Psychosocial wellbeing and place characteristics in Mexico

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ABSTRACT

This paper maps psychosocial wellbeing in Mexico and explores its relationship with the characteristics of the place where a person lives, using multilevel models. Psychosocial wellbeing is measured as self-reported depressive symptoms, feelings of sadness and experience of stress. Results suggest a negative relationship between psychosocial wellbeing and local levels of unemployment, and heterogeneity in the role of place characteristics depending on individual characteristics. First, local unemployment levels tend to harm women more than men, and older more than younger people. Second, local poverty increases the depression symptoms and feelings of sadness of wealthier people, but, at high levels of local poverty, poorer people are significantly more likely to experience stress compared to wealthier people. Moreover, local poverty significantly worsens the psychosocial wellbeing of unemployed people. Third, an increase in local inequality harms the psychosocial wellbeing of younger people, while it does not seem to affect individuals older than 35. Fourth, an increase in the provision of local amenities can improve psychosocial wellbeing among people younger than 50, but it does not seem to moderate the relationship between age and depression among older people.

Keywords: Psychosocial wellbeing; Place characteristics; Mexico; Multilevel models

1. INTRODUCTION

The psychological aspects of an individual's experience, such as thoughts, emotions and behaviour, are shaped by her interaction with her social environment, that is, are inherently psychosocial in nature (Ray, 2006). Psychosocial wellbeing can affect people's decision making process, aspirations and beliefs about the future, and all this in turn is a critical determinant of people's behaviour and of resulting economic outcomes (Carneiro et al., 2015; Bernard et al., 2014; Haushofer & Fehr, 2014; Moya & Carter, 2014; Beaman et al., 2012; Duflo, 2012; Macours & Vakis, 2009; Heckman et al., 2006).

Place characteristics are potentially a very important determinant of psychosocial wellbeing especially in countries characterized by high spatial inequality, that is, by high levels of disparities among places in economic activities, incomes and social indicators. The influence of place characteristics on psychosocial wellbeing may occur through at least two channels. First, place provides a person with the opportunities and constraints that influence her experiences in the world and her (perceived) successes and failures, which, in turn, shape agency thinking and perceived locus of control. Second, place provides both a network of support which can buffer against adverse events; and the peers and role models that a person uses to define behaviours, expectations and aspirations about her future. Mair et al. (2012), Ludwig et al. (2012), MacKerron & Mourato (2013), and Voors et al. (2012), among others, all suggest the existence of a significant relationship between place characteristics and psychosocial wellbeing in the US, the UK and Burundi, respectively. Mexico is characterized by high levels of spatial inequality (Modrego & Berdegué, 2015), but we know little about the impacts of place characteristics on psychosocial wellbeing. In turn, a better understanding of the relationship between place characteristics and psychosocial wellbeing can provide useful information to improve the design and effectiveness of both place-based and people-based policies for development.

This paper takes a first step towards closing this gap by investigating the relationship between psychosocial wellbeing of working-age Mexicans (between 15 and 65 years old) and the characteristics of the place where they live, and by analysing how this relationship varies across gender, age, socio-economic and employment status. We use nationally representative household survey data and multilevel econometric models, and measure psychosocial wellbeing as self-reported depressive symptoms, feelings of sadness and experience of stress. We analyse the role of place at two alternative levels: the municipality and the locality where a person lives, that is, higher and lower administrative level respectively. Information on different place characteristics is available at each level. Place characteristics of interest at municipal level include poverty and inequality, unemployment and violence. At the locality level, characteristics of interest are organized crime, provision of public services, production structure, and community participation. Our results suggest the existence of a significant relationship between individual psychosocial wellbeing and place characteristics, and provide evidence of heterogeneity in how place characteristics affect the psychosocial wellbeing of different groups by gender, age, individual wealth and employment status.

The remainder of this paper is organized as follows. Section 2 provides a conceptual map of how "place" can affect individual psychosocial wellbeing. Sections 3 and 4 present the methodology and the data, respectively. Section 5 discusses the results and Section 6 concludes.

2. CONCEPTUAL FRAMEWORK

The relationships between individual outcomes and the physical and social context where a person lives has gained increasing attention in both the social sciences and the public health literature in recent years. In the public health literature, several studies of neighbourhoods and health found that living in a poor or socioeconomically disadvantaged neighbourhood is associated with poor health outcomes including adverse mental health outcomes and greater prevalence of chronic disease risk factors, such as hypertension (among others, Pickett & Pearl, 2001; Truong & Ma, 2006; Mair et al., 2008).

In this paper we define place as the physical and social context where a person lives. Examples of physical characteristics that can affect psychosocial health include population density, the physical decay of man-made constructions and infrastructure, transportation, land use, amenities, etc. Features of the social

environment, in turn, include social norms, social stressors such as unemployment, violence and insecurity, and social connections, all of which may facilitate the transmission of behaviours, and reduce or increase stress. The influence of place characteristics on psychosocial wellbeing may occur through at least two channels. First, place provides a person with the opportunities and constraints that influence her experiences in the world and her (perceived) successes and failures, which in turn contributes to shape her sense of agency and subjective wellbeing. Second, place provides both a network of support to buffer stressors, and the peers and role models that a person looks at to shape her behaviours. The effect of place characteristics on individual psychosocial outcomes, on the other hand, is likely to be mediated by individual characteristics. Understanding the role of place characteristics in defining individual outcomes, however, is complicated by several issues, including the possibility that individuals select or are selected into their place of residence based on their individual characteristics, including outcomes of interest such as health or predisposition to certain health behaviours. Figure 1 in the Appendix provides a simplified depiction of the interactions between individual characteristics, place attributes, and individual psychosocial outcomes.

Following Manski's typology (1995), we can think of three kinds of effects that place can on individual psychosocial wellbeing. First, endogenous effects, that is, effects of aggregate outcomes at the group-level on individual-level outcomes: e.g. the effect of the prevalence of a certain attitude or behaviour in the group on the probability that a given member of the group develops a similar attitude or behaviour. Second, contextual effects of group composition: e.g. when the skill composition of a residential area affects the earnings of residents independently of their own characteristics through local employment opportunities. Third, environmental effect: e.g. the effects of exogenous features of the groups (e.g. built environment) on individual-level outcomes.

It is very difficult to disentangle endogenous and contextual effects (Manski, 1993). In this paper, we are mainly interested in environmental effects, that is, how exogenous physical and social features of a place may affect psychosocial wellbeing through constraints on, or enhancement of, behaviours related to psychosocial health; and/or through mechanisms involving the experience of stress and the buffering effects of social support and social connections. Even so, our results should be interpreted as correlational results, not as causal effects.

3. METHODOLOGY

We investigate empirically how the characteristics of the place where a person lives shape her psychosocial wellbeing by using the maximum likelihood estimation of a multilevel linear model, which explicitly models the interaction between the micro-level (individuals) and the macro-level (place characteristics) (Snijders & Bosker, 1999; Raudenbush & Bryk, 2002). Multilevel models allow detecting the effects of macro-level characteristics, such as local levels of violence, poverty or availability of public services, on individual psychosocial wellbeing, and allow for the impact of contextual characteristics to vary both across locations and across individuals within the same location.

Multilevel models also account for the fact that, in a structure where individuals are nested within communities, individuals within communities are more similar to each other, at least in some respects, than to individuals across communities, because of their shared context and social interactions. When individuals are nested within communities, covariation between higher-level variables and lower-level outcomes cannot be ignored, because it leads to correlated error terms and underestimated standard errors, and increases the probability of concluding that community characteristics are relevant when in fact they are not (Moulton, 1990). Multilevel models, in turn, give correct estimates in the presence of correlated errors that arise from hierarchical data.

In this framework, individuals (level 1 of the hierarchy) are nested within the place where they live (level 2 of the hierarchy). Place is modelled in two alternative ways: as municipality and as locality. Analysing municipality-level contextual effects is useful because, from a policy point of view, many of the place characteristics we are interested in (such as provision of public goods and services) are managed at the level of municipalities. Locality-level contextual effects, on the other hand, allow gaining information on the closest environment in which the individual is immersed.

