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Neighborhood Marginalization and Labor Market Disparities in Mexico*

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Abstract

This study examines the relationship between neighborhood marginalization and labor market outcomes in Mexico from 2010 to 2020. Using census data combined with CONAPO marginalization index, we estimate two-way fixed-effects models controlling for individual, labor market, municipal, and temporal factors. A 10-point increase in marginalization is associated with a 1.1% rise in participation, no change in total employment, a 7.6% decline in formal employment, a 5.4% increase in informal employment, and a 15.1% decrease in wages. These patterns are robust across commuting distance, distance to the state capital, urban samples, and lowmarginalization-variance municipalities. Non-linear results show that participation rises in highly marginalized deciles, while formal employment and wages fall sharply. Men experience a larger wage penalty (-16.0%) than women (-12.6%), while women are more likely to work informally. Older workers (55–65) show the largest participation increase but also the steepest wage loss. The findings highlight persistent structural barriers limiting access to quality jobs and earnings, as well as sharp heterogeneities across gender, age groups, and spatial contexts, which can help inform more targeted and place-based policy interventions.

Keywords: Neighborhood effects, Marginality, Labor market outcomes. Spatial inequality.
JEL codes: R23, J46, C36

*The views and conclusions presented in this paper are exclusively the author's responsibility and do not necessarily reflect those of Banco de México. All remaining errors are the author's own

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1. Introduction

Persistent social and spatial inequalities remain a defining feature of Mexico's development trajectory. Despite decades of economic growth and structural transformation, access to economic opportunities continues to be unevenly distributed across the population, with strong geographic and social gradients. In this context, understanding how social marginalization shapes individuals' labor market outcomes is central to both academic debates and policy design. Marginalization—broadly defined as the structural exclusion of individuals or groups from full participation in the social, economic, and political life of society—has profound implications for welfare, productivity, and long-run growth prospects CONAPO (2020). Yet, isolating its impact on labor market trajectories remains empirically challenging.

Mexico provides a particularly relevant setting to study these issues. Its labor market is characterized by a pronounced duality, with formal and informal employment coexisting on a large scale (Maloney, 2004; Moreno, 2007; Moreno and Cuellar, 2021). Informality accounts for nearly 60% of total employment, reflecting both limited access to formal jobs and the absence of a comprehensive social safety net (OECD, 2019). In periods of economic downturn, low official unemployment rates often mask adjustments that occur through shifts into informal employment rather than joblessness, as workers cannot afford to remain unemployed (Puggioni et al., 2022). These dynamics disproportionately affect women and older workers, for whom informal employment remains the dominant form of labor market attachment.

At the same time, income inequality and poverty remain pervasive. In 2020, 43.9% of the Mexican population—approximately 55.7 million people—lived in poverty, with particularly high incidence in states such as Chiapas, Guerrero, and Oaxaca (CONEVAL, 2022). The income of individuals in the richest decile was roughly twenty times that of those in the poorest decile, underscoring that economic well-being in Mexico is shaped not only by employment levels, but by the quality of jobs and the distribution of earnings. These disparities are closely intertwined with territorial patterns of deprivation, where limited access to education, basic services, and infrastructure constrains economic opportunities across generations.

This paper focuses on one key dimension of this inequality: the role of neighborhood marginalization in shaping labor market outcomes. A large interdisciplinary literature documents the existence of neighborhood effects, whereby residential environments influence individual outcomes beyond personal characteristics (Dietz, 2002; Durlauf, 2004; Wilson, 2012). However, identifying these effects empirically is difficult. Individuals do not randomly sort into neighborhoods; residential choices are shaped by income, preferences, and unobserved characteristics such as ability or motivation. As emphasized by Small and Feldman (2012), observational data rarely allow researchers to fully disentangle whether poorer outcomes reflect causal neighborhood effects or selective sorting into disadvantaged areas.

Existing research on marginalization in Mexico and Latin America reflects this tension. Qualitative studies provide rich insights into lived experiences but often lack generalizability, while quantitative analyses frequently face endogeneity concerns and limited longitudinal variation (Tienda, 1991). As a result, the causal interpretation of estimated neighborhood effects remains contested. This study contributes to the literature by adopting a rigorous empirical strategy designed to mitigate these challenges and by leveraging rich census data covering an entire decade.

Specifically, we combine individual-level data from the 2010 and 2020 Population and Housing Censuses and the 2015 Intercensal Survey with the municipal-level marginalization index constructed by the National Population Council (CONAPO). The CONAPO index captures multiple dimensions of structural deprivation—education, health, housing, and asset ownership—and provides a consistent measure of marginalization across time and space. This allows us to examine how changes in neighborhood marginalization are associated with labor market outcomes, including labor force participation, employment,

To address concerns related to unobserved heterogeneity, reverse causality, and residential sorting, we estimate two-way fixed-effects models that include municipality and year fixed effects, along with state-specific time trends and rich individual and local labor market controls. This approach absorbs time-invariant differences across municipalities—such as historical infrastructure, long-standing segregation patterns, or persistent institutional quality—as well as common macroeconomic shocks affecting all regions. While this framework does not fully eliminate endogeneity concerns inherent to observational data, it substantially improves identification relative to cross-sectional analyses and allows us to exploit within-municipality variation over time.

To mitigate concerns related to unobserved heterogeneity, residential sorting, and timevarying contextual factors, we estimate two-way fixed-effects models that include municipality and year fixed effects, as well as state-specific time trends and rich individual and local labor market controls. This approach absorbs time-invariant differences across municipalities—such as historical infrastructure, long-standing patterns of segregation, or persistent institutional characteristics—and common macroeconomic shocks affecting all regions. This framework allows us to characterize systematic and economically meaningful associations between neighborhood marginalization and labor market outcomes, leveraging rich individual-level information and within-municipality variation over time, even though the underlying data consist of repeated cross-sections rather than a longitudinal panel.

Our results reveal a stark pattern of labor market disadvantage associated with marginalization. A 10-point increase in the marginalization index is associated with a 1.1% increase in labor force participation, no significant change in overall employment, a 7.6% decline in formal employment, a 5.4% increase in informal employment, and a 15.1% reduction in wages. These findings suggest a strong "necessity effect": individuals in highly marginalized areas are more likely to enter the labor force, yet face substantially worse job quality and lower earnings. The results are robust across commuting distances, urban subsamples, and municipalities with more homogeneous levels of marginalization, and they persist in nonlinear specifications that reveal particularly sharp penalties at high levels of deprivation.

We further document important heterogeneity. Men experience larger wage penalties than women, while women are more likely to adjust through informal employment. Older workers show the strongest increase in participation but also the steepest earnings losses, consistent with cumulative disadvantage over the life course. Together, these patterns highlight how structural neighborhood conditions interact with individual characteristics to reinforce labor market inequality

By providing comprehensive evidence on the relationship between neighborhood marginalization and labor market outcomes in Mexico, this study contributes to a growing literature on spatial inequality and neighborhood effects in middle-income countries. The findings underscore the importance of place-based disadvantage in shaping access to quality employment and earnings, with implications for policies aimed at reducing informality, improving job quality, and breaking persistent cycles of deprivation.

The remainder of the paper is organized as follows. Section 2 outlines the conceptual framework and reviews the related literature. Section 3 describes the data sources. Section 4 presents the identification strategy and empirical specification. Section 5 discusses the main results, while Section 6 examines heterogeneous effects. Section 7 reports robustness checks, and Section 8 concludes.

2. Conceptual Framework

This paper is guided by a conceptual framework in which marginalization, understood as a multidimensional and spatially structured phenomenon, is systematically associated with individual labor market outcomes. Neighborhood characteristics at the municipality level shape the opportunity set individuals face, influencing labor supply decisions, employment status, job quality, and earnings. The framework emphasizes robust

correlations arising from structural constraints, social interactions, and institutional environments that vary across space.

Guided by this framework, the section proceeds in four steps. First, we define the labor market outcomes examined in the empirical analysis. Second, we clarify how marginalization is conceptualized and measured in the Mexican context. Third, we review the neighborhood effects literature and its main empirical findings. Finally, we discuss the key mechanisms and identification challenges that motivate the empirical strategy adopted in this study.

2.1. Labor Market Outcomes

Labor Force Participation. Our analysis begins by considering labor force participation, measured through the Economically Active Population (PEA). The PEA includes individuals aged 12 years and older who were either employed or actively seeking employment during the two months prior to the survey week. This definition follows international statistical standards and captures individuals' engagement with the labor market, regardless of employment status (Instituto Nacional de Estadística y Geografía, 2025).

Employment. Employment is defined as engagement in any productive activity for at least one hour during the reference week, whether paid or unpaid and irrespective of formality. This definition is consistent with ILO recommendations and reflects the broad scope of economic activity in contexts characterized by widespread informality.

Unemployment. Unemployment refers to individuals actively seeking but unable to find work. In Mexico, unemployment rates remain relatively low even during economic downturns, reflecting the limited availability of social insurance mechanisms that would allow workers to remain unemployed while searching for jobs (Moreno and Cuellar, 2021). Although overall rates are similar for men and women, women experience higher unemployment during specific periods (Puggioni et al., 2022).

Informality. Informal employment refers to labor relations not regulated or protected by labor law, typically lacking access to social security, benefits, or formal contracts. In Mexico, formality is defined by entitlement to contributory social security, as established in Article 123 of the Constitution. Informal salaried workers lack such coverage, while self-employed workers and employers are considered informal if they operate small, unregistered units. Informality is particularly relevant given its association with lower productivity, income instability, and limited access to social protection. Over the study period, informality rates range between 56% and 60%, with consistently higher incidence among women. Agricultural employment is excluded due to its distinct institutional features.

Wages. Wages capture the monetary remuneration received from labor and reflect both job quality and economic security. Lower earnings are closely associated with precarious employment arrangements and constrained opportunity sets, conditions that disproportionately affect individuals residing in highly marginalized areas. The 2008–2009 financial crisis led to widespread earnings losses, particularly among men and workers at the bottom of the income distribution, while top earners exhibited greater resilience (Puggioni et al., 2022). Income inequality provides important context for these outcomes. In 2020, 43.9% of the Mexican population, approximately 55.7 million individuals, lived in poverty. Income disparities are stark: the richest decile earned roughly twenty times more than the poorest decile. These inequalities are closely intertwined with spatial patterns of deprivation, as areas with higher poverty also exhibit deeper social deprivations in education, housing, and access to basic services.

2.2. Defining Marginalization

Marginalization is conceptualized as a composite measure capturing systematic exclusion from essential goods, services, and opportunities. According to CONAPO (2020), marginalization is a structural phenomenon rooted in Mexico's historical development path, limiting the diffusion of technical progress and restricting the integration of certain social groups into the development process. This generates a precarious structure of social opportunities, exposing individuals to persistent risks and vulnerabilities.

The primary explanatory variable in this study is the CONAPO Marginalization Index (MI). The MI is a multidimensional measure that aggregates indicators across three structural dimensions and eight forms of exclusion, capturing the share of the population lacking essential conditions for basic capability development. A detailed description of the index components and underlying indicators is provided in Table A.1 in the Appendix. Importantly, the updated methodology allows for cardinal comparisons over time, enabling the analysis of changes in marginalization across municipalities.

The 2020 MI reveals pronounced territorial inequality. While approximately half of all localities exhibit low or very low marginalization, nearly one-quarter display medium marginalization and over one-quarter exhibit high or very high marginalization. More than 4.5 million individuals reside in highly marginalized localities. These localities are spatially concentrated, with roughly 64% located in five states, Chiapas, Oaxaca, Guerrero, Veracruz, and Chihuahua, highlighting the strong geographic clustering of disadvantage. In contrast, states such as Colima, Quintana Roo, Mexico City, and Baja California Sur have the fewest highly marginalized localities. Mexico City, Estado de México, and Jalisco concentrate a significant portion (nearly 30%) of the population in low and very low marginalization localities. This stark asymmetry highlights how central urban areas concentrate resources and opportunities, while small, dispersed localities face significant deficiencies in education, housing, and basic services, leading to a precarious structure of social opportunities.

2.3. Defining Neighborhood Effects

Neighborhood effects refer to systematic associations between residential environments, local social interactions, and individual outcomes that persist beyond observable personal characteristics (Dietz, 2002; Van Ham and Manley, 2010). A large interdisciplinary literature documents that neighborhood context is strongly correlated with a wide range of outcomes, including educational attainment, school dropout, health, morbidity and mortality, social mobility, and access to employment opportunities (Durlauf, 2004; Ellen and Turner, 1997; Galster et al., 2002). These associations are central to poverty trap theories, which emphasize how spatially concentrated deprivation constrains opportunity sets and reinforces disadvantage among vulnerable populations (Wilson, 2012). Early contributions, such as Mayer and Jencks (1989), hypothesized that children raised in disadvantaged neighborhoods face greater barriers to upward mobility than otherwise similar children growing up in more affluent environments. As a result, neighborhood effects have attracted sustained attention across economics, sociology, and related social sciences, motivated by the potential role of place-based factors in shaping individual life chances.

2.4. Empirical Findings on Neighborhood Effects

A large empirical literature examines how residence in marginalized neighborhoods is associated with outcomes over the life course. Observational studies consistently document poorer outcomes, including lower educational attainment, worse health, higher exposure to crime, and reduced earnings, for individuals residing in high-poverty neighborhoods (Jencks et al., 1990; Sharkey and Faber, 2014; Wilson, 2012). However, these findings are primarily correlational. Individuals sort into neighborhoods based on observed and un-

observed characteristics—such as income, preferences, social networks, or ability—that may independently affect outcomes, complicating interpretation (Clampet-Lundquist and Massey, 2008; Harding et al., 2010).

Most neighborhood effects studies rely on observational data, often drawn from crosssectional surveys collected at a single point in time (Oakes, 2004). Such data limit researchers' ability to account for unobserved individual traits that influence both neighborhood choice and subsequent outcomes. As a result, regression estimates of neighborhood effects may be biased by unmeasured confounders (Brooks-Gunn and Duncan, 1997; DeLuca et al., 2012; Goering, 2003; Harding, 2003; Harding et al., 2010; Jencks et al., 1990; Katz et al., 2008; Tienda, 1991). Using longitudinal evidence on residential mobility, Clampet-Lundquist and Massey (2008) show that moves out of disadvantaged neighborhoods are highly selective, with movers differing systematically from those who remain in terms of resources and constraints. This selectivity implies that observed differences in outcomes across neighborhoods may reflect compositional sorting rather than the influence of neighborhood conditions per se.

In response to these challenges, researchers have increasingly employed more rigorous empirical designs, including randomized controlled trials (RCTs), instrumental variable (IV) strategies, and fixed-effects approaches. This body of work has examined a wide range of outcomes, such as mental health (Leventhal and Brooks-Gunn, 2003), social mobility (Musterd et al., 2003), self-sufficiency (Kling and Liebman, 2004), long-run income (Chetty et al., 2016; Ludwig et al., 2013), child and youth development (Chetty and Hendren, 2018b,a; Gennetian et al., 2012), and political attitudes (Gay, 2012).

Evidence from housing mobility programs suggests that changes in neighborhood context are associated with differences in long-run outcomes: for example, analyses of the Moving to Opportunity experiment and the HOPE VI program document higher earnings among individuals relocating from disadvantaged neighborhoods, particularly when moves occur early in life or improve access to jobs (Chetty et al., 2016; Haltiwanger et al., 2020). Similar patterns are observed in Brazil's Minha Casa Minha Vida housing lottery, where more disadvantaged beneficiaries experience higher probabilities of formal employment when assigned to projects with improved neighborhood characteristics (Belchior et al., 2023). At the same time, research emphasizing residential sorting highlights that estimated neighborhood effects are sensitive to identification strategies. Using longitudinal data from England and Wales, Knies et al. (2021) show that negative associations between neighborhood disadvantage and earnings are substantially attenuated once time-invariant individual and neighborhood characteristics are accounted for, underscoring the challenge of disentangling contextual influences from selective mobility in observational data.

2.5. Mechanisms Underlying Neighborhood Effects

Theoretical contributions propose several mechanisms through which neighborhood context may be associated with individual outcomes (Ellen and Turner, 1997; Jencks et al., 1990; Sampson et al., 2002). Early frameworks highlight the role of (i) local service quality and resource availability (e.g., schools, healthcare), (ii) adult role modeling, (iii) peer influences and social contagion, (iv) social networks, (v) exposure to crime and violence, (vi) spatial mismatch between residence and employment, and (vii) institutional resources.

Small and Newman (2001) classify these mechanisms into socialization-based and instrumental channels. Socialization models—such as Wilson's epidemic model, Jencks' collective socialization framework, and Labov's linguistic isolation hypothesis—emphasize how neighborhood environments shape behaviors and expectations through social interactions. Instrumental models, including Elliott's network isolation and Brooks-Gunn's resource constraints frameworks, focus on how material and institutional limitations restrict access to socioeconomic opportunities.

