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

Andrea Cerrato* Francesco Filippucci†

April, 2025

**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 but hardly reduced regional output per worker differentials. To account for the macroeconomic effects of the program, we develop a two-region growth model with public capital, factor mobility, and agglomeration economies. The welfare gains from the program outweighed its costs, although large crowding-out effects on the non-targeted regions substantially reduced its benefits. A counterfactual exercise reveals that the welfare gains would have been larger under a place-neutral allocation of resources.

**Keywords:** Big Push; Regional Development; Crowding-Out

**JEL code:** O11, O14, O25, O41

*Federal Reserve Bank of Boston. Contact: andrea.cerrato@bos.frb.org

†Organisation for Economic Cooperation and Development (OECD). Contact: francesco.filippucci@oecd.org

We thank Luisa Cefalà, Gabriel Chodorow-Reich, Jaedo Choi, David Lagakos, Nathan Lane, Enrico Moretti, Emi Nakamura, Dhiren Patki, Filippo Palomba, Christina Romer, Francesco Ruggieri, Fabio Schiantarelli, Benjamin Schoefer, Jón Steinsson, Damián Vergara, and Eric Verhoogen for helpful comments about the paper. We are grateful to Corrado Bonifazi and Frank Heins for sharing their data. We also thank all the participants at the UC Berkeley Macro Seminar, Macro Lunch, Labor Lunch, the Public-Labor Job Market Symposium, the SED 2024 conference, the Boston College Macro Seminar, and the Columbia SIPA New Thinking for Industrial Policy conference. This project has received funding from the UC Berkeley Opportunity Lab – Place-Based Policy Initiative. The views expressed in this document do not necessarily reflect the views of the Federal Reserve Bank of Boston, the principals of the Board of Governors, or the Federal Reserve System, nor of the OECD.

# 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 aggregate 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 macroeconomic effects of regional development programs can therefore be substantially lower than local gains due to crowding-out, especially when factors of production are highly mobile. Moreover, the presence of regional differentials in the elasticity of productivity to public capital and agglomeration externalities may make regional development programs sub-optimal with respect to equally large *place-neutral* programs.

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 evaluates the short-term partial-equilibrium effects of relatively small programs, rather than the lasting macroeconomic effects 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 country's 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

[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.

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 investments 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 further document that province-level employment gains in the targeted areas stem almost 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 19%, while it decreased by 2.7% in the rest of the country due to factor reallocation. Expressed in dollar values, these results imply that accounting for crowding-out effects from factor reallocation approximately halves the estimated output gains induced by CasMez's investments.

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 1.34. This result implies that the aggregate welfare benefits induced by CasMez outweighed its costs.[2] However, we estimate modest long-run effects on the regional differentials in output per worker. Examined through the lenses of our model, this implies that the South vs. Center-North convergence in output per worker observed between 1951 and 2011 is mostly a consequence of high labor mobility from the South to the Center-North and diminishing returns to labor rather than of the program itself.

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 larger than those of CasMez. Therefore, we conclude that CasMez was cost-effective but not optimal. Second, we perform the cost-benefit analysis in a counterfactual scenario with no labor mobility and find that the program would have induced larger output gains due to the absence of crowding-out effects from factor mobility, lower welfare benefits due to the inability for individuals to move across regions, and would have markedly reduced the regional differentials in output per worker between the Center-North and the South.

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

[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 1.71.

[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.

gains from regional development programs are curtailed by their effect on factor reallocation.[4] Specifically, we estimate a high degree of labor mobility in the long run, which increases crowding-out effects on the non-targeted regions, thus reducing the aggregate effects of the program. 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 1956; Eckaus 1961; 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 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.

[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.

[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.

# 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 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 two decades 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 since unification 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 residents – 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]

[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.

[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.

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 A.1 shows the territory covered by CasMez's jurisdiction. Between 1950 and 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 A.2a 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.[10] Figure A.2b 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] 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*

[10] Throughout its activity, CasMez financed and executed significant investments in water and electricity provision, roads, waste management, ports, and the prevention of natural calamities. A smaller amount of resources was devoted to other infrastructures, including railways and airports, tourism, training programs, schools, hospitals, and sports facilities.

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

*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 Effects 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 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 measure yearly province-to-province migration flows, as in Bonifazi and Heins (2000). 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.

[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.

### 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 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.3 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 $\alpha_i$ denotes municipality fixed effects, $\delta_t$ 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 $\beta_k$ denotes the dynamic coefficients of interest. $Y_{it}$ denotes cumulative per-capita investments – the sum of public infrastructure spending and firm financial incentives divided

[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.

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 2 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 (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 3, 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. 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.

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

Figure A.4 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 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, $\delta_t$ 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 $\beta_k$ 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 $\beta_k$ 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.5. 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 4 and 5 display the coefficients $\beta_k$ for all outcome variables and periods to capture the dynamic

[15] Our benchmark specification excludes Rome from the control sample, but results do not change when Rome is included.
[16] The third-degree polynomial provides the best fit of the data on both sides of the border (see Figure A.5).

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 5, 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, 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.

Columns (1) and (2) of Table 1 summarize the results of 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 the two columns. 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

### 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.6 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:

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

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

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.

[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 $t$, $\alpha_p$ denotes province fixed effects, $\delta_t$ 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, $\Gamma_t$, to control for heterogeneous trends across provinces induced by differences in baseline industry mix, education levels, labor productivity, and region-specific characteristics.