The starting point of the analysis is a random intercept model of psychosocial wellbeing. This model tests for the existence of contextual effects, that is, of variation in psychosocial wellbeing across places, by allowing each place to have a different intercept. Evidence of significant contextual effects may be due to differences in individual characteristics across places, to differences in place characteristics, or to a combination of both. At this stage, we are not able to separate between these two sources of contextual effects, but we will be able to do so as the complexity of the model increases. The general specification of a base random intercept multilevel model is:

$$y_{ij} = \beta_0 + u_{0j} + e_{ij} \tag{1}$$

Where y_{ij} is the psychosocial outcome of individual i in place j; β_0 is the overall mean level of psychosocial wellbeing across places, u_{0j} is the effect of place j on individual psychosocial wellbeing, and e_{ij} is an individual-level residual. The place effect u_{0j} represents the degree of heterogeneity in psychosocial wellbeing across places. The individual and place level residuals are assumed to follow a normal distribution with zero means and variances σ_e^2 and σ_{u0}^2. Both variances indicate the degree to which variables at individual and place level contribute to explaining individual variation in psychosocial wellbeing. The relative weight of place-level variation in explaining psychosocial wellbeing, that is, the intra-class correlation coefficient (ICC), is calculated as

$$\rho = \frac{\sigma_{u0}^2}{\sigma_e^2 + \sigma_{u0}^2} \tag{2}$$

Building on the base random intercept multilevel model, the level of psychosocial wellbeing of the individual i in place j is modelled as a function of individual-level characteristics Xij and of place-level characteristics Zj in a two-level random slope model with contextual effects. This model allows for psychosocial wellbeing to vary across places, and for place characteristics to influence the relationship between individual characteristics and psychosocial wellbeing. That is, each place j is allowed to have a different intercept and slope coefficient:

$$y_{ij} = \beta_{0j} + \beta_{1j} X_{ij} + e_{ij} \tag{3}$$

Place variation in the regression coefficients is modelled as:

$$\beta_{0j} = \gamma_{00} + \gamma_{01} Z_j + \mu_{0j} \tag{4}$$

and

$$\beta_{1j} = \gamma_{10} + \gamma_{11} Z_j + \mu_{1j} \tag{5}$$

Substituting Equations 4 and 5 into Equation 3 and rearranging gives the following two-level random slope model with contextual effects:

$$y_{ij} = \gamma_{00} + \gamma_{10} X_{ij} + \gamma_{01} Z_j + \gamma_{11} X_{ij} Z_j + \mu_{0j} + \mu_{1j} X_{ij} + e_{ij} \tag{6}$$

The segment $\gamma_{00} + \gamma_{10} X_{ij} + \gamma_{01} Z_j + \gamma_{11} X_{ij} Z_j$ is the fixed part of the model. The segment $\mu_{0j} + \mu_{1j} X_{ij} + e_{ij}$ contains all the error terms and is the stochastic part of the model, with zero means and variances σ_{u0}^2, σ_{u1}^2 and σ_e^2. Place-level residuals μ_{0j} and μ_{1j} are allowed to covary, and are assumed to have a multivariate normal distribution with an expected value of zero, and to be independent from the residual errors e_{ij}. The term $X_{ij} Z_j$ is included to model the fixed part of the interaction between individual level and place level characteristics.

4. THE DATA

4.1. The mexican family life survey

The main source of data for this paper is the third wave of the Mexican Family Life Survey (MxFLS-3), which began in 2009 and concluded in 2012. MxFLS is a multi-purpose survey of individuals, households and communities, representative at national and state level, and at rural and urban levels, covering over 8 thousand households in 150 communities. The survey interviewed each household member age 15 and above and collected information on a broad range of issues, including demographics, income, consumption, livelihood strategies, human capital (including a cognitive Raven's test), migration, social interactions, health and victimization. The MxFLS also collected extensive data on locality-level economic, social and physical infrastructure, through a community questionnaire administered to key informants.

The measures of psychosocial wellbeing we use in the paper derive from modules on emotional wellbeing and physical health. The emotional wellbeing module contains 21 questions asking about feelings in the past four weeks relating to sadness, lack of energy, difficulty concentrating, loneliness, insecurity, sleeplessness and anxiety, among others. The health module includes information on self-reported health and extensive data on morbidity and physical symptoms, including self-reported experience of stress over the previous four weeks.

We combine the MxFLS-3 data with employment data from the 2010 Population Census and with vital statistics (INEGI 2010), aggregated at the level of municipality to characterize municipal-level contextual features. We also use Small Area Estimates (SAE) of 2010 municipal poverty headcount and inequality (Gini index). SAE is a methodology developed by Elbers, Lanjouw, and Lanjouw (2002, 2003) to improve the accuracy of survey estimates of municipal characteristics by combining survey data with other sources, including population censuses. We measure contextual effects at locality level using data from the MxFLS community survey, because it is not possible to link the survey to Census data aggregated at locality level.[1]

The sample used for the analysis includes 6961 working age individuals (between 15 and 65 years of age) distributed across 85 municipalities and 88 localities. Only municipalities and localities with more than 51 observations are included, to avoid the "small cell" problems mentioned in Maas & Joop (2005).

4.2. Psychosocial outcomes

We use three measures of psychosocial wellbeing: self-reported depressive symptoms over the past four weeks; feelings of sadness over the past four weeks; and experience of stress over the past four weeks. These questions were designed and tested to diagnose depressive symptoms and have. The indicator for depressive symptoms is the Calderón depression score, which was designed and tested specifically for the Mexican context by researchers at the Mexican Institute of Psychiatry, and has proved reliable in the past (Calderón, 1997). The depression score is calculated using the first 20 questions of the emotional wellbeing module of the MxFLS. Possible answers follow a 4-point scale and include "No", "Yes, sometimes", "Yes, many times", "Yes, all the time". The final scale is created by summing these values and potential values range from 20 to 80. A higher score indicates a greater number and intensity of depressive symptoms. Following the clinical experience provided in Calderón (1997), the score can be interpreted as follows: 20-35 = Normal levels of depression and anxiety; 36-45 = A low level of anxiety, which can be considered as normal under the stress of participating in a survey; 46-65 = Moderate depression; 66-80 = Severe depression. Only scores above 45 are qualified as clinical depression. However, in order not to lose a more nuanced understanding of the relationship between place characteristics and depression symptoms, in this paper we use the continuous depression syndrome score, ranging from 20 to 80.

Feelings of sadness are measured using the first question of the Calderón depressive symptoms measure, which asks whether the person has experienced feelings of sadness over the past four weeks, with values

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[1] The MxFLS does not use the official locality identifier used in the Population Census, for privacy reasons.

ranging from 1 to 4 (from "No" to "Yes, all the time"). We transform this variable into a dummy equal to one if the person has experienced sadness many times or all the time over the previous four weeks, and zero otherwise. The experience of stress is recorded in the survey as a dummy equal to 1 if the person has suffered from stress over the previous four weeks, zero otherwise.

Table 1 reports summary statistics for the three outcome variables. The depression score is strongly correlated with reporting feelings of sadness (rho=0.602, p-val<0.01), while the correlation is weaker with the experience of stress, although still highly significant (rho=0.266, p-val<0.01). Feelings of sadness and experience of stress are also positively and significantly correlated (rho=0.224, p-val<0.01). Figure 1 shows substantial variation across states in the share of the sample reporting feelings of sadness and experience of stress, while the mean depression score displays less variation.

Table 1: Summary statistics for the outcome variables

Variable	Obs	Mean	Std. Dev.	Min	Max
Depression score	13897	24.96877	9.680364	0	80
Sadness	13016	.3379687	.473036	0	1
Stress	13016	.1981407	.3986141	0	1

Figure 1: Depression score, sadness and stress across states
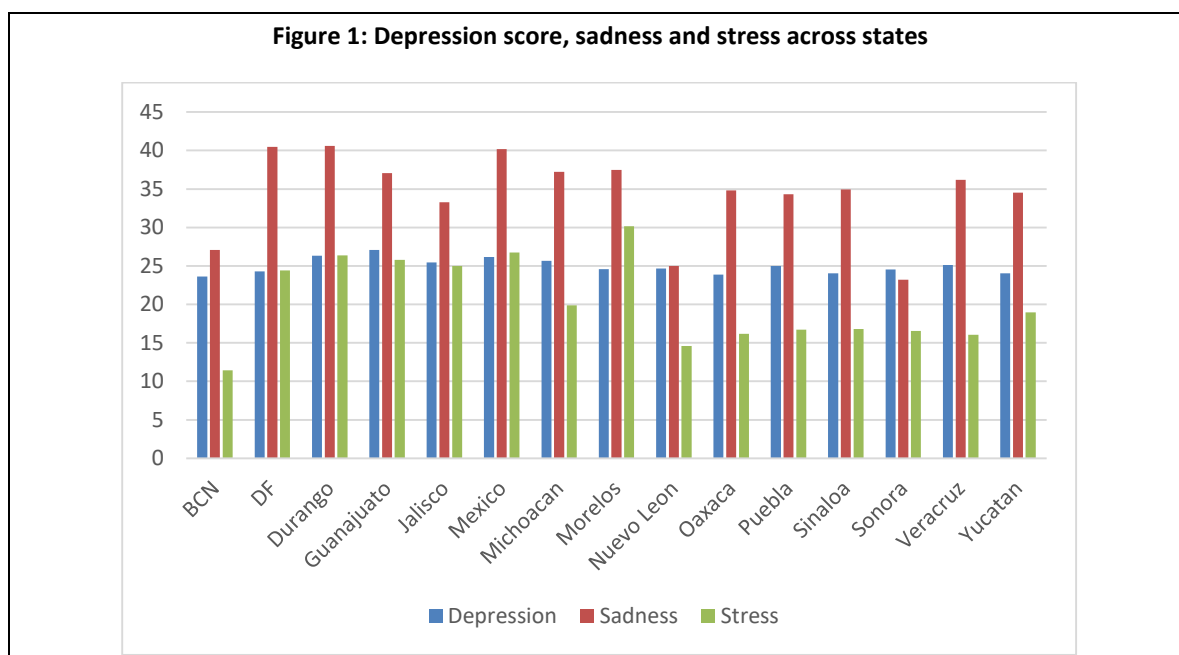
4.3. Place characteristics

