Why people (continue to) live near mining and industrial sites? Empirical evidence from France, Portugal and Spain

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Abstract: This article claims to empirically identify the main determinants that explain why households live and continue to live near mining and industrial hazardous wastes. Representative household survey were implemented in three European over-polluted sites at the end of 2018 and beginning of 2019: Viviez in France (an ex-mining site rehabilitated in chemical complex), the Sierra Minera of Cartagena in Spain (combining an ex-mining site and an active petro-chemical complex); Estarrega in Portugal (an active petro-chemical complex). For each area, we also collected data from households living in neighboring, but cleaner, areas in order to compare over-polluted areas to lower-polluted reference points. Based on this comparative dataset, we employ multivariate binomial regressions and instrumental variables strategy (based on anthropometric indicators) to estimate the impacts of socioeconomic factors on the probability of living in an over-polluted areas against in cleaner areas. Then, using interaction terms, we analyze the factors that determine the intention to move out in the next 5 years against the choice to stay. Our results suggest that the probability of living near over-polluted sites is strongly guided by socioeconomic factors. Indeed, ceteris paribus, a 10% decrease in owned assets, educated members and incomes increases by about 12.5, 9 and 9.3 percentage points the risk of living in over-polluted areas, respectively. Although education factor remains an important causal predictor of the intention to move out over-polluted areas, household economic factors (i.e. incomes and wealth) do not infer the move-out intention. Even if residents seem correctly aware about pollution exposure and related health risks, they often choose to stay in over-polluted areas for demographic (aging) and emotional reasons (attachment to place). These results have important involvements in terms of public policy.

Keywords: Europe; exposure to pollution; residential choice; socioeconomic status; instrumental variables strategy.

INTRODUCTION

First, we seek to identify how household socioeconomic factors affect people's decision to live in an over-polluted area, i.e. their pollution exposure. Second, we investigate the social and economic determinants of the decision to move away in the next five years, i.e. causes of emigration choice due to pollution exposure.

To our knowledge, it is the first study that empirically explores the social and economic determinants of the risk of living and staying in over-polluted lands at the household and individual level. More specifically, our contribution to the literature is to assess the causal impacts of socioeconomic status on pollution exposure and emigration choice. Our analysis also includes individual specific variables such as risk perception, which are often omitted in residential location models. Another contribution of this study is to conjointly analyze the *admitted* determinants of the probability of living and staying in an over-polluted site (i.e. economic and social circumstances and misunderstanding of risks), as well as the more *hidden* determinants revealed by the psychological and sociological literature, such as attachment to place and industry-related advantages (Devine-Wright, 2011 ; Flanquart, Hellequin and Vallet, 2013). See Schirmer, Eggermond and Axhausen (2014) for an exhaustive literature survey about the determinants of (re)location choice models. For a more specific literature survey about the socioeconomic determinants of pollution exposure, see Bowen (2002). For a literature survey on the effects and interactions between social position and pollution exposure on health, see O'Neill et al. (2003). See Dielemann (2001) for a review of residential mobility determinants. See Millock (2015) for a review of the literature on migration due to environmental factors. See Schaeffer et al. (2016) and Schaeffer and Dissart (2018) for literature surveys regarding the impacts of natural amenities on locational choice.

Despite the strong development of (re)locational choice models these last decades, empirical evidence on the relationship between socioeconomic status and pollution exposure remain scarce in the literature. Moreover, the causality of the relationship has not been clearly established. Indeed, the existing literature clearly identifies a negative relationship between household socioeconomic status and pollution exposure (e.g. Jerrett et al., 2001), but to our knowledge, no work infers a causal impact. Among the rare studies that approach a semblance of causality, we find the article of Bae (1997) who focus on the inverse relationship, i.e. how pollution exposure influences health indicators and inequality indices at the community level. More specifically, this author shows that after the implementation of an air quality management plan in 1989 in the Los Angeles region, welfare gains (health benefits, home price increases for homeowners, unemployment decrease, etc.) were higher for households living in poor communities (typically polluted) than households living in rich communities (less polluted). Moreover, intra-income inequalities (measured by a GINI index) improved in most communities. Hence, the rehabilitation of over-polluted neighborhoods would mainly benefit to poor households. Nonetheless, another interpretation could explain the results. Insofar as environmental-friendly policies make poor and polluted neighborhoods ecologically more attractive, richer households are likely to move in these “cleaned” neighborhoods. In other words, the GINI index could artificially decrease and health benefits could be a statistical artifact if, at a larger level (regional, national end even international), health and income inequalities have not decreased. Poor people could have just move to less expensive -and probably more polluted- lands. Indeed, considering the dual world of Tiebout (1956), where the poorest lives in over-polluted lands and the richest in clean areas, it is likely that relocation alternatives for poor households are cheaper –and thus more polluted- than the ex-polluted land where they left (after the housing price increase). Consequently, further studies must identify the real impact of ecological rehabilitation programs on health improvement and poverty reduction, as well as explore the relocation behaviors of poor households. Decision makers should design rehabilitation programs by minimizing these potential move-outs in order that poor households really benefit from such interventions. Obviously, before implementing such programs, it is necessary to better identify the socioeconomic determinants of the probability of living and staying in over-polluted areas, hence the realization of the following work.

DATA

An original data set

From the last trimester of 2018 and the beginning of 2019, we implemented three original comparative household surveys, among 1194 households in France, Portugal and Spain, especially designed to study the socioeconomic issues of pollution exposure. These surveys form a unprecedented database, called Comparative Survey on Pollution Exposure (CSPE), which is representative of three over-polluted areas: Viviez in France (156 households and 293 individuals); the municipality of Estarreja in Portugal (300 households and 800 individuals); and three villages of the Spanish Sierra Minera (Portman, Estrecho de San Ginès, Alumbres) located to the East of Cartagena (228 households and 557 individuals). We also collect representative data in neighboring and analogous low-polluted areas to have reference points and better identify the effects related to pollution exposure. These control areas are: Montbazens in France (138 households and 309 individuals); the municipality of Vagos in Portugal (200 households and 500 individuals); and a group of villages (Portus, Galifa, Perin, La Corona, Cantera, Molinos

Marfagones) located to the West of Cartagena in Spain (172 households and 452 individuals). The over- and low-polluted study-areas are shown in Figure 1.

(insert Figure 1 mapping the three areas, source OSM geodata)

It is important to note that this quantitative survey is initially designed to complete a set of well-documented qualitative interviews. Although the results from these qualitative fieldworks are not directly included in this article, they have strongly contributed to our understanding of the study context and issues.

Context of study-areas

The three study-areas have specific mining and industrial experience that make their comparison highly generalizable to a large spectrum of pollution contexts. In the following paragraphs, we describe the selected over-polluted areas by confronting their historical, demographic and socioeconomic characteristics. Based on the CSPE database, Table 1 compares socio-demographic and economic characteristics between over-polluted sites and their respective control areas, as well as related local advantages and variables linked to community satisfaction and involvement in community tasks. Moreover, Table 2 provides complementary information based on data from the French, Spanish and Portuguese national statistics institutes.

(insert Table 1 and Table 2)

The Spanish Sierra Minera is an ex-mining site that was particularly active between 1957 and 1990 through the activity of a French multinational company called Peñarroya (first mining activities date back to the Roman time). Since the decline of the mining activity, few industrial alternatives have been developed and several villages have become ghost-mining towns with uncertain future development perspectives (Conesa, Schulin and Nowack, 2008 ; Banos-Gonzales and Baños Paez, 2013 ; Littlewood, 2014), such as Portman and Estrecho de San Ginès (ESG). By comparing Portman and ESG to other towns located to the West side of Cartagena (control group), Table 1 shows that lower housing prices, household incomes and employment rates, but higher unemployment rates, characterize such ex-mining sites. Table 1 also indicates a lower perceived availability of services and retails in these areas.

Alumbres is a small city located at the foot of the Sierra Minera (between Cartagena and La Union) not directly concerned by ex-mining activities (but probably exposed to toxic winds of heavy metal residuals). Alumbres is of particular interest because this small city has prospered alongside the gradual development of a large petro-chemical complex since 1950. Now, this industrial site includes an oil refinery (Repsol), a gas plant (Enagas), an electrical central transforming fuel oils and gas (Iberdrola), a factory of white minerals oils, natural sulfonates and sulfuric acid (Aemedsa), a fertilizer industry (Quimica del Estroncio), and, a producer of lubrication bases (Ilboc). As shown in Table 1, there is no significant difference between Alumbres and Molinos Marfagones (control group) in terms of housing price, employment, unemployment and perceived retails availability. Note that the significant difference regarding the availability of public services might be due to a size effect because of Molinos Marfagones is a larger city than Alumbres.

As Alumbres in Spain, the Portuguese region of Estarreja hosts an active industrial site since 1946. First, ammoniac, chlorine-sodium and PVC manufactures installed in Estarreja respectively in 1946, 1956 and 1960.[1] Then, since 1977, several hydrocarbon-related industries have begun their activity. Nowadays, Estarreja hosts six complementary industries producing a large number of chemical products and other derived goods (CUF, Quimigal, Dow, IRES, A.Q.P and Air Liquide). Hence, Estarreja has the specificity to be an active petro-chemical complex without any mining past. In fact, this enormous industrial complex has made the area more dynamic and has improved the average socioeconomic and demographic characteristics of the area. Indeed, as suggested by Table 1, the municipality of Estarreja shows better average characteristics than the municipality of Vagos. Yet Inácio, Neves and Pereira (2014) and Guihard-Costa et al. (2012) explain that both municipalities have the same potentials in terms of location and resources, except that Estarreja has a chemical complex while Vagos only has a smaller steel company.

The case of Viviez in France is particularly interesting because it makes the transition between an ex-mining site and an active industrial site. While the zinc exploitation began in 1855, an international company (Vieille Montagne) undertook a large-scale industrialization of mines by extracting, transforming and exporting zinc since 1871. In 1922, the site is the first factory that adopts electrolysis technic to chemically extract zinc from other minerals/materials. Although the mining activity definitely stopped in 1987, the company (recalled UMICORE) continues to transform zinc and other metals. In addition, Viviez has benefited from the arrival of several industries after the decline of the mining activity (recycling heavy metals residuals in batteries since 1981 - SNAM, plastic recycling industry since 1987 – SOPAVE, and a Chinese metallurgic industry since 1966 in liquidation proceeding - SAM). The intense mining activity has strongly polluted the area, partly due to the rejection of heavy metal residuals. For instance, earth analyses show a high concentration of cadmium (maximum concentration greater than 4200 mg/kg), lead

[1] Portuguese data are still missing, hence tables and figures are incomplete (expected for the beginning of February).

(18 490 mg/kg) and arsenic (11020 mg/kg) in Viviez soils. In reaction to these alarming measures, the French Institute of Public Health conducted a health study in 2008 comparing individuals from Viviez and a neighboring municipality with lower soil pollution indices, Montbazens (Durand, Sauthier and Schwoebel, 2011). The study shows important health risks in Viviez, mainly due to the ingestion of local food products and contact with contaminated soils and dusts.[2] The study also finds a disproportionate mortality rate in Viviez, namely due to nephropathy (kidney disease) compared to the lower polluted municipality of Montbazens. Among the measures following this study, the French health services emitted recommendations for households' daily behaviors (avoiding contact with dust, reducing consumption of locally produced vegetables, cleaning toys, etc.). Interestingly, Table 1 shows that Viviez has mixed characteristics between Portman/ESG (an ex-mining site without industrial rehabilitation) and Alumbres/Estarreja (active industrial sites without mining activities). Considering the economic indicators available in Table 1, Viviez looks more like Portman/ESG than Alumbres. For instance, compared to Montbazens (control group), Viviez has lower housing prices, household incomes and employment rates (higher unemployment rates), as well as a lower perceived availability of public services and retails. As relevantly discussed by Flanquart, Hellequin and Vallet (2013), over-polluted lands may constitute an acceptable residential alternative for poor households insofar as such towns provide several (non-environmental) amenities at an affordable price. Indeed, Table 1 and Figure 3 show that residents more often mention to have chosen to live in Viviez and Portman/ESG for "interesting economic reasons" (e.g. affordable housing price) compared to residents from non-polluted areas, which more often mention "environmental amenities" as residential motivation. Note that social ties play an important role on residential motivations for all study-areas (Figure 3); even more mentioned than "professional reasons" and "economic reasons". Nonetheless, referring to Table 1, social ties is especially cited as a motivation for living in Alumbres and Estarreja (Table 1).