Column (3) of Table 1 reports the 2SLS coefficients estimated at the province level from Equation (3), 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 2 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 3, column (1), reports the estimated coefficients for manufacturing, services, agriculture, and total employment. Column (2) instead displays the corresponding coefficients for manufacturing, services,

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

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 general equilibrium effects on both the 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 modest 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 sub-optimal.

[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:

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

where $y_{it}$ denotes output, $z_{it}$ represents regional productivity, $k_{it}$ is private capital, $F_i$ denotes the fixed factor, and $\ell_{it}$ 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:

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

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, $\ell_{it}$, divided by regional area, $A_i$), and $\omega_{it}$ captures region-specific idiosyncratic productivity shocks. The parameter $\eta_i$ 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 $\gamma$ 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:

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

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 $\ell_{it}$ 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

$$u^w_{it} = \ln(c^w_{it}) + \varepsilon_{it}, \tag{8}$$

where $c^w_{it}$ denotes workers' consumption and $\varepsilon_{it}$ 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, $c^w_{it} = w_{it}$, 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 $\varepsilon_{it}$, and chooses the location that maximizes $u^w_{it}$. Then, she supplies her unit of labor inelastically, earns $w_{it}$, and consumes $c^w_{it} = w_{it}$.

A worker chooses region $i$ if

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

Assuming $\varepsilon_{it}$ 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 $\chi$ in Equation (10) is the inverse long-run regional labor supply elasticity and 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) $\chi$ is associated to a lower (higher) degree of labor mobility and a less (more) elastic long-run regional labor supply elasticity. The parameter $\theta$ 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:

$$\ell_{it} + \ell_{jt} = \ell_t = \bar{w}_t^{\iota}, \tag{12}$$

where $\bar{w}_t = \lambda_{it} w_{it} + \lambda_{jt} w_{jt}$ denotes the average national wage rate and $\iota$ denotes the aggregate labor supply elasticity.

### 4.3 Private Capital

Capital owners are geographically immobile and rent capital to representative firms assumed to depreciate at the constant rate $\delta$. 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, $\phi$ the discount factor, and $\psi$ 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 $\theta \to 1$, 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 $\xi_t$ 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 $\phi$, and the intertemporal elasticity of substitution $\psi$. In the particular case of log-utility ($\psi = 1$), capital owners have a constant saving rate $\phi$, 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, $\phi$, and the depreciation rate, $\delta$.

### 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 $\eta_i$ 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, $y_i/\ell_i$, and the regional agglomeration elasticity, $\gamma$. 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 $y_j/\ell_j$, and the regional agglomeration elasticity, $\gamma$. 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, $\alpha$, and employment density, $\gamma$.

**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

[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.

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 $\alpha$ 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 so, 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 also 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 $\alpha$ 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. As in Solow (1956), steady-state savings are positive because they have to make up for capital depreciation and follow the *golden rule* which maximizes steady-state consumption.

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 minus the dollar value of their opportunity cost of working in the formal sector. 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 proportional 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] Following the same logic, the aggregate output gains derived from higher aggregate employment do not translate into proportional welfare gains for the marginal workers because they have to bear the opportunity cost of working in the

[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 and equals the difference between realized wages in the Center-North and wages in the South.

formal sector.[33] Workers' welfare gains induced by the regional development program can therefore be expressed as follows:

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

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 the welfare and the 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, the size of the crowding-in effects on output from non-employment, which measures the marginal workers' opportunity cost of working in the formal sector, and the parameter $\phi$, which governs the extent to which capital income gains translate into consumption gains. Intuitively, the first term makes welfare gains larger relative to output gains, while the other two terms make welfare gains smaller relative to output gains. In all our simulations, the sum of the second and third terms dominate the first, 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 $\beta$ and $\alpha$ and increasing in $\chi$. 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

[33] Similarly, we assume that the opportunity cost of working in the formal sector is constant across new workers and equals the realized average national wage rate.

$i$ on $(w_j/w_i)$:[34]

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

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, $\chi$, and the regional agglomeration elasticity, $\gamma$.

# 5 The Aggregate Effects of the Regional Big Push

## 5.1 Recovering the Structural Parameters

The structural parameters needed to make inference on the impact of the regional development program on output, welfare, and regional disparities are $\frac{\eta_i}{G_i}$, $\alpha$, $\beta$, $\gamma$, $\phi$, $\chi$, and $\iota$. 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 investments as a share of GDP in the 1970-2011 period are on average 0.23. We recover $\phi$ by dividing investments as a share of GDP by the capital share of income $\alpha = 0.3$, obtaining $\phi = \frac{0.23}{0.3} = 0.77$.[35] 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 $\gamma = 0.31$.[36]

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

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

[34]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 $\ln(G_i)$.

[35]Recall that $\phi$ denotes the 10-year discount factor and the steady-state saving rate of capital owners. Its empirical counterpart is therefore aggregate savings/investments (i.e., gross fixed capital formation) divided by capital – not total – income.

[36]In Appendix E we estimate $\gamma$ 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.