Table 2 displays summary statistics of municipal level data. The mean food poverty headcount ratio is 19%, ranging from 4% to 67%. The mean Gini index is relatively high, at 0.35, ranging between 0.27 and 0.40. The mean municipal unemployment rate is less than 5%, but reaches a maximum of 11%. The number of homicides per 100 thousand inhabitants ranges from zero to 240, with a mean value of 27.

Table 2: Summary statistics of municipal level variables

|	mean	sd	count	min	max
Food poverty headcount ratio	19	13	16994	4	67
Gini coefficient 2010	0.35	0.03	16994	0.27	0.40
Municipal unemployment rate	4.54	1.58	16994	0.92	11.03
Homicides/100'000 inhab	26.75	39.57	16994	0.00	240.53

Table 3 displays summary statistics of locality level data. With respect to sanitary conditions, the mean share of people in a locality reporting that their dwelling is surrounded by animal or human waste is 2%, and the mean share of people reporting that their dwelling is surrounded by garbage piles is 1%. Almost 60% of localities report the existence of gangs or organized crime, and 76% report problems with people consuming drugs in the street. Community participation, defined as the organization by inhabitants of community assemblies, activities or events is relatively high, with 75% of locality reporting at least one community organized event. In about 10% of localities, key informants report that a substantial number of firms or factories have closed in the previous five years. To capture availability of local amenities, and avoid potential multicollinearity problems derived from correlations between amenities, we construct an index summarizing whether the locality where the individual lives offers the physical infrastructure for a wholesale market; a post office; a library; a theatre; and green areas (see the Appendix for more details on the construction of the index). Figure 2 shows the kernel density function of the amenities index, which indicates that the largest share of the sample lives in localities offering a low level of amenities.

Table 3: Summary statistics of locality level variables

	mean	sd	count	min	max
Housing surrounded by waste	2	15	16209	0.00	100
Housing surrounded by garbage	1	11	16209	0.00	100
Gangs	59	49	16535	0.00	100
Drugs	76	43	16535	0.00	100
Amenities index	0.41	1.52	16535	-1.44	2.18
Community participation	75	43	16535	0.00	100
Closing down of firms	9	29	15587	0.00	100

Figure 2: Kernel density distribution of the amenites index
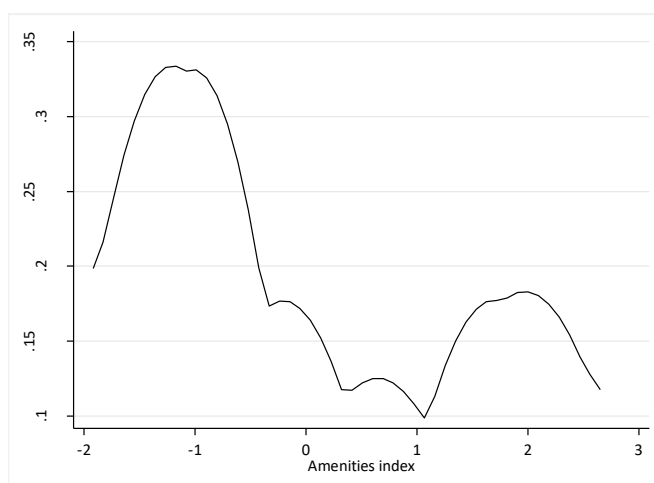
4.4. Individual controls

We control for individual socio-demographic characteristics traditionally considered in economics and public health literature, including age, gender, ethnicity, education level, employment status, household size, and a wealth index (see the Appendix for more details on the construction of the index). We control for additional potential correlates of psychosocial wellbeing by including a dummy equal to one if the individual belongs to a household that experienced economic shocks over the previous three years; and a dummy equal to one if the individual has been a victim of assault, robbery or a violent incident outside their households (victimization). We also control for self-reported physical health, using a categorical variable taking values from 1 (very bad) to 5 (very good). Table 4 reports summary statistics of individual characteristics.

Table 4: Summary statistics of individual characteristics

	mean	sd	count	min	max
Age	34.94	13.74	16994	16.00	65.00
Female	0.52	0.50	16994	0.00	1.00
Indigenous	0.13	0.33	13035	0.00	1.00
Household size	5.84	2.75	16994	1.00	22.00
Level of education	2.13	1.09	12287	0.00	5.00
Unemployed	0.01	0.12	13933	0.00	1.00
Assets index	-0.19	1.07	16486	-3.62	5.53
Self-reported bad health	2.40	0.70	13035	1.00	5.00
One or more shocks in the last 5 yrs	0.34	0.47	16683	0.00	1.00
Victimization rate	0.06	0.24	8294	0.00	1.00

In Table 5 we can see differences in composition between people in our sample that report clinical depression (measured as a depression score higher than 45, following the Calderón definition) and people who do not. At a 95 percent level of statistical significance, we observe that people between 45 and 55 years old, women, people with primary education only, people over the median of self-reported ill health, people that experienced one or more shocks in the last five years, and people that live in households with more than 5 members, are overrepresented in the group of people that report depression. Meanwhile, people between 16 and 24 years of age are significantly overrepresented in the group of people that do not report depression.

Table 5: Composition of the sample over report of depression

Variables	Report depression?				Total	
	No		*Yes*			
	Percent	95% CI	Percent	95% CI	Percent	95% CI
Age						
16-24 (n=4,691)	29.55	[28.84,30.28]	23.80	[19.75,28.38]	29.42	[28.72,30.13]
25-34 (n=3,344)	21.07	[20.44,21.72]	16.84	[13.38,20.98]	20.97	[20.35,21.61]
35-44 (n=3,217)	20.13	[19.51,20.77]	21.93	[18.02,26.40]	20.18	[19.56,20.81]
45-54 (n=2,754)	17.17	[16.59,17.77]	21.39	[17.53,25.84]	17.27	[16.69,17.87]

55-65 (n=1,939)	12.07	[11.56,12.59]	16.04	[12.66,20.12]	12.16	[11.66,12.68]

Female

No (n=7,321)	46.08	[45.30,46.86]	24.67	[20.58,29.27]	45.58	[44.81,46.35]
Yes (n=8,741)	53.92	[53.14,54.70]	75.33	[70.73,79.42]	54.42	[53.65,55.19]

Indigenous

No (n=13,330)	88.61	[88.08,89.11]	89.84	[86.34,92.52]	88.64	[88.12,89.13]
Yes (n=1,709)	11.39	[10.89,11.92]	10.16	[7.48,13.66]	11.36	[10.87,11.88]

Level of education

None (n=52)	0.35	[0.27,0.47]	0.90	[0.29,2.75]	0.37	[0.28,0.48]
Primary (n=4,854)	33.93	[33.14,34.72]	43.11	[37.90,48.48]	34.14	[33.37,34.93]
Secundary (n=4,400)	31.02	[30.26,31.80]	27.84	[23.30,32.90]	30.95	[30.19,31.71]
High school (n=2,919)	20.64	[19.97,21.32]	16.17	[12.60,20.51]	20.53	[19.88,21.20]
Vocational (n=1,702)	11.99	[11.46,12.54]	11.08	[8.13,14.92]	11.97	[11.45,12.52]
University (n=290)	2.07	[1.84,2.32]	0.90	[0.29,2.75]	2.04	[1.82,2.29]

Unemployed

No (n=15,814)	98.58	[98.39,98.76]	98.93	[97.19,99.60]	98.59	[98.40,98.76]
Yes (n=226)	1.42	[1.24,1.61]	1.07	[0.40,2.81]	1.41	[1.24,1.60]

Self-reported ill health

Below median (n=8,372)	52.60	[51.82,53.38]	32.36	[27.83,37.25]	52.12	[51.35,52.90]
Above median (n=7,690)	47.40	[46.62,48.18]	67.64	[62.75,72.17]	47.88	[47.10,48.65]

One or more shocks in the last 5 yrs

No (n=10,456)	65.87	[65.12,66.61]	59.73	[54.69,64.58]	65.72	[64.98,66.46]
Yes (n=5,453)	34.13	[33.39,34.88]	40.27	[35.42,45.31]	34.28	[33.54,35.02]

Victimization

No (n=8,937)	93.77	[93.26,94.24]	92.56	[88.50,95.26]	93.74	[93.23,94.21]
Yes (n=597)	6.23	[5.76,6.74]	7.44	[4.74,11.50]	6.26	[5.79,6.77]

Household size

5 or less (n=8,743)	54.57	[53.79,55.35]	48.54	[43.53,53.58]	54.43	[53.66,55.20]
More than five (n=7,319)	45.43	[44.65,46.21]	51.46	[46.42,56.47]	45.57	[44.80,46.34]

Elaborated with data from MxFLS 2009-2012.