Empirical evidence supports the relevance of both channels. Social-interactive mechanisms, such as peer

and role-model effects, are associated with individual aspirations and labor market behavior (Jencks et al., 1990; Sampson, 2011; Wilson, 2012). For example, Kondo and Shoji (2017), exploiting randomized housing assignments among Fukushima evacuees, document higher employment probabilities in areas with stronger peer employment. Instrumental mechanisms highlight how constrained access to education, healthcare, and employment networks is systematically associated with worse labor market outcomes (Brooks-Gunn and Duncan, 1997). Spatial mismatch theories further emphasize geographic channels, showing that greater distance to employment centers is correlated with weaker employment prospects (Gobillon et al., 2007). Evidence from Brazil and India supports this view, with relocations that increase commuting burdens associated with poorer employment outcomes (Barnhardt et al., 2017; Belchior et al., 2023).

Galster (2012) synthesizes these insights into an epidemiological framework that identifies fifteen pathways operating across four domains: social-interactive, environmental, geographic, and institutional.[1] This framework highlights the complexity of neighborhood effects and underscores the difficulty of isolating specific mechanisms empirically.

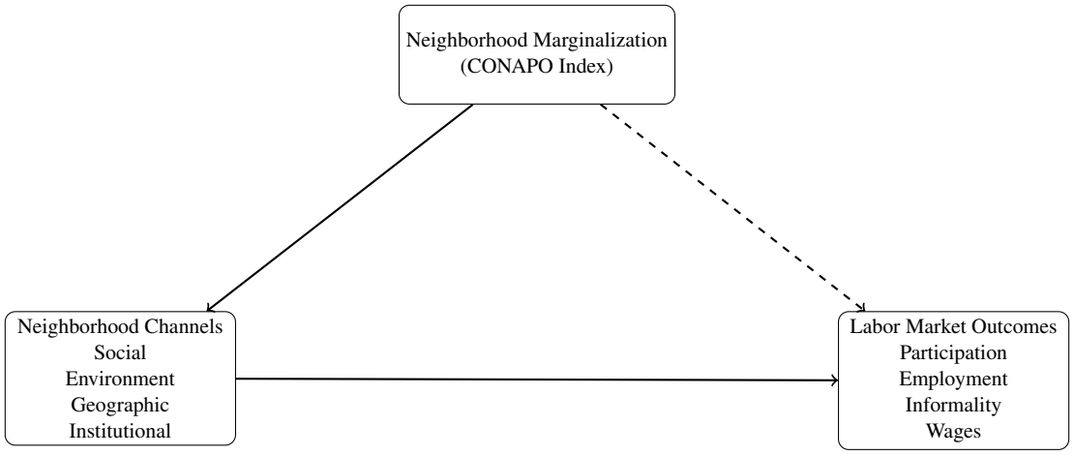


Figure 1: Conceptual framework linking neighborhood marginalization to labor market outcomes through multiple channels. Solid arrows represent indirect associations mediated by neighborhood mechanisms, while the dashed arrow captures direct correlations.

2.6. Identification Challenges and Methodological Considerations

Identifying correlation-based neighborhood effects remains methodologically challenging due to selection bias and reverse sorting. Unobserved individual traits may simultaneously influence neighborhood choice and labor market outcomes, complicating empirical interpretation (Harding et al., 2010; Jencks et al., 1990). Additionally, neighborhood exposure varies in intensity, timing, and duration across individuals, further complicating measurement (Galster, 2012).

To address the inconsistent estimates of neighborhood associations with employment and income, often driven by unobserved individual characteristics and neighborhood attributes correlated with deprivation, two-way fixed-effects approaches allow researchers to absorbtime-invariant unobserved heterogeneity at the individual or neighborhood levels (Galster et al., 2016). While such models do not resolve all identification challenges, they provide a useful framework for documenting robust and policy-relevant associations between neighborhood conditions and labor market outcomes.

[1]Detailed descriptions of these mechanisms are provided in Table B.1 in the Appendix. The primary empirical challenge lies in accurately measuring these channels without bias.

3. Data

The analysis relies on large-scale, nationally representative microdata that allow us to observe labor market outcomes at the individual level while linking them to time-varying measures of neighborhood marginalization at the municipal level.[2] The richness and geographic coverage of these data are essential for exploiting within-municipality variation over time and for implementing the fixed-effects framework described in the previous section. This study relies primarily on two main data sources to investigate the association between marginality and labor market outcomes in Mexico: the Mexican Population and Housing Censuses and the Marginalization Index.

3.1. Mexican Population and Housing Censuses (2010 — 2020)

The Mexican Population and Housing Censuses, conducted by INEGI, serve as a fundamental data source for this research. These censuses, available for 2010 and 2020, along with the 2015 Intercensal Survey, provide comprehensive individual and household-level data. The 2015 Intercensal Survey, while based on a large, probabilistic sample rather than a full enumeration, is nationally and subnationally representative down to the municipal level. Its methodological alignment with the 2010 and 2020 censuses, using the same definitions, classifications, and residence criteria, ensures high comparability and continuity in sociodemographic trends across the decade.

The granular nature of this census data, particularly at the municipal level, is crucial as it allows us to link individual labor market outcomes directly with their neighborhood context. Concatenating the information from these censuses provides a considerable number of observations with national representativeness.

3.2. Marginalization Index

The MI, developed by the CONAPO, is a composite measure of social deprivation and exclusion derived from census data. This index provides a robust and nationally recognized measure of marginalization at various geographic scales, including municipal levels. For this study, we will utilize the CONAPO indices from 2010 to 2020. The methodology for calculating the MI has been improved over time, allowing for direct temporal and territorial comparisons of marginalization levels. As recommended by (Peláez Herreros, 2023), normalizing the MI results is desirable for appropriate intertemporal comparisons. This is the one used as independent variable in our study.

Beyond its widespread use in applied work, the CONAPO marginalization index constitutes a suitable proxy for neighborhood effects because the dimensions underlying its construction mirror the mechanisms highlighted in the epidemiological model proposed by Galster (2012). In particular, the MI aggregates indicators related to housing quality and overcrowding, access to basic services and infrastructure and educational attainment. These components correspond directly to Galster's environmental and institutional mechanisms (e.g., housing conditions and service provision), geographic mechanisms (e.g., spatial disadvantage and access constraints), and social-interactive mechanisms (e.g., human capital composition and social context)[3].

[2]The data structure corresponds to a municipal-level panel with repeated cross-sections of individuals rather than a longitudinal panel following the same individuals over time. As a result, changes over time reflect within-municipality variation in average outcomes rather than individual labor market trajectories.

[3]In the empirical specification, we explicitly control for individual-level characteristics such as educational attainment, age, gender, marital status, number of children in the household, indigenous status, and household head status. As a result, the education-related component of the marginalization index captures contextual neighborhood characteristics, such as peer composition, social norms, and local human capital externalities, rather than the direct effect of an individual's own educational attainment. This distinc-

As a result, variation in the MI captures multiple pathways through which neighborhood context may be associated with labor market outcomes, making it a meaningful summary measure of neighborhood disadvantage in the context of neighborhood effects research.

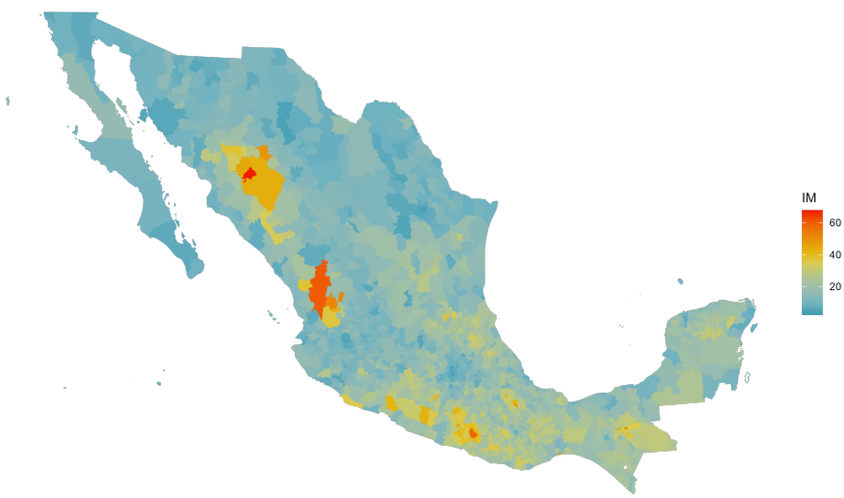
3.3. Spatial Distribution of Marginalization and Labor Market Outcomes

By combining these rich datasets, we aim to construct a comprehensive picture of the spatial distribution of marginalization and its association with diverse labor market outcomes across Mexico. An exploratory data analysis was conducted at the municipal level over 2020 to understand these spatial distributions.

The results of marginalization by municipality show enormous social and territorial inequality across Mexico. While one in two municipalities has a low or very low degree of marginalization, nearly 23% have a medium degree, and over 26% have high or very high degrees. More than 4.5 million people live in municipalities with high or very high marginalization. Educational deficiencies are particularly concerning in these highly marginalized municipalities, with two out of three people aged 15 or older not completing basic education and 23% being illiterate.

The spatial distribution of marginalization in Mexico (Figure 2) reveals that regions with higher marginalization (indicated by warmer colors) are predominantly concentrated in the southern and southeastern states, particularly Chiapas, Oaxaca, and Guerrero. These states, along with Veracruz and Chihuahua, concentrate almost 64% of municipalities with high and very high marginalization degrees. In contrast, states like Colima, Quintana Roo, Mexico City, and Baja California Sur have the fewest municipalities with high and very high marginalization, and nearly 30% of the population in low and very low marginalization municipalities is concentrated in the State of Mexico, Mexico City, and Jalisco. This highlights the severe asymmetry where central urban areas concentrate resources and opportunities, while small, dispersed municipalities face significant deficiencies in education, housing, and basic services. For instance, one in four residents of Chiapas lives in highly marginalized municipalities, whereas nearly all the population in Mexico City, Coahuila, or Aguascalientes lives in municipalities with low and very low marginalization.

Figure 2: Marginality by municipality 2020

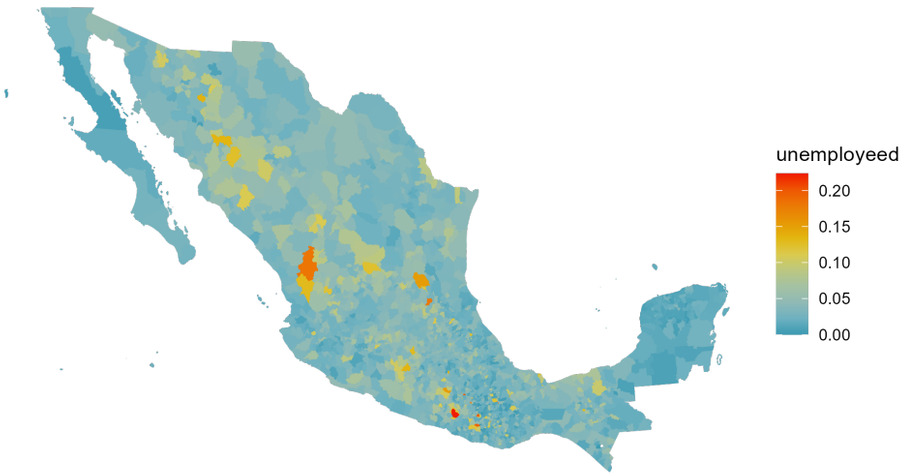


Source: Own elaboration with data from INEGI and CONAPO

tion is consistent with the interpretation of education as a social-interactive mechanism in the neighborhood effects literature.

An exploratory spatial analysis of the labor market outcomes (Figures 3, 4, and 5) reveals distinct patterns. First, unemployment in Mexico (Figure 3) shows a more dispersed pattern without a clear, strong regional concentration, although some higher rates appear in specific central and northern areas. This is consistent with the general observation that Mexico's unemployment rate is relatively low, even during crises, due to the lack of a social safety net pushing individuals into alternative forms of employment.

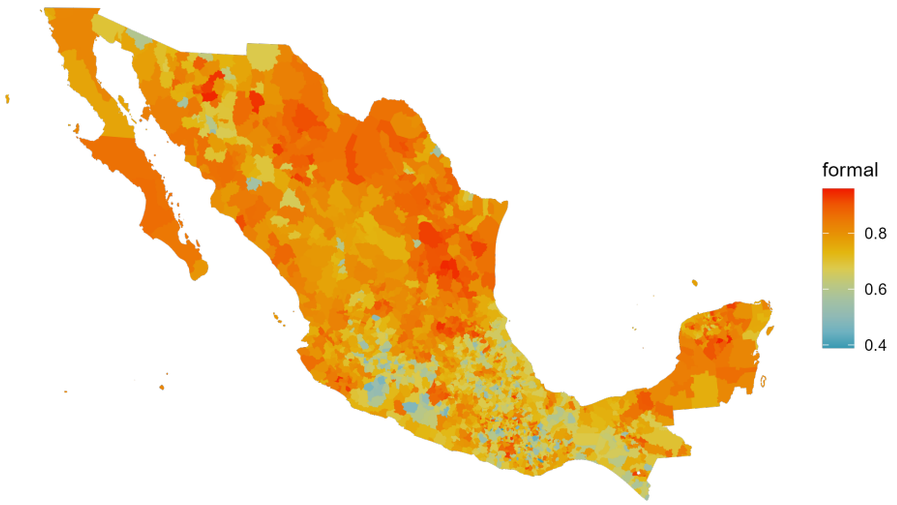
Figure 3: Unemployment by municipality 2020



Source: Own elaboration with data from INEGI and CONAPO

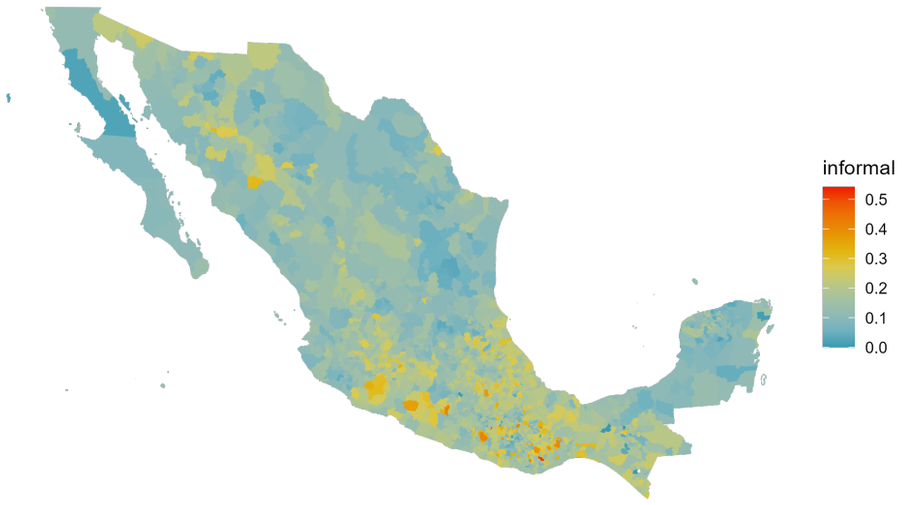
In contrast, formal employment (Figure 4 is clearly higher (indicated by warmer colors) in the more urbanized and economically developed regions, particularly in the northern border states and areas around Mexico City and Jalisco. In contrast, informal employment (Figure 5) shows a spatial distribution that largely mirrors the pattern of marginality, with higher rates (indicated by warmer colors) prevalent in the southern and southeastern states, aligned with regions of higher marginalization. This visual correlation suggests that informality is a prevalent feature in marginalized areas, where a significant portion of employment lacks legal or institutional protection and social security benefits.

