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These jobs are going, and they ain't coming back: internal mobility in response to manufacturing decline

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Abstract

This paper investigates the impact of severe manufacturing crises on internal migration patterns across Italian local labour markets (LLMs) between 2000 and 2019. Leveraging a staggered difference-in-differences design, we estimate the causal effect of these shocks on the mobility of the working-age resident population. The results indicate a significant decline in net migration, primarily driven by an immediate reduction in inflows, which is nearly twice the size of the concurrent rise in outflows to other LLMs. We uncover substantial heterogeneity by citizenship, as foreign nationals are significantly less likely to migrate into affected areas following a crisis, while no systematic differences emerge by gender. The effects are more evident in district-based LLMs, moderately urbanized areas, and those located in Central and Northern Italy. The results are robust across alternative model specifications and difference-in-differences estimators. These findings highlight the uneven impact of manufacturing decline on internal migration patterns across both population groups and LLM characteristics.

JEL Class.: J61, J63, R23, R58

Keywords: internal mobility, manufacturing crises, mass lay-offs, local labour markets

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These jobs are going, and they ain't coming back: internal mobility in response to manufacturing decline[†]

Giulia Bettin *Silvia Mattiozzi*

1 Introduction

In advanced countries, the process of globalization accelerated and amplified the decline of manufacturing, especially in low-tech industries, due to both competition from low-cost imports and the increasing level of automation (Acemoglu et al., 2016; Autor et al., 2016; Dorn and Levell, 2024; Vu et al., 2021). Plant closures accounted for 75 percent of the 6.6 million job losses between 1977 and 2012 in U.S. manufacturing firms (Fort et al., 2018), with immediate economic repercussions[1] (Dorn and Levell, 2024), but also broader long-term social consequences such as increasing drug use and mortality rates (Clainche and Lengagne, 2023; Pierce and Schott, 2020; Venkataramani et al., 2020), declining marriage and fertility rates (Autor et al., 2019) and the rise of far-right populist parties (Bekhtiar, 2025).

Labor market shocks due to plant closures and mass layoffs can also affect migration patterns[2]. While industrialization has been a key driver of inward migration in the past, the current decline of manufacturing may instead be prompting population outflows, besides reducing new inflows. Such reversal underscores the evolving role of manufacturing in shaping the demographic and economic landscape.

This paper explores how the decline of the manufacturing sector in Italy affected internal mobility patterns among the working-age population. Like many industrialised countries, Italy faced a significant decline in its manufacturing sector, providing a setting that preserves the external validity of our findings and may offer valuable insights for understanding similar trends in internal migration in other advanced economies. However, Italy has also a long history of

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[1] The literature extensively documented the direct effects of mass layoffs on displaced workers, explored among the others by Ruhm (1991) and Jacobson et al. (1993). However, large-scale layoffs exert also spillover effects on the surrounding labor markets (Jofre-Monseny et al., 2018; Gathmann et al., 2020; vom Berge and Schmillen, 2022).

[2] The literature examined the demographic effects of various economic and environmental shocks, including natural disasters (Mahajan and Yang, 2020; Dottori, 2024), air pollution (Wang and Zhou, 2025; Zhang et al., 2022), adverse climatic conditions (Roeckert and Kraehnert, 2022), political changes (Bellodi et al., 2024), resource discoveries (Gittings and Roach, 2020; Wilson, 2022), policy interventions (Bazillier et al., 2023; Facchini et al., 2017), and migration law reforms (Czaika and de Haas, 2017).

internal migration driven by the persistent North-South divide (Fratesi and Percoco, 2014). Studying the impact of manufacturing crises allows to assess whether they reinforce the existing South-North gradient in internal mobility, or whether they contribute to the emergence of new left-behind areas, with a different geographical pattern.

Using a staggered difference-in-differences design, we investigate whether structural crises, or the closure of nationally significant production plants, affected internal labor mobility of individuals aged 18–64 across Italian local labor markets (LLMs) over the period 2000–2019. To identify episodes of acute industrial distress, we rely on the official designation of "complex industrial crisis area" by the Italian government, which marks particularly severe and nationally relevant downturns. While these designations often prompt targeted policy interventions, we do not assess the effects of such measures in this analysis. Instead, we use the classification of complex industrial crisis areas as a criterion to identify major crisis events. Since the analysis does not explicitly account for post-crisis policies, the estimated effects should be interpreted as a lower bound of the true causal impact, potentially reflecting the mitigating influence of policy responses.

The work builds on and extends the still limited causal evidence available for the Italian context. Despite a longstanding academic interest in regional disparities and labor mobility in Italy (Biagi et al., 2011; Avola et al., 2023; Panichella, 2025), only a few studies have provided robust causal estimates of the effects of local labor demand shocks. Ciani et al. (2019) were among the first to examine such effects within Italian LLMs from 1971 to 2011, using ten-year Census data. They found that mobility played a limited role as an adjustment mechanism. More recently, Basso et al. (2023) used administrative data on job transitions from 2010 to 2018 to estimate the effects of firm-level labor demand shocks. They showed that internal migration responses were more pronounced for job creation than job destruction, with inflows being more geographically dispersed and outflows more locally concentrated.

Our paper differs from these contributions in three main respects. First, we use restricted-access microdata on changes of residence between Italian municipalities, provided by ISTAT, to compute net flows, inflows, and outflows of the working-age population at the LLM level. This allows for a more detailed analysis than Ciani et al. (2019), who used decennial changes in the working-age population stock as a proxy for migration. We also depart from Basso et al. (2023), who inferred migration from Statistical Information System of Compulsory Communications (SISCO) administrative data on individual workplace transitions (activation, transformation, extension, termination), assuming that a change in the workplace location implied a change in residence. While they found a strong correlation between job-based and residence-based flows, SISCO data cannot capture movements of non-employed individuals. The use of residence change data over a longer period (2000–2019) enables us to study both short- and long-term responses to industrial crises, complementing their shorter-term findings.

Second, our identification strategy focuses on severe negative labor demand shocks, defined by the official classification of "complex industrial crisis area" by the Italian Ministry of Economic Development. Unlike approaches that rely on imputed shocks such as Bartik-type instruments (Ciani et al., 2019), we use observed, policy-relevant events tied to major industrial disruptions. This aligns more closely with strategies based on actual episodes of mass layoffs (Basso et al., 2023).

Third, we expand on previous evidence by exploring heterogeneity in mobility patterns according to the individual-level characteristics provided by data on residence changes such as gender, citizenship and age. We also differentiate our analysis according to the available characteristics at LLM-level: level of urbanisation, industrial intensity, and geographical location.

In general, our findings indicate that net migration decreases following manufacturing crises, due to both reduced inflows from other Italian LLMs and increased outflows towards other LLMs. However, the contraction in inflows is about twice as large as the increase in outflows. The results are robust to the use of both alternative DiD estimators and extended pre-treatment periods.

Mobility responses are broadly similar across genders, though estimates for men are more precise, possibly reflecting lower baseline heterogeneity, or (unobservable) gender-specific constraints. Older residents show a gradual rise in outward mobility, likely linked to declining services, shifting amenities, or family reunification motives, while foreign citizens respond more strongly and immediately than Italian nationals, with more pronounced inflow declines over time. The strongest effects appear in highly specialized areas such as industrial districts, yet even seemingly resilient LLMs (medium-sized/moderately urbanised and those located in Northern-Central Italy) face sizeable losses, hinting at the hidden roles of wage support schemes and tight-knit social networks in delaying or reshaping migration responses. By disentangling these demographic and spatial patterns, our study shows that migration can act as a partial adjustment mechanism to local economic shocks, but its scale, timing, and selectivity are deeply shaped by place-specific vulnerabilities, individual characteristics and institutional contexts.

The remainder of the paper is structured as follows. Section 2 provides a review of the empirical contributions on the effects that industrial crises have on internal mobility. The Italian context, the data and the identification strategy are described in Section 3. Section 4 presents the main results, while the robustness checks and the heterogeneity analysis are shown in Section 5 and Section 6. Section 7 concludes.

2 Background and Related Literature

This paper lies at the intersection of two strands of economic literature: one that investigates the broad consequences of labour market shocks, such as plant closures and mass layoffs (Blien et al., 2021; Bertheau et al., 2023), and another that examines the determinants of internal labour mobility (Alvarez et al., 2021; Jia et al., 2023). A growing body of research has begun to explore the direct relationship between these two phenomena, studying internal mobility as a potential absorption mechanism at the aggregate level in the aftermath of adverse shocks (Blanchard and Katz, 1992; Decressin and Fatas, 1995).

Much of the early evidence comes from the United States, traditionally viewed as a country with high internal mobility. However, even there internal mobility has declined over time (Cooke, 2011). Azzopardi et al. (2020) observed that the U.S. population has become less mobile, with the percentage of people moving each year falling from around 20% in the 1970s to less than 10% in recent years. These findings are confirmed by Basso and Peri (2020), especially with reference to the Great Recession. Dao et al. (2017) argued that also the way U.S. local labor markets adjust to labor demand shocks has declined over time. Using long-term data and administrative records on migration flows, they find that while migration played a significant role in adjustment from the 1970s to the 1990s, since then, unemployment and labor force participation have become the main adjustment mechanisms. This slowdown is largely due to a lower willingness to migrate among those living in the poorest areas. Foote et al. (2015) studied the relationship between mass layoffs and changes in the local labor force at the county level. They observed that, before the Great Recession, the decline in the county's labor force following layoffs was primarily due to migration. In contrast, after the 2008 crisis, the decline is mostly attributable to non-participation in the labour force. Faber et al. (2022) analyzed the migration response in U.S. Commuting Zones to two major recent shocks affecting manufacturing: the automation of production and the rise in Chinese imports. While both shocks reduced employment, only automation had a measurable impact on migration dynamics. In contrast, Foschi et al. (2025) suggested that mobility still plays an important role in labor market adjustments, though with a time lag. Following an increase in regional labor demand, the initial adjustment mechanism is mainly a reduction in unemployment. After 5 years, however, roughly 60 percent of the increase in employment is explained by net immigration.

While much of the literature has focused on the US, an emerging body of work examines how

European labor markets respond to mass layoffs and plant closures. Vermeulen and Braakmann (2023) used data from the European Restructuring Monitor Database to estimate the impact of mass layoffs on employment and productivity across European regions between 2007 and 2018. They showed that mobility patterns were significantly affected only when the layoffs involved a substantial share of the regional labor force. Focusing on individual European countries, the existing evidence is quite heterogeneous. Using data from the German Employee History database for the period 1999–2008, Neffke et al. (2018) found that following plant closures in Germany about one-fifth of full-time dismissed workers aged 25-50 did not find a stable job within three years of dismissal. Among those who did find new employment, about two-thirds changed industries, while one-third moved out of the region. Based on administrative panel data on Denmark for the period 2007-2015, Hansen et al. (2021) observed a positive relationship between living in rural regions and migration following dismissal. However, there is also a high probability of being re-employed within two years while continuing to live in the same rural area. The authors conclude that, based on their evidence, it is plausible to assume that job loss does not immediately trigger outward migration. Rather, changes in population are more likely due to a decline in incoming migration flows. In contrast to the previous studies, Jofre-Monseny et al. (2018) used a difference-in-differences approach to examine the impact of the closure of 45 large manufacturing plants in Spain between 2001 and 2006 and showed that these closures had no effect on migration dynamics in the affected areas.

In the Italian context, internal migration is a longstanding structural phenomenon that has evolved through distinct historical phases. Traditionally, mobility has followed a South-to-North trajectory, a pattern already evident in the aftermath of World War II and persisting until the mid-1970s (Panichella, 2025). Despite enduring regional disparities in employment opportunities, South-to-North flows declined between the mid-1970s and the mid-1990s (Biagi et al., 2011). Since the late 1990s, internal mobility has picked up again, still primarily directed northward, and increasingly driven by younger, highly educated individuals (Mocetti and Porello, 2010).

Despite the historical relevance of internal migration, relatively few studies have examined how mobility responds to localized labour demand shocks in Italy. A first contribution was offered by Ciani et al. (2019), who investigated long-term population responses to labor demand shocks at the local labor market level between 1971 and 2011, using Census data and Bartik-style instruments to identify shocks. Their results indicated that internal migration plays only a limited compensatory role, insufficient to offset job losses at the Local Labour Market (LLM) level. More recently, Basso et al. (2023) analyzed the effects of local labour demand shocks using administrative data for the 2010–2018 period. Exploiting variation from large-scale firm-level events, they found that net migration responses are asymmetric: positive shocks lead to larger in-migration flows, while negative shocks result in smaller or negligible outflows. Their estimates suggested that a one-percentage-point increase in job creation raises the in-migration rate by 0.23 percentage points, whereas job destruction reduces in-migration by roughly two-thirds.