Table 6 reports descriptive statistics for people who reported feelings of sadness and people who did not. Also in this case, women, people with primary education only, people over the median of self-reported ill health, and people who experienced one or more shocks in the previous five years, are significantly overrepresented in the group reporting feelings of sadness. People who reported been victim of assault, robbery or a violent incident outside their households, as well as people between 35 and 65 years, are also significantly overrepresented in the group reporting feelings of sadness. Meanwhile, people between 16 and 34 years, and people with high school and vocational education, are significantly overrepresented in the group of people that do not report feelings of sadness.

Table 6: Composition of the sample over report of sadness

Variables	Report sadness?				Total	
	No		Yes			
	Percent	95% CI	Percent	95% CI	Percent	95% CI
Age						
16-24 (n=4,364)	31.99	[31.07,32.91]	23.78	[22.64,24.97]	29.18	[28.46,29.91]
25-34 (n=3,078)	21.44	[20.64,22.26]	18.93	[17.88,20.03]	20.58	[19.94,21.24]
35-44 (n=3,043)	19.04	[18.28,19.83]	22.86	[21.73,24.03]	20.35	[19.71,21.00]
45-54 (n=2,619)	16.10	[15.39,16.84]	20.22	[19.14,21.35]	17.51	[16.91,18.13]
55-65 (n=1,851)	11.43	[10.82,12.07]	14.20	[13.27,15.18]	12.38	[11.86,12.91]
Female						
No (n=6,699)	51.69	[50.71,52.67]	30.56	[29.32,31.83]	44.46	[43.67,45.25]
Yes (n=8,369)	48.31	[47.33,49.29]	69.44	[68.17,70.68]	55.54	[54.75,56.33]
Indigenous						
No (n=13,285)	88.73	[88.09,89.34]	88.40	[87.49,89.25]	88.61	[88.10,89.11]
Yes (n=1,707)	11.27	[10.66,11.91]	11.60	[10.75,12.51]	11.39	[10.89,11.90]
Level of education						
None (n=52)	0.34	[0.24,0.48]	0.42	[0.27,0.65]	0.37	[0.28,0.48]

Primary (n=4,842)	31.61	[30.68,32.56]	39.18	[37.80,40.57]	34.16	[33.39,34.95]
Secundary (n=4,386)	30.58	[29.66,31.52]	31.67	[30.36,33.00]	30.95	[30.19,31.71]
High school (n=2,908)	22.05	[21.23,22.90]	17.50	[16.45,18.60]	20.52	[19.86,21.19]
Vocational (n=1,696)	13.27	[12.60,13.97]	9.40	[8.60,10.26]	11.97	[11.44,12.51]
University (n=289)	2.14	[1.87,2.45]	1.84	[1.50,2.26]	2.04	[1.82,2.29]
Unemployed						
No (n=14,825)	98.57	[98.31,98.78]	98.39	[98.01,98.70]	98.50	[98.30,98.69]
Yes (n=225)	1.43	[1.22,1.69]	1.61	[1.30,1.99]	1.50	[1.31,1.70]
Self-reported ill health						
Below median (n=8,372)	63.00	[62.05,63.95]	41.26	[39.93,42.61]	55.56	[54.77,56.35]
Above median (n=6,696)	37.00	[36.05,37.95]	58.74	[57.39,60.07]	44.44	[43.65,45.23]
One or more shocks in the last 5 yrs						
No (n=9,817)	68.88	[67.96,69.79]	59.46	[58.11,60.80]	65.66	[64.90,66.42]
Yes (n=5,134)	31.12	[30.21,32.04]	40.54	[39.20,41.89]	34.34	[33.58,35.10]
Victimization						
No (n=8,918)	94.54	[93.94,95.09]	92.47	[91.55,93.30]	93.78	[93.28,94.25]
Yes (n=591)	5.46	[4.91,6.06]	7.53	[6.70,8.45]	6.22	[5.75,6.72]
Household size						
5 or less (n=8,256)	55.22	[54.24,56.20]	53.97	[52.60,55.32]	54.79	[54.00,55.59]
More than 5 (n=6,812)	44.78	[43.80,45.76]	46.03	[44.68,47.40]	45.21	[44.41,46.00]

Elaborated with data from MxFLS 2009-2012.

As for stress, Table 7 shows that people between 25 and 44 years, females, non-indigenous, people with vocational or university education, people with higher self-reported ill-health, who have faced some economic shock in the last five years, have been victims of violence or live in a household with less than six members, all have a higher and significant (at a 95% level) incidence of self-reported stress. Conversely, people between 16 and 24 years, and between 55 and 65 years, as well as people with just primary education, show a lower incidence of stress.

11

Table 7: Composition of the sample over reported experience of stress

Variables	Reports stress?				Total	
	No		*Yes*			
	Percent	95% CI	Percent	95% CI	Percent	95% CI
Age						
16- (n=3,777)	30.3	[29.42,31.19]	24.8	[23.17,26.50]	29.2	[28.42,29.99]
25- (n=2,693)	20.32	[19.55,21.10]	22.85	[21.27,24.52]	20.82	[20.13,21.53]
35- (n=2,609)	19.02	[18.28,19.79]	24.8	[23.17,26.50]	20.17	[19.49,20.87]
45- (n=2,238)	17.11	[16.40,17.85]	18.07	[16.63,19.61]	17.3	[16.66,17.96]
55- (n=1,617)	13.25	[12.61,13.92]	9.48	[8.41,10.68]	12.5	[11.94,13.08]
Gender						
Male (n=5,781)	46.7	[45.74,47.66]	34.86	[33.04,36.72]	44.35	[43.50,45.21]
Female (n=7,253)	53.3	[52.34,54.26]	65.14	[63.28,66.96]	55.65	[54.79,56.50]
Indigenous						
No (n=11,325)	86.4	[85.73,87.05]	91.3	[90.14,92.33]	87.37	[86.79,87.93]
Yes (n=1,637)	13.6	[12.95,14.27]	8.7	[7.67,9.86]	12.63	[12.07,13.21]
Level of education						
None (n=45)	0.36	[0.26,0.50]	0.4	[0.22,0.75]	0.37	[0.28,0.49]
Primary (n=4,261)	36.45	[35.50,37.41]	28.74	[26.99,30.55]	34.88	[34.04,35.73]
Secundary (n=3,797)	30.74	[29.83,31.67]	32.4	[30.58,34.26]	31.08	[30.26,31.91]
High school (n=2,471)	20.35	[19.56,21.16]	19.73	[18.22,21.35]	20.23	[19.52,20.95]
Vocational (n=1,411)	10.5	[9.91,11.13]	15.64	[14.26,17.12]	11.55	[10.99,12.13]
University (n=232)	1.59	[1.36,1.86]	3.09	[2.48,3.85]	1.9	[1.67,2.16]
Unemployed						
Unemp:no (n=12,828)	98.49	[98.23,98.70]	98.8	[98.29,99.15]	98.55	[98.33,98.74]
Unemp:yes (n=189)	1.51	[1.30,1.77]	1.2	[0.85,1.71]	1.45	[1.26,1.67]
Self-reported ill health						
Below median (n=7,187)	58.01	[57.06,58.95]	43.53	[41.63,45.45]	55.14	[54.29,55.99]
Above median (n=5,847)	41.99	[41.05,42.94]	56.47	[54.55,58.37]	44.86	[44.01,45.71]
One or more shocks in the last 5 yrs						
No (n=8,553)	67.5	[66.59,68.39]	60.75	[58.84,62.62]	66.16	[65.34,66.97]
Yes (n=4,375)	32.5	[31.61,33.41]	39.25	[37.38,41.16]	33.84	[33.03,34.66]
Victimization						

No (n=7,725)	94.82	[94.26,95.34]	89.45	[87.92,90.81]	93.69	[93.15,94.20]
Yes (n=520)	5.18	[4.66,5.74]	10.55	[9.19,12.08]	6.31	[5.80,6.85]
Household size						
Five or less (n=7,044)	53.21	[52.25,54.16]	57.44	[55.52,59.33]	54.04	[53.19,54.90]
More than five (n=5,990)	46.79	[45.84,47.75]	42.56	[40.67,44.48]	45.96	[45.10,46.81]

Elaborated with data from MxFLS 2009-2012.

