How Big Is the Big Push? The Macroeconomic Effects of a Large-Scale Regional Development Program

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Abstract

From 1950 to 1992, Italy implemented one of the largest regional development programs in history to foster industrialization in its Southern regions. The program persistently boosted local economic activity. To account for crowding-out effects on non-targeted regions, we develop a two-region growth model with public capital, factor mobility, and agglomeration economies. Despite large crowding-out effects, the welfare gains from the program outweighed its costs. However, we estimate negligible long-run effects on regional output per worker differentials. Counterfactual exercises reveal that welfare gains would have been larger under a place-neutral allocation of resources and in the absence of labor mobility.

Keywords: Big Push; Regional Development; Crowding-Out

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1 Introduction

Many countries exhibit remarkable differences in GDP per capita across regions. Governments often address such disparities through large-scale regional development programs targeting disadvantaged areas. These programs usually combine infrastructure spending and financial incentives to firms with a twofold objective. First, they aim to encourage convergence by narrowing regional productivity gaps. Second, they intend to foster long-term aggregate economic growth by channeling investments in relatively underdeveloped areas, where returns to public capital should be higher (Rosenstein-Rodan 1943; Murphy et al. 1989). However, the macroeconomic effects of these policies are, in principle, ambiguous. First, encouraging economic activity in distressed areas may be inefficient if place-specific factors prevent them from generating long-term self-sustaining productivity gains. Second, these policies may crowd out production factors from more productive regions and mitigate the gains accruing to the targeted, less productive, regions.

The empirical evidence assessing this ambiguity is scarce because of both identification problems – the negative selection of targeted areas – and measurement issues – the scant availability of high-quality data spanning multiple decades. Moreover, most of the empirical *place-based policy* literature focuses on evaluating the short-term partial-equilibrium effects of relatively small programs, rather than the lasting macroeconomic impact of large programs. We overcome these challenges by studying the long-term local and aggregate effects of one of the most extensive regional big push programs in history: the Italian *Cassa per il Mezzogiorno* (CasMez). From 1950 to 1992, CasMez devoted an extraordinary amount of resources to foster the development of Southern Italian regions, whose economies considerably diverged from the Center-North ones since the onset of the Italian industrialization. Specifically, CasMez provided Southern regions with key infrastructures and offered firms generous financial incentives to locate production in the South.

Two reasons make CasMez a particularly suited context to examine the general equilibrium consequences of large-scale regional development programs. First of all, the size of the program is unprecedented. According to administrative sources, a total of 450 billion US$ (2010) was devoted to this industrialization effort, corresponding to an average of 1% of national GDP per year for more than 40 years (Felice and Lepore, 2017) and about 6 times the GDP of Southern Italian regions in 1950. In absolute terms, the program was 17 times larger than the Tennessee Valley Authority, the most extensive regional development program ever implemented in the U.S. (Kline and Moretti, 2014), 12 times larger than what Germany spent to foster convergence of its Eastern regions after unification (Siegloch et al.,

2021), and 3.5 times larger than the Marshall Plan, whose target was whole Western Europe (Bianchi and Giorcelli, 2023). Second, the diverging economic conditions of the targeted and the non-targeted areas at the time were pushing millions of individuals to move from the lagging South to the industrialized Center-North. This suggests that factors of production were extremely mobile and the program might have had large crowding-out effects on the rest of the country.

Our analysis proceeds in steps. First, we combine administrative data from historical archives covering the universe of CasMez-financed projects and decennial census data geo-localized at the municipality level to provide reduced-form evidence of the impact of CasMez's investments on local economies up to 2011. Our main identification strategy leverages variation in the allocation of funds across municipalities within CasMez's jurisdiction originating from the establishment of *Industrial Development Areas* (IDAs).[1] Specifically, we employ a difference-in-differences approach comparing municipalities belonging to an IDA with other Southern municipalities not belonging to an IDA, matched according to baseline characteristics and pre-treatment trends. We further corroborate our analysis through a second identification strategy, exploiting variation in the allocation of funds across municipalities arising from their location just North vs. South of CasMez's jurisdiction border.

Consistently across the two empirical strategies, we find that CasMez's funds substantially increased manufacturing and services employment in the targeted areas, with gains persisting up to 20 years after the end of the program. According to our benchmark specification, municipalities belonging to an IDA cumulatively received about €10,000 (2010 Euros) per capita more than their non-IDA counterparts. As a result, their employment levels in 2011 were 28% higher. Nevertheless, a substantial positive effect of IDAs on resident population suggests the presence of sizeable crowding-out effects on the non-targeted areas.

To account for local crowding-out effects, we perform the reduced-form analysis at the more aggregated province level, exploiting the cross-sectional variation in the allocation of funds induced by the presence of IDAs. The estimated province-level effects on sectoral and total employment closely match the municipality-level results, suggesting negligible within-province spillovers. In addition, province-level data allow us to study the effect of CasMez investment on value added. We find positive and quantitatively consistent effects on sectoral and total value added, and non-significant effects on value added per worker and employment rates. Using administrative data on province-to-province migration flows, we

[1] IDAs consist of agglomerates of municipalities (i.e., *Aree di Sviluppo Industriale* or *Nuclei di Industrializzazione*) that become eligible for extra manufacturing-oriented investments upon formation. 48 IDAs, corresponding to the major urban areas of the South, were formed over the 1960-1974 period.

further document that province-level employment gains in the targeted areas stem entirely from improved net migration flows to both the rest of the South and the Center-North. This implies that the program shifted national production across provinces and limited the ongoing mass migratory waves from the South to the Center-North.

To assess the aggregate effects of the program, we develop a one-sector two-region growth model that builds on typical features of both the growth (Solow, 1956; Swan, 1956) and economic geography (Roback, 1982; Kleinman et al., 2023) literature. In our model, regional production depends on regional productivity, labor, capital, and a fixed factor. We allow for increasing returns to scale by modeling regional productivity as a function of *public capital* (i.e., the cumulative government funds spent on infrastructures and financial incentives to firms) and employment density. This second channel captures the idea that the local effects of temporary public investments might be highly persistent due to agglomeration economies (Ciccone and Hall, 1996). Notably, the model accounts for cross-regional crowding-out effects due to factor reallocation with perfect private capital mobility and imperfect labor mobility (Blanchard and Katz, 1992). The model's structural parameters are derived by combining standard calibration techniques with the causally identified estimates in our reduced-form analysis.

We use steady-state approximations of the model to derive closed-form expressions for the effects of a region-specific change in the public capital stock on aggregate output, the regional differentials in output per worker, and welfare. The model-based analysis reveals that aggregate value added in 2011 was 1.6% higher thanks to the regional development program. This average masks substantial regional heterogeneity. Relative to the counterfactual, value added in the South increased by 16.9%, while it decreased by 2.7% in the rest of the country. Under standard assumptions regarding the real annual discount rate and the deadweight cost of taxation, the ratio between the aggregate welfare benefits and the costs of the program – the benefit-to-cost ratio (BCR) (Heckman et al., 2010) – is 1.32. This result implies that the aggregate welfare benefits induced by CasMez outweighed its costs.[2] However, we estimate null long-run effects on the regional differentials in output per worker.

Finally, we perform two counterfactual exercises. First, to distinguish between *cost-effectiveness* and *optimality* of the program, we quantify the impact of an alternative, same-sized, development program not specifically directed to the South (i.e., *place-neutral* on a per-capita basis) on aggregate welfare. Under conservative assumptions about the effect of public investments on regional productivity in the Center-North, we find that the welfare benefits induced by a place-neutral program would have been

[2] An alternative statistic proposed by Hendren and Sprung-Keyser (2020) to compare the benefits and the costs of a policy – the marginal value of public funds (MVPF) – delivers the same conclusion, with a MVPF of 1.88.

larger than the ones of CasMez. Second, we perform the cost-benefit analysis in a counterfactual scenario with no labor mobility and find that the program would have induced larger welfare benefits and markedly reduced the regional differentials in output per worker between the Center-North and the South. This result implies that, *ceteris paribus*, the degree of labor mobility determines both the welfare gains of regional development programs and their efficacy in reducing regional per-capita income differentials.

This paper builds on and contributes to three strands of the literature. First, we contribute to the literature on big push programs and economic growth by studying one of the largest government-financed industrialization efforts of the past century. The big push literature dates back to Rosenstein-Rodan (1943) and Hirschman (1958). Juhász et al. (2023) provide the most updated and comprehensive review of recent papers on industrial policy. Among them, studies focusing on the long-term effects of different industrial policies in South Korea (Kim et al., 2021; Choi and Levchenko, 2021; Lane, 2022; Choi and Shim, 2024) and the U.S. (Kantor and Whalley, 2023) tend to find positive partial and general equilibrium effects.[3] We find that one of the largest industrial policies ever implemented was cost-effective, even after accounting for the negative general equilibrium effects induced by cross-regional reallocation of economic activity.

Second, our work contributes to the literature on place-based policies (Busso et al., 2013; Kline and Moretti, 2014; Neumark and Simpson, 2015; Criscuolo et al., 2019; Slattery and Zidar, 2020; Fajgelbaum and Gaubert, 2020; Siegloch et al., 2021; Bianchi and Giorcelli, 2023). We find that the long-run welfare gains from regional development programs are curtailed by their effect on factor reallocation.[4] Indeed, high labor mobility implied by our estimates amplifies the difference between crowding-in and crowding-out effects, resulting in lower aggregate gains. A counterfactual exercise confirms that a lower degree of labor mobility increases the social desirability of the policy, consistently with Kline and Moretti (2013). Finally, we show that the place-targeting feature of CasMez was likely not optimal as it allocated excessive public capital to the South and limited reallocation of labor to the Center-North. This adds empirical substance to the literature on how asymmetric policies can exacerbate misallocation (Restuccia and Rogerson, 2008; Glaeser and Gottlieb, 2008; Hsieh and Klenow, 2009; Hsieh and Moretti, 2019; Fajgelbaum and Gaubert, 2024).

Third, we contribute to the long-standing literature on the Italian regional divide (Clough and Livi

[3] Kim et al. (2021) represent an exception in this respect, as they find worsened resource allocation within industries-regions in South Korea with null effects at the industry-region level.

[4] In contemporaneous work, Atalay et al. (2023) also find that the impact on factor allocation reduces the general equilibrium effect of a place-based industrial policy in Turkey in 2012. However, they are not able to empirically test the prediction in the long run. Fan and Zou (2021) suggest a similar conclusion held for industrialization policies in China starting in mid 1960s but lack data to estimate the effect on factor reallocation and evaluate cost-effectiveness.

1956; Eckaus 1961; Iuzzolino et al. 2011; Felice 2019; Fernández-Villaverde et al. 2023), the problem of Southern Italy's development (Chenery, 1962), and CasMez's activity (Faini and Schiantarelli 1983; Felice and Lepore 2017). Faini and Schiantarelli (1985) propose an oligopolistic model of firms' investment and employment decisions in a regional setting with an empirical application to CasMez, finding small employment effects. The enhanced geographical granularity of our data allows us to update this finding, pointing to positive long-run employment effects. In contemporaneous work, Incoronato and Lattanzio (2024) study the local effects of CasMez's firm grants, focusing more on the microeconomic mechanisms behind the long-run persistence of such effects rather than on the general equilibrium impact of CasMez's activity. More broadly, this paper relates to Borgomeo (2018), Buscemi and Romani (2022), and Albanese et al. (2023), who study relevant political economy aspects of the program.[5]

The paper is structured as follows. Section 2 provides a historical background of the Center-North vs. South divide in Italy and describes the institutional context. Section 3 discusses the identification strategies and presents the reduced-form results at the municipality and province levels. In Section 4, we present the model, while Section 5 uses the model to quantify the aggregate effects of the program. Section 6 concludes.

2 Historical Background

2.1 The Center-North vs. South Divide

The Italian economy has been characterized by a pronounced divide between the Center-North and the South of the country ever since the country's unification in 1861.[6] Figure 1a displays the ratio between the Center-North and the South GDP per capita and GDP per worker over the 1871-2011 period (Vecchi et al., 2011). Starting in the late 1800s, the two regions began diverging markedly, as the economy of the Center-North was industrializing fast, while the Southern economy was primarily trapped in agriculture. Many factors contributed to this rising divergence. The Center-North was geographically closer and better connected to the rapidly expanding European markets. Moreover, the Center-North was characterized by relatively more pro-market institutions encouraging private entrepreneurial initiatives. Between 1891

[5] Borgomeo (2018) and Buscemi and Romani (2022) document that political interests affected resource allocation, finding limited long-run effects induced by this subset of interventions. Exploiting the spatial discontinuity induced by CasMez's border, Albanese et al. (2023) show that higher exposure to government transfers persistently increases demand for redistributive policies.

[6] The Center-North of the country includes the following regions: Valle d'Aosta, Piedmont, Lombardy, Liguria, Veneto, Trentino Alto Adige, Friuli Venezia Giulia, Emilia Romagna, Toscana, Umbria, Marche, and Lazio. The South includes the following regions: Abruzzo, Molise, Campania, Apulia, Basilicata, Calabria, Sicilia, and Sardegna.

and 1951, the ratio between the Center-North and the South GDP per capita increased from 1.2 to 2.

In the aftermath of WWII, Italy underwent a 20-year period of significant and sustained development encouraged by the 1948-1952 U.S. reconstruction aid and consolidated by fast capital accumulation in the following decades.[7] The 1951-1971 period is the only one in Italian history in which the Southern GDP per capita converged vis-à-vis the rest of the country. The ratio between Center-North vs. South GDP per capita decreased from 2 to 1.6 in these two decades. The convergence in GDP per worker started in 1951 continued instead until 1991. In these four decades, the ratio between Center-North vs. South GDP per worker decreased from 1.7 to 1.1.

Two important factors contributed to this achievement. First, sizeable regional differentials in 1951 triggered private capital accumulation in the South and mass migratory waves from the South to the Center-North. In this period, a net of about 3 million citizens – approximately 16% of the 1951 Southern population – moved their residence from the lagging South to the Northern industrial hubs (Figure 1b), providing relatively cheap labor to the fast-growing manufacturing and construction sectors.[8] Second, the government undertook an unprecedented effort to bring industrialization to the South by establishing CasMez and prioritizing investments of government-owned companies in the South.[9]

The convergence process suddenly stopped at the beginning of the 1970s. From 1971 to 1991, the ratio between the Center-North and the South GDP per capita remained relatively stable at 1.6, and migration flows fell by about two-thirds. Interestingly, this period corresponds to the peak in CasMez's investment in the South. Starting in 1991, net migration flows from the South to the Center-North increased again in response to expanding regional differentials in both per-capita and per-worker GDP. However, they remained far from the 1951-1971 levels, thus curbing convergence. A large gap in GDP per capita persists today, explained more by regional differences in employment-to-population ratios than in GDP per worker.

2.2 A Brief History of CasMez

In 1950, Prime Minister Alcide De Gasperi established CasMez to promote self-sustained economic development in the South. Figure 2 shows the territory covered by CasMez's jurisdiction. Between 1950 and

[7]The average annual growth rate of GDP was 5.8% between 1950 and 1963 and 5% between 1964 and 1973, with peaks of more than 8% between 1958 and 1963.

[8]The size of the South to Center-North internal migration flow occurred between 1951 and 1991 is comparable to the size of the US Great Migration occurred between 1910 and 1970, as both migrations involved about 6.5% of the national population at baseline.

[9]Law 634/1957 massively financed CasMez's activity and required at least 60% of the investments in new productive establishments performed by government-owned companies to be located in the South.

1992, CasMez spent the equivalent of about 6 times the 1950 GDP of Southern regions, with the largest share of expenditures devoted to land improvements, public infrastructures, and financial incentives to firms. Figure 3a shows the time series of CasMez's investments in public infrastructures and financial incentives to firms, the focus of this paper. The value of these investments accounts for about 62% of CasMez's total funds transferred to the South over the 1951-1992 period.

During the first decade of its activity, CasMez's expenditures were concentrated in basic public infrastructures and land improvements. Throughout its activity, CasMez financed and executed significant investments in water and electricity provision, roads, waste management, ports, and the prevention of natural calamities.[10] Figure 3b shows the amount of resources devoted to each type of public infrastructure. Starting from 1957, the main focus of CasMez's activity shifted from land improvements toward financial incentives to firms in an attempt to foster industrialization in the South.[11] Subsidized loans and grants could cover installation costs, which included expenses for opening new establishments in the South, expanding existing ones, or purchasing machinery. In this period, several large Italian firms responded to these incentives and located their manufacturing facilities in the South. CasMez's management body was technical and independent during this period, and the decision-making process was centralized.

From the 1970s, with the establishment of regional governments, allocating funds and assessing projects increasingly became a prerogative of local bureaucrats. The amount of resources devoted to firms, as opposed to public infrastructures, increased dramatically during this period, causing the costs of the regional development program to rise substantially (Buscemi and Romani, 2022). CasMez was suppressed in 1984 and substituted in 1986 by a new entity, named *Agenzia per la Promozione e lo Sviluppo del Mezzogiorno* (AgenSud), with similar goals and endowments. The so-called *Extraordinary Intervention* was gradually phased out and officially terminated in 1992.

3 The Local Effect of the Regional Big Push

3.1 Data Collection

We assemble two panel datasets, at the municipality and province levels, combining four data sources. To measure local exposure to the regional development program, we collect data on the universe of

[10] A smaller amount of resources was devoted to other infrastructures, including railways and airports, tourism, training programs, schools, hospitals, and sports facilities.

[11] See Law 634/1957 and Law 555/1959.

infrastructure projects and incentives to firms financed by CasMez from digitized historical archives, named *Archivi dello Sviluppo Economico Territoriale* (ASET). Importantly, the data provide information regarding each project's timing and cost, specifying the exact amount financed by CasMez. We geo-localize all infrastructure projects and firm incentives at the municipality level to measure the total funds invested in each municipality for every year of CasMez's activity.[12] The year assigned to each project corresponds to the year in which the project was approved.

We measure municipality-level demographic and labor market outcomes using data from the decennial population Censuses. The main outcome variables include manufacturing, agriculture, services, and total employment, resident population, and employment rate. Other variables in this dataset, such as the share of the illiterate population and the share of manufacturing employment, are useful to control for selection on observable characteristics in our main specification.

To estimate the impact of CasMez's investments on internal migration patterns, we use an updated version of the data in Bonifazi and Heins (2000), measuring yearly province-to-province migration flows. The data cover the 1955-2011 period and are constructed using entries to, and cancellations from, the population registries for changes of residence. From the province-to-province migration matrix, we compute the net migration flows for each province to the South and the Center-North.

Finally, to assess the impact of CasMez's investments on value added, we draw data from Istituto Tagliacarne measuring total, manufacturing, agriculture, and services value added at the province level for each Census year, from 1951 to 2011. We use these data to test whether the employment effects estimated at the province level are mirrored by the effects on value added and estimate the province-level impact of CasMez's investments on total and sectoral value added per worker.

3.2 Industrial Development Areas vs. Matched Control

Law 634/1957 established that CasMez could cover up to 20% of the expenses incurred by firms for the installation of new establishments within CasMez's jurisdiction and up to 10% of the expenses for purchasing machinery. Moreover, in an attempt to trigger agglomeration economies, the government sought to identify areas within CasMez's jurisdiction that were particularly suited for industrial development. Therefore, the status of *Industrial Development Area* (IDA) was introduced, defining a consortium of municipalities with the power to propose, execute, and manage infrastructure projects apt to encourage

[12]The source typically provides the location of the project. If missing, we parse the provided description to assign at least one location to each project. Sometimes, multiple locations are affected by the realization of a project. In those cases, we divide the amount of resources assigned to the project among the municipalities involved proportionally to their population.

local industrial production. A governmental committee established the necessary criteria to constitute an IDA, and CasMez was authorized to cover up to 50% of the proposed infrastructure projects' costs.