Table 1 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 relative value added per worker and wage rate to cumulative investments is $\frac{dw_i}{w_i}\frac{1}{G_i} - \frac{dw_j}{w_j}\frac{1}{G_i} = 0.0018$ (Table 3, column 3), suggesting that the wage rate increased only modestly in the targeted areas relative to the non-targeted areas. As a result of the program, workers who would have moved to and worked in the Center-North remained in the South, causing wages in the Center-North to increase relative to the counterfactual according to the semi-elasticity $\frac{dw_j}{w_j}\frac{1}{G_i} = -\frac{\beta-\gamma}{1-\alpha}\frac{d\ell_j}{\ell_j}\frac{1}{G_i} = 0.001$. Therefore, $\frac{dw_i}{w_i}\frac{1}{G_i} = 0.0018 + 0.001 = 0.0028$. Plugging these results, the estimate of $\gamma = 0.31$, and the calibration of $\alpha = 0.3$ and $\beta = 0.47$ in Equation (25), we obtain $\eta_S/G_S = 0.0059$.[37]

Finally, by combining Equations (7) and (10), we derive that the inverse regional labor supply elasticity $\chi$, 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 relative output per worker to cumulative investments is 0.0018 (Table 3, column 3) and the semi-elasticity of regional employment stemming from improved net migration flows is 0.0215 (Table 2, column 2), we obtain $\chi = 0.0018/0.0215 = 0.084$.[38] This value is low and implies that our benchmark calibration, informed by our empirical estimates, provides high labor mobility in the long run. Finally, the aggregate labor supply elasticity implied by our estimates is $\iota = 0.3$.[39] Table 4 lists the values of all 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 $\mu$. 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 $\mu$, 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 $\Delta W$ and $C$ the present discounted value of the aggregate welfare benefits and costs of the

[37] 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.

[38] Recall that $\chi$ denotes the inverse long-run regional labor supply elasticity. The long-run regional labor supply elasticity is therefore $1/0.084 = 11.9$.

[39] According to computations based on our estimates in Tables 1, 2, and 3, aggregate employment and the average national wage rate in 2011 are 0.45% and 1.5% higher than in the counterfactual. This implies $\iota = 0.45/1.5 = 0.3$. In interpreting a positive, though small, long-run labor supply elasticity, recall that it could also capture shifts from informal to formal labor.

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 now indicates a year and $\rho$ denotes the real annual discount rate. Furthermore, let $\tau$ 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.

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.[40] 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 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 5, Panel 1, summarizes the results of our model-based analysis. In 2011, productivity in the South was 9.9% higher than what it would have been without CasMez's investments. 6.3% 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 19% relative to the counterfactual (i.e., €332 billion vs. €279 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 1.9% higher than in the counterfactual (€1,330 billion vs. €1,305 billion). Notice that most of this increase is explained by the direct productivity effect of CasMez in the South (+2.1%), while crowding-in effects in the South and crowding-out effects in the Center-North

[40] 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.

tend to offset each other (-0.2%).

Our cost-benefit analysis (Panel 1, lower section) 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 $\rho = 0.03$,[41] $\tau = 0.3$, and a deadweight cost of taxation parameter of $\mu = 0.5$ (Heckman et al., 2010), we compute a BCR of 1.34. Figure 6 shows the sensitivity of the cost-benefit analysis over a range of real annual discount rates and deadweight cost of taxation parameters. The figure illustrates how, applying more (less) conservative assumptions on the discount rate and on the deadweight cost of taxation, the policy may turn out to be less (more) cost-effective in terms welfare.

Table 5 (Panel 1, lower section) and Figure 6 display the same analysis performed using output – as opposed to welfare – gains, first focusing only on outcomes measured in the South and then accounting for crowding-out effects on the Center-North. It is interesting to note that the partial-equilibrium cost-benefit figures would grossly over-estimate the cost-effectiveness of the program, as crowding-out effects reduce the output-based BCR by approximately 50%, from 3.53 to 1.80. Moreover, the net benefits of the policy in terms of output are higher than those in terms of welfare. This occurs because a considerable fraction of the output gains stemming from higher aggregate employment and private capital stock simply compensate the marginal workers and the capital owners for the opportunity cost of working in the formal sector and for higher savings, respectively.

Finally, an important result of our empirical analysis is that the regional development program had a modest impact on regional wage differentials. A small long-run effect on relative output per worker implies that $\chi$ is low, labor mobility is high, and the program hardly increases output per worker and wages in the targeted region relative to non-targeted regions. Consistently with this intuition, we find that CasMez decreased the 2011 relative wage gap between the Center-North and the South only by 2.3% relative to the counterfactual.[42] 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 substantially boosting *relative wages* in the South. Examined through the lenses of our model, these results imply that the South vs. Center-North convergence in output per worker observed between 1951 and 2011 is mostly a consequence of high labor mobility from the South to the Center-North and diminishing returns to labor rather than of the program itself.

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

[42] This corresponds to a 12% of the decrease in the Center-North vs. South wage gap occurred from 1951 to 2011.

### 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., $\eta_N/G_N$).

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, $\eta_i$, could depend on region-specific factors. We assume $\eta_S/G_S = 1.5 \times \eta_N/G_N$.[43] 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 $\eta_S/G_S = 0.67 \times \eta_N/G_N$.[44]

Table 5, Panel 2, indicates the BCR of such a program would have been 1.68. Comparing it with the corresponding 1.34 estimated for CasMez, we conclude that channeling the same amount of resources uniformly across regions would have resulted in larger aggregate welfare gains, even under conservative assumptions. This happens because, although – following our assumption on $\eta_S/G_S$ – 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 small 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 when assessing the cost-effectiveness of regional development programs. Crowding-out effects are relevant in our context because we estimate high labor mobility. The goal of

[43] 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., $G_N = 1.5 \times G_S$) for the whole 1951-2011 period.