5. RESULTS

5.1. Intercept models

Table 8 reports results from an intercept regression model (equation 1) at municipal and locality level respectively. The intra-class correlation coefficient (ICC) indicates that place characteristics explain little of the residual variation in individual depression symptoms and feelings of sadness (between 2 and 3 percent), but much more of the variation in reported feelings of stress, between 11 and 12 percent. A likelihood ratio test comparing each multilevel model to a single-level model indicates that a multilevel model is to be preferred in all cases.

Table 8: Intercept models

	(1)	(2)	(3)	(4)	(5)	(6)
Place effects:	Municipality			Locality		
	Depression score	Sadness	Stress	Depression score	Sadness	Stress
Constant	25.138***	-0.661***	-1.528***	25.122***	-0.664***	-1.541***
	(0.168)	(0.042)	(0.076)	(0.166)	(0.041)	(0.078)
lns1_1_1						
Constant	0.269**	-1.092***	-0.432***	0.264**	-1.095***	-0.386***
	(0.105)	(0.105)	(0.093)	(0.106)	(0.104)	(0.092)
Observations	13915	13034	13034	13584	12718	12718
Log-likelihood	-51576	-8254	-6249	-50390	-8058	-6101
Multi vs single level	137.579	182.340	477.131	127.012	178.409	487.166
ICC	0.017	0.033	0.114	0.017	0.033	0.123

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

5.2. Regressions with municipal level random intercepts

Table 9 reports results for municipality random intercept models of depression symptoms, feelings of sadness and experience of stress, as a function of individual and municipal characteristics. Coefficients in columns (2) and (3) are exponentiated.

Several individual characteristics are significantly correlated with all three psychosocial wellbeing outcomes. Women, people with worse self-reported health, individuals who experienced a shock over the previous years, and those who were victim of a violent crime have a higher predicted depression score, and a higher predicted probability of reporting feelings of sadness and stress, on average and ceteris paribus. For instance, the mean predicted depression score is 27.9 for women, versus 25.4 for men; the probability

13

of experiencing sadness is 1.6 times higher for women than for men, and that of experiencing stress is 70% higher for women than for men. The predicted depression score for people who have been the victim of a violent crime is 28.6, versus 26.7 for people who have never been victimized. The former group is also 66% and 87% more likely to experience sadness and stress, respectively.

Other individual characteristics that show some significant correlations with the three outcomes are education, age, unemployment status, assets and household size. Having higher education, whether technical or university, is associated with lower depression scores compared to having no formal schooling, while it does not show any significant relationship with the probability of reporting feelings of stress or sadness. Being older is associated with a higher probability of feeling sadness and a lower probability of feeling stress. Being wealthier and having a larger family are both associated with lower stress. In contrast, being unemployed is associated with an increase by 84% in the probability of experiencing feelings of sadness, while it does not seem to alter depression symptoms or stress.

With respect to municipal characteristics, living in a municipality with a high level of poverty does not appear to influence depression symptoms or sadness, while it is associated with a lower probability of experiencing stress, as Figure 3 shows. Living in a municipality with high inequality and violence is not significantly related with psychosocial wellbeing, on average. In contrast, living in a municipality with a high rate of unemployment is negatively and significantly associated with all three measures of psychosocial wellbeing.

Figure 4 shows this for depression symptoms. For instance, a one point increase in the unemployment rate is associated with a 0.41 increase in depression score, a 9% increase in the probability of experiencing sadness, and a 10% increase in the probability of experiencing stress.

The estimation of random slope models (not reported to save space but available upon request) indicates no evidence of spatial heterogeneity in the relationship between municipal characteristics and psychosocial wellbeing: for instance, a high rate of unemployment has the same kind of negative relationship with psychosocial wellbeing in both the north and south of the country.

**Figure 3: Predicted probability of experiencing stress as a function of municipal poverty rates**
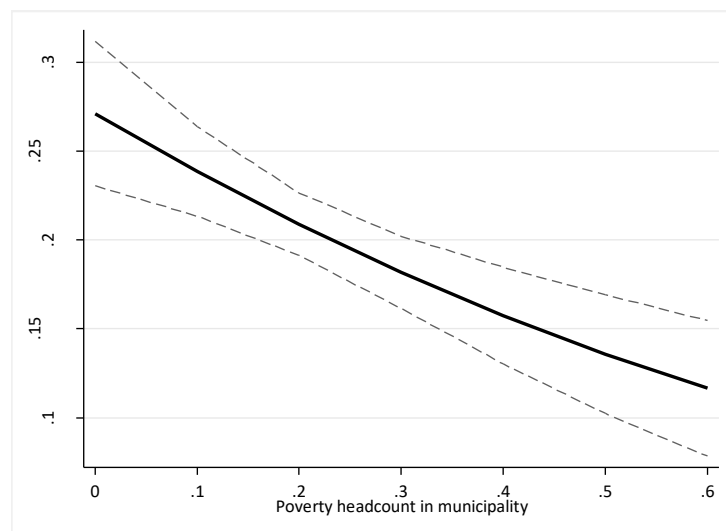
Table 9: Regressions with municipal level random intercepts

	(1) Depression score	(2) Sad	(3) Stress
Incidence of food poverty 2010	-1.593	0.999	0.164***
	(1.145)	(0.325)	(0.077)
Gini coefficient 2010	6.644	2.957	0.349
	(5.463)	(4.560)	(0.751)
Unemployment rate in municipality	0.405***	1.090***	1.099***
	(0.086)	(0.026)	(0.038)
Homicides/100'000 inhab	-0.002	0.998	0.999
	(0.003)	(0.001)	(0.001)
Age	-0.009	1.005*	0.993**
	(0.008)	(0.003)	(0.003)
Female	2.549***	2.576***	1.670***
	(0.172)	(0.140)	(0.104)
Indigenous	0.207	1.078	0.970
	(0.299)	(0.096)	(0.109)
Household size	-0.001	0.998	0.974**
	(0.035)	(0.011)	(0.013)
Education: Primary	-1.664	1.256	0.725
	(1.244)	(0.479)	(0.312)
Education: Secondary	-1.650	1.363	1.047
	(1.255)	(0.524)	(0.455)
Education: High school	-1.804	1.232	1.037
	(1.271)	(0.480)	(0.457)
Education: Vocational	-2.431*	1.031	1.501
	(1.279)	(0.405)	(0.663)
Education: University	-2.479*	1.168	2.015
	(1.373)	(0.493)	(0.940)
Unemployed	1.203	1.842***	0.780
	(0.764)	(0.415)	(0.228)
Assets index	0.159	1.023	0.903***
	(0.097)	(0.030)	(0.033)
Self-reported bad health	2.620***	1.737***	1.617***
	(0.130)	(0.071)	(0.075)
One or more shocks in the last 5 yrs	0.991***	1.391***	1.225***
	(0.182)	(0.076)	(0.076)
Victim	1.886***	1.662***	1.869***
	(0.346)	(0.171)	(0.199)
Observations	7535	7535	7535
Log-likelihood	-25683.278	-4485.247	-3680.372
Chi2	71.824	37.456	107.782
ICC	0.019	0.021	0.052

Coefficients for columns (2) and (3) are exponentiated. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Figure 4: Predicted depression score as a function of unemployment rates in the municipality
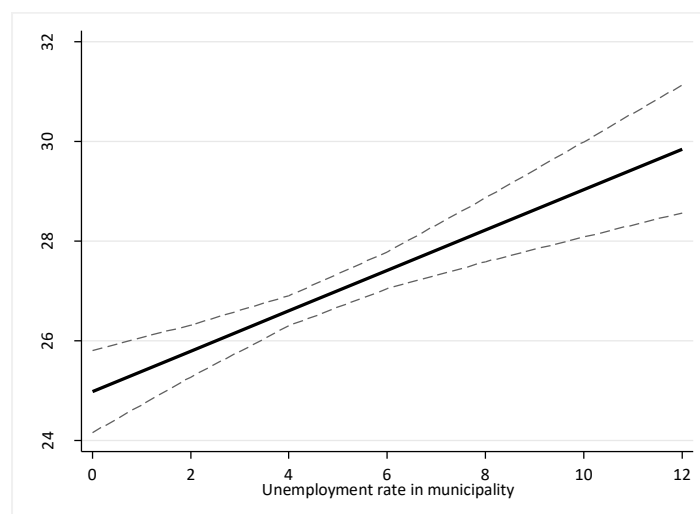
5.3. Regressions with locality level random intercepts

Table 10 shows the results for the locality random intercept regression for individual depression score, and for the probability of experiencing sadness and stress. The individual characteristics that were significant in the municipal random intercept models remain significant also at locality level. With respect to individual characteristics that reflect the person's immediate environment, we find that living in a dwelling surrounded by waste is associated with a 1.1 points higher depression score ($p < 0.10$), and with a 54% higher probability of experiencing stress ($p < 0.05$). Living in a place where the availability of amenities is higher is also associated with a higher depression score and a higher probability of experiencing stress. The value of the amenities index increases with the size of the local population and is a proxy for the degree of urbanization of the locality, suggesting that living in an urban environment is associated with a higher level of stress on average. As in the case of municipal effects, the estimation of random slope models by locality (available upon request) indicates no evidence of spatial heterogeneity in the relationship between locality characteristics and psychosocial wellbeing.

