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The interplay of spatial diffusion and marital assimilation of Mexicans in the United States, 1980–2011

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1 Introduction

Intermarriage is a central indicator of the extent to which social boundaries exist and persist between different groups (Hwang, Saenz and Aguirre 1997; Kalmijn 1998; Bean and Stevens 2003; Alba and Nee 2003; Rosenfeld 2008; Lichter, Carmalt and Qian 2011). According to assimilation theory, there is a higher likelihood that groups will accept each other as social equals when intimate relations cross racial or ethnic boundaries, become more frequent, and are sustained (Kalmijn 1998, Alba and Nee 2003). Until the 1990s, the rate of Mexican¹/white intermarriage steadily increased suggesting progressive structural assimilation (Rosenfeld 2002). More recent studies, however, paint a less optimistic picture of the subsequent decades and report “unprecedented declines” in Mexican/white intermarriage during the 1990s (Qian and Lichter 2007:90; Lichter, Brown, Qian, and Carmalt 2007). Albeit at comparatively high levels, Mexican/white intermarriages rates have since stalled.

According to classic assimilation models, intermarriage is the ultimate endpoint of assimilation processes following from socioeconomic, spatial and linguistic assimilation (Gordon 1964, Alba and Nee 2003, Waters and Jiménez 2005). In the classic models, assimilation is understood as a process of “interpenetration and fusion in which persons and groups acquire the memories, sentiments and attitudes of other persons and groups and [...] are incorporated with them in a common cultural life” (Park and Burgess 1890: qtd. in Alba

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¹This article will focus on Mexicans since they represent by far the largest origin group of all Hispanic migrants to the United States. Moreover, a focus on Mexicans is common in the literature as they also constitute one of the largest ethnic minorities in the United States.

and Nee 2003:19). At the time when early models of assimilation were being developed, this process was most evident in the case of European immigrants who progressively assimilated into American mainstream society with each passing generation. This view of “straight-line assimilation” has been critiqued in recent times for its inadequacy in accounting for the present patterns of immigration. Historically, the implementation of the Immigration Act of 1924 facilitated European assimilation by drastically reducing immigration from Europe, which effectively cut off the steady supply of co-ethnics. Scholars argued that this cut off gave European migrants and their decedents the opportunity “to acquire the memories, sentiments and attitudes” of the American mainstream and incorporate them into their daily lives (Alba and Nee 2003). Thus, over time ethnic boundaries blurred and/or shifted facilitating acculturation and structural assimilation.

Contrary to the European experience, the steady influx of Mexicans over the last four decades has continuously replenished the pool of co-ethnics with strong ties to Mexico. For example, according to a report by the Pew Hispanic Center the Mexican-born population rose from under two million in 1970 to over 12 million by 2011. In absolute terms, no origin country has had more individuals migrate to the United States than Mexico in this time (Passel, D’Vera, and Gonzale-Barrerra 2012). While this same report reveals that *net* migration fell to zero or less in 2012 as a result of high levels of return migration, Custom and Border Protections apprehension statistics—a proxy for flows of unauthorized migrants—reveal that Mexicans continue to constitute the largest share of the annual flow of unauthorized migrants (U.S. Custom and Border Protection 2013).

In order to explain recent declines in Mexican/white intermarriage rates, researchers have argued that a process of ethnic replenishment—where high immigration rates maintain a large foreign born stock with cultural and social ties to the origin country—acts as the primary mechanism that stalls intermarriage with non-Hispanic whites (Lichter et al. 2007, Lichter et al. 2011, Qian and Lichter 2011). This can happen either because ethnic replenishment affects relative group size or because it shifts the preferences for intermarriage. In line with Blau’s structural theory of group interaction (Blau et al 1982), high levels of immigration should reduce the likelihood of routine interethnic contact as it creates structural conditions that increase the likelihood of co-ethnic interaction (Blau 1977; Blau and Schwartz 1984). Beyond expanding structural opportunities, however, ethnic replenishment is argued to also have the potential to fundamentally affect the dynamics of cross-group interaction and mixing (Jiménez 2008, Lichter, Carmalt, and Qian 2011). According to Jimenz (2008), the continuous replenishment of co-ethnics through immigration has prevented the blurring or shifting of ethnic social boundaries by providing frequent contact with individuals with “authentic” Mexican culture traits and an intensification of awareness of intergroup differences vis-à-vis non-Hispanic whites. Similarly, Lichter, Carmalt and Qian (2011:258) argue that the “influx of Hispanic immigration may also have heightened ethnic identity and reinforced social or cultural boundaries.” This process then leads to a reduction in the rate of intermarriage with whites and a slowdown in the rate of marital incorporation (Bisin and Verdier 2000).

The recent downward trend in Mexican marital assimilation is particularly puzzling in that it has taken place at the same time that a dramatic spatial diffusion of Mexican immigrant

settlement has occurred across the country (Durand, Massey and Charvet 2000, Singer 2004, Iceland and Nelson 2008, Massey 2008, Mouw and Sharma 2009, Card and Lewis 2007). Urban and rural areas alike have seen substantial increases in their Mexican population including non-traditional areas, outside the Borderlands and the Great Lakes region, which has led to the formation of “new” Mexican communities (Singer 2004, Donato et al. 2007, Leach and Bean 2008, Riosmena and Massey 2012, Barcus and Simmons 2013). This spatial diffusion of Mexicans into settlement areas with a smaller number of co-ethnics should have created structural opportunities that facilitate intermarriage.

The impact of ethnic replenishment on intermarriage rates is likely to vary considerably at sub-national levels as result of the movement of Mexican immigrants towards new destination areas. While arguments regarding changes in cultural retention and ethnic solidarity due to ethnic replenishment might be highly relevant in traditional Mexican settlement areas, its impact is less definite in the newly settled areas around the country, where, despite rapid growth rates, Mexicans still comprise a small percentage of the overall population. In effect, spatial diffusion and ethnic replenishment shape the likelihood of intermarriage in very opposing ways—spatial diffusion increases the structural opportunities for exogamy, while any shift in preferences due to ethnic replenishment should increase the rate of marital endogamy. Research relying on national-level data will ultimately be unable to disentangle those two processes as they potentially cancel each other out.