Contrary to Portman/ESG, Viviez has some similarities with Alumbres. Indeed, perceived area attractiveness and social cohesion are significantly lower in Viviez and Alumbres compared to their respective control groups. This low perceived area attractiveness might be due to the presence of an active industrial site, which frequently emits smokes, smells and noises near the Viviez and Alumbres downtowns. Other proofs support this assumption. While there are stronger intentions to move out for residents from Viviez and Alumbres compared to their respective control groups (Table 1), "environmental issues" appear as the most mentioned motivation for moving out (Figure

[2] In Viviez, lead poisoning was identified in children and pregnant women and residuals of cadmium were found in urinary samples. The study also shows higher absorptions of arsenic in individuals living in Viviez compared to Montbazens.

4). In contrast, the absence of significant gap in perceived area attractiveness between Portman/ESG residents and their counterparts is not surprising since there is no active industrial sites in these towns (i.e. mines closed since 1990). In addition, contrary to other over-polluted case study, Table 1 does not show significant gap in the intention to move out between Portman/ESG and their control group. Even when some residents would like to move out from Portman/ESG, "environmental issues" do not appear as mains motivations (Figure 4). In other word, the presence of past and invisible pollutions might not affect current perceptions about area attractiveness and attachment, nor emigration intentions.

Regarding risk perception indicators in Table 1, people living in over-polluted lands correctly identify a higher level of pollution, a higher exposure to heavy metal residuals and higher exposure-related health risks (except for Viviez) compared to people living in low-polluted areas. Moreover, as shown in Figure 5, respondents properly mention the main source of pollution into the area: i.e. mines in Portman/ESG, industry in Alumbres and Estarreja, and industry and, to a lower extent, mines in Viviez. Despite the good awareness about pollution exposure, people from over-polluted towns/cities systematically express the weakest levels of knowledge about health risks and anti-pollution protection measures (Table 1). This is particularly surprising in Viviez where public information campaigns followed the health study from the French Institute of Public Health (Durand, Sauthier and Schwoebel, 2011). Interestingly, people living in active industrial sites (e.g. Viviez, Alumbres, Estarreja) are more often risk-takers than their respective counterparts, whereas people living in an ex-mining site (e.g. Portman/ESG) are more often risk-averse than their counterparts.

In terms of declared health indicators, we find alarming results in Table 1. For the three over-polluted areas considered, residents' health statuses (regarding perceived health status and declared diseases) are globally worse than those of residents living in lower-polluted lands. Moreover, we note significant gaps regarding children birthweights and local-family member mortality. Indeed, children recently born in Viviez have a lower birthweight than those who born in Montbazens. Furthermore, respondents in Portman/ESG and Alumbres report a larger amount of premature deaths around them compared to their respective control group.Similarly, hospitalizations and medical visits, as well as absenteeism at work/school, tend to be higher in over-polluted lands than lower-polluted ones.

In a nutshell, our European sample makes possible to observe three benchmark stages which characterize numerous over-polluted areas around the world: ex-mining towns (Portman and ESG); ex-mining lands rehabilitated in chemical industrial sites (Viviez); and active and exclusive petro-chemical complexes (Estarreja, and to a lower extent Alumbres). Interestingly, demographic and socioeconomic indicators tend to be worse in the first group (ex-mining towns) and better in the third group (active chemical-industrial complexes). Concerning the second group (ex-mining lands rehabilitated in chemical industrial sites), demographic and socioeconomic indicators are mixed and suggest an intermediate stage between the two opposing stages. By contrast, area attractiveness and attachment appear to be stronger in the first group where pollution is invisible, and, lower in the second and third group where industries frequently emit noises, smells and smokes. Finally, it is worth noting that active industrial sites without direct mining past (e.g. Alumbres, Estarreja) dissociates themselves from (rehabilitated or not) ex-mining sites (e.g. Viviez, Portman/ESG) through higher community satisfaction and involvement (e.g. regular participations to community parties).

Confronting data to the existing literature

(insert Figure 2)

As shown in Figure 2, the pyramids of ages tend to be more skewed to the right in ex-mining sites, especially in Viviez and Portman/ESG. Based on data from the French Statistic Institute, we observe a population decrease of -1.5% in Viviez between 2010 and 2015, while the Montbazens population remained the same on the period. This strong decrease of population in Viviez could have led to massive store and service closings, highlighted by the lack of public facilities that most respondents mention (Table 1). It is well known that the availability of public facilities shapes the residential choice and the socioeconomic and demographic distribution of a zone (Guo and Bhat, 2007 ; Schirmer, Eggermond and Axhausen, 2014). Through Figure 2, one can speculate that, while initial residents are obviously aging, a significant part of the young population moves out (i.e. a young exodus). Furthermore, the significant higher lifetime observed in over-polluted cities, compared to relative control groups, may go along with weaker arrivals of new (dynamic) residents in these areas (Table 1). Two main factors are likely to limit the installation of new active, younger, richer and educated individuals in industrial sites. First, Habib and Miller (2009) show that the proximity to industrial sites reduces the area attractiveness and decreases the arrival of richer households. Schaeffer et al. (2016) add that the presence (or absence) of natural amenities potentially strengthens the socio-spatial segregation (Schaeffer et al., 2016). In respect to the mean comparison tests available in Table 1, this trend appears to be particularly true for Viviez. Second, Schirmer, Eggermond and Axhausen (2014, p.14) point out that "households avoid locations with a high unemployment rate". Consequently, in line with Table 1, one can assume that over-polluted areas with high unemployment rates do not attract household with relatively high funding capacities, especially when there is an active and visible industrial site (e.g. Viviez). In contrast, dynamic over-polluted areas, where the local industry maintains an important amount of employment opportunities, might be less threatened by such an effect (e.g. Alumbres, Estarreja).

In addition, the relatively higher local advantages and/or community involvement observed for Alumbres and Estarreja in Table 1 echo the anthropological literature. For example, in West Germany, Phillimore and Bell (2013) observe that older residents positively valorize the time when their city had a vast chemical industry. Although they consider this industry heavily pollutant and risky for health, they feel nostalgia for the time when the zone was economically dynamic, not only because the industry was an important employment generator but also because of other advantages.[3] For instance, the industrial company generally funds the construction of infrastructures such as roads and rapid transit lines for import/export activity and workers' daily commutes, which benefit to the local population. Moreover, in exchange to the right to implant a pollutant industry into a municipality, the city hall can negotiate some subsidies from the company. Then, these subsidies can be used by local decision makers for funding community goods, such as development of green spaces, sport and leisure facilities (e.g. cinema and theatre in Estarreja) or improvements of public services (e.g. schooling/health centers) and infrastructures. In some cases, the company can also have a paternalistic role by norming and controlling the societal life (which could be view as a disadvantage for deviant individuals). Wakefield et al. (2001) assume that, even if damaged places may suffer from a lack of community identity, paradoxically, several residents feeling themselves as unpleasant outsiders are deeply attached to their community. This attachment might be an important starting point for environmental and social actions (Lewicka, 2011). For example, in a North French over-polluted town, Flanquart, Hellequin and Vallet (2013) observe that the four main attractions cited by interviewed participants are tranquility, village life, good neighbors and public facilities (especially swimming pool, football pitch and other sports and leisure infrastructures). By contrast, the most mentioned disadvantage of living in the town is the gossip, confirming the power of sociability. Hence, it is not so surprising that Table 1 shows that people living near active industrial sites (e.g. Alumbres, Estarreja) are likely to have a higher relative community satisfaction and involvement, besides mentioning "social ties" as a particular motivation for living there.

[3] Similarly, in a case study of an over-polluted English community, a qualitative analysis of memories suggests that older residents traditionally associate pollution and health damage with economic vitality (Walker et al., 1998). Other interviews with people living in Teesside in the North East of England show industrial air pollution to be a recurring motif in Teesside's identity as a place (Phillimore and Moffatt, 2004).

METHODS

In this article, we plan to study the determinants of two types of outcome indicators. First, we are interesting in better understand why households live near industrial and mining wastes that they know as hazardous (see Table 1). In this research perspective, we consider as outcome indicators the probability of living in over-polluted areas and the time of exposure to pollution (i.e. lifetime in the area). Then, we claim to identify why households intend to stay/leave such over-polluted lands. Hence, in this second part of the article, we will use as outcome indicators a binary response variable that identify households that project to move out in the next 5 years. To analyze the effects of pollution exposure on emigration choice, pollution exposure factors should be included as regressors and interacted with socioeconomic factors.

Main empirical challenges

Apart from pollution features, over-polluted (treated) and low-polluted (control) areas are often different in terms of ecological, social and economic attractiveness (landscape quality, points of interest, average housing price, unemployment rates, household composition, socioeconomic distribution, etc.). As discussed earlier through Table 1, there are several significant differences between over-polluted and low-polluted areas.

A first challenge is to correct the expected intra-group correlation within over-polluted villages that could reduce the variance of certain factors, and thus overestimate their significance. Indeed, it is well known that households tend to live or relocate around households groups with similar incomes (Guo and Bhat, 2007 ; Pinjari et al., 2011 ; Schirmer, Eggermond and Axhausen, 2014). Moreover, the presence (or absence) of public facilities is an important predictor of residential choice (Guo and Bhat, 2007 ; Schirmer, Eggermond and Axhausen, 2014 ; Schaeffer et al., 2016), which could re-enforce the intra-correlation within area with strong deprivations, such as Viviez and Portman/ESG. Table 1 concords with this assumption. We detect lower standard deviations of household incomes and/or perceived shops and retails availability in Viviez and Portman/ESG compared to their respective control areas; hence the necessity to control for intra-group correlation in the regression models.

A second challenge is to deal with endogeneity problems. First, there is a potential selection bias due to the omission of factors simultaneously correlated to household socioeconomic status and outcome indicators. Note that the presence of heterogeneity does not systematically lead to a selection bias insofar as several factors are observed and controlled for, like household characteristics and perceptions. By contrast, some differences are not observed and constitute a larger problem. In our context, we assume the presence of unobserved heterogeneity between households living in over-polluted and households living in low-polluted areas due to divergences in respect to landscape or geographical preferences. Indeed, these factors can be simultaneously correlated with socioeconomic status and the unexplained part of (re)location choice, and thus bias estimations. Next, our estimations could be biased because of the presence of reverse causality between household socioeconomic status and pollution exposure. Not only pollution reduces housing price that leads to attract poor households, but also one could speculate that pollutant industries move in poor areas where employment opportunities and land price are initially low. A study focusing on France shows for instance a strong spatial correlation between towns with high proportion of poor and immigrant residents and the presence of hazardous sites (Laurian, 2008).

Empirical strategy

Beforehand, to control for the potential intra-group correlation within villages, cluster robust standard errors will be systematically estimated at the village level (i.e. the standard errors are not calculated at the individual level but at the village level).

Then, we limit the presence of unobserved heterogeneity by capturing the highest part of the variance of the probability of living/leaving the polluted village. More specifically, a comprehensive set of explicative factors will be integrated in the analysis, based on exhaustive literature surveys. Moreover, we plan to use sophisticated empirical procedures allowing endogeneity problems and selection bias to be dealt with. In this perspective, an instrumental variables (IV) strategy can be used (i.e. IV Probit and 2SLS estimators). Moreover, a regression discontinuity design can be performed to reinforce the findings from the migration outcome indicators.

The models

As mentioned above, we need a whole understanding about the determinants of (re)location and pollution exposure. For this, we review exhaustive literature surveys based on the respective determinants of residential (re)location (Dielemann, 2001 ; Schirmer, Eggermond and Axhausen, 2014), migration (Hunter, 2005 ; Millock, 2015) and pollution exposure (Bowen, 2002).

Schirmer, Eggermond and Axhausen (2014) propose a classification of residential location into built environment (housing and infrastructural density, etc.), socioeconomic environment (income, education, employment, etc.), points of interest (services, retail, etc.) and accessibility (commuting time and facilities). This classification is very useful to structure estimation models according to available data and research objectives. In the CSPE database, we assume that over-polluted (treated) and low-polluted (control) areas have similar built environment and accessibility. Thus, such factors do not appear in our analysis. However, in respect to our research objectives (which is to identify determinants of pollution exposure at the household and individual levels), we refine the socioeconomic dimension by distinguishing socioeconomic from demographic factors. We also enrich the "points of interest" dimension by introducing community-based factors (local advantages, attachment to place, etc.). Finally, we add respondent-based individual preferences to reduce a substantial part of the "hardly observable" heterogeneity. In particular, we include measures of risk perceptions, knowledge and behaviors, an initiative rarely done in the literature.