Figure 4: Formal employment by municipality 2020



Source: Own elaboration with data from INEGI and CONAPO

Figure 5: Informal employment by municipality 2020

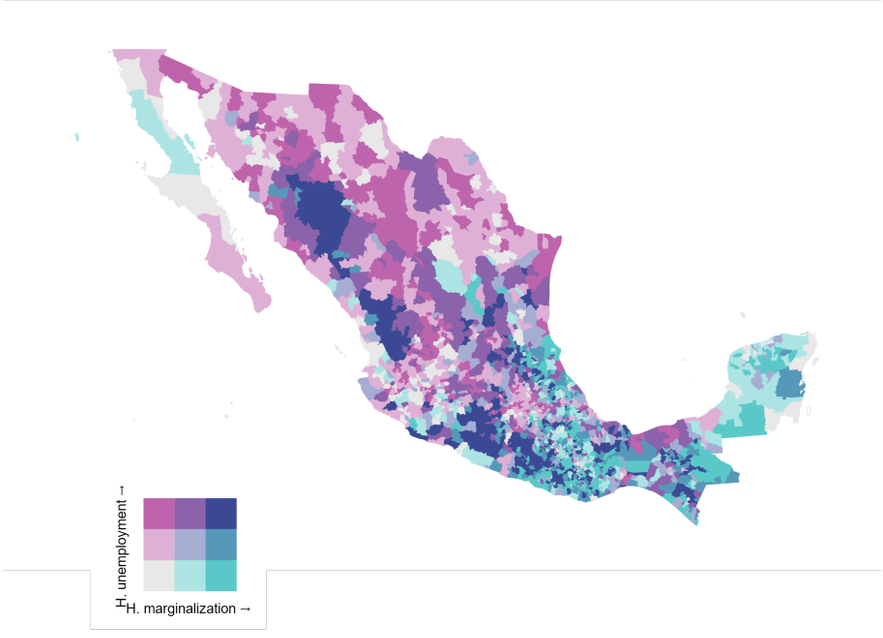


Source: Own elaboration with data from INEGI and CONAPO

A bivariate spatial analysis[4] 4 further investigated the relationship between marginality and labor market outcomes. Although unemployment does not show a clear spatial relationship with marginality (Figures 6), there is a strong inverse correlation between formal employment and marginality (Figures 7), where higher formality tends to be in areas of lower marginality. In contrast, the analysis reveals a strong positive correlation between informal employment and marginality (Figures 8). This observation leads to the assumption that informal labor is high in highly marginalized areas, suggesting that informality serves as a coping mechanism or a dominant mode of employment in contexts of limited formal opportunities.

In conclusion, this exploratory analysis uncovers important spatial correlations between marginality and labor outcomes, particularly informal employment. These findings will form the basis for the econometric modeling in the next phase of the study, which will seek to examine and quantify the association between marginality and labor market outcomes in Mexico.

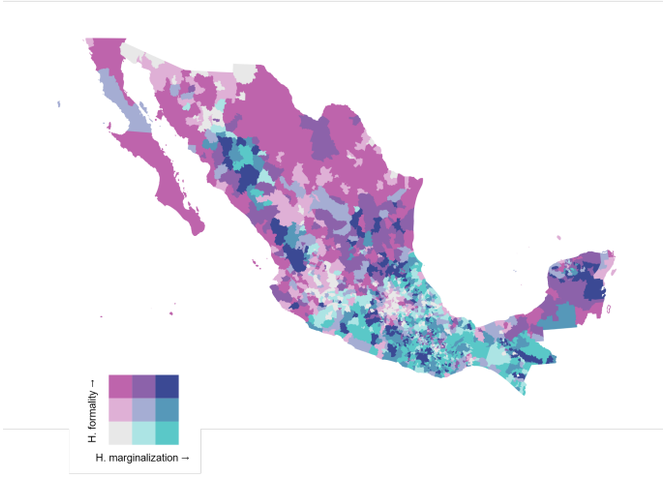
Figure 6: Unemployment vs Marginality by municipality 2020



Source: Own elaboration with data from INEGI and CONAPO

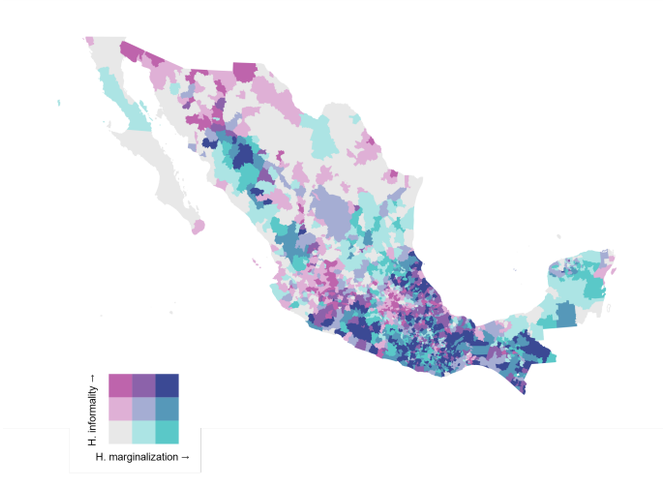
[4]This figure presents a bivariate choropleth map classifying municipalities jointly by two variables of interest using quantile-based groupings. Darker shades indicate municipalities that simultaneously exhibit higher values of both variables, while lighter shades correspond to areas with lower levels of both. The spatial concentration of darker categories suggests a positive spatial association between the variables, indicating that municipalities with higher levels of social and economic disadvantage also tend to display worse labor market outcomes. This pattern reflects a correlation in the joint distribution of the variables across space rather than a causal relationship.

Figure 7: Formal employment vs Marginality by municipality 2020



Source: Own elaboration with data from INEGI and CONAPO

Figure 8: Informal employment vs Marginality by municipality 2020



Source: Own elaboration with data from INEGI and CONAPO

4. Empirical strategy

The empirical strategy used in this study is designed to address the complex identification challenges inherent in estimating the association of residential marginality on labor market outcomes. Neighborhood effects research typically deals with issues such as selection bias, endogeneity, reverse causality, and the heterogeneity of effects (Knies et al., 2021).

The most fundamental issue in observational data is selection bias, which occurs when individuals self-select into certain neighborhoods based on unobserved characteristics (e.g., residential preferences, unmeasured skills, or motivation). This self-selection results in systematic differences across groups that directly influence labor outcomes, and traditional cross-sectional regressions fail to account for these differences, leading to biased estimates. Reverse causality is another significant concern; for example, individuals with better labor market outcomes might self-select into neighborhoods on the lower end of the marginality scale, or improvements in individual employment status could enable relocation to less marginalized areas. Moreover, unobserved neighborhood conditions correlated with area deprivation can also lead to inconsistent estimates of the effect of neighborhood marginality on well-being. We discuss these sources of bias in greater detail in a dedicated subsection below, where we clarify the specific channels through which selection, sorting, and unobserved neighborhood characteristics may affect our empirical estimates and how our empirical strategy addresses them.

To address these challenges and obtain more robust estimates of the association between neighborhood marginality and labor market outcomes, this study will employ a *two-way fixed-effects approach*. This methodology incorporates time-varying individual-level controls, labor market controls, *neighborhood fixed effects at municipal level* (ω_j), *year fixed effects* (ρ_t), and *state-specific time trends with state-by-time fixed effects* ($\theta_s \times t$). This comprehensive strategy explicitly accounts for various sources of bias, including spatial sorting based on time-invariant unobserved neighborhood characteristics (Galster et al., 2016).

Specifically, the inclusion of:

- **Time-varying individual-level controls (X_{ijt})**: These consist of observable characteristics such as age, education, gender, presence of children in the household, indigenous status, marital status, and household head status. Their inclusion helps to control for individual attributes that may vary over time and confound the association between marginality and labor market outcomes.
- **Labor market controls (L_{jt})**: These are included at the municipal level and comprise the number of people employed, the number of economic establishments, and job accessibility. These variables serve as proxies for the local labor market conditions and help address the effects of specific labor supply and demand situations within a municipality.
- **Neighborhood fixed effects at municipal level (ω_j)**: These absorb all unobserved, time-invariant differences across municipalities. Such factors include long-term infrastructure quality, historical patterns of segregation, inherent social capital, or persistent local amenities that not only influence the attractiveness of neighborhoods but may also be correlated with neighborhood deprivation. By holding these unchanging municipal characteristics constant, we mitigate bias arising from structural neighborhood disadvantage.
- **Year fixed effects (ρ_t)**: These account for common temporal shocks that affect all individuals and municipalities equally across the country. This includes macro-economic trends, national policy changes, or other time-varying external conditions that could broadly influence labor market outcomes. By netting out these year-specific trends, we further reduce potential sources of bias.

- **State-by-time fixed effects ($\theta_s \times t$)**: Going beyond simple year fixed effects, the baseline specification includes state-specific time trends, allowing labor market outcomes to follow state-specific temporal trajectories. This is particularly important in the Mexican context, where substantial regional disparities in economic development, policy implementation, and institutional dynamics imply that national shocks may manifest differently across states. By flexibly absorbing state-level time-varying factors, such as differential growth paths, policy changes, or institutional reforms, state-by-time fixed effects help remove potential confounding dynamics that could otherwise overlap with changes in marginalization and labor market outcomes.

Then, the general form of our fixed-effects model[5] can be expressed as:

$$Y_{ijt} = \alpha + \beta_1 \text{Marginality}_{jt} + \beta_2 X_{ijt} + \beta_3 L_{jt} + \omega_j + \rho_t + \theta_s \times t + \epsilon_{ijt}$$

Where:

- Y_{ijt} represents the labor market outcome (employment status, informality, earnings) for individual i in municipality j at time t.
- Marginality_{jt} is the CONAPO marginalization index for municipality j at time t.
- X_{ijt} is a vector of time-varying individual-level controls (e.g., age, education, gender, children in household, indigenous status, married status, household head status).
- L_{jt} is a vector of municipal-level labor market controls (e.g., municipal employment, economic establishments, job accessibility).
- ω_j denotes the municipal-specific fixed effect, capturing all unobserved time-invariant characteristics of municipality j.
- ρ_t denotes the year-specific fixed effect, capturing all unobserved time-varying factors common to all municipalities at time t.
- $\theta_s \times t$ denotes the state-specific linear time trend (state-by-time fixed effects), where s is the state of municipality j and t is the year.
- ϵ_{ijt} is the idiosyncratic error term.

This methodology allows us to better isolate the association between marginalization and labor market outcomes, moving beyond purely descriptive analyses by exploiting withinmunicipality variation over time. Our two-way fixed effects framework controls for timeinvariant unobserved characteristics at the municipal level, as well as common shocks across census years, thereby strengthening identification relative to cross-sectional approaches. Unlike individual-level panel studies, however, our data structure corresponds to a municipallevel panel with repeated cross-sections of individuals. As a result, municipality fixed effects absorb persistent unobserved characteristics of places, but do not control for unobserved individual heterogeneity in the same way as individual fixed effects.

In this sense, our approach is conceptually related to that discussed by Knies et al. (2021), who use fixed-effects models to study neighborhood effects, but differs substantively in the level of analysis and interpretation. Accordingly, our estimates should be interpreted as average contextual effects at the municipal level, rather than individual-level causal effects. Standard errors are clustered at the municipal level.

[5]All regressions are estimated using the official census and intercensal survey sampling weights provided by INEGI. Applying these weights ensures that the estimates are representative of the population at the national and subnational levels and appropriately account for the complex sampling design of the census and intercensal survey.

We also analyze heterogeneous effects by estimating non-linear associations using the 5th decile of marginalization as the reference group, as well as interactions by gender and age cohorts. A key limitation of this study is that census data do not include individuals' workplace locations, preventing direct observation of the labor market characteristics where people are employed. Consequently, our spatial analysis focuses on place of residence and its socioeconomic conditions. While this limits the ability to fully separate residential and workplace influences, our approach aligns with the neighborhood effects literature, which emphasizes the role of local environments in shaping opportunities, social capital, and exposure to disadvantage. In highly marginalized areas, where transportation options are limited, residence and workplace are more likely to overlap. However, in urban or better-connected regions, commuting across areas with different marginalization levels is more feasible. Therefore, our estimates capture the association between neighborhood marginalization and labor market outcomes rather than the isolated impact of local labor market characteristics.

To partially address this limitation, we incorporate self-reported commuting time as a proxy for spatial proximity between residence and workplace. This variable, available in the extended questionnaire of the 2015 Census, measures total commuting time, including waiting and transfers. We classify municipalities into two groups based on commuting patterns: those below the median share of workers commuting less than 30 minutes ("Less Time to Work") and those above the median ("More Distance to Work"). This specification allows us to contrast individuals who are more likely to work near their place of residence with those who commute longer distances, potentially accessing different labor markets.

In addition, we exploit geographic variation in municipalities' distance to state capital cities as an alternative proxy for access to economic centers. Distance to the capital captures broader spatial frictions, such as remoteness from administrative hubs, agglomeration economies, and high-productivity labor markets, that are not fully reflected in individual commuting times. By jointly examining commuting behavior and geographic distance to economic centers, we provide complementary evidence on how spatial isolation and labor market access are associated with labor outcomes across municipalities.

As part of our robustness checks, we restrict the sample to urban municipalities with better public transport connectivity to examine whether the estimated associations differ in contexts characterized by improved accessibility and potentially higher degrees of labor market integration. In addition, we conduct a focused analysis of the Mexico City Metropolitan Area (Zona Metropolitana del Valle de México), given its economic size, institutional complexity, and central role in national labor markets. Studying this metropolitan area separately allows us to assess whether the relationship between neighborhood marginalization and labor outcomes differs in the country's largest and most integrated urban agglomeration, where commuting patterns, job accessibility, and spatial sorting mechanisms may operate differently from the national average.

Finally, because municipalities can be internally heterogeneous, average levels of marginalization may conceal substantial within-municipality variation across neighborhoods. To address this concern, we assess intra-municipal homogeneity in marginalization using intracluster correlations computed at the AGEB level. This approach allows us to quantify the extent to which marginalization is spatially concentrated within municipalities, rather than dispersed across heterogeneous neighborhoods. We then restrict the analysis to municipalities exhibiting higher intra-cluster correlation, indicating greater internal homogeneity, and re-estimate our baseline specifications on this subsample. This exercise helps verify whether the documented associations between marginalization and labor market outcomes persist in more homogeneous municipal contexts. The detailed construction of the intracluster correlation measure and additional robustness results are reported in the Appendix.

This framework allows us to assess the robustness of the relationship between neighborhood marginalization and labor market outcomes while mitigating biases from unobserved correlated neighborhood characteristics, providing a more precise understanding of how residential context influences economic opportunities in Mexico.

4.1. Selection Bias, Reverse Causality, and Limitations of Two-Way Fixed Effects

Despite the use of a two-way fixed effects (TWFE) framework, the identification of neighborhood effects remains subject to important limitations related to selection bias, reverse causality, and unobserved time-varying confounders. These challenges are well documented in the neighborhood effects literature (Dietz, 2002; Durlauf, 2004; Fumagalli and Fumagalli, 2019) and are particularly relevant in observational settings where individuals are not randomly assigned to neighborhoods.

Selection bias arises because individuals self-select into municipalities based on characteristics that may be unobserved by the researcher but correlated with both neighborhood marginalization and labor market outcomes. For example, individuals with higher unobserved ability, stronger labor market attachment, or greater access to informal networks may be more likely to migrate out of highly marginalized municipalities, while individuals facing stronger constraints may remain concentrated in disadvantaged areas. As a result, observed differences in employment or earnings across municipalities may partly reflect compositional differences rather than the causal effect of neighborhood conditions. As emphasized by Fumagalli and Fumagalli (2019), this non-random sorting makes it difficult to disentangle whether poor labor outcomes are caused by neighborhood disadvantage or whether disadvantaged individuals disproportionately reside in such neighborhoods.

The TWFE strategy mitigates some sources of bias by absorbing all time-invariant unobserved characteristics at the municipal level and controlling for common shocks across census years. However, because the data consist of repeated cross sections rather than a true individual-level panel, individual fixed effects cannot be included. Consequently, time-varying unobserved individual characteristics and selective migration patterns remain potential sources of bias. For instance, if more employable individuals disproportionately exit highly marginalized municipalities over time, changes in average labor outcomes may reflect shifts in population composition rather than changes in neighborhood conditions. Reverse causality constitutes an additional limitation. Labor market outcomes may themselves influence measured neighborhood marginalization over time. Improvements in employment or wages may reduce marginalization through higher incomes, better housing conditions, or improved access to services. Similarly, individuals experiencing positive labor market shocks may relocate to less marginalized municipalities, reinforcing the observed association between marginalization and labor outcomes. Such bidirectional relationships cannot be fully addressed by fixed effects alone..

More generally, TWFE models address only unobserved heterogeneity that is constant over time. Unobserved factors that evolve at the municipal level and are correlated with both marginalization and labor market outcomes, such as place-based policies, changes in governance quality, or evolving institutional conditions, may still confound the estimates. While our specification incorporates state-specific time trends and a vector of time-varying municipal labor market controls capturing changes in employment levels, economic establishments, and job accessibility, these adjustments can only partially account for such dynamics and cannot fully eliminate bias arising from time-varying unobservables.

For these reasons, our estimates should be interpreted as robust descriptive associations rather than definitive causal effects. The TWFE framework improves upon purely crosssectional analyses by exploiting within-municipality variation over time, but causal interpretation remains conditional on strong assumptions regarding the absence of correlated time-varying confounders. Following the guidance of Fumagalli and Fumagalli (2019), we therefore frame our findings as evidence consistent with neighborhood effects, while acknowledging that residual selection bias and reverse causality cannot be fully resolved in an observational setting.