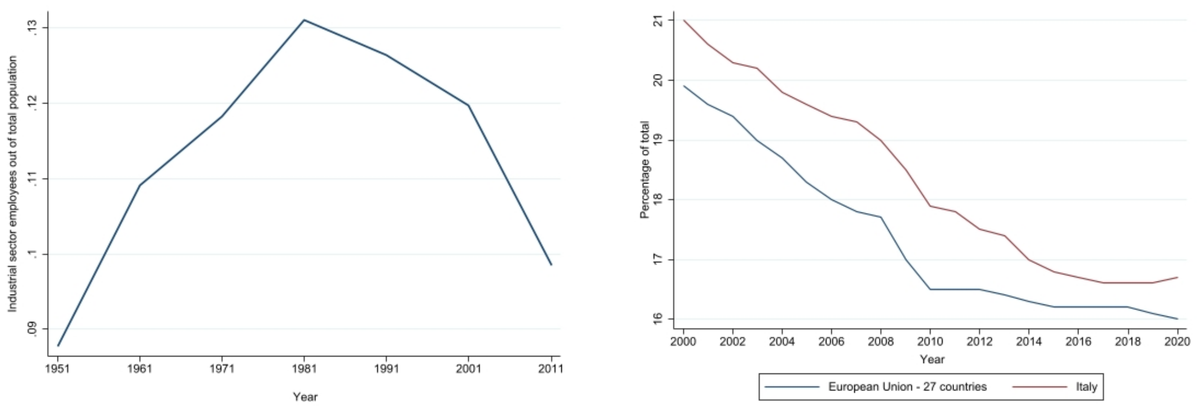
3 Empirical Setting: Data and Methods

3.1 The Italian Context

In the decades following the end of World War II, the Italian economy experienced remarkable growth, with the manufacturing sector playing a major role (Gomellini and Toniolo, 2017). As in many other advanced countries, the share of manufacturing employees followed a steeply increasing trend (Figure 1a). By the early 1980s, Italy was ranked as the second-largest manufacturing power in Europe after West Germany, and fifth among OECD and major industrial economies (OECD, 1984). Italy's industrial growth was underpinned by two distinct models of production. The first was the industrial district model, based on dense local networks of small and micro firms specializing in different stages of a shared production process. This system, concentrated in specific geographic areas and strongly rooted in traditional, labor-intensive sectors, such as textiles, clothing, furniture, and wood, was a key driver of Italy's export competitiveness throughout the 1980s and 1990s (Signorini, 2001). The second was a vertically integrated subcontracting model, centered around large firms in sectors such as household appliances and automotive. This system relied heavily on a hierarchical network of suppliers and on cost competitiveness, often achieved through the use of low-wage labor.

While both models were effective in sustaining industrial development up to the 1990s, they proved increasingly vulnerable in the face of globalization and technological change between the 1990s and 2000s (Di Giacinto et al., 2013). The industrial district model struggled to adapt to rising import competition and rapid technological innovation, both of which favored scale, capital intensity, and R&D capacity, areas where small firms faced structural disadvantages. At the same time, the vertically integrated model came under pressure as lead firms, exposed to competition from emerging economies, found it difficult to maintain cost advantages and secure long-term investment in domestic production chains. Import competition from low-wage countries—especially China—hit low-skilled, labor-intensive firms the hardest (Federico, 2014; Citino and Linarello, 2022). Relative to the EU-27 average, Italy experienced a steeper decline in the manufacturing employment share, highlighting the depth of its deindustrialization process (Figure 1b).

Figure 1: Manufacturing employment in Italy and EU countries



(a) Employees in manufacturing and extractive sectors out of total population, Italy

(b) Employment in manufacturing out of total employment, Italy and EU-27

Note: Authors' elaboration on Istat and Eurostat data. Data in panel A are from Italian Census (1951–2011). Data in panel B refer to the share of employment in NACE Rev. 2 sectors B–E (excluding construction).

The crisis of both the district-based and vertically integrated production models triggered widespread plant closures and significant layoffs across the country. In many cases, these crises were preceded by formal announcements from business associations or labor representatives and were followed by negotiations at both the local and national levels. During this period, the use of social safety nets, particularly unemployment support measures such as the Cassa Integrazione Guadagni and early retirement schemes, became a common response to mitigate the impact of large-scale labour market shocks.

The most severe manufacturing crises were formally acknowledged by the Italian Ministry of Economic Development through the designation of "complex industrial crisis areas". These areas are defined as territories undergoing deep economic downturns and substantial job losses that exceed the capacity of regional institutions and require coordinated national-level intervention.[3] The complexity typically stems either from the collapse of one or more medium- or large-sized companies, with spillover effects across local supply chains, or from the decline of an industrial sector characterized by high territorial specialization, often within industrial districts.

Complex industrial crisis areas are geographically widespread, affecting not only peripheral or rural zones but also major urban centers such as Turin, Venice, and Trieste. A comprehensive list of all such areas recognized by the Italian government since 2010 is provided in Appendix A. The policy response aimed to promote reindustrialization and regional redevelopment, with a focus on fostering investment in innovation, infrastructure, and human capital.[4]

3.2 Sample Definition

The objective of this study is to examine the extent to which manufacturing crises have influenced internal migration patterns among the working-age population in Italy. We use the list of complex industrial crisis areas established by the Ministry of Economic Development to identify severe industrial crises. The treatment we focus on is the onset of the crisis itself, which typically predates any formal policy intervention, and not the policy interventions themselves. In most cases, the establishment of a complex industrial crisis area occurred after a crisis had persisted and remained unresolved by conventional measures. To reconstruct the timeline of each crisis, we rely on reports from national and local media, programmatic agreements related to industrial crisis areas, and documents from trade unions and government agencies such as Invitalia[5]. The treatment year for each crisis is provided in Table 1.

Estimating the causal impact of industrial crises entails substantial methodological complexity, particularly when subsequent policy interventions are not explicitly modeled. In the present framework, we do not evaluate the effects of the policy measures associated with the official designation of "complex industrial crisis area" by the Italian government; rather, we use it as an exogenous criterion to isolate episodes of acute industrial distress. Since the analysis does not explicitly account for the policy measures implemented following these designations, the estimated effects should be interpreted as a lower bound of the true causal impact of industrial crises. Indeed, policy responses such as fiscal incentives, labor market support, and infrastructure investments may have mitigated the economic consequences of the crises. By not controlling for these interventions, the analysis captures the combined outcome of the crisis and any subsequent policy-induced attenuation. In cases where mitigation policies were effective, the observed effects will necessarily understate the full magnitude of the crisis. This approach avoids conflating the crisis with its policy aftermath, but it also implies that the estimated coefficients reflect a conservative approximation of the true causal effect. The interpretation of results must therefore be framed within this context, acknowledging the potential downward bias introduced by unobserved policy responses.

The territorial extent of complex industrial crisis areas varies considerably between cases and rarely aligns with standard administrative boundaries, such as municipalities or provinces. Frequently, affected areas span multiple provinces or even regions, making administrative units ill-suited to capture the full scope of the crisis. For this reason, the local labor market constitutes

[3] The official definition provided by the Italian government is: *"aree che riguardano specifici territori soggetti a recessione economica e perdita occupazionale di rilevanza nazionale e con impatto significativo sulla politica industriale nazionale, non risolvibili con risorse e strumenti di sola competenza regionale"*. See https://www.mimit.gov.it/it/impresa/imprese-in-difficolta/crisi-industriale-complessa.

[4] These measures were implemented through legal frameworks including Decreto Legge n. 83/2012 and Legge n. 181/1989, which were designed to support the recovery of regions most severely impacted by industrial decline.

[5] Invitalia is responsible for monitoring the progress of industrial reconversion and redevelopment projects in complex industrial crisis areas, as outlined in the Program Agreements. The Ministry of Economic Development also provides minutes from relevant meetings regarding these areas. Deatiled information on the crises and references to the institutional reports and press releases are provided in Appendix B.

a more appropriate unit of analysis. LLMs are sub-regional geographical units[6] functionally defined on the basis of commuting flows. They represent self-contained areas within which the majority of the working population both resides and is employed, thereby minimizing cross-boundary labour mobility. As such, they provide a more accurate representation of local labor market dynamics and worker mobility patterns than administrative units. When a complex industrial crisis area is established, it is the Ministry itself that formally identifies and designates the relevant LLMs that constitute the area, thereby reinforcing their analytical relevance in this context.

Of the 610 local labour markets in Italy, 59 have been included within a complex crisis area in the period 2000-2019.[7] The list includes large urban centers such as Venice, Turin, Trieste or Naples, as well as medium-sized cities or rural areas; there are inner provinces such as Rieti, but also coastal areas such as Livorno or Piombino. This heterogeneity could make it difficult to isolate the increase or decrease in population flows that respond primarily to a manufacturing shock, rather than to other confounding factors such as agglomeration dynamics (in the case of large cities) or production diversification. For these reasons, all LLMs defined as large cities[8] have been excluded from both the treated and control sample as well as LLMs which are classified by Istat as *"not specialized"* and *"not specialized in manufacturing"*[9]. The treated sample consists of 34 LLMs (Table 1), identified within 11 complex industrial crisis areas, while the control group includes 235 LLMs that either did not experience any crises or were only affected by minor manufacturing downturns. Figure 2 shows that the sample of treated units broadly mimics the geographical distribution of complex industrial crisis areas throughout the country.

3.3 Data and Variable Definitions

Inter-LLMs migration dynamics have been retrieved through restricted-access administrative microdata on annual changes of residence, provided by Istat for the period 2000-2019. For each transfer, these data provide information on the municipality of departure and destination, which allow to net out all movements within the same local labour market[10]. A few individual characteristics such as gender, age and citizenship are also available for recorded transfers, whereas information such as education level, marital status or the reason behind the decision to move is missing in most cases. The dependent variable $NF_{s,t}$ for LLM s at time t is the ratio between the annual inter-LLMs net flow of working-age population (WAP), calculated as the difference between the inflows and outflows of the population aged 18-64, and the total resident population in each LLM in 2000. According to Bellodi et al. (2024), this variable could be considered as an index of LLM attractiveness. We further investigate mobility patterns by considering inflows and outflows as separate outcomes, to understand whether changes in LLM attractiveness over time due to manufacturing crises were driven primarily by reduced inflows or

[6] Italian Local Labour Markets, formally known as Sistemi Locali del Lavoro (SLL), roughly correspond to US commuting zones or Travel-To-Work areas in the United Kingdom.

[7] The complex industrial crisis area of Melfi–Potenza–Rionero in Vulture is not included in the present analysis, as it was designated by the Ministry only in April 2023, whereas the period considered in this study spans from 2000 to 2019.

[8] Istat provides a classification of the LLMs according to their level of urbanization: 1 refers to LLMs which includes big cities, 2 to LLMs which include medium cities and 9 to the remaining LLMs. All LLMs belonging to group 1 have been excluded from our sample.

[9] In the two or three *digit* code assigned by Istat to all Italian LLMs, the first *digit* is a capital letter: A, B, C and D. A is assigned to LLMs without a specific specialization, B to LLMs that are not specialized in manufacturing, C is assigned to LLMs dealing with the production of the so-called "Made in Italy", whereas D is assigned to LLMs dealing with heavy manufacturing (D1 = Transportation Means, D2 = Metals, D3 = Building Materials, D4 = Petrochemical and Pharmaceutical). LLMs belonging to group A and B have been excluded from our baseline sample.

[10] Given the focus on internal mobility patterns transfers to/from abroad were excluded from computing LLM-level net flows, inflows and outflows.

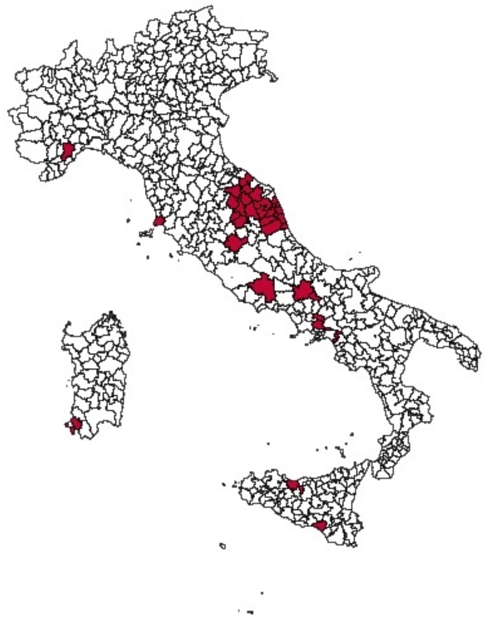
Table 1: Local Labour Markets included in the treated sample for the baseline specification

Treatment year	**Local Labour Market**	**Complex Industrial Crisis' Area**
2013	CAIRO MONTENOTTE	Savona
2012	PIOMBINO	Piombino
2007	ASSISI	Antonio Merloni's crisis
2007	GUALDO TADINO	Antonio Merloni's crisis
2007	FOLIGNO	Antonio Merloni's crisis
2007	GUBBIO	Antonio Merloni's crisis
2011	TERNI	Terni
2007	CAGLI	Antonio Merloni's crisis
2007	FANO	Antonio Merloni's crisis
2007	PERGOLA	Antonio Merloni's crisis
2007	FABRIANO	Antonio Merloni's crisis
2007	JESI	Antonio Merloni's crisis
2014	CIVITANOVA MARCHE	District of Fermo and Macerata
2014	MACERATA	District of Fermo and Macerata
2007	MATELICA	Antonio Merloni's crisis
2007	TOLENTINO	Antonio Merloni's crisis
2008	ASCOLI PICENO	Val Vibrata - Valle del Tronto – Piceno
2008	COMUNANZA	Val Vibrata - Valle del Tronto – Piceno
2008	SAN BENEDETTO DEL TRONTO	Val Vibrata - Valle del Tronto – Piceno
2014	FERMO	District of Fermo and Macerata
2014	MONTEGIORGIO	District of Fermo and Macerata
2014	MONTEGRANARO	District of Fermo and Macerata
2014	PORTO SANT'ELPIDIO	District of Fermo and Macerata
2008	FROSINONE	Frosinone
2008	MARTINSICURO	Val Vibrata - Valle del Tronto – Piceno
2012	BOJANO	Molise
2012	ISERNIA	Molise
2012	MONTESARCHIO	A-M-A., T-C, B-S
2012	CASTELLAMMARE DI STABIA	A-M-A., T-C, B-S
2012	NOLA	A-M-A., T-C, B-S
2012	SOLOFRA	A-M-A., T-C, B-S
2012	BATTIPAGLIA	A-M-A., T-C, B-S
2010	TERMINI IMERESE	Termini Imerese
2012	CARBONIA	Porto Vesme

Note: *"A-M-A., T-C, B-S"* means Acerra-Marcianise-Airola, Torre Annunziata-Castellammare and Battipaglia-Solofra.