Between 1960 and 1974, 48 IDAs, made of 879 municipalities, were approved. Table A.2 lists all the IDAs, the Presidential Decrees that established their formation, and the year of approval.[13] Our first identification strategy exploits variation in the allocation of funds across municipalities within CasMez's jurisdiction induced by the status of IDA. Specifically, we match each municipality belonging to the 48 IDAs with one Southern municipality not belonging to any IDA using a set of 14 baseline characteristics and pre-treatment trends, including municipality-level measures of size, education, employment density, and industry mix. Table A.3 shows the list of variables used for the matching procedure and the balance of characteristics between the treatment and the matched control group, while Figure A.1 shows the map of the two groups.

This approach controls for selection into IDA status through a broad range of observable characteristics. Formally, we estimate 2SLS coefficients from a dynamic difference-in-differences design with 1961 (i.e., the closest Census year to 1960, when the first IDA was approved) as the reference year. In practice, we restrict the sample to municipalities belonging to IDAs and their 1-to-1 matched counterparts and estimate the following specification:

$$Y_{it} = \alpha_i + \delta_t + \sum_{k \neq 1961} \beta_k D_{it}^k + \varepsilon_{it}, \tag{1}$$

where α_i denotes municipality fixed effects, δ_t represents time fixed effects, D_{it}^k is a dummy variable taking value 1 for municipalities belonging to an IDA interacted with a dummy variable taking value 1 for each period in which $t = k$, and β_k denotes the dynamic coefficients of interest. Y_{it} denotes cumulative per-capita investments – the sum of public infrastructure spending and firm financial incentives divided by the 1961 municipal population – in the first-stage specification and employment and demographic outcomes in the reduced-form specification.

Intuitively, municipalities belonging to an IDA should receive more funds than their non-IDA counterparts because of their special status. Figure 4 shows the dynamic of decade-specific and cumulative per-capita investments for the treatment and the control group between 1951 and 2011. Starting from the 1960s, municipalities belonging to an IDA received considerably more funds than their non-IDA counterparts up to the end of the program. Cumulatively, treated municipalities received around €10,000

[13] After the formal approval, IDAs were required to draft a local strategic plan (i.e., *Piano Regolatore*) that typically became fully operational after a minimum of 2 to a maximum of 5 years.

(2010 Euros) per capita more than control municipalities. Identification requires that no municipality-level time-varying characteristic omitted from the ones used to match treated and control municipalities affects both the probability of obtaining the IDA status and the outcomes. Reassuringly, we detect no difference in investments in the 1951-1961 period, suggesting that CasMez was not targeting eventually treated municipalities before the establishment of IDAs.

Our results reveal that CasMez's investments substantially impacted municipal economic activity.[14] Figure 5, Panel (a), shows that manufacturing employment increased markedly in the treatment group relative to the control group between 1961 and 1991, with a gap expanding even after CasMez's suppression. By 2011, manufacturing employment was about 35% higher in municipalities belonging to an IDA. Consistently with Incoronato and Lattanzio (2024), local employment in services also increased persistently under the impulse of CasMez's investments (i.e., 25% higher in treatment vs. control municipalities in 2011). As a result, total employment was about 28% higher in treated municipalities by 2011. Municipalities belonging to an IDA experienced similar, though quantitatively smaller, gains in population, which translated into a small increase in the municipal employment rate in 2011. Interestingly, we find null long-term effects of CasMez's investments on employment in agriculture, suggesting that cross-sectoral reallocation of workers within municipalities was limited.

3.3 Discontinuity at the Border

Our second empirical strategy exploits plausibly exogenous variation in public infrastructure investments and financial incentives to firms across municipalities located just South vs. North of the sharp CasMez's jurisdiction border. Municipalities outside CasMez's jurisdiction were not eligible for funds. However, geographical proximity to the border may control for numerous unobservable confounders that could correlate both with the probability of being included in CasMez's jurisdiction and the outcomes of interest.

Figure A.2 shows the border of CasMez's jurisdiction and the municipalities included within a radius of 100 kilometers South and North of the border, which we use to define treated and control municipalities.[15] Some segments of CasMez's border coincided with administrative borders (e.g., regions, provinces, etc.) or with other historical borders separating the North and the South of Italy before unification and during the Nazi occupation. Importantly, unobserved variation across municipalities determined by such historical borders could affect the outcomes of interest through channels different from CasMez's

[14] The graphs displaying standard errors on the estimated β_k are in Appendix B.

[15] Our benchmark specification excludes Rome from the control sample, but results do not change when Rome is included.

investments (Albanese et al., 2023). For this reason, we estimate the impact of CasMez's investments on the growth rate of the outcomes rather than on their levels. First-differencing with respect to 1951 levels allows us to control for all those time-invariant municipality-specific characteristics that might correlate with treatment eligibility and the outcomes.

Formally, we estimate 2SLS coefficients from a long difference-in-discontinuities design (Grembi et al., 2016) relative to 1951 at the border of CasMez's jurisdiction. The first-stage and reduced-form specifications take the following form:

$$Y_{it} - Y_{i1951} = \delta_t + \sum_{k=1961}^{2011} \left[\beta_k D_{it}^k + \sum_{j=1}^{3} \eta_{jk} R_i^j + \sum_{j=1}^{3} \gamma_{jk} R_i^j D_{it}^k \right] + \varepsilon_{it} \tag{2}$$

where $(Y_{it} - Y_{i1951})$ denotes the long difference of the outcome variable relative to 1951, δ_t captures time fixed effects, D_{it}^k is a dummy variable taking value 1 for municipalities located just South of the border interacted with a dummy variable taking value 1 for each period in which $t = k$, and β_k are the dynamic coefficients of interest. R_i denotes the running variable (i.e., distance from the border). We control flexibly for the impact of R_i on $(Y_{it} - Y_{i1951})$, using a third-degree polynomial function, whose coefficients are allowed to change for observations located North or South of the border.[16]

To grasp the intuition behind the estimation procedure of the β_k coefficients in each period k, we provide a graphical representation of the static long difference-in-discontinuities in 1991 (i.e., the closest Census year to 1992, when CasMez was suppressed) in Figure A.3. Panel (a) shows that cumulative CasMez's investments per capita in 1991 jump at CasMez's border from around €20,000 (2010 Euro) to almost zero, providing evidence of a strong first stage. Panel (b) shows that employment between 1951 and 1991 increased by about 60% more in municipalities located just South of the border relative to those located just North.

Figures 6 and 7 display the coefficients β_k for all outcome variables and periods to capture the dynamic effects of CasMez's investments. Municipalities located South of the border received more funds over the 1951-1991 period, with a difference in cumulative investments of about €20,000 (2010 Euro). As a result, even 20 years after the end of the program, manufacturing employment increased 50% more in treated municipalities, as shown by Figure 7, Panel (a). Panel (b) documents positive long-run effects on services employment. Between 1951 and 2011, total employment and population increased by about 30% more South of the border. Panels (c) and (d) show that employment increased faster in the 1970s and 1980s,

[16] The third-degree polynomial provides the best fit of the data on both sides of the border (see Figure A.3).

with population levels adjusting over time. The resulting employment rate dynamic, displayed in Panel (f), is characterized by substantial gains in the 1970s and 1980s, mitigated by population inflows in the following decades. Consistently with previous results, Panel (e) displays null effects on municipal employment in agriculture.

3.4 Municipal-Level Results

Municipality-level evidence on the impact of CasMez's investments points to substantial long-term effects on local labor market outcomes. Specifically, the combination of public infrastructure spending and financial incentives for firms has a strong positive impact on manufacturing employment, with gains persisting even after the end of the program and suggesting the presence of robust agglomeration economies. These gains are accompanied by increases in total employment and population. Municipal employment in the services sector and employment rates are positively affected by the program overall, although the strength and dynamics of these effects differ by specification.

Table 1 summarizes the results in the two specifications. Following the 2SLS literature (Angrist et al., 1996), the ratio between the first-stage and the reduced-form coefficients estimates the impact of €1,000 (2010 Euro) per capita of cumulative CasMez's investments on the outcome variable of interest. Specifically, columns (1) and (2) report the coefficients obtained from the static versions of Equations (1) and (2), where the $\sum_{k\neq 1961}^{2011} \beta_k D_{it}^k$ terms are replaced by $(D_i \times T_t)$ and T_t denotes a dummy variable for the post-1961 period.

The estimated semi-elasticities of most of our outcomes are extremely similar across columns (1) and (2). This reinforces the credibility of our results since we are exploiting two distinct sources of quasi-experimental variation in investments across the two specifications. The reported coefficients in column (1) imply that €1,000 worth of additional cumulative investments caused manufacturing employment, services employment, and total employment to increase, on average, by 3.1%, 2.1%, and 2.3%, respectively. The semi-elasticity of services employment to cumulative investments is lower in column (2), while the impact on employment rates is slightly higher and statistically significant.[17]

[17] Appendix C discusses additional results on municipality-level human capital, measured as the share of population with a college degree. In short, our two identification strategies deliver contrasting, and therefore not conclusive, results on the long-run local effects of CasMez on human capital.

3.5 Province-Level Analysis: Mobility, Value Added, and Labor Productivity

Two distinct identification strategies document the positive effects of the regional development program on municipal employment and population. However, if factors of production are mobile, these gains may come, at least in part, at the expense of other areas. In this section, we extend the reduced-form analysis carried out at the municipal level to a more aggregated geographical level (i.e., provinces) with three objectives. First, we obtain causally identified estimates of the impact of CasMez's investments that account for *within-province* spillover effects. Second, we estimate the impact of CasMez's investments on cross-province migration flows, which in turn helps us quantify the *cross-province* spillover effects. Finally, we estimate the impact of CasMez's investments on sectoral and total value added, whose measures are available only at the province level. This is important to verify that local employment gains go hand-in-hand with local gains in value added.

The intuition behind this spillover analysis follows Criscuolo et al. (2019). If the impact of CasMez's investments on the outcomes of interest is lower at the province level than at the municipal level, then adverse spillover effects on neighboring municipalities (i.e., crowding-out effects) prevail over positive ones (i.e., crowding-in effects) within a province. Otherwise, positive spillovers outweigh the negative ones. In practice, this method tests for the presence of within-province cross-municipal spillover effects and delivers reduced-form estimates of the impact of CasMez's investments that absorb such spillovers.

To identify quasi-exogenous variation in cumulative investments across provinces, we rely on province-level variation stemming from the presence of IDAs within a province. Specifically, we instrument province-level cumulative investments per capita with the interaction of two variables. First, a dummy variable taking value 1 for provinces with at least an IDA within their territory. Second, a dummy variable taking value 1 for all periods after 1961, the closest Census year to 1960, when the first IDA was established. Figure A.4 shows a map of treatment and control provinces in this setting.[18]

Formally, we estimate 2SLS coefficients from a difference-in-differences design. The first-stage and reduced-form equations take the following form:

$$Y_{pt} = \alpha_p + \delta_t + \beta(D_p \times T_t) + \mathbf{X}'_{p1951}\Gamma_t + \varepsilon_{pt}, \tag{3}$$

where Y_{pt} denotes the outcome variable (i.e., decade-specific or cumulative CasMez's investments per

[18] In practice, our identifying variation comes from IDA vs. non-IDA provinces located in Sicily – the only region within CasMez's jurisdiction with non-IDA provinces in its territory – Lazio, and Marche – where both provinces inside and outside CasMez's jurisdiction are present.

capita for the first stage and the outcome variables of interest for the reduced form) in province p and period t, α_p denotes province fixed effects, δ_t denotes time fixed effects, D_p is a dummy variable for provinces located within CasMez's jurisdiction, and T_t is a dummy variable for the post-1961 period. As in the municipality-level specification, $\mathbf{X}'_{p1951}$ is a vector of baseline characteristics including the share of illiterate population, manufacturing and agriculture employment shares, value added per worker, and regional dummies. These baseline characteristics interact with time dummies, Γ_t, to control for heterogeneous trends across provinces induced by differences in baseline industry mix, education levels, labor productivity, and region-specific characteristics.

Table 2 reports the 2SLS coefficients estimated at the municipality and province levels from Equations (1), (2), and (3) respectively, revealing two critical findings. First, the percent effect of €1,000 (2010 Euro) cumulative investments per capita on most outcomes of interest is very similar and not statistically distinguishable at the municipality and province levels. This implies that within-province spillover effects are not particularly important in explaining the positive effects estimated at the municipality level. Second, total employment and population respond substantially to investments also at the province level, delivering a statistically non-significant effect on employment rates. This suggests that crowding-out effects operate across provinces both within and outside CasMez's jurisdiction, significantly affecting the rest of the country.

Given these results, it is reasonable to hypothesize that a large part of province-level employment gains induced by the regional big push program stemmed from improved net migration flows for Southern provinces. To test this hypothesis, we use data on province-to-province migration flows (Bonifazi and Heins, 2000).[19] Table 3 decomposes the semi-elasticity of province-level employment to investments (column 1) into the contribution of higher net migration inflows from the Center-North (column 3) and the South (column 6). The estimated coefficients document that, of the 2.3% province-level employment gains stemming from additional €1,000 of cumulative investments, 1% comes from improved net migration flows from the Center-North and 1.1% from the rest of the South. These contributions can be further broken down into contributions coming from higher inflows or lower outflows from the Center-North or the South (columns 4, 5, 7, and 8). These results imply that the province-level employment gains stem almost entirely from improved net migration flows and not reduced slack in the labor market.

Finally, we estimate the impact of CasMez's investments on value added and labor productivity. Table 4, column (1), reports the estimated coefficients for manufacturing, services, agriculture, and total

[19] We impute the number of working migrants assuming that their employment rate equals the national employment rate in 1951.

employment. Column (2) instead displays the corresponding coefficients for manufacturing, services, agriculture, and total value added. Comparing columns (1) and (2), we observe that the province-level semi-elasticity of employment and value added to CasMez's investments exhibit remarkably similar patterns. This result confirms that sizeable local manufacturing and total employment gains are accompanied by comparable gains in manufacturing and total value added. However, the impact of the program on labor productivity, measured as the value added per worker, is not statistically significant, with counterbalancing effects on the value added per worker in the manufacturing and services sectors (column 3). Finally, column (4) shows that the program induced an increase in the manufacturing employment share at the expense of the other sectors.

Overall, our province-level analysis shows that local employment gains are explained by cross-province migration flows and that the partial equilibrium effects of CasMez's investments value added per worker and employment rates are negligible. These results suggest that CasMez shifted factor demand from the Center-North and the least targeted areas of the South to the most targeted areas of the South. In response to higher regional productivity, factors of production moved across provinces, arbitraging away differences in real wage rates and returns to capital. Indeed, a negligible partial-equilibrium effect on value added per worker does not exclude a tangible effect on aggregate value added per worker driven by positive effects on both targeted and non-targeted regions. Therefore, to properly assess the aggregate impact of the regional big push, we develop a general equilibrium model that accounts for positive local effects on productivity and employment as well as cross-regional factor reallocation.

4 Model

In this section, we derive closed-form expressions for the impact of a regional development program on regional and aggregate output, welfare, and the regional differentials in output per worker. Importantly, we aim to match three basic facts emerging from our empirical analysis: (i) The regional development program has positive effects on regional employment – almost entirely explained by improved net migration flows – and value added; (ii) These effects persist well after the end of the program; (iii) The program has negligible partial equilibrium effects on employment rates and output per worker.

The model features one sector and two regions of endogenous size. In each region, there are three types of agents (i.e., workers, capital owners, and firms). Workers are homogeneous, supply one unit of labor inelastically to firms, and choose where to live in every period. They have idiosyncratic preferences for

location, derive their utility from consumption, and are hand-to-mouth (i.e., they exhaust their budget in consumption in every period). Capital owners rent capital to the representative firms but do not supply labor. They maximize their lifetime utility by deciding how much to consume and save in each period. Capital owners are assumed to be immobile across regions but can invest in all regions at zero costs. Therefore, capital is fully mobile and the equilibrium cost of capital is common across regions. The model allows for aggregate accumulation of capital, while its cross-regional allocation is determined by the period-by-period evolution of the regional capital demand curves.[20]

Firms in each region produce a homogeneous tradable good across regions with the same technology using labor, capital, and a fixed factor. Productivity depends on a region-specific time-invariant component (e.g., geography, institutions), a time-specific region-invariant component (e.g., aggregate technological progress), regional public capital, and regional employment density (i.e., agglomeration economies). Public funds constituting the development program are exogenously allocated across regions and increase regional productivity with diminishing returns. Agglomeration economies may arise from learning-by-doing (Choi and Levchenko, 2021), demand externalities, technology spillovers, and thick markets (Marshall, 1890). The model does not take a particular stance on the specific source of agglomeration economies. Instead, it postulates a reduced-form relationship between local productivity and employment density to capture them.

This model features two sources of market failure. First, public capital can only be provided by the government and induces increasing returns to scale. Second, spillovers arising from agglomeration economies are not taken into account by firms when making their hiring decision. In this context, a regional development program can increase aggregate efficiency by channeling funds toward regions with higher marginal returns to public capital and agglomeration (Fajgelbaum and Gaubert, 2024). Since these programs typically target regions with low public capital and low output per worker, their *cost-effectiveness* depends on the marginal returns to public capital in these regions, the degree of labor mobility, and the marginal returns to agglomeration in these regions relative to other regions. Notably, if market failures are present in all regions (Kline and Moretti, 2014), these programs' *optimality* additionally depends on the marginal returns to public capital in other regions.[21] As a result, it may be possible to find an alternative allocation of resources that delivers larger welfare gains. In this sense, a cost-effective development program targeting specific regions may be suboptimal.

[20] The model's setting with mobile hand-to-mouth workers and immobile capital owners is appealing because it separates the migration decision from the dynamic consumption/saving decision as in Kleinman et al. (2023).

[21] For instance, the marginal returns to public capital may differ across regions because the elasticity of regional productivity to public capital may differ across regions.

4.1 Production

A region indexed by i produces a homogeneous good, tradable at zero costs across regions, in any period t according to the following technology:

$$y_{it} = z_{it} k_{it}^{\alpha} F_i^{\beta} \ell_{it}^{1-\alpha-\beta} \tag{4}$$

where y_{it} denotes output, z_{it} represents regional productivity, k_{it} is private capital, F_i denotes the fixed factor, and ℓ_{it} denotes labor.

To capture the impact of public investments in infrastructures and firm grants on regional productivity, as well as the persistence of this effect induced by agglomeration economies, we define z_{it} as follows:

$$z_{it} = \bar{z}_i \bar{z}_t G_{it}^{\eta_i} \left(\frac{\ell_{it-1}}{A_i} \right)^{\gamma} \omega_{it} \tag{5}$$

where $\bar{z}_i$ captures region-specific time-invariant factors affecting productivity, $\bar{z}_t$ represents period-specific productivity shocks common across regions, G_{it} denotes the stock of public capital (i.e., infrastructures, grants), $\frac{\ell_{it-1}}{A_i}$ denotes employment density (employment, ℓ_{it}, divided by regional area, A_i), and ω_{it} captures region-specific idiosyncratic productivity shocks. The parameter η_i is region-specific and denotes the elasticity of regional productivity to public capital.[22] Employment density captures agglomeration economies and is assumed to affect productivity with a period lag.[23] The parameter γ denotes the elasticity of productivity to employment density (i.e., the *agglomeration elasticity*).[24]

Combining the labor and capital demand equations derived from profit maximization, we obtain the following expression for the regional labor demand:

$$\ell_{it} = \left(\frac{1-\alpha-\beta}{w_{it}} \right)^{\frac{1-\alpha}{\beta}} \left(\frac{\alpha}{r_t} \right)^{\frac{\alpha}{\beta}} z_{it}^{\frac{1}{\beta}} F_i. \tag{6}$$

where w_{it} denotes the regional wage rate and r_t denotes the cost of capital, common across regions. Intuitively, labor demand is decreasing in the wage rate w_{it} and the cost of capital r_t and increasing in region-specific productivity z_{it} and the fixed factor F_i. Finally, isolating w_{it} on the left-hand side of the

[22] The elasticity of regional productivity to public capital may be heterogeneous for region-specific factors determining the efficiency of public investments (Pritchett, 2000; Dabla-Norris et al., 2012).

[23] This ensures that the model delivers deterministic predictions in every period and prevents regions from achieving extremely different levels of economic activity by chance in any given period (Krugman, 1991).