To narrow the set of plausible alternative explanations, we complement the baseline specification with a series of robustness and sensitivity analyses. These include the inclusion of rich individual-level controls; the examination of heterogeneous associations across demographic groups and commuting patterns; the use of

distance to state capital cities as a proxy for exposure to economic centers; and sample restrictions to municipalities that are more homogeneous in marginalization or exhibit better transport connectivity. In addition, we conduct placebo exercises in which the marginalization index is randomly reassigned across municipalities and years, as well as across municipalities within years, to verify that the estimated associations do not arise mechanically from the structure of the data. While these strategies do not eliminate endogeneity concerns, they strengthen confidence that the documented patterns are not driven by a narrow set of compositional, spatial, or spurious artifacts.

5. Results

This section presents the main empirical findings on the association between neighborhood marginalization and labor market outcomes in Mexico. Building on the conceptual framework and identification strategy outlined above, we estimate two-way fixed effects models that exploit within-municipality variation over time while controlling for a rich set of individual and local characteristics, municipal labor market conditions, year and municipal fixed effects, and state-specific time trends. As discussed in the previous section, this approach is designed to mitigate biases arising from time-invariant unobserved heterogeneity across municipalities and common macroeconomic shocks, while acknowledging the remaining limitations inherent to observational data based on repeated cross sections. Accordingly, the results should be interpreted as robust contextual correlations that characterize how changes in neighborhood marginalization are systematically associated with labor market participation, employment composition, and earnings. Standard errors are clustered at the municipality level throughout.

5.1. Marginalization Effects on Labor Market Outcomes

Table 1 presents the estimated coefficients for the Marginalization Index Normalized—IMN, by its acronym in Spanish—, alongside time-varying individual and labor market control variables across five key labor market outcomes: participation to labor force, employment, formal employment, informal employment and wages. To ensure the robustness and consistency of our coefficients, each outcome variable was subjected to a series of progressive model specifications.

The columns of Table 1 represent sequential model-building steps. Specification 1 (Column 1) is a simple linear regression (OLS) serving as a baseline comparison, although it produces biased estimators due to the absence of controls for confounding characteristics. Specification 2 (Column 2) adds time-varying individual-level controls, while Specification 3 (Column 3) further incorporates labor market controls. Specification 4 (Column 4) extends the model to a two-way fixed-effects framework, including municipal and year fixed effects alongside individual and labor market controls. Finally, Specification 5 (Column 5) presents the most robust model, adding state-specific time trends to the full set of controls and fixed effects from Specification 4.

Both labor force participation (Panel A) and the probability of being employed (Panel B) exhibit similar patterns in the estimated marginalization coefficients across model specifications. For labor force participation, the coefficient is significantly negative in the baseline OLS model and becomes less negative as individual and labor market controls are added (Specifications 2 and 3). Once municipal and year fixed effects are included (Specification 4), the coefficient shifts to a significant positive value of 1.4% and remains positive in the most robust model (1.1% in Specification 5). A similar trend is observed for the probability of being employed: the coefficient is initially negative in simpler models but turns close to 0 and not statistically significant with the inclusion of richer controls and fixed effects, reaching 0.3% in Specification 4 and 0% in

Specification 5. These results suggest that higher marginalization, once unobserved municipal characteristics and temporal shocks are controlled for, is associated with increased labor force participation but does not significantly affect employment likelihood. Economically, this pattern may reflect a "necessity effect," whereby individuals residing in marginalized areas face greater economic pressures to seek work, even though their chances of securing stable employment remain unchanged.

Formal employment (Panel C) consistently exhibits a robust negative association with marginalization. The magnitude strengthens notably from -4.7% in the baseline model to -9.4% upon introducing fixed effects, settling at -7.6% in Specification 5. These results suggest significant structural barriers preventing access to formal jobs in marginalized contexts. Informal employment (Panel D), in contrast, shows a strong positive relationship, rising from 6.8% initially to 10.3% with fixed effects, and settling at 5.4% in Specification 5. These findings highlight informal employment as a critical, albeit precarious, alternative for individuals excluded from formal opportunities in highly deprived areas.

Galster (2012) epidemiological model, fully described in the conceptual framework section, provides an insightful economic interpretation for these findings, highlighting multiple causal mechanisms through which neighborhood marginalization could influence labor market outcomes. The observed positive association with informal employment and negative association with formal employment align particularly with Galster's geographic and institutional mechanisms: spatial barriers limit access to formal job markets, while institutional factors such as inadequate governance and resource allocation restrict opportunities and push residents toward informal employment. Additionally, the social-interactive mechanisms, involving peer influences and social norms in marginalized neighborhoods, may reinforce dependence on informal economic activities, creating persistent labor market vulnerabilities.

Finally, wages (Panel E) exhibit a consistently strong negative association with marginalization. In the baseline model, a 10-point increase in marginalization is associated with a 45.0% reduction in wages. As individual, labor market controls, and fixed effects are progressively included, the magnitude decreases to a still substantial 15.1% wage penalty in the final specification. Even after controlling comprehensively for individual characteristics, labor market conditions, and municipal-temporal unobservables, individuals residing in marginalized neighborhoods face significant earnings disadvantages. This earnings penalty likely reflects restricted access to high-quality employment due to geographic isolation, limited transportation, weak local labor market networks, and informational barriers reducing exposure to employment opportunities. Employer discrimination or negative signaling associated with neighborhood stigma may further exacerbate wage disparities, compounding disadvantage regardless of individual qualifications.

The table in the Appendix displays the full set of estimated coefficients for Specification 5, including all control variables.

Table 1: Model saturation - different specification

	Spec 1 (1) No controls	Spec 2 (2) Cont. pers.	Spec 3 (3) Cont. all	Spec 4 (4) FE mun year	Spec 5 (5) FE all
Panel A: Participation					
10-point marginalization	-0.096***	-0.055***	-0.048***	0.014***	0.011***
	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
Observations	154,861,255	154,861,255	154,798,882	154,798,882	154,798,882
R-squared	0.020	0.336	0.338	0.345	0.345
Panel B: Employment					
10-point marginalization	-0.003***	-0.002***	-0.002**	0.003	0.000
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Observations	104,494,131	104,494,131	104,450,370	104,450,370	104,450,370
R-squared	0.000	0.014	0.014	0.019	0.019
Panel C: Formal Employment					
10-point marginalization	-0.047***	-0.030***	-0.038***	-0.094***	-0.076***
	(0.004)	(0.004)	(0.004)	(0.008)	(0.009)
Observations	104,494,131	104,494,131	104,450,370	104,450,370	104,450,370
R-squared	0.005	0.033	0.036	0.075	0.078
Panel D: Informal Employment					
10-point marginalization	0.068***	0.058***	0.068***	0.103***	0.054***
	(0.004)	(0.004)	(0.004)	(0.012)	(0.010)
Observations	104,494,131	104,494,131	104,450,370	104,450,370	104,450,370
R-squared	0.014	0.034	0.044	0.163	0.171
Panel E: Wages					
10-point marginalization	-0.455***	-0.299***	-0.277	-0.115***	-0.151***
	(0.013)	(0.010)	(0.010)	(0.032)	(0.020)
Observations	95,675,739	95,675,739	95,675,739	95,675,739	95,675,739
R-squared	0.084	0.247	0.252	0.279	0.281
Individual controls		X	X	X	X
Labor market controls			X	X	X
Municipalities FE				X	X
State Time Trend					X

Clustered errors at the municipal level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Specification 1 is the direct form, in the specification 2 we add individuals controls, in the third we had local job market control, in the fourth we add municipal and time controls and in the fifth we add state time trends.
Source: Own elaboration based on research.

6. Heterogeneous effects

6.1. Non-linear Effects

While the linear regression models provide an average association between marginalization and labor market outcomes, examining non-linear patterns across marginalization deciles allows for a more precise interpretation of how these relationships vary along the distribution. Figures 9, 10, 11, 12 and 13 report estimates based on decile indicators, using the 5th decile of marginalization as the reference category. Decile 1 corresponds to the least marginalized municipalities, while Decile 10 represents the most marginalized.

To clarify the interpretation of these non-linear estimates, Appendix F Figures F.1, F.2, F.3, F.4 and F.5 additionally report predictive margins for each marginalization decile. These margins allow us to recover the total level of each outcome by decile, rather than only differences relative to the 5th decile, and directly address whether outcomes are higher or lower in absolute terms across the marginalization distribution.

Figure 9 shows that individuals in the lowest marginalization deciles (Deciles 1 and 2) exhibit a lower probability of labor force participation relative to the middle of the distribution. Participation increases with marginalization and is highest in the top decile. The predictive margins confirm that participation levels are monotonically increasing across deciles, consistent with a "necessity effect" whereby individuals in highly marginalized areas are more likely to engage in the labor market due to limited alternative sources of income.

Figure 10 documents a non-linear association between marginalization and employment. While employment probabilities are similar or slightly higher in intermediate deciles relative to the 5th decile, they decline sharply at high levels of marginalization. The predictive margins show that, in absolute terms, employment rates peak around the middle of the marginalization distribution and fall substantially in the most marginalized deciles. This pattern suggests that although individuals in moderately marginalized areas may be able to access employment, extreme marginalization is associated with reduced employment opportunities.

Figure 11 shows a clear and monotonic decline in formal employment with increasing marginalization beyond the 5th decile. The predictive margins confirm that formal employment rates are highest in low-marginalization deciles and decrease steadily as marginalization rises, reaching their lowest levels in the most marginalized areas. This result highlights the increasing difficulty of accessing formal jobs in contexts characterized by high social and economic deprivation.

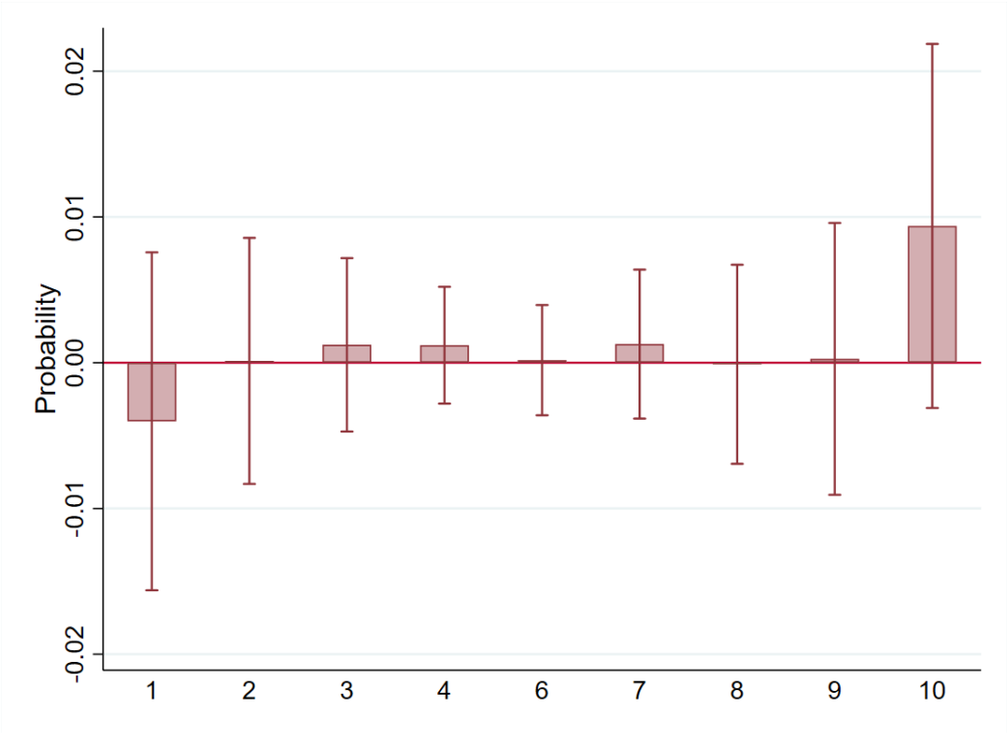
Consistent with this pattern, Figure 12 indicates a strong positive and non-linear association between marginalization and informal employment. Predictive margins show that informal employment rates increase steadily across the marginalization distribution, with particularly large increases in the top deciles. In contrast, individuals in the least marginalized areas display the lowest levels of informality. This reinforces the role of informal employment as a key labor market adjustment mechanism in highly marginalized settings.

Finally, Figure 13 examines the relationship between marginalization and wages. While coefficient estimates relative to the 5th decile indicate that wages are higher in lowmarginalization deciles and lower in high-marginalization deciles, the predictive margins clarify the total effect. Specifically, individuals residing in the least marginalized deciles exhibit the highest predicted wages in absolute terms, with wages declining steadily as marginalization increases. Thus, marginalization is negatively associated with wage levels across the distribution, even though this relationship is non-linear and more pronounced at higher levels of marginalization.

Taken together, the non-linear analysis and the predictive margins indicate that marginalization is associated with systematic and economically meaningful differences in labor market outcomes across the distribution. While individuals in moderately marginalized areas may still access employment and formal jobs, once marginalization reaches higher deciles, labor market penalties intensify sharply. These patterns are con-

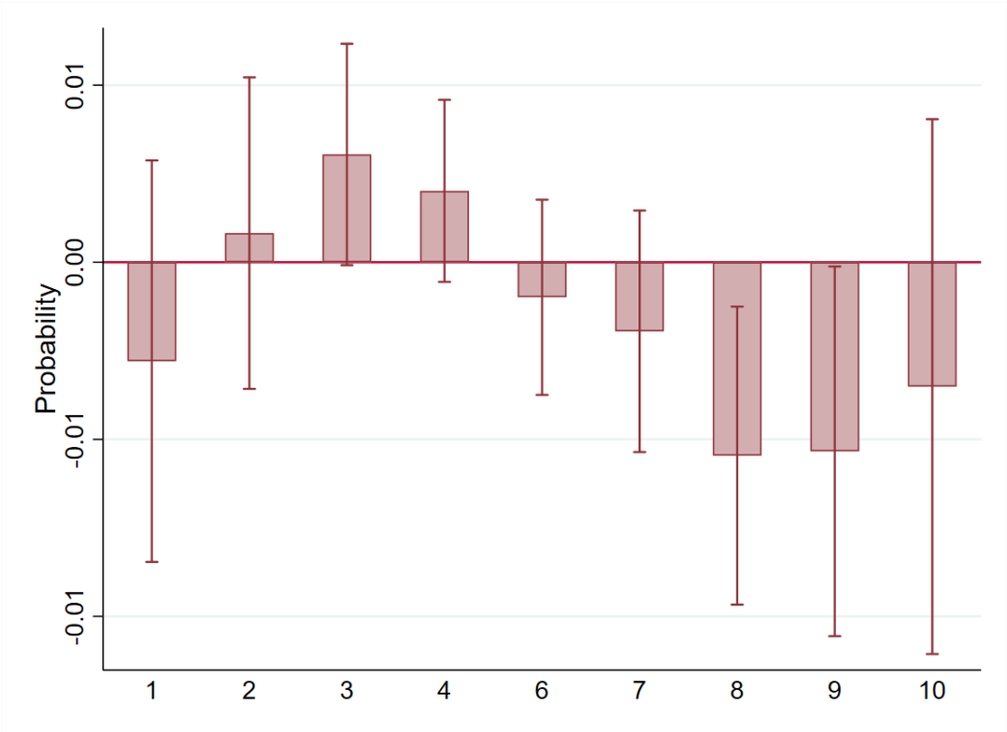
sistent with structural constraints, such as geographic isolation, limited institutional presence, weaker labor demand, and restricted access to education and childcare, that disproportionately affect highly marginalized areas. Importantly, these results emphasize that marginalization should not be viewed as a linear gradient of disadvantage, but rather as a multidimensional process whose labor market consequences accelerate as deprivation becomes more severe.