Table 10: Regressions with locality level random intercepts

	(1) Depression score	(2) Sadness	(3) Stress
Waste	1.097*	1.050	1.535**
	(0.608)	(0.195)	(0.326)
Garbage	-0.435	0.851	0.651
	(0.834)	(0.217)	(0.218)
Gangs	0.357	1.156	0.956
	(0.356)	(0.119)	(0.143)
Drugs	0.254	1.017	0.954
	(0.378)	(0.112)	(0.150)
Amenities index	0.400***	1.020	1.174***
	(0.128)	(0.038)	(0.063)
Community participation	-0.127	1.113	1.016
	(0.369)	(0.120)	(0.156)
Closing-down	-0.779	0.913	1.005

	(1)	(2)	(3)
	(0.698)	(0.184)	(0.290)
Age	-0.013	1.005*	0.993**
	(0.009)	(0.003)	(0.003)
Female	2.601***	2.577***	1.629***
	(0.180)	(0.146)	(0.105)
Indigenous	0.127	1.077	0.895
	(0.305)	(0.098)	(0.106)
Household size	0.015	0.999	0.980
	(0.036)	(0.011)	(0.013)
Education: Primary	-1.456	1.286	0.922
	(1.288)	(0.505)	(0.443)
Education: Secondary	-1.530	1.342	1.305
	(1.301)	(0.532)	(0.631)
Education: High school	-1.588	1.318	1.321
	(1.318)	(0.530)	(0.646)
Education: Vocational	-2.558*	1.008	1.883
	(1.326)	(0.409)	(0.924)
Education: University	-2.490*	1.163	2.379*
	(1.425)	(0.507)	(1.225)
Unemployed	1.236	1.914***	0.708
	(0.799)	(0.449)	(0.220)
Assets index	0.221**	1.053	0.903**
	(0.106)	(0.034)	(0.037)
Self-reported bad health	2.649***	1.749***	1.590***
	(0.137)	(0.075)	(0.077)
One or more shocks in the last 5 yrs	1.033***	1.410***	1.265***
	(0.191)	(0.081)	(0.083)
Victim	1.726***	1.636***	1.755***
	(0.365)	(0.177)	(0.197)
Observations	6961	6961	6961
Log-likelihood	-23764.260	-4145.237	-3388.835
Chi2	57.594	41.739	102.435
ICC	0.021	0.027	0.065

Coefficients for columns (2) and (3) are exponentiated. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

5.4. Variation across individuals

We investigate how the relationship between place characteristics and psychosocial wellbeing varies across different groups of individuals by estimating variations of equation (6). The term of interest is $\gamma_{11}X_{ij}Z_j$, which models the fixed part of the interaction between individual level and place level characteristics. The individual level characteristics we focus on are gender, age, wealth and employment status. We only show our main findings to save space, but complete results are available upon request.

5.4.1. Gender

The depression score of women increases significantly with the unemployment rate of the municipality where they live, as Figure 5(a) shows: women living in high-unemployment municipalities score about 5 points higher compared to women living in low-unemployment areas. In contrast, the depression score of men does not seem to be significantly influenced by local unemployment. The negative relationship between local unemployment and women's psychosocial health is significantly stronger for women with

larger household sizes, as Figure 5(b) shows. Women's psychosocial health is also more likely than men's to suffer from local violence and crime rates: an increase in the local number of homicides by 10% is associated with an increase in the depression score of women by 0.07, and with a higher probability of experiencing stress for women than for men.

**Figure 5: Predicted depression score by gender as a function of local rates of unemployment**
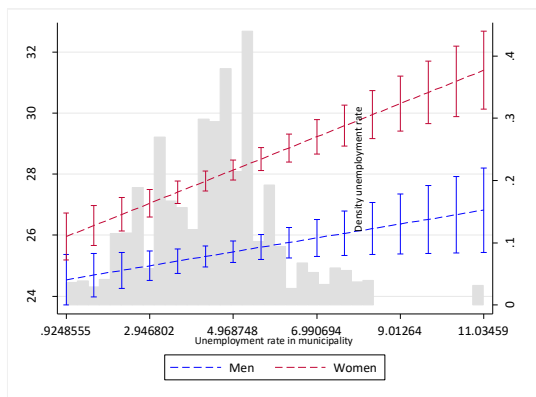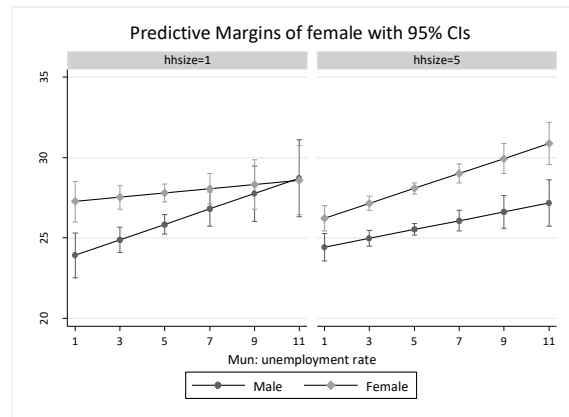
(a)   (b)

5.4.2. Age

The severity of depression symptoms among younger people is not significantly related to local employment conditions. In contrast, the depression score of older people increases significantly with the local rate of unemployment: the depression score of older people living in high unemployment areas is about 10 points higher compared to older people living in low unemployment areas, as Figure 6 shows. A similar relationship holds for the probability of experiencing sadness. In contrast, the average marginal effect of local inequality is to significantly increase depression symptoms among people younger than 35, as Figure 7 shows. Meanwhile, the average marginal effect of local amenities is to decrease depression symptoms among people younger than 50, but does not moderate the relationship between age and depression among older people, as Figure 8 shows.
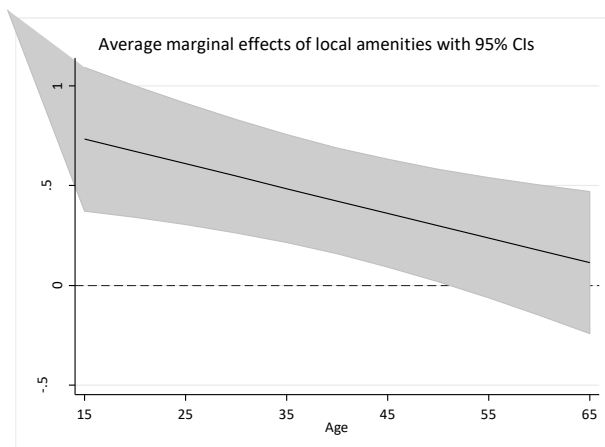
Figure 6: Predicted depression score for younger and older people, as a function of local rates of unemployment
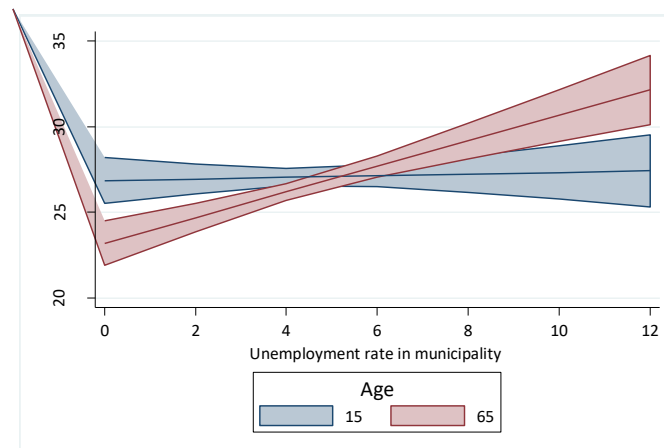
Figure 7: Average marginal effects of local inequality on depression symptoms, by age
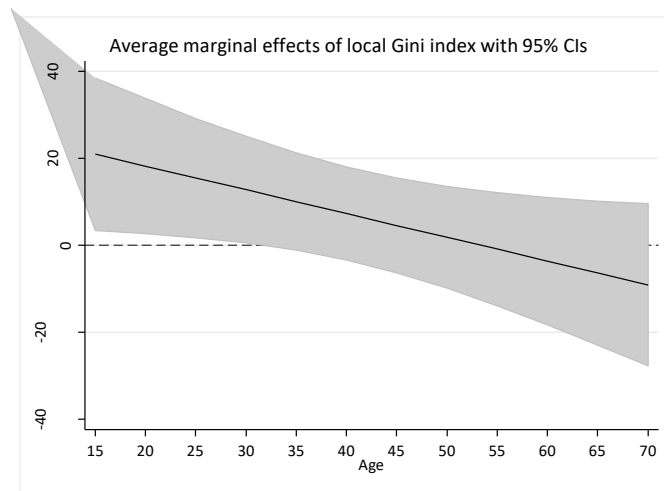
Figure 8: Average marginal effects of local amenities on depression symptoms, by age