In this article, we propose a better-suited analytical framework to account for the separate effects of spatial diffusion and ethnic replenishment on intermarriage by exploiting the structural variation across geographic areas over time. If the marital preferences of Mexicans have indeed fundamentally shifted away from whites—as suggested by the ethnic replenishment argument—we should be able to identify these shifts by investigating whether the magnitude of the effect of relative group size on intermarriage has declined over time. An increase in preferences for endogamy will decrease the magnitude of the effect of relative group size because individuals will actively seek co-ethnic marriage partners and differential coethnic population sizes across areas will be less important. Disaggregating Mexican marital behavior to smaller geographic units therefore serves an essential analytical purpose: it provides access to variation in the structural conditions Mexicans experience across high-density areas in traditional settlement regions as well as the newly formed low-density areas in the new destinations, which allows us to better test the impact of spatial diffusion and ethnic replenishment on intermarriage.

Overall, we aim to contribute to this discussion about fundamental changes in Mexican/white relations in two ways: we reexamine and disaggregate the trends in Mexican/white intermarriage while explicitly considering the process of spatial diffusion. We do so by using micro-level data from the 1980–2000 Decennial Censuses and the 2008–2011 American Community Surveys (ACS) and examine trends in intermarriage across 543 Consistent Public Use Microdata Areas (c-PUMAs). The benefit of this approach is that it allows us to exploit variation in demographic change over a comparatively large number of small-scale marriage markets. With the help of multilevel modeling strategies and quasi-longitudinal data at the c-PUMA level we investigate whether the impact of demographic change (ethnic replenishment) and spatial diffusion have changed fundamentally over the last 30 years.

2 Literature Review

Research on Hispanic² intermarriage over the last four decades documents important variations in Hispanic marriage trends. In general, Hispanics have the highest intermarriage rates of all ethnic minorities in the United States, followed by Asians and Blacks (Qian and Lichter 2007). Until the 1990s, intermarriage was on an upward trend for all racial groups. One of the few studies with an explicit focus on marital assimilation of Mexicans documents a decline of endogamy (within-group marriages, i.e., Mexican-Mexican unions) between 1970 and 1990 suggestive of progressive assimilation, leading the author to “consider whether Mexican Americans are becoming white” (Rosenfeld 2002:160). More recent studies paint a less optimistic picture of the subsequent decades and report declines in Hispanic/white intermarriage during the 1990s with intermarriage rates declining from 27 to 20 percent (Qian and Lichter 2007; Lichter et al. 2007). This decline was largely driven by the marriage patterns of foreign-born Hispanics. The intermarriage rates of 2nd+ generation Hispanics still increased over the same study period pointing to sustained, but somewhat slower, assimilation trends (Qian and Lichter 2007). This pattern of 1st generation decline and 2nd+ generation increase in intermarriage appears to persist during the 2000s, however the overall intermarriage rates increased between 2000 and 2008 implying that the 2nd+ increases in intermarriage outweighed the 1st generation decline (Qian and Lichter 2011).

Borrowing heavily from Blau’s structural theory of group interaction (Blau et al 1982), intermarriage, whether across groups (Kalmijn 1998; Gullickson 2006; Okamoto 2007; Fu 2010; Furtado and Theodoropoulos 2011), across geographic units (Hwang, Saenz and Aguirre 1997; Lichter et al. 2011) or both simultaneously (Lievens 1998; Kalmijn and van Tubergen 2010; Spörlein, Schlüter and van Tubergen 2014) is seen as a function of the structure of the local marriage market. This is because variation in the demographic characteristics of local context creates differential opportunities to meet suitable partners (Blau 1977; Blau and Schwartz 1984). Meeting and interacting with members of the majority population on daily basis increases the chances of forming intimate relationships.

Structural conditions, however, are not static and maybe especially influenced by processes of population redistribution. For example, industrial restructuring and deteriorating living conditions in traditional settlement areas ushered in a period of spatial diffusion of Mexicans across the United States during the 1990s (Waters and Jiménez 2005; Zúniga and Hernández-León 2005; Card and Lewis 2007; Massey 2008; Riosmena and Massey 2012). Before 1990, Mexicans overwhelmingly settled in a few traditional gateway states (Massey and Capoferro 2008; Lichter and Johnson 2009). The following period of spatial diffusion saw the establishment of Mexican communities in areas with previously very few Mexican immigrants including many rural areas (Kandel and Cromartie 2004; Singer 2004; Donato et al. 2007; Leach and Bean 2008). In some counties population redistribution fueled

²The vast majority of studies describing and analyzing intermarriage trends focus on broad racial and ethnic categories where Mexicans are subsumed under the panethnic label “Hispanic” despite studies noting important variations in intermarriage across ethnic groups within panethnic categories (Okamoto 2007; Qian, Glick and Batson 2012). Hence, although people of Mexican descent account for more than 60 percent of all Hispanics, this literature review can only be indicative of broad trends in Mexican/white intermarriage due to the literature’s strong focus on the marital behavior across panethnic groups. It should also be noted that there is little evidence to suggest that increases in the rate of intermarriage with other ethnic or racial groups can be considered a viable alternative explanation for the observed trends. As with other racial groups (see Okamoto 2007), unions between Mexicans and other non-Mexican, non-white individuals are rare (~3 to 5 percent) and their frequency has changed little over time.

population growth or offset population decline (Donato et al. 2007). The U.S. Midwest and South census regions with previously little migrant settlement, experienced large percentage growth, in extreme cases such as Georgia, Nevada or North Carolina amounting up to 600 percent (Singer 2004). Figure 1 presents a graphical depiction of the spatial diffusion of Mexicans across the United States. The 1980s panel shows the strong concentration of Mexicans in states close to the border. The situation is drastically different in 2010 documenting the North- and Eastward expansion of Mexican settlement and the substantial increase of Mexican population share in the traditional settlement areas.

The recent changes in settlement patterns certainly affected the structural and demographic conditions Mexicans experience when looking for a suitable mate in the local marriage markets. Generally, Mexicans in traditional settlement areas encounter an abundant pool of co-ethnics within an established ethnic infrastructure—and the stock of first generation immigrants has been maintained at high levels due to consistently high rates of immigration since 1990. However, the recent diffusion of Mexicans to other parts of the U.S. means that an increasing proportion of Mexicans are now living in non-traditional settlement areas where they rarely account for more than 10 percent of the local population, a fact that—all else being equal—should increase the rate of intermarriage. Since intermarriage rates have declined after 1990 along with the expansion of the Mexican population in new destination areas, some researchers have argued that this reflects a fundamental shift in Mexican/white relations and a reversal of the Hispanic structural assimilation process (Lichter et al. 2007, Lichter et al. 2011, Qian and Lichter 2011). According to this interpretation of the trends, ethnic replenishment leads to changing marital preferences of U.S.-born Mexicans promoting cultural and ethnic solidarity, which interrupts assimilation pathways.

