



Air Pollution and Migration in Italy: An Empirical Investigation at Provincial Level

Human mobility in relation to climate change and environmental degradation has been gaining increasing prominence in public and policy debates. Though many factors can come into play on mobility decisions, it is suggested that the increased concerns with environmental risks may be influential in shaping internal and external migration patterns

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This paper is an initial exploration to investigate the relationship between migration and environmental pollution in Italy. It first provides a brief survey of the main strictly related literature and, then, it aims to discuss the major concepts behind the research question, i.e. whether air pollution could be one of the push factors that force people to migrate. In order to capture the potential links between local economic conditions (i.e., unemployment, income, level of infrastructures, entrepreneurial spirit, etc.), demographic characteristics, environmental pollution and migration patterns, an empirical model will be developed including data, at provincial level, reflecting all these characteristics. We need to say that this is a preliminary analysis of an ongoing work. As such, it is not intended to be definitive but to inform about future work. To the best of our knowledge, so far, there is no nation-wide study designed to explore the relationship between environmental risks and migration streams in Italy and we believe that the results might be particularly important, as they will offer the first empirical examination of the association between population migration/redistribution at provincial level and environmental risk factors in Italy.

Air pollution and migration

Air pollution is amongst the major environmental problems in Italy especially in some provinces that suffer heavy levels of pollution due to industrial activities. Although increasing attention is being devoted to the effects of road traffic in large urban areas, the problem still remains very serious. In recent years, the city of

Taranto and the municipalities in the so-called *Land of Fires*, for example, have characterized both the national and international debate due to the integration of human health, environmental impact, economic and social issues. This research explores the possibility that concern with environmental risk may also be reflected in the choice of residential location. More specifically, we consider the relationship between the presence of environmental risk and migrations streams between provinces in the different regions within and outside Italy. While many factors can come into play on mobility decisions, we should test whether the increased concerns with environmental risks may be influential in shaping the Italian internal and external migration patterns. We aim to

investigate whether population flows move away from areas which pose higher levels of environmental risk toward those characterized by lower risk levels, net of the other contextual factors associated with migration streams. Specific attention is, indeed, paid to the environmental risk posed by air pollution.

The public's environmental concern has begun to take a new level of importance in Italy and the willingness of several grassroots organizations, activists, NGOs and local communities to react against local environmental risk represents a significant shift in the public perception of the environment. Events such as the outcome of the Seveso tragedy that occurred in Lombardy in 1976, the industrial petrochemical pole of Melilli-Priolo-Augusta, Gela and



Fig. 1 Sites of National Interest for the Remediation (SIN)/Italian Polluted Sites (IPS)
Source: SENTIERI Project (2011). Studio epidemiologico nazionale dei territori e degli insediamenti esposti a rischio da inquinamento: risultati, in *Epidemiologia e Prevenzione*, 35 (5-6) Suppl. 4: 1-204

Milazzo sites in Sicily, the dioxin pollution of the ILVA steel plant in Puglia, the waste mismanagement disaster of the *Terra dei Fuochi*¹ in Campania, have brought the emergence of citizen involvement in the determination of environmental risk (EFFACE, 2015 [1]).²

The *Terra dei Fuochi* is a clear example of how, during the twenty years of environmental conflicts in Campania region, the victims have reinforced their networks unveiling the environmental burden of illegal trafficking of waste (with the resulting burying and burning of toxic waste) and denouncing the tragic consequences of such criminal activities on health [2]. This increasing awareness has created more attention on the effects of pollution and population has begun to realize that environmental risk can be found in their own backyard. Moreover, the consolidation of grassroots organizations (most of those that fight against the waste related environmental crime have formed a social coalition called “Stop Biocide”) has been increasing public awareness on the impacts of illegal waste disposal, thus, shedding light on the capacity of civil society to influence policy changes and decision makers at different institutional levels [1].

In Italy, the sites considered to be very contaminated are numerous and often belong to industrial agglomerates. Epidemiological studies represent the scientific basis used to verify the existence of negative health effects caused by air pollution (i.e., cancer, respiratory, cardiovascular and neurological diseases) and to quantify the value of these effects, estimating the dose-response relationships. In relation to this, already in 2006, the Italian Ministry of Health funded a project called

“SENTIERI”³ with the purpose of analyzing the mortality of populations living in proximity of a number of industrial agglomerates which, by their nature, could potentially have a high factor of hazardous health and/or environmental contamination such as to be classified as SIN (Sites of National Interest for the Reme-

diation). The SENTIERI project includes the analysis of residents’ mortality in 44 out of the 57 SIN (those for which the analysis of mortality at the municipal level was assessed as appropriate), where pollution levels are beyond the legal thresholds (see Figure 1), from Valle D’Aosta to Sicily with almost six million people

Ranking	Provinces	Local pollution index	Ranking	Provinces	Per-capita local pollution
1	Catania	1826046.33	1	Catania	6051
2	Messina	735798.83	2	Messina	3688
3	Taranto	257281.84	3	Taranto	1085
4	Torino	109539.29	4	Nuoro	768
5	Roma	97926.51	5	Cuneo	631
6	Napoli	68904.84	6	Sassari	395
7	Livorno	66024.18	7	Olbia-Tempio	393
8	Palermo	63914.11	8	Enna	382
9	Brescia	63017.02	9	Cagliari	342
10	Milano	62280.79	10	Torino	333
11	Genova	56209.05	11	Carbonia-Iglesias	323
12	Cuneo	53574.42	12	Potenza	322
13	Siracusa	50926.61	13	Perugia	303
14	Bergamo	49078.24	14	Foggia	280
15	Varese	45101.40	15	Siracusa	270
16	Venezia	41809.62	16	Vercelli	266
17	Cagliari	41159.01	17	Alessandria	260
18	Bari	39283.08	18	Palermo	257
19	Pavia	38829.53	19	Bolzano-Bozen	256
20	Verona	37620.28	20	Caltanissetta	248

Tab. 1 Most polluted provinces by local pollution and by per-capita local pollution (measured in megagrams – year 2010): top-20 cities
Source: our elaborations on ISPRA air pollution data

exposed to the risk of very serious diseases.