Figure 9: Non-linear effects of marginalization on participation into labour market



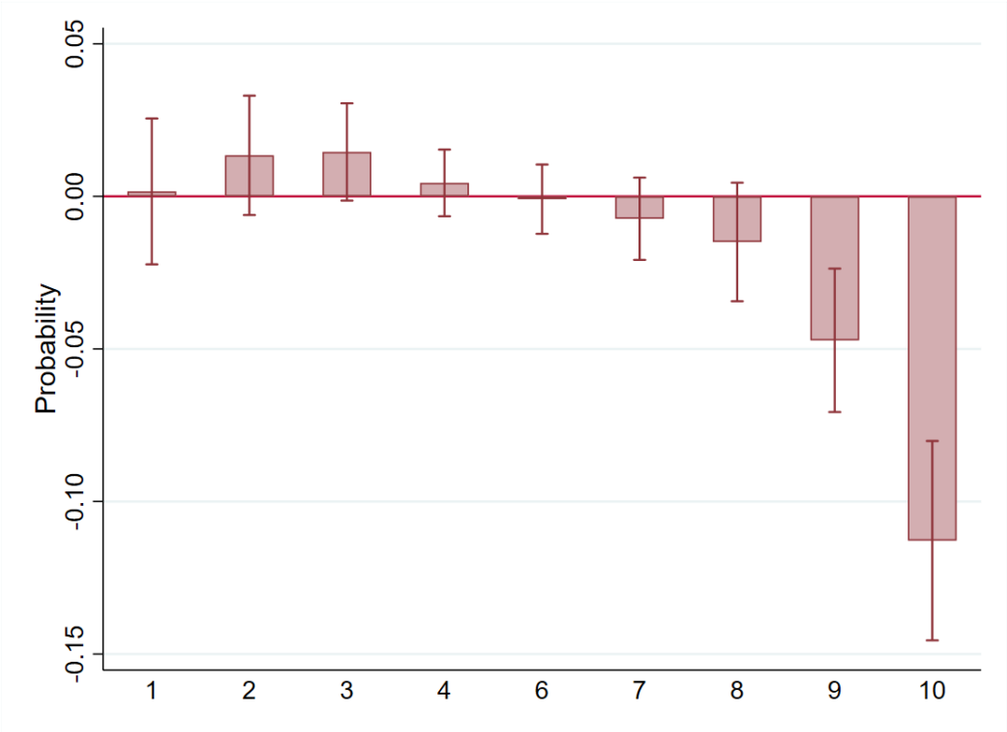
Source: Own elaboration with data from INEGI and CONAPO

Figure 10: Non-linear effects of marginalization on employment



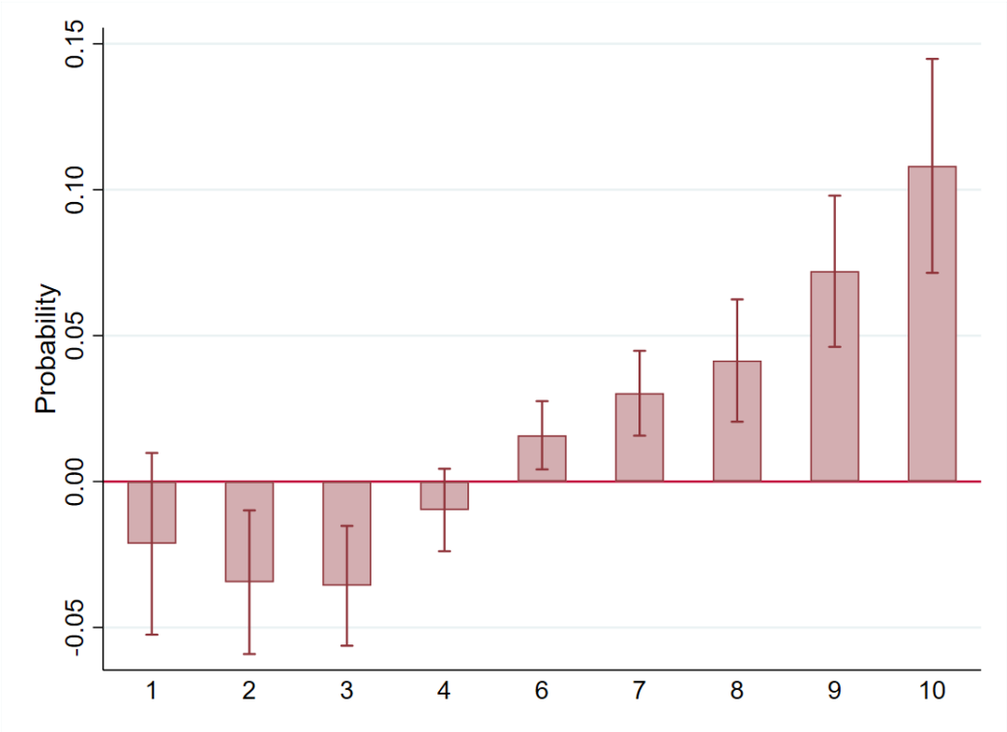
Source: Own elaboration with data from INEGI and CONAPO

Figure 11: Non-linear effects of marginalization on formal employment



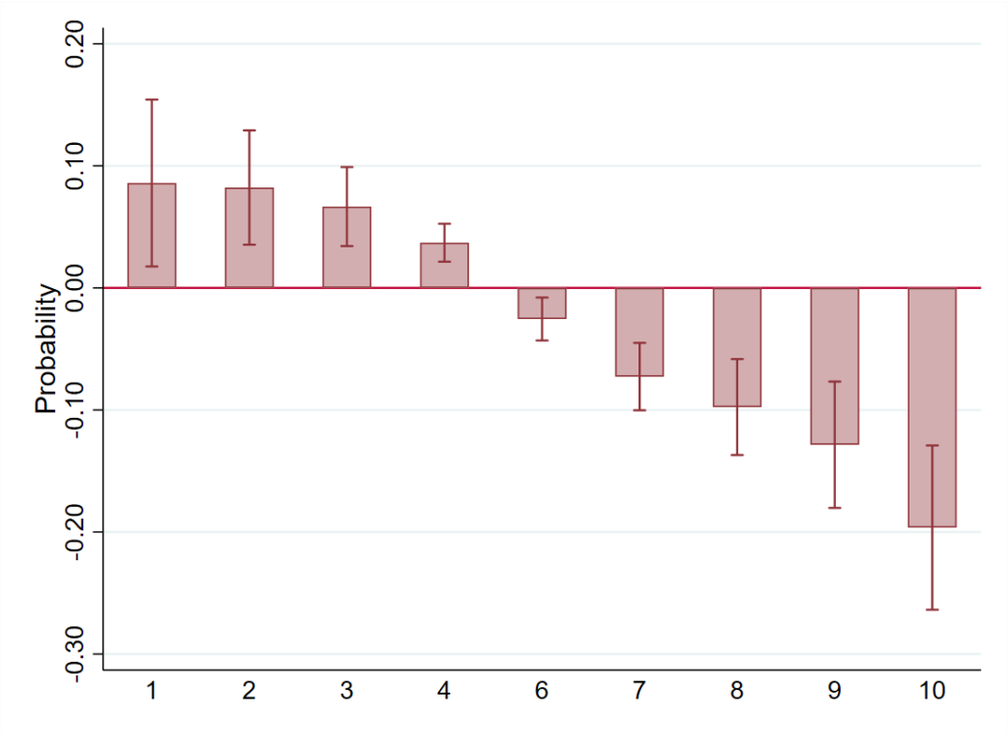
Source: Own elaboration with data from INEGI and CONAPO

Figure 12: Non-linear effects of marginalization on informal employment



Source: Own elaboration with data from INEGI and CONAPO

Figure 13: Non-linear effects of marginalization on wages



Source: Own elaboration with data from INEGI and CONAPO

6.2. Gender Heterogeneous Effects

Table 2 provides insights into the heterogeneous effects of marginalization by gender, examining its impact separately for men and women across the same labor market outcomes. This analysis is particularly relevant in the context of Mexico, where significant gender gaps persist in labor force participation, employment, and wages. Understanding how marginalization interacts with gender helps to uncover whether women in deprived areas face compounded disadvantages, and whether the labor market penalties associated with marginalization are distributed unequally between men and women. The results indicate that labor force participation is positively and significantly associated with marginalization for both men and women. A 10-point increase in marginalization is linked to a roughly 1.3–1.4% higher probability of participation for both genders, suggesting that individuals in more marginalized areas are more likely to enter the labor force, likely due to economic necessity. Marginalization also shows a positive but small association with overall employment, with the effect being slightly stronger for men.

By contrast, marginalization has a strong negative impact on formal employment for both men and women, reducing the probability of securing a formal job by approximately 7–8%. This finding underscores the structural barriers to formal sector access in highly deprived areas. At the same time, marginalization is positively associated with informal employment, with the effect being more pronounced for women, indicating that women in marginalized areas are especially likely to rely on informal work.

Finally, marginalization is negatively associated with wages for both genders, with the earnings penalty being larger for men. These results collectively highlight the multifaceted labor market disadvantages faced by individuals in marginalized areas, emphasizing the need for targeted employment policies that account for these differential impacts by gender and employment type.

Table 2: Gender Heterogeneous Effects

	Participation	Total Employment	Formal Employment	Informal Employment	Wage
	(1)	(2)	(3)	(4)	(5)
Panel A: Men					
10-point marginalization	0.013***	0.003	-0.071***	0.037***	-0.160***
	(0.004)	(0.003)	(0.009)	(0.010)	(0.020)
Observations	73,174,348	67,301,123	67,301,123	67,301,123	60,790,411
R-squared	0.075	0.019	0.080	0.182	0.267
Panel B: Women					
10-point marginalization	0.014***	0.001	-0.073***	0.061***	-0.126***
	(0.004)	(0.001)	(0.009)	(0.011)	(0.024)
Observations	83,606,965	37,994,154	37,994,154	37,994,154	35,599,676
R-squared	0.211	0.017	0.065	0.147	0.287
Controls:	Individual, labor market, year FE, municipality FE, state time trend				

Clustered errors at the municipal level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Source: Own elaboration based on research.

6.3. Age Heterogeneous Effects

To further dissect the differential impacts of marginalization, Table 3 presents the results disaggregated by age cohorts. This allows us to investigate whether the effects of living in marginalized areas vary across different stages of an individual's working life. This analysis is particularly relevant because age often shapes access to opportunities, labor market experience, and vulnerability to economic shocks. Older workers, for example, may face barriers to reentry into formal employment or face steeper wage penalties, especially in deprived contexts.

Labor force participation shows the strongest positive association with marginalization among individuals aged 55 to 65, where a 10-point increase in marginalization is associated with a 7.8% higher probability of participation. For younger cohorts (ages 25 to 39 and 40 to 54), the association is small and not statistically significant.

The relationship with overall employment remains weak and generally insignificant across age groups, although the coefficient is slightly positive for the oldest cohort. Clearer patterns emerge for formal and informal employment as well as wages. The negative effect of marginalization on formal employment is strong and significant for all age groups, ranging from -8.2% for those aged 25 to 39 to -6.5% for those aged 40 to 54, suggesting persistent barriers to accessing formal jobs throughout the working life course.

Conversely, marginalization is positively associated with informal employment across all cohorts, with the effect slightly increasing with age, from 5.1% for the youngest group to 7.8% for the oldest group, indicating that older individuals in marginalized areas are more likely to rely on informal work.

Finally, wages exhibit a consistently negative and significant association with marginalization for all age groups. The earnings penalty is largest for individuals aged 55 to 65 (-17.8%), pointing to increasing cumulative disadvantages or reduced bargaining power at later stages of the working life. These results underscore that marginalization amplifies vulnerabilities in formal employment opportunities and earnings potential, especially as individuals age.

When considered jointly, the age-disaggregated results reveal a clear life-cycle gradient in the association between neighborhood marginalization and labor market outcomes. While marginalization is weakly related to overall employment across age groups, it is systematically associated with lower formal employment and higher informality throughout the working life, with these patterns becoming more pronounced at older ages. The increase in labor force participation among individuals aged 55–65 in more marginalized municipalities appears consistent with necessity-driven participation rather than improved labor market opportunities, as it coincides with a stronger shift toward informal employment and substantial wage penalties. The persistent and increasing earnings disadvantage with age suggests that exposure to marginalized environments may compound vulnerabilities over the life course, limiting access to stable, formal employment and reducing earnings capacity as workers approach the end of their working lives. Overall, these findings indicate that neighborhood marginalization is not only associated with contemporaneous labor market disparities, but also with the accumulation of disadvantage across age cohorts.

Table 3: Age Heterogeneous Effects

	Participation	Total Employment	Formal Employment	Informal Employment	Wage
	(1)	(2)	(3)	(4)	(5)
Panel A: Age 25 to 39					
10-point marginalization	-0.003	-0.002	-0.082***	0.051***	-0.137***
	(0.003)	(0.002)	(0.009)	(0.010)	(0.019)
Observations	73,418,476	51,578,303	51,578,303	51,578,303	47,418,212
R-squared	0.348	0.022	0.083	0.177	0.272
Panel B: Age 40 to 54					
10-point marginalization	0.004	-0.000	-0.065***	0.046***	-0.160***
	(0.004)	(0.002)	(0.009)	(0.010)	(0.022)
Observations	58,394,957	40,189,933	40,189,933	40,189,933	37,016,045
R-squared	0.336	0.018	0.075	0.165	0.281
Panel C: Age 55 to 65					
10-point marginalization	0.078***	0.003	-0.080***	0.078***	-0.178***
	(0.006)	(0.003)	(0.011)	(0.012)	(0.027)
Observations	24,967,880	13,527,041	13,527,041	13,527,041	11,955,830
R-squared	0.336	0.020	0.075	0.177	0.309
Controls:	Individual, labor market, year FE, municipality FE, state time trend				

Clustered errors at the municipal level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Source: Own elaboration based on research.

6.4. Distance Heterogeneous Effects

To account for differences in commuting patterns and accessibility to employment opportunities, the analysis controls for spatial factors that influence individuals' ability to reach jobs. It is important to consider that, in practice, the observed effects of marginalization on labor market outcomes may not be driven by marginalization per se, but rather by the fact that marginalized areas are often less connected to urban centers or areas of economic activity. As a result, residents may have limited access to formal labor markets or may be confined to nearby jobs that are lower quality or offer lower wages. This highlights the importance of distinguishing between the effects of socioeconomic deprivation and those of spatial isolation when analyzing labor market inequalities. At the municipal level, the percentage of individuals with a commuting time of less than 30 minutes was calculated. Municipalities below the median of this distribution were assigned to the "Less Time to Work" group, while those above the median were classified as the "More Distance to Work" group. This specification enables a comparison between individuals who live and work within the same neighborhood and those who travel longer distances, potentially to different labor markets.

The results in Table 4 show that marginalization is positively and significantly associated with labor force participation for both groups, with slightly larger effects for individuals with shorter commuting times. The relationship with total employment is small and mixed, being positive for those with longer commuting times but negative for those with shorter ones.

For formal employment, the negative association with marginalization is strong and significant across both groups, indicating persistent barriers to accessing formal jobs regardless of commuting time. Conversely, the

positive association with informal employment is robust in both cases, with slightly larger magnitudes for those with shorter commutes. Wages are consistently and significantly negatively associated with marginalization in both groups, with similar magnitudes of the earnings penalty.

These findings suggest that while commuting time influences the magnitude of some effects, the disadvantages associated with marginalization, particularly reduced access to formal employment and lower wages, remain pervasive across different commuting patterns.

A similar analysis is conducted for gender and age subgroups, as presented in Appendix D. These complementary results reveal that the patterns of association between marginalization and labor market outcomes are largely consistent across demographic groups, though the magnitudes vary by gender and age, highlighting important sources of heterogeneity in the effects.

Table 4: Distance Heterogeneous Effects

	Participation	Total Employment	Formal Employment	Informal Employment	Wage
	(1)	(2)	(3)	(4)	(5)
Panel A: Less Time to Work					
10-point marginalization	0.015***	-0.007**	-0.072***	0.062***	-0.149***
	(0.004)	(0.003)	(0.014)	(0.016)	(0.021)
Observations	62,322,540	40,800,031	40,800,031	40,800,031	37,494,232
R-squared	0.348	0.022	0.090	0.177	0.314
Panel B: More Distance to Work					
10-point marginalization	0.013***	0.007**	-0.082***	0.054***	-0.151***
	(0.004)	(0.003)	(0.012)	(0.013)	(0.030)
Observations	94,273,305	64,381,461	64,381,461	64,381,461	58,804,316
R-squared	0.344	0.018	0.071	0.169	0.264
Controls:	Individual, labor market, year FE, municipality FE, state time trend				

Clustered errors at the municipal level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Source: Own elaboration based on research.

6.5. Distance to Capital Cities and Spatial Spillovers

To further exploit the geographical dimension of the data and assess the role of spatial spillovers, we examine whether the association between neighborhood marginalization and labor market outcomes varies with proximity to state capital cities. Capital cities concentrate economic activity, public services, and formal labor market opportunities, and therefore may partially mitigate the disadvantages associated with living in marginalized areas. Conversely, municipalities located farther from capital cities may face compounded disadvantages arising from both socioeconomic deprivation and spatial isolation.

Using geospatial information, we calculate the distance between each municipality's centroid and the centroid of the nearest state capital city. The sample is then divided into terciles based on this distance: municipalities closest to capital cities (Tercile 1), those at intermediate distances (Tercile 2), and those farthest away (Tercile 3). For each subsample, we estimate the same two-way fixed-effects specification as in the main analysis, including individual, labor market, municipality, and year fixed effects, as well as state-specific time trends. Distance itself is not included directly in the regression, as it is time-invariant and therefore collinear with municipality fixed effects. Instead, heterogeneity is identified through sample stratification by distance

terciles.