As a test of the role of relative group size, Lichter et al. (2007) use aggregate data from 155 metropolitan areas for 1990 and 2000 to estimate how changes in structural factors and city-level characteristics affect the aggregate rate of intermarriage in metropolitan areas. Their findings suggest that any trend in intermarriage rates across metropolitan areas can be attributed to structural conditions and socioeconomic measures of assimilation. A problem with this aggregate approach, however, rests with the inability to include individual characteristics alongside macro-level structural variables. This makes it difficult to separate the effect of individual factors that affect marital choice—such as preferences and individual measures of social incorporation—from aggregate effects such as relative group size. In addition, Lichter et al. (2007) estimate a constant effect of group size over time, while we argue that a key question posed by the ethnic replenishment perspective is whether the effect of group size on intermarriage rates has changed over time.

An alternative approach to examine intermarriage trends involves employing log-linear models with the assumption of a single, national-level marriage market (Qian and Lichter 2007; Lichter et al. 2011, Qian and Lichter 2011). The research strategy pursued by this approach entails purging the impact of recent demographic changes on marital behavior and interpreting residual time trends as evidence for preference shifts. Findings from these studies suggest, however, that time trends in intermarriage are accounted for by demographic changes alone. In other words, no evidence for a preference shift has been found. However, while employing log-linear models with a single, national-level marriage market accounts

for changes in the marginal distributions (e.g., changes in the size of the Mexican population), it does not incorporate changes in local structural conditions that result from the spatial diffusion of Mexicans since the 1990s. This is because spatial diffusion changes the marginal distributions of small-scale marriage markets, which are analyzed in highly aggregate fashion in the log-linear models. As a result, a national-level log-linear approach, although it uses individual level data, fails to incorporate the kind of spatial and temporal variation across local marriage markets that allows for a more realistic test of relative group size on intermarriage rates.

Taking both the aggregate and log-linear approaches together, we argue that the current literature on intermarriage trends and preference shifts among Hispanics have been limited by the use of methodology that does not account for the various concurrent processes that shape these trends. Thus, we employ multilevel logistic regression in order to analyze intermarriage patterns because this methodological approach allows us to include individual and structural factors enabling us to more directly assess how intergroup relations between Mexicans and whites may have shifted. The benefit of this approach is that we will be able to pick up any fundamental changes in preferences towards endogamy or cultural homogamy by investigating whether the impact of structural conditions (i.e., relative group size) on intermarriage has shifted over time.

In theory, increases in preferences for within-group marriage should decrease the relative impact of the size of the ethnic community in a given local marriage market on the rate of intermarriage. This is because the largest (negative) effect of increasing co-ethnic group size on the rate of exogamy occurs when there are no preferences for same-group marriage, hence the rate of intermarriage is purely the result of random mixing. As preferences for homogamy increase, the overall rate of exogamy declines, but the (negative) slope on the effect of group size is flatter, and variation in group size per se is a less important explanatory variable for variation in exogamy across geographic areas.³ This would occur if high preferences for same-group marriage result in Mexicans actively seeking out other Mexicans in the area in such a way that even relative small numbers of co-ethnics result in a decrease in the incidence of intermarriage. Put differently, a preference change should reduce the difference between low and high density areas as individuals in the former will tend to invest more effort in their search for co-ethnic mates, investments that individuals in high density areas are simply not required to make. Thus, we would expect to find that the impact of relative group size decreases over the study period. Investigations that effectively conceptualize the whole United States as a single marriage market will therefore not be able to uncover these patterns and draw unsubstantiated conclusions.

³To test that an increase in preferences for endogamy results in a decline in the magnitude of relative group size on intermarriage rates (i.e., the negative coefficient on group size moves closer towards 0) we conducted a Monte Carlo experiment with simulated data under a wide range of conditions. The results confirm this expectation. Full results and computer code are available upon request.

3. Data and Methods

3.1. Data

Our analyses are based on the 1980, 1990 and 2000 Decennial Censuses as well as pooled data from the 2008 to 2012 American Community Surveys (Ruggles et al. 2010). Geographic information is based on 543 “consistent Public Use Microdata Areas” (c-PUMA). C-PUMAs represent the most detailed geographic areas without boundary changes over time and consist of administrative units that contain up to 100,000 inhabitants. In contrast to metropolitan statistical areas, c-PUMAs also cover non-urban areas. The sample is limited to 1st and 2nd+ generation Mexicans aged 20 to 30 years. This comparatively narrow age range is necessary to measure current rates and define local marriage market characteristics as adequately as possible. Due to homophily with respect to age it is unlikely that potential partners ten or more years older (or younger) than the respondent should be counted among the pool of potential mates. Including them when defining macro level characteristics potentially misrepresents the current marriage market conditions.⁴ Moreover, we exclude Mexicans who immigrated after the age of 17 in order to reduce the inflation of endogamy rates introduced by immigrants married abroad (Hwang and Saenz 1990).⁵ These restrictions leave us with 42,442 1st generation and 133,775 2nd+ generation Mexicans living in one of the 543 c-PUMAs across the United States.

3.2. Methods

In order to analyze Mexican marital behavior over time and place, we rely on multilevel logistic regression models for repeated cross-sectional data (Fairbrother 2014). Within each of our four measurement occasions (i.e., 1980i.e., 1990i.e., 2000i.e., 2010) individuals are clustered in c-PUMAs. Extending standard multilevel models to appropriately deal with repeated cross-sectional data entails introducing an additional time level comprising of a cross-classification of time and c-PUMA. The resulting nesting structure is captured in a three level model with a “c-PUMA-time” level situated between the c-PUMA and the individual level. Another crucial step involves group-mean centering (i.e., within-c-PUMA centering) macro level predictors with the group-mean serving as cross-sectional component and de-measured values serving as longitudinal components. Group-mean centering removes the correlation between longitudinal and cross-sectional components thus allowing us to estimate their effects separately in one combined model (Fairbrother 2014). Equation 1 depicts our model formally where i denotes individuals, t time-points, j c-PUMAs and the dependent variable Y_{ijt} represents a dichotomous variable with Mexican/white couples coded 1 and endogamous marriages coded 0:

$$Y_{ijt} = \beta_0 + \beta_1 x_{ijt} + \beta_2 x_{ijM} + \beta_3 \bar{x}_j + \beta_4 \text{time}_{ij} + u_j + u_{tj} + e_{ijt} \quad (1)$$

⁴Using a broader age range does not affect the results. These results are available upon request.