The existing literature on the environment-migration nexus is dominated by neo-Malthusian and push-pull theories. Though the migration theory does historically take into account environmental indicators, it is only recently that it has received renewed attention. Economic theoretical issues concerning determinants of migration are commonly explored at either macro or micro level. Neo-classical *macro*-economists focus on differentials in wages and employment conditions between locations, and on migration costs: individuals migrate from lower-wage to higher-wage locations to increase their current and future incomes. Neoclassical *micro*-economists regard migration as a rational decision by individuals to maximize their income: prospective migrants will decide to migrate if they can expect a positive net return from movement. Sociologists highlight migrant networks and a 'culture of migration'. Political scientists stress political instability and armed violence as driving forces of migration. To the extent environmental factors are considered in these approaches, they are regarded as either 'stressors' or 'locational characteristics' that can influence the likelihood of migration.

In a recent work [3], the authors found that air pollution in China has a significant impact on labor migration; they use the average PM2.5 index and number of good days in a year as proxy variables for air pollution to investigate the effects of air pollution on labour outflow. The main empirical results revealed that air pollution has a significantly positive effect on labour force outflow. Just to mention a few academic papers, Xu and Sylwester [4] found



that air pollution is positively associated with emigration (to OECD countries) rates but mostly for higher educated migrants although the estimated magnitudes suggest that pollution is not a dominant factor as to why people emigrate. Hunter [5] found that in the U.S. counties with environmental hazards (air and water pollution, hazardous waste) do not lose residents at greater rates than areas without such hazards. However, areas with such risks gain relatively fewer new residents. Hsieh and Liu [3] found that, in the U.S., in the short-run, a better environmental quality is the dominant factor in explaining interregional migration. The environmental factors that they consider include climatological data and information on recreational areas and facilities, as well as solid waste production and air, water and noise pollution.

Based on the review of this literature, the main purpose of our work is to come to an assessment on the likely impacts of environmental pollution on population migration within (and outside) the Italian provinces, with a view to bridging the gap between the most classical theories on migration which tend to ignore the environ-

ment as a driver of migration and the most theories on environmental governance which tend to ignore migration flows. The results might be particularly important, as they will offer the first empirical examination on the association between population migration/redistribution at provincial level and environmental risk factors in Italy.

We shall implement a simple model of environmental migrations, which posits a relationship between migration flows in the years 2011-2015 in each Italian province and provincial-level environmental quality variables, plus some socio-economic-demographic control variables. This allows to explore the main research question, namely, to what extent does pollution lead to migration to other provinces in the same region/in other regions/or outside the country. Based on the 2010 air pollution emissions data provided by the Italian Institute for Environmental Protection and Research (ISPRA)⁴, which is also responsible for the National Emission Inventory, Table 1 illustrates local air emission levels and their per-capita emission levels for the first twenty most polluted Italian provinces.

While air pollution in the Northern regions is generally higher due to the high level of industrialization and urbanization, in the Southern regions the illegal disposal of hazardous industrial waste together with the presence of high environmental impact industrial plants play a most significant role. In Italy, the perception that people have of pollution has begun to increase and it could, eventually, induce bigger

proportions of population to leave their homes and migrate toward places with a better quality of life. While research on the environment-migration nexus has been conducted for some time, the relationship between environmental degradation and migration in Italy is relatively new an issue and the relevant information is rather poor. Whatever our investigation results will be – i.e., whether the decision

to emigrate can be associated with air pollution for the sake of safe good health conditions, or with the perspective of possible higher income in areas with increased economic activity, they will sure contribute to increase our understanding of the environmental-footprint migrations in Italy.

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¹ The *Terra dei Fuochi* is an area comprising the municipalities of Acerra, Nola and Marigliano near the city of Naples (Italy). The area has recently experienced increasing deaths caused by cancer and other diseases, related to pollution from illegal waste disposal by criminal organizations

² EFFACE is a research project, “European Union Action to Fight Environmental Crimes” (www.efface.eu), which has been funded (for the period 2012-2016) by the European Commission under the Seventh Framework Programme

³ Studio Epidemiologico Nazionale dei Territori e degli Insediamenti Esposti a Rischio da Inquinamento - National Epidemiologic Study of the Territories and Settlements Exposed to Risk from Pollution. <http://www.epiprev.it/sentieri/home>

⁴ ISPRA is the Institute for Environmental Protection and Research established by Italian Law 133/2008. The ISPRA dataset includes data on air emissions in all the Italian provinces (110 provinces distributed over 20 regions). This is a comprehensive database that collects all emission estimates of the major pollutants including greenhouse gases, ozone precursors, benzene, particulate matters, heavy metal and polycyclic aromatic hydrocarbon. Disaggregazione dell’Inventario Nazionale, data available at <http://www.sinanet.isprambiente.it/it/sia-ispra/inventaria/disaggregazione-dellinventario-nazionale-2010/disaggregazione-dell2019inventario-nazionale-2013-versione-completa/view>

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