[24] The regularity condition $\beta > \gamma$ ensures that there is no equilibrium in which all workers are located in one region only. The intuition behind this condition is that higher ℓ_{it} causes output per worker in region i to fall in $t+1$ because labor productivity decreases because of the crowding of the fixed factor more than it increases thanks to agglomeration economies.

equation and substituting Equation (4) on the right-hand side we obtain the following expression for the regional wage rate:

$$w_{it} = (1 - \alpha - \beta)\frac{y_{it}}{\ell_{it}}. \tag{7}$$

This expression shows that the regional wage rate is proportional to the regional output per worker, implying that our empirically estimated cross-sectional effects of investments on output per worker can be equivalently interpreted as effects on wages.

4.2 Labor Supply

Workers' utility in region i is

$$u_{it}^{w} = \ln(c_{it}^{w}) + \varepsilon_{it}, \tag{8}$$

where c_{it}^{w} denotes workers' consumption and ε_{it} is an idiosyncratic preference draw for region i. In this context, real wages are not equalized across locations because workers have heterogeneous preferences for location and not because frictions are present. Since workers are hand-to-mouth, $c_{it}^{w} = w_{it}$, where w_{it} denotes the real wage rate in region i. At the beginning of each period, a worker observes labor demand in all regions, draws ε_{it}, and chooses the location that maximizes u_{it}^{w}. Then, she supplies her unit of labor inelastically, earns w_{it}, and consumes $c_{it}^{w} = w_{it}$.

A worker chooses region i if

$$\varepsilon_{jt} - \varepsilon_{it} \leq \ln(w_{it}) - \ln(w_{jt}). \tag{9}$$

Assuming ε_{it} is i.i.d. following an extreme value Type I distribution, the difference $(\varepsilon_{jt} - \varepsilon_{it})$ is i.i.d following a logistic distribution with parameters $(0,\ \chi)$. Hence, in the absence of dynamic mobility frictions, the utility of the marginal worker is equalized across regions, and the probability that a worker chooses region i is the CDF of $(\varepsilon_{jt} - \varepsilon_{it})$ evaluated at $\ln(w_{it}) - \ln(w_{jt})$:

$$\lambda_{it} = \frac{w_{it}^{\frac{1}{\chi}}}{w_{it}^{\frac{1}{\chi}} + w_{jt}^{\frac{1}{\chi}}}. \tag{10}$$

To account for the sluggish convergence of output per worker across regions (Figure 1a), we further assume that in each period only an exogenous fraction $\theta > 0$ of workers willing to relocate can actually do so. As a consequence, we derive the following law of motion of regional employment:

$$\ell_{it} = (1 - \theta)\ell_{it-1} + \theta\lambda_{it}(\ell_{it-1} + \ell_{jt-1}). \tag{11}$$

The parameter χ in Equation (10) governs the extent to which an increase in relative regional productivity translates into higher relative wages vs. higher relative employment in the long-run. Intuitively, a high (low) χ is associated to a lower (higher) degree of labor mobility and a less (more) elastic long-run regional labor supply elasticity. The parameter θ in Equation (11) governs the short-run regional labor supply elasticity, thus the speed of convergence to the steady state.[25] Finally, the aggregate labor supply takes the following form:

$$\ell_{it} + \ell_{jt} = \ell_t = \ell(\bar{u}_t^w). \tag{12}$$

Since we can empirically quantify the contribution of labor mobility to regional employment gains, we allow the aggregate labor supply to be somewhat elastic and aggregate employment gains to contribute to aggregate output and welfare gains.

4.3 Private Capital

Capital owners are geographically immobile and rent capital to representative firms assumed to depreciate at the constant rate δ. Their intertemporal utility takes the following form:

$$\upsilon_{it}^k = E_t \sum_{s=0}^{\infty} \phi^{t+s} \frac{(c_{it+s}^k)^{1-\psi}}{1-\frac{1}{\psi}}, \tag{13}$$

where c_{it}^k denotes capital owners' consumption, ϕ the discount factor, and ψ the intertemporal elasticity of substitution. The intertemporal budget constraint requires that rental flows from the existing stock of capital equal the sum of capital owners' consumption and the value of investments, net of depreciation, i.e., $r_t k_{it} = c_{it}^k + k_{it+1} - (1-\delta)k_{it}$.[26] Importantly, the term k_{it} denotes the stock of capital in the hands of capital owners located in region i at period t and the cost of capital r_t is not region-specific, as landlords allocate capital to equalize returns across regions. After defining $R_t = r_t + 1 - \delta$, the gross return on capital, the capital owners' problem takes the following form:

$$\max_{c_{it+s}^k, k_{it+s+1}} \frac{(c_{it}^k)^{1-\psi}}{1-\frac{1}{\psi}} + \phi E_t \upsilon(k_{it+1}, t+1) \tag{14}$$

subject to

$$c_{it}^k + k_{it+1} = R_t k_{it}. \tag{15}$$

[25] As θ goes to 1, the short-run regional labor supply elasticity converges to the long-run regional labor supply elasticity.
[26] We are implicitly assuming that the price of one unit of consumption c_{it}^k is the same as one unit of capital k_{it}.

Following Kleinman et al. (2023), we obtain:

$$c_{it}^{k} = \xi_t R_t k_{it} \tag{16}$$

$$k_{it+1} = (1 - \xi_t) R_t k_{it}, \tag{17}$$

where ξ_t is defined recursively as follows:

$$\xi_t^{-1} = 1 + \phi^{\psi} (E_t[R_{t+1}^{\frac{\psi-1}{\psi}} \xi_{t+1}^{-\frac{1}{\psi}}])^{\psi}. \tag{18}$$

This result implies that capital owners have a linear saving rate $(1 - \xi_t)$ out of current period wealth $R_t k_{it}$. In general, capital owners' saving rate $(1 - \xi_t)$ is endogenous, forward-looking, and depends on the expectation of the sequence of future returns on capital R_{t+s}, the discount rate ϕ, and the intertemporal elasticity of substitution ψ. In the particular case of log-utility ($\psi = 1$), capital owners have a constant saving rate ϕ, as in the Solow (1956) and Swan (1956) models.

Since we use steady-state approximations of the model to derive the long-term effects of the regional development program, we derive closed-form expressions for the steady-state saving rate and cost of capital. Combining Equations (17) and (18) with the definition of the gross return on capital R_t, we derive that the steady-state saving rate equals the discount rate (i.e., $1 - \xi = \phi$) and the following expression for the steady-state cost of capital:

$$r = \frac{1 - \phi(1 - \delta)}{\phi}. \tag{19}$$

These derivations imply that the steady-state saving rate $(1 - \xi)$ and cost of capital r are constant and depend solely on the discount rate, ϕ, and the depreciation rate, δ.

4.4 The Impact of a Regional Development Program

In this subsection, we derive closed-form expressions for the impact of a regional development program implemented in region i (dG_i) on aggregate output ($y = y_i + y_j$), welfare ($W = W^k + W^w$), and the regional real wage differential (w_i/w_j). To do so, we use steady-state approximations of our model.[27] The main advantage of using steady-state approximations of the model to evaluate the long-term impact of the program is that they deliver easily interpretable expressions for the effects of interest and allow to

[27] For this reason, we drop the t subscript from the variables in the subsequent paragraphs.

transparently quantify the distinct contributions of the key channels at play.[28]

Impact on Aggregate Output. If the regional development program targets only region i, then its impact on aggregate output $y = y_i + y_j$ can be expressed as follows:

$$\underbrace{\frac{dy}{dG_i}}_{\substack{\text{Aggregate}\\ \text{effect}}} = \underbrace{\frac{\eta_i}{1-\alpha}\frac{y_i}{G_i}}_{\substack{\text{Direct effect}\\ \text{on targeted region}}} + \frac{1}{1-\alpha}\left[\underbrace{(1-\alpha-\beta+\gamma)\frac{d\ell_i}{dG_i}\frac{y_i}{\ell_i}}_{\substack{\text{Crowding-in effect}\\ \text{on targeted region}}} + \underbrace{(1-\alpha-\beta+\gamma)\frac{d\ell_j}{dG_j}\frac{y_j}{\ell_j}}_{\substack{\text{Crowding-out effect}\\ \text{on non-targeted region}}}\right]. \tag{20}$$

This expression decomposes the total impact of a change in G_i on aggregate output y into a first-order direct effect on the targeted region i, a crowding-in effect on the targeted region i, and a crowding-out effect on the non-targeted region j.[29]

The first-order productivity effect is increasing in the parameter $\eta_i/(1-\alpha)$ and the inverse of the regional public capital-to-output ratio, y_i/G_i. The parameter η_i denotes the elasticity of regional productivity to regional public capital, the parameter $(1-\alpha)$ governs the amplification of the impact of public capital on productivity due to regional private capital accumulation, and the inverse of the public capital-to-output ratio captures diminishing returns to public capital. The crowding-in effect is increasing in the regional employment gains induced by the regional development program, $d\ell_i/dG_i$, the baseline regional output per worker, y_i/ℓ_i, and the regional agglomeration elasticity, γ. The regional employment gains, $d\ell_i/dG_i$, capture the number of individuals working in the South as a result of CasMez's investments that would have otherwise moved or not worked.

Finally, the crowding-out effect on the non-targeted region is increasing in the regional employment losses induced by the development program, $d\ell_j/dG_i$, the baseline regional output per worker y_j/ℓ_j, and the regional agglomeration elasticity, γ. The regional employment losses, $d\ell_j/dG_i$, correspond to the number of individuals staying in the South as a result of CasMez's investments that would have otherwise moved to and worked in the Center-North. This expression captures the notion that the cost associated with diverting production from relatively more to relatively less productive regions is increasing in the output elasticities to private capital, α, and employment density, γ.

[28] Using steady-state approximations, the long-run gains from CasMez we obtain are slightly lower than the gains arising in steady state. This happens because our calculations include some net crowding-out effects stemming from the South vs. Center-North difference in output per worker along the transition dynamics that cancels out in steady state.

[29] See Appendix D for the derivation of this expression.

Impact on Aggregate Welfare. To quantify the welfare effects of the regional development program we face two challenges. First, we need to ensure that the factors' shares of income sum up to 1 in the presence of a fixed factor of production, F_i, which does not receive any income, and increasing returns to scale, which induce the sum of output elasticities with respect to each production factor to exceed 1. To do that, we assume that the capital share of income equals α and the labor share of income equals $(1-\alpha)$, that is, labor absorbs all the income generated through the fixed factor and agglomeration economies.[30] Second, we need to express welfare effects in dollar values. To do that, we adopt the Equivalent Variation (EV) approach and compute the dollar amount needed for capital owners and workers in the initial steady state to be indifferent between the new steady state and the initial steady state. For simplicity, we assume $\psi = 1$, so that utility of both workers and capital owners is logarithmic in consumption.[31]

For capital owners, the EV is equivalent to the increase in consumption between the new and the initial steady state. Since the steady-state saving rate is $1 - \xi = \phi$, capital owners' consumption gains stemming from the regional development program can be expressed as

$$\frac{dW^k}{dG_i} = \alpha(1-\phi)\frac{dy}{dG_i}, \tag{21}$$

where α denotes the capital share of income, $(1-\phi)$ is the share of capital income consumed, and $\frac{dy}{dG_i}$ is the change in aggregate output induced by the regional development program.

For workers, the EV is equivalent to the increase in consumption between the new and the initial steady state plus the dollar value stemming from not leaving their preferred region. In other words, the aggregate output cost derived from the difference between the crowding-in and the crowding-out effects in Equation (20) does not translate into a direct welfare cost for workers. This happens because the welfare gains they would have enjoyed thanks to higher real wages and consumption if they moved to the Center-North equal the welfare losses they would have suffered in leaving the South.[32] Workers' welfare gains induced by the regional development program can therefore be expressed as follows:

$$\frac{dW^w}{dG_i} = (1-\alpha)\left[\frac{dy}{dG_j} - \frac{1-\alpha-\beta+\gamma}{1-\alpha}\left(\frac{d\ell_i}{dG_i}\frac{y_i}{\ell_i} + \frac{d\ell_j}{dG_i}\frac{y_j}{\ell_j}\right)\right]. \tag{22}$$

[30] Alternatively, we could assume that income generated through the fixed factor and agglomeration economies is equally shared between capital and labor. The quantitative implications of changing this assumptions are negligible.

[31] Note that in the case of logarithmic utility the EV approach delivers the same results of the compensating variation (CV) approach, which consists in computing the dollar amount needed to be taken away from capital owners and workers in the new steady state to make them indifferent between the initial steady state and the new steady state.

[32] For simplicity, we assume that the utility gains from not leaving the South are constant across workers. This partially underestimates the actual welfare gains accruing to workers not leaving the South.

Finally, we can express the impact of the regional development program on aggregate welfare as the sum of Equations (21) and (22). Notably, the discrepancy between welfare and output gains induced by the program depends on the size of net crowding-out effects on output, which measures the workers' willingness to pay to avoid migration, and the size of the parameter ϕ, which governs the extent to which capital income gains translate into consumption gains. Intuitively, the former makes welfare gains larger relative to output gains, while the latter makes welfare gains smaller relative to output gains. The latter component typically dominates the former, making welfare gains smaller than output gains.

Impact on Real Wage Differentials. Combining the equations for the relative regional labor demand (Equation 6) and the relative regional labor supply (Equation 10) evaluated at the steady state, we obtain the following expression for the relative real wages:

$$\frac{w_j}{w_i} = \left(\frac{z_j}{z_i}\right)^{\frac{\chi}{\beta+(1-\alpha)\chi}} \left(\frac{F_j}{F_i}\right)^{\frac{\beta\chi}{\beta+(1-\alpha)\chi}}. \tag{23}$$

Intuitively, relative real wages are increasing in relative productivities and fixed factor endowments. The elasticity of relative real wages to relative productivity is decreasing in β and α and increasing in χ. The more elastic the relative regional labor supply, the less responsive real wage differentials are to productivity differentials. As a consequence, a development program that increases productivity in region i will be more effective in compressing real wage differentials if the regional labor supply is very inelastic, that is, if labor mobility is very low.

Analytically, we can derive the following expression for the impact of cumulative investments in region i on (w_j/w_i):[33]

$$\frac{d\left(\frac{w_j}{w_i}\right)}{dG_i} = -\frac{\chi}{\beta-\gamma+(1-\alpha)\chi}\frac{\eta_i}{G_i}\frac{w_j}{w_i}. \tag{24}$$

The effectiveness of public investments in reducing steady-state real wage differentials increases in the semi-elasticity of regional productivity to cumulative investments, $\frac{\eta_i}{G_i}$, the inverse elasticity of relative regional labor supply, χ, and the regional agglomeration elasticity, γ.

[33] This procedure requires substituting the relative labor supply equation into the expression for the derivative of $\ln\left(\frac{w_j}{w_i}\right)$ with respect to $\ln(G_i)$.

5 The Aggregate Effects of the Regional Big Push

5.1 Recovering the Structural Parameters

According to Equations (20) and (24), the structural parameters needed to make inference on the impact of the regional development program on output, welfare, and regional disparities are $\frac{\eta_i}{G_i}$, α, β, γ, ϕ, and χ. We start by calibrating the capital share of income $\alpha = 0.3$ (Griliches, 1967), and the regional labor demand elasticity $\frac{1-\alpha}{\beta} = 1.5$ (Kline and Moretti, 2014). These values imply that $\beta = 0.47$. Italy's gross fixed capital formation as a share of GDP in the 1970-2011 period is approximately 0.23. We recover ϕ by dividing the gross fixed capital formation share of GDP by the capital share of income $\alpha = 0.3$, obtaining $\phi = \frac{0.23}{0.3} = 0.77$. Since a time period in our model corresponds to a decade, $\phi = 0.77$ implies an annual discount factor of approximately 0.97.

In Appendix E, we discuss in detail how we estimate $\frac{\gamma}{\beta}$. In practice, we log-linearize both sides of Equation (6) and estimate the impact of one-decade lagged employment density on current employment and output. To do so, we instrument one-decade lagged employment density with two-decade lagged employment density, and control for cumulative CasMez investments, log value added per worker, and the same set of baseline characteristics interacted with time trends used in Equation (3). The implied estimate of the agglomeration elasticity is $\gamma = 0.31$.[34]

The long-run semi-elasticity of regional productivity to cumulative investments, η_i/G_i, can be recovered from the expression of the long-run semi-elasticity of regional employment to cumulative investments:

$$\frac{d\ell_i}{\ell_i}\frac{1}{dG_i} = \frac{\eta_i}{G_i}\frac{1}{\beta-\gamma} - \frac{1-\alpha}{\beta-\gamma}\frac{dw_i}{w_i}\frac{1}{dG_i}. \tag{25}$$

Table 2 reports our estimate for the semi-elasticity of regional employment to cumulative investments, $\frac{d\ell_i}{\ell_i}\frac{1}{dG_i} = 0.023$. The semi-elasticity of regional value added per worker and wage rate to cumulative investments (Table 4, column 3) is small and not statistically significant, suggesting that the wage rate did not increase in targeted areas more than in non-targeted areas. However, the calibration of $(1-\alpha)/\beta = 1.5$ and the estimates of the contributions of net migration flows to regional employment gains imply that the wage rate increased in both targeted areas and non-targeted areas, with a semi-elasticity to cumulative investments $\frac{dw_i}{w_i}\frac{1}{dG_i} = 0.001$. Combining these two results with the estimate of

[34] In Appendix E we estimate γ separately for the South and the Center-North obtaining negligible differences in our estimates across the two macroregions. Kline and Moretti (2014) estimate agglomeration elasticities for US counties in the neighborhood of 0.2.

$\gamma = 0.31$ and the calibration of $\alpha = 0.3$ and $\beta = 0.47$, we obtain $\eta_S/G_S = 0.0046$.[35]

Finally, by combining Equations (7) and (10), we derive that the inverse regional labor supply elasticity χ, which equals the ratio between the semi-elasticity of relative regional output per worker and the semi-elasticity of relative regional employment to cumulative investments. Since the estimate of the semi-elasticity of output per worker to cumulative investments is small and not statistically significant (Table 4, column 3), we calibrate $\chi = 0$. This implies that our benchmark calibration, informed by our empirical estimates, provides perfect labor mobility in the long run. Table 5 lists the values of these parameters used in our model calibration.

5.2 Cost-Benefit Analysis

To evaluate the program's cost-effectiveness, we compute the benefit-to-cost ratio (BCR), as in Heckman et al. (2010). In doing so, we take into account the deadweight cost of taxation incurred into by the government to finance the development program, denoted by μ. For instance, if €1 spent in the regional development program is raised through an increase in taxes that induces a decrease in aggregate output of μ, we will need to multiply the costs of the program by a factor equal to $(1+\mu)$. Appendix F discusses an alternative cost-benefit analysis based on the concept of Marginal Value of Public Funds (MVPF), introduced by Hendren and Sprung-Keyser (2020), with substantively similar results.

Denote by ΔW and C the present discounted value of the aggregate welfare benefits and costs of the program, respectively. Specifically,

$$\Delta W = \sum_{t=1950}^{2011} \frac{1}{(1+\rho)^{(t-1950)}} \frac{dW_t}{dG_{it}} \quad \text{and} \quad C = \sum_{t=1950}^{2011} \frac{1}{(1+\rho)^{(t-1950)}} G_{it}, \tag{26}$$

where the t subscript indicates a year and ρ denotes the real annual discount rate. Furthermore, let τ denote the effective tax rate prevailing in the economy. Then, the BCR is defined as follows:

$$\text{BCR} = \frac{(1-\tau)\Delta W + (1+\mu)\tau\Delta W}{(1+\mu)C}. \tag{27}$$

Intuitively, the BCR is the ratio between the welfare gains induced by the program, with the portion of welfare gains accruing to the government through a larger tax base and the costs of the program augmented by the deadweight cost of taxation parameter.

[35] From now on, the subscript S denotes the South, the region targeted by CasMez. The subscript N denotes the Center-North, the region not targeted by CasMez.

Finally, we compute alternative BCRs and MVPFs measures using output gains, as opposed to welfare gains. This allows us to further distinguish between partial equilibrium (PE) and general equilibrium (GE) cost-benefit analyses.[36] The PE analysis establishes cost-effectiveness as-if we were focusing only on the target region, the South, summing up the direct productivity effects and the crowding-in effects. The GE analysis instead also accounts for crowding-out effects on the rest of the country (i.e., direct productivity effects plus crowding-in effects minus crowding-out effects).