Figure 2: Sample Definition

(a) LLMs in Complex Industrial Crisis Areas



(b) LLMs in the treated sample

increased outflows. $IF_{s,t}$ for LLM s at time t is the ratio between the annual inflow of population aged 18-64 and the total resident population in 2000. $OF_{s,t}$ for LLM s at time t is the ratio between the annual outflow of population aged 18-64 and the total resident population in 2000.

The set of covariates include two variables related to the demographic structure of each observation unit, provided by Istat: the share of working-age foreign population[11] and the dependency ratio, calculated as the ratio of the number of economically dependent individuals (those aged 0–17 and 65 and over) to those considered economically productive (aged 18–64). Controlling for the foreign population is important, as migrants are usually more mobile compared to natives (Venhorst et al., 2010) and hence they could be more responsive to local economic shocks. At the same time, due to network effects migration flows are often directed towards places where there is already a community of from the same origin (Card, 2001). A larger share of foreign population could act as a magnet for new inflows, even with worsening local economic shocks. The dependency ratio was included among the covariates, because age impacts the decision to move (Faggian et al., 2007; Prenzel, 2021). All covariates are lagged to $t-1$, due to the fact that the decision to migrate in period t is likely based on the information available at period $t-1$. Year and LLM fixed effects are included in our model. With LLM fixed effects we are also able to account for the time-invariant unobservable heterogeneity related to macroarea common trends, specialization[12] and urbanization patterns[13]. Finally, standard errors are clustered at the local labour market level.

3.4 Methodology and identification strategy

Estimating the causal impact of manufacturing crises on internal mobility at the local labor market level entails several identification challenges. Ideally, one would compare the outcomes of treated units before and after the treatment with the counterfactual outcomes, that is what

[11]Foreign population is defined according to the citizenship criterion, i.e. people without Italian citizenship.

[12]Our sample includes LLMs with the following productive specialization: textile and clothing, leather and hide, machinery manufacturing, wood and furniture, agri-food, jewelry, glasses and musical instruments; transportation means, metal production and processing, building materials, petrochemical and pharmaceutical.

[13]Given that large cities have been excluded, our sample includes medium cities and less urbanized LLMs.

would have occurred in the absence of treatment. Since this counterfactual is unobservable, the key challenge lies in approximating it credibly. To address this, we construct a control group of untreated units, represented by local labor markets that were never designated as complex crisis areas by the Ministry. These units were selected based on their similarity in observable characteristics to the treated units, as described in Section 3.2.

Given the panel structure of the data and the availability of a comparison group, a Difference-in-Differences (DiD) approach is a natural choice. This method relies on three core assumptions: (i) parallel trends, i.e., in the absence of treatment, treated and untreated units would have followed similar outcome trajectories; (ii) no anticipation, meaning that the treatment has no impact before its actual implementation; iii) absence of other contemporaneous shocks that differentially affect the treated and control groups around the time of treatment.

An additional complexity in our setting is treatment heterogeneity: manufacturing crises occur at different points in time throughout the study period (2000–2019), leading to a staggered treatment setting. In such cases, standard two-way fixed effects (TWFE) models may yield biased or even misleading estimates of the the Average Treatment Effect on the Treated (ATT) due to their assumption of homogeneous treatment effects and their inability to handle correctly staggered timing (Callaway, 2020; Roth et al., 2023; Braakmann and Vermeulen, 2023).

To overcome these limitations, our baseline estimates rely on the estimator developed by Callaway and Sant'Anna (2021). This method accommodates staggered adoption and treatment effect heterogeneity, and it is designed for settings where treatment is irreversible: once a unit is treated, it remains so throughout the observation window.[14] This aligns with our empirical context as the status of complex crisis area, once assigned by the Italian government, was never formally revoked.

Beyond the standard assumption of random sampling, this estimator relies on a conditional parallel trends assumption, which allows for the inclusion of covariates and holds whether control units are "never treated units", but also "not-yet-treated". Although both approaches are methodologically valid, the authors advocate for the use of never treated units when these are sufficiently numerous and comparable to the treated group, as is the case in our dataset. This choice also mitigates concerns about potential violations of the no anticipation assumption (Wing et al., 2024).

Among the available alternatives (de Chaisemartin and D'Haultfœuille, 2020; Callaway and Sant'Anna, 2021; Sun and Abraham, 2021; Borusyak et al., 2024), the estimator by Callaway and Sant'Anna (2021) is the most general, imposing fewer restrictions on the data-generating process. To assess the robustness of our findings, we complement our baseline estimates with results from TWFE and the other recently developed estimators (Borusyak et al., 2024; Sun and Abraham, 2021), which will be discussed in Section 5.

4 Main results

The main results are presented in Column 1 of Table 2 and in Figure 3. Following the onset of a local manufacturing crisis, net flows between Local Labor Markets (LLMs) decline, with statistically significant effects emerging from the second post-treatment period onward. The estimated Average Treatment Effect on the Treated (ATT) is -0.002 and is significant at the 1% level. All pre-treatment coefficients are individually insignificant, except for $t - 4$, and the joint test does not reject the null of no effect, supporting the validity of the parallel trends assumption.

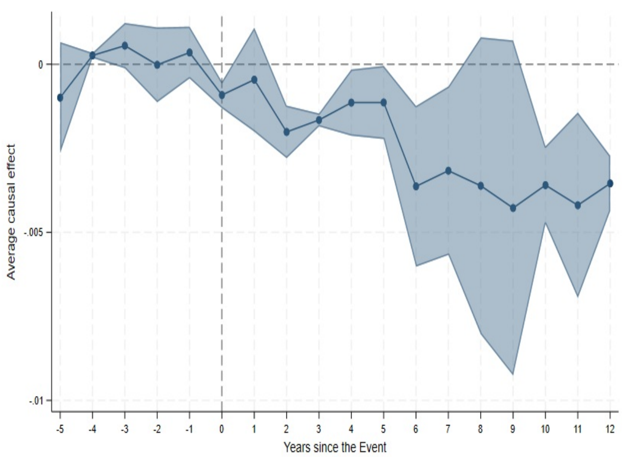
The decline in net mobility appears both significant and relatively swift in the years following the event. Notably, the effect persists over time, with an increasing magnitude as net flows continue to deteriorate in subsequent years. However, it is important to recognize that the

[14] Unlike Callaway and Sant'Anna (2021), de Chaisemartin and D'Haultfœuille (2020) introduced an estimator that can be used when units enter and exit the treatment, i.e. in the absence of irreversibility of the treatment.

outcome variable measures a net balance, that is the difference between migration inflows and outflows of the working-age population within the local labor market. To identify the underlying drivers of this overall decline, we separately analyze inflows and outflows. As reported in Table 2 and illustrated in Figure 4, both components show statistically significant responses, and the parallel trends assumption is satisfied for each series. In terms of magnitude, the reduction in inflows is nearly twice as large as the increase in outflows: the ATT for inflows is -0.130, while for outflows it is 0.062. Moreover, inflows begin to decline almost immediately after the onset of the crisis, whereas the impact on outflows becomes statistically significant only from the sixth year onward.

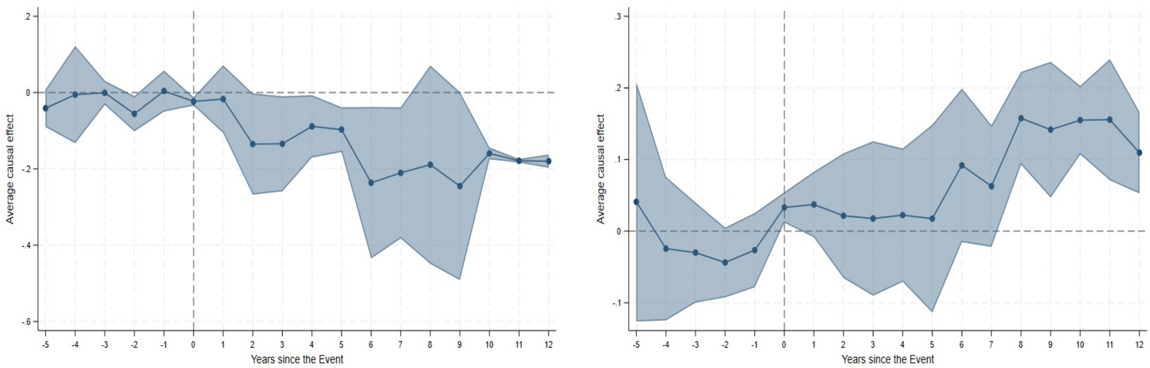
These dynamics suggest that local manufacturing crises rapidly reduce the economic attractiveness of affected labor markets, deterring immigration almost immediately. In contrast, the significant out-migration response unfolds more gradually. The asymmetry is consistent with the findings by Basso et al. (2023), who show that while job creation tends to trigger immediate inflows, job destruction is associated with a more delayed outflow response. One possible explanation for this pattern lies in the different economic and non-economic frictions faced by potential versus incumbent workers. Immigration flows tend to adjust more rapidly to local economic downturns because prospective migrants can alter their plans before making substantial commitments. When labor market conditions in a given area worsen, individuals who were considering relocation may simply choose alternative destinations or postpone migration altogether, often at relatively low cost. In contrast, workers who are already residing in the affected region face higher adjustment barriers when responding to the same shock. These include financial constraints associated with moving, uncertainty about employment opportunities elsewhere, and the potential loss of local support networks, housing, or access to public services. Additionally, workers may be constrained by skill mismatches that limit their mobility across sectors or regions. Non-economic factors such as social ties, family obligations, and place attachment can further discourage immediate relocation. Taken together, these frictions help explain why immigration inflows decline swiftly in response to negative shocks, while out-migration tends to adjust more gradually.

Figure 3: Baseline: Net Flows of Working-Age People



Note: Plots are based on 95% confidence intervals. Estimates are carried out using the methodology proposed by Callaway and Sant'Anna (2021), throught the `csdid` Stata routine. The baseline estimation window includes 5 pre-treatment and 12 post-treatment periods. The dependent variable is the difference between inflows and outflows of population aged 18-64 to/from a specific local labour market over total resident population in 2000. Control variables include the share of working-age foreign population, the dependency ratio and the set of fixed effects described in Section 3.3.

Figure 4: Inflows and Outflows of Working-Age People



(a) Inflows (b) Outflows

Note: Plots are based on 95% confidence intervals. Estimates are carried out using the methodology proposed by Callaway and Sant'Anna (2021), throught the `csdid` Stata routine. The baseline estimation window includes 5 pre-treatment and 12 post-treatment periods. The dependent variable in panel a) is the ratio between the annual inflow of population aged 18-64 and the total resident population in 2000. The dependent variable in panel b) is the ratio between the annual outflow of population aged 18-64 and the total resident population in 2000. Control variables include the share of working-age foreign population, the dependency ratio and the set of fixed effects described in Section 3.3.