⁵In the absence of data on date of marriage, excluding all 1st generation Mexicans who immigrated after the age of 17 may overstate the level of intermarriage among 1st generation immigrants who were single when they entered the U.S. Nonetheless, because we focus on trends in intermarriage over time, this restriction should not affect our results unless there is something fundamentally different about the trends for those who immigrated as unmarried adults.

$\bar{x}_j$ represent the means of c-PUMA characteristics aimed at capturing cross-sectional differences while x_{ijM} represents the corresponding de-meaned c-PUMA characteristics. For example, $\bar{x}_j$ measures the average Mexican population size for each c-PUMA over the 30 years while x_{ijM} effectively represents a time-series of the development of the Mexican population within each c-PUMA. u_j , u_{tj} and e_{itj} denote the random effects related to c-PUMAs, c-PUMA-time and individuals respectively. In general terms, cross-sectional components aim to explain differences across c-PUMAs while longitudinal components deal with the development of intermarriage within c-PUMAs. The resulting components are orthogonal allowing an estimation of their coefficients separately in one combined model. This procedure is applied to all macro level predictors yielding a regression model in which Mexicans are nested in 2,073 c-PUMA-time units and 543 c-PUMAs. This baseline model will be further adapted to fit what Fairbrother (2014) terms “societal growth curves” in order to get at the question of fundamental preference shifts among the Mexican population. “Societal growth curves” model the changing impact of time-invariant variables of the model. We therefore formulate interaction terms between the time indicator and the cross-sectional component of our group density measure (see below). Our expectation is that preference shifts should materialize in a negative effect of group density that decreases in magnitude over time. The substantive implication would be that differences between low and high density areas become smaller. Models are estimated separately for 1st and 2nd+ generation Mexicans using maximum likelihood estimation implemented in the lme4 package for R (Bates et al. 2013).

3.3. Measures

The dependent variable measures whether Mexican respondents married a white spouse (i.e., exogamy, $Y=1$) or a Mexican spouse (i.e., endogamy, $Y=0$). In the following, we will discuss each of the structural measures in turn. Note that all structural measures computed from Census and ACS data (i.e., occupational segregation, sex ratio, % speaking Spanish at home and relative group size) are based on respondents age 18 to 35. Moreover, these measures are sex-specific and are based on potentially available, that is non-married, co-ethnics and majority group members. By doing so, we aim to include only the most relevant marriage market population.

Independent variables—% of PUMA living in metro area is measured using data on whether respondents lived in a metropolitan area. This variable aims to control differences between urban and rural PUMAs expecting co-ethnic meeting opportunities and thus endogamy to be higher in urban settings.

Occupational segregation between Mexicans and whites is measured using the index of dissimilarity D (Duncan and Duncan 1955). D is calculated using 1-digit ISCO categories and records the percentage of Mexicans that would have to change occupational categories to achieve an even distribution with whites. Higher occupational segregation corresponds to more limited meeting opportunities between Mexicans and whites hence we expect this measure to have a negative effect on intermarriage.

Sex ratio represents the proportion of male Mexicans to female Mexicans. Values above 1 indicate a higher supply of male Mexicans suggesting structural conditions in favor of (male) exogamy.

In order to measure origin culture retention among the 2nd+ generation Mexicans, we record the *% speaking Spanish at home*. The underlying reasoning being that the fewer 2nd+ generation Mexicans who speak Spanish, the more likely claims of “losing touch” with the origin culture are voiced by 1st generation members.

Differences in the extent to which Mexicans might encounter nativism are measured using *White’s negative feelings towards Hispanics*. Data for this measure was gathered from the American National Election Study (ANES 2010). We took the five-year average in white’s scores on the feeling thermometer prior to each time point. Higher scores on the thermometer indicate “warmer” feelings towards Hispanics. We therefore reversed the scores on this indicator to better correspond to our hypotheses. Note that due to data availability issues, this measure was only available for states. Thus, c-PUMAs within a state have the same score.

Relative group size represents a central indicator for the potential availability of co-ethnic spouses. This variable records the percentage of a c-PUMAs population that is Mexican. In order to avoid placing functional restrictions on this measure, we include relative group size as splines. The splines are defined as the quartiles of the relative group size variable⁶. More specifically, the splines range from 0.1 to 3.8 percent, 3.8 to 8.3 percent, 8.3 to 12.6 percent and 12.6 to 31 percent.

We also include a number of individual level control variables to account for (1) essential micro level predictors of marital behavior and for (2) compositional differences across c-PUMAs: age (measured in years), a gender dummy (with males as the reference category), years of education and a dummy variable indicating respondent’s ability to speak English (1=“speaks only English” to “speaks English well”, 0=“does not speak English” and “speaks English but not well”). Moreover, a linear time term (with decades as the unit) is added with respondents in the 1980s scoring 0 and respondents in the 2010s scoring 3.

Descriptive statistics for the independent variables are presented in Table 1.

4. Results

4.1. Descriptive results

Table 2 presents time trends in intermarriage rates. The overall ethnic intermarriage rates conform to the picture painted in the literature: There was an increase in Mexican/white intermarriage until the 1990s, a subsequent decline to pre-1990 levels in the 2000s and

⁶We approached the question of spline definition in two ways. The first, as described above, took the whole sample to define the quartiles. This approach approximates population weighted splines. We also defined splines based only on the 543 c-PUMAs effectively assuming that each c-PUMAs has an equal weight. Both approaches reach very similar conclusions (see Appendix B for results based on the second approach). Additional robustness checks regarding the parametrization of the time trend (quadratic or dummy variable specification) produced no difference in the substantive conclusions. We therefore decided to use the more parsimonious linear trend model formulation.

finally an increase in intermarriage to 41 percent in the 2010s. Thus, the overall ethnic intermarriage rates do not show a clear trend pattern but rather a pattern of ups and downs remaining on fairly stable levels. If we disaggregate the overall rate by generational status, we see a clear trend of generational divergence appearing: the ethnic intermarriage rates of 1st generation Mexicans decline from 13 percent in the 1980s to 9 percent in the 2010s, whereas the corresponding rates for 2nd+ generation Mexicans show a strong increase of 13 percentage points from 40 percent in the 1980s to 53 percent in the 2010s. According to these findings, 2nd+ generation Mexicans are firmly on the path towards marital assimilation with the U.S. white population.