[44] 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.

this counterfactual exercise is instead to replicate the assessment in a context of no labor mobility (i.e., $\chi \to \infty$), in which crowding-out effects on output due to labor reallocation are muted. This is particularly important in light of a recent literature documenting that, contrary to our context, labor mobility is often scarce in both developing and developed countries characterized by large regional productivity differentials (Manning and Petrongolo, 2017; 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 assume 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 0.3, which corresponds to $\iota$, the *aggregate* labor supply elasticity implied by our benchmark calibration with high mobility.

Table 5, Panel 3, reveals that the aggregate welfare gains in the absence of labor mobility would be smaller than those in our benchmark calibration. Specifically, the BCR in terms of welfare would be 1.24 (vs. 1.34) and the MVPF would be 1.46 (vs. 1.71).[45] 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 8.4% 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

[45] Introducing an infinite mobility cost increases the benefits of the policy in terms of output but reduces them in terms of welfare, relative to the baseline scenario. Larger effects on output arise because, with no labor mobility, the absence of crowding-out effects on the non-targeted regions dominates the lower output effects on the targeted regions. Lower effects on welfare arise because higher output in this scenario stems from higher aggregate employment associated with higher aggregate opportunity costs of working in the formal sector for the marginal workers.

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 almost 50%. Nevertheless, our cost-benefit analysis documents that these gains are 34% 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 have larger effects on output, smaller effects on welfare, and are more effective in reducing regional output per worker differentials. 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.

## References

**Albanese, Giuseppe, Guido de Blasio, and Lorenzo Incoronato**, "Government Transfers and Votes for State Intervention," 2023.

**Angrist, Joshua D, Guido W Imbens, and Donald B Rubin**, "Identification of causal effects using instrumental variables," *Journal of the American statistical Association*, 1996, *91* (434), 444–455.

**Atalay, Enghin, Ali Hortaçsu, Mustafa Runyun, Chad Syverson, and Mehmet Fatih Ulu**, "Micro-and Macroeconomic Impacts of a Place-Based Industrial Policy," Technical Report, National Bureau of Economic Research 2023.

**Bianchi, Nicola and Michela Giorcelli**, "Reconstruction Aid, Public Infrastructure, and Economic Development: The Case of the Marshall Plan in Italy," *The Journal of Economic History*, 2023, *83* (2), 501–537.

**Blanchard, Olivier Jean and Lawrence F. Katz**, "Regional Evolutions," *Brookings Papers on Economic Activity*, 1992, *23* (1), 1–76.

**Bonifazi, Corrado and Frank Heins**, "Long-term Trends of Internal Migration in Italy," *International Journal of Population Geography*, 2000, *6* (2), 111–131.

**Borgomeo, Letizia**, "Determinants and Outcomes of Industrial Policies: Evidence from Italy." PhD dissertation, University of Warwick 2018.

**Buscemi, Tancredi and Giulia Romani**, "The Political Economy of Regional Development: Evidence from the Cassa per il Mezzogiorno," *Available at SSRN 4308599*, 2022.

**Busso, Matias, Jesse Gregory, and Patrick Kline**, "Assessing the Incidence and Efficiency of a Prominent Place-Based Policy," *American Economic Review*, 2013, *103* (2), 897–947.

**Chenery, Hollis B.**, "Development Policies for Southern Italy," *The Quarterly Journal of Economics*, 1962, *76* (4), 515–547.

**Choi, Jaedo and Andrei A Levchenko**, "The Long-Term Effects of Industrial Policy," Technical Report, National Bureau of Economic Research 2021.

— **and Younghun Shim**, "Industrialization and the Big Push: Theory and Evidence from South Korea," Technical Report, International Monetary Fund 2024.

**Ciccone, Antonio and Robert E. Hall**, "Productivity and the Density of Economic Activity," *The American Economic Review*, 1996, *86* (1), 54–70.

**Cingano, Federico, Filippo Palomba, Paolo Pinotti, and Enrico Rettore**, "Making subsidies work: Rules vs. Discretion," *Bank of Italy Temi di Discussione (Working Paper) No*, 2022, *1364*.

**Clough, Shepard B. and Carlo Livi**, "Economic Growth in Italy: an Analysis of the Uneven Development of North and South," *The Journal of Economic History*, 1956, *16* (3), 334–349.

**Criscuolo, Chiara, Ralf Martin, Henry G. Overman, and John Van Reenen**, "Some Causal Effects of an Industrial Policy," *American Economic Review*, 2019, *109* (1), 48–85.

**Dabla-Norris, Era, Jim Brumby, Annette Kyobe, Zac Mills, and Chris Papageorgiou**, "Investing in public investment: an index of public investment efficiency," *Journal of Economic Growth*, 2012, *17*, 235–266.

**Eckaus, Richard S.**, "The North-South Differential in Italian Economic Development," *The Journal of Economic History*, 1961, *21* (3), 285–317.

**Eeckhout, Jan**, "Gibrat's Law for (All) Cities," *American Economic Review*, 2004, *94* (5), 1429–1451.

**Faini, Riccardo and Fabio Schiantarelli**, "Regional implications of industrial policy: the Italian case," *Journal of Public Policy*, 1983, *3* (1), 97–117.