5.3 Regional and Aggregate Effects

Table 6, Panel 1, summarizes the results of our model-based analysis. In 2011, productivity in the South was 8.5% higher than what it would have been without CasMez's investments. 5% of this increase is explained by the direct impact of investments on regional TFP, while the remaining is explained by agglomeration economies. Higher productivity attracted capital and labor, ultimately resulting in an increase in 2011 value added of 16.9% relative to the counterfactual (i.e., €332 billion vs. €284 billion). However, we also quantify sizeable crowding-out effects. In 2011, productivity and value added in the Center-North were 1.1% and 2.7% lower than in the counterfactual (i.e., €998 billion vs. €1,025 billion), respectively. Summing the direct effects on the South and the crowding-out effects on the Center-North, we conclude that Italian GDP in 2011 was 1.6% higher than in the counterfactual (€1,330 billion vs. €1,310 billion). Notice that most of this increase is explained by the direct productivity effect of CasMez (+1.7%), while crowding-in and crowding-out effects tend to offset each other (-0.1%).

Our cost-benefit analysis reveals that the present discounted value of the welfare gains induced by CasMez investments was higher than the present discounted value of its costs, implying that the program was cost-effective. Under the assumptions of a real annual discount rate of $\rho = 0.03$,[37] $\tau = 0.3$, and a deadweight cost of taxation parameter of $\mu = 0.5$ (Heckman et al., 2010), we compute a BCR of 1.32.[38] Table 6 also displays the same analysis carried out using output – as opposed to welfare – gains, documenting that crowding-out effects reduce the BCR from 3.20 to 1.46. This implies that accounting for crowding-out effects from labor reallocation reduces the estimated output gains induced by CasMez's investments by more than 50%.

[36] Capital owners are immobile and can invest in any region at zero costs. Therefore, the model features a discrepancy between regional value added (which is observed) and regional income (which is not observed). Since we have data on local value added but not on local income, we can measure PE/GE effects on value added but only GE effects on welfare.

[37] $\rho = 0.03$ is the real annual discount rate consistent with an annual discount factor of 0.97 and our calibration of the 10-year discount factor $\phi = 0.77$.

[38] Figure 8 shows the sensitivity of the cost-benefit analysis to these assumptions by providing a heat map of the BCR and MVPF obtained from combining real annual discount rates in the 0-0.1 range and deadweight cost of taxation parameters in the 0.2-0.8 range.

Finally, an important result of our empirical analysis is that the regional development program had a negligible impact on regional wage differentials. A null long-run effect on relative output per worker implies that labor mobility is high and the program increases output per worker and wages in all regions, as opposed to increasing them in the targeted region relative to the non-targeted region. Consistently with this intuition, we find that CasMez did not contribute to the convergence in output per worker observed between 1951 and 2011. Taken together, these results indicate that the productivity gains brought by the regional development program increased the *relative size* of the Southern economy rather than boosting *relative wages* in the South. As a result, the South vs. Center-North convergence in output per worker observed between 1951 and 2011 is a product of high labor mobility from the South to the Center-North and diminishing returns to labor rather than of the program itself.

5.4 Two Counterfactual Exercises

Place-neutral Program. The goal of this counterfactual exercise is to illustrate the distinction between *cost-effectiveness* and *optimality* of CasMez. To do so, we simulate the impact of a program of the same size as CasMez without any regional target (i.e., a *place-neutral* program) and show that the implied long-run effects on aggregate output and welfare would have been larger. Performing this exercise requires an assumption regarding the direct impact of public funds on the productivity of the Center-North (i.e., η_N/G_N).

Decreasing returns of regional productivity to public capital imply that an additional Euro spent in the Center-North, if already endowed with a stock of functioning public capital, should increase regional productivity less than in the South. However, the elasticity of regional productivity to public capital, η_i, could depend on region-specific factors. We assume $\eta_S/G_S = 2 \times \eta_N/G_N$.[39] This assumption is extremely cautious in light of recent empirical evidence from Cingano et al. (2022). They estimate the cost per new job in the Center-North vs. South induced by a firm subsidy program (Law 488/92) implemented after CasMez, finding that it is 74% higher in the South. Through the lenses of our model, this would imply that $\eta_S/G_S = 0.67 \times \eta_N/G_N$.[40]

Table 6, Panel 2, indicates the BCR of such a program would have been 1.41. Comparing it with the corresponding 1.32 estimated for CasMez, we conclude that channeling the same amount of resources

[39] We do not measure the public capital stock in the Center-North and the South. If $\eta_S = \eta_N$, our assumption implies that the per-capita stock of public capital in the Center-North was twice the one in the South (i.e., $G_N = 2 \times G_S$) for the whole 1951-2011 period.

[40] Table A.4 displays results from alternative cost-benefit analyses of the place-neutral development program under different assumptions for the relative (South vs. Center-North) semi-elasticity of productivity to public capital.

uniformly across regions would have resulted in larger aggregate welfare gains, even under conservative assumptions. This happens because, although subsidizing the marginal job is more expensive in the Center-North than in the South, value added per worker is also higher in the Center-North. The welfare gains associated with locating production in regions with a higher output per worker may be null for workers, who trade off their location preferences for higher wages and consumption, but are not negligible for capital owners, who enjoy higher income and higher consumption. These results emphasize that regional development programs can be cost-effective but their place-targeting feature is unlikely to be optimal.

Immobile Labor. In our main analysis, we focus on the importance of accounting for crowding-out effects induced by factor mobility in assessing the cost-effectiveness of regional development programs. The goal of this counterfactual exercise is to replicate the assessment in a context of no labor mobility, in which crowding-out effects due to labor reallocation are muted. This is particularly important in light of a recent literature documenting scarce labor mobility in both developing and developed countries characterized by large regional productivity differentials (Heise and Porzio, 2022; Lagakos et al., 2023).

The main challenge we face in performing this counterfactual exercise lies in the appropriate labor supply elasticity to use in the model parametrization. Intuitively, with no labor mobility, the regional labor supply elasticity solely depends on the labor supply elasticity of non-employed individuals. On the one hand, if the labor supply elasticity of non-employed individuals is smaller than the one of employed individuals, a regional development program with the same direct productivity effects of CasMez translates more into relative real wage gains than relative employment gains. This in turn reduces gains in steady-state productivity induced by agglomeration economies. On the other hand, the absence of labor mobility neutralizes the negative contribution of crowding-out effects. For our exercise, we assume a labor supply elasticity of non-employed individuals of 0.5, which corresponds to the *aggregate* labor supply elasticity implied by our benchmark calibration with perfect mobility.

Table 6, Panel 3, reveals that the aggregate welfare gains in the absence of labor mobility would be larger than those in our benchmark calibration. Specifically, the BCR would be 1.61 (vs. 1.32) and the MVPF would be 5.30 (vs. 1.88). Given the lower elasticity of labor supply, the effectiveness of the program in reducing the regional real output per worker differentials would be more pronounced. Our calibration suggests that, without labor mobility, the ratio between output per worker in the Center-North vs. the South would be 8.7% lower in 2011. These results highlight that, *ceteris paribus*, the degree of labor mobility plays a key role in determining the welfare gains induced by regional development programs and

their efficacy in reducing regional per-capita income differentials.

6 Conclusion

Regional disparities in many countries often motivate large-scale regional development programs to foster economic activity in distressed areas. However, the aggregate effects of these policies are *ex ante* ambiguous. Their desirability depends on their costs, the presence of long-term self-sustained productivity gains induced by public investments, and the size of crowding-out effects affecting the more productive areas of the country.

In this paper, we quantify the regional and aggregate long-term effects of one of the largest regional development programs in history, which devoted around $450 billion (2010 USD) between 1950 and 1992 to fostering the industrialization of the Italian South. To do so, we combine reduced-form evidence consistent across two distinct identification strategies with a model-based analysis to account for cross-regional crowding out effects induced by factor mobility. We find that the program substantially boosted economic activity in the South, particularly so in the targeted manufacturing sector. These gains persisted up to 20 years after the end of the program.

At the same time, the program diverted production from the highly productive Center-North, thus limiting the ongoing mass migratory waves from the South. In the context of our model, distorting the spatial allocation of public capital and labor toward less productive regions induces crowding-out effects. Calibration exercises matching our reduced-form estimates reveal that these effects were sizeable and reduced the aggregate output and welfare gains induced by the program by more than 50%. Nevertheless, our cost-benefit analysis documents that these gains are 32% larger than the program's costs.

In conclusion, we document that regional big push programs can promote structural change in distressed regions, considerably increase the relative size of their economies, and be cost-effective in the long run. In contexts characterized by high factor mobility and large regional productivity differentials, general equilibrium effects substantially mitigate the benefits of these programs on aggregate output, welfare, and per-capita income differentials across regions. In contexts of low labor mobility, these programs are more effective in achieving their objectives and may even pay for themselves. Importantly, cost-effectiveness does not imply optimality. A counterfactual exercise reveals that if the same amount of resources was invested equally across regions, the impact of the program on aggregate welfare would have been larger.

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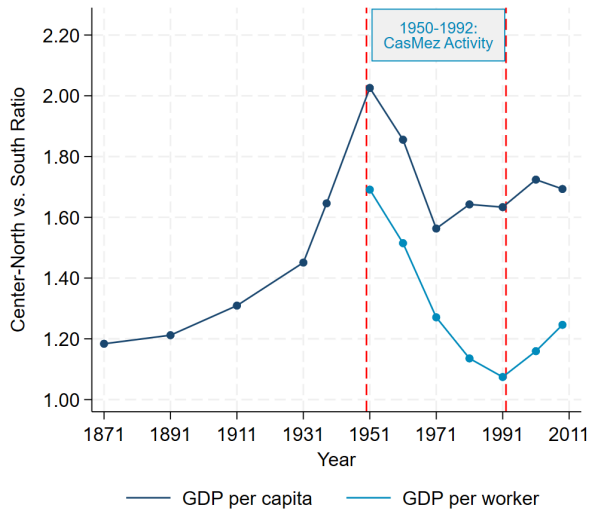
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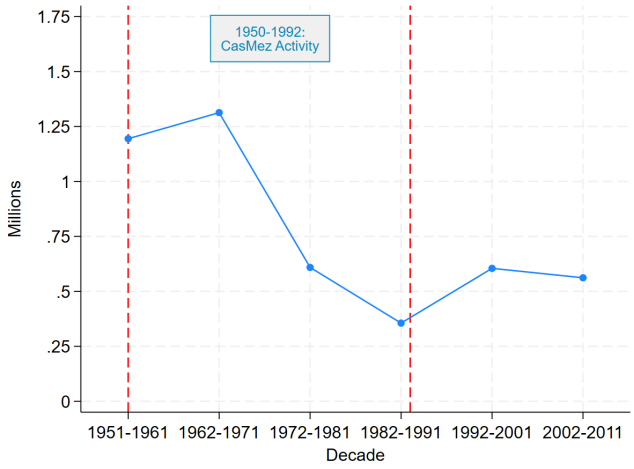
Main Figures

Figure 1: Regional Differentials and Migration Flows over Time

(a) Center-North vs. South Productivity Divide



(b) South → Center-North Net Migration Flows



Notes. Figure 1a shows the time series of the Center-North vs. South per-capita GDP ratio for the 1871-2011 period. The light blue line displays the Center-North vs. South per-worker GDP ratio for the 1951-2011 period. For both series, a ratio of 1 implies no gap. Data source: Vecchi et al. (2011). Figure 1b shows South to Center-North net migration flows, by decade. Net migration flows are computed as the difference between the number of individuals moving from the South to the Center-North and the number of individuals moving from the Center-North to the South. The number computed for the 1951-1961 period is obtained by extrapolating to the 1951-1954 period the average annual net migration flows computed for the period 1955-1961, for which the data are available. Province-to-province data on migration flows come from an updated version of Bonifazi and Heins (2000).

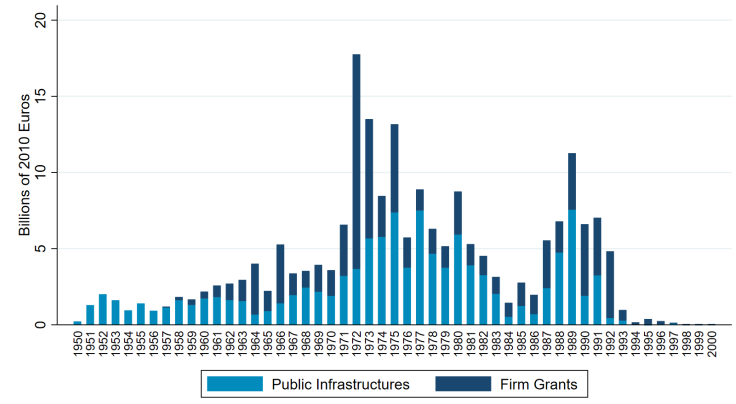
Figure 2: CasMez's Jurisdiction



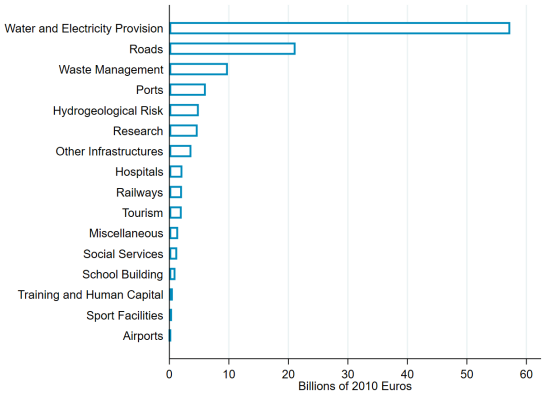
Notes. The figure shows a map of Italy divided into municipal territories. The dark blue areas denote municipalities belonging to CasMez's jurisdiction. CasMez's jurisdiction includes the regions of Abruzzo, Molise, Campania, Apulia, Basilicata, Calabria, Sicily, and Sardinia, the provinces of Latina and Frosinone and parts of the provinces of Rieti and Roma in Lazio, parts of the provinces of Ascoli Piceno in Marche, and the municipalities belonging to the Elba, Giglio, and Capraia Islands in Tuscany.

Figure 3: CasMez's Activity

(a) Time Series of CasMez's Investments, by type



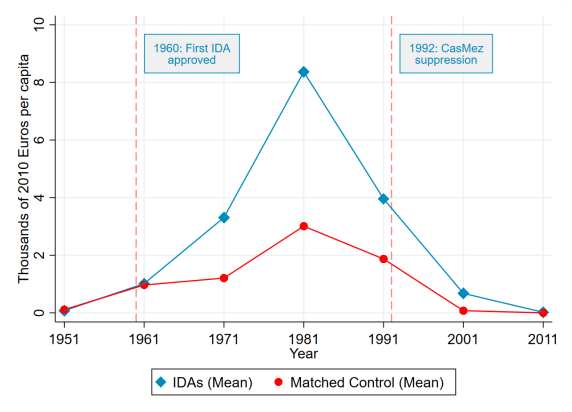
(b) Public Infrastructures Investments, by type



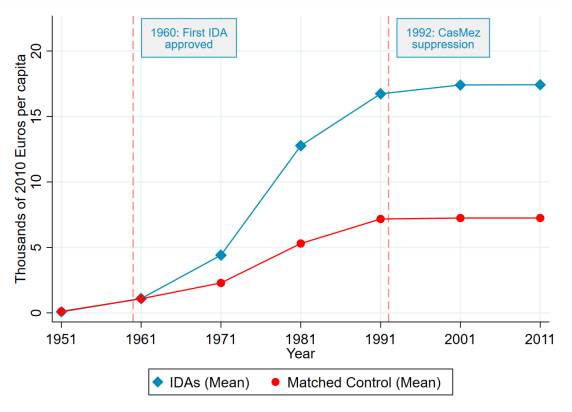
Notes. Figure 3a shows the time series of CasMez's investments, decomposed between "Public Infrastructures" and "Firm Grants/Loans". For each year, the bar indicates the billions of 2010 Euros spent by CasMez. The dark blue portion of the bar measures financial incentives to firms, while the light blue portion of the bar measures investments in public infrastructures. Data on CasMez's investments come from the *Archivi dello Sviluppo Economico Territoriale* (ASET). Website: https://aset.acs.beniculturali.it/aset-web/. Figure 3b shows how CasMez's spending in "Public Infrastructures" is allocated across different types of projects over the whole 1950-1992 period. Each light blue bar indicates the billions of 2010 Euros approved by CasMez for each public infrastructure category. Data on CasMez's investments come from the *Archivi dello Sviluppo Economico Territoriale* (ASET). Website: https://aset.acs.beniculturali.it/aset-web/.

Figure 4: IDAs vs. Non-IDAs - First Stage

(a) Decade-Specific Investments



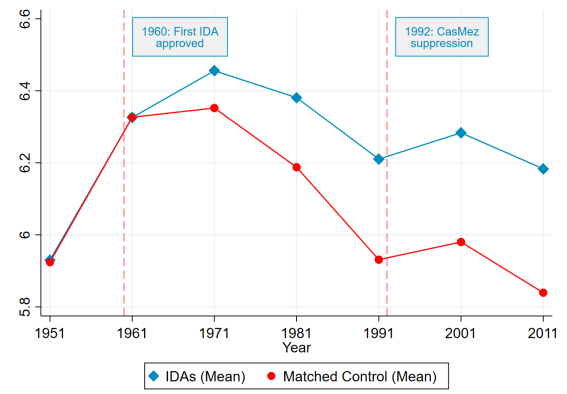
(b) Cumulative Investments



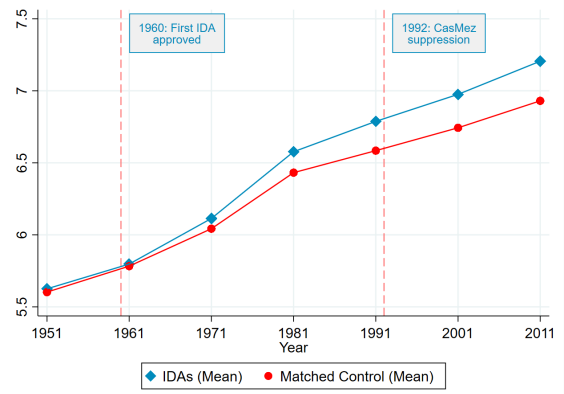
Notes. The figure plots the treatment vs. control group means of the first-stage outcome variables in Equation (1). Recall that the unit of observation is a municipality and this dynamic difference-in-differences design compares each municipality belonging to IDAs with one municipality not belonging to IDAs, matched on 1951 characteristics and 1951-1961 trends. See Table A.3 for the list of the variables used to perform the matching and the balance table between treated and control municipalities. The outcome variable in Panel (a) is decade-specific per-capita investments, while the outcome variable in Panel (b) is cumulative per-capita investments. Investments comprise public infrastructure spending and firm grants and they are converted in per-capita terms by dividing for 1961 municipal population. See Appendix B for graphs with the estimated $\hat{\beta}_k$ first-stage coefficients and standard errors.