5.4.3. Individual wealth

Living in a poor place increases depression symptoms for wealthier individuals, and decreases them for poorer individuals (Figure 9a). There are at least two possible interpretations for this finding. First, it could be evidence supporting a "relative income" hypothesis: it is not just absolute wealth, but wealth compared to others what determines wellbeing. A society with highly polarized social classes could affect the psychosocial wellbeing of the minority upper class as there is less social cohesion, isolation and/or a higher need of protection against crime or social unrest (Wilkinson 1997), or by an intrinsic aversion to inequality (Fehr & Schmidt 1999).

Another (not necessarily mutually exclusive) interpretation is a "big fish in a small pond" type of hypothesis: poorer places impose material constraints to the development potential and capabilities of individuals, and these constraints are felt more strongly by wealthier individuals. This may happen especially if the reference group that wealthier people in poor places use to form their aspirations and expectations about the future is composed by wealthy individuals living in a richer environment that offers more opportunities (an argument akin to Ray's (2006) "aspiration window" and "aspirations gap").

Figure 9(b) shows that depression symptoms of wealthier people also increase with local inequality, while no significant difference is observed among poorer people. Given that there is no strong correlation between local poverty and inequality (Figure 9(c)), Figure 9(b) appears to lend some support to the "relative income" and aversion to inequality interpretation.

A similar pattern of differences between wealthier and poorer individuals is found for the experience of feelings of sadness (not shown). In contrast, Figure 9(d) shows that at high levels of local poverty, poorer people have a significantly higher probability of experiencing stress compared to wealthier people. Meanwhile, at low levels of local poverty, the probability of experiencing stress is not significantly different between the two groups.

Figure 9: Predicted psychosocial wellbeing by personal wealth over local poverty and inequality levels

(a)   (b)

(c)   (d)
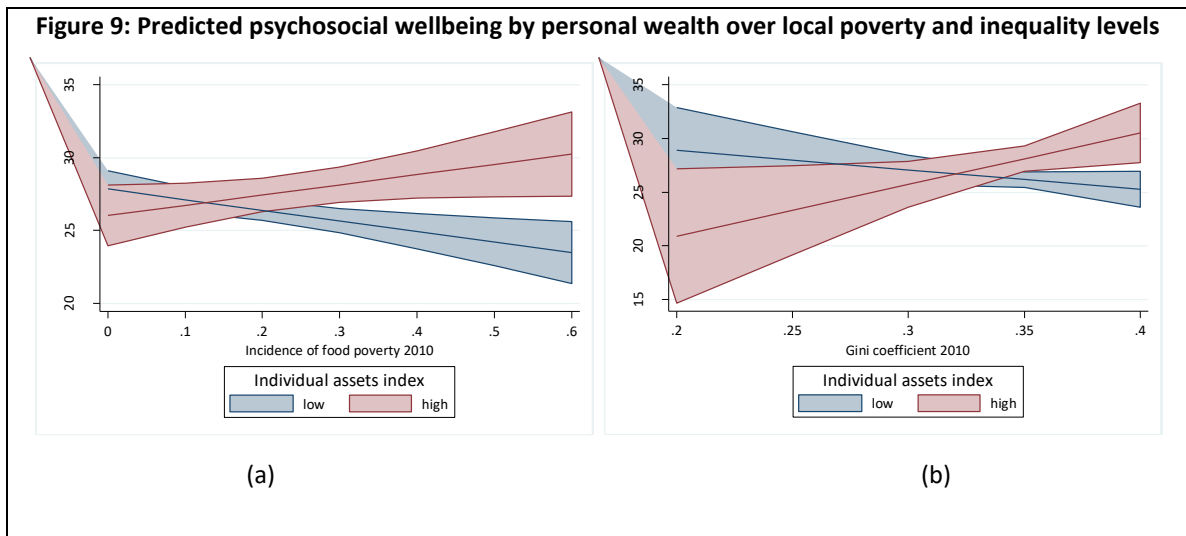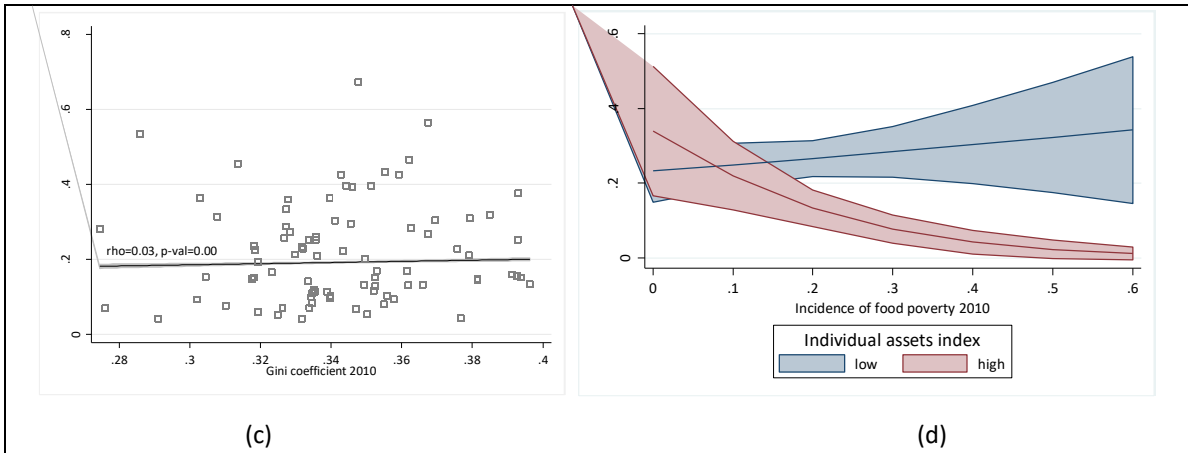
5.4.4. Employment status

At low levels of local poverty, there are no significant differences in the intensity of depression symptoms of employed and unemployed people. In contrast, depression symptoms in poor places are significantly higher among unemployed individuals than among employed people, as Figure 10(a) shows. Depression symptoms among unemployed people living in poorer places are strongest for people who live alone, compared to people who belong to a larger household, as Figure 10(b) shows. Importantly, individual employment status does not moderate the relationship between psychosocial wellbeing and local unemployment levels: high local unemployment levels decrease individual psychosocial wellbeing of employed and unemployed individuals alike.