Table 2: Baseline: Net Flows, Inflows and Outflows of Working-Age People

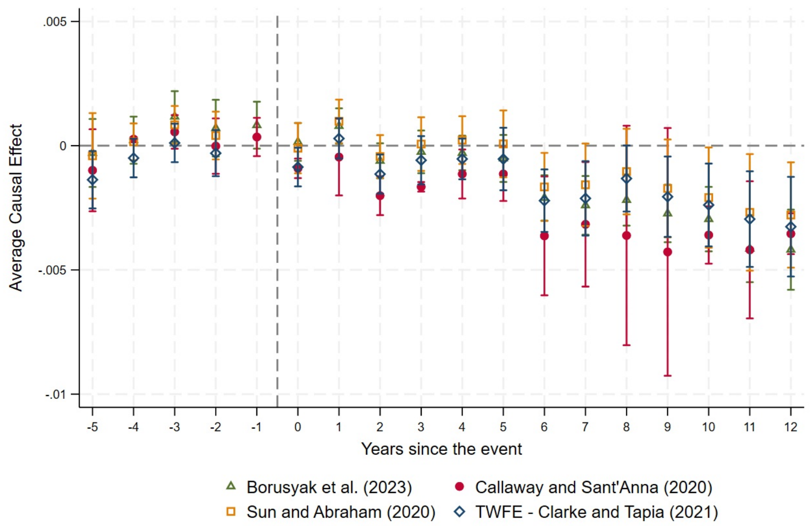
	Netflows	Inflows	Outflows
Pre Average Treatment Effect	0.00003	-0.0197	-0.0167
	(0.12)	(-1.10)	(-0.53)
Post Average Treatment Effect	-0.0025***	-0.146***	0.0787***
	(-3.24)	(-2.75)	(4.20)
5 Pre	-0.001	-0.0410	0.0409
	(-1.17)	(-1.63)	(0.48)
4 Pre	0.0003***	-0.00529	-0.0244
	(6.82)	(-0.08)	(-0.48)
3 Pre	0.0006	-0.000593	-0.0300
	(1.61)	(-0.04)	(-0.84)
2 Pre	-0.00002	-0.0555**	-0.0437*
	(-0.03)	(-2.36)	(-1.76)
1 Pre	0.0004	0.00406	-0.0265
	(0.89)	(0.15)	(-1.00)
0 Post	-0.0009**	-0.0231***	0.0331***
	(-4.56)	(-4.14)	(3.07)
1 Post	-0.0005	-0.0171	0.0372
	(-0.58)	(-0.38)	(1.60)
2 Post	-0.0020*	-0.135**	0.0215
	(-5.03)	(-1.99)	(0.48)
3 Post	-0.0017***	-0.134**	0.0177
	(-16.77)	(-2.12)	(0.32)
4 Post	-0.0011*	-0.0886**	0.0223
	(-2.26)	(-2.13)	(0.47)
5 Post	-0.0011**	-0.0970***	0.0175
	(-2.04)	(-3.25)	(0.26)
6 Post	-0.0036***	-0.236**	0.0919*
	(-2.98)	(-2.34)	(1.68)
7 Post	-0.0032**	-0.210**	0.0629
	(-2.47)	(-2.40)	(1.45)
8 Post	-0.0036	-0.189	0.158***
	(-1.60)	(-1.43)	(4.79)
9 Post	-0.0043*	-0.245*	0.142***
	(-1.68)	(-1.95)	(2.93)
10 Post	-0.0036*	-0.159***	0.155***
	(-6.11)	(-20.31)	(6.36)
11 Post	-0.0042**	-0.179***	0.156***
	(-2.98)	(-75.35)	(3.60)
12 Post	-0.0035***	-0.180***	0.110***
	(-8.45)	(-20.13)	(3.78)
ATT	-0.0022**	-0.130***	0.062**
	(-4.12)	(-2.67)	(1.98)

Note: * significant at 10%, ** significant at 5%, *** significant at 1%. $t - statistics$ are reported in parentheses. Estimates are carried out using the methodology proposed by Callaway and Sant'Anna (2021), throught the `csdid` Stata routine. The dependent variable in column [1] is the difference between inflows and outflows of population aged 18-64 to/from a specific local labour market over total resident population in 2000. The dependent variable in column [2] is the ratio between the annual inflow of population aged 18-64 and the total resident population in 2000. The dependent variable in column [3] is the ratio between the annual outflow of population aged 18-64 and the total resident population in 2000. Control variables include the share of working-age foreign population, the dependency ratio and the set of fixed effects described in Section 3.3.

5 Robustness Checks

As discussed in Section 3.4, the recent literature on staggered DiD estimators has grown substantially, and the choice of the most appropriate estimator is far from trivial. In this section, we compare several estimators commonly used in the empirical literature. In addition to the baseline results obtained using the estimator proposed by Callaway and Sant'Anna (2021), we also include estimates from Borusyak et al. (2024), Sun and Abraham (2021), and the conventional Two-Way Fixed Effects (TWFE) approach. Although the limitations of TWFE in staggered adoption settings are well known, it is reported here for the sake of completeness. Each estimator relies on different assumptions, particularly regarding the parallel trends condition, and entails a trade-off between statistical efficiency and robustness to potential violations of these assumptions (Roth et al., 2023). For instance, the estimator proposed by Borusyak et al. (2024) relies on a precise assumption about the parallel trend, while the estimator by Callaway and Sant'Anna (2021) allows for greater flexibility in modeling group-time specific effects and it is preferred in presence of an extended pre-treatment period. As shown in Figure 5, the estimated dynamic treatment effects across the four methods are largely consistent. Appendix E reports the corresponding coefficients. Despite methodological differences, the estimators yield results with the same sign and comparable magnitudes. The parallel trends assumption appears to be satisfied in all specifications, as indicated by the lack of statistical significance in the pre-treatment coefficients. Regarding post-treatment effects, there is strong consistency across estimators: all suggest that the impact of industrial crises on migration dynamics becomes statistically significant starting from the sixth period onward.

Figure 5: Robustness: Alternative Estimators

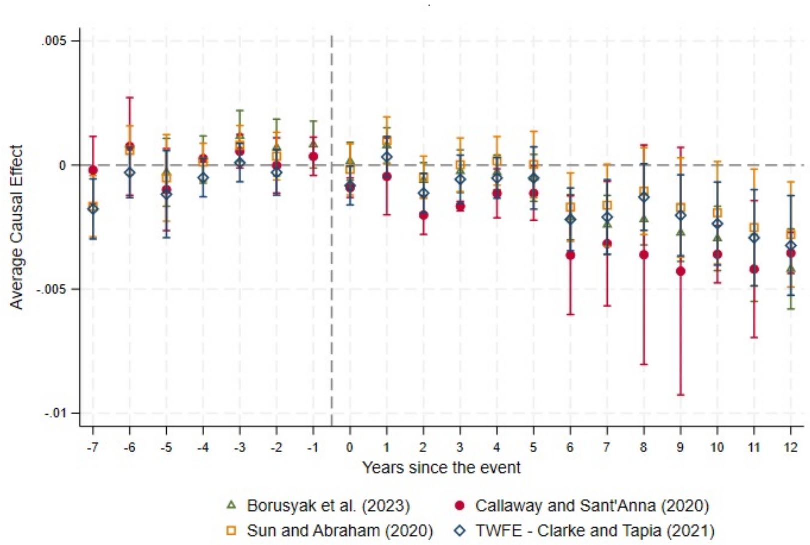


Note: Estimates are carried out using the methodologies proposed by Borusyak et al. (2024), Callaway and Sant'Anna (2021), Sun and Abraham (2021) and Clarke and Tapia-Schythe (2021), throught the `did_imputation`, `csdid`, `eventstudyinteract` and `eventdd` Stata routines. The baseline estimation window includes 5 pre-treatment and 12 post-treatment periods. The dependent variable is the difference between inflows and outflows of population aged 18-64 to/from a specific local labour market over total resident population in 2000. Control variables include the share of working-age foreign population, the dependency ratio and the set of fixed effects described in Section 3.3.

An additional robustness check involves extending the length of the pre-treatment period. The number of pre-event periods is, to a large extent, at the discretion of the researcher. As noted by Miller (2023), there is no "hard-and-fast rule" for selecting a valid pre-event window in event-study designs: using only a single pre-event period may introduce statistical noise, while including too many periods may reduce the plausibility of the counterfactual. In the baseline specification, as well as in the heterogeneity analysis, a five-period pre-treatment window is adopted. This choice is aligned with Jacobson et al. (1993), among the first to apply the event-study design to estimate the impact of job displacement on earnings, who also used a five-period pre-event window. In our context of analysis, the first observed manufacturing crisis occurs in 2007, while the dataset begins in 2000. A five-period pre-treatment window is therefore consistent with the available data and sufficiently balanced across the treated units.

To test the sensitivity of the results to this choice, an alternative specification is estimated using a seven-period pre-treatment window. This exercise is repeated for each of the estimators considered. Figure 6 shows that results remain broadly consistent with those of the baseline, reinforcing the validity of the main findings.

Figure 6: Robustness: Alternative Estimators (7-Period Pre-Trend)



Note: Estimates are carried out using the methodologies proposed by Borusyak et al. (2024), Callaway and Sant'Anna (2021), Sun and Abraham (2021) and Clarke and Tapia-Schythe (2021), throught the `did_imputation`, `csdid`, `eventstudyinteract` and `eventdd` Stata routines. The baseline estimation window includes 5 pre-treatment and 12 post-treatment periods. The dependent variable is the difference between inflows and outflows of population aged 18-64 to/from a specific local labour market over total resident population in 2000. Control variables include the share of working-age foreign population, the dependency ratio and the set of fixed effects described in Section 3.3.

A final robustness check excludes LLMs affected by major natural disasters, particularly earthquakes, which may independently influence migration decisions (Dottori, 2024) and thus constitute a rather important confounding factor. We remove from the baseline sample all LLMs affected by four major seismic events recorded in EM-DAT (Emergency Events Database): Molise (2002), Abruzzo (2009), Emilia-Romagna (2012), and Umbria-Marche (2016)[15]. This results in a sample of 262 LLMs (29 treated, 233 untreated). The results remain broadly consistent with the baseline specification, confirming the robustness of the findings even after controlling for this additional source of exogenous shock (see Appendix F).

[15] Specifically, the LLMs of Fabriano, Matelica, Tolentino, Comunanza, Gualdo Tadino, Termoli, and Mirandola have been excluded. The EM-DAT disaster database is available at `https://www.emdat.be/`.

6 Heterogeneity

6.1 Demographic groups

The next section investigates the heterogeneous response of internal migration flows to local labor market shocks. As emphasized in the literature, while the overall population may exhibit limited or no response to such shocks, migration rates and behaviors can vary significantly across different demographic groups. Leveraging the information available in the dataset, the analysis focuses on three key dimensions of heterogeneity: citizenship (native vs. non-native), gender (male vs. female), and age, with a specific focus on the over-65 population.

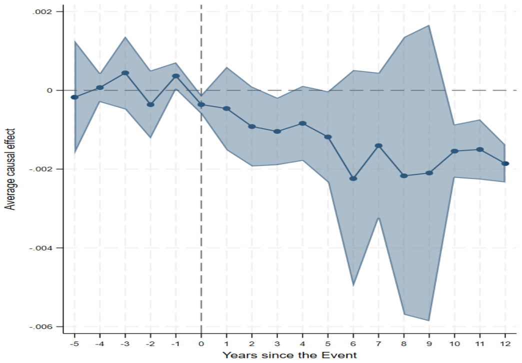
Figure 7 presents the results disaggregated by citizenship. When comparing net migration flows of individuals aged 18–64 by Italian versus foreign citizenship, the overall trends appear broadly similar: in both cases, the parallel trends assumption is satisfied, and a decline in net migration follows the onset of the manufacturing crisis. From the fifth post-treatment period onward, the estimated effects converge in magnitude across the two groups. However, notable differences emerge in both the timing and precision of the estimated responses. Among foreign citizens, the decline in net migration becomes statistically significant as early as the second year after the shock and remains significant with the exception of years three and four, where estimates are less precise. In contrast, the response for Italian citizens remains statistically insignificant up to ten years after the crisis, reflecting both a delayed and more uncertain adjustment.

These findings are consistent with international evidence showing that foreign-born populations exhibit greater geographic responsiveness to both persistent regional labor market differences (Schündeln, 2014) and adverse labor market shocks (Cadena and Kovak, 2016; Gutiérrez-Portilla et al., 2018; Autor et al., 2023). Native populations, by comparison, tend to display more inertia in their migration behavior under similar conditions (Peri and Zaiour, 2023). Such pattern also mirrors Italian-specific evidence: internal migration rates among non-natives are persistently higher than among natives, with inter-provincial mobility among individuals with foreign citizenship being nearly twice that of Italian citizens (Casacchia et al., 2019, 2022).

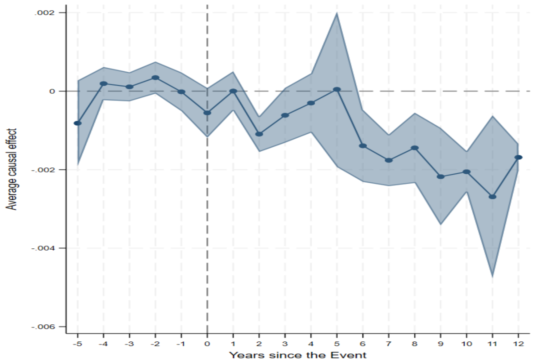
Further insight comes from separately examining inflow and outflow dynamics. In both groups, the decline in net migration is driven primarily by reduced inflows rather than increased outflows. Yet the contraction in inward mobility is more pronounced among foreign citizens: in the later years of the sample, the decline in inflows is approximately twice as large as that observed for natives. This decline becomes statistically significant for foreigners starting in the second year post-shock, with the exception of years three and four, whereas the effect for natives is only detectable after a full decade, due to substantially wider confidence intervals. As for outflows, the effects become statistically significant only in the second part of the observation window for both groups, with broadly similar magnitude.

