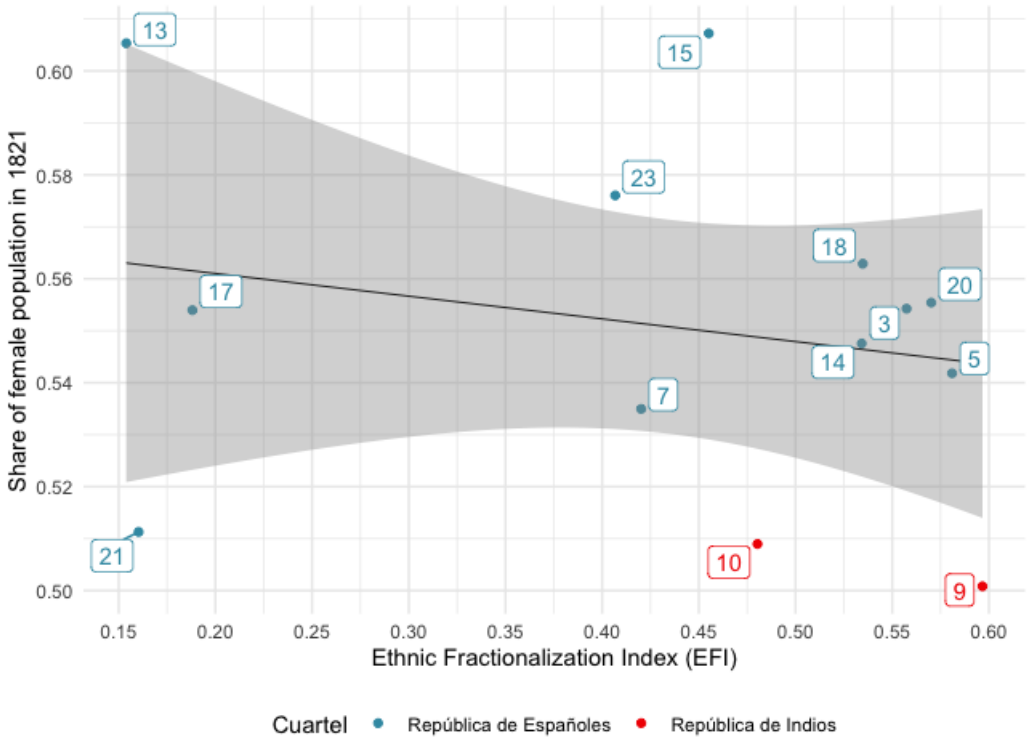

Figure 10: EFI and Female share (Own elaboration).

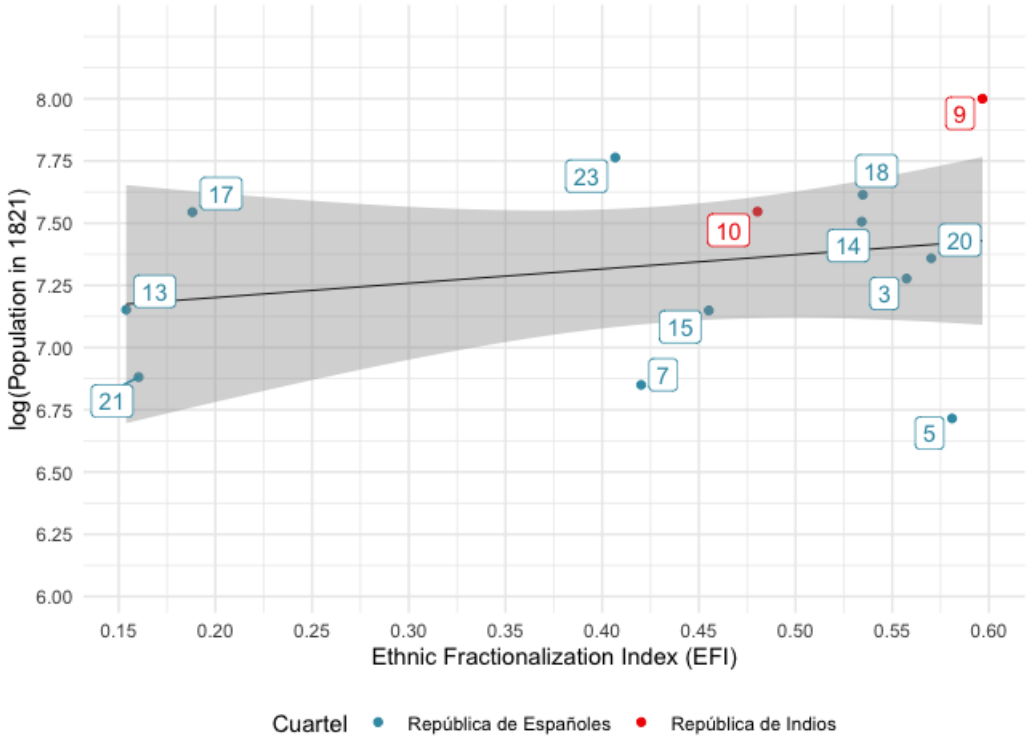

Figure 11: EFI and Population (Own elaboration).