Figure 2 further disaggregates these trends by traditional, re-emerging, or new destination areas based on the classification of states in Riosmena and Massey (2012)⁷. Irrespective of settlement area, the trends presented here seem to agree with the overall conclusions drawn from Table 2. We do however see important variation in the trend level across settlement areas. Ethnic intermarriage rates dropped markedly outside traditional destinations for first generation Mexican immigrants. In the 1980s, around 60 percent of 1st generation Mexicans intermarried in new destinations but this number dropped to a little more than 15 percent in the 2010s. The situations seems similar albeit less drastic in re-emerging settlement areas. However, the reader should also keep in mind that relatively few Mexican immigrants lived outside traditional destinations in the 1980s. Despite the shifts in intermarriage rates in new and re-emerging destination areas, the relative size distribution of the population across the three settlement areas prevents these trends from having a pronounced effect on the overall trend presented in Table 2. The majority of Mexican immigrants still live in traditional settlement areas, and according to Figure 2 the intermarriage rate among first generation immigrants in these areas shows little evidence of a pronounced decline over the 30 year study period, remaining fairly stable at around 10 percent.

In Figure 2 we see that there is a large difference in the rate of intermarriage among 2nd+ generation Mexicans across the three types of settlement areas, although the time trend is remarkably similar. As expected, intermarriage is least common in traditional settlement areas with around 40 percent marrying a white spouse. Also in line with our expectations, intermarriage is most frequent in new destinations, followed by re-emerging destinations. Relative to traditional settlement areas, the intermarriage rate is an astonishing 40 percentage points higher in new destinations. Surprisingly, the intermarriage rates in new destinations have declined slightly since the 1990s while corresponding rates in traditional destinations remained fairly stable.

4.2. Variance partition

Table 3 presents the results from our baseline models, which decompose the variance in intermarriage rates across the geographic areas. These models provide insights into the relative importance of the local marriage market (i.e., the c-PUMA) with respect to ethnic intermarriage. Not surprisingly most of the variation in intermarriage is associated with individual differences. Around 35 percent of the variation is attributable to differences across

⁷This classification of settlement areas is presented in Appendix A.

c-PUMAS (see Table 3: $\text{Var}(\text{c-PUMA})/[\pi^2/3 + \text{Var}(\text{c-PUMA}) + \text{Var}(\text{c-PUMA-time})]$). An additional 2 percent of the variation relates to differences in the trajectory development of intermarriage within c-PUMAs (i.e., $\text{var}[\text{c-PUMA-time}]$).

When investigating the average pattern over time, Table 3 reinforces the impression of divergent interethnic marriage trends gained by studying the descriptive findings above. While the time coefficient is strongly negative for the 1st generation, it is substantially smaller, though still negative for 2nd+ generation Mexicans. Another important insight generated by Table 3 relates to the variation of the average time trend as signified by its random slope. While the effect of time is uniformly negative for 1st generation Mexicans, even taking into account the slope variation, we see that the confidence interval for the variation in the estimated time coefficient across c-PUMAs ranges from $-.664$ to $.492$ for 2nd+ generation Mexicans. Thus, there is no uniform intermarriage trend across c-PUMAs with 2nd+ generation Mexicans becoming more assimilated in some while becoming less assimilated in others. In other words, disaggregating intermarriage beyond the state level is essential in providing a representative picture of the state of Mexican assimilation patterns.

4.3. Multivariate results

The results for the full gender-specific logistic multilevel models investigating interethnic marriages are presented in Table 4 for Mexican immigrants and in Table 5 for 2nd+ generation Mexicans. Note that in all models presented, macro level variables have been standardized to facilitate interpretation and provide some indication of their relevance. In general, the longitudinal components relate to intermarriage *within* c-PUMAs whereas the cross-sectional components relate to underlying differences in intermarriage *across* c-PUMAs. Since the aim of this article is to account for the development of intermarriage over time, we will focus the discussion on the longitudinal components of our models.

Before discussing findings regarding the main research question of this article, we will briefly summarize the results for the structural conditions. In the case of 2nd+ generation Mexicans, we find that changes in local sex ratios and group size impact the odds of exogamy. For both male and female Mexicans, a one standard deviation increase in relative group size decreases the odds of exogamy by 4 percent while a similar increase in the sex ratio increases the odds by 2 percent for males and 3 percent for females ($e^{.020}-1$ and $e^{.030}-1$). While the relationship between intermarriage and group size changes is more or less the same across generations, the impact of changes in origin culture retention (i.e., the percentage of Mexicans speaking Spanish at home) differs across generations. Our results suggest that an increase in the proportion of Mexicans speaking Spanish at home reduces the likelihood of marrying a white spouse. More specifically, a one standard deviation increase in the proportion of Spanish-results in a predicted decrease in the odds of marrying a white spouse ranging from 6 for 1st generation members to 10 percent for 2nd+ generation members. Thus, it appears that the extent to which 2nd+ generation Mexicans retain their origin culture shapes marriage patterns for both 1st and 2nd+ generation Mexicans. This suggests that ethnic and racial boundaries are more distinct when a larger proportion of native-born Mexicans maintain the use of Spanish, which impacts ethnic marriage patterns. Finally, neither changes in the extent of occupational segregation between Mexicans and

whites nor changes in White's feelings towards Hispanics are related to changes in marital behavior.

We now turn to findings regarding the main research question of this article, namely whether there has been a fundamental shift in the marital preferences of Mexicans over time. First, we note that one of the key features of analysis in Tables 4 and 5 is that we model the effect of relative group size using a series of linear splines, which allows for a flexible estimation of the effect of group size on the rate of intermarriage. An important finding from the results is that the coefficients on the splines tend to get smaller as the relative group size increases; for first generation female immigrants in Table 4, for example, the coefficient of the first group size spline (group size between 0.1 to 3.8 percent of the population) is -0.149 , whereas the effect falls to -0.049 for the fourth spline (group sizes greater than 12.6 percent). This curvilinear effect of relative group size is evident for both 1st and 2nd+ generation Mexicans. Hence, when the Mexican population density has reached a certain level, the difference between “low” and “high” density c-PUMAs within the specific group size spline becomes less pronounced. Accurately fitting the nonlinear effect of relative group size on intermarriage rates with a spline function or higher order polynomial—as opposed to assuming a constant linear effect—is important because otherwise the large increase in the relative size of the Mexican population during the study period would induce a change in the estimated effect of group size even in the absence of a preference shift.