Figure 5: IDAs vs. Non-IDAs - Reduced Form

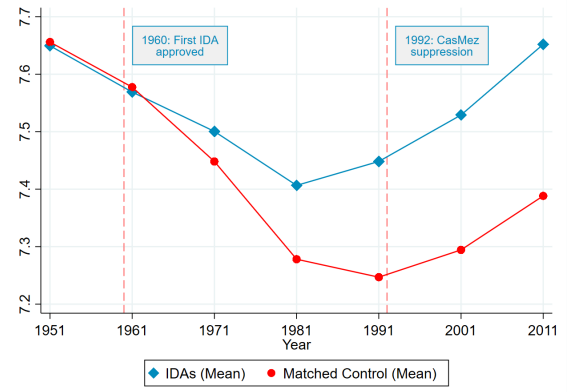
(a) Log Manufacturing Employment



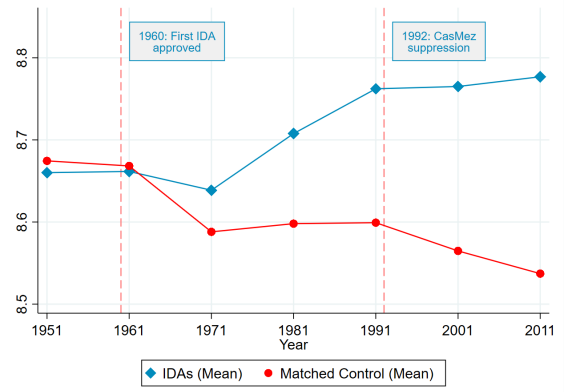
(b) Log Services Employment



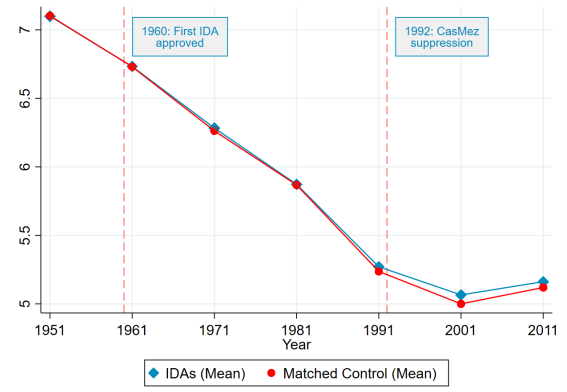
(c) Log Employment



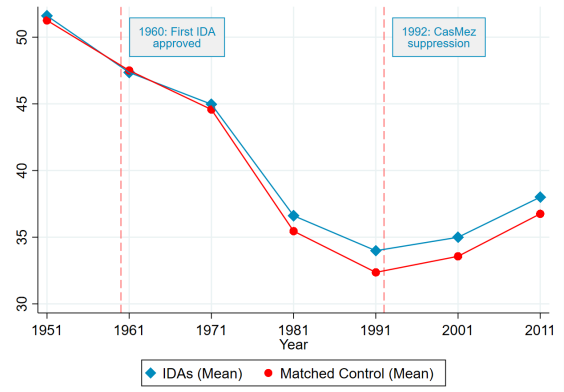
(d) Log Population



(e) Log Agriculture Employment



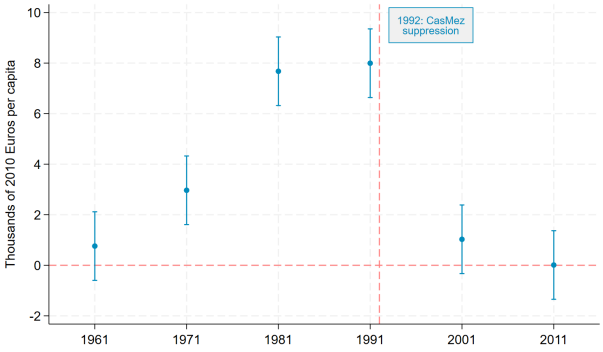
(f) Employment Rate



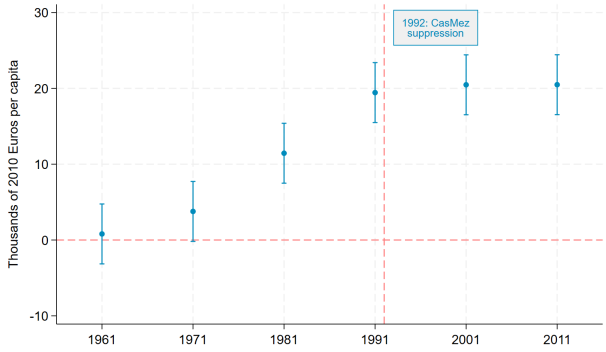
Notes. The figure plots the treatment vs. control group means of six reduced-form outcome variables in Equation (1). Panel (a): log manufacturing employment; Panel (b): log services employment; Panel (c): log total employment; Panel (d): log population; Panel (e): log agriculture employment; Panel (f): employment rate. The unit of observation is a municipality and this dynamic difference-in-differences design compares each municipality belonging to an IDA with one municipality not belonging to an IDA, matched on 1951 characteristics and 1951-1961 trends. See Table A.3 for the list of the variables used to perform the matching and the balance table between treated and control municipalities. See Appendix B for graphs with the estimated $\hat{\beta}_k$ reduced-form coefficients and standard errors clustered at the municipality level.

Figure 6: Dynamic Long Difference-in-Discontinuities - First Stage

(a) Decade-Specific Investments



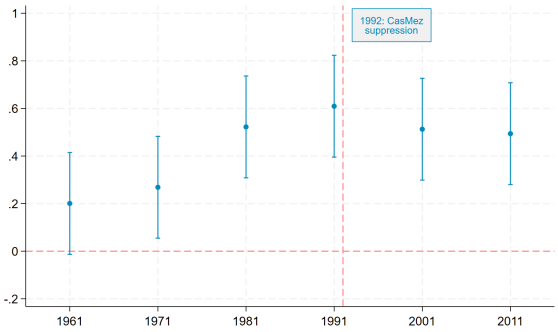
(b) Cumulative Investments



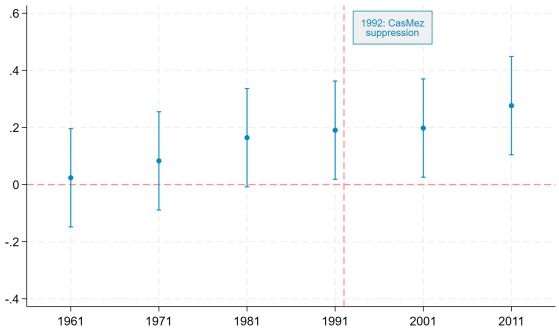
Notes. The figure shows the coefficients $\hat{\beta}_k$ estimated from Equation (2) and 95% cluster-robust confidence intervals. Recall that the unit of observation is a municipality, and this dynamic long difference-in-discontinuities design compares municipalities just South vs. North of CasMez's jurisdiction border. The outcome variable in Panel (a) is decade-specific investments per capita, while in Panel (b) is cumulative investments per capita. Measures of investments per capita comprise public infrastructures and firm grants divided by the 1961 municipal population.

Figure 7: Dynamic Long Difference-in-Discontinuities - Reduced Form

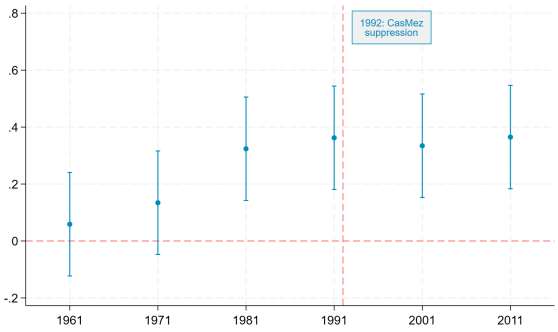
(a) Log Manufacturing Employment



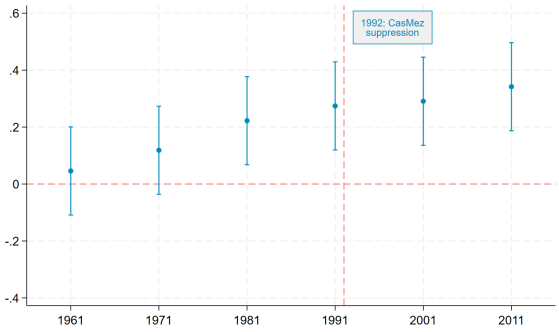
(b) Log Services Employment



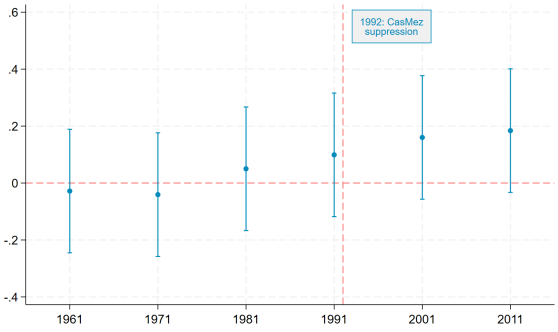
(c) Log Total Employment



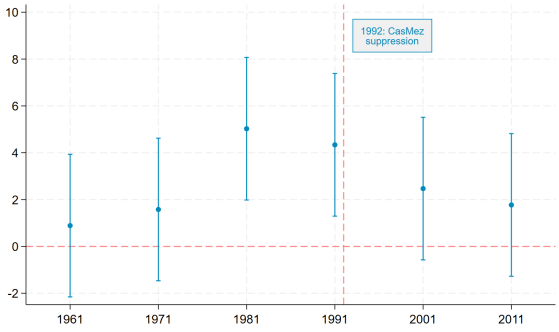
(d) Log Population



(e) Log Agriculture Employment

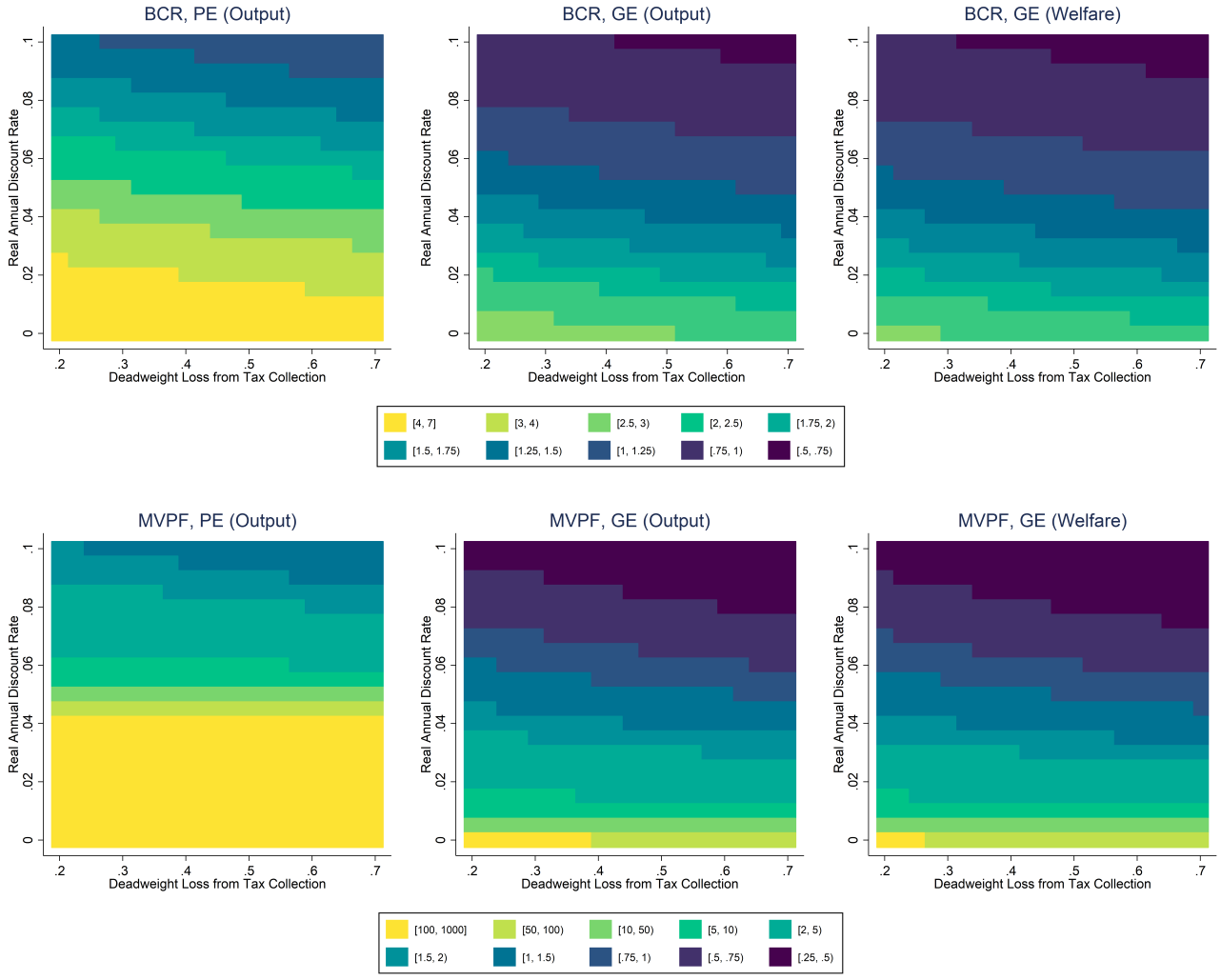


(f) Employment Rate



Notes. The figure shows the coefficients $\hat{\beta}_k$ estimated from Equation (2) and 95% cluster-robust confidence intervals. Recall that the unit of observation is a municipality, and this dynamic long difference-in-discontinuities design compares municipalities just South vs. North of CasMez's jurisdiction border. Results are reported for six different outcome variables. Panel (a): log manufacturing employment; Panel (b): log services employment; Panel (c): log total employment; Panel (d): log population; Panel (e): log agriculture employment; Panel (f): employment rate.

Figure 8: Sensitivity of CasMez Cost-Benefit Measures to Real Annual Discount Factor and Deadweight Cost of Taxation (μ)



Notes. The figure shows the results of our cost-benefit analysis under different assumptions for the real annual discount rate (0-0.1 range) and the deadweight cost of taxation (0.2-0.7 range). The upper panel reports the Benefit-to-Costs Ratio (Equation 27) using output gains in the South only (PE, output), output gains in the whole country (GE, output), and welfare gains in the whole country (GE, welfare). The lower panel reports the Marginal Value of Public Funds (Section F in the Appendix) using output gains in the South only (PE, output), output gains in the whole country (GE, output), and welfare gains in the whole country (GE, welfare). Values of MVPF that go to infinity are capped at 1000, so that the highest bin for MVPF contains infinite MVPF. The brighter the color of one bin in the heatmap, the larger the BCR/MVPF associated with that pair of discount rate and deadweight cost parameter.

Main Tables

Table 1: Effect of €1,000 Cumulative Investments Per Capita (Municipality)

Outcome Variables	(1) IDA vs. non-IDA: 1-to-1 Match	(2) South vs. North: Long Diff-in-Disc
Log MFG Employment	.031***	.033***
	(.008)	(.001)
Log Services Employment	.021***	.012**
	(.006)	(.006)
Log Agr. Employment	.004	.005
	(.005)	(.008)
Log Total Employment	.023***	.020**
	(.007)	(.007)
Log Population	.021***	.016**
	(.006)	(.006)
Employment Rate	.135	.020*
	(.093)	(.105)
Observations	12,194	4,662
Municipalities	1,414	777
First Stage F-Stat	55.90	12.76

Notes. The table displays two-stage least squares (2SLS) coefficients obtained from regressions with different variables as outcomes and cumulative per-capita CasMez's investments as the main regressor. In all columns, an observation is a municipality-year. The first-stage and reduced-form regressions correspond to the static versions of the dynamic specifications described by Equation (1) for column (1) and Equation (2) for column (2), respectively. Each column reports the semi-elasticity of the municipality-level outcome variables to €1,000 (2010 Euro) additional CasMez's investments per capita. The table reports the number of observations, the number of unique units of observations, and the Kleibergen-Paap F-statistic for weak identification, for the two specifications. See Table A.3 for a complete list of variables used to match treatment and control municipalities in column (1). Standard errors in parentheses are clustered at the municipality level. * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$).

Table 2: Effect of €1,000 Cumulative Investments Per Capita (Municipality vs. Province)

Outcome Variables	(1) Municipality-Level: IDA vs. non-IDA	(2) Municipality-Level: South vs. North	(3) Province-Level
Log MFG Employment	.031***	.033***	.039**
	(.008)	(.010)	(.012)
Log Employment Services	.021***	.012**	.014*
	(.006)	(.006)	(.008)
Log Agr. Employment	.004	.005	.007
	(.005)	(.008)	(.015)
Log Total Employment	.023***	.020**	.023***
	(.007)	(.007)	(.009)
Log Population	.021***	.016**	.018**
	(.006)	(.006)	(.007)
Employment Rate	.135	.020*	.025
	(.093)	(.105)	(.202)
Observations	12,194	4,662	637
Units	1,414	777	91
First Stage Coeff.	7.90***	13.15***	4.72***
First Stage F-Stat	55.90	12.76	38.36

Notes. The table displays two-stage least squares (2SLS) coefficients obtained from regressions with different variables as outcomes and cumulative per-capita CasMez's investments as the main regressor. In columns (1) and (2), an observation is a municipality-year, while in column (3) an observation is a province-year. The first-stage and reduced-form regressions correspond to the static versions of the dynamic specifications described by Equation (1) for column (1), Equation (2) for column (2), and Equation (3) for column (3), respectively. The table reports the semi-elasticity of the municipality-level (columns 1 and 2) and province-level (column 3) outcome variables to €1,000 (2010 Euro) additional CasMez's investments per capita. The table reports the number of observations, the number of unique units of observations, the first-stage regression coefficient, and the Kleibergen-Paap F-statistic for weak identification. Controls in column (3) include unit fixed effects, region-specific trends, and the interaction of baseline unit-level characteristics (i.e., the manufacturing and agriculture shares of employment, the share of illiterate population, and log value added per worker) with time dummies. Standard errors in parentheses in columns (1) and (2) are clustered at the municipality level. * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$).

Table 3: Effect of €1,000 Investments Per Capita - 2SLS Estimates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Log Employment	Higher Net Domestic Inflows	Higher Net Inflows from	Higher Inflows From	Lower Outflows to	Higher Net Inflows From	Higher Inflows From	Lower Outflows to
			Center-North	Center-North	Center-North	South	South	South
Investments	.0233***	.0215**	.0104*	-.0065	.0168**	.0112**	.0088*	.0024
Per Capita	(.009)	(.010)	(.0063)	(.0052)	(.0085)	(.0053)	(.0051)	(.0055)
Observations	637	637	637	637	637	637	637	637
Units	91	91	91	91	91	91	91	91
First Stage Coeff.	4.72***	4.72***	4.72***	4.72***	4.72***	4.72***	4.72***	4.72***
First Stage F-Stat	38.36	38.36	38.36	38.36	38.36	38.36	38.36	38.36

Notes. The table displays two-stage least squares (2SLS) coefficients obtained from 8 regressions with different variables as outcomes and cumulative per-capita CasMez's investments as the main regressor. An observation is a province-year. Cumulative per-capita investments are instrumented by an interaction of a dummy taking value 1 if an IDA is present in the province and a dummy for the post-1961 periods. The first-stage and reduced-form regressions are described by Equation (3). Column (1) reports the semi-elasticity of the province-level employment to €1,000 (2010 Euro) additional CasMez's investments per capita. Column (2) captures the percent employment gains due to higher net domestic inflows. Columns (3) and (6) decompose the effect estimated in column (2). Columns (4) and (5) further decompose the effect estimated in column (3). Columns (7) and (8) further decompose the effect estimated in column (6). The table reports the number of observations, the number of unique provinces, and the Kleibergen-Paap F-statistic for weak identification. Controls include province fixed effects and region-specific trends, and the interaction of baseline province-level characteristics (i.e., the manufacturing and agriculture share of employment, the share of illiterate population, and log value added per worker) with time dummies. * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$).

Table 4: Effect of €1,000 Investments Per Capita - 2SLS Estimates

	(1) Log Emp.	(2) Log VA	(3) Log VA/Emp.	(4) Emp. Sh.
Manufacturing	.039***	.052***	.014	.005**
	(.012)	(.016)	(.012)	(.002)
Services	.014*	.000	-.013**	-.003*
	(.008)	(.008)	(.006)	(.002)
Agriculture	.007	.002	-.005	-.001
	(.015)	(.019)	(.019)	(.002)
Total	.023***	.025***	.002	-
	(.009)	(.010)	(.005)	(-)
Observations	637	637	637	637
Units	91	91	91	91
First Stage Coeff.	4.72***	4.72***	4.72***	4.72***
First Stage F-Stat	38.36	38.36	38.36	38.36

Notes. The table displays two-stage least squares (2SLS) coefficients obtained from four regressions with different variables as outcomes and cumulative per-capita CasMez's investments as the main regressor. An observation is a province-year. Cumulative per-capita investments are instrumented by an interaction of a dummy taking value 1 if the province is located within CasMez's jurisdiction and a dummy for the post-1961 periods. The first-stage and reduced-form regressions are described by Equation (3). Column (1)-(3) reports the semi-elasticity of the province-level employment, value added, value added per worker in each sector (i.e., manufacturing, services, agriculture, and total) to €1,000 (2010 Euro) additional CasMez's investments per capita. Column (4) reports the effect of €1,000 (2010 Euro) additional CasMez's investments on sectoral employment shares. The table reports the number of observations, the number of unique provinces, and the Kleibergen-Paap F-statistic for weak identification. Controls include province fixed effects and region-specific trends, and the interaction of baseline province-level characteristics (i.e., the manufacturing and agriculture shares of employment, the share of illiterate population, and log value added per worker) with time dummies. * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$).