Table 3: Ethnicity probit regressions

	Dependent variable:			
	Español	Indio	Mestizo	Castas
	(1)	(2)	(3)	(4)
República de Indios	-1.084^{***}	1.194^{***}	-0.256	-0.240
	(0.166)	(0.206)	(0.197)	(0.306)
Distance to boundary	0.640^{***}	-0.765^{***}	0.408^{***}	-0.064
	(0.095)	(0.109)	(0.132)	(0.136)
Merchant/Master	0.093	-0.187	0.640^{**}	-3.092^{***}
	(0.318)	(0.337)	(0.325)	(0.396)
Journeyman Artisans	-0.212	0.267	-0.002	-0.042
	(0.252)	(0.248)	(0.382)	(0.276)
Laborers	-0.414	0.485^{*}	-0.099	-0.006
	(0.257)	(0.255)	(0.383)	(0.279)
Servants	-0.498^{*}	0.252	0.303	0.221
	(0.284)	(0.278)	(0.394)	(0.287)
Not Don/Doña	-1.949^{***}	1.564^{***}	1.977^{***}	0.944^{***}
	(0.162)	(0.175)	(0.247)	(0.195)
Female	0.138^{**}	-0.091	0.017	-0.149
	(0.064)	(0.060)	(0.073)	(0.096)
Age	0.0004^{**}	-0.0001	-0.003	-0.00000
	(0.0002)	(0.0002)	(0.002)	(0.0004)
Birth place: Elsewhere	0.223^{***}	-0.239^{***}	0.070	-0.030
	(0.075)	(0.081)	(0.082)	(0.098)
Year 1822	0.192	0.003	-0.716^{***}	0.106
	(0.139)	(0.150)	(0.209)	(0.207)
Observations	4,202	4,202	4,202	4,202
Log Likelihood	$-2,143.095$	$-2,345.120$	$-1,142.039$	-555.885
Akaike Inf. Crit.	4,310.190	4,714.239	2,308.077	1,135.770

Notes: Own elaboration. HAC standard errors in parenthesis. Cluster by cuartel. The base for ethnicity categories is Español. The base for *hidalguía* is Don/Doña. The base for sex is Male. The base for Birth place is Guadalajara. The base for Year is 1821. *p<0.1; **p<0.05; ***p<0.01

Table 4: Economic activity probit regressions

	Dependent variable:				
	Elite	Merchant or Master	Journeyman & Artisans	Laborer	Servant
	(1)	(2)	(3)	(4)	(5)
República de Indios	−0.052	−0.179	0.530***	0.989***	−2.345***
	(0.216)	(0.221)	(0.137)	(0.112)	(0.208)
Distance to boundary	−0.052	0.312*	−0.272***	−0.652***	1.470***
	(0.138)	(0.175)	(0.084)	(0.065)	(0.143)
Indio	−0.381*	−0.658**	−0.228***	0.197***	0.047
	(0.217)	(0.309)	(0.070)	(0.059)	(0.092)
Mestizo	−0.169	0.098	−0.140	−0.119	0.326***
	(0.321)	(0.310)	(0.094)	(0.083)	(0.108)
Mulato	−3.159***	−2.486***	−0.490***	0.116	0.585***
	(0.163)	(0.315)	(0.166)	(0.155)	(0.177)
Other castes	−0.012	−4.825***	0.089	−0.032	−0.350
	(0.371)	(0.223)	(0.226)	(0.217)	(0.425)
Not Don/Doña	−1.786***	−3.128***	0.872***	2.224***	1.268***
	(0.180)	(0.316)	(0.109)	(0.223)	(0.161)
Female	−1.230***	−0.286	−0.642***	0.283***	1.018***
	(0.308)	(0.228)	(0.075)	(0.051)	(0.098)
Age	−0.0004	−0.001	−0.001	0.002**	−0.009***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Birthplace: Elsewhere	0.021	0.207*	−0.084	−0.091*	0.146*
	(0.106)	(0.121)	(0.061)	(0.051)	(0.084)
Year 1822	0.116	0.030	0.044	−0.187*	−0.766*
	(0.199)	(0.238)	(0.124)	(0.097)	(0.421)
Observations	4,202	4,202	4,202	4,202	4,202
Log Likelihood	−455.333	−468.856	−2,577.263	−2,298.349	−1,040.917
Akaike Inf. Crit.	934.666	961.712	5,178.527	4,620.699	2,105.835

Notes: Own elaboration. HAC standard errors in parenthesis. Cluster by cuartel. The base for ethnicity categories is Español. The base for *hidalguía* is Don/Doña. The base for sex is Male. The base for Birth place is Guadalajara. The base for Year is 1821. *p<0.1; **p<0.05; ***p<0.01