**_ and _** , "Oligopolistic models of investment and employment decisions in a regional context: Theory and empirical evidence from a putty-clay model," *European Economic Review*, 1985, *27* (2), 221–242.

**Fajgelbaum, Pablo and Cecile Gaubert**, "Place-Based Policies: Lessons from Theory (Preliminary)," 2024.

**Fajgelbaum, Pablo D and Cecile Gaubert**, "Optimal spatial policies, geography, and sorting," *The Quarterly Journal of Economics*, 2020, *135* (2), 959–1036.

**Fan, Jingting and Ben Zou**, "Industrialization from scratch: The "Construction of Third Front" and local economic development in China's hinterland," *Journal of Development Economics*, 2021, *152*, 102698.

**Felice, Emanuele**, "The Roots of a Dual Equilibrium: GDP, Productivity, and Structural Change in the Italian Regions in the Long Run (1871–2011)," *European Review of Economic History*, 2019, *23* (4), 499–528.

**_ and Amedeo Lepore**, "State Intervention and Economic Growth in Southern Italy: The Rise and Fall of the 'Cassa per il Mezzogiorno' (1950–1986)," *Business History*, 2017, *59* (3), 319–341.

**Fernández-Villaverde, Jesús, Dario Laudati, Lee Ohanian, and Vincenzo Quadrini**, "Accounting for the Duality of the Italian Economy," *Review of Economic Dynamics*, 2023.

**Glaeser, Edward L. and Joshua D. Gottlieb**, "The Economics of Place-Making Policies," Technical Report, National Bureau of Economic Research 2008.

**Grembi, Veronica, Tommaso Nannicini, and Ugo Troiano**, "Do fiscal rules matter?," *American Economic Journal: Applied Economics*, 2016, pp. 1–30.

**Griliches, Zvi**, "Production Functions in Manufacturing: Some Preliminary Results," in "The Theory and Empirical Analysis of Production," NBER, 1967, pp. 275–340.

**Heckman, James J, Seong Hyeok Moon, Rodrigo Pinto, Peter A Savelyev, and Adam Yavitz**, "The rate of return to the HighScope Perry Preschool Program," *Journal of public Economics*, 2010, *94* (1-2), 114–128.

**Heise, Sebastian and Tommaso Porzio**, "Labor misallocation across firms and regions," Technical Report, National Bureau of Economic Research 2022.

**Hendren, Nathaniel and Ben Sprung-Keyser**, "A unified welfare analysis of government policies," *The Quarterly Journal of Economics*, 2020, *135* (3), 1209–1318.

**_ and _** , "The case for using the MVPF in empirical welfare analysis," Technical Report, National Bureau of Economic Research 2022.

**Hirschman, Albert O.**, "The Strategy of Economic Development," 1958.

**Hsieh, Chang-Tai and Enrico Moretti**, "Housing Constraints and Spatial Misallocation," *American Economic Journal: Macroeconomics*, 2019, *11* (2), 1–39.

**_ and Peter J. Klenow**, "Misallocation and Manufacturing TFP in China and India," *The Quarterly Journal of Economics*, 2009, *124* (4), 1403–1448.

**Incoronato, Lorenzo and Salvatore Lattanzio**, "Place-based industrial policies and local agglomeration in the long run," *Working Paper*, 2024.

**Juhász, Réka, Nathan J Lane, and Dani Rodrik**, "The New Economics of Industrial Policy," Technical Report, National Bureau of Economic Research 2023.

**Kantor, Shawn and Alexander T. Whalley**, "Moonshot: Public R&D and Growth," Technical Report, National Bureau of Economic Research 2023.

**Kim, Minho, Munseob Lee, and Yongseok Shin**, "The Plant-Level View of an Industrial Policy: The Korean Heavy Industry Drive of 1973," Technical Report, National Bureau of Economic Research 2021.

**Kleinman, Benny, Ernest Liu, and Stephen J. Redding**, "Dynamic Spatial General Equilibrium," *Econometrica*, 2023, *91* (2), 385–424.

**Kline, Patrick and Enrico Moretti**, "Local Economic Development, Agglomeration Economies, and the Big Push: 100 years of evidence from the Tennessee Valley Authority," *The Quarterly Journal of Economics*, 2014, *129* (1), 275–331.

**Krugman, Paul**, "History Versus Expectations," *The Quarterly Journal of Economics*, 1991, *106* (2), 651–667.

**Lagakos, David, Ahmed Mushfiq Mobarak, and Michael E Waugh**, "The welfare effects of encouraging rural–urban migration," *Econometrica*, 2023, *91* (3), 803–837.

**Lane, Nathan**, "Manufacturing Revolutions: Industrial Policy and Industrialization in South Korea," *Available at SSRN 3890311*, 2022.

**Manning, Alan and Barbara Petrongolo**, "How local are labor markets? Evidence from a spatial job search model," *American Economic Review*, 2017, *107* (10), 2877–2907.

**Marshall, Alfred**, *The Principles of Economics* number marshall1890. In 'History of Economic Thought Books.', McMaster University Archive for the History of Economic Thought, 1890.

**Moretti, Enrico**, "Workers' education, spillovers, and productivity: evidence from plant-level production functions," *American Economic Review*, 2004, *94* (3), 656–690.