Table 5 reports the results. Marginalization is positively and significantly associated with labor force participation for municipalities located closer to capital cities, while the effect becomes smaller and statistically insignificant for municipalities in the farthest tercile. This pattern suggests that proximity to capital cities may facilitate labor market entry even in marginalized areas, likely reflecting greater job availability and better connectivity to economic centers.

In contrast, the negative association between marginalization and formal employment is strong and statistically significant across all distance terciles, but its magnitude increases with distance from capital cities. Similarly, marginalization is positively associated with informal employment in all terciles, with particularly large effects among municipalities closest to capital cities. These findings indicate that while proximity to urban centers may expand employment opportunities, marginalized workers remain disproportionately concentrated in informal jobs.

Wage effects display a clear spatial gradient. Marginalization is associated with significantly lower wages across all distance terciles, with sizable penalties both near and far from capital cities. This persistence of wage losses suggests that access to urban labor markets does not fully offset the disadvantages associated with marginalization and may even amplify earnings inequality in areas with higher economic concentration.

Overall, these results provide evidence of spatial spillovers in the relationship between marginalization and labor market outcomes. Proximity to capital cities partially attenuates some extensive-margin effects, such as labor force participation, but does not eliminate the adverse impacts of marginalization on job quality and earnings. Instead, socioeconomic deprivation and spatial isolation appear to interact, reinforcing labor market inequalities across space.

Table 5: Spatial Spillovers and Marginalization

	Participation	Total Employment	Formal Employment	Informal Employment	Wage
	(1)	(2)	(3)	(4)	(5)
Panel A: Tercile 1 (Closest to Capital)					
10-point marginalization	0.013**	-0.000	-0.057***	0.067***	-0.270***
	(0.006)	(0.003)	(0.014)	(0.017)	(0.040)
Observations	93,033,921	65,068,022	65,068,022	65,068,022	60,506,531
R-squared	0.323	0.018	0.072	0.165	0.245
Panel B: Tercile 2 (Intermediate Distance)					
10-point marginalization	0.009**	0.005	-0.064***	0.024	-0.051***
	(0.004)	(0.004)	(0.014)	(0.015)	(0.015)
Observations	25,285,032	15,521,542	15,521,542	15,521,542	13,644,126
R-squared	0.381	0.024	0.100	0.210	0.344
Panel C: Tercile 3 (Farthest from Capital)					
10-point marginalization	0.005	-0.002	-0.105***	0.068***	-0.068***
	(0.004)	(0.004)	(0.015)	(0.018)	(0.023)
Observations	38,462,360	24,705,713	24,705,713	24,705,713	22,239,430
R-squared	0.367	0.023	0.081	0.169	0.324
Controls:	Individual, labor market, year FE, municipality FE, state time trends				

Clustered errors at the municipal level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Source: Own elaboration based on research.

7. Robustness Checks

7.1. Urban municipalities

As part of the robustness checks, the analysis focuses exclusively on urban municipalities characterized by better public transport connectivity. This restriction allows us to verify whether the associations between marginalization and labor market outcomes differ in contexts with improved access to transportation and potentially better labor market integration.

Table 6 presents the results for the full sample of urban municipalities. Marginalization shows a positive and significant association with labor force participation and total employment, although the magnitudes are modest. In contrast, the relationship with formal employment remains negative and statistically significant, while the association with informal employment is positive. Wages consistently display a strong and significant negative association with marginalization, indicating that even in better-connected urban areas, individuals residing in marginalized neighborhoods face an earnings penalty and limited access to formal jobs.

The Appendix E presents additional analyses disaggregated by gender and age groups. These results confirm that the main patterns observed in the baseline estimations remain consistent across demographic subgroups: marginalization is generally associated with higher participation and informal employment, lower access to formal jobs, and a significant wage penalty. While the magnitudes of the effects vary by gender and age, the overall direction and significance of the coefficients are robust to these subgroup analyses.

These complementary analyses confirm that the adverse effects of marginalization on formal employment and wages persist even in urban contexts with better transport connectivity. However, the magnitude of the effects varies across gender and age groups, underscoring the importance of accounting for demographic heterogeneity in labor market outcomes.

Table 6: Only urban municipalities - Total

	Participation	Total Employment	Formal Employment	Informal Employment	Wage
	(1)	(2)	(3)	(4)	(5)
Urban Municipalities – All Sample					
10-point marginalization	0.009*	0.006*	-0.063***	0.024*	-0.116***
	(0.005)	(0.003)	(0.010)	(0.013)	(0.026)
Observations	54,837,760	34,595,409	34,595,409	34,595,409	30,512,966
R-squared	0.383	0.021	0.092	0.200	0.332
Controls:	Individual, labor market, year FE, municipality FE, state time trend				

Clustered errors at the municipal level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Source: Own elaboration based on research.

7.2. Homogeneous municipalities

A key concern in the analysis is that municipalities may be too large a spatial unit to accurately capture neighborhood-level marginalization. Within a single municipality, neighborhoods (AGEBs) with vastly different levels of deprivation can coexist, ranging from highly marginalized areas to relatively advantaged ones. This internal heterogeneity may confound the estimated effects of marginalization on labor market outcomes and obscure the relationship of interest.

To address this concern, we assess the degree of within-municipality homogeneity in marginalization using an intra-cluster correlation (ICC) approach. Specifically, we compute the intra-cluster correlation of the AGEB-level marginalization index within each municipality. The ICC measures the share of total variation in marginalization that is attributable to differences across municipalities rather than differences within municipalities. A higher ICC implies that marginalization levels are more similar across AGEBs within the same municipality, indicating greater internal homogeneity, while a lower ICC reflects substantial within-municipality heterogeneity.

We compute the ICC for each municipality and examine its distribution across Mexico. Municipalities are then divided into two groups based on the population-weighted median of the ICC distribution. We define as *homogeneous municipalities* those with an ICC above the median, indicating that marginalization is relatively uniform across neighborhoods within the municipality. This approach directly captures the extent of within-municipality clustering in marginalization and provides an appropriate measure of homogeneity.

To assess robustness, we re-estimate the main specification restricting the sample to individuals residing in homogeneous municipalities. As in the baseline analysis, we employ the same two-way fixed-effects methodology, including individual characteristics, labor market controls, municipality and year fixed effects, and state-specific time trends.

Table 7 reports the results. The estimated associations between marginalization and labor market outcomes remain remarkably consistent with the baseline findings. Marginalization continues to be positively and significantly associated with labor force participation, while its relationship with total employment is small and statistically insignificant. In contrast, marginalization is strongly negatively associated with formal employment and wages, and positively associated with informal employment. The magnitudes of the coefficients are very similar to those obtained in the full sample, indicating that internal heterogeneity within municipalities is unlikely to be driving the main results.

Overall, these findings confirm that the baseline estimates are not an artifact of aggregation bias arising from heterogeneous neighborhoods within municipalities. Even when restricting the analysis to municipalities with high intra-cluster homogeneity in marginalization, the central patterns persist, underscoring the robustness of the descriptive relationship between marginalization and labor market outcomes.

Table 7: Only high Homogeneous municipalities

	Participation	Total Employment	Formal Employment	Informal Employment	Wage
	(1)	(2)	(3)	(4)	(5)
10-point marginalization	0.010**	0.002	-0.071***	0.051***	-0.181***
	(0.004)	(0.002)	(0.012)	(0.014)	(0.031)
Observations	78,324,476	52,062,093	52,062,093	52,062,093	47,402,628
R-squared	0.353	0.019	0.076	0.169	0.277
Controls:	Individual, labor market, year FE, municipality FE, state time trends				

Clustered errors at the municipal level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Source: Own elaboration based on research.

7.3. Additional robustness tests

We evaluate the robustness of our estimates to unobserved confounding using the proportional selection framework proposed by Oster (2016). As we can see in table 8 the estimated effect of marginalization (IM) remains stable across alternative specifications, the values of δ required to attenuate the coefficient to zero are small in magnitude. In addition, imposing the assumption of equal selection on observables and unobservables ($\delta = 1$) yields numerically unstable adjusted coefficients, reflecting the limited residual variation in the treatment variable once a rich set of fixed effects is absorbed. We therefore view the Oster bounds as only weakly informative in this highly saturated fixed-effects setting. For this reason, we complement the Oster analysis with a series of placebo tests and specification stability exercises that provide additional evidence on the credibility of the baseline results.

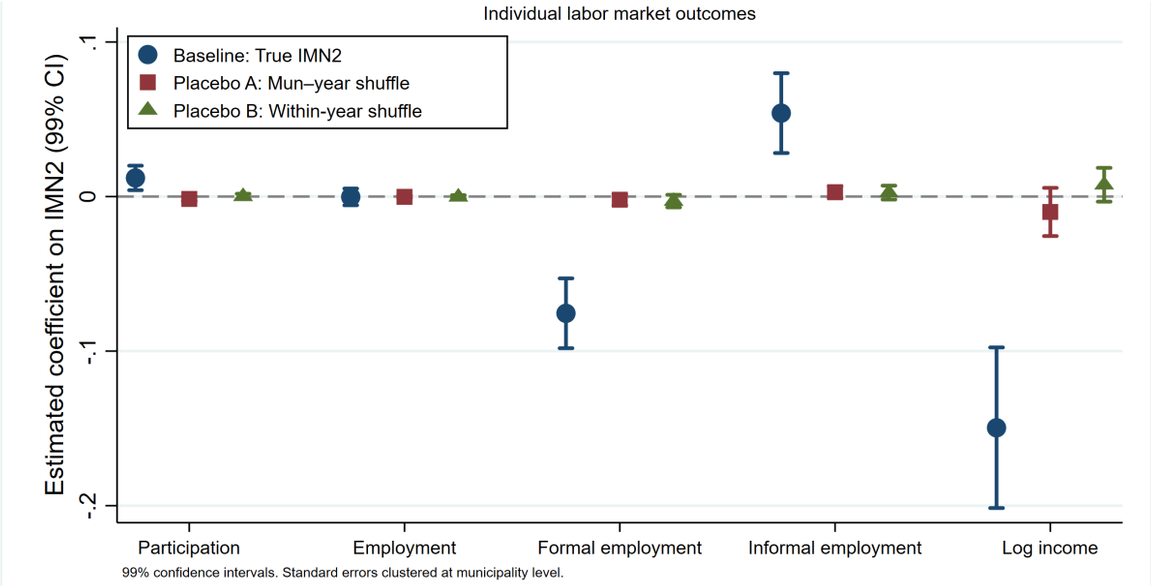
Table 8: Only high Homogeneous municipalities

	Participation	Employment	Formal Employment	Informal Employment	Log Income
	(1)	(2)	(3)	(4)	(5)
Panel A: Oster (2016) bounds					
$\hat{\beta}_{\text{controls}}$	0.0120	0.0002	-0.0756	0.0540	0.1120
$\hat{\beta}_{\delta=1}$	9.3320	2.6704	-6.4390	-20.5350	11.7581
δ $(\beta = 0)$	-0.0106	0.0063	0.1482	0.0741	0.0377
R^2 (full model)	0.3460	0.0192	0.0777	0.1713	0.2804
Controls:	Individual controls, labor market controls, municipality FE, year FE, state-by-year FE				

Note: This table reports robustness checks to unobserved confounding using the proportional selection framework of Oster (2016). $\hat{\beta}_{\text{controls}}$ is the estimated coefficient from the fully controlled specification. $\hat{\beta}_{\delta=1}$ reports the implied treatment effect assuming equal selection on observables and unobservables. $\delta(\beta = 0)$ denotes the proportional selection parameter required to attenuate the estimated effect to zero. R^2 corresponds to the full model.

For this reason, we complement the Oster analysis with a set of placebo tests that directly assess whether the estimated relationship could arise mechanically from the empirical design rather than from economically meaningful variation in marginalization. Specifically, we reassign the municipal marginalization index across municipality–year pairs and, alternatively, shuffle it across municipalities within the same year, preserving the overall distribution of the treatment. As shown in Figure 14, these placebo exercises yield coefficients that are tightly centered around zero and statistically insignificant across all labor market outcomes, in sharp contrast with the economically meaningful and precisely estimated baseline effects. The absence of systematic effects under randomized treatment assignments provides reassurance that the baseline estimates are not mechanically driven by spurious correlation, residual trends, or overfitting induced by high-dimensional fixed effects. Importantly, while these tests cannot rule out all sources of bias arising from unobserved selection, they indicate that the results do not depend mechanically on unobservables embedded in the empirical design. Taken together, the placebo evidence and specification stability exercises strengthen the credibility of our main results in a setting where conventional selection-on-unobservables diagnostics are inherently limited.

Figure 14: Placebo test: Baseline vs. shuffled municipal marginalization



Source: Own elaboration with data from INEGI and CONAPO

8. Conclusion

This study provides a comprehensive quantitative assessment of the relationship between neighborhood marginalization and labor market outcomes, participation, total employment, formal employment, informal employment, and wages, in Mexico between 2010 and 2020. Using rich census data combined with the CONAPO marginalization index and applying a robust two-way fixed-effects econometric framework, that progressively addresses individual characteristics, labor market conditions, and municipal-level temporal dynamics, we comprehensively capture how neighborhoods shape economic opportunities. The sequential inclusion of controls and fixed effects responds to the critical need to isolate the relationship of marginalization from confounding factors, such as individual heterogeneity, local economic trends, and unobserved municipality-specific attributes.

Our baseline results reveal clear patterns. Once fully controlling for individual, labor market, municipal fixed effects, and state by time fixed effects, a 10-point increase in marginalization raises labor force participation by 1.1%, leaves total employment unchanged, significantly reduces formal employment by 7.6%, increases informal employment by 5.4%, and leads to a substantial 15.1% reduction in wages. These findings suggest that marginalization incentivizes economic participation out of necessity, yet simultaneously restricts access to stable, formal employment and higher wages. Drawing from Galster (2012) neighborhood-effects framework, these outcomes likely reflect combined geographic and institutional barries, such as spatial isolation, inadequate governance, and constrained local resources, which limit formal job opportunities and push residents toward informal, precarious employment. Additionally, social-interactive factors, such as neighborhood norms and peer influences, may reinforce reliance on informal economic activities.

Recognizing that linear models only provide average effects, we next investigated nonlinear effects by estimating separate coefficients across deciles of marginalization. This step was motivated by the expectation that disadvantage may not scale proportionally, beyond certain thresholds, deprivation may accelerate exclusion. The results confirmed this intuition: in the highest deciles of marginalization, labor force participation

increases more steeply, formal employment and wages decline sharply, and informal employment reaches its peak. These non-linear patterns point to a tipping point where cumulative disadvantages reinforce themselves and access to stable, well-paying jobs becomes increasingly unlikely. Understanding this non-linear dynamic is critical for policy, as it highlights that interventions may need to be disproportionately targeted toward the most deprived neighborhoods to disrupt cycles of exclusion.

Building on these core results, we conducted heterogeneous analyses by gender and age to identify differential vulnerabilities. Gender-disaggregated estimates revealed that men face larger wage penalties (16.0 %) while women exhibit a stronger increase in informal employment (6.1 % vs. 3.7 % for men). This suggests that women in marginalized neighborhoods are more likely to rely on informal activities, possibly due to constrained formal opportunities and domestic responsibilities. Age-specific estimates indicate that individuals aged 55–65 experience both the largest increase in participation (7.8 %) and the most severe wage penalty (-17.8 %), consistent with life-course accumulation of disadvantage and reduced adaptability to labor-market shocks. These heterogeneous patterns highlight that marginalization interacts with pre-existing inequalities, compounding vulnerabilities in distinct ways.

A critical question in neighborhood-effects research is whether observed labor market penalties primarily reflect socioeconomic deprivation or spatial isolation from economic opportunities. To shed light on this distinction, we exploit variation in commuting time as a proxy for access to local labor markets. The results indicate that the association between marginalization and labor outcomes persists regardless of commute length. Among individuals with short commutes (less than 30 minutes), higher marginalization is associated with a 1.5% increase in labor force participation, a 6.2% increase in informal employment, and a 14.9% reduction in wages. For those with longer commutes (more than 30 minutes), the wage penalty remains comparable (-15.1%), and formal employment declines sharply (-8.2%). These patterns suggest that labor market disadvantage is not driven solely by physical distance to employment opportunities but also reflects local institutional and social constraints embedded in marginalized areas.

We further examine spatial isolation by exploiting municipalities' geographic distance to state capital cities, which proxies access to administrative centers, agglomeration economies, and higher-productivity labor markets. The results show that proximity to capital cities partially attenuates some margins of disadvantage, particularly labor force participation, but does not eliminate the negative association between marginalization and formal employment or wages. In more remote municipalities, the penalties associated with marginalization are at least as large, and in some cases larger, highlighting the role of spatial frictions in amplifying, rather than solely generating, labor market disparities.