The second column in the gender-specific models of Tables 4 and 5 presents the results for our main research question which is whether the marital preferences of Mexicans have shifted over the study period net of individual and group level explanatory variables and the baseline effect of relative group size. The underlying idea, again, is that shifts in the marital preferences of Mexicans towards endogamy would reduce the importance of whether an individual lives in a low as opposed to a high-density area because individuals will try to satisfy their endogamy preferences irrespective of the structural conditions. Evidence for these preference shifts would present itself in our model as significant changes of the cross-sectional group size components over time. In other words, the difference between high and low density areas should decline (or vanish) over the study period. When investigating the “societal growth curves” (i.e., the interaction effects labeled “Time*spline 1–4”) our results suggest that no significant change in the impact of relative group size over time has occurred. Hence, we see a very stable pattern in the relevance of living in low versus high density areas over the study period. We therefore do not find evidence for “fundamental” preference shifts for either 1st or 2nd+ generation Mexicans.

5. Conclusion and discussion

In this article, we argue that two simultaneously occurring demographic processes, ethnic replenishment and spatial diffusion of immigrant settlement since the 1990s, impact Mexican intermarriage trends in distinct ways (Singer 2004; Massey 2008; Lichter et al. 2008). Thus, previous conclusions regarding Mexican intermarriage trends and the potential role of homogamy preference shifts are misleading given that past researchers have relied on inadequate methods that do not disentangle these demographic processes. Methodology that conceptualizes the United States as one single marriage market is also unlikely to adequately

model these differential processes and their impact on Mexican/white intermarriage (Lichter et al. 2011; Qian and Lichter 2011). We therefore propose the use of multilevel models for repeated cross-sectional data in order to exploit the variation within and across comparatively small-scale marriage markets [i.e., c-PUMAs] (Fairbrother 2014). Modelling “societal growth curves” allows us to assess whether there really has been a “fundamental” change in the marital preferences of Mexicans as stated in the literature. Overall, this paper reveals a series of important findings suggesting that there is little evidence to support the notion that continued immigration negatively impacts assimilation trends *beyond* the change it has on local structural conditions.

First, our analysis provides a more nuanced picture of Mexican marriage assimilation in a national context of spatial diffusion. The overall ethnic intermarriage rates of pooled 1st and 2nd+ generation Mexicans have not followed a uniform trend across destination types over the last 30 years. Rather, a pattern of ups and downs is evident. Moreover, when we disaggregate by generational status diverging trends are apparent. Mexican immigrants’ ethnic intermarriage rates have declined slightly from 1980 to 2010 and 2nd+ generation Mexican ethnic intermarriage rates have increased more substantially in the same time frame. Thus, the slowdown in marital assimilation does not represent a uniform process for Mexicans across the United States, especially when immigrant generation is taken into consideration. When we further examine patterns across destination type greater variation is apparent. For 1st generation Mexicans outside of traditional destinations, intermarriage rates decreased from 1980 to 1990 but increased between 1990 and 2010. For 2nd+ generation Mexicans, trends across destination type do not vary much from the national time trend. In line with our expectations, absolute ethnic intermarriage rates for 2nd+ generation Mexicans vary such that intermarriage is much more frequent in new destinations compared to re-emerging or traditional destinations. Overall, these findings allow us to conclude that 2nd+ generation Mexicans are firmly on the path towards marital assimilation with the U.S. white population, regardless of destination type.

Second, our multivariate analysis also offers important findings related to trend in Mexican/white intermarriage. In line with earlier findings in the literature, we find that an increase in relative group size, sex ratios, and origin culture retention over times deters interethnic marriage in favor of endogamy (Hwang et al. 1997; Kalmijn and van Tubergen 2010; Spörlein et al 2014). With regard to the main research question of this article, we find no evidence for substantial shifts in marital preferences of Mexicans. None of the interactions between the time effect and the relative group size splines indicates a significant change in the impact of group density on marital behavior. In other words, we did not find evidence for the proposition that preference shifts lead a reduced importance of whether Mexicans live in low vs high density areas. It is still the case the endogamy is more likely in high density marriage markets as opposed to low density marriage markets.

Our analysis is of course not without its limitations. We cannot distinguish at a higher level than 2nd generation. This is important given the volume of research that suggests third and higher generation Mexicans are at risk for stagnation or decline on other assimilation measures (Rumbaut 2005; Telles and Ortiz 2008). Second, our research design does not allow us to investigate the question whether unfavorable marriage market conditions

ultimately lead to delayed or foregone marriage. We believe this to be fruitful avenue for future research and may provide indirect evidence for or against marital preference shifts. A substantive increase in the number of individuals remaining single or delaying marriage in the absence of marriageable co-ethnics might imply a strong shift towards endogamous preferences. Furthermore, this current research on marital assimilation only considers one of the many dimensions of assimilation (Gordon 1967). Future researchers should consider quantitative tests how and if immigrant replenishment affects complementary structural and cultural measures including spatial mobility, friendship formation, or native language retention/abandonment. Alternatively, future scholars may apply similar methods used in this paper to examine assimilation measures for other immigrant groups or consider comparative research across multiple immigrant groups. Disaggregating and conducting similar analyzes at lower levels may also prove necessary to further our understanding of the effects of immigrant replenishment, spatial diffusion, and marital assimilation.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Appendix A

Table 1

Classification of settlement areas based on Riosmena and Massey (2012)

Settlement areas	States
Traditional	Arizona, California, Illinois, Indiana, New Mexico, Michigan, Ohio, Texas and Wisconsin
Re-emerging	Colorado, Idaho, Iowa, Kansas, Minnesota, Missouri, Montana, Nebraska, Nevada, North Dakota, Oklahoma, Oregon, South Dakota, Utah, Washington and Wyoming
New	Alabama, Arkansas, Connecticut, Delaware, Washington D.C., Florida, Georgia, Kentucky, Louisiana, Maine, Massachusetts, Mississippi, New Hampshire, New Jersey, New York, North Carolina, Pennsylvania, Rhode Island, South Carolina, Tennessee, Vermont, Virginia and West Virginia

Appendix B

Table 1

Multilevel logistic regression predicting exogamous behavior of 1st and 2nd+ generation Mexicans, 1980–2012, by sex: Alternative specification of the group size splines.