In a nutshell, we frame our estimation models based on four main dimensions measured at the household level: socioeconomic factors (income, education, etc.), demographic factors (age, household size, etc.), community factors (perceived availability of services and retails, area attractiveness perception, societal wellbeing, etc.), and respondent-based individual factors (ecological involvement and knowledge, risk-related knowledge and behaviors, risk perception, etc.). More formally, we consider two general equations with θ designing the functional form of the equation (i.e. binomial):

Eq.1: $\theta(Pollution\ exposure) = \beta_0 + \beta_1 SocioeconomicFactors + \beta_2 DemographicFactors + \beta_3 CommunityFactors + \beta_4 IndividualFactors + \varepsilon$

Eq.2: $\theta(Move\ out) = \beta_0 + \beta_1 SocioeconomicFactors + \beta_2 DemographicFactors + \beta_3 CommunityFactors + \beta_4 IndividualFactors + \beta_5 PollutionExposure + \beta_6 [SocioeconomicFactors * PollutionExposure] + \varepsilon$

In a preliminary step, multivariate binomial regressions are performed for equations 1 and 2 (i.e. Probit estimator). However, despite the comprehensive set of observed factors included in the analysis, our models potentially remain sensitive to the omission of unobserved heterogeneity, mainly due to variations in unobserved individual preferences (landscape preference, geographical location, etc.). Therefore, to establish a causal inference regarding socioeconomic factors, we perform an instrumental variables (IV) strategy (i.e. IV-Probit estimator). We use small height and high weight as IV to instrument socioeconomic factors. The justification of both instruments is discussed later in the results section.

RESULTS[4]

Descriptive statistics

As expected, real rents and expected rents are significantly lower near over-polluted sites compared to cleaner areas (Figure 6.a). In addition, Figure 6.a reveals interesting relationships that concord with the existing literature. For instance, we denote a U-shape relationship between aging and the probability of living in a polluted area. In line with the literature, we can imagine the following explanation. At the beginning of the life cycle, the probability decreases because pollution sensitivity increases (Shi and He, 2012) and mobility-related facilities are the highest (Dielemann, 2001 ; Clark and Huang, 2003). However, after a certain age, feelings such as attachment and fatality take over pollution perception (i.e. cognitive bias) and thus the probability of living/staying in over-polluted areas increases (Chanel et al., 2004 ; Flanquart, Hellequin and Vallet, 2013 ; Schirmer, Eggermond and Axhausen, 2014). Figures 6.b and 6.c justify this explanation: the relationship between age and pollution perception (and related health risks) takes a U-inverted form.

(insert Figure 6)

Figure 6.a also shows that the probability of living in an over-polluted area decreases when the absolute gap between household income and average community income increases. As observed by Guo and Bhat (2007), the lower is the absolute gap, the higher is the risk of living in a polluted land (especially when the gap is negative, result not shown). Indeed, the income variance of poor areas is supposed lower than the income variance of richer areas.

Why do people live in over-polluted areas?

Multivariate analysis

Table 3 exhibits binomial multivariate regressions of the probability of living in an over-polluted area on several individual-, household- and community-based explicative factors (Eq.1). Pseudo R-squares indicate a relatively good explicative power of our model specifications (around 23-28%). The results are consistent with the literature and the elements that we discuss earlier. Interestingly, household socioeconomic factors are the strongest predictors of residential locations. A 10% increase of household wealth (based on seven owned assets) decreases by 2 percentage points the risk of living near hazardous wastes (column 1). In alternative specifications, we observe

[4] Estimates only include French and Spanish data and will be completed when the Portuguese data will be available.

that a 10% increase of the number of educated members (who at least obtained a high-school grade) reduces by 3 percentage points this risk (column 2), while a 10% increase of household incomes decreases it by 2.7 percentage points (column 3). We regress each socioeconomic factor independently to avoid multi-collinearity problems, especially between wealth index and income as observed in column 4.

(insert Table 3)

As expected, the area attractiveness index is negatively correlated to the probability of living in over-polluted areas (Guo and Bhat, 2007 ; Habib and Miller, 2009 ; Schirmer, Eggermond and Axhausen, 2014 ; Schaeffer et al., 2016). In addition, associative involvement is negatively correlated to the risk of living in over-polluted sites. However, attachment to place seems to increase the risk of living near hazardous wastes. Indeed, the presence of a family network raises by 14-17 percentage points the risk, while 10 extra year of lifetime in the area raises it by 6-7 percentage points. These results are consistent with assumptions discussed in the literature (Flanquart, Hellequin and Vallet, 2013 ; Schirmer, Eggermond and Axhausen, 2014). Moreover, as expected, pollution-based risk aversion is positively correlated with the probability of living in over-polluted areas (12 percentage point by extra score unit), even if people living in polluted areas slightly tend to wash more systematically fruits from supermarkets before eating it compared to people who live in cleaner areas (-3 percentage point by extra score unit). This latter correlation might be explained by the fact that agriculture is the main productive sector in our set of control areas. Therefore, one can speculate that people from control areas are more risk taker regarding pesticides (i.e. the main hazardous contaminant over unwashed apples) compared to people living in mining- and industrial-based over-polluted areas, which by contrast are more risk taker concerning life expectancy loss induced by daily pollution exposure. Finally, demographic factors are relatively surprising. In terms of marital status, we find a higher probability of living in over-polluted areas for single individuals and couples compared to individuals who suffered from marital shocks (divorced, separated or widowed). Moreover, we observe that, ceteris paribus, aging is negatively correlated to the probability of living in over-polluted areas. For instance, one extra year old in the household average age decreases by 2-3 percentage points this probability (columns 2 and 4). Similarly, one extra children increases by 1 percentage point this probability.

Instrumental variables strategy

To establish a causal inference regarding household socioeconomic factors, we perform an instrumental variables (IV) strategy based on a conditional maximum likelihood estimator (IV-

Probit). We select declared anthropometric indicators to instrument household socioeconomic factors. More specifically, we use the number of adult members who belong to the lowest height category (tercile 1 of declared height) and the number of adult members who belong to the highest weight category. Obviously, height and weight are classified in tercile using gender-specific samples. To be suitable, an instrument must meet two conditions: (i) it must be a non-weak predictor of the endogenous variable conditional on control variables; and (ii) it must satisfy the exclusion restriction assumption (i.e. not to be related directly to the error component in the structural equation (i.e. not to affect the unexplained part of the probability of living in over-polluted areas). The recent literature abounds of works evidencing a strong relationship between anthropometric indicators and socioeconomic status (e.g. Cawley, 2004 ; Levasseur, 2015, 2019). Indeed, there is a vicious cycle between small height/high weight and poverty, namely due to micronutrient deficiencies, schooling and labor market discriminations, productivity inequalities, risky food consumptions and hazardous lifestyles. In contrast, there is few evidence about a direct correlation between height/weight and pollution exposure, at least concerning heavy metals' residuals exposure. Some evidence exist regarding intense coal smoke inhalation during the English industrial revolution (Bailey, Hatton and Inwood, 2018), but, to our understanding, the effect of pollution exposure on health is mainly due to socioeconomic status and anti-pollution habits. Indeed, as discussed by O'Neill et al. (2003), the poorest are likely to be the most exposed to pollution, in respect to place of living, work and behaviors, and thus the most affected by pollution-related diseases.

(insert Table 4)

Empirical estimates presented in Table 4 suggest that declared anthropometric indicators satisfy the first requirement of an instrument. As expected, even after controlling for all covariates, the numbers of adults with small height and high weight are strong and negative predictors of household socioeconomic status. It is comforting to note that all first-stage F-statistics on the excluded instrument are relatively high. In addition, Angrist and Pischke (2008) recommend estimating a reduced-form model, by regressing the dependent variable on the instruments (Table 5). The instrument is said strong if its effect on the dependent variable is proportional to the effect of the endogenous variable (socioeconomic status) on the same dependent variable. The results in Table 5 are encouraging. As clearly expressed by Angrist and Pischke (2008, p.213), if one can perceive the causal relation of interest in the reduced-form regression, it probably indicates that causality does exist. In other words, in Table 7, the positive and significant effects of small height and high weight on the probability of living in over-polluted areas would be due to the existence of a negative causal relationship between socioeconomic status and the risk of living in over-polluted areas, assuming that the exclusion restriction hypothesis is respected.

The second requirement of an instrument (exclusion restriction assumption) cannot be tested empirically (Wooldridge, 2010). In our application, the exclusion restriction assumption means that declared anthropometric indicators should not directly correlate with the probability of living in over-polluted lands through channels other than the household socioeconomic status. It means that the link between anthropometric indicators and pollution exposure must go through socioeconomic status. Such assumption could be violated if there are uncontrolled factors that simultaneously determine both anthropometric indicators and pollution exposure, which is, to our knowledge, unlikely to occur.

(insert Table 5)

Table 6 shows the results from IV-Probit estimates. As expected, we observe negative effects of household socioeconomic status on the probability of living in polluted areas. Since we reject the Wald test of exogeneity, we can conclude that the use of an IV procedure is justified to establish a causal link in the tested relationship. Note that conditional marginal effects are consistent with results from Probit estimates from Table 3. However, comparing the influence of socioeconomic factors in Table 3 and Table 6, we observe that fitted coefficients in IV-Probit estimates are three time stronger. This gap suggests that Probit estimates probably understated the impacts of socioeconomic factors on the risks of living in over-polluted areas because of the presence of unobserved factors that biased the estimates. For example, Table 6 shows that a 10% increase of household incomes at the mean point negatively affects the probability of living near hazardous wastes from petro-chemical industry and/or mining exploitation by 9 percentage points.

(insert Table 6)

What factors motivate people to move out over-polluted areas?

To identify the determinants influencing the decision to leave from over-polluted areas, we regress the intention to move out in the next five years on several factors interacted with the fact of living in over-polluted lands against living in a cleaner area. We consider that such model specification, described earlier in Eq.2, is not affected by endogeneity-related biases. Indeed, an inverse causality bias is impossible since the intention to move out cannot affect current income, education or wealth. In addition, we do not find any reason to think that unobserved factors are simultaneously correlated with socioeconomic status and emigration intentions. In fact, by employing a similar IV strategy as in the previous subsection (i.e. using declared anthropometric indicators as instruments for socioeconomic factors), the Wald exogeneity test suggests that an ordinary binomial regression model (i.e. Probit) does not suffer from potential endogeneity problems (see Table 7). In other word, we can discuss the Probit estimates from Table 7 as causal effects.

(insert Table 7)

In Probit estimates available in Table 7, pseudo R-squares vary from 15.55 to 18.11 depending on model specifications, which is relatively correct considering other empirical studies analyzing the determinants of move-out intentions (e.g. Permentier, van Ham and Bolt, 2009). Beforehand, the higher predictor of the move-out intention is the fact of living in over-polluted lands (Table 7, column 1), especially if pollution is still visible as in Viviez and Alumbres (results not shown). Living in over-polluted areas increases by 8 percentage points the intention to move out in the next five years. Interestingly, we also find in alternative specifications (not shown) that pollution perception is a strong predictor of move-intention. In addition, since this indicator is collinear with the fact of living in over-polluted lands (i.e. significance disappears when both indicators are specified), we can consider that people tend to correctly identify their pollution exposure.

In over-polluted areas as well as in cleaner areas, the social cohesion perception, the area attractiveness perception and the presence of a family network are three factors that significantly decrease the intention to move out in the next five years (Table 7). Interestingly, we do not find heterogeneous effects when we interact these factors with the fact of living an over-polluted area (Table 8). It means that, even if over-polluted are generally less attractive and less socially cohesive (see Table 1), which reduce the probability of living there (Table 3), both factors do not particularly influence move-out motivations. In other words, attractiveness index and social cohesion perception are collinear with the fact of living in over-polluted areas. By contrast, average age and the number of educated members (at least obtained a high-school grade) are factors that not only affect the global motivation to move-out, but especially the motivations of households living in over-polluted areas (Table 7). For instance, 10 additional years old decrease by 4 percentage points the move-out intentions of household living in over-polluted areas increases, compared to cleaner control areas (10*[-0.0023-0.00.14]=-0.037). This result is consistent with the aging theories of mobility and pollution perception: older individuals are less sensitive to pollution and related risks (i.e. cognitive bias) than younger ones (Lee and Waddell, 2010), besides being less mobile (Dielemann, 2001 ; Clark and Huang, 2003). Regarding the effect of education, we find that increasing the number of educated members by 25% increases the move-out intention by 1 percentage point for households living in over-polluted areas, compared to cleaner areas (25*[0.0358+0.0008]=1). This result concords with the results of Chanel et al. (2004) who find that educated individuals are more likely to pay for moving from an over-polluted area to a cleaner area. In theory, education may affect move-out intentions by three principal pathways: (i) employment opportunities, (ii) pollution-related knowledge and sensitivity, and (iii) community involvement. Even if the effects of pollution-related knowledge and sensitivity are not verified in Table 8, associative involvement positively affects the intention to move out polluted areas, increasing by almost 12 percentage points this intention compared to cleaner areas (0.177-0.0.059=0.116). In an opposite way, we find that regular participations in community parties tend to increase the intention to stay in over-polluted areas. This result echoes the existence of certain local advantages in over-polluted sites as discussed in Flanquart, Hellequin and Vallet (2013). Nonetheless, this effect is very small (a 0.1 reduction of percentage point, Table 7, column 6) and disappears in the most complete model specification (Table 7, column 7). More robustly, the importance of attachment to over-polluted place is strongly visible through the lifetime variable. Indeed, 50 extra years living in an over-polluted area decrease by 0.5 percentage point the move-out intention compared to cleaner areas (50*[0.0027-0.0028]=0.005).