**Murphy, Kevin M., Andrei Shleifer, and Robert W. Vishny**, "Industrialization and the Big Push," *Journal of Political Economy*, 1989, *97* (5), 1003–1026.

**Neumark, David and Helen Simpson**, "Place-Based Policies," in "Handbook of Regional and Urban Economics," Vol. 5, Elsevier, 2015, pp. 1197–1287.

**Pritchett, Lant**, "The tyranny of concepts: CUDIE (cumulated, depreciated, investment effort) is not capital," *Journal of Economic Growth*, 2000, *5*, 361–384.

**Restuccia, Diego and Richard Rogerson**, "Policy Distortions and Aggregate Productivity with Heterogeneous Establishments," *Review of Economic Dynamics*, 2008, *11* (4), 707–720.

**Roback, Jennifer**, "Wages, Rents, and the Quality of Life," *Journal of Political Economy*, 1982, *90* (6), 1257–1278.

**Rosenstein-Rodan, Paul N.**, "Problems of Industrialisation of Eastern and South-Eastern Europe," *The Economic Journal*, 1943, *53* (210-211), 202–211.

**Siegloch, Sebastian, Nils Wehrhöfer, and Tobias Etzel**, "Direct, Spillover and Welfare Effects of Regional Firm Subsidies," *ZEW-Centre for European Economic Research Discussion Paper*, 2021, (21-038).

**Slattery, Cailin and Owen Zidar**, "Evaluating State and Local Business Incentives," *Journal of Economic Perspectives*, 2020, *34* (2), 90–118.

**Solow, Robert M.**, "A Contribution to the Theory of Economic Growth," *The Quarterly Journal of Economics*, 1956, *70* (1), 65–94.

**SVIMEZ**, *150 Anni di Statistiche Italiane: Nord e Sud, 1861-2011*, Il mulino, 2011.

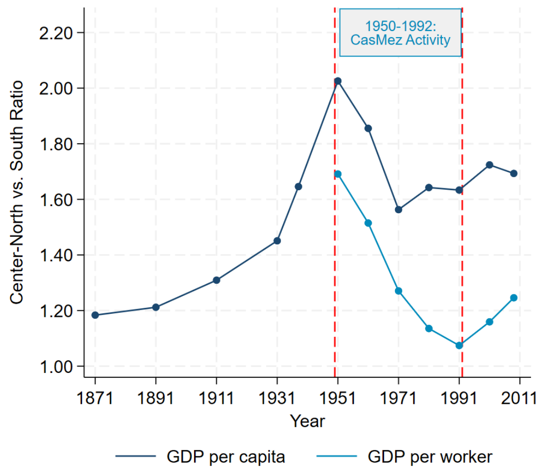
**Swan, Trevor W.**, "Economic Growth and Capital Accumulation," *Economic Record*, 1956, *32* (2), 334–361.

**Vecchi, Giovanni et al.**, *In ricchezza e in Povertà: il Benessere degli Italiani dall'Unità a Oggi*, Il mulino, 2011.

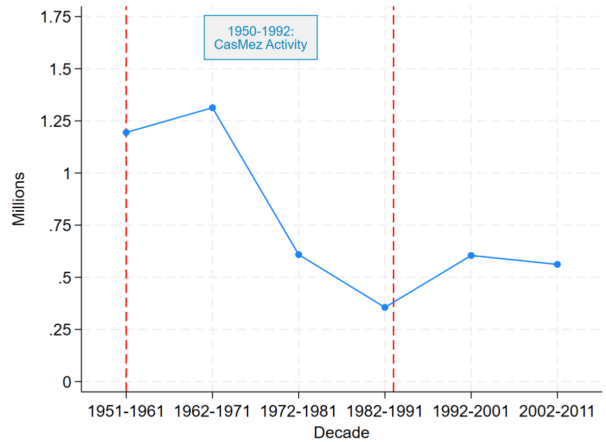
# Main Figures

Figure 1: Regional Differentials and Migration Flows over Time

(a) Center-North vs. South Productivity Divide



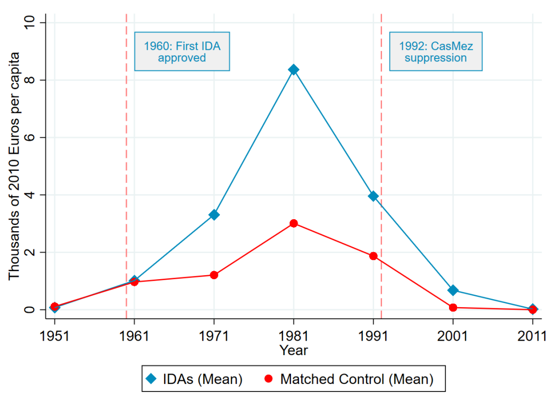

(b) South → Center-North Net Migration Flows



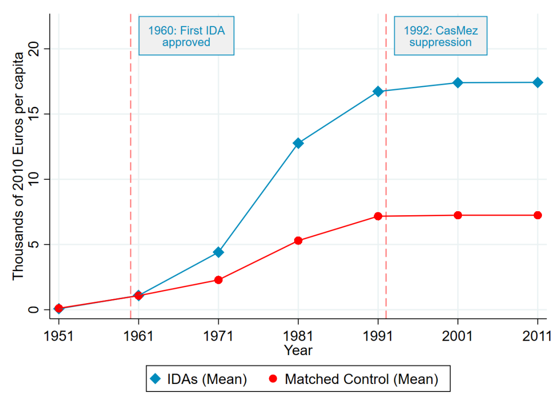

*Notes.* Figure 1a shows the time series of the Center-North vs. South per-capita GDP ratio for the 1871-2011 period. The light blue line displays the Center-North vs. South per-worker GDP ratio for the 1951-2011 period. For both series, a ratio of 1 implies no gap. Data source: Vecchi et al. (2011). 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: IDAs vs. Non-IDAs - First Stage