Figure 8 displays the evolution of net migration flows by gender. Following the labor demand shock, both men and women experience a decline in net migration, with effects of broadly similar magnitude. However, important differences emerge in terms of timing and estimate precision. Among men, the decline becomes statistically significant from the second year after the shock and remains so for most of the post-treatment period, whereas for women the drop follows a similar trajectory but statistical significance appears only in the later years of the observation window, with wider confidence intervals throughout. This divergence may reflect the joint influence of sectoral exposure and gendered migration dynamics, whereby women may be less responsive to short-term changes in labor demand due to occupational segregation, care responsibilities, or joint decision-making within households. As shown by Abraham et al. (2019), women in cohabiting couples are generally less willing than men to relocate for employment opportunities, indicating that traditional gender roles continue to shape household migration behavior. This can result in delayed or muted migration responses among women even when economic incentives are aligned. In a similar vein, Greenland et al. (2019) document that in U.S. regions affected

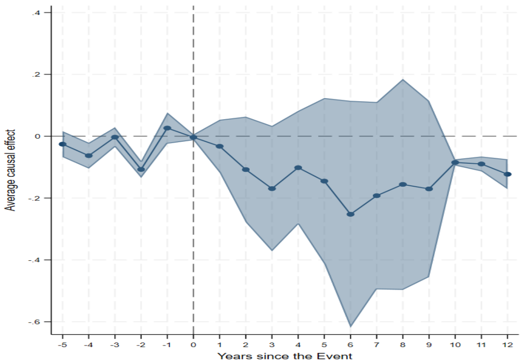
Figure 7: Heterogeneity: net migration flows, inflows and outflows of working-age population by citizenship



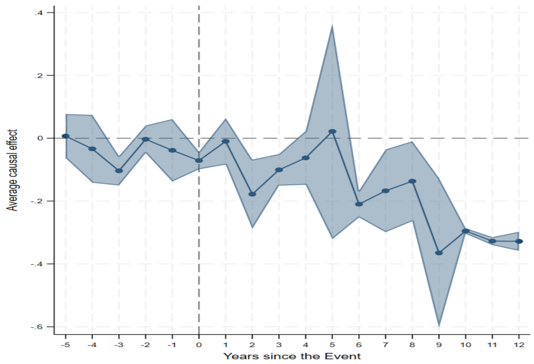
(a) Net migration flows of natives



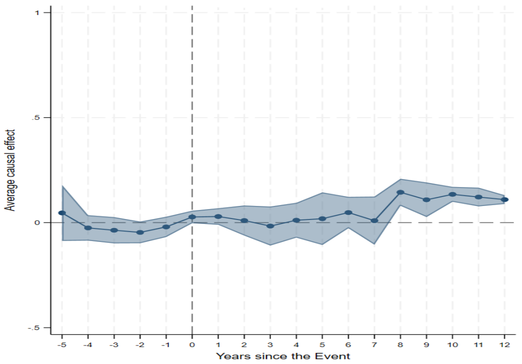
(b) Net migration flows of non natives



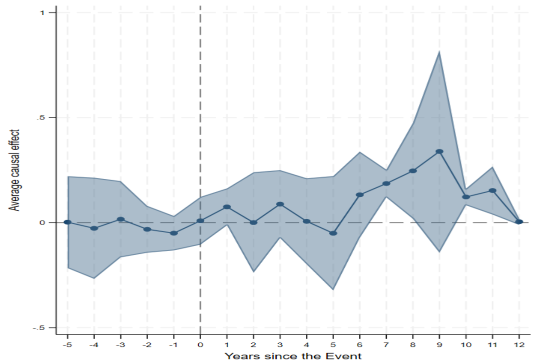
(c) Inflows of natives



(d) Inflows of non natives



(e) Outflows of natives



(f) Outflows of non natives

Note: Plots are based on 95% confidence intervals. Estimates are carried out using the methodology proposed by Callaway and Sant'Anna (2021), throught the `csdid` Stata routine. The baseline estimation window includes 5 pre-treatment and 12 post-treatment periods. The dependent variable in panel a)-b) is the difference between inflows and outflows of population aged 18-64 to/from a specific local labour market over total resident population in 2000. The dependent variable in panel c)-d) is the ratio between the annual inflow of population aged 18-64 and the total resident population in 2000. The dependent variable in panel e)-f) is the ratio between the annual outflow of population aged 18-64 and the total resident population in 2000. Control variables include the share of working-age foreign population, the dependency ratio and the set of fixed effects described in Section 3.3.

by Chinese import competition population declines were significantly more pronounced among men, while female responses were smaller and not statistically significant, despite similar overall shocks to local labor markets.

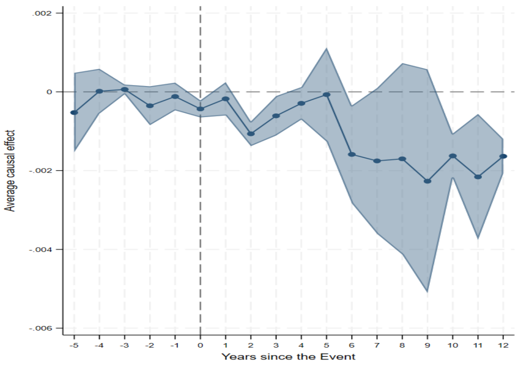
Turning to inflows, both genders exhibit a decline following the shock, which appears to be the primary driver of the reduction in net migration. Among men, the decrease in inflows becomes statistically significant from the second year onward and remains pretty robust in subsequent periods, with an average treatment effect estimated at –0.141. For women, the downward trend in inflows is also evident and often larger in magnitude, but the estimates are less precise, and statistical significance emerges only at the end of the estimation window. This may again reflect gender-specific constraints and behavioral asymmetries in migration decisions. Outflows, by contrast, show much weaker and less consistent responses. Among men, point estimates for outflows remain close to zero with narrow confidence intervals, suggesting no substantial reaction to the shock. For women, there is a modest increase in outflows toward the end of the observation period, but the effect is only marginally significant and imprecisely estimated. Overall, the decline in net migration following the shock appears to be driven almost entirely by reductions in inflows, especially among men, while outflows play a minor role in the adjustment process for both genders.

Since migration is a highly age-selective process, no significant impact of manufacturing crises on the mobility of the older population would generally be expected. The propensity to migrate typically increases during childhood and adolescence, peaks in young adulthood, often in connection with education or labor market entry, and then declines steadily with age, particularly after retirement. A substantial body of work shows that mobility in later life is low overall, as older individuals are no longer directly affected by employment opportunities, but it is responsive to changes in non-economic conditions such as health status, proximity to relatives, and access to care services (Ermisch and Mulder, 2019; Perry et al., 2013; Thomas and Dommermuth, 2020; Zaiceva, 2014). The concept of aging in place emphasizes that most older adults prefer to remain in familiar environments, but will relocate when significant life events, the deterioration of local amenities, or the loss of essential services occur (Clark et al., 1996; Evandrou et al., 2010). Empirical evidence also finds that better access to healthcare services is significantly associated with later-life migration decisions (Dorfman and Mandich, 2016).

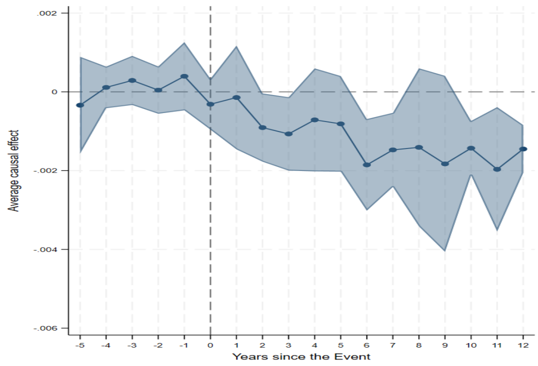
Figure 9 displays the dynamics of net migration flows, inflows, and outflows for the population aged over 65 in the aftermath of the manufacturing shock. Overall, the response in net migration flows appears limited, with point estimates suggesting a mild decline over time, but no statistically significant effects are detected in the post-treatment period, as the 95% confidence intervals consistently include zero up to ten years after the shock. A more nuanced picture emerges when examining inflows and outflows separately. Inflows exhibit a delayed but pronounced decline, becoming statistically significant only in the final years of the observation window. This suggests that over time, fewer older individuals move into the affected areas, possibly due to deteriorating amenities, shrinking family networks, or declining housing attractiveness. In contrast, outflows begin to increase earlier: estimates remain statistically significant from approximately the third year after the shock through the end of the period, thus pointing to a gradual but robust rise in the propensity of older residents to leave, potentially driven by long-term responses to declining local services or the need to relocate closer to family members or healthcare providers.

Taken together, these dynamics reflect the indirect consequences of a broader local economic decline. Negative spillover effects from the crisis extend beyond the manufacturing sector itself, weakening the local economy and eroding the provision of public and private services. Such deterioration could reduce the area's overall quality of life, making it less attractive for older residents as well.

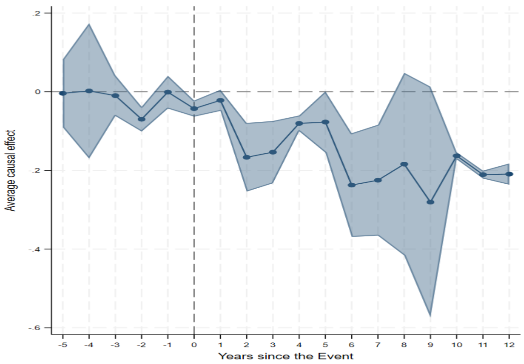
Figure 8: Heterogeneity: net migration flows, inflows and outflows of working-age population by gender



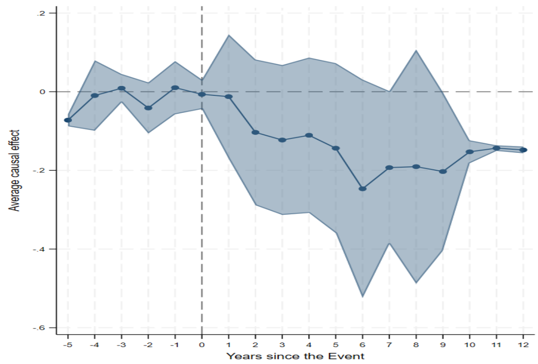
(a) Net migration flows of males



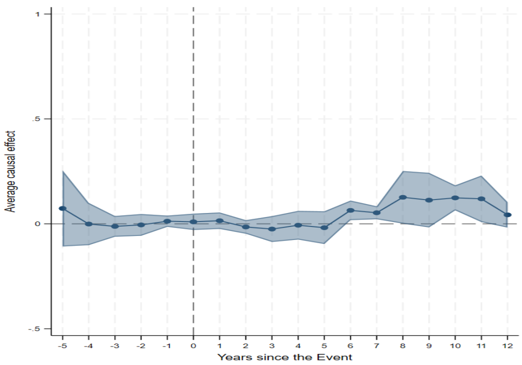
(b) Net migration flows of females



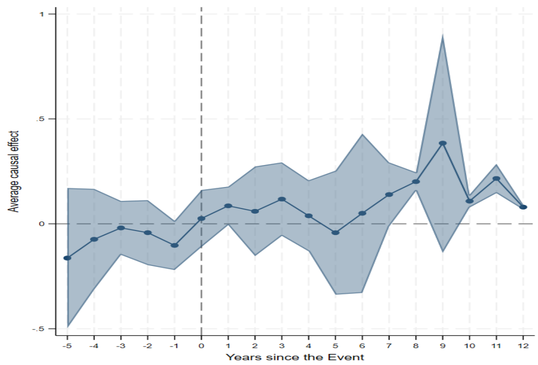
(c) Inflows of males



(d) Inflows of females



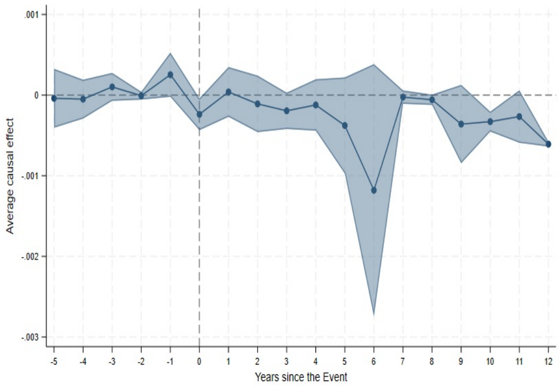
(e) Outflows of males



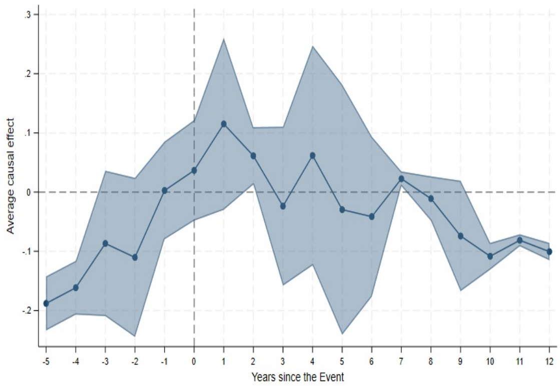
(f) Outflows of females

Note: Plots are based on 95% confidence intervals. Estimates are carried out using the methodology proposed by Callaway and Sant'Anna (2021), throught the `csdid` Stata routine. The baseline estimation window includes 5 pre-treatment and 12 post-treatment periods. The dependent variable in panel a)-b) is the difference between inflows and outflows of population aged 18-64 to/from a specific local labour market over total resident population in 2000. The dependent variable in panel c)-d) is the ratio between the annual inflow of population aged 18-64 and the total resident population in 2000. The dependent variable in panel e)-f) is the ratio between the annual outflow of population aged 18-64 and the total resident population in 2000. Control variables include the share of working-age foreign population, the dependency ratio and the set of fixed effects described in Section 3.3.