Finally, we conduct a series of robustness and validation exercises. Restricting the sample to urban municipalities with better public transport connectivity confirms that marginalization remains associated with lower formal employment (-6.3%) and wages (-11.6%), alongside a modest increase in labor force participation (0.9%). To address concerns related to within-municipality heterogeneity, we identify more homogeneous municipalities using intra-cluster correlations of marginalization at the AGEB level and re-estimate the models on this subsample; the results remain virtually unchanged (participation +1.0%, formal employment -6.6%, informal employment +5.2%, wages -18.0%). In addition, placebo tests that randomly reassign the marginalization index across municipality–year pairs or across municipalities within years yield coefficients centered around zero and statistically insignificant across all outcomes. Taken together, these exercises indicate that the documented associations are not driven by rural composition, spatial misclassification, internal heterogeneity, or mechanical artifacts of the empirical design, but instead reflect economically meaningful variation in neighborhood marginalization.

Overall, the evidence points to persistent structural barriers in marginalized areas that limit access to quality jobs and lead to substantial earnings penalties. The consistency of the results across multiple specifications non linear effects, commuting distance groups, and robustness checks emphasizes the pervasiveness of

neighborhood effects in shaping labor market opportunities. The results align closely with the neighborhood-effects literature, emphasizing that effective interventions must simultaneously address individual skill development and the structural disadvantages embedded within marginalized areas. Importantly, this evidence extends these insights to an emerging-market context characterized by high informality, spatial inequality, and limited social insurance, where neighborhood conditions play a central role in shaping labor market opportunities. Policies aiming to foster more equitable and inclusive labor markets must therefore address both individual-level human capital deficits and the structural disadvantages embedded in marginalized neighborhoods. Interventions should focus on expanding access to formal employment opportunities, improving local infrastructure and transport connectivity, and strengthening social protection to reduce reliance on precarious informal work. By addressing spatial inequalities in opportunity, such policies can help break the cycle of marginalization and foster more inclusive economic growth. Finally, future research should further unpack the causal mechanisms, particularly the interplay of geographic, institutional, and social-interactive channels, to guide precise policy design.

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Appendix

A. CONAPO marginalization index

Table A.1: CONAPO Marginalization Index

Dimension	**Indicator**
Education	% of the population aged 6 to 14 not attending school % of the population aged 15 or older without completed basic education
Health	% of the population without access to health services % of women aged 15 to 49 who have experienced child mortality
Housing	% of households without drainage connected to a public network or septic tank % of households without a toilet connected to a water supply % of households without piped water inside the home
Assets	% of households without a refrigerator

Source: CONAPO estimates based on INEGI data.

B. Galster's Epidemiological Model

Table B.1: Neighborhood Effect Mechanisms

Neighborhood Effect Category	**Theoretical Mechanism**
Social Interactions	
Social Contagion	Changes in behavior, aspirations, and attitudes due to peer influence within the neighborhood. It can have an epidemic-like dynamic.
Collective Socialization	Individuals conform to local social norms influenced by role models and social pressures. This occurs beyond a critical threshold, significantly impacting residents' behavior.
Social Networks	Composed of strong or weak ties established within the neighborhood, which facilitate the exchange of information and resources, affecting opportunities such as job vacancies.
Relative Deprivation	Occurs when some residents achieve a higher level of socioeconomic success, causing distress and discouragement among those with fewer resources. It can generate feelings of envy and dissatisfaction, impacting mental health.
Social Cohesion and Control	
Competition	Arises under conditions where local resources are limited and not pure public goods, leading to rivalries within the neighborhood as groups compete for resources in a zero-sum game.

Continuation of Table B.1

Neighborhood Effect Category	Theoretical Mechanism
Cohesion and Social Control	Represents the level of social disorder in the neighborhood and its opposite, collective efficacy, which influences various behaviors and psychological reactions among residents.
Parental Mediation	Includes all previously mentioned mechanisms but indirectly affects younger residents through parental influences, impacting the family environment.
Environmental Factors	
Exposure to Violence	Violent incidents create uncertainty and a sense of danger, negatively affecting residents' physical and mental health. The impact is more severe for direct victims, leading to long-term consequences.
Physical Environment	A deteriorating physical environment (e.g., poorly maintained buildings and public infrastructure) can cause psychological distress, such as feelings of helplessness. Studies show that exposure to noise pollution impairs decision-making by creating "environmental overload."
Exposure to Toxic Agents	High concentrations of toxic substances in the air or soil harm residents' health, preventing them from maintaining a healthy lifestyle.

Continuation of Table B.1

Neighborhood Effect Category	Theoretical Mechanism
Geographic and Institutional Factors	
Spatial Mismatch	Occurs when neighborhoods lack adequate transportation infrastructure, limiting residents' access to job opportunities that match their skills.
Public Services	Found in neighborhoods within politically corrupt or inefficient local governments, leading to a lower-quality supply of public goods and infrastructure compared to other areas.
Institutional Stigmatization	Happens when institutions or private-sector employers stereotype neighborhood residents, limiting job opportunities and affecting self-esteem.
Availability of Local Institutional Resources	The presence or absence of high-quality private schools, NGOs, public institutions like medical clinics, or charity organizations affects residents' personal development opportunities.
Market Actors	
Local Market Actors	The presence of private market agents, such as fast-food restaurants or fresh produce markets, varies across neighborhoods, creating differences in access to essential goods.

C. Base model with controls

Beyond the direct effects of marginalization, several control variables provide important insights into labor market dynamics. Schooling consistently shows a positive and significant association with desirable outcomes, increasing participation, overall and formal employment, and wages, while reducing informal employment, underscoring the critical role of human capital. Gender differences reveal that females, relative to males, exhibit lower labor force participation and wages but are more likely to be in formal employment and less likely to work informally, suggesting distinct labor market pathways despite a persistent wage gap. Age is generally associated with higher participation, employment, and wages up to a certain point, after which diminishing returns are observed. The presence of children in the household is linked to higher participation and formal employment but slightly lower overall employment and wages. Indigenous individuals tend to have higher participation, employment, and formal employment rates yet face notably lower wages, pointing to persistent ethnic wage disparities. Being married is associated with lower participation but higher overall, formal employment, and wages, as well as reduced informal employment, indicating greater labor market stability. Household heads are more likely to participate in the labor force, be employed—particularly in formal jobs—and earn higher wages, reflecting their greater economic responsibilities. Among labor market controls, municipal employment levels have limited but generally positive associations with formal employment, whereas the number of economic establishments shows minimal influence on labor market outcomes. Job accessibility increases participation, overall employment, and informal work, but is negatively associated with formal employment, suggesting that readily available jobs in marginalized areas are predominantly informal, with no substantial impact on wages.

Table C.1: Marginalization effects

	Participation (1)	Employment (2)	Formal (3)	Informal (4)	Wages (5)
Marginalization index	0.011***	0.000	-0.076***	0.054***	-0.151***
	(0.003)	(0.002)	(0.009)	(0.010)	(0.020)
Schooling	0.016***	0.001***	0.011***	-0.007***	0.074***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Gender	-0.201***	0.017***	0.045***	-0.029***	-0.139***
	(0.002)	(0.000)	(0.001)	(0.000)	(0.002)
Age	0.023***	0.002***	-0.000	-0.000	0.028***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Age squared	-0.000***	-0.000***	0.000***	-0.000	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Children in the household	0.004***	-0.000***	0.002***	-0.001***	-0.007***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Indigenous	0.013***	0.003***	0.003*	-0.001	-0.073***
	(0.001)	(0.000)	(0.001)	(0.001)	(0.004)
Married	-0.144***	0.030***	0.097***	-0.063***	0.078***
	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)
Household head	0.139***	0.016***	0.047***	-0.031***	0.116***
	(0.001)	(0.000)	(0.001)	(0.001)	(0.003)
Municipal employment	-0.000***	-0.000	0.000***	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Economic establishments	-0.000	0.000	-0.000	-0.000	-0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Job accessibility	0.570***	0.188***	-0.191***	0.204***	-0.008
	(0.023)	(0.013)	(0.041)	(0.045)	(0.124)
Year FE	X	X	X	X	X
Municipalities FE	X	X	X	X	X
State Time Trend	X	X	X	X	X
Observations	154,861,255	104,450,370	104,450,370	104,450,370	95,675,739
R-squared	0.345	0.019	0.078	0.171	0.282

Clustered errors at the municipal level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Source: Own elaboration based on research.

D. Distance Heterogeneous Effects

Tables D.1 and D.2 present the heterogeneous effects of marginalization on labor market outcomes by gender and age, accounting for differences in commuting time to work. The analysis separates individuals into two groups: those with a commuting time of less than 30 minutes ("Less Time to Work") and those with a commuting time exceeding 30 minutes ("More Distance to Work"). This approach allows for assessing whether the relationship between marginalization and labor market outcomes differs for individuals who live and work within the same neighborhood compared to those who travel longer distances.

Table D.1 shows that marginalization is positively and significantly associated with labor force participation for both men and women, regardless of commuting time. However, the magnitude of the effect is consistently larger for women, particularly among those with shorter commuting times. Total employment

shows small and mostly insignificant associations, except for a slight positive effect for women with longer commutes. Formal employment is negatively and significantly affected by marginalization across all groups, with somewhat larger magnitudes for women. Informal employment is positively associated with marginalization, with stronger effects for women than for men. Finally, wages display a consistently negative and significant association with marginalization for all groups, with slightly larger penalties for men.

Table D.2 presents the same analysis by age group (25–39, 40–54, and 55–65). The positive association between marginalization and participation is particularly strong among older workers (ages 55–65), especially for those with shorter commuting times. Total employment effects remain small and generally insignificant across age groups. Formal employment is negatively and significantly associated with marginalization for all cohorts, with magnitudes ranging from approximately -5.7% to -8.3%. Informal employment shows a robust positive association with marginalization, particularly among the oldest cohort. Wages are consistently and significantly lower for individuals in more marginalized areas, with the largest earnings penalties observed among older workers.

Overall, these results confirm that the adverse effects of marginalization on formal employment and wages are pervasive across gender, age, and commuting time, while the positive association with informal work is particularly pronounced for women and older individuals.

Table D.1: Distance Heterogeneous Effects by gender

	Participation	Total Employment	Formal Employment	Informal Employment	Wage
	(1)	(2)	(3)	(4)	(5)
Panel A: Male					
A1. Less Time to Work					
10-point marginalization	0.013***	-0.006	-0.070***	0.054***	-0.158***
	(0.005)	(0.004)	(0.015)	(0.017)	(0.021)
Observations	29,112,552	26,459,148	26,459,148	26,459,148	24,010,648
R-squared	0.079	0.022	0.093	0.188	0.293
A2. More Distance to Work					
10-point marginalization	0.013***	0.012***	-0.076***	0.035***	-0.159***
	(0.005)	(0.003)	(0.013)	(0.013)	(0.030)
Observations	43,973,123	40,763,128	40,763,128	40,763,128	36,718,122
R-squared	0.071	0.017	0.074	0.180	0.252
Panel B: Female					
B1. Less Time to Work					
10-point marginalization	0.019***	-0.001	-0.065***	0.054***	-0.121***
	(0.006)	(0.002)	(0.014)	(0.016)	(0.029)
Observations	33,209,988	14,340,883	14,340,883	14,340,883	13,483,584
R-squared	0.204	0.016	0.076	0.151	0.324
B2. More Distance to Work					
10-point marginalization	0.015***	0.004*	-0.081***	0.065***	-0.131***
	(0.005)	(0.002)	(0.012)	(0.014)	(0.035)
Observations	50,300,182	23,618,333	23,618,333	23,618,333	22,086,194
R-squared	0.214	0.017	0.059	0.145	0.264
Controls:	Individual, labor market, year FE, municipality FE, state time trend				

Clustered errors at the municipal level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Source: Own elaboration based on research.

Table D.2: Distance Heterogeneous Effects by ages

	Participation (1)	Total Employment (2)	Formal Employment (3)	Informal Employment (4)	Wage (5)
Panel A: Age 25–39					
A1. Less Time to Work					
10-point marginalization	0.001	-0.010***	-0.083***	0.067***	-0.121***
	(0.004)	(0.004)	(0.015)	(0.017)	(0.029)
Observations	29,079,097	19,981,668	19,981,668	19,981,668	18,491,773
R-squared	0.345	0.024	0.096	0.182	0.304
A2. More Distance to Work					
10-point marginalization	0.000	0.006*	-0.087***	0.050***	-0.133***
	(0.004)	(0.003)	(0.013)	(0.013)	(0.028)
Observations	44,253,200	31,542,174	31,542,174	31,542,174	28,881,784
R-squared	0.350	0.021	0.076	0.175	0.255
Panel B: Age 40–54					
B1. Less Time to Work					
10-point marginalization	0.008	-0.006*	-0.057***	0.049***	-0.134***
	(0.005)	(0.003)	(0.014)	(0.017)	(0.020)
Observations	23,108,783	15,503,581	15,503,581	15,503,581	14,322,745
R-squared	0.340	0.022	0.087	0.169	0.315
B2. More Distance to Work					
10-point marginalization	0.005	0.007**	-0.073***	0.047***	-0.172***
	(0.005)	(0.003)	(0.013)	(0.013)	(0.034)
Observations	35,218,880	24,643,922	24,643,922	24,643,922	22,659,126
R-squared	0.333	0.016	0.068	0.163	0.262
Panel C: Age 55–65					
C1. Less Time to Work					
10-point marginalization	0.082***	-0.003	-0.074***	0.076***	-0.193***
	(0.007)	(0.005)	(0.017)	(0.018)	(0.031)
Observations	10,134,660	5,314,782	5,314,782	5,314,782	4,679,714
R-squared	0.344	0.024	0.091	0.189	0.331
C2. More Distance to Work					
10-point marginalization	0.071***	0.009**	-0.082***	0.078***	-0.163***
	(0.007)	(0.004)	(0.016)	(0.016)	(0.039)
Observations	14,801,225	8,195,365	8,195,365	8,195,365	7,263,406
R-squared	0.330	0.017	0.067	0.171	0.295
Controls:	Individual, labor market, year FE, municipality FE, state time trend				

Clustered errors at the municipal level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Source: Own elaboration based on research.

E. Robustness Checks: gender and ages heterogeneity in urban municipalities

Tables E.1 and E.2 present robustness checks restricted to urban municipalities, disaggregated by gender and age groups, respectively. These analyses verify whether the relationship between marginalization and labor market outcomes remains consistent in better-connected urban contexts.

Table E.1 shows the heterogeneous effects of marginalization for men and women. For both genders, marginalization is positively associated with labor force participation and informal employment but negatively associated with formal employment and wages. The positive association with participation is slightly larger for women, whereas the wage penalty tends to be stronger for men.

Table E.2 reports the results by age groups (25–39, 40–54, and 55–65). The positive association between marginalization and participation is most pronounced for the oldest cohort (55–65), while the negative impact on wages is consistently observed across all age groups, with the largest penalty for older workers. For all cohorts, marginalization is negatively associated with formal employment and positively associated with informal employment.

Overall, these subgroup analyses confirm that the main patterns identified in the baseline results are robust across gender and age groups, even when the sample is restricted to urban municipalities with better transport connectivity.

Table E.1: Only urban municipalities- Gender heterogeneity

	Participation	Total Employment	Formal Employment	Informal Employment	Wage
	(1)	(2)	(3)	(4)	(5)
Urban Municipalities – Men					
10-point marginalization	0.005	0.010**	-0.058***	0.010	-0.122***
	(0.006)	(0.004)	(0.010)	(0.012)	(0.026)
Observations	23,069,230	13,156,198	13,156,198	13,156,198	11,691,956
R-squared	0.088	0.019	0.097	0.191	0.331
Urban Municipalities – Women					
10-point marginalization	0.014**	0.002	-0.065***	0.033**	-0.096***
	(0.006)	(0.002)	(0.012)	(0.013)	(0.028)
Observations	11,526,179	4,647,614	4,647,614	4,647,614	3,867,316
R-squared	0.228	0.019	0.075	0.172	0.340
Controls:	Individual, labor market, year FE, municipality FE, state trend				

Clustered errors at the municipal level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Source: Own elaboration based on research.