(a) Decade-Specific Investments



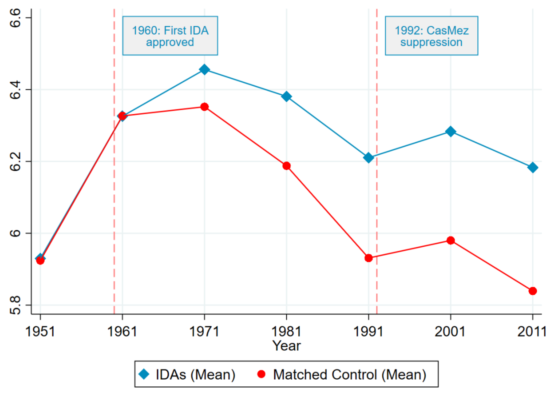

(b) Cumulative Investments



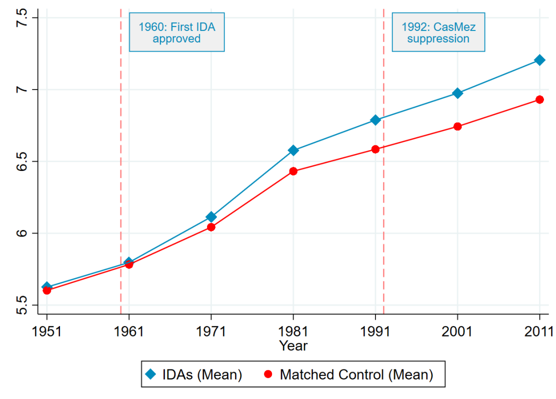

*Notes.* The figure plots the treatment vs. control group means of the first-stage outcome variables in Equation (1). Recall that the unit of observation is a municipality and this dynamic difference-in-differences design compares each municipality belonging to IDAs with one municipality not belonging 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 3: IDAs vs. Non-IDAs - Reduced Form