	Married exogamously vs. married endogamously							
	Females				Males			
	1 st generation		2 nd + generation		1 st generation		2 nd + generation	
	coef	s.e.	coef	s.e.	coef	s.e.	coef	s.e.
Intercept	1.655	1.382	2.582 *	0.407	1.305	1.511	2.493 *	0.512
% of c-PUMA living in metro area	−0.201 *	0.086	−0.311 *	0.040	−0.443 *	0.088	−0.336 *	0.041
Relative group size (cross-sectional) spline 1	−0.726	1.974	−1.718 *	0.583	−1.729	3.025	−2.435 *	1.013
Relative group size (cross-sectional) spline 2	−0.230	0.801	0.479	0.268	−1.092	1.148	0.443	0.421
Relative group size (cross-sectional) spline 3	−0.717 *	0.172	−0.312 *	0.76	−0.541 *	0.213	−0.232 *	0.103
Relative group size (cross-sectional) spline 4	−0.045 *	0.007	−0.056 *	0.005	−0.028 *	0.007	−0.59 *	0.006
Relative group size (longitudinal)	−0.064	0.043	−0.032	0.018	−0.102	0.054	−0.038	0.019
Time*spline 1	0.350	0.909	0.341	0.302	0.091	1.305	0.045	0.501
Time*spline 2	−0.297	0.359	−0.327 *	0.130	0.154	0.494	−0.061	0.188
Time*spline 3	0.114	0.078	0.010	0.034	0.133	0.096	−0.032	0.043
Time*spline 4	0.009	0.006	0.001	0.002	0.000	0.004	0.001	0.002
Occupational segregation (cross-sectional)	−0.164 *	0.045	0.037	0.027	0.030	0.037	0.096 *	0.027
Occupational segregation (longitudinal)	0.007	0.034	0.020	0.011	−0.047	0.032	−0.021	0.013
Sex ratio (cross-sectional)	0.051	0.033	0.027	0.017	0.023	0.030	−0.069 *	0.020
Sex ratio (longitudinal)	−0.065	0.036	0.028 *	0.009	−0.040	0.028	0.020	0.010
% speaking Spanish at home (cross-sectional)	−0.140 *	0.057	−0.206 *	0.033	−0.348 *	0.050	−0.229 *	0.037
% speaking Spanish at home (longitudinal)	−0.062	0.032	−0.061 *	0.013	−0.021	0.030	−0.065 *	0.014
White's negative feelings towards Hispanics (cross-sectional)	0.014	0.041	−0.042	0.027	−0.041	0.038	−0.043	0.031
White's negative feelings towards Hispanics (longitudinal)	−0.034	0.042	−0.024	0.014	−0.057	0.050	−0.016	0.015
Age	0.062 *	0.010	0.017 *	0.003	−0.003	0.010	0.015 *	0.004
Years of education	0.318 *	0.014	0.300 *	0.005	0.205 *	0.012	0.281 *	0.006
Speaks English	2.035 *	0.153	1.066 *	0.071	1.697 *	0.116	1.310 *	0.092
Time	−0.784	0.639	−0.176	0.209	−0.620	0.650	−0.035	0.256
Var(c-PUMA)	0.030		0.318		0.000		0.403	
Var(c-PUMA-time)	0.014		0.013		0.075		0.008	
sd(time)	0.049		0.217		0.096		0.196	
Observations								
c-PUMA	413		524		405		504	

	Married exogamously vs. married endogamously							
	Females				Males			
	1 st generation		2 nd + generation		1 st generation		2 nd + generation	
	coef	s.e.	coef	s.e.	coef	s.e.	coef	s.e.
c-PUMA-time	1,048		1,752		1,005		1,596	
Individuals	22,087		74,989		20,215		57,214	

Note: Macro level variables standardized, micro level variables grand-mean centered. Time represents the trend indicator and was measured as 0=1980, 1=1990, 2=2000 and 3=2010. Relative group size splines are defined as [0.1;.8]; [.8;1.6]; [1.6;3.7] and [3.7;62] and are based on relative group size quartiles with each c-PUMA having equal weight.

*
p<.05 (two-sided).

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Figure 1.
Couples with at least one Mexican partner as a proportion of all couples across c-PUMAs

Figure 2. Mexican/White intermarriage rates across time, generational status and settlement area, 1980–2012.

Table 1

Descriptive statistics of independent variables

	Range	Mean	SD
Macro level variables			
% of c-PUMA living in metro area	.00–100.00	35.73	39.91
Occupational segregation	.04–.95	.33	.09
Sex ratio	.14–16.00	1.18	.35
% speaking Spanish at home	.00–100.00	61.30	18.62
White's negative feeling towards Hispanics (measured at state level)	–89.00—20.00	–61.95	6.04
Relative group size (in %)	.01–34.01	8.98	7.15
Micro level variables			
Female	0–1	.56	
Age	20–30	25.92	2.92
Years of education	0–17	11.78	2.56
Speaks English	0–1	.91	

Table 2

Mexican Intermarriage by Generation and Year

Intermarriage rate	1980	1990	2000	2010
Overall	.38	.43	.38	.41
1 st generation	.13	.13	.08	.09
2 nd + generation	.40	.48	.51	.53

Table 3

Variance components and random slope for time based on logistic multilevel model predicting exogamous behavior.

	1 st generation	2 nd + generation
Variance components		
Var(c-PUMA)	1.795	1.715
Var(c-PUMA-time)	.094	.096
Random slope		
b _{time}	-.518**	-.086**
sd(b _{time})	.205	.295
95% CI b _{time}	[-.920; -.116]	[-.664; .492]

Note: individual level variance component fixed to $\pi^2/3$ in logistic multilevel models. Time was measured as linear variable (0=1980, 3=2010).

Table 4Multilevel logistic regression predicting exogamous behavior of 1st generation Mexicans, 1980–2012, by sex.