Table 5: Structural Parameters and Measured Quantities

	Parameter	Value	Method	Source
	ϕ	0.77	Calibration	-
	α	0.3	Calibration	Griliches (1967)
	$(1-\alpha)/\beta$	1.5	Calibration	Kline and Moretti (2014)
$\rightarrow$	β	0.47	Calibration	-
	γ/β	0.66	Estimation	Table E.1
$\rightarrow$	γ	0.31	Estimation/Calibration	-
	$(\eta_S/G_S)/(\beta-\gamma)$	0.023	Estimation	Table 2
$\rightarrow$	η_S/G_S	0.0046	Estimation/Calibration	-
	χ	0	Estimation	Tables 2 and 4
	τ	0.3	Calibration	-
	μ	0.5	Calibration	-

Quantity	Method	Source
dG_S	Measurement	ASET
y_S	Measurement	Istituto Tagliacarne
y_N	Measurement	Istituto Tagliacarne
ℓ_S	Measurement	Decennial Census
ℓ_N	Measurement	Decennial Census
$(d\ell_S/dG_S)$	Estimation/Calibration	Tables 2 and 3
$(d\ell_N/dG_S)$	Estimation/Calibration	Tables 2 and 3

Notes. The table lists the structural parameters and quantities used in our model-based analysis. A parameter value is attached to each parameter in the second column. The third column specifies the methodology followed to retrieve the parameter or quantity of interest. The methodology is a "Calibration" if the parameter value is calibrated taking a value from an external source. In that case, the source is listed in the fourth column. The methodology is "Estimation" if the parameter value is estimated in the empirical analysis of the paper. In that case, the Table with the relevant result is listed in the fourth column. When the parameter value is obtained by combining calibration and estimation, the table reports "Estimation/Calibration". For quantities measured directly from primary sources the table reports "Measurement" in the third column and the source in the last column.

Table 6: Aggregate Effects and Cost-Effectiveness of CasMez

	Panel 1: Actual			Panel 2: Place-neutral			Panel 3: Immobile labor		
% Effects on 2011...	Aggregate	South	Center-North	Aggregate	South	Center-North	Aggregate	South	Center-North
TFP	.	+8.5%	-1.1%	.	+1.3%	+1.5%	.	+6.4%	-
- Public capital	.	+5.0%	-	.	+1.9%	+0.9%	.	+5.0%	-
- Agglomeration	.	+3.6%	-1.1%	.	-0.6%	+1.5%	.	+1.4%	-
Value-added	+1.6%	+16.9%	-2.7%	+2.2%	+1.0%	+2.6%	+2.4%	+11.0%	-
- Direct	+1.7%	+7.7%	-	+0.6%	+2.7%	+1.4%	+1.5%	+7.1%	-
- Crowding In/Out	-0.1%	+9.2%	-2.7%	+1.7%	-1.7%	+1.2%	+0.9%	+4.0%	-

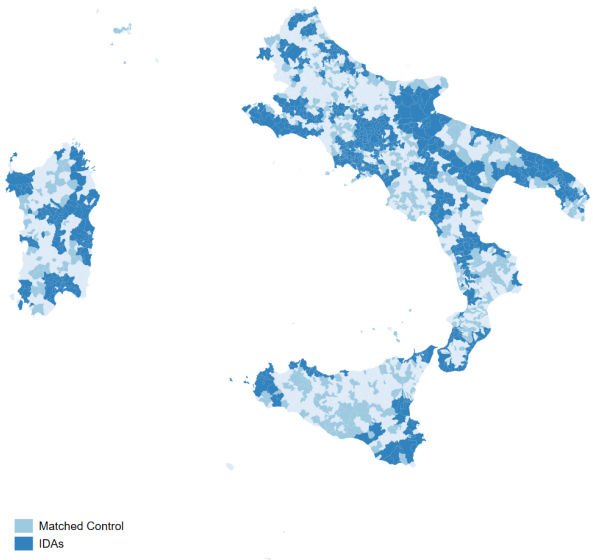
Cost-benefit analysis	BCR	MVPF	BCR	MVPF	BCR	MVPF
PE South: Output	3.20	∞	.	.	2.08	6.84
GE: Output	1.46	2.08	1.82	3.86	2.08	6.84
GE: Welfare	1.32	1.88	1.41	2.99	1.61	5.30

Notes. The upper panel of the table reports the percentage effects of the regional development program on 2011 TFP and value added. The effects on TFP are further decomposed into the effects driven by investments vs. agglomeration, while the effects on value added are decomposed into direct and indirect effects (crowding-in minus crowding-out effects). Panel 1 reports the effects of CasMez. Panel 2 evaluates a scenario where CasMez funds are equally allocated across regions on a per-capita basis (*place-neutral program*). Panel 3 evaluates a scenario where the allocation of resources is the same as in the actual scenario but labor is assumed to be immobile. The lower panel reports the benefit-to-costs ratio (BCR) and the marginal value of public funds (MVPF) for each scenario, calculating benefits through either output or welfare gains, both in partial equilibrium (ignoring crowding-out effects) and general equilibrium (accounting for crowding-out effects).

Appendix

A Additional Figures and Tables

Figure A.1: IDA Municipalities vs. Matched Non-IDA Municipalities



Notes. The figure shows a map of CasMez's jurisdiction. The dark blue areas indicate municipalities belonging to IDAs, while light blue areas indicate 1-to-1 matched control municipalities not belonging to any IDA. Treated and control municipalities are matched on a set of 1951 characteristics and 1951-1961 trends. See Table A.3 for the list of the variables used to perform the matching and the balance table between treated and control municipalities.

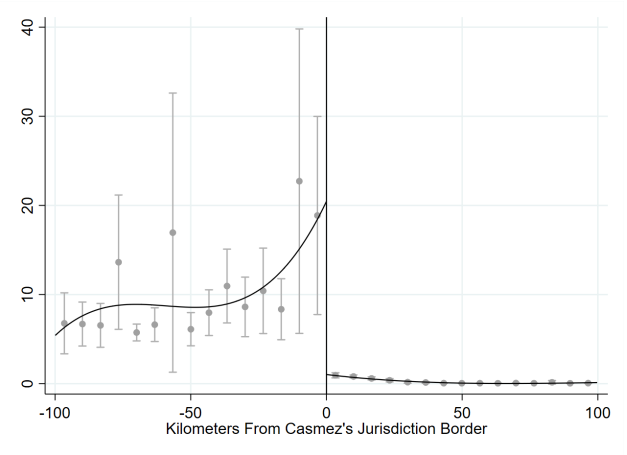
Figure A.2: Municipalities North vs. South of CasMez's Jurisdiction Border



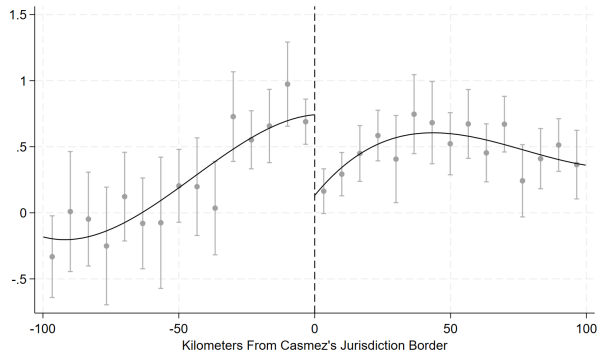
Notes. The figure shows a map of the municipalities 100 km North vs. South of CasMez's jurisdiction border. The light blue areas indicate municipalities located North of the border, while the dark blue areas indicate municipalities located South of the border.

Figure A.3: Static Long Difference-in-Discontinuities (1991)

(a) Cumulative Investments



(b) Δ Log Manufacturing Employment (1991-1951)



Notes. The figure shows the coefficients $\hat{\beta}_{1991}$ estimated from Equation (2). Recall that the unit of observation is a municipality, and this static long difference-in-discontinuities design compares municipalities just South vs. North of CasMez's jurisdiction border. The two continuous lines fit polynomial functions of degree 3 of distance from the border, separately for the South vs. North sample. The outcome variable in Panel (a) is cumulative investments per capita, while in Panel (b) is the percent change in log manufacturing employment from 1951. Cumulative investments per capita comprise public infrastructures and firm grants divided by the 1961 municipal population.

Figure A.4: IDA vs. non-IDA Provinces



Notes. The figure shows a map of Italian provinces. The light blue areas indicate provinces where no IDA is present, while the dark blue areas indicate provinces where IDAs are present. The province of Rome is left blank because it is excluded from the sample.

Table A.1: CasMez Endowment Over Time

Law n.	Date	Thousands of Euros (2010)	Thousands of USD (2010)
646/1950	August 10th, 1950	€17,500,601	$23,384,303
949/1952	July 25th, 1952	€4,284,333	$5,724,726
634/1957	July 29th, 1957	€10,097,702	$13,492,549
1349/1957	December 28th, 1959	€112,935	$150,904
622/1959	July 24th, 1959	€369,234	$493,371
454/1961	June 2nd, 1961	€361,518	$483,061
28/1962	January 30th, 1962	€48,730	$65,113
588/1962	June 11th, 1962	€30,590	$40,875
608/1964	July 6th, 1964	€805,388	$1,076,160
221/1965	March 30th, 1965	€28,945	$38,676
717/1965	June 26th, 1965	€15,823,029	$21,142,731
498/1967	June 21st, 1967	€2,411,085	$3,221,692
160/1969	April 8th, 1969	€8,015,985	$10,710,959
1034/1970	December 18th, 1970	€847,570	$1,132,523
205/1971	April 15th, 1971	€2,114,880	$2,825,903
853/1971	October 6th, 1971	€55,397,355	$74,021,946
868/1973	December 27th, 1973	€865,570	$1,156,575
371/1974	August 12th, 1974	€5,797,304	$7,746,357
493/1975	October 16th, 1975	€4,947,869	$6,611,342
183/1976	May 2nd, 1976	€68,792,273	$91,920,235
843/1978	December 21st, 1978	€12,470,382	$16,662,925
218/1978	March 6th, 1978	€789,650	$1,055,130
146/1980	April 24th, 1980	€4,561,039	$6,094,460
874/1980	December 22nd, 1980	€233,108	$311,479
119/1981	March 30th, 1981	€3,712,659	$4,960,855
13/1982	January 26th, 1982	€2,145,126	$2,866,318
546/1982	August 12th, 1982	€6,588,957	$8,804,165
132/1983	April 30th, 1983	€4,737,704	$6,330,520
651/1983	December 1st, 1983	€20,885,965	$27,907,826
64/1986	March 1st, 1986	€82,459,237	$110,182,033
113/1986	April 11th, 1986	€701,057	$936,753
Total:		€337,937,783	$451,552,465

Notes. The table reports all the laws that provided CasMez with resource endowments over the period 1950-1992. The first column indicates the law that was passed to confer transfers to CasMez and the second column reports the exact date in which the law was passed. The third and fourth columns report the amount of resources devolved to CasMez by each law in 2010 Euros and US dollars, respectively. At the bottom of the table, the total amount of resources devoted to CasMez over the whole period is reported. Source: SVIMEZ (2011).

Table A.2: IDA Approvals Over Time

Decree	Year	Type	IDA
DPR 804/1960	1960	Area di Sviluppo Industriale	Bari
DPR 805/1960	1960	Area di Sviluppo Industriale	Brindisi
DPR 806/1960	1960	Area di Sviluppo Industriale	Taranto
DPR 1013/1961	1961	Nucleo di Industrializzazione	Potenza
DPR 1314/1961	1961	Area di Sviluppo Industriale	Salerno
DPR 1410/1961	1961	Area di Sviluppo Industriale	Cagliari
DPR 50/1962	1962	Nucleo di Industrializzazione	Valle del Basento
DPR 235/1962	1962	Nucleo di Industrializzazione	Trapani
DPR 235/1962	1962	Nucleo di Industrializzazione	Golfo di Policastro
DPR 236/1962	1962	Nucleo di Industrializzazione	Avellino
DPR 238/1962	1962	Nucleo di Industrializzazione	Foggia
DPR 293/1962	1962	Nucleo di Industrializzazione	Piana di Sibari
DPR 574/1962	1962	Nucleo di Industrializzazione	Messina
DPR 575/1962	1962	Area di Sviluppo Industriale	Caserta
DPR 770/1962	1962	Nucleo di Industrializzazione	Gela
DPR 1374/1962	1962	Nucleo di Industrializzazione	Avezzano
DPR 1554/1962	1962	Nucleo di Industrializzazione	Sassari
DPR 1589/1962	1962	Nucleo di Industrializzazione	Vasto
DPR 1601/1962	1962	Nucleo di Industrializzazione	Tortoli-Arbatax
DPR 1872/1962	1962	Area di Sviluppo Industriale	Napoli
DPR 2048/1962	1962	Nucleo di Industrializzazione	Teramo
DPR 2054/1962	1962	Nucleo di Industrializzazione	Crotone
DPR 791/1963	1963	Nucleo di Industrializzazione	Ragusa
DPR 808/1963	1963	Nucleo di Industrializzazione	Oristano
DPR 1016/1963	1963	Nucleo di Industrializzazione	Reggio Calabria
DPR 1328/1963	1963	Nucleo di Industrializzazione	Sulcis-Iglesias
DPR 1526/1963	1963	Nucleo di Industrializzazione	Frosinone
DPR 2390/1963	1963	Area di Sviluppo Industriale	Catania
DPR 75/1964	1964	Area di Sviluppo Industriale	Palermo
DPR 103/1964	1964	Nucleo di Industrializzazione	Ascoli Piceno
DPR 596/1964	1964	Area di Sviluppo Industriale	Siracusa
DPR 890/1964	1964	Nucleo di Industrializzazione	Olbia
DPR 1480/1964	1964	Nucleo di Industrializzazione	Caltagirone
DPR 1383/1965	1965	Nucleo di Industrializzazione	Rieti

Table A.2: IDA Approvals Over Time (cont.)

Decree	Year	Type	IDA
DPR 562/1966	1966	Area di Sviluppo Industriale	Latina
DPR 609/1966	1966	Nucleo di Industrializzazione	Lecce
DPR 719/1967	1967	Nucleo di Industrializzazione	Gaeta-Formia
DPR 1019/1967	1967	Nucleo di Industrializzazione	Valle del Biferno
DPR 320/1968	1968	Nucleo di Industrializzazione	Santa Eufemia-Lamezia
DPR 657/1968	1968	Nucleo di Industrializzazione	Benevento
DPR 468/1969	1969	Area di Sviluppo Industriale	Valle del Pescara
DPR 15/1970	1970	Nucleo di Industrializzazione	Sulmona
DPR 88/1970	1970	Area di Sviluppo Industriale	L'Aquila
DPR 299/1970	1970	Nucleo di Industrializzazione	Sangro Aventino
DPR 1447/1970	1970	Nucleo di Industrializzazione	Vibo Valentia
DPR 205/1972	1972	Nucleo di Industrializzazione	Sardegna Centrale
DPR 153/1974	1974	Nucleo di Industrializzazione	Isernia-Venafro
DPR 414/1974	1974	Nucleo di Industrializzazione	Campobasso-Boiano

Notes. The table reports a comprehensive list of the approved Industrial Development Areas (IDAs) within CasMez's jurisdiction between 1960 and 1974. The first column indicates the Presidential Decree (*Decreto del Presidente della Repubblica*) that formally approves the IDA. The second column reports the year of IDA approval. The third column indicates the type of IDA (*Area di Sviluppo Industriale* or *Nucleo di Industrializzazione*). The last column reports the name of the IDA. The data to produce this table were collected by the authors.

Table A.3: IDAs vs. non-IDAs: 1-to-1 Match Balance Table

	(1) Treated	(2) Matched Control	(3) Difference
1951 Sh. of Illiterate Pop.	25.12	25.51	-0.38
	(7.28)	(8.42)	(10.88)
1951 Employment Rate	51.60	51.26	0.34
	(10.53)	(11.68)	(14.97)
1951 Sh. Manufacturing Emp.	21.47	21.20	0.27
	(12.96)	(12.80)	(15.01)
1951 Log Population	8.66	8.67	-0.01
	(1.02)	(1.03)	(0.80)
1951 Log Employment	7.65	7.66	-0.01
	(0.98)	(0.96)	(0.81)
1951 Log Manufacturing Emp.	5.93	5.92	0.01
	(1.32)	(1.30)	(0.92)
1951 Log Agriculture Emp.	7.10	7.10	-0.00
	(0.87)	(0.89)	(1.06)
1951-1961 Change Sh. of Illiterate Pop.	-8.05	-8.30	0.25
	(3.43)	(3.47)	(4.91)
1951-1961 Change Employment Rate	-4.25	-3.76	-0.49
	(6.11)	(6.40)	(8.86)
1951-1961 Change Sh. Manufacturing Emp.	10.31	10.27	0.04
	(8.24)	(8.59)	(11.53)
1951-1961 Change Log Population	0.00	-0.01	0.01
	(0.15)	(0.13)	(0.15)
1951-1961 Change Log Employment	-0.08	-0.08	-0.00
	(0.20)	(0.18)	(0.22)
1951-1961 Change Log Manufacturing Emp.	0.40	0.40	-0.01
	(0.39)	(0.41)	(0.55)
1951-1961 Change Log Agriculture Emp.	-0.37	-0.37	0.01
	(0.31)	(0.29)	(0.41)
Observations	879	879	879

Notes. The table reports the means and standard deviations of all variables used to match each municipality belonging to IDAs with one municipality not belonging to an IDA, for both the treatment and the matched control group. The third column reports the difference between the means and its standard deviation. * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$).

Table A.4: Aggregate Effects and Cost-Effectiveness of CasMez

	BCR (GE, Welfare)	MVPF (GE, Welfare)
Actual:		
	1.32	1.88
Place-neutral: $\frac{\eta_S/G_S}{\eta_N/G_N}$		
0.5	4.44	∞
0.67	3.41	∞
1	2.42	∞
1.5	1.75	9.08
2	1.41	2.99
2.5	1.21	1.89
3	1.08	1.43

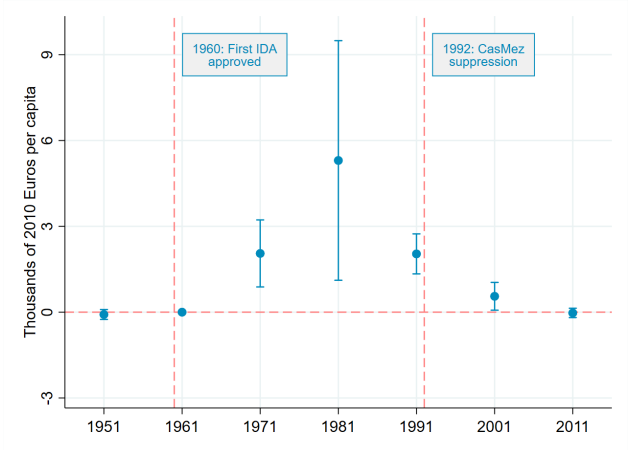
Notes. The upper panel reports the general-equilibrium Benefits-to-Costs (BCR) ratio and Marginal Value of Public Funds (MVPF) implied by the estimated aggregate effects of the actual CasMez, which focused on the South only. The lower panel reports the counterfactual estimates when CasMez funds are allocated to regions proportionally to their population (*place-neutral program*), under different assumptions about the ratio of the long-run semi-elasticities of regional productivity to cumulative investments, $\frac{\eta_S/G_S}{\eta_N/G_N}$, which measures the direct impact of public funds on productivity in the South relative to the Center-North. The parametrization with 2 is the one we assume in the text. The parametrization with 0.67 is the one implied by the estimates of cost per new job in the South vs. Center-North in Cingano et al. (2022). An infinite MVPF implies that the program eventually pays for itself.