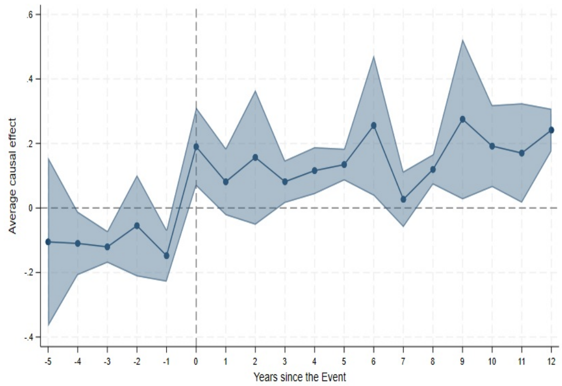
Figure 9: Heterogeneity: net migration flows, inflows and outflows of working-aged population by age (over 65 individuals)



(a) Net migration flows of over-65



(b) Inflows of over-65



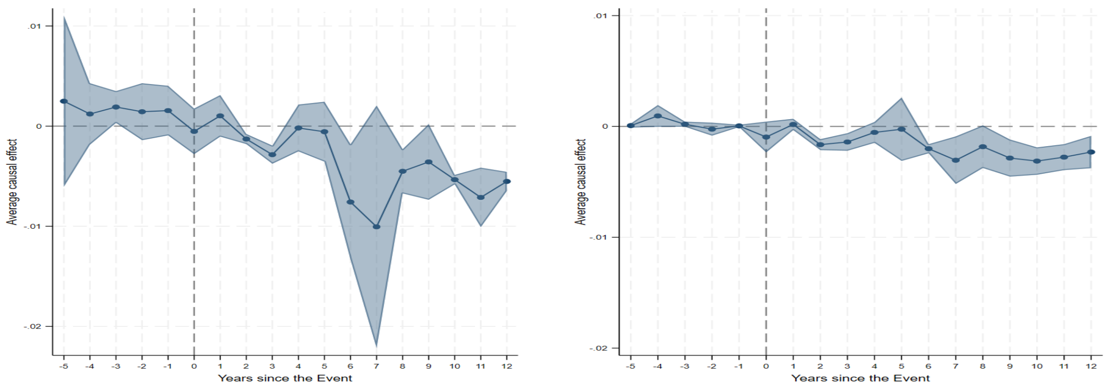
(c) Outflows of over-65

Note: Plots are based on 95% confidence intervals. Estimates are carried out using the methodology proposed by Callaway and Sant'Anna (2021), throught the `csdid` Stata routine. The baseline estimation window includes 5 pre-treatment and 12 post-treatment periods. The dependent variable in panel a) is the difference between inflows and outflows of population aged 18-64 to/from a specific local labour market over total resident population in 2000. The dependent variable in panel b) is the ratio between the annual inflow of population aged 18-64 and the total resident population in 2000. The dependent variable in panel c) is the ratio between the annual outflow of population aged 18-64 and the total resident population in 2000. Control variables include the share of working-age foreign population, the dependency ratio and the set of fixed effects described in Section 3.3.

6.2 LLM-level characteristics

The first exercise focuses on the heterogeneity between LLMs defined as *industrial districts* and all other LLMs. Industrial districts are localized production systems characterized by a high concentration of small and medium-sized enterprises (SMEs) operating within the same or closely related industries. These firms are geographically clustered and embedded in a network of economic, social, and institutional relationships that foster cooperation, specialization, and knowledge spillovers. Restricting the analysis to industrial districts yields a sample of 132 LLMs, of which 17 are treated and 115 are untreated. In contrast, the sample of LLMs not classified as industrial districts includes 137 units (17 treated, 120 untreated).

Figure 10: Heterogeneity: net migration flows of working-aged population by LLM's production structure



(a) Districts

(b) No districts

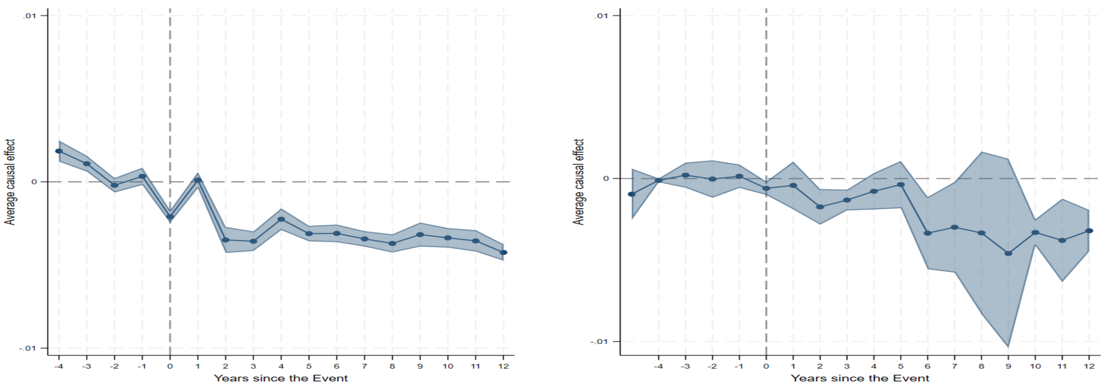
Note: Plots are based on 95% confidence intervals. Estimates are carried out using the methodology proposed by Callaway and Sant'Anna (2021), throught the `csdid` Stata routine. The baseline estimation window includes 5 pre-treatment and 12 post-treatment periods. The dependent variable in panel a) is the difference between inflows and outflows of population aged 18-64 to/from a specific local labour market over total resident population in 2000. The dependent variable in panel b) is the ratio between the annual inflow of population aged 18-64 and the total resident population in 2000. The dependent variable in panel c) is the ratio between the annual outflow of population aged 18-64 and the total resident population in 2000. Control variables include the share of working-age foreign population, the dependency ratio and the set of fixed effects described in Section 3.3.

As shown in Figure 10, the crisis significantly affects net migration flows of the working-age population in both subsamples. However, the magnitude of the effect is nearly twice as large among LLMs classified as industrial districts.

The sharper net emigration response observed in industrial districts likely stems from two complementary channels. On the out-migration side, high sectoral concentration amplifies the local impact of a manufacturing downturn, as job losses spread across tightly interlinked supply chains and leave few opportunities for reabsorption into alternative employment. The skills developed in district-based industries are often highly specific, limiting their transferability within the same locality, and less urbanised settings typically offer fewer alternative employers and a narrower range of economic activities, prompting relocation. Pre-existing migration networks can further accelerate outflows, producing sharper demographic adjustments than in more diversified local economies, where alternative job opportunities and broader sectoral variety can mitigate the need to migrate. On the immigration side, the loss of the district's main economic engine quickly erodes its attractiveness to potential newcomers, who can redirect their mobility towards areas with more diverse job opportunities and greater economic resilience.

A second specification examines the level of urbanization. In the baseline, LLMs classified as large cities were excluded to avoid potential confounding from agglomeration effects. We further disaggregate the remaining sample into medium-sized cities and other local labour markets, based on Istat classifications. The former group includes 41 LLMs (7 treated, 34 untreated), while the latter 228 LLMs (27 treated, 201 untreated).

Figure 11: Heterogeneity: net migration flows of working-aged population by LLM's level of urbanization



(a) Medium-sized LLMs

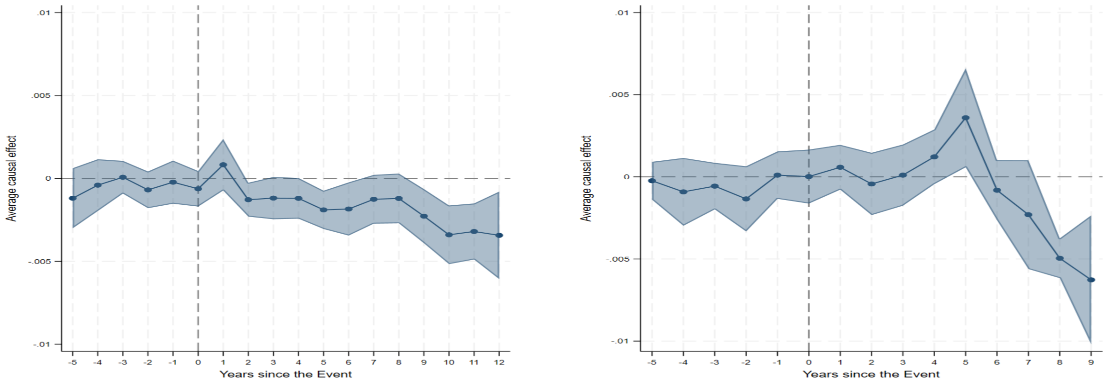
(b) Small-sized LLMs

Note: Plots are based on 95% confidence intervals. Estimates are carried out using the methodology proposed by Callaway and Sant'Anna (2021), throught the `csdid` Stata routine. The baseline estimation window includes 5 pre-treatment and 12 post-treatment periods. The dependent variable in panel a) is the difference between inflows and outflows of population aged 18-64 to/from a specific local labour market over total resident population in 2000. The dependent variable in panel b) is the ratio between the annual inflow of population aged 18-64 and the total resident population in 2000. The dependent variable in panel c) is the ratio between the annual outflow of population aged 18-64 and the total resident population in 2000. Control variables include the share of working-age foreign population, the dependency ratio and the set of fixed effects described in Section 3.3.

While the magnitude of the net emigration response to the industrial crisis is similar in less and moderately urbanised local labour markets (Figure 11), especially in the second half of the observation period, the estimates for the former are less precise, with wider confidence intervals. This lower precision likely reflects the combined influence of opposing forces on migration decisions in less urbanised settings. On the one hand, push factors such as limited local job opportunities, reduced access to public services, and fewer amenities can encourage residents to leave in the wake of an economic shock. On the other hand, pull-back factors such as strong family networks, deep community attachment, and lower housing costs may restrain out-migration, even when employment prospects worsen. Indeed, Sonzogno et al. (2022) report that while individuals living in peripheral or inner areas of Italy often consider migrating, most ultimately choose to stay. The same study also underscores the role of social connections in reducing interprovincial migration flows among low-skilled individuals, who are generally more embedded in close family networks (D'Ingiullo et al., 2023). More generally, rural and small-town communities tend to exhibit higher levels of social connections, as lower population density fosters stronger interpersonal relationships and greater engagement in cooperative activities, volunteering, and mutual aid (Glendinning et al., 2003; Ziersch et al., 2009). Because the relative weight of these factors can vary substantially across places and over time, the resulting migration patterns are more heterogeneous, making the statistical relationship between industrial decline and net migration harder to estimate with precision.

The third exercise considers heterogeneity in the geographical location of LLMs throughout the country. LLMs in the North-West and Centre are analyzed separately from those in the South and Islands. The former group consists of 134 LLMs (24 treated, 110 untreated), while the latter includes 64 LLMs (10 treated, 54 untreated).

Figure 12: Heterogeneity: net migration flows of working-aged population by LLM's geographical area



(a) North-Center Italy

(b) South Italy

Note: Plots are based on 95% confidence intervals. Estimates are carried out using the methodology proposed by Callaway and Sant'Anna (2021), throught the `csdid` Stata routine. The baseline estimation window includes 5 pre-treatment and 12 post-treatment periods. The dependent variable in panel a) is the difference between inflows and outflows of population aged 18-64 to/from a specific local labour market over total resident population in 2000. The dependent variable in panel b) is the ratio between the annual inflow of population aged 18-64 and the total resident population in 2000. The dependent variable in panel c) is the ratio between the annual outflow of population aged 18-64 and the total resident population in 2000. Control variables include the share of working-age foreign population, the dependency ratio and the set of fixed effects described in Section 3.3.