(insert Table 8)

CONCLUSION

This article contributes to identify the main determinants of living and move-out intention in the context of over-polluted European areas by mining and industrial hazardous wastes. The results are particularly interesting because we observe convergences and divergences between the locational determinants and the re-locational determinants. Table 9 illustrates these convergences and divergences.

(insert Table 9)

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Table 1: Comparisons tests between treated and control areas

	Viviez			Montbazens			Comparison tests	
	N	***Mean***	***SD***	***N***	***Mean***	***SD***	***Mean diff***	***SD ratio***
Sociodemographic characteristics								
Age of adults	253	58	18	239	54	18	4.10**	1
Marital status (% in a couple)	252	0,70		239	0,74		-0,04	
High-school level at least (%)	250	0,28		237	0,51		-0.23***	
Economic characteristics								
Declared housing price	55	108200	106376	54	190000	78133	-81800***	1,4**
Monthly total income	64	414	136	80	518	211	-104***	0,6***
Monthly total income	96	1981	1063	106	2542	1404	-561***	0,8***
Employment (%)	293	0,31		309	0,37		-0,06***	
Unemployment and inactivity (%)	293	0,54		309	0,40		0,14**	
Local advantages								
Perception of area attractiveness (1-to-5 scale)	156	1,85	1,05	138	3,06	1,15	-1.21***	0,9
Perception of public services availability (1-to-5 scale)	156	2,33	1,38	138	3,08	1,13	-0.75***	1.2**
Perception of shops and retails availability (1-to-5 scale)	156	1,67	1,03	138	2,76	1,20	-1.09***	0.9*
Community life and involvement								
Perception of social cohesion (1-to-5 scale)	155	3,46	1,04	137	3,97	0,87	-0.51***	1.2**
Regularly participating in community meetings (%)	151	0,06		136	0,09		-0,03	
Regularly participating in community parties (%)	152	0,36		136	0,48		-0.12**	
Involved in a local association (%)	155	0,26		136	0,35		-0.09*	
Attachment to the area								
Lifetime in the area (in years)	156	30	25	137	23	22	7**	1.2**
Ratio of lifetime/age (%)	154	0,46	0,35	137	0,38	0,32	0.08*	1,1
Already thought to move out (%)	154	0,29		138	0,14		0.14***	
Intention to move out in the next 5 years (%)	152	0,22		138	0,09		0.13***	
Living here for economic reasons (%) (affordable price)	154	0,30		138	0,18		0.12**	
Living here for professional reasons (%)	154	0,40		138	0,50		-0.10*	
Living here for social/family reasons (%)	154	0,59		138	0,60		-0,01	
Living here for environmental reasons (%)	154	0,11		138	0,39		-0.28***	
Living here for public facilities (%)	154	0,03		138	0,09		-0.07**	
Risk perception, knowledge and behaviors								
Perception of pollution level (1-to-5 scale)	155	3,36	1,13	138	2,01	0,91	1.35***	1.2***
Perception of exposition to heavy metals (1-to-5 scale)	140	2,88	1,37	131	1,44	0,88	1.44***	1.6***
Perception that heavy metals exposure increases of health risks (%)	156	0,69		139	0,33		0.36***	
Perception of knowledge about pollution-based health risks (1-to-5 scale)	153	2,33	1,45	137	2,64	1,39	-0.32*	1
Perception of knowledge about anti-pollution protection measures (1-to-5 scale)	153	2,06	1,31	137	2,36	1,36	-0.31*	1
Willingness to take risks (1-to-5 scale)	156	2,13	1,31	136	2,34	1,12	-0,21	1.2*
Probability of eating a commercial fruit without washing it (1-to-5 scale)	156	2,72	1,73	135	2,90	1,68	-0,18	1
Probability of living in a polluted site if life expectancy decreases by 5yo (1-to-5 scale)	156	1,29	0,80	136	1,09	0,45	0.20***	1.8***
Probability of living in a polluted site if life expectancy decreases by 5yo but income is twice higher (1-to-5 scale)	156	1,33	0,84	137	1,16	0,56	0.17**	1.5***
Probability of living in a polluted site if life expectancy decreases by 1yo but income is twice higher (1-to-5 scale)	156	1,58	1,10	137	1,33	0,85	0.25**	1.3***
Health indicators								
Perception of health status (1-to-5 scale)	292	3,95	0,99	304	4,12	0,98	-018**	1
Health status needs treatment (%)	293	0,43		307	0,33		0,10**	
Already suffered from allergies (%)	293	0,25		307	0,20		0,04	
Already suffered from respiratory problems (%)	293	0,15		307	0,13		0,03	
Already suffered from skin diseases (%)	293	0,08		307	0,08		-0,01	
Already suffered from cardiovascular attacks (%)	293	0,09		307	0,08		0,01	
Already suffered from other chronic diseases (%)	289	0,21		307	0,16		0,06*	
Number of days hospitalized for the first 2018 semester	292	1,31	7,66	306	0,78	5,66	0,53	1,4***
Number of medical visits for the first 2018 semester	290	3,20	4,17	305	2,47	3,66	0,74**	1,1**
Number of days missing work/school for the first 2018 semester	133	5,63	18,56	180	4,06	17,73	1,58	1
Birthweight of the last child (kg)	106	3,21	0,54	101	3,35	0,47	-0.14*	1,2
Number of disease-related deaths before 65yo in the local family	74	0,45	0,74	57	0,32	0,91	0,13	0,8

	ESG/Portman			Cant./Per./Portus/Gal.			Comparison tests	
	N	***Mean***	***SD***	***N***	***Mean***	***SD***	***Mean diff***	***SD ratio***
Sociodemographic characteristics								
Age of adults	318	54	19	156	50	18	3.38*	1
Marital status (% in a couple)	318	0,6824		156	0,6538		0,03	
High-school level at least (%)	318	0,1289		156	0,1346		-0,01	
Economic characteristics								
Declared housing price	82	101061	40950	62	138387	48770	- 37326***	0,8
Monthly total income	102	366	127	71	427	111	-62***	1,1
Monthly total income	116	1228	662	72	1732	764	-504***	0,9
Employment (%)	371	0,29		180	0,49		-0,20***	
Unemployment and inactivity (%)	371	0,53		180	0,33		0,20***	
Local advantages								
Perception of area attractiveness (1-to-5 scale)	153	3,86	1,16	76	4,01	1,23	-0,16	0,9
Perception of public services availability (1-to-5 scale)	153	2,86	1,31	76	3,92	1,44	-1.06***	0,9
Perception of shops and retails availability (1-to-5 scale)	153	3,01	1,27	76	3,37	1,53	-0.36*	0.8*
Community life and involvement								
Perception of social cohesion (1-to-5 scale)	153	3,98	0,90	76	4,18	1,12	-0,20	0.8**
Regularly participating in community meetings (%)	153	0,09		76	0,21		-0.12**	
Regularly participating in community parties (%)	153	0,47		76	0,41		0,06	
Involved in a local association (%)	153	0,26		76	0,37		-0.11*	
Attachment to the area								
Lifetime in the area (in years)	153	46	25	71	34	23	12***	1,1
Ratio of lifetime/age (%)	153	0,78	0,32	71	0,67	0,34	0.11**	1
Already thought to move out (%)	153	0,16		76	0,08		0.08*	
Intention to move out in the next 5 years (%)	153	0,08		76	0,07		0,01	
Living here for economic reasons (%) (affordable price)	153	0,27		76	0,08		0.19***	
Living here for professional reasons (%)	153	0,37		76	0,05		0.31***	
Living here for social/family reasons (%)	153	0,86		76	0,76		0.10*	
Living here for environmental reasons (%)	153	0,07		76	0,32		-0.24***	
Living here for public facilities (%)	153	0,04		76	0,00		0.04*	
Risk perception, knowledge and behaviors								
Perception of pollution level (1-to-5 scale)	153	3,29	1,43	76	1,72	0,92	1.56***	1.6***
Perception of exposition to heavy metals (1-to-5 scale)	153	3,37	1,41	76	1,25	0,64	2.12***	2.2***
Perception that heavy metals exposure increases of health risks (%)	153	0,73		76	0,20		0.53***	
Perception of knowledge about pollution-based health risks (1-to-5 scale)	153	1,89	1,28	76	2,21	1,41	-0.32*	0,9
Perception of knowledge about anti-pollution protection measures (1-to-5 scale)	153	1,54	1,01	76	2,01	1,26	-0.48***	0.8**
Willingness to take risks (1-to-5 scale)	153	1,68	1,15	76	2,11	1,20	-0.43***	1
Probability of eating a commercial fruit without washing it (1-to-5 scale)	153	1,30	0,86	76	1,50	1,10	-0,20	0.8**
Probability of living in a polluted site if life expectancy decreases by 5yo (1-to-5 scale)	153	1,36	0,82	76	1,58	1,25	-0,22	0.7***
Probability of living in a polluted site if life expectancy decreases by 5yo but income is twice higher (1-to-5 scale)	153	1,51	1,05	76	1,92	1,46	-0.41**	0.7***
Probability of living in a polluted site if life expectancy decreases by 1yo but income is twice higher (1-to-5 scale)	153	1,73	1,27	76	2,55	1,72	-0.82***	0.7***
Health indicators								
Perception of health status (1-to-5 scale)	371	3,99	1,20	180	4,33	1,06	-0.34***	1.1**
Health status needs treatment (%)	371	0,49		180	0,29		0.20***	
Already suffered from allergies (%)	371	0,16		180	0,14		0,02	
Already suffered from respiratory problems (%)	371	0,13		180	0,11		0,02	
Already suffered from skin diseases (%)	371	0,10		180	0,05		0.05**	
Already suffered from cardiovascular attacks (%)	371	0,08		180	0,03		0.05***	
Already suffered from other chronic diseases (%)	371	0,43		180	0,27		0.15***	
Number of days hospitalized for the first 2018 semester	371	0,73	2,92	180	0,75	2,58	-0,02	1.1*
Number of medical visits for the first 2018 semester	371	3,87	4,61	180	1,76	3,15	2.11***	1.5***
Number of days missing work/school for the first 2018 semester	166	1,43	6,20	119	0,49	1,29	0.95*	4.8***
Birthweight of the last child (kg)	115	3,29	0,41	63	3,38	0,53	-0,09	0,8
Number of disease-related deaths before 65yo in the local family	153	0,53	0,81	76	0,34	0,60	0.19**	1.4**