B IDAs vs. non-IDAs: Estimated Coefficients Plots

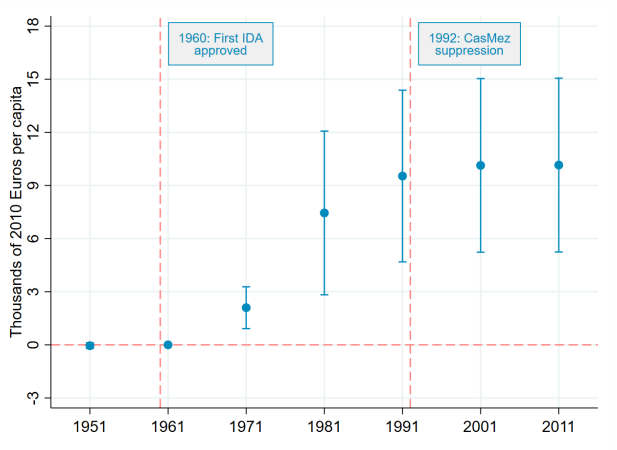
Figure B.1 and B.2 and plots the difference-in-differences coefficients from Equation (1). Both first-stage and reduced-form coefficients are statistically significant.

Figure B.1: IDAs vs. non-IDAs - First Stage

(a) Decade-Specific Investments



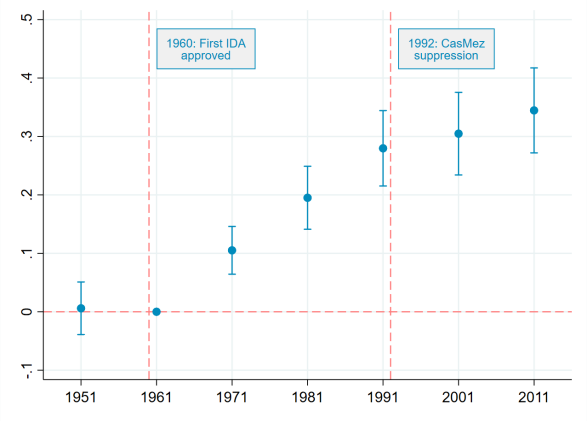
(b) Cumulative Investments



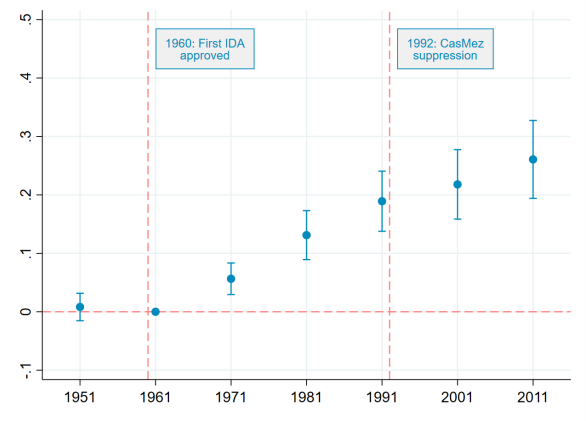
Notes. The figure shows the coefficients $\hat{\beta}_k$ estimated from Equation (1). Recall that the unit of observation is a municipality and this dynamic difference-in-differences design compares each municipality belonging to IDAs with one municipality not belonging to IDAs, matched on 1951 characteristics and 1951-1961 trends. See Table A.3 for a complete list of variables used to match treatment and control municipalities. The outcome variable in Panel (a) is decade-specific per-capita investments, while the outcome variable in Panel (b) is cumulative per-capita investments. Investments comprise public infrastructure spending and firm grants and they are converted in per-capita terms by dividing for 1961 municipal population. The period assigned to each investment is the year in which the project was approved by CasMez. Standard errors are clustered at the municipality level.

Figure B.2: IDAs vs. non-IDAs - Reduced Form

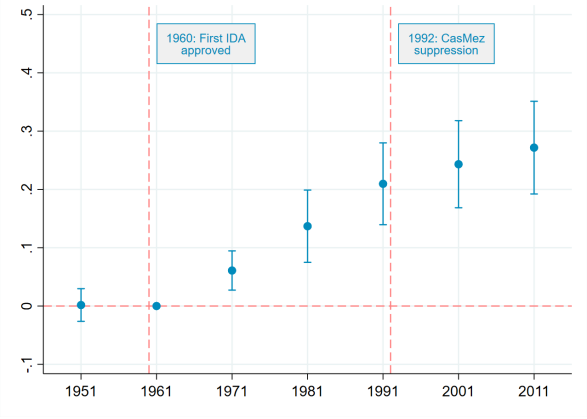
(a) Log Manufacturing Employment



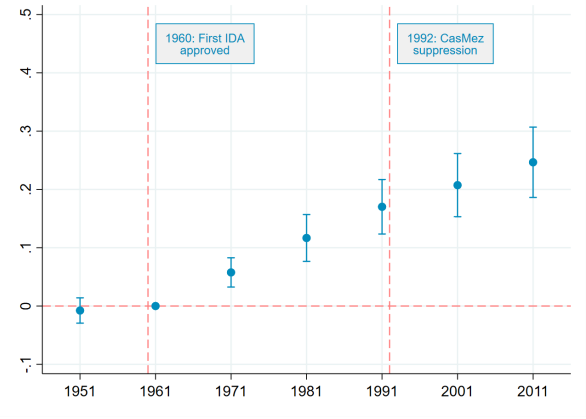
(b) Log Services Employment



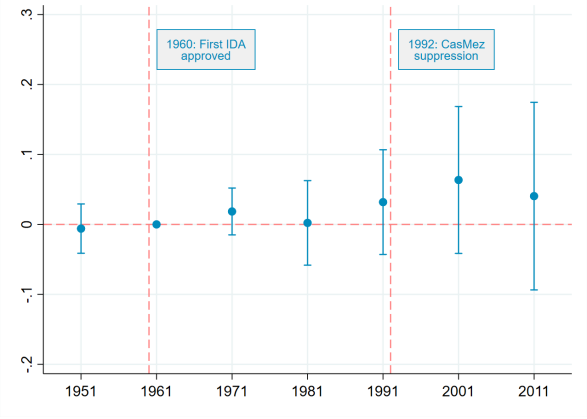
(c) Log Employment



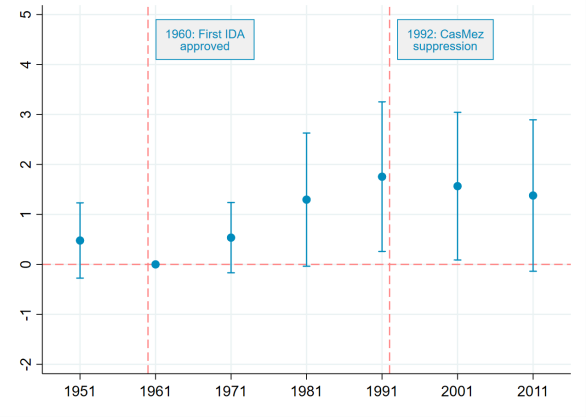
(d) Log Population



(e) Log Agriculture Employment



(f) Employment Rate



Notes. The figure shows the coefficients $\hat{\beta}_k$ estimated from Equation (1) for five different outcome variables. Panel (a): log manufacturing employment; Panel (b): log services employment; Panel (c): log employment; Panel (d): log population; Panel (e): log agriculture employment; Panel (f): employment rate. Recall that the unit of observation is a municipality and this dynamic difference-in-differences design compares each municipality belonging to IDAs with one municipality not belonging to IDAs, matched on 1951 characteristics and 1951-1961 trends. See Table A.3 for a complete list of variables used to match treatment and control municipalities.

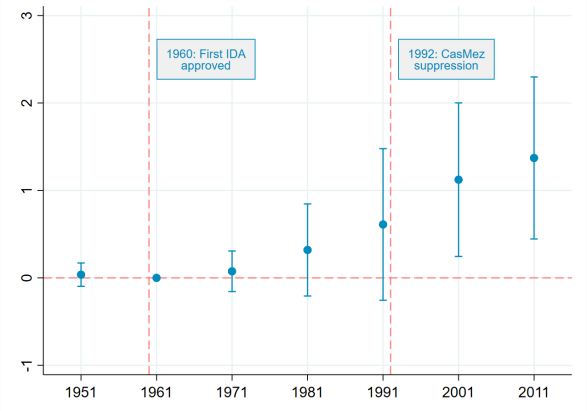
C Results on Municipality-Level Human Capital

Some theories of agglomeration economies involve knowledge spillovers, the idea that a higher density of workers increases the productivity of all workers because of social interactions and knowledge transfers (Moretti, 2004). This channel could be at play, especially when agglomeration increases the density of highly qualified workers. Since our main results point to the presence of agglomeration economies, we test this hypothesis by examining the impact of CasMez's investments on the concentration of college-educated individuals in municipalities more exposed to investments. Specifically, we estimate the reduced-form coefficients from Equations (1) and (2) with the college-educated share of the population as the dependent variable.

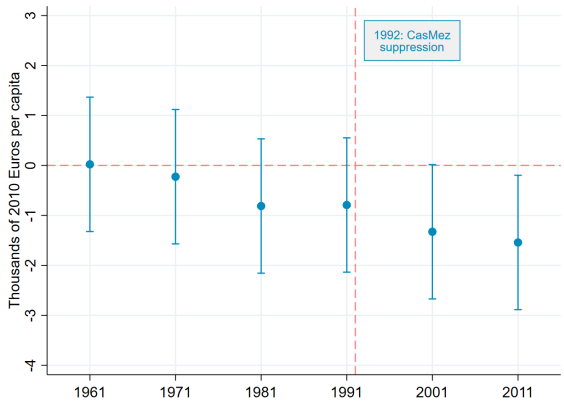
As shown by Figure C.1, we do not find unequivocal support for a long-term effect of CasMez's investments on municipality-level human capital, as measured by the share of the college-educated population. Panel (a) shows that comparing municipalities belonging to IDAs to matched municipalities not belonging to IDAs we find a positive long-term effect on the share of the college-educated population. Specifically, this share increased 1.5 percentage points more in IDA municipalities relative to non-IDA municipalities from 1951 to 2011. Panel (b) shows that the long difference-in-discontinuities design at the border of CasMez's jurisdiction delivers negative long-term effects of CasMez's investments on the share of the college-educated population.

Figure C.1: Reduced-Form Coefficients - Share of College-Educated Population

(a) IDAs vs. non-IDAs



(b) Long Difference-in-Discontinuities



Notes. The figure shows the coefficients $\hat{\beta}_k$ estimated from Equations (1), and (2), with the college-educated share of the population as an independent variable. Each panel reports the coefficient from a distinct empirical strategy. Panel (a): IDAs vs. non-IDAs; Panel (b): Long difference-in-discontinuities. Recall that the unit of observation is a municipality.

Different hypotheses could be made about the impact of manufacturing-oriented public investments on local human capital both in the short and in the long run. On the one hand, relatively high-paying manufacturing jobs could increase the demand for education from families. Also, manufacturing density could increase the local demand for knowledge-intensive services (Incoronato and Lattanzio, 2024). This would translate into a positive effect on the share of the college-educated population which, in turn, could drive agglomeration economies in the

long run. On the other hand, the specialization of the local economy in manufacturing could increase the demand for non-college-educated workers and crowd out investments in human capital accumulation. This would translate into a negative effect on the share of the college-educated population. The evidence provided does not shed light on which mechanism prevails. However, it casts doubt on the possibility that the persistent effects on manufacturing and total employment estimated consistently across the two empirical strategies could be driven mainly by local human capital accumulation.

D Model Appendix

The macroeconomy comprises two regions of endogenous size and one final-good sector. The final good is homogenous, freely traded across regions, and produced combining labor, capital, and a fixed factor of production. Regional productivity depends on cumulative government expenditures and lagged employment density to account for agglomeration economies.

In each region, two types of infinitely-lived households live: workers and capital owners. Workers are homogeneous, supply one unit of labor inelastically, and are hand-to-mouth (i.e., they exhaust their income in consumption in every period). The strength of preferences for location governs the long-run regional labor supply elasticity. The strength of dynamic mobility frictions inducing slugghish migration govern the short-run regional labor supply elasticity. Capital owners are immobile. In each period, they choose how much of their income to save/invest and consume. As a result, they are responsible for capital accumulation. Capital is assumed to be freely mobile. Therefore, capital owners allocate capital across regions to arbitrage away profitable investment opportunities, so that the cost of capital is equalized across regions.

D.1 Production

Production takes place in each region according to the following technology:

$$y_{it} = z_{it} k_{it}^{\alpha} F_i^{\beta} \ell_{it}^{1-\alpha-\beta}, \tag{D.1}$$

where z_{it} denotes productivity, k_{it} private capital, F_i a fixed factor of production, and ℓ_{it} employment. Regional productivity z_{it} is further defined as follows:

$$z_{it} = \bar{z}_i \bar{z}_t G_{it}^{\eta_i} \ell_{it-1}^{\gamma} \omega_{it}, \tag{D.2}$$

where $\bar{z}_i$ denotes region-specific characteristics affecting productivity, such as geography or institutions, $\bar{z}_t$ captures productivity trends and shocks common across regions, G_{it} denotes cumulative per-capita public funds in the form of infrastructure investments and firm grants, ℓ_{it-1} denotes lagged employment, and ω_{it} denotes exogenous productivity shocks. Modeling regional productivity as a function of lagged employment is a way to capture the presence of agglomeration economies. Specifically, the parameter γ denotes the elasticity of regional productivity to lagged employment, i.e., the *agglomeration elasticity*.

Since y_{it} denotes a homogeneous product freely traded across regions, its price p_t^y, common across regions, can be normalized to 1 without loss of generality. Any other price in the model (e.g., wages) must therefore be interpreted in real terms. Firms in each region choose capital and labor to maximize profits:

$$\pi_{it} = z_{it} k_{it}^{\alpha} F_i^{\beta} \ell_{it}^{1-\alpha-\beta} - r_{it} k_{it} - w_{it} \ell_{it}, \tag{D.3}$$

where π_{it} denotes real profits, r_{it} denotes the real rental rate of capital, and w_{it} denotes the real wage rate. The first-order conditions of this problem lead the following expressions for the capital and labor demands:

$$k_{it} = \left[\frac{\alpha z_{it} F_i^{\beta} \ell_{it}^{1-\alpha-\beta}}{r_{it}}\right]^{\frac{1}{1-\alpha}} \quad \text{and} \quad \ell_{it} = \left[\frac{(1-\alpha-\beta) z_{it} k_{it}^{\alpha} F_i^{\beta}}{w_{it}}\right]^{\frac{1}{\alpha+\beta}}. \tag{D.4}$$

Substituting the capital demand equation into the labor demand equation, we obtain the following expression for the labor demand, independent of k_{it}.

$$\ell_{it} = \left[\frac{(1-\alpha-\beta)}{w_{it}}\right]^{\frac{1-\alpha}{\beta}} \left[\frac{\alpha}{r_{it}}\right]^{\frac{\alpha}{\beta}} z_{it}^{\frac{1}{\beta}} F_i. \tag{D.5}$$

We can derive their relative labor demand curve as follows:

$$\frac{\ell_{it}}{\ell_{jt}} = \left(\frac{w_{jt}}{w_{it}}\right)^{\frac{1-\alpha}{\beta}} \left(\frac{z_{it}}{z_{jt}}\right)^{\frac{1}{\beta}} \frac{F_i}{F_j}. \tag{D.6}$$

Intuitively, labor demand in i relative to j is decreasing in the relative real wage, increasing in the relative productivity, and increasing in the relative fixed factor endowment. The regional labor demand elasticity is $-\frac{1-\alpha}{\beta}$.

D.2 Consumption, Labor Allocation, and Capital Accumulation

Workers' Problem Workers' utility in region i is

$$u_{it}^{w} = \ln(c_{it}^{w}) + \varepsilon_{it}, \tag{D.7}$$

where c_{it}^{w} denotes workers' consumption and ε_{it} is an idiosyncratic preference draw for region i. Since workers are hand-to-mouth, i.e., they exhaust their budget in consumption in every period, their indirect utility function in region i takes the following form:

$$u_{it}^{w} = \ln(w_{it}) + \varepsilon_{it}, \tag{D.8}$$

where w_{it} denotes the real wage rate in region i. At the beginning of each period, a worker observes labor demand in all regions, draws ε_{it}, and chooses the location that maximizes u_{it}^{w}. Then, she supplies her unit of labor inelastically, earns w_{it}, and consumes $c_{it}^{w} = w_{it}$.

We assume ε_{it} is i.i.d. distributed according to an Type I Extreme Value distribution. A worker chooses region i if their indirect utility in region i is higher than in any other region:

$$u_{it}^{w} = \ln(w_{it}) + \varepsilon_{it} \geq \ln(w_{jt}) + \varepsilon_{jt} = u_{jt}^{w} \tag{D.9}$$

for each $j \neq i$.

For simplicity, we start characterizing this decision in the context of a two-region economy (i.e., with only i and j). A worker chooses region i if

$$\varepsilon_{jt} - \varepsilon_{it} \leq \ln(w_{it}) - \ln(w_{jt}). \tag{D.10}$$

Since ε_{it} is i.i.d. distributed according to an extreme value Type I distribution, the difference $(\varepsilon_{jt} - \varepsilon_{it})$ is i.i.d distributed according to a logistic distribution with parameters $(0, \chi)$. The probability that a worker chooses region i is therefore the CDF of $(\varepsilon_{jt} - \varepsilon_{it})$ evaluated at $[\ln(w_{it}) - \ln(w_{jt})]$. Formally:

$$\lambda_{it} = \Pr[\varepsilon_{jt} - \varepsilon_{it} \leq \ln(w_{it}) - \ln(w_{jt})] = \frac{1}{1 + e^{\frac{-(\ln(w_{it}) - \ln(w_{jt}))}{\chi}}} = \tag{D.11}$$

$$= \frac{1}{1 + e^{-\ln\left(\frac{w_{it}}{w_{jt}}\right)^{\frac{1}{\chi}}}} = \tag{D.12}$$

$$= \frac{1}{1 + \left(\frac{w_{jt}}{w_{it}}\right)^{\frac{1}{\chi}}} = \tag{D.13}$$

$$= \frac{1}{\frac{w_{it}^{\frac{1}{\chi}} + w_{jt}^{\frac{1}{\chi}}}{w_{it}^{\frac{1}{\chi}}}} = \tag{D.14}$$

$$= \frac{w_{it}^{\frac{1}{\chi}}}{w_{it}^{\frac{1}{\chi}} + w_{jt}^{\frac{1}{\chi}}}. \tag{D.15}$$

Similarly, the probability that a worker chooses region j is

$$\lambda_{jt} = \frac{w_{jt}^{\frac{1}{\chi}}}{w_{it}^{\frac{1}{\chi}} + w_{jt}^{\frac{1}{\chi}}}. \tag{D.16}$$

To account for the sluggish dynamic adjustment of regional employment, we further assume that in each period only an exogenous fraction θ of workers willing to relocate can do that. As a consequence, we can derive the law of motion of regional employment as follows:

$$\ell_{it} = \ell_{it-1} + \theta\lambda_{it}(\ell_{t-1} - \ell_{it-1}) - \theta(1 - \lambda_{it})\ell_{it-1} = \tag{D.17}$$

$$= (1 - \theta)\ell_{it-1} + \theta\lambda_{it}\ell_{t-1}. \tag{D.18}$$

Capital Owners' Problem Capital owners' inter-temporal utility takes the following form:

$$\upsilon_t^k = E_t \sum_{s=0}^{\infty} \phi^{t+s} \frac{(c_{t+s}^k)^{1-\psi}}{1 - \frac{1}{\psi}}, \tag{D.19}$$

where ϕ denotes the discount factor, c_t^k denotes capital owner's consumption, and ψ denotes the inter-temporal elasticity of substitution. The inter-temporal budget constraint requires that rental flows from the existing stock

of capital equal the sum of capital owners' consumption and the value of investments, net of depreciation, i.e., $r_t k_t = c_t^k + k_{t+1} - (1-\delta)k_t$, where δ denotes the depreciation rate of capital.[41] After defining $R_t = r_t + 1 - \delta$, the gross return on capital, the capital owners' problem takes the following form:

$$\max_{c_{t+s}^k, k_{t+s+1}} \frac{(c_t^k)^{1-\psi}}{1-\frac{1}{\psi}} + \phi E_t v(k_{t+1}, t+1) \tag{D.20}$$

subject to

$$c_t^k + k_{t+1} = R_t k_t \tag{D.21}$$

We follow Kleinman et al. (2023) to show that:

$$c_t^k = \xi_t R_t k_t \tag{D.22}$$

$$k_{t+1} = (1-\xi_t) R_t k_t \tag{D.23}$$

where ξ_t is defined recursively as follows:

$$\xi_t^{-1} = 1 + \phi^{\psi} (E_t[R_{t+1}^{\frac{\psi-1}{\psi}} \xi_{t+1}^{-\frac{1}{\psi}}])^{\psi} \tag{D.24}$$

This result implies that capital owners have a linear saving rate $(1-\xi_t)$ out of current period wealth $R_t k_t$. In general, capital owners' saving rate $(1-\xi_t)$ is endogenous, forward-looking, and depends on the expectation of the sequence of future returns on capital R_{t+s}, the discount factor ϕ, and the inter-temporal elasticity of substitution ψ. In the particular case of log-utility ($\psi = 1$), capital owners have a constant saving rate ϕ, as in the Solow (1956) and Swan (1956) models. Finally, we assume that capital is mobile across regions, implying that $r_{it} = r_{jt} = r_t$.