Figure 10: Marginal effects of individual unemployment on depression symptoms, by levels of local poverty

(a)   (b)
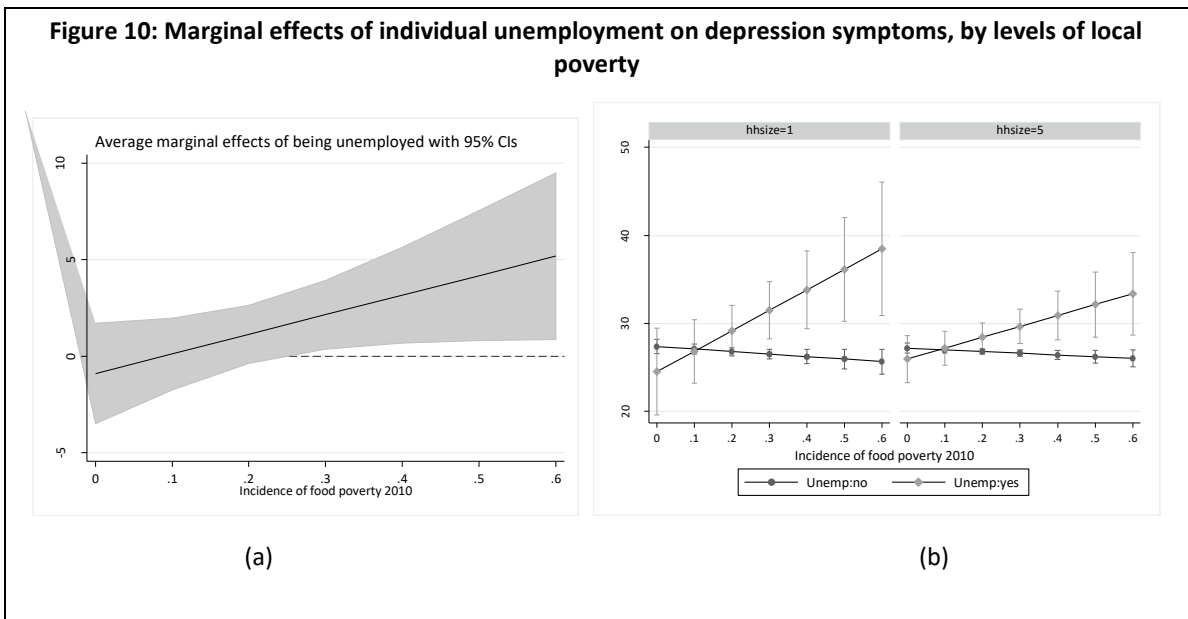
6. CONCLUSIONS

This paper described the relationship between individual psychosocial wellbeing of working age Mexicans and the characteristics of the place they live. We explored psychosocial wellbeing in terms of depression symptoms, self-reported feelings of sadness and experience of stress; analysed place characteristics at the level of municipality and at the level of locality; and investigated heterogeneities in the relationship between place characteristics and psychosocial wellbeing by gender, age, individual wealth and employment status.

Our aggregate results suggest that the local level of unemployment is a critical determinant of individual psychosocial wellbeing, regardless of the employment status of the individual. Meanwhile, local levels of poverty are significantly associated with lower individual stress on average. There is, however, evidence of heterogeneity in how place characteristics affect the psychosocial wellbeing of different groups.

First, local unemployment levels tend to harm women more than men, and older more than younger people. Second, local poverty increases the depression symptoms and feelings of sadness of wealthier people, but, at high levels of local poverty, poorer people are significantly more likely to experience stress compared to wealthier people. Moreover, local poverty significantly worsens the psychosocial wellbeing of unemployed people. Third, an increase in local inequality harms the psychosocial wellbeing of younger people, while it does not seem to affect individuals older than 35. Fourth, an increase in the provision of local amenities can improve psychosocial wellbeing among people younger than 50, but it does not seem to moderate the relationship between age and depression among older people.

As a next step, we plan to investigate these relationships further, by exploiting the longitudinal nature of the data and a difference-in-difference framework relating changes in outcomes to changes in place characteristics, to establish the existence of causal relationships between place characteristics and individual psychosocial wellbeing.

APPENDIX

Figure 1: Individual characteristics, place features and psychosocial wellbeing
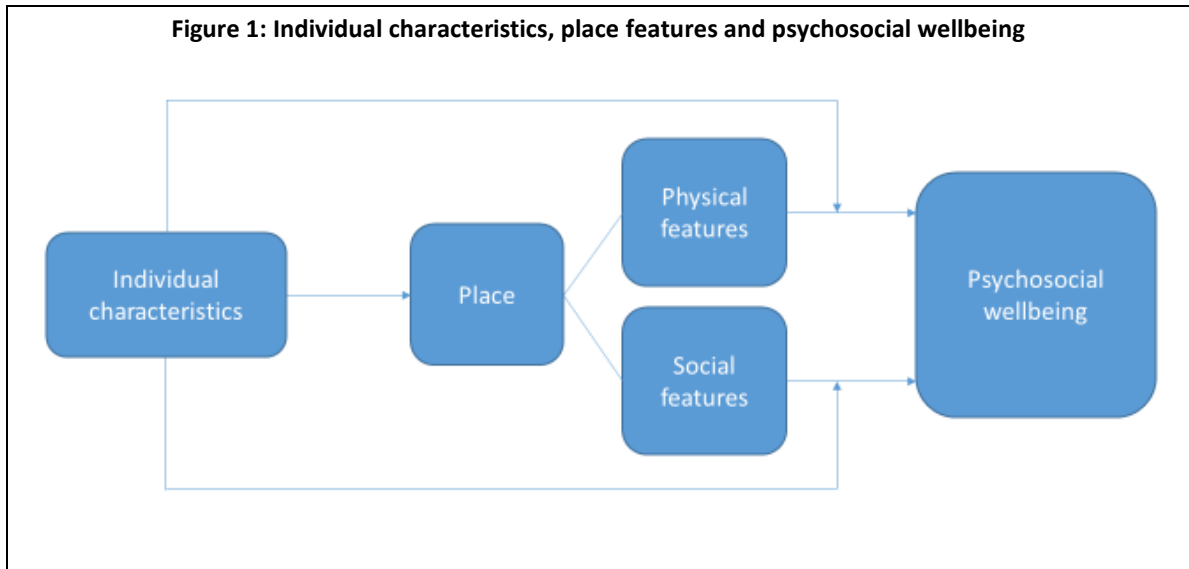
Source: Authors' elaboration

Construction of indices

We construct the following two indices: (a) an index of assets, as a proxy for individual wealth; (b) an amenities index at locality level. Each index is constructed using polychoric principal component analysis (PCA) (Kolenikov & Angeles, 2009). This method assumes that the observed ordinal variables are underlain by latent continuous and normally distributed variables, whose correlation matrix can be decomposed using PCA. Polychoric PCA is specifically designed to deal with ordinal and continuous variables. It also has the additional advantage that it allows computing coefficients of both having and not having a characteristic, which sometimes conveys more information than having it.

Assets index: Assets are used to proxy individual wealth since they can better capture long-term wealth and tend to be less volatile compared to income and consumption (Sahn et al., 2003). The index summarizes information on ownership of consumer durables, housing quality and basic services, captured by, respectively, (a) a set of five dummy variables measuring whether a household member owns a bike, a vehicle, an electronic device, a washing machine or heater, other electrical appliances; (b) a set of four dummy variables equal to one if the house has brick or plastered wall, a sturdy roof (such as corrugated iron, tiles or concrete), a floor made of finished material (such as cement, tile or a laminated material), and if no household member has to sleep in the kitchen; and (c) a set of four dummy variables equal to one if the house has electricity, drinking water inside the dwelling, toilet inside the dwelling, and whether the household uses gas or electricity to cook. A higher value of the index indicates higher wealth. The proportion of the variance explained by the first component is 0.51. Table x shows the estimated coefficients of the variables composing the wealth index.

Table 11: Individual assets index: Polychoric PCA coefficients

Variable		Coefficient
Vehicle	*No*	-0.154
	Yes	0.278
Electronics	*No*	-0.615
	Yes	0.052
Washing machine	*No*	-0.602
	Yes	0.072
Appliances	*No*	-0.578
	Yes	0.085
Electricity	*No*	-0.700
	Yes	0.012
Water	*decanter*	0.204
	tap inside	-0.136
	tap outside	-0.342
	truck	-0.390
	gathered	-0.507
Sanitation	*toilet*	0.148
	latrine	-0.279
	black hole	-0.435
	no sanitation	-0.611
Floor	*wood/stone/carpet*	0.323
	cement	-0.112
	unfinished material	-0.526
Walls	*brick/concrete*	0.116
	adobe	-0.340
	wood/asbestos	-0.515
	unfinished material	-0.747
Roof	*beam/concrete/slate*	0.134
	asbestos	-0.208
	wood/metal/plastic	-0.315
	unfinished material	-0.527
Bedrooms	*number*	0.198

Source: Authors' calculations using data from the 2009 MxFLS

Amenities index: Summarizes information on a set of five dummy variables which indicate whether the locality where the individual lives offers the following amenities: the physical infrastructure for a wholesale market; a post office; a library; a theatre; and green areas. A higher value of the index indicates a higher presence of amenities. The proportion of the variance explained by the first component is 0.88. Table x shows the estimated coefficients of the variables composing the amenities index.

Table 12: Local amenities index: Polychoric PCA coefficients

Variable		Coefficient
Market	No	-0.310065
	Yes	0.409244
Post office	No	-0.309366
	Yes	0.420611
Library	No	-0.385718
	Yes	0.319215
Theater	No	-0.194499
	Yes	0.584628
Park	No	-0.239498
	Yes	0.442379

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