	Alumbres			Molinos Marfagones			Comparison tests	
	N	***Mean***	***SD***	***N***	***Mean***	***SD***	***Mean diff***	***SD ratio***
Sociodemographic characteristics								
Age of adults	158	54	20	238	47	17	7.18***	1.2*
Marital status (% in a couple)	158	0,66		238	0,64		0,02	
High-school level at least (%)	158	0,14		238	0,45		-0.31***	
Economic characteristics								
Declared housing price	72	127306	63205	67	131493	39051	-4187	1,6***
Monthly total income	75	415	110	83	441	115	-26	1
Monthly total income	70	1477	768	67	1616	709	-139	1,1
Employment (%)	186	0,31		272	0,38		-0,07	
Unemployment and inactivity (%)	186	0,47		272	0,33		0,14	
Local advantages								
Perception of area attractiveness (1-to-5 scale)	75	3,32	1,37	96	3,85	1,20	-0.53***	1,1
Perception of public services availability (1-to-5 scale)	75	3,57	1,34	96	3,98	1,05	-0.41**	1.3**
Perception of shops and retails availability (1-to-5 scale)	75	3,48	1,37	96	3,73	1,07	-0,25	1.3**
Community life and involvement								
Perception of social cohesion (1-to-5 scale)	75	3,79	1,13	96	4,19	0,97	-0.40**	1,2
Regularly participating in community meetings (%)	75	0,07		96	0,13		-0,06	
Regularly participating in community parties (%)	75	0,56		96	0,36		0.20**	
Involved in a local association (%)	75	0,24		96	0,28		-0,04	
Attachment to the area								
Lifetime in the area (in years)	75	48	21	89	26	19	22***	1,1
Ratio of lifetime/age (%)	75	0,82	0,27	89	0,52	0,34	0.30***	0.8**
Already thought to move out (%)	75	0,27		96	0,11		0.15**	
Intention to move out in the next 5 years (%)	75	0,17		96	0,07		0.10*	
Living here for economic reasons (%) (affordable price)	75	0,15		96	0,25		-0.10*	
Living here for professional reasons (%)	75	0,27		96	0,15		0.12**	
Living here for social/family reasons (%)	75	0,88		96	0,73		0.15**	
Living here for environmental reasons (%)	75	0,03		96	0,10		-0.08**	
Living here for public facilities (%)	75	0,03		96	0,01		0,02	
Risk perception, knowledge and behaviors								
Perception of pollution level (1-to-5 scale)	75	4,68	0,68	96	2,15	1,09	2.53***	0.6***
Perception of exposition to heavy metals (1-to-5 scale)	75	2,93	1,51	96	1,41	0,84	1.53***	1.8***
Perception that heavy metals exposure increases of health risks (%)	75	0,96		96	0,60		0.36***	
Perception of knowledge about pollution-based health risks (1-to-5 scale)	75	1,68	1,04	96	2,10	1,53	-0.42**	0.7***
Perception of knowledge about anti-pollution protection measures (1-to-5 scale)	75	1,56	0,87	96	1,92	1,39	-0.36**	0.6***
Willingness to take risks (1-to-5 scale)	75	1,91	1,03	96	1,57	1,03	0.33**	1
Probability of eating a commercial fruit without washing it (1-to-5 scale)	75	1,56	0,87	96	1,50	0,99	0,06	0,9
Probability of living in a polluted site if life expectancy decreases by 5yo (1-to-5 scale)	75	3,36	1,43	96	1,22	0,58	2.14***	2.4***
Probability of living in a polluted site if life expectancy decreases by 5yo but income is twice higher (1-to-5 scale)	75	3,43	1,42	96	1,34	0,78	2.08***	1.8***
Probability of living in a polluted site if life expectancy decreases by 1yo but income is twice higher (1-to-5 scale)	75	3,55	1,40	96	1,79	1,11	1.76***	1.3**
Health indicators								
Perception of health status (1-to-5 scale)	186	3,73	1,03	272	4,38	0,91	-0.65***	1.1*
Health status needs treatment (%)	186	0,41	0,49	272	0,29	0,45	0.13***	
Already suffered from allergies (%)	186	0,11	0,31	272	0,14	0,34	-0,03	
Already suffered from respiratory problems (%)	186	0,08	0,26	272	0,04	0,19	0.04*	
Already suffered from skin diseases (%)	186	0,07	0,26	272	0,06	0,24	0,01	
Already suffered from cardiovascular attacks (%)	186	0,03	0,18	272	0,07	0,26	-0.04*	
Already suffered from other chronic diseases (%)	186	0,39	0,49	272	0,24	0,42	0.16***	
Number of days hospitalized for the first 2018 semester	186	1,24	5,88	272	0,42	2,40	0.83*	2.5***
Number of medical visits for the first 2018 semester	186	2,18	3,77	272	2,17	3,76	0,01	1,0
Number of days missing work/school for the first 2018 semester	95	0,23	1,12	179	0,25	1,58	-0,02	0.7***
Birthweight of the last child (kg)	64	3,25	0,57	71	3,29	0,57	-0,03	1,0
Number of disease-related deaths before 65yo in the local family	75	0,53	0,81	96	0,16	0,39	0.38***	2.1***

Notes: (1) Mean comparison tests (H0:diff=0) are corrected for unequal variances when the standard deviation (SD) ratio is significantly different to 1 (H0: ratio=1). Bilateral significance levels: ***1%, **5%, *10%,
(2) Education levels, age and marital status are based on adult individuals only (>=18yo).
(3) Monthly renting price is hypothetic for housing owners.
(4) Chronic diseases refers to Types I and II diabetes, high blood pressure, mental disorders, kidney cancer, lung cancer, skin cancer, other cancers, depression and other chronic diseases.

Source: Authors' calculation from the CSPE database.

Table 2: Basic information from national statistics institutes

Insert Table 2

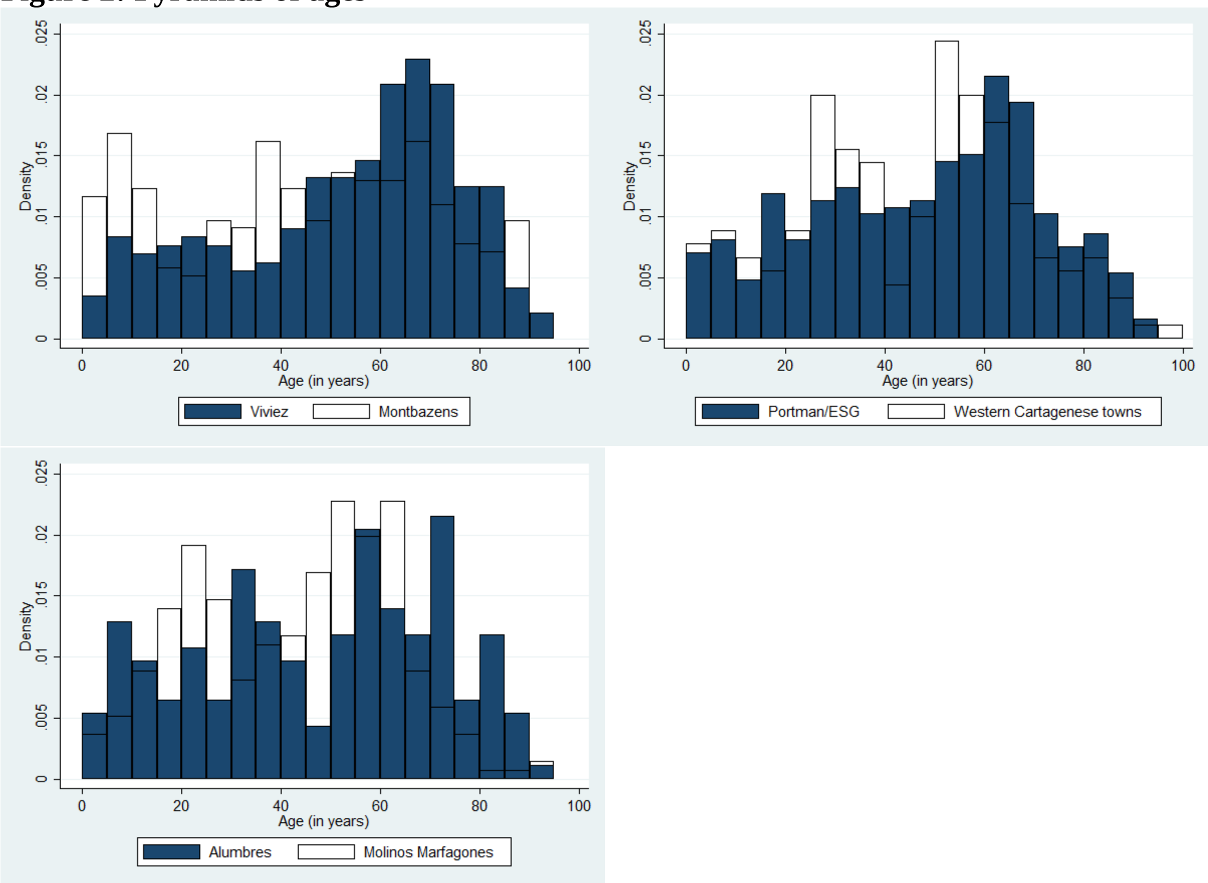
Source: INSEE, Spanish INE and Portuguese INE

Figure 1: Mapping of treatment and control areas

Insert Figure 1

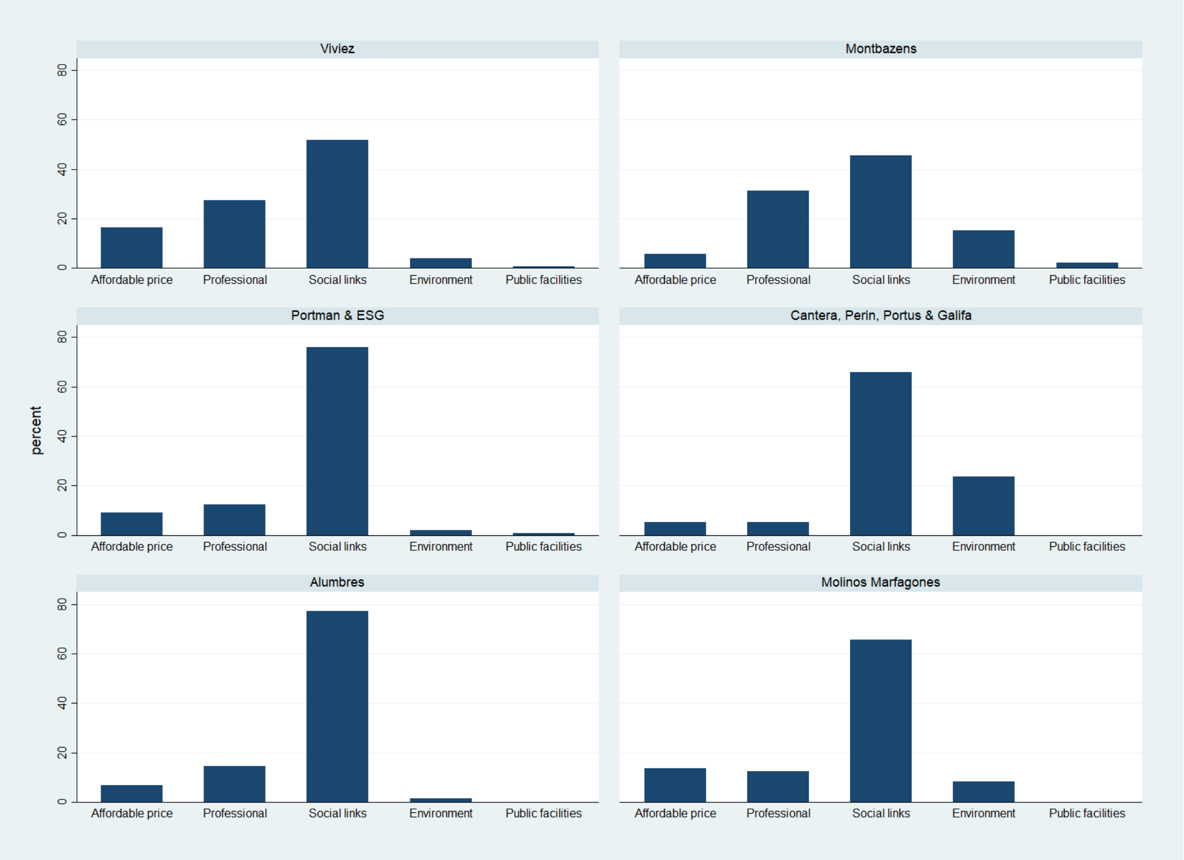
Source: OSM, authors' computation.