As Figure 12 shows, in the North-Center, point estimates are negative from the outset of the post-treatment period, although they remain small and not statistically significant, suggesting that some out-migration begins early even if the effect is modest. In the South, by contrast, the initial years show no evidence of a decline in net migration, before turning sharply negative from around the sixth year onwards, with effects that get statistically significant in the late post-treatment period and larger in magnitude compared to treated LLS located in the North-Center. This delayed adjustment in the South may reflect a higher reliance on social safety nets, such as wage supplementation schemes (short–time work compensation schemes), which can temporarily cushion the impact of job losses and reduce the immediate incentive to migrate. Indeed, manuifacturing crises are often managed through the use of Cassa Integrazione Guadagni Straordinaria (CIGS), a wage supplementation scheme aimed at supporting workers in firms undergoing significant restructuring or experiencing severe economic distress[16]. Unlike ordinary short-time work compensation schemes, CIGS is specifically targeted at firms undergoing restructuring, reorganization, or closure, and is typically activated in coordination with trade unions and public authorities. By allowing employers to suspend or reduce working hours without terminating employment contracts, CIGS functions as a temporary labour market buffer, with the aim of facilitating internal adjustments and mitigating the immediate consequences of job loss. Under current legislation, CIGS is limited to a maximum of 24 months over a rolling five-year period for each production unit, extendable to 36 months in the case of solidarity contracts. Further extensions are possible in exceptional cases, most notably in complex industrial crisis areas, and are subject to ministerial approval and union agreements. However, as these

[16]CIGS is mostly regulated under Legislative Decree No. 148/2015. Recent reforms have further updated this regulatory framework. In particular, the 2022 Budget Law (Law No. 234/2021) introduced a comprehensive reform of social safety nets, amending several provisions of Legislative Decree No. 148/2015. Further modifications were enacted through subsequent decrees, including the "Sostegni-ter" (Decree Law No.4/2022) and Decree Law No. 21/2022, both later converted into law. Detailed information is provided by the Ministry of Labour (Ministero del Lavoro e delle Politiche Sociali, 2024).

supports expire and local labour market conditions fail to recover, both push factors (limited employment opportunities, weak diversification) and existing migration networks contribute to accelerating out-migration. The earlier, albeit weaker, response in the North-Center may be linked to greater labour market fluidity and higher opportunity costs of remaining unemployed, prompting mobility sooner but in smaller magnitudes thanks to a more diversified economic base and stronger absorptive capacity.

7 Conclusions

People move for different reasons, with varying intensities, at different points in time, and from different types of places. From an economic perspective, internal migration flows can reflect long-term structural patterns, such as those driven by regional development gaps, but they can also respond to short-term negative shocks, including plant closures and sudden job losses that trigger economic decline in local communities.

In this paper, we have examined whether and to what extent the occurrence of a severe manufacturing crisis affects the mobility of the working-age resident population across Italian local labour markets (LLMs) between 2000 and 2019. Our findings reveal that the net migration response materializes in the years immediately following the shock and persists over time, with a gradually increasing magnitude. Both the outflow and inflow margins contribute to this response, but the reduction in inward mobility is about twice as large as the increase in outflows. This highlights how the loss of economic attractiveness can significantly inhibit population inflows and suggests that selective immobility may play a critical role in reinforcing local demographic decline.

When disaggregating by demographic groups, we find no substantial difference in the direction or timing of the response between men and women. However, the effect for men is estimated with greater precision, which may reflect lower baseline heterogeneity or point to the complex interplay between economic conditions and non-economic constraints, such as intra-household bargaining and social norms about care-giving roles within the family, that influence female migration behaviour. Among older age groups, we observe a gradual increase in outward mobility, potentially driven by reduced service availability, changing local amenities, or the desire to reunite with younger family members who have already relocated for economic reasons. In line with existing international evidence, the migration response is stronger and more immediate among foreign citizens compared to Italian nationals, whose mobility remains largely unaffected for up to ten years after the shock. The decline in inflows becomes particularly pronounced for foreigners in the later years of the estimation window, highlighting how economic decline can durably undermine the area's appeal to prospective newcomers.

Results on heterogeneity across local labour markets are more nuanced. On the one hand, impacts appear stronger in highly specialized areas such as industrial districts, where sectoral vulnerability and limited internal flexibility likely reduce resilience to adverse shocks. On the other hand, medium-sized and moderately urbanised LLMs, as well as LLMs in Northern and Central Italy, presumably better equipped to absorb economic shocks, also experience substantial declines in net migration, suggesting that other factors, such as the local availability of wage supplementation schemes (e.g., CIGS) or the strength of social and family ties, may shape migratory inertia or delay responses.

Differently from the evidence provided for Italy by Ciani et al. (2019), our results indicate that population mobility can serve as a partial adjustment mechanism in the face of local labour demand shocks. However, these demographic adjustments are unlikely to be sufficient to offset the long-term effects of industrial decline. On the contrary, selective out-migration and the erosion of inward flows may exacerbate territorial imbalances by draining human capital from already fragile areas.

A critical open question concerns the composition of net migration flows. In particular, the lack of reliable and comprehensive information on individual educational attainment represents a key limitation of the present analysis. Understanding whether net flows are predominantly composed by high-skilled or low-skilled workers is essential to fully grasp the implications of demographic decline and consequent labour market adjustment. If population losses disproportionately affect the most educated groups, the long-term consequences for local development and recovery potential may be even more severe. While this information is largely missing from the administrative records covering most of our sample period, it has been introduced in population register data from 2012 onward. Once a sufficiently long time span becomes available to construct robust pre- and post-event windows, future research will be able to leverage this source to explore the skill composition of migration responses more systematically.

From a policy perspective, these findings highlight the importance of jointly considering both economic and demographic dimensions when assessing the impact of local industrial decline. Too often, recovery strategies focus narrowly on employment and production indicators, overlooking demographic dynamics that may follow a different trajectory. An area may show some signs of economic stabilization, such as limited job creation or business retention, while continuing to lose population due to persistent out-migration or low attractiveness to newcomers. Conversely, demographic inertia, dependence on social safety nets or strong place attachment may delay population losses, even in the absence of meaningful economic opportunities. The distinction between economic and demographic resilience is thus essential to identify truly vulnerable areas and design effective local-level policy responses.

These dynamics echo broader concerns in the literature on left-behind places (Pike et al., 2024; Rodríguez-Pose, 2018; Dijkstra et al., 2020), which emphasize how cumulative disadvantages in labor market performance, service provision, and demographic vitality can trap regions in self-reinforcing cycles of decline. As noted by Iammarino et al. (2020), territorial inequality in Europe increasingly reflects not only differences in productivity, but also diverging demographic paths and unequal access to opportunities. In this context, migration flows become both a symptom and a driver of marginalization: the loss of human capital exacerbates existing structural weaknesses and reduces the potential for recovery.

Preventing the crystallization of new left-behind areas requires policies that integrate economic regeneration with demographic renewal (Martin et al., 2021). This entails going beyond standard labor market interventions and investing in factors that promote well-being and place attractiveness, such as access to education, healthcare, transportation, and digital infrastructure. In structurally fragile regions, the demographic decline is not just a consequence of economic shocks, but a key factor shaping long-term development prospects. For recovery strategies to be effective, they must explicitly address demographic decline, ensuring not only economic revitalization, but also the sustainable capacity of places to retain and attract people over time, in line with the international agenda set by the Sustainable Development Goals and the long-standing objectives of (territorial) cohesion that have guided European policy making (European Commission, 2022; Medeiros et al., 2024).

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Appendix A

Areas of Complex Industrial Crisis

Area of Complex Industrial Crisis	Crisis Year	Local Labour Markets Involved	Region
Torino	2016	Torino	Piedmont
Savona	2013	Albenga, Cairo Montenotte, Savona	Liguria
Venezia	2010	Venezia	Veneto
Trieste	2012	Trieste	Friuli Venezia Giulia
Livorno	2008	Livorno	Tuscany
Piombino	2012	Piombino	Tuscany
Antonio Merloni's crisis	2007	Assisi, Foligno, Gualdo Tadino, Gubbio, Spoleto, Cagli, Fano, Pergola, Fabriano, Jesi, Matelica, Tolentino, Visso	Marche, Umbria
District of Fermo and Macerata	2014	Fermo, Montegiorgio, Montegranaro, Porto Sant'Elpidio, Civitanova Marche, Macerata *	Marche
Val Vibrata - Valle del Tronto – Piceno	2008	Ascoli Piceno, San Benedetto del Tronto, Comunanza and Martinsicuro	Marche, Abruzzo
Terni	2011	Terni	Umbria
Rieti	2009	Rieti	Lazio
Frosinone	2008	Frosinone	Lazio
Molise	2012	Isernia, Bojano	Molise
Acerra - Marcianise - Airola, Torre Annunziata - Castellammare and Battipaglia - Solofra	2012	Caserta, Napoli, Salerno, Nola, Montesarchio, Solofra, Battipaglia, Castellammare, Torre del Greco	Campania
Melfi - Potenza - Rionero in Vulture	2021	Melfi, Potenza and Rionero in Vulture	Basilicata
Taranto	2012	Taranto	Apulia
Termini Imerese	2010	Termini Imerese	Sicily
Gela	2012	Gela, Mazzarino, Vittoria, Caltagirone, Riesi, Caltanissetta, Piazza Armerina	Sicily
Porto Vesme	2012	Carbonia, Iglesias, Teulada	Sardinia
Porto Torres	2009	Sassari	Sardinia

Appendix B

Areas of Complex Industrial Crisis in the treated sample - Detailed description

Here we provide a detailed description of the manufacturing crises considered in our treated sample. The timeline of each crisis has been retrieved through reports from national and local media, programmatic agreements, and documents from trade unions and government agencies, such as Invitalia. The Ministry of Economic Development also provides minutes of the meetings with all the relevant stakeholders regarding these areas.

Val Vibrata - Valle del Tronto – Piceno

The complex industrial crisis area was established in 2016 and involves 4 local labour markets (53 municipalities). According to the Program Agreement, the territory experienced economic difficulties due to crises in the chemical, rubber and plastic materials, metalworking and electronics, and textile sectors.
The *SGL Carbon* plant employed around 900 workers in the early 1980s, but numbers gradually declined. In June 1994, approximately 150 employees were made redundant, leading to the plant's definitive closure in 2007. The *Biasi Group*, composed of *Bluterma* and *Bluradia*, maintained high employment levels but went bankrupt in 2008, causing 350 layoffs. The *ATR Group* employed around 1100 people, but the workforce was drastically reduced by approximately 900. Regarding *Prysmian*, on 27 February 2015, the company announced the closure of its Ascoli Piceno plant, which employed 120 workers.
Based on these events, it is plausible to date the onset of the crisis to 2008.

Acerra-Marcianise - Airola, Torre Annunziata - Castellammare and Battipaglia - Solofra

Established in 2017, this complex industrial crisis area encompasses 9 local labour markets. An analysis of the local press reveals no major plant closures or corporate crises. The Campania region identified this area as a crisis zone based on an overall economic deterioration starting in 2012.

Frosinone

The crisis area was established in 2014 and involves only the local labour market of Frosinone. Multinational companies operated here in sectors such as electronics, mechanics, chemistry, and pharmaceuticals.
A significant case is *Videocon*, founded in Anagni in the late 1960s specializing in television production, becoming the second largest factory in the region. The crisis began in the 1990s, and despite attempts to relaunch it, foreign partners withdrew in 2005. By June 2008, the company shifted to merely assembling products before definitively going bankrupt in 2012. Another notable crisis involved *Marazzi*, a ceramics producer that announced redundancies beginning in 2009.
These events justify dating the crisis onset to 2008.

Savona

Established in 2016, the Savona complex industrial crisis area is strategically located at the junction of trade routes linking Italy, France, and Spain. Since 2013, the territory has experienced significant difficulties, particularly in the energy and transport sectors, which represent the two main pillars of the local economy. These structural challenges have led to a prolonged economic downturn, prompting the formal recognition of the area as being in a state of complex industrial crisis.

Fermo - Macerata

Created in 2018 and encompassing 5 local labour markets, this area's crisis is mainly tied to difficulties in the footwear sector. Invitalia identifies 2014 as the onset of the crisis.

Molise

Established in 2015, the crisis area covers two local labour markets: Isernia and Bojano. The programmatic agreement outlines production–related crises, especially those involving two major industrial players: *ITTIERRE* (textile sector) and *GAM-SOLAGRITAL* (poultry sector). Both crises trace back to 2012, with *GAM-SOLAGRITAL* placed in compulsory administrative liquidation that year. Additionally, a metalworking crisis is documented, with a trade union press release from November 2011 reporting a 30% employment contraction between 2005 and 2013.
These factors suggest 2012 as the start of the crisis.

Porto Vesme

Established in 2016 and covering three local labour markets, this area includes the Portovesme Industrial Center, created in the 1970s following the reconversion of Sulcis' coal and lead-zinc mining industries into an aluminum production chain, now Italy's most important site for such metals. The crisis starts with the ALCOA plant closure in October 2012.

The Antonio Merloni Crisis

Established in 2010, Italy's first complex industrial crisis area was triggered by the collapse of Antonio Merloni, whose production was primarily concentrated in Fabriano and affected several surrounding local labor markets. The Merloni family began with Aristide in the 1930s producing industrial scales, later diversifying into white goods and other metal products. Antonio Merloni founded the independent business *ARDO* in 1968, renamed *Antonio Merloni* in 1989. The group became Europe's largest subcontractor of white goods. The outsourcing crisis began in the early 1990s as buyers reduced orders favoring cheaper East European suppliers. Despite recapitalization in 2003 and social safety efforts, the company faced heavy debts and losses, culminating in the Ministry for Economic Development admitting it to controlled administration under the *Marzano* Law in October 2008, which we consider as the beginning of the crisis.