Table E.2: Only urban municipalities- Age heterogeneity

	Participation	Total Employment	Formal Employment	Informal Employment	Wage
	(1)	(2)	(3)	(4)	(5)
Urban Municipalities – Age 25–39					
10-point marginalization	0.001	0.003	-0.072***	0.027**	-0.112***
	(0.004)	(0.003)	(0.011)	(0.013)	(0.027)
Observations	25,576,245	16,791,597	16,791,597	16,791,597	14,953,694
R-squared	0.395	0.023	0.097	0.206	0.322
Urban Municipalities – Age 40–54					
10-point marginalization	0.001	0.007**	-0.051***	0.016	-0.127***
	(0.005)	(0.003)	(0.011)	(0.013)	(0.027)
Observations	20,311,756	13,156,198	13,156,198	13,156,198	11,691,956
R-squared	0.376	0.019	0.088	0.191	0.331
Urban Municipalities – Age 55–65					
10-point marginalization	0.060***	0.011**	-0.057***	0.029**	-0.112***
	(0.007)	(0.005)	(0.013)	(0.014)	(0.028)
Observations	8,949,759	4,647,614	4,647,614	4,647,614	3,867,316
R-squared	0.358	0.022	0.090	0.209	0.348
Controls:	Individual, labor market, year FE, municipality FE, state trend				

Clustered errors at the municipal level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Source: Own elaboration based on research.

F. Predictive Margins by Marginalization Decile

To complement the coefficient-based non-linear estimates reported in the main text, Figures F.1, F.2, F.3, F.4 and F.5 present predictive margins of labor market outcomes by marginalization decile. These figures recover the expected level of each outcome at each decile of marginalization, holding all other covariates at their observed values and accounting for the full set of fixed effects. This approach allows for a direct assessment of the total association between marginalization and labor market outcomes, rather than differences relative to an omitted reference category.

The predictive margins clarify the interpretation of the decile coefficients reported in the main specifications, which are estimated relative to the 5th marginalization decile. In particular, while some coefficients for low marginalization deciles appear positive or negative relative to the reference group, the margins reveal whether outcome levels are higher or lower in absolute terms across the distribution.

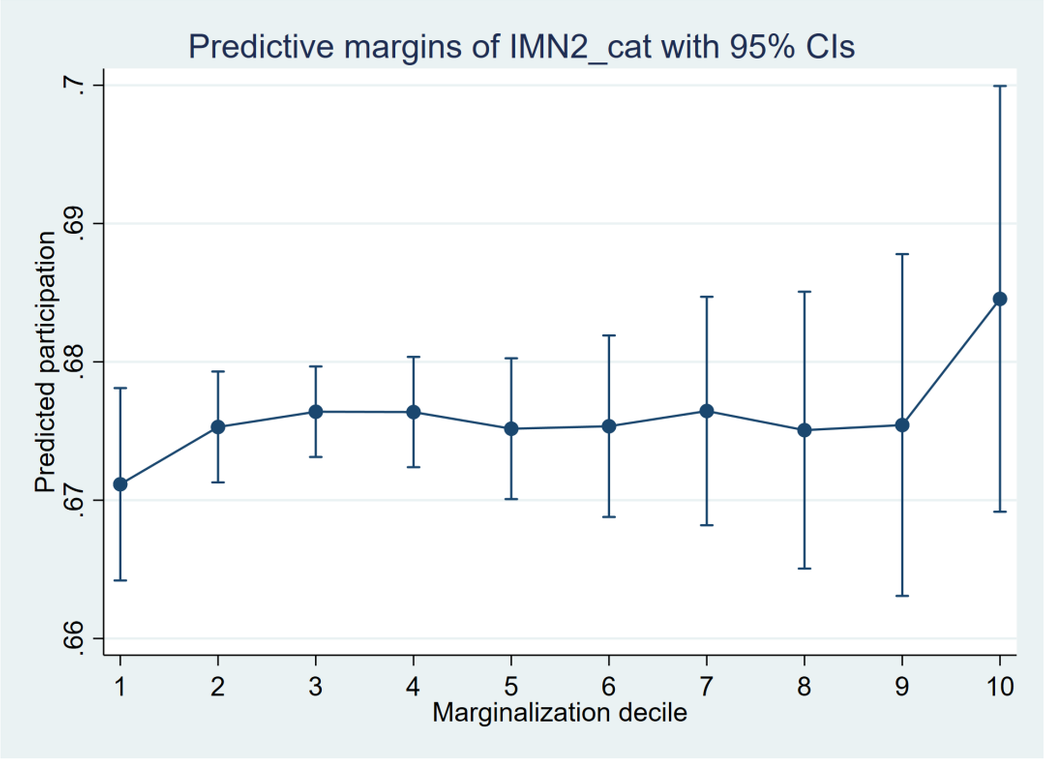
Consistent with the coefficient estimates, labor force participation increases with marginalization, with the highest predicted participation rates observed in the most marginalized deciles. This pattern supports the interpretation of a "necessity-driven" labor supply response in highly deprived contexts. Employment probabilities, in contrast, display a non-monotonic relationship: they peak around the middle of the marginalization distribution and decline at higher deciles, indicating that extreme marginalization is associated with reduced employment opportunities despite higher participation.

Formal employment exhibits a clear and monotonic decline with increasing marginalization. Predictive margins show that individuals in the least marginalized deciles have the highest probability of holding formal jobs, while those in the most marginalized deciles experience a substantial reduction in formality. Informal employment displays the opposite pattern, rising steadily across the marginalization distribution and reaching its highest levels in the most marginalized areas.

Finally, the margins for wages indicate a strong negative association between marginalization and earnings. Individuals in the least marginalized deciles have the highest predicted wages in absolute terms, while wages decline progressively as marginalization increases. Although decile coefficients are reported relative to the 5th decile in the regression tables, the predictive margins confirm that marginalization is associated with lower wage levels overall, with the largest penalties concentrated in the upper deciles.

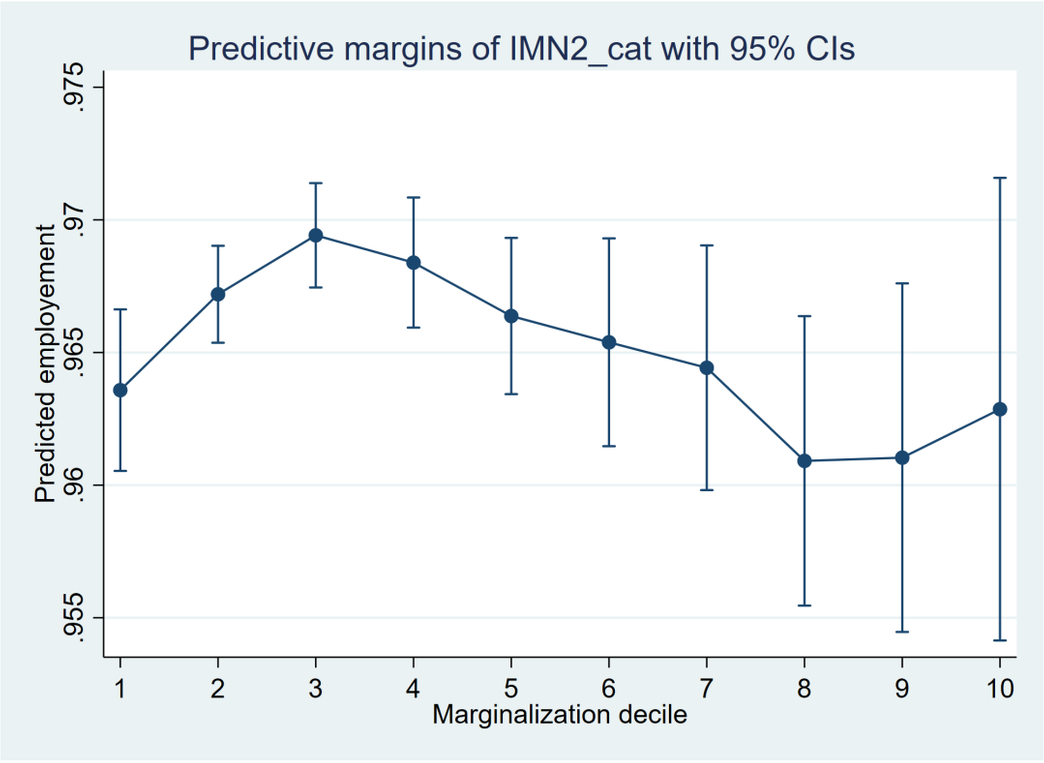
Taken together, the predictive margins confirm that the non-linear patterns identified in the regression results reflect meaningful differences in outcome levels across the marginalization distribution. They further show that the positive coefficients for low marginalization deciles in some specifications reflect relative differences around the middle of the distribution, rather than evidence that marginalization is associated with higher wages or improved labor market outcomes in absolute terms.

Figure F.1: Predictive Margins of Formal Employment by Marginalization Decile



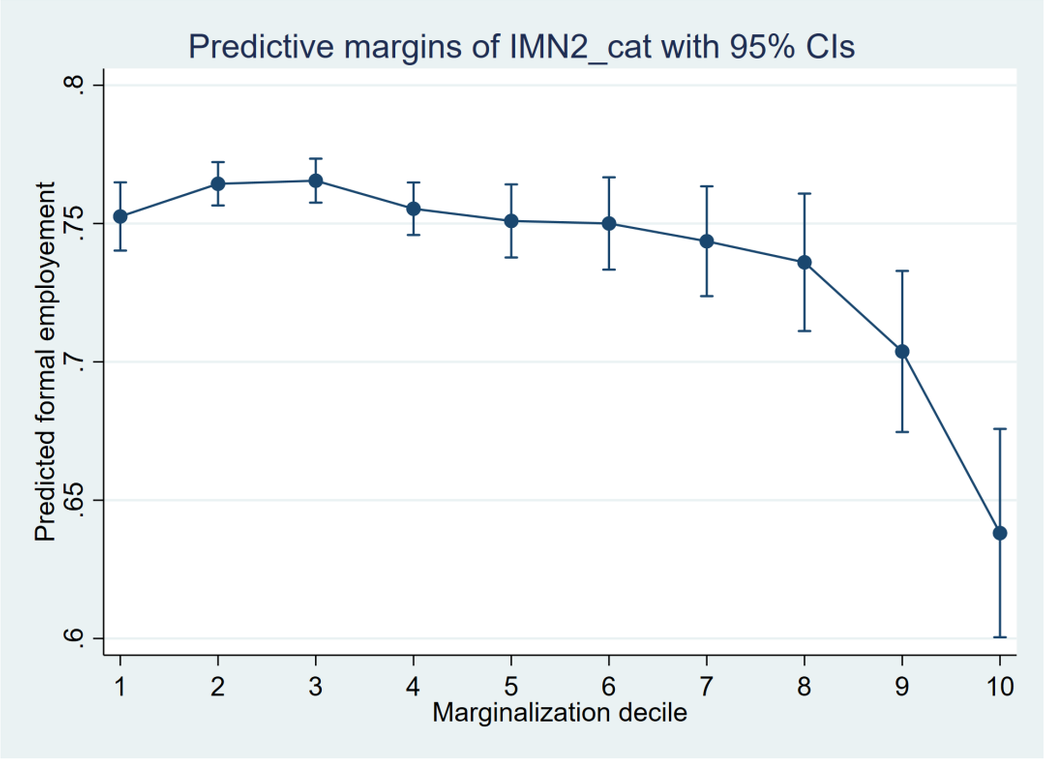
Source: Own elaboration with data from INEGI and CONAPO

Figure F.2: Predictive Margins of Formal Employment by Marginalization Decile



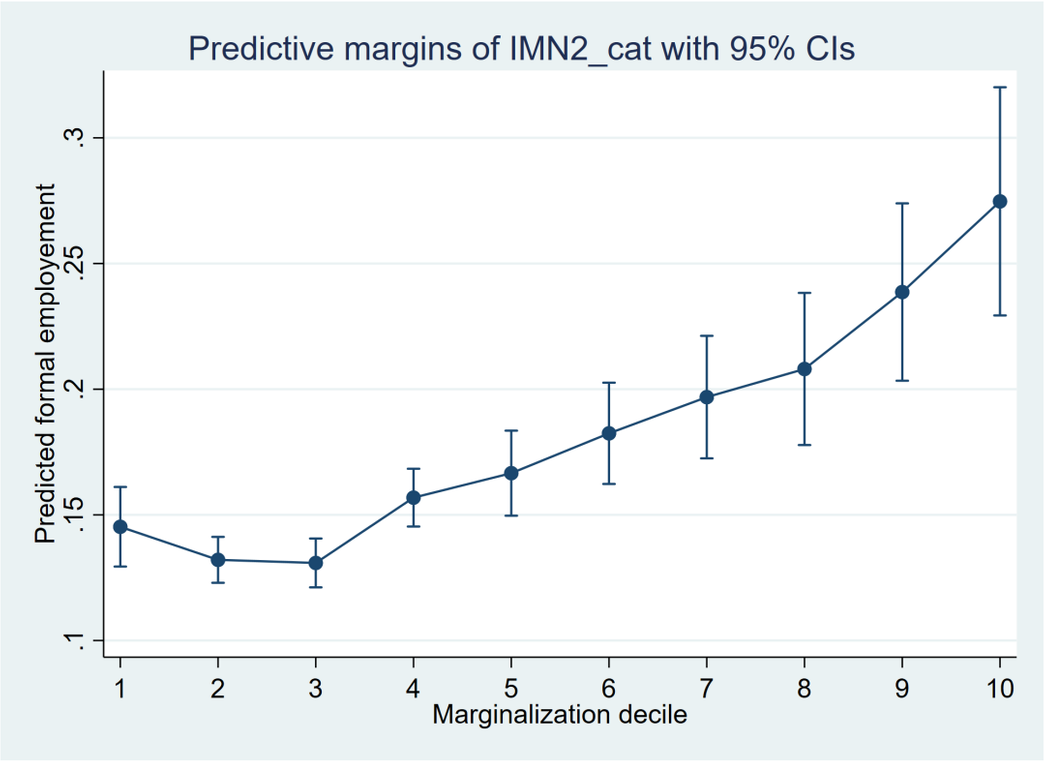
Source: Own elaboration with data from INEGI and CONAPO

Figure F.3: Predictive Margins of Formal Employment by Marginalization Decile



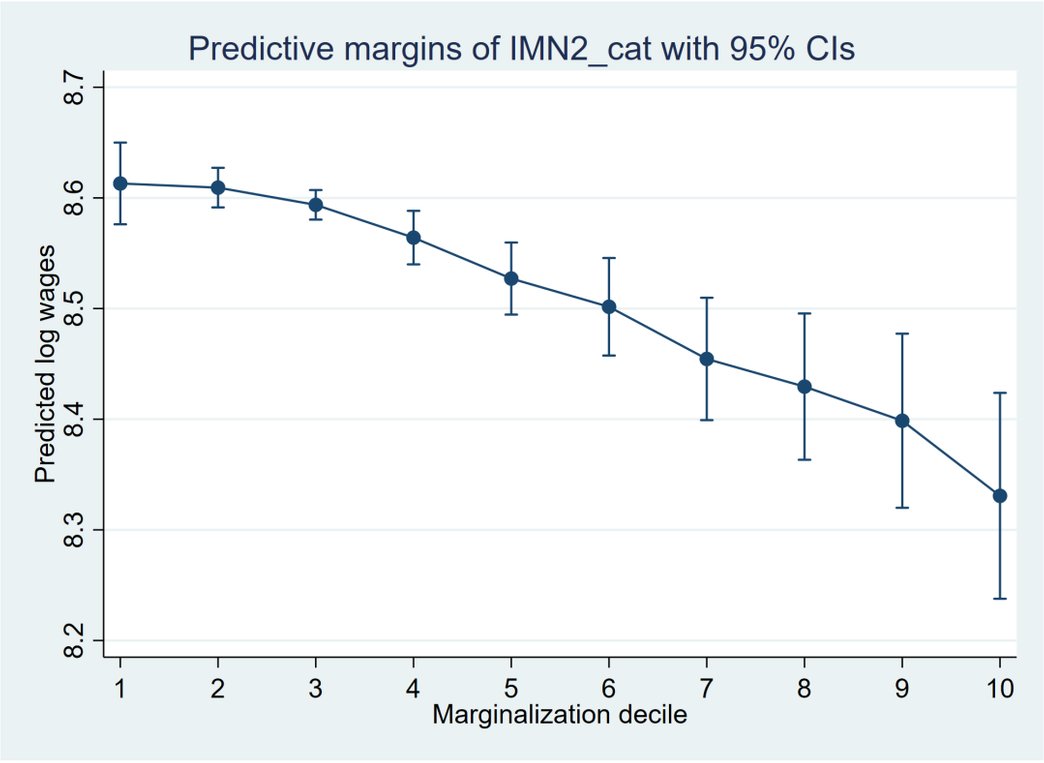
Source: Own elaboration with data from INEGI and CONAPO

Figure F.4: Predictive Margins of Formal Employment by Marginalization Decile



Source: Own elaboration with data from INEGI and CONAPO

Figure F.5: Predictive Margins of Formal Employment by Marginalization Decile



Source: Own elaboration with data from INEGI and CONAPO