Figure 2: Pyramids of ages



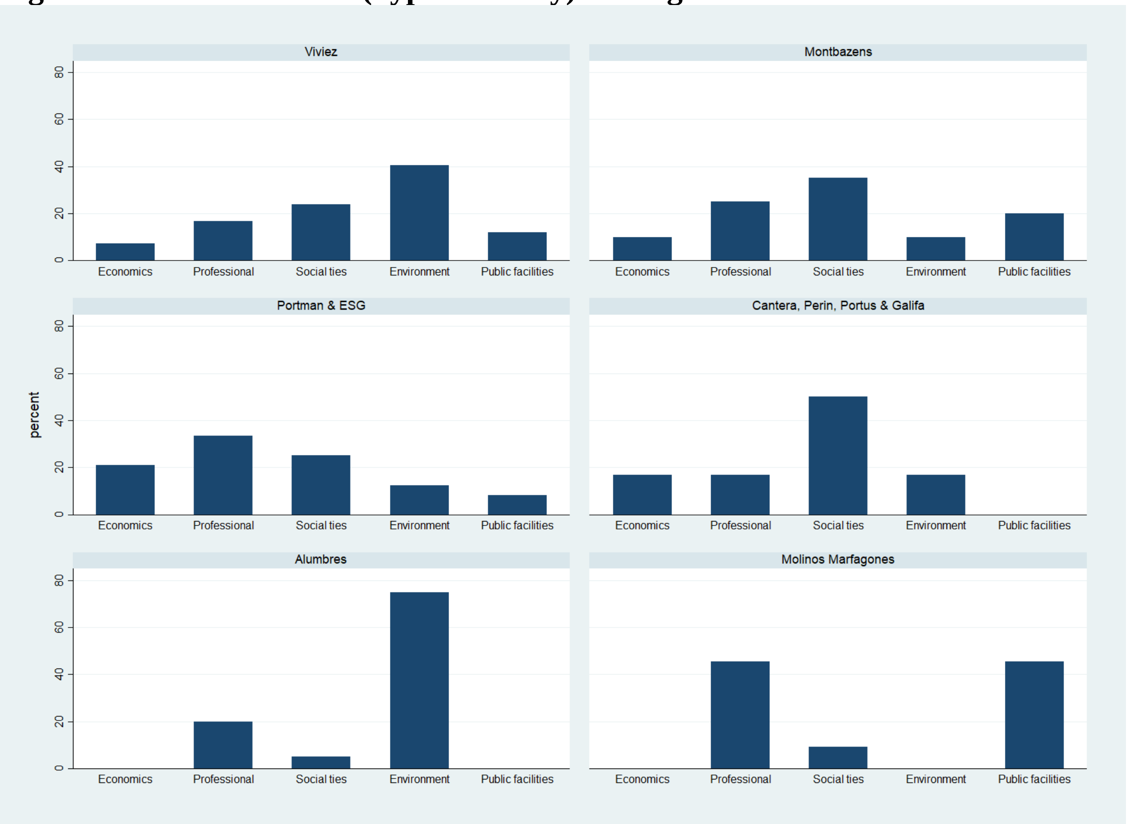
Source: CSPE database, authors' computation.

Figure 3: Main mentioned reason for living in the area



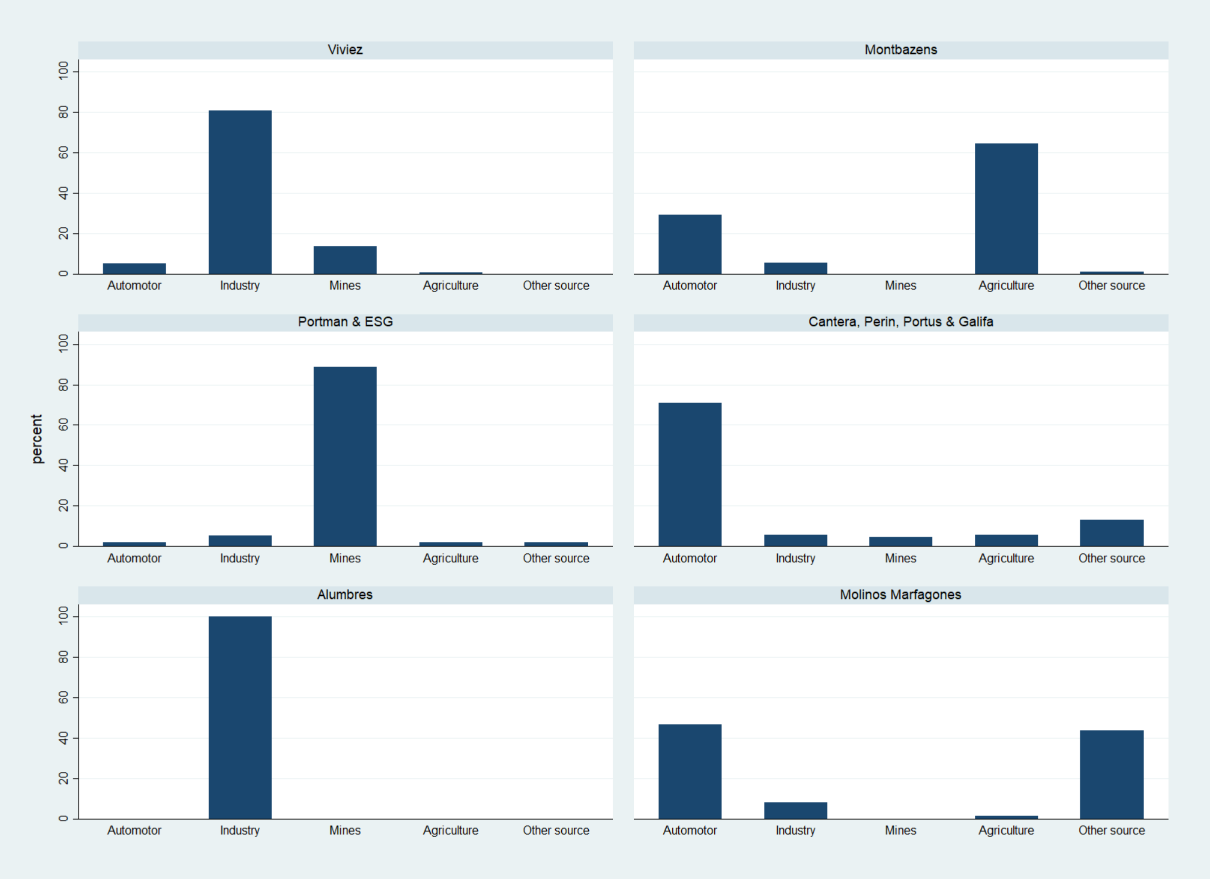
Source: CSPE database, authors' computation.

Figure 4: Main reason for (hypothetically) leaving the area



Source: CSPE database, authors' computation.

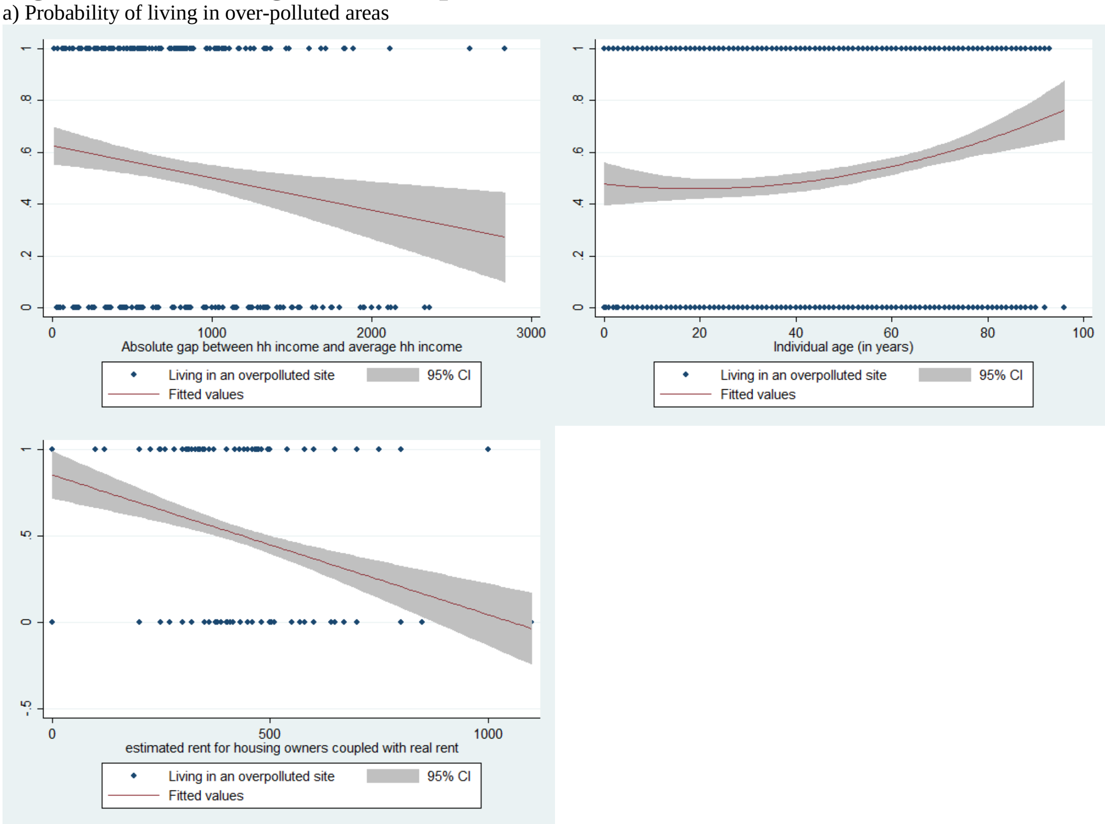
Figure 5: Declared main source of pollution in the area



Source: CSPE database, authors' computation.

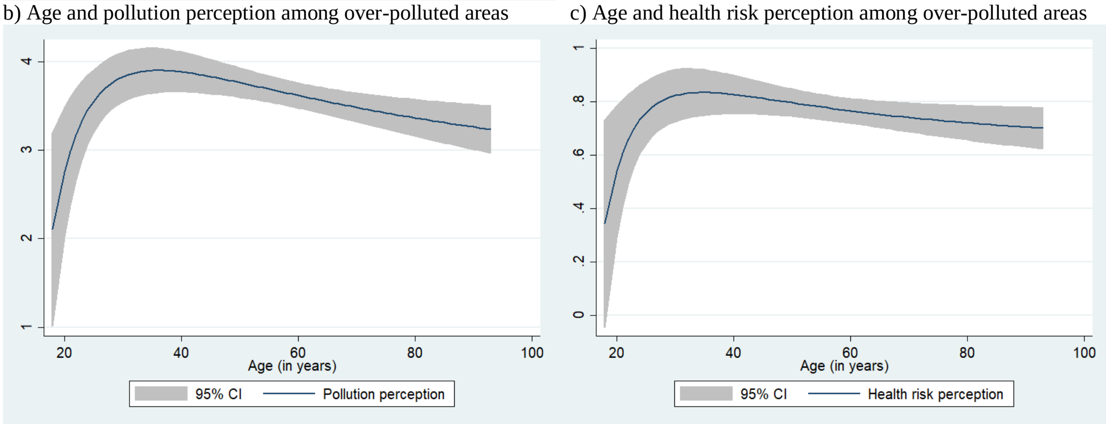
Figure 6: Interesting relationships

a) Probability of living in over-polluted areas



b) Age and pollution perception among over-polluted areas

c) Age and health risk perception among over-polluted areas



Source: Authors' calculation from the CSPE database.

Table 3: Factors correlated with the probability of living in polluted lands, average marginal effects (Probit estimates based on Eq.1)

	(1)	(2)	(3)	(4)
Household size	-0.082*	-0.042	-0.036	-0.014
	(-1.69)	(-1.00)	(-0.47)	(-0.20)
Number of children	0.096**	0.050	0.062	0.029
	(2.25)	(1.55)	(1.40)	(0.86)
Average age of adults (in years)	-0.001	-0.002***	-0.001	-0.003***
	(-1.06)	(-2.62)	(-1.49)	(-3.26)
Number of male members	0.010	0.011	-0.002	0.001
	(0.32)	(0.32)	(-0.05)	(0.03)
Respondent is in a couple (dummy)	0.146***	0.102***	0.254***	0.238***
	(3.42)	(2.92)	(6.15)	(5.04)
Respondent is single (dummy)	0.109***	0.078***	0.192***	0.171***
	(3.73)	(4.68)	(3.81)	(4.09)
Area attractiveness index (3-to-15 scale)	-0.070***	-0.071***	-0.066***	-0.066***
	(-7.24)	(-8.36)	(-6.96)	(-7.70)
Presence of family members around	0.137*	0.112	0.166**	0.145**
	(1.93)	(1.50)	(2.51)	(2.09)
Lifetime in the area (in year)	0.006***	0.006***	0.007***	0.006***
	(6.93)	(8.28)	(7.86)	(9.20)
Willingness to eat a fruit from supermarkets without washing it (1-to-5 scale)	-0.031***	-0.030***	-0.030**	-0.029**
	(-2.62)	(-3.15)	(-2.13)	(-2.56)
Willingness to live in a polluted land that decreases life expectancy by 5yo (1-to-5 scale)	0.125*	0.133*	0.119*	0.126*
	(1.74)	(1.83)	(1.65)	(1.72)
Associative involvement (dummy)	-0.082**	-0.081**	-0.119**	-0.113**
	(-2.23)	(-2.30)	(-2.13)	(-1.96)
France (dummy)	-0.118	-0.057	0.031	0.037
	(-0.26)	(-0.12)	(0.07)	(0.08)
ln(wealth index +1)	**-0.198*** **			**-0.004**
	(-3.84)			**(-0.09)**
ln(number of members who obtained a high-school grade +1)		**-0.312*** **		**-0.227*** **
		(-11.04)		**(-5.94)**
ln(monthly total household income)			**-0.266*** **	**-0.215** **
			(-3.88)	**(-2.37)**
Observations	671	671	512	512
Pseudo R-square	0.232	0.260	0.265	0.283

Notes: (1) Standard errors are robust to intra-group correlation. Significance levels are: ***1%, **5%, *10%,

(2) Wealth index is the sum of the following owned (or not) assets: former house, second house, car, air conditioner, computer, cellphone and financial assets. Thus, the wealthiest households have a score of 7 while the most deprived household a score of 0. Then, this score is log-transformed by adding 1 for avoiding the generation of missing values (i.e. log(0)=.). We employ the same log-transformation for the number of members who obtained a high-school grade at least.