D.3 Equilibrium

List of 24 endogenous variables: c_{it}^w, c_{jt}^w, c_t^k, c_t, z_{it}, z_{jt}, y_{it}, y_{jt}, y_t, k_{it}, k_{jt}, k_t, λ_{it}, λ_{jt}, ℓ_{it}, ℓ_{jt}, L_t, w_{it}, w_{jt}, r_{it}, r_{jt}, r_t, R_t, ξ_t.

List of parameters and pre-determined variables: α, β, η_i, γ, $\bar{z}_i$, $\bar{z}_j$, F_i, F_j, χ, θ, ψ, ϕ, δ.

List of exogenous variables: $\bar{z}_t$, G_{it}, G_{jt}, ω_{it}, ω_{jt}.

List of equations:

1. Region i's workers' consumption: $c_{it}^w = w_{it}$
2. Region j's workers' consumption: $c_{jt}^w = w_{jt}$
3. Aggregate capital owners' consumption: $c_t^k = \xi_t R_t k_t$
4. Aggregate consumption: $c_t = c_{it}^w + c_{jt}^w + c_t^k$

[41] We are implicitly assuming that the price of one unit of consumption c_t^k is the same as one unit of capital k_t.

5. Definition of region i's productivity: $z_{it} = \bar{z}_i \bar{z}_t G_{it}^{\eta_i} \ell_{it-1}^{\gamma} \omega_{it}$
6. Definition of region j's productivity: $z_{jt} = \bar{z}_j \bar{z}_t G_{jt}^{\eta_i} \ell_{jt-1}^{\gamma} \omega_{jt}$
7. Region i's production function: $y_{it} = z_{it} k_{it}^{\alpha} F_i^{\beta} \ell_{it}^{1-\alpha-\beta}$
8. Region j's production function: $y_{jt} = z_{jt} k_{jt}^{\alpha} F_j^{\beta} \ell_{jt}^{1-\alpha-\beta}$
9. Product market clearing: $y_t = c_t + (1 - \xi_t) R_t k_t$
10. Competitive capital market: $r_{it} = r_{jt}$
11. Definition of aggregate return on capital: $r_t = r_{it}$
12. Definition of gross return on capital: $R_t = r_t + 1 - \delta$
13. Frictionless share of total employment in region i : $\lambda_{it} = \frac{w_{it}^{\frac{1}{\chi}}}{w_{it}^{\frac{1}{\chi}} + w_{jt}^{\frac{1}{\chi}}}$
14. Frictionless share of total employment in region j: $\lambda_{jt} = \frac{w_{jt}^{\frac{1}{\chi}}}{w_{it}^{\frac{1}{\chi}} + w_{jt}^{\frac{1}{\chi}}}$
15. Region i's labor demand: $\ell_{it} = \left[\frac{(1-\alpha-\beta)}{w_{it}}\right]^{\frac{1-\alpha}{\beta}} \left[\frac{\alpha}{r_{it}}\right]^{\frac{\alpha}{\beta}} z_{it}^{\frac{1}{\beta}} F_i$
16. Region j's labor demand: $\ell_{jt} = \left[\frac{(1-\alpha-\beta)}{w_{jt}}\right]^{\frac{1-\alpha}{\beta}} \left[\frac{\alpha}{r_{jt}}\right]^{\frac{\alpha}{\beta}} z_{jt}^{\frac{1}{\beta}} F_j$
17. Law of motion of region i labor supply: $\ell_{it} = (1 - \theta)\ell_{it-1} + \theta \lambda_{it} \ell_{t-1}$
18. Law of motion of region j labor supply: $\ell_{jt} = (1 - \theta)\ell_{jt-1} + \theta \lambda_{jt} \ell_{t-1}$
19. Labor market clearing: $\ell_t = \ell_{it} + \ell_{jt}$
20. Region i's capital demand: $k_{it} = \left[\frac{\alpha z_{it} F_i^{\beta} \ell_{it}^{1-\alpha-\beta}}{r_{it}}\right]^{\frac{1}{1-\alpha}}$
21. Region j's capital demand: $k_{jt} = \left[\frac{\alpha z_{jt} F_j^{\beta} \ell_{jt}^{1-\alpha-\beta}}{r_{jt}}\right]^{\frac{1}{1-\alpha}}$
22. Optimal saving/consumption of capital owners: $\xi_t^{-1} = 1 + \phi^{\psi} (E_t[R_{t+1}^{\frac{\psi-1}{\psi}} \xi_{t+1}^{-\frac{1}{\psi}}])^{\psi}$
23. Law of motion of aggregate capital: $k_{t+1} = (1 - \xi_t) R_t k_t$
24. Capital market clearing: $k_t = k_{it} + k_{jt}$

D.4 Steady State

In this section, we derive the steady-state equilibrium of the model. Then, we derive closed-form expressions for the impact of a change in regional cumulative government investments on steady-state aggregate output and real wage differentials.

Steady-State Equilibrium List of equations:

1. Region i's workers' consumption: $c_{i,ss}^{w} = w_{i,ss}$
2. Region j's workers' consumption: $c_{j,ss}^{w} = w_{j,ss}$
3. Aggregate capital owners' consumption: $c_{ss}^{k} = \xi_{ss} R_{ss} k_{ss}$
4. Aggregate consumption: $c_{ss} = c_{i,ss}^{w} + c_{j,ss}^{w} + c_{ss}^{k}$
5. Definition of region i's productivity: $z_{it} = \bar{z}_i \bar{z}_{ss} G_{i,ss}^{\eta_i} \ell_{i,ss}^{\gamma}$

6. Definition of region j's productivity: $z_{j,ss} = \bar{z}_j \bar{z}_{ss} G_{j,ss}^{\eta_i} \ell_{j,ss}^{\gamma}$
7. Region i's production function: $y_{i,ss} = z_{i,ss} k_{i,ss}^{\alpha} F_i^{\beta} \ell_{i,ss}^{1-\alpha-\beta}$
8. Region j's production function: $y_{j,ss} = z_{j,ss} k_{j,ss}^{\alpha} F_j^{\beta} \ell_{j,ss}^{1-\alpha-\beta}$
9. Product market clearing: $y_t = c_{ss} + (1 - \xi_{ss}) R_{ss} k_{ss}$
10. Competitive capital market: $r_{i,ss} = r_{j,ss}$
11. Definition of aggregate return on capital: $r_{ss} = r_{i,ss}$
12. Definition of gross return on capital: $R_{ss} = r_{ss} + 1 - \delta$
13. Frictionless share of total employment in region i : $\lambda_{i,ss} = \frac{w_{i,ss}^{\frac{1}{\chi}}}{w_{i,ss}^{\frac{1}{\chi}} + w_{j,ss}^{\frac{1}{\chi}}}$
14. Frictionless share of total employment in region j: $\lambda_{j,ss} = \frac{w_{j,ss}^{\frac{1}{\chi}}}{w_{i,ss}^{\frac{1}{\chi}} + w_{j,ss}^{\frac{1}{\chi}}}$
15. Region i's labor demand: $\ell_{i,ss} = \left[\frac{(1-\alpha-\beta)}{w_{i,ss}}\right]^{\frac{1-\alpha}{\beta}} \left[\frac{\alpha}{r_{i,ss}}\right]^{\frac{\alpha}{\beta}} z_{i,ss}^{\frac{1}{\beta}} F_i$
16. Region j's labor demand: $\ell_{j,ss} = \left[\frac{(1-\alpha-\beta)}{w_{j,ss}}\right]^{\frac{1-\alpha}{\beta}} \left[\frac{\alpha}{r_{j,ss}}\right]^{\frac{\alpha}{\beta}} z_{j,ss}^{\frac{1}{\beta}} F_j$
17. Law of motion of region i labor supply: $\ell_{i,ss} = \lambda_{i,ss} \ell_{ss}$
18. Law of motion of region j labor supply: $\ell_{j,ss} = \lambda_{j,ss} \ell_{ss}$
19. Labor market clearing: $\ell_{ss} = \ell_{i,ss} + \ell_{j,ss}$
20. Region i's capital demand: $k_{i,ss} = \left[\frac{\alpha z_{i,ss} F_i^{\beta} \ell_{i,ss}^{1-\alpha-\beta}}{r_{i,ss}}\right]^{\frac{1}{1-\alpha}}$
21. Region j's capital demand: $k_{j,ss} = \left[\frac{\alpha z_{j,ss} F_j^{\beta} \ell_{j,ss}^{1-\alpha-\beta}}{r_{j,ss}}\right]^{\frac{1}{1-\alpha}}$
22. Optimal saving/consumption of capital owners: $1 - \xi_{ss} = \phi$
23. Law of motion of aggregate capital: $R_{ss} = \frac{1}{1-\xi_{ss}}$
24. Capital market clearing: $k_{ss} = k_{i,ss} + k_{j,ss}$

Impact on Aggregate Output Substituting region i's capital demand into the production function, we derive the following expression for steady-state output:

$$y_{i,ss} = \left[\frac{\alpha^{\alpha} z_{i,ss} F_i^{\beta} \ell_{i,ss}^{1-\alpha-\beta}}{r_{ss}^{\alpha}}\right]^{\frac{1}{1-\alpha}}, \tag{D.25}$$

where the subscript SS indicates steady-state values. Since

$$z_{i,ss} = \bar{z}_i \bar{z}_{ss} G_{i,ss}^{\eta_i} \ell_{i,ss}^{\gamma}, \tag{D.26}$$

we can express $\ln(y_{i,ss})$ as follows:

$$\ln(y_{i,ss}) = C_{1i} + \frac{\eta_i}{1-\alpha} \ln(G_{i,ss}) + \frac{1-\alpha-\beta+\gamma}{1-\alpha} \ln(\ell_{i,ss}) \tag{D.27}$$

where $C_{1i} = \frac{\alpha}{1-\alpha}\ln(\alpha) + \frac{1}{1-\alpha}\ln(\bar{z}_i\bar{z}_{ss}) + \frac{\beta}{1-\alpha}\ln(F_i) - \frac{\alpha}{1-\alpha}\ln(r_{ss})$ is a region-specific constant term. Taking the derivative of $\ln(y_{i,ss})$ with respect to $\ln(G_{i,ss})$ and rearranging, we obtain

$$\frac{dy_{i,ss}}{dG_{i,ss}} = \frac{\eta_i}{1-\alpha}\frac{y_{i,ss}}{G_{i,ss}} + \frac{1-\alpha-\beta+\gamma}{1-\alpha}\frac{y_{i,ss}}{\ell_{i,ss}}\frac{d\ell_{i,ss}}{dG_{i,ss}}. \tag{D.28}$$

In the two-region (i.e., i and j) context with government funds directed to region j, and $y_{ss} = y_{i,ss} + y_{j,ss}$, then the impact of government funds on aggregate output can be expressed as follows:

$$\frac{dy_{ss}}{dG_{j,ss}} = \frac{\eta_i}{1-\alpha}\frac{y_{j,ss}}{G_{j,ss}} + \frac{1-\alpha-\beta+\gamma}{1-\alpha}\left(\frac{d\ell_{j,ss}}{dG_{j,ss}}\frac{y_{j,ss}}{\ell_{j,ss}} + \frac{d\ell_{i,ss}}{dG_{j,ss}}\frac{y_{i,ss}}{\ell_{i,ss}}\right). \tag{D.29}$$

Impact on Real Wage Differentials Combining the equations for the relative labor demand and the relative labor supply, we obtain the following expression for the steady-state relative real wages:

$$\frac{w_{i,ss}}{w_{j,ss}} = \left(\frac{z_{i,ss}}{z_{j,ss}}\right)^{\frac{\chi}{\beta+(1-\alpha)\chi}}\left(\frac{F_i}{F_j}\right)^{\frac{\beta\chi}{\beta+(1-\alpha)\chi}}. \tag{D.30}$$

Intuitively, relative real wages are increasing in relative productivities and fixed factor endowments. The elasticity of relative real wages to relative productivities is decreasing in β and α and increasing in χ. The more elastic the relative labor supply, the less responsive regional real wage differentials are to regional productivity differentials. As a consequence, public funds that increase productivity in region j will be more effective in decreasing steady-state real wage differentials if the regional labor supply is very inelastic (i.e., if labor mobility is very low). Analytically, we can derive the following expression for the impact of public investments in region j on $(w_{i,ss}/w_{j,ss})$:[42]

$$\frac{d\left(\frac{w_{i,ss}}{w_{j,ss}}\right)}{dG_j} = -\frac{\chi}{\beta-\gamma+(1-\alpha)\chi}\frac{\eta_i}{G_{j,ss}}\frac{w_{i,ss}}{w_{j,ss}}. \tag{D.31}$$

The effectiveness of public investments in reducing steady-state real wage differentials increases in $\frac{\eta_i}{G_{j,ss}}$ (i.e., the semi-elasticity of regional productivity to public funds), χ (i.e., the inverse elasticity of regional labor supply), and γ (i.e., the elasticity of regional productivity to regional employment or *agglomeration elasticity*).

[42] This procedure requires substituting the relative labor supply equation into the expression for the derivative of $\ln\left(\frac{w_{i,ss}}{w_{j,ss}}\right)$ with respect to $\ln(G_{j,ss})$.

E Estimating Agglomeration Elasticities

The first step to quantify the impact of CasMez's investments on aggregate output and welfare is to estimate the agglomeration elasticity, γ. To do that, we follow the methodology developed by Kline and Moretti (2014). We start by considering the labor demand equations (Equations 6 and 7). Taking logs, we derive the following expression for the employment in region i and period t:

$$\ln(\ell_{it}) = \nu_i + \delta_t + \frac{\eta_i}{\beta}\ln(G_{it}) + \frac{\gamma}{\beta}\ln\left(\frac{\ell_{it-1}}{A_i}\right) - \frac{1-\alpha}{\beta}\ln\left(\frac{y_{it}}{\ell_{it}}\right) + \omega_{it}, \tag{E.1}$$

where ν_i denotes a region-specific constant term, δ_t denotes a time-specific constant term, and $\omega_{it} = (1/\beta)\varepsilon_{it}$. We estimate this structural equation using a two-way fixed effects regression of period-t employment on the lag of employment density and recover the parameter (γ/β). Conveniently, ν_i is absorbed by unit fixed effects, and δ_t is absorbed by time fixed effects. Formally, we estimate the following specification:

$$\ln(\ell_{it}) = \nu_i + \delta_t + \frac{\eta_i}{G_i\beta}dG_i + \frac{\gamma}{\beta}\ln\left(\frac{\ell_{it-1}}{A_i}\right) - \frac{1-\alpha}{\beta}\ln\left(\frac{y_{it}}{\ell_{it}}\right) + \mathbf{X}'_{i1951}\Gamma_t + \omega_{it}, \tag{E.2}$$

where ν_i denotes unit fixed effects, δ_t controls for time trends, dG_i are cumulative investments per capita, (γ/β) is the coefficient of interest, (ℓ_{it-1}/A_i) measures lagged employment density, (y_{it}/ℓ_{it}) is output per worker, $\mathbf{X}'_{i1951}$ is a vector of baseline characteristics interacted with time dummies, Γ_t, to control for heterogeneous trends induced by differences in education levels, industry mix, and regional evolutions, and ω_{it} is the error term.

A threat to identification is that the error term $\omega_{it} = (1/\beta)\varepsilon_{it}$ is likely correlated with lagged employment density and the outcome of interest. For instance, it could be the case that local productivity shocks are serially correlated. This would imply that provinces with a higher employment density are characterized by heterogeneous productivity trends that affect employment independently of agglomeration economies. To address this concern, we instrument the one-decade lag of manufacturing employment density with its two-decade lag. Our instrument is uncorrelated with present and one-decade lag productivity shocks by construction. Therefore, the identifying assumption is that, after conditioning on all the fixed effects and the control variables included in Equation (E.2), productivity shocks are independent over a 20-year horizon. This assumption is pretty conservative in light of theories that describe local growth as the result of random productivity processes (Eeckhout, 2004).

Table E.1 reports the estimated 2SLS coefficients for the whole sample and separately for the Center-North and the South. The agglomeration elasticity is similar across provinces in the Center-North and in the South. For this reason, our model features constant agglomeration elasticities across regions. Assuming $\beta = 0.47$, our estimates imply $\gamma = 0.31$.

Table E.1: IV Estimates of Agglomeration Elasticities

	(1) Whole Sample	(2) South	(3) Center-North
$(\hat{\gamma/\beta})$	0.66***	0.64***	0.69***
	(0.03)	(0.05)	(0.06)
Observations	455	185	260
Units	91	37	52
First Stage F-Stat	402.42	141.11	298.48

Notes. The table displays the 2SLS coefficient of γ/β obtained by estimating Equation (E.2) for the whole sample and separately for the South and the Center-North. An observation is a province-year and the panel covers the period 1971-2011. The dependent variable is province-level employment. The main regressor is one-decade-lagged employment density. The main regressor is instrumented with two-decade-lagged employment density. The table reports the number of observations, the number of unique provinces, and the Kleibergen-Paap F-statistic for weak identification. Baseline controls include the share of manufacturing and agriculture employment, the share of the illiterate population, and regional dummies. Standard errors are clustered at the province level. * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$).

F The Marginal Value of Public Funds (MVPF)

The MVPF is defined as follows:

$$\text{MVPF} = \frac{(1-\tau)\Delta W}{(1+\mu)(C-\tau\Delta W)}. \tag{F.1}$$

Note that differently from Hendren and Sprung-Keyser (2020) we directly include the dead-weight loss of taxation $1+\mu$ in our MVPF estimate, assuming the policy is financed with distortionary taxation. As Hendren and Sprung-Keyser (2022) clarifies, this is equivalent to estimating a joint MVPF of the spending of interest – CasMez in our case – and tax raised to finance it. Intuitively, the MVPF is the ratio between the net-of-tax welfare gains induced by the program and the costs of the program, net of tax revenue increases induced by the program and augmented by the cost of funds parameter.

The main difference between MVPF and BCR is the treatment of the term $(1+\mu)\tau\Delta W$, present in the numerator of the BCR and in the denominator of the MVPF. This difference makes the interpretation of the two measures slightly distinct. The BCR measures benefits per Euro of upfront government expenditure, treating government savings as a benefit with value $(1+\mu)$. The MVPF measures the benefits of a policy per Euro of net government expenditure. All savings to the government are counted in the denominator as offsetting initial costs. Note that in both cases the benefits accruing to the government through a larger tax base are augmented by $(1+\mu)$ because they allow the government to reduce the deadweight loss necessary to finance the program.