	Married exogamously vs. married endogamously					
	Females			Males		
	coef	s.e.	coef	s.e.	coef	s.e.
Intercept	0.715 [*]	0.195	0.916 [*]	0.259	-0.182	0.184
% of c-PUMA living in metro area	-0.128	0.088	-0.152	0.086	-0.408 [*]	0.084
Relative group size (cross-sectional) spline 1	-0.235 [*]	0.024	-0.201 [*]	0.043	-0.172 [*]	0.023
Relative group size (cross-sectional) spline 2	0.010	0.023	-0.100 [*]	0.036	-0.044 [*]	0.020
Relative group size (cross-sectional) spline 3	-0.070 [*]	0.021	-0.040	0.031	-0.009	0.021
Relative group size (cross-sectional) spline 4	-0.011	0.008	-0.019	0.012	-0.017 [*]	0.008
Relative group size (longitudinal)	-0.052	0.043	-0.065	0.043	-0.072	0.049
Time*spline 1			-0.026	0.021		0.025
Time*spline 2			0.070	0.043		-0.004
Time*spline 3			-0.015	0.015		0.018
Time*spline 4			0.004	0.006		-0.002
Occupational segregation (cross-sectional)	-0.154 [*]	0.044	-0.146 [*]	0.045	-0.022	0.036
Occupational segregation (longitudinal)	0.017	0.035	0.005	0.035	-0.054	0.031
Sex ratio (cross-sectional)	0.027	0.034	0.031	0.034	0.022	0.029
Sex ratio (longitudinal)	-0.060	0.036	-0.072 [*]	0.036	-0.030	0.027
% speaking Spanish at home (cross-sectional)	-0.170 [*]	0.056	-0.174 [*]	0.057	-0.330 [*]	0.048
% speaking Spanish at home (longitudinal)	-0.091 [*]	0.033	-0.067 [*]	0.032	-0.039	0.029
White's negative feelings towards Hispanics (cross-sectional)	0.056	0.044	0.055	0.044	0.007	0.038
White's negative feelings towards Hispanics (longitudinal)	-0.038	0.043	-0.038	0.043	-0.049	0.045
Age	0.064 [*]	0.010	0.063 [*]	0.001	-0.002	0.010
Years of education	0.321 [*]	0.014	0.321 [*]	0.014	0.208 [*]	0.012
Speaks English	2.041 [*]	0.152	2.035 [*]	0.152	1.701 [*]	0.116
Time	-0.456 [*]	0.052	-0.541 [*]	0.104	-0.328 [*]	0.052
					-0.449 [*]	0.095

Married exogamously vs. married endogamously					
Females			Males		
	coef	s.e.	coef	s.e.	coef
Var(c-PUMA)	0.078	0.047	0.000	0.000	0.000
Var(c-PUMA-time)	0.017	0.005	0.061	0.058	0.058
sd(time)	0.156	0.019	0.070	0.071	0.071
Observations					
c-PUMA	413	413	405	405	405
c-PUMA-time	1,048	1,048	1,005	1,005	1,005
Individuals	22,087	22,087	20,215	20,215	20,215

Note: Macro level variables standardized, micro level variables grand-mean centered. Time represents the trend indicator and was measured as 0=1980, 1=1990, 2=2000 and 3=2010. Relative group size splines are defined as [0.1;3.8]; [3.8;8.3]; [8.3;12.6] and [12.6;31] and are based on relative group size quartiles.

* p<.05 (two-sided).

Table 5

Multilevel logistic regression predicting exogamous behavior of 2nd+ generation Mexicans, 1980–2012, by sex.

	Married exogamously vs. married endogamously					
	Females			Males		
	coef	s.e.	coef	s.e.	coef	s.e.
Intercept	1.719 *	0.099	1.601 *	0.116	1.569 *	0.109
% of c-PUMA living in metro area	-0.314 *	0.040	-0.312 *	0.040	-0.339 *	0.041
Relative group size (cross-sectional) spline 1	-0.149 *	0.016	-0.109 *	0.024	-0.140 *	0.019
Relative group size (cross-sectional) spline 2	-0.090 *	0.018	-0.126 *	0.028	-0.114 *	0.021
Relative group size (cross-sectional) spline 3	-0.004	0.020	0.001	0.031	0.007	0.025
Relative group size (cross-sectional) spline 4	-0.049 *	0.007	-0.044 *	0.011	-0.051 *	0.008
Relative group size (longitudinal)	-0.037 *	0.017	-0.035	0.018	-0.037 *	0.018
Time*spline 1			-0.022	0.021		-0.018
Time*spline 2			0.020	0.012		0.018
Time*spline 3			-0.003	0.013		-0.012
Time*spline 4			-0.003	0.005		0.001
Occupational segregation (cross-sectional)	0.040	0.026	0.042	0.026	0.064 *	0.027
Occupational segregation (longitudinal)	0.022	0.011	0.022	0.012	-0.020	0.013
Sex ratio (cross-sectional)	0.013	0.016	0.012	0.017	-0.071 *	0.019
Sex ratio (longitudinal)	0.030 *	0.009	0.028 *	0.009	0.020 *	0.010
% speaking Spanish at home (cross-sectional)	-0.203 *	0.032	-0.204 *	0.032	-0.200 *	0.036
% speaking Spanish at home (longitudinal)	-0.059 *	0.013	-0.060 *	0.012	-0.063 *	0.014
White's negative feelings towards Hispanics (cross-sectional)	-0.014	0.027	-0.014	0.027	-0.015	0.030
White's negative feelings towards Hispanics (longitudinal)	-0.024	0.014	-0.025	0.014	-0.017	0.015
Age	0.017 *	0.003	0.017 *	0.003	0.016 *	0.004
Years of education	0.298 *	0.005	0.298 *	0.005	0.281 *	0.006
Speaks English	1.071 *	0.071	1.071 *	0.071	1.310 *	0.092
Time	-0.112 *	0.023	-0.045	0.041	-0.068 *	0.041

Married exogamously vs. married endogamously					
Females			Males		
	coef	s.e.	coef	s.e.	coef
Var(c-PUMA)	0.312		0.302		0.373
Var(c-PUMA-time)	0.013		0.013		0.008
sd(time)	0.222		0.217		0.194
Observations					
c-PUMA	524		524		504
c-PUMA-time	1,752		1,752		1,596
Individuals	74,989		74,989		57,214

Note: Macro level variables standardized, micro level variables grand-mean centered. Time represents the trend indicator and was measured as 0=1980, 1=1990, 2=2000 and 3=2010. Relative group size splines are defined as [0.1;3.8]; [3.8;8.3]; [8.3;12.6] and [12.6;31] and are based on relative group size quartiles.

* p<.05 (two-sided).