(3) Area attractiveness index is the sum of the following 1-to-5 perception scores: global attractiveness, availability of public services and availability of shops and retails. Thus, areas perceived as the most attractive have a score equal to 15, while areas perceived as the most deprived have a score of 3.

Source: Authors' calculation from the CSPE database.

Table 4: First step regressions of IV-Probit estimates, based on Eq.1

	ln(wealth index +1)	**ln(number of members who obtained a high-school grade +1)**	**ln(monthly total household income)**
Household size	0.079***	0.226***	0.261***
	(5.71)	(15.16)	(5.41)
Number of children	-0.081***	-0.247***	-0.200***
	(-4.65)	(-4.45)	(-3.41)
Average age of adults (in years)	-0.003***	-0.005***	-0.001
	(-2.61)	(-3.43)	(-0.79)
Number of male members	0.005	0.003	-0.046
	(0.32)	(0.09)	(-1.17)
Respondent is in a couple (dummy)	0.207***	-0.006	0.306***
	(6.39)	(-0.23)	(5.58)
Respondent is single (dummy)	0.032	-0.072	-0.045
	(0.66)	(-1.24)	(-0.53)
Area attractiveness index (3-to-15 scale)	0.004	0.009**	0.013**
	(1.09)	(1.98)	(2.44)
Presence of family members around	-0.036**	-0.118***	-0.004
	(-1.96)	(-2.93)	(-0.06)
Lifetime in the area (in year)	-0.001	-0.002*	-0.004***
	(-1.12)	(-1.93)	(-3.08)
Willingness to eat a fruit from supermarkets without washing it (1-to-5 scale)	0.007	0.013	0.023*
	(0.61)	(0.76)	(1.71)
Willingness to live in a polluted land that decreases life expectancy by 5yo	0.020*	0.013	0.002
(1-to-5 scale)	(1.78)	(0.70)	(0.12)
Associative involvement (dummy)	0.063*	0.067	0.042
	(1.78)	(1.54)	(0.59)
France (dummy)	-0.090**	0.126	0.445***
	(-2.47)	(1.64)	(5.95)
Number of members in the third weight tercile	**-0.020*** **	**-0.071*** **	**-0.023** **
	(-5.05)	**(-5.23)**	**(-2.17)**
Number of members in the first height tercile	**-0.045*** **	**-0.090*** **	**-0.079*** **
	(-3.51)	**(-5.10)**	**(-6.20)**
Constant	1.423***	0.243*	6.582***
	(22.96)	(1.68)	(48.09)
Observations	671	671	512
F-Fisher	15.35	17.08	29.24
(p-value)	(0.000)	(0.000)	(0.000)
Adjusted R-square	0.2601	0.2647	0.4533

Notes: (1) Standard errors are robust to intra-group correlation. Significance levels are: ***1%, **5%, *10%,

(2) Wealth index is the sum of the following owned (or not) assets: former house, second house, car, air conditioner, computer, cellphone and financial assets. Thus, the wealthiest households have a score of 7 while the most deprived household a score of 0. Then, this score is log-transformed by adding 1 for avoiding the generation of missing values (i.e. log(0)=.). We employ the same log-transformation for the number of members who obtained a high-school grade at least.

(3) Area attractiveness index is the sum of the following 1-to-5 perception scores: global attractiveness, availability of public services and availability of shops and retails. Thus, areas perceived as the most attractive have a score equal to 15, while areas perceived as the most deprived have a score of 3.

(4) IV-Probit regressions are employed using conditional maximum-likelihood estimator.

Source: Authors' calculation from the CSPE database.

Table 5: Reduced-form model, regressions of the probability of living in a polluted land on instruments, based on Eq.1

	(1)	(2)	(3)	(4)
Household size	-0.153***	-0.142***	-0.095**	-0.093
	(-2.95)	(-2.64)	(-1.99)	(-1.15)
Number of children	0.170***	0.158***	0.106***	0.124**
	(3.76)	(3.41)	(3.09)	(2.54)
Average age of adults (in years)	-0.002**	-0.002**	-0.003***	-0.002***
	(-2.12)	(-2.50)	(-3.71)	(-2.65)
Number of male members	0.013	0.015	0.015	0.002
	(0.38)	(0.41)	(0.38)	(0.05)
Respondent is in a couple (dummy)	0.097***	0.132***	0.096**	0.238***
	(2.60)	(2.88)	(2.47)	(4.88)
Respondent is single (dummy)	0.101***	0.103***	0.078***	0.184***
	(3.11)	(3.00)	(3.09)	(3.37)
Area attractiveness index (3-to-15 scale)	-0.074***	-0.074***	-0.074***	-0.070***
	(-7.67)	(-7.68)	(-8.57)	(-6.69)
Presence of family members around	0.126*	0.119*	0.101	0.152**
	(1.71)	(1.65)	(1.30)	(2.22)
Lifetime in the area (in year)	0.006***	0.006***	0.006***	0.007***
	(7.53)	(7.16)	(8.46)	(6.89)
Willingness to eat a fruit from supermarkets without washing it (1-to-5 scale)	-0.033***	-0.032***	-0.030***	-0.030**
	(-2.66)	(-2.88)	(-3.27)	(-2.31)
Willingness to live in a polluted land that decreases life expectancy by 5yo (1-to-5 scale)	0.124*	0.127*	0.134*	0.121*
	(1.74)	(1.84)	(1.89)	(1.69)
Associative involvement (dummy)	-0.100***	-0.088**	-0.087***	-0.125**
	(-3.37)	(-2.49)	(-2.63)	(-2.36)
France (dummy)	-0.074	-0.092	-0.043	0.036
	(-0.16)	(-0.20)	(-0.09)	(0.08)
Number of members in the third weight tercile	**0.079*** **	**0.079*** **	**0.060*** **	**0.064*** **
	(4.60)	**(4.52)**	**(4.09)**	**(4.63)**
Number of members in the first height tercile	**0.114*** **	**0.107*** **	**0.091*** **	**0.106*** **
	(5.25)	**(4.91)**	**(4.99)**	**(4.01)**
ln(wealth index +1)		-0.174***		
		(-3.24)		
ln(number of members who obtained a high-school grade +1)			-0.280***	
			(-18.22)	
ln(monthly total household income)				-0.245***
				(-3.17)
Observations	671	671	671	512
Pseudo R-square	0.244	0.250	0.272	0.279

Notes: (1) Standard errors are robust to intra-group correlation. Significance levels are: ***1%, **5%, *10%,
(2) Wealth index is the sum of the following owned (or not) assets: former house, second house, car, air conditioner, computer, cellphone and financial assets. Thus, the wealthiest households have a score of 7 while the most deprived household a score of 0. Then, this score is log-transformed by adding 1 for avoiding the generation of missing values (i.e. log(0)=.). We employ the same log-transformation for the number of members who obtained a high-school grade at least.
(3) Area attractiveness index is the sum of the following 1-to-5 perception scores: global attractiveness, availability of public services and availability of shops and retails. Thus, areas perceived as the most attractive have a score equal to 15, while areas perceived as the most deprived have a score of 3.
(4) IV-Probit regressions are employed using conditional maximum-likelihood estimator.

Source: Authors' calculation from the CSPE database.

Table 6: Determinants of the probability of living in polluted lands, conditional marginal effects at mean points (IV-Probit estimates based on Eq.1)

	(1)	(2)	(3)
Household size	0.029	0.089***	0.156**
	(0.77)	(2.88)	(2.46)
Number of children	-0.023	-0.095**	-0.090*
	(-0.58)	(-2.42)	(-1.88)
Average age of adults (in years)	-0.004***	-0.006***	-0.002**
	(-3.62)	(-5.60)	(-2.25)
Number of male members	0.013	0.013	-0.035
	(0.43)	(0.31)	(-0.98)
Respondent is in a couple (dummy)	0.305***	0.065*	0.381***
	(5.36)	(1.72)	(10.12)
Respondent is single (dummy)	0.089	0.007	0.081
	(1.47)	(0.21)	(0.81)
Area attractiveness index (3-to-15 scale)	-0.029**	-0.048***	-0.030***
	(-2.33)	(-7.05)	(-3.80)
Presence of family members around	0.014	-0.009	0.086
	(0.35)	(-0.15)	(1.21)
Lifetime in the area (in year)	0.001	0.003***	0.000
	(0.61)	(7.85)	(0.29)
Willingness to eat a fruit from supermarkets without washing it (1-to-5 scale)	-0.007	-0.013	0.000
	(-0.66)	(-1.09)	(0.03)
Willingness to live in a polluted land that decreases life expectancy by 5yo (1-to-5 scale)	0.082**	0.107**	0.072*
	(2.52)	(2.50)	(1.91)
Associative involvement (dummy)	0.034	-0.016	-0.039
	(0.56)	(-0.37)	(-0.62)
France (dummy)	-0.150	0.057	0.370*
	(-0.88)	(0.20)	(1.84)
ln(wealth index +1)	**-1.253*** **		
	(-12.41)		
ln(number of members who obtained a high-school grade +1)		**-0.903*** **	
		(-17.45)	
ln(monthly total household income)			**-0.932*** **
			(-27.54)
Observations	671	671	512
Wald test of exogeneity (H0=no endogeneity)	22.12	127.04	52.14
(p-value)	(0.000)	(0.000)	(0.000)
Log pseudolikelihood	-491.84	-655.40	-525.76

Notes: (1) We use as instrumental variables (IV) the numbers of household members belonging to the lowest height category (tercile 1) and the highest weight category (tercile 3). Both categories are determined in gender-specific samples. Note that both instruments are strong and negative predictors of household socioeconomic status (Table 5). We assume no direct effects of adult anthropometric factors on the probability of living in an over-polluted site. In other words, the potential correlation between anthropometric status and the probability of living in over-pollution site transits by socioeconomic status (i.e. wealth, income and education).

(2) Standard errors are robust to intra-group correlation. Significance levels are: ***1%, **5%, *10%,

(3) Wealth index is the sum of the following owned (or not) assets: former house, second house, car, air conditioner, computer, cellphone and financial assets. Thus, the wealthiest households have a score of 7 while the most deprived household a score of 0. Then, this score is log-transformed by adding 1 for avoiding the generation of missing values (i.e. log(0)=.). We employ the same log-transformation for the number of members who obtained a high-school grade at least.

(4) Area attractiveness index is the sum of the following 1-to-5 perception scores: global attractiveness, availability of public services and availability of shops and retails. Thus, areas perceived as the most attractive have a score equal to 15, while areas perceived as the most deprived have a score of 3.

(5) IV-Probit regressions are employed using conditional maximum-likelihood estimator.

Source: Authors' calculation from the CSPE database.