Termini Imerese

Established in 2011 and limited to the local labour market of Termini Imerese, the area was specialized in the automotive sector, particularly *Fiat* plants. *Fiat* announced plant closures in January 2010, with permanent shutdowns completed by the end of 2011.

Piombino

Established in 2013 and covering the local labour market of Piombino, the area's economy is dominated by steel production. The main firm, *Lucchini spa*, entered extraordinary administration in December 2012.

Terni - Narni

Designated as a complex industrial crisis area in 2016, it includes only the LLM of Terni. The territory has suffered a prolonged industrial decline, particularly in the chemical and steel sectors. In 2011, *AST-TK* (ThyssenKrupp) began exiting the stainless steel sector, leading to 400 layoffs in 2013. That same year, *Lyondell-Basell* closed its plant, dismissing 120 employees. *Meraklon Yarn* shut down in 2014 with 240 job losses, and *SGL Carbon* closed its Narni facility in 2016, cutting 110 positions. In 2021, *Jindal* closed its plant, laying off 142 workers. The area also faced serious difficulties in the food sector.[17] The industrial crisis can be traced back to at least 2011.

[17] Claudia Sensi, *Terni, dalla Basell alla Tct: le ferite aperte delle crisi aziendali mai risolte*, Il Messaggero, 13/05/2023.

Appendix C

Productive Specialization of Italian Local Labour Markets

Class	Class Description	Sub-Class	Sub-Class Description	Group	Group Description	Included in the sample
A	LLM without Specialization	A	LLM without Specialization	A1	without Specialization	no
B	Non-Manufacturing LLM	BA	Urban LLM	BA1	High-Specialized Urban	no
B	Non-Manufacturing LLM	BA	Urban LLM	BA2	Multi-Specialized Urban	no
B	Non-Manufacturing LLM	BA	Urban LLM	BA3	Mainly-Port Urban	no
B	Non-Manufacturing LLM	BA	Urban LLM	BA4	Non-Specialized Urban	no
B	Non-Manufacturing LLM	BB	Other Non-manufacturing LLM	BB1	touristic vocation	no
B	Non-Manufacturing LLM	BB	Other Non-manufacturing LLM	BB2	agricultural vocation	no
C	LLM of “Made in Italy”	CA	Textile, Leather and Clothing LLM	CA1	Textile and Clothing	yes
C	LLM of “Made in Italy”	CA	Textile, Leather and Clothing LLM	CA2	Leather and Hide	yes
C	LLM of “Made in Italy”	CB	Other LLM of “Made in Italy”	CB1	Machinery Manufacturing	yes
C	LLM of “Made in Italy”	CB	Other LLM of “Made in Italy”	CB2	Wood and Forniture	yes
C	LLM of “Made in Italy”	CB	Other LLM of “Made in Italy”	CB3	Agri-Food	yes
C	LLM of “Made in Italy”	CB	Other LLM of “Made in Italy”	CB4	Jewelry, Glasses and Musical Instruments	yes
D	LLM of Heavy Manufacturing	D	LLM of Heavy Manufacturing	D1	Transportation Means	yes
D	LLM of Heavy Manufacturing	D	LLM of Heavy Manufacturing	D2	Metal Production and Processing	yes
D	LLM of Heavy Manufacturing	D	LLM of Heavy Manufacturing	D3	Building Materials	yes
D	LLM of Heavy Manufacturing	D	LLM of Heavy Manufacturing	D4	Petrochemical and Pharmaceutical	yes

Appendix D

Descriptive Statistics

	Treated LLMs				Not-Treated LLMs			
	Mean	Standard Deviation	Max	Min	Mean	Standard Deviation	Max	Min
ln(Inflows of WAP)	6.598	0.748	8.559	4.304	6.654	1.000	9.524	2.708
ln(Outflows of WAP)	6.417	0.684	8.536	4.745	6.474	0.858	8.992	3.258
ln(Inflows of Foreign WAP)	5.440	1.185	8.144	1.099	5.472	1.389	8.707	0
ln(Outflows of Foreign WAP)	4.729	0.980	7.479	1.099	4.815	1.186	8.092	0
ln(Inflows of Native WAP)	6.067	0.762	7.869	3.829	6.173	0.948	9.016	2.485
ln(Outflows of Native WAP)	6.148	0.707	8.117	4.691	6.217	0.837	8.635	3.136
ln(Inflows of Male WAP)	5.909	0.749	8.185	3.497	5.978	1.011	8.841	1.792
ln(Outflows of Male WAP)	5.729	0.704	8.095	4.007	5.802	0.880	8.441	2.398
ln(Inflows of Female WAP)	5.892	0.761	7.851	3.714	5.935	1.001	8.821	1.792
ln(Outflows of Female WAP)	4.733	1.031	7.028	0.693	4.806	1.185	7.976	0.693
ln(Inflows of Over 65)	4.335	0.747	6.486	2.079	4.449	0.891	7.660	0
ln(Outflows of Over 65)	4.120	0.743	7.851	1.792	4.250	0.877	7.897	0
Net Flow Ratio of WAP	0.003	0.004	0.022	-0.013	0.003	0.005	0.028	-0.014
Net Flow Ratio of Foreign WAP	0.003	0.003	0.015	-0.007	0.033	0.003	0.020	-0.004
Net Flow Ratio of Native WAP	-0.001	0.002	0.008	-0.009	-0.000	0.003	0.026	-0.011
Net Flow Ratio of Male WAP	0.001	0.002	0.010	-0.009	0.002	0.002	0.015	-0.008
Net Flow Ratio of Female WAP	0.004	0.002	0.015	-0.001	0.005	0.002	0.020	-0.003
Net Flow Ratio of Over 65	0.000	0.001	0.002	-0.014	0.000	0.001	0.004	-0.009

Appendix E

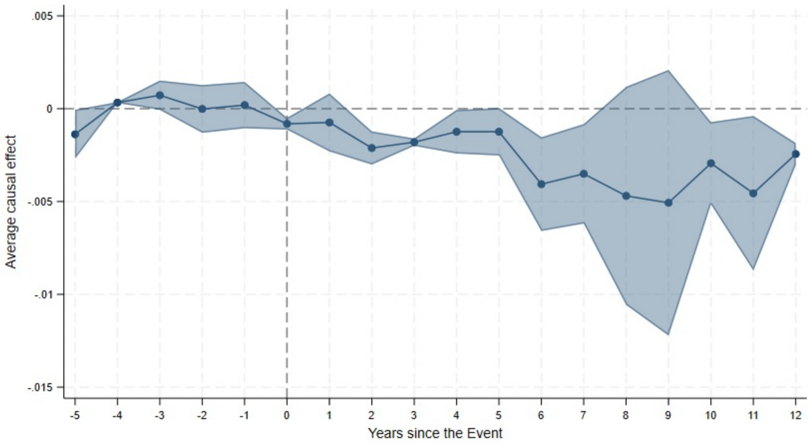
Robustness: Alternative Estimators and 7-Period Pre-Trend

	5 Pre-Treatment Periods				7 Pre-Treatment Periods			
	Callaway-Sant'Anna	Borusyak	TWFE	Sun-Abraham	Callaway-Sant'Anna	Borusyak	TWFE	Sun-Abraham
7 Pre					-0.000202	0.000320	-0.00177***	-0.00166***
					(-0.29)	(0.72)	(-2.86)	(-2.64)
6 Pre					0.000751	0.00175***	-0.000301	0.000589
					(0.75)	(2.95)	(-0.58)	(1.17)
5 Pre	-0.000990	-0.000294	-0.00137**	-0.000408	-0.00990	0.000178	-0.00117	-0.000516
	(-1.17)	(-0.42)	(-2.32)	(-0.47)	(-1.17)	(0.23)	(-1.31)	(-0.58)
4 Pre	0.000264***	0.000221	-0.000497	0.000157	0.000264***	0.000701	-0.000504	0.000120
	(6.82)	(0.46)	(1.26)	(0.42)	(6.82)	(1.20)	(-1.28)	(0.31)
3 Pre	0.000555	0.00117**	0.000111	0.000839***	0.000555	0.00165***	0.0000981	0.000792*
	(1.61)	(2.25)	(0.28)	(2.16)	(1.61)	(2.64)	(0.25)	(1.94)
2 Pre	-0.0000156	0.000706	-0.000302	0.000409	-0.0000156	0.00119*	-0.000297	0.000356
	(-0.03)	(1.21)	(-0.64)	(0.83)	(-0.03)	(1.73)	(-0.64)	(0.73)
1 Pre	0.000351	0.000825*			0.000351	0.00133**		
	(0.89)	(1.71)			(0.89)	(2.26)		
0 Post	-0.000913***	0.000153	-0.000860	-0.0000996	-0.000913***	0.000153	-0.000826**	-0.000174
	(-4.56)	(0.39)	(-2.17)	(-0.19)	(-4.56)	(0.39)	(-2.07)	(-0.33)
1 Post	-0.000913***	0.000153	-0.000860**	-0.0000996	-0.000913***	0.000153	-0.000826**	-0.000174
	(-4.56)	(0.39)	(-2.17)	(-0.19)	(-4.56)	(0.39)	(-2.07)	(-0.33)
2 Post	-0.00201***	0.000608*	-0.00114***	-0.000436	-0.00201***	-0.000608*	-0.00112***	-0.000494
	(-5.03)	(-1.69)	(-2.84)	(-0.99)	(-5.03)	(-1.69)	(-2.78)	(-1.14)
3 Post	-0.00166***	-0.000248	-0.000586	0.0000654	-0.00166***	-0.000248	-0.000573	0.0000110
	(-16.77)	(-0.57)	(-1.18)	(0.12)	(-16.77)	(-0.57)	(-1.15)	(0.02)
4 Post	-0.00114**	-0.000292	-0.000534	0.000226	-0.00114**	-0.000292	-0.000521	0.000169
	(-2.26)	(-0.82)	(-1.28)	(0.46)	(-2.26)	(-0.82)	(-1.25)	(0.34)
5 Post	-0.00114**	-0.000514	-0.000536	0.0000737	-0.00114**	-0.000514	-0.000522	0.0000212
	(-2.04)	(-1.07)	(-0.84)	(0.11)	(-2.04)	(-1.07)	(-0.82)	(0.03)
6 Post	-0.00363***	-0.00210***	-0.00221***	-0.00166**	-0.00363***	-0.00210***	-0.00219***	-0.00170**
	(-2.98)	(-4.52)	(-3.45)	(-2.38)	(-2.98)	(-4.52)	(-3.40)	(-2.42)
7 Post	-0.00316**	-0.00240***	-0.00212***	-0.00157*	-0.00316**	-0.00240***	-0.00209***	-0.00162*
	(-2.47)	(-3.99)	(-2.78)	(-1.86)	(-2.47)	(-3.99)	(-2.73)	(-1.92)
8 Post	-0.00361	-0.00219***	-0.00132*	-0.00104	-0.00361	-0.00219***	-0.00129*	-0.00105
	(-1.60)	(-4.16)	(-1.92)	(-1.19)	(-1.60)	(-4.16)	(-1.88)	(-1.18)
9 Post	-0.00427*	-0.00273***	-0.00205**	-0.00172*	-0.00427*	-0.00273***	-0.00202	-0.00171*
	(-1.68)	(-4.62)	(-2.49)	(-1.71)	(-1.68)	(-4.62)	(-2.43)	(-1.68)
10 Post	-0.00359***	-0.00296***	-0.00239***	-0.00209	-0.00359***	-0.00296***	-0.00236***	-0.00192*
	(-6.11)	(-4.47)	(-2.81)	(-2.03)	(-6.11)	(-4.47)	(-2.76)	(-1.82)
11 Post	-0.00419***	-0.00415***	-0.00295***	-0.00268**	-0.00419***	-0.00415***	-0.00293***	-0.00252**
	(-2.98)	(-6.03)	(-3.01)	(-2.24)	(-2.98)	(-6.03)	(-2.96)	(-2.10)
12 Post	-0.00354***	-0.00419***	-0.00326***	-0.00279***	-0.00354***	-0.00419***	-0.00324***	-0.00280***
	(-8.45)	(-5.08)	(-3.19)	(-2.58)	(-8.45)	(-5.08)	(-3.16)	(-2.59)

Note: estimates obtained with different event study estimators: Callaway and Sant'Anna (2021), Borusyak et al. (2024), the standard Two-Way Fixed Effects (TWFE), and the estimator proposed by Sun and Abraham (2021). For each estimator, results are reported using both a 5-period pre-treatment window (baseline specification) and an extended 7-period window.

Appendix F

Baseline specification excluding LLMs affected by earthquakes



Note: Plots are based on 95% confidence intervals. Estimates are carried out using the methodology proposed by Callaway and Sant'Anna (2021), throught the `csdid` Stata routine. The baseline estimation window includes 5 pre-treatment and 12 post-treatment periods. The dependent variable is the difference between inflows and outflows of population aged 18-64 to/from a specific local labour market over total resident population in 2000. Control variables include the share of working-age foreign population, the dependency ratio and the set of fixed effects described in Section 3.3.