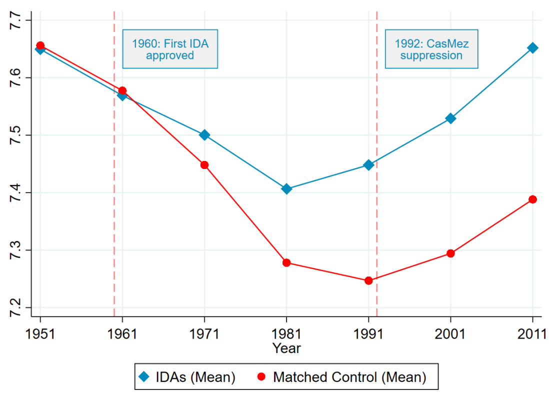
(a) Log Manufacturing Employment



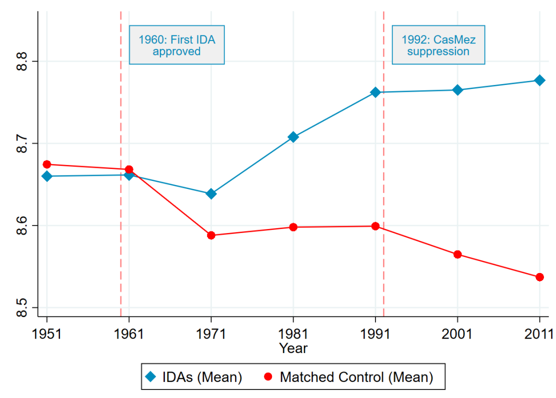

(b) Log Services Employment



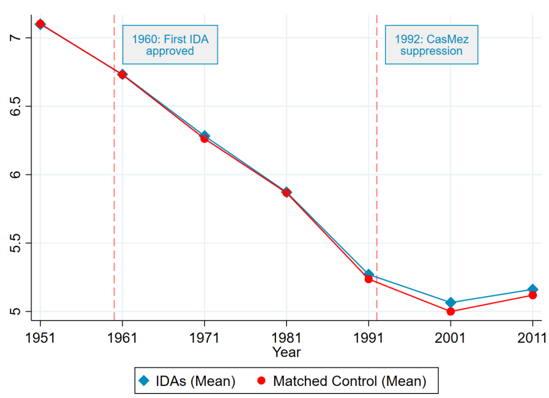

(c) Log Employment



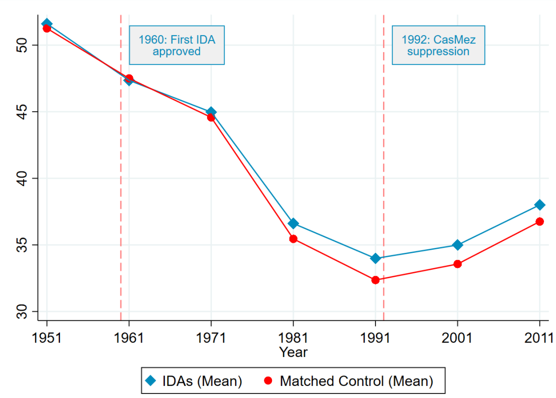

(d) Log Population




(e) Log Agriculture Employment



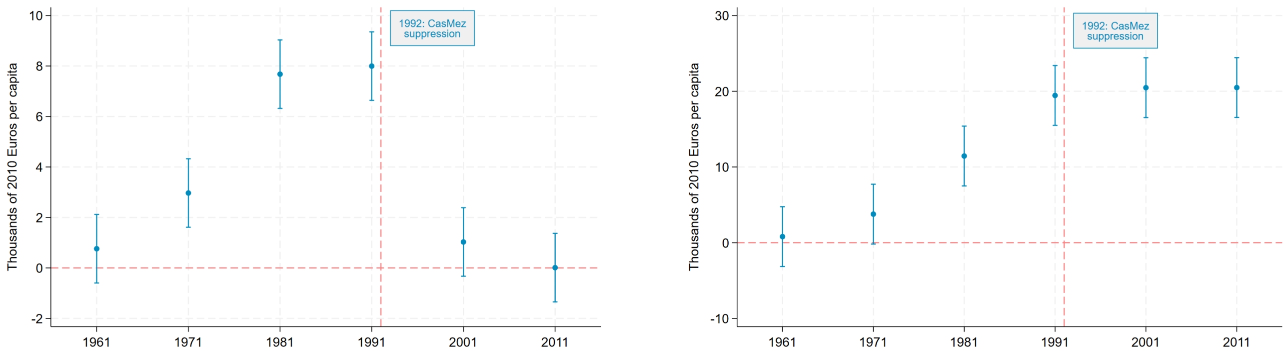

(f) Employment Rate




*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 4: Dynamic Long Difference-in-Discontinuities - First Stage

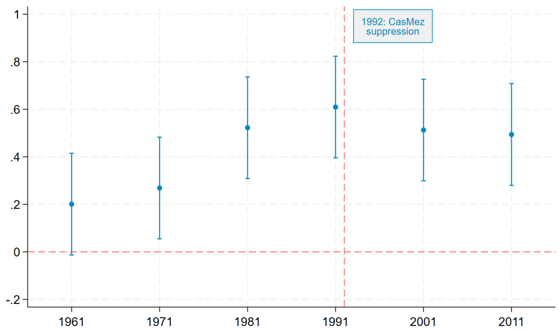
(a) Decade-Specific Investments (b) Cumulative Investments



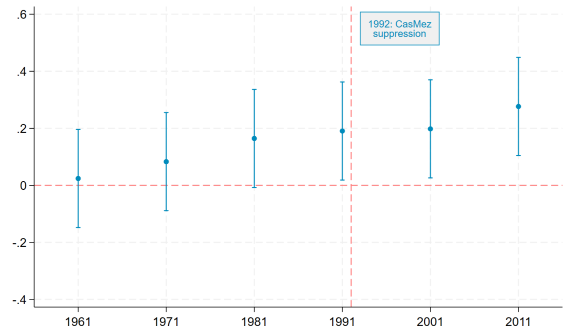

*Notes.* The figure shows the coefficients $\hat{\beta}_k$ estimated from Equation (2) and 95% cluster-robust confidence intervals. Recall that the unit of observation is a municipality, and this dynamic long difference-in-discontinuities design compares municipalities just South vs. North of CasMez's 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 5: Dynamic Long Difference-in-Discontinuities - Reduced Form

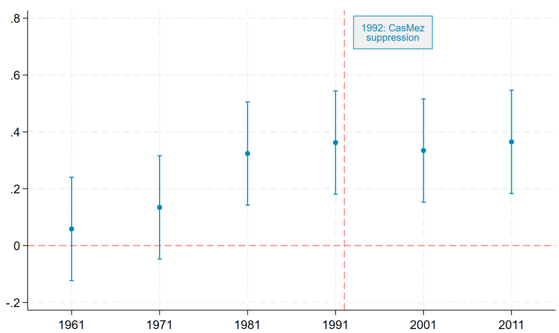
(a) Log Manufacturing Employment



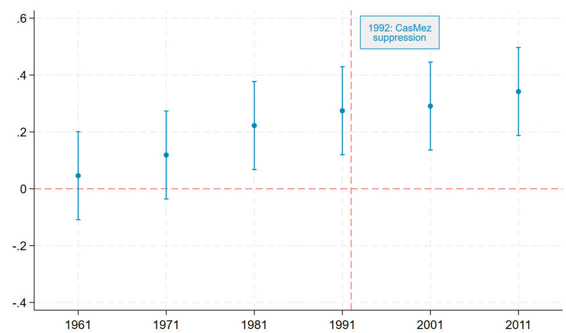

(b) Log Services Employment



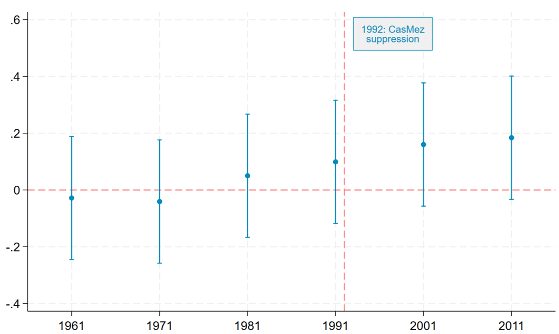

(c) Log Total Employment