Table 7: Factors correlated to the intention to move out in the next 5 years, average marginal effects based on Eq.3

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Household size	-0.008	-0.009	-0.007	-0.006	0.001	-0.010	0.000
	(-0.40)	(-0.43)	(-0.36)	(-0.32)	(0.04)	(-0.51)	(0.02)
Number of children	0.009	0.009	0.010	0.007	0.003	0.012	0.003
	(0.46)	(0.49)	(0.50)	(0.38)	(0.16)	(0.58)	(0.19)
Average age of adults (in years)	-0.003***	-0.003***	-0.002***	-0.003***	-0.003***	-0.003***	-0.001**
	(-3.09)	(-3.25)	(-3.21)	(-3.00)	(-2.88)	(-2.95)	(-2.30)
Number of male members	-0.004	-0.003	-0.005	-0.004	-0.007	-0.004	-0.008
	(-0.13)	(-0.10)	(-0.16)	(-0.14)	(-0.23)	(-0.14)	(-0.25)
Respondent is in a couple (dummy)	-0.019	-0.017	-0.017	-0.023*	-0.024*	-0.016	-0.023*
	(-1.36)	(-1.23)	(-1.13)	(-1.88)	(-1.92)	(-1.07)	(-1.95)
Respondent is single (dummy)	-0.003	-0.005	-0.002	-0.005	-0.003	-0.001	-0.003
	(-0.11)	(-0.17)	(-0.05)	(-0.17)	(-0.13)	(-0.04)	(-0.10)
Area attractiveness index (3-to-15 scale)	-0.007*	-0.006*	-0.006*	-0.006**	-0.006*	-0.007**	-0.006*
	(-1.90)	(-1.85)	(-1.78)	(-2.01)	(-1.84)	(-2.02)	(-1.83)
Presence of family members around	-0.053*	-0.054*	-0.055*	-0.050*	-0.052*	-0.053*	-0.052*
	(-1.75)	(-1.70)	(-1.78)	(-1.72)	(-1.74)	(-1.74)	(-1.77)
Lifetime in the area (in year)	-0.001	-0.001*	-0.001	-0.003***	-0.001	-0.001	-0.003***
	(-1.51)	(-1.67)	(-1.39)	(-8.78)	(-1.59)	(-1.47)	(-10.69)
Willingness to eat a fruit from supermarkets without washing it (1-to-5 scale)	-0.003	-0.003	-0.003	-0.003	-0.002	-0.003	-0.002
	(-0.30)	(-0.28)	(-0.26)	(-0.36)	(-0.19)	(-0.30)	(-0.21)
Willingness to live in a polluted land that decreases life expectancy by 5yo (1-to-5 scale)	0.006	0.005	0.005	0.005	0.005	0.004	0.002
	(0.37)	(0.33)	(0.33)	(0.32)	(0.32)	(0.27)	(0.11)
Perceived knowledge about health impacts of pollution exposure (1-to-5 scale)	-0.000	-0.000	-0.000	0.000	-0.001	-0.001	-0.001
	(-0.02)	(-0.05)	(-0.01)	(0.02)	(-0.11)	(-0.13)	(-0.10)
Perceived knowledge about anti-pollution protection methods (1-to-5 scale)	-0.003	-0.004	-0.003	-0.005	-0.004	-0.004	-0.005
	(-0.46)	(-0.49)	(-0.46)	(-0.68)	(-0.48)	(-0.59)	(-0.78)
Associative involvement (dummy)	0.022	0.017	0.021	0.022	-0.064**	0.024	-0.060**
	(0.67)	(0.53)	(0.63)	(0.69)	(-2.27)	(0.75)	(-2.10)
Social cohesion perception (1-to-5 scale)	-0.029***	-0.031***	-0.030***	-0.027***	-0.029***	-0.030***	-0.029***
	(-3.83)	(-4.35)	(-4.02)	(-3.93)	(-3.97)	(-4.07)	(-4.82)
Regular participation in community meetings (dummy)	0.043	0.040	0.041	0.045	0.059	0.043	0.053
	(0.65)	(0.62)	(0.62)	(0.71)	(0.80)	(0.65)	(0.77)
Regular participation in community parties (dummy)	-0.042	-0.039	-0.046	-0.039	-0.036	-0.083**	-0.048*
	(-1.45)	(-1.31)	(-1.55)	(-1.44)	(-1.27)	(-2.56)	(-1.68)
ln(wealth index +1)	-0.046	-0.048	-0.049	-0.033	-0.042	-0.046	-0.031
	(-1.25)	(-1.35)	(-1.35)	(-0.91)	(-1.17)	(-1.32)	(-0.98)
ln(number of members who obtained a high-school grade +1)	0.028**	-0.011	0.031**	0.024*	0.019	0.033**	-0.001
	(1.99)	(-0.61)	(2.10)	(1.70)	(1.23)	(2.40)	(-0.06)
Overpolluted area (dummy)	**0.078*** **	**0.047** **	**0.154*** **	**0.035*** **	**0.044**	**0.053*** **	**0.089** **
	(3.67)	**(2.35)**	**(4.11)**	**(3.05)**	**(1.63)**	**(4.05)**	**(2.01)**
ln(highschool)*OverpollutedArea		**0.072*** **					**0.039** **
		(6.08)					**(2.43)**
AverageAge*OverpollutedArea			**-0.002*** **				**-0.003*** **
			(-2.80)				**(-2.99)**
Lifetime*OverpollutedArea				**0.002*** **			**0.003*** **
				(3.65)			**(3.87)**
AssociativeInvolvement*OverpollutedArea					**0.200*** **		**0.181*** **
					(3.62)		**(3.07)**
CommunityParties*OverpollutedArea						**0.082* **	**0.019**
						(1.92)	**(0.41)**
Country fixed-effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	656	656	656	656	656	656	656
Pseudo R-square	0.155	0.159	0.157	0.159	0.168	0.159	0.181
Wald test of exogeneity when an IV-Probit is run (p-value)		0.32 (0.8509)					

Notes: (1) Standard errors are robust to intra-group correlation. Significance levels are: ***1%, **5%, *10%,

(2) Wealth index is the sum of the following owned (or not) assets: former house, second house, car, air conditioner, computer, cellphone and financial assets. Thus, the wealthiest households have a score of 7 while the most deprived household a score of 0. Then, this score is log-transformed by adding 1 for avoiding the generation of missing values (i.e. log(0)=.). We employ the same log-transformation for the number of members who obtained a high-school grade at least.

(3) Area attractiveness index is the sum of the following 1-to-5 perception scores: global attractiveness, availability of public services and availability of shops and retails. Thus, areas perceived as the most attractive have a score equal to 15, while areas perceived as the most deprived have a score of 3.

(4) When IV-Probit is run for testing the exogeneity hypothesis (Wald test), we use the numbers of household members belonging to the lowest height category (tercile 1) and the highest weight category (tercile 3) as instrumental variables for the logarithm of the number of educated numbers. This IV-Probit regression is employed using a two-step estimator.

Source: Authors' calculation from the CSPE database.

Table 8: Factors NOT correlated to the intention to move out over-polluted areas in the next 5 years, average marginal effects based on Eq.3

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Household size	-0.006	-0.008	-0.007	-0.007	-0.008	-0.008	-0.008
	(-0.29)	(-0.41)	(-0.38)	(-0.37)	(-0.45)	(-0.40)	(-0.40)
Number of children	0.009	0.009	0.009	0.009	0.008	0.010	0.009
	(0.44)	(0.46)	(0.44)	(0.44)	(0.41)	(0.47)	(0.46)
Average age of adults (in years)	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***
	(-3.07)	(-3.12)	(-3.10)	(-3.06)	(-3.18)	(-3.10)	(-2.98)
Number of male members	-0.006	-0.004	-0.005	-0.007	-0.003	-0.004	-0.004
	(-0.19)	(-0.13)	(-0.14)	(-0.21)	(-0.11)	(-0.14)	(-0.13)
Respondent is in a couple (dummy)	-0.022*	-0.019	-0.019	-0.017	-0.019	-0.019	-0.019
	(-1.82)	(-1.52)	(-1.32)	(-1.27)	(-1.35)	(-1.43)	(-1.35)
Respondent is single (dummy)	-0.003	-0.003	-0.004	-0.003	-0.004	-0.004	-0.003
	(-0.10)	(-0.10)	(-0.15)	(-0.11)	(-0.12)	(-0.13)	(-0.09)
Area attractiveness index (3-to-15 scale)	-0.006*	-0.006	-0.007**	-0.007**	-0.006*	-0.007*	-0.006*
	(-1.83)	(-0.96)	(-1.98)	(-2.04)	(-1.72)	(-1.83)	(-1.87)
Presence of family members around	-0.053*	-0.053*	-0.052*	-0.115*	-0.053*	-0.053*	-0.053*
	(-1.78)	(-1.76)	(-1.80)	(-1.81)	(-1.76)	(-1.76)	(-1.74)
Lifetime in the area (in year)	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	(-1.50)	(-1.50)	(-1.56)	(-1.51)	(-1.56)	(-1.42)	(-1.41)
Willingness to eat a fruit from supermarkets without washing it (1-to-5 scale)	-0.004	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003
	(-0.39)	(-0.30)	(-0.27)	(-0.29)	(-0.29)	(-0.30)	(-0.28)
Willingness to live in a polluted land that decreases life expectancy by 5yo (1-to-5 scale)	0.005	0.006	0.005	0.004	-0.022	0.006	0.006
	(0.30)	(0.37)	(0.35)	(0.26)	(-0.89)	(0.37)	(0.37)
Perceived knowledge about health impacts of pollution exposure (1-to-5 scale)	0.001	-0.000	-0.000	-0.000	-0.000	0.003	-0.000
	(0.06)	(-0.02)	(-0.01)	(-0.05)	(-0.01)	(0.17)	(-0.02)
Perceived knowledge about anti-pollution protection methods (1-to-5 scale)	-0.004	-0.004	-0.003	-0.003	-0.004	-0.004	-0.005
	(-0.54)	(-0.50)	(-0.44)	(-0.46)	(-0.51)	(-0.49)	(-0.40)
Associative involvement (dummy)	0.022	0.022	0.022	0.022	0.022	0.023	0.022
	(0.68)	(0.68)	(0.66)	(0.67)	(0.66)	(0.68)	(0.66)
Social cohesion perception (1-to-5 scale)	-0.030***	-0.029***	-0.021	-0.029***	-0.029***	-0.029***	-0.029***
	(-3.94)	(-3.85)	(-1.09)	(-4.48)	(-3.61)	(-3.63)	(-3.69)
Regular participation in community meetings (dummy)	0.044	0.043	0.041	0.040	0.043	0.043	0.043
	(0.68)	(0.65)	(0.63)	(0.62)	(0.65)	(0.65)	(0.66)
Regular participation in community parties (dummy)	-0.043	-0.042	-0.041	-0.043	-0.044	-0.041	-0.042
	(-1.58)	(-1.50)	(-1.44)	(-1.56)	(-1.47)	(-1.48)	(-1.53)
ln(wealth index +1)	-0.096**	-0.046	-0.046	-0.041	-0.046	-0.047	-0.046
	(-2.09)	(-1.31)	(-1.26)	(-1.12)	(-1.26)	(-1.22)	(-1.24)
ln(number of members who obtained a high-school grade +1)	0.030**	0.028**	0.029**	0.026	0.029**	0.028**	0.028**
	(2.15)	(2.04)	(2.32)	(1.56)	(2.17)	(1.99)	(1.98)
Overpolluted area (dummy)	**-0.045**	**0.081**	**0.124**	**0.039****	**0.041**	**0.088****	**0.074****
	(-0.58)	**(1.29)**	**(1.47)**	**(2.52)**	**(1.13)**	**(2.06)**	**(2.00)**
ln(wealth)*OverpollutedArea	**0.082**						
	(1.57)						
Attractiveness*OverpollutedArea		**-0.000**					
		(-0.05)					
SocialCohesion*OverpollutedArea			**-0.013**				
			(-0.66)				
FamilyNetwork*OverpollutedArea				**0.095**			
				(1.41)			
RiskTaker*OverpollutedArea					**0.032**		
					(1.17)		
HealthKnowledge*OverpollutedArea						**-0.005**	
						(-0.26)	
ProtectionMethods*OverpollutedArea							**0.003**
							(0.15)
Country fixed-effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	656	656	656	656	656	656	656
Pseudo R-square	0.158	0.155	0.156	0.161	0.157	0.155	0.155

Notes: (1) Standard errors are robust to intra-group correlation. Significance levels are: ***1%, **5%, *10%,

(2) Wealth index is the sum of the following owned (or not) assets: former house, second house, car, air conditioner, computer, cellphone and financial assets. Thus, the wealthiest households have a score of 7 while the most deprived household a score of 0. Then, this score is log-transformed by adding 1 for avoiding the generation of missing values (i.e. log(0)=.). We employ the same log-transformation for the number of members who obtained a high-school grade at least.

(3) Area attractiveness index is the sum of the following 1-to-5 perception scores: global attractiveness, availability of public services and availability of shops and retails. Thus, areas perceived as the most attractive have a score equal to 15, while areas perceived as the most deprived have a score of 3.

Source: Authors' calculation from the CSPE database.

Table 9: Convergence and divergences between living and move-out intention determinants

	Main determinants of the probability of living in over-polluted areas	Determinants of the intention to remain living in the next 5 years in over-polluted area
Socioeconomic factors	Low wealth index (including housing former and second properties, car, cellphone, air conditioner, computer and financial assets)	No effect of wealth
	Low income (because rent prices are low)	No effect of income
	Low education	Low education
Demographic factors	Number of children, low average age of adults	Aging
	Being single and in a couple (compared to being divorced, separated or widowed)	
Local (des)advantages	Low area attractiveness index (including perceived availability of public facilities and retails and global attractiveness perception)	No effect of area attractiveness
	Presence of a family network in place	No effect of family network
Attachment	Lifetime (in years)	Lifetime
		Regular participation in community parties
Behaviors against risk	Being risk taker in terms of life expectancy loss	No effects
	Being risk averse in terms of pesticide ingestion	
Associative involvement	No associative involvement	No associative involvement
Knowledge about pollution	-	No effect
Pollution exposure	-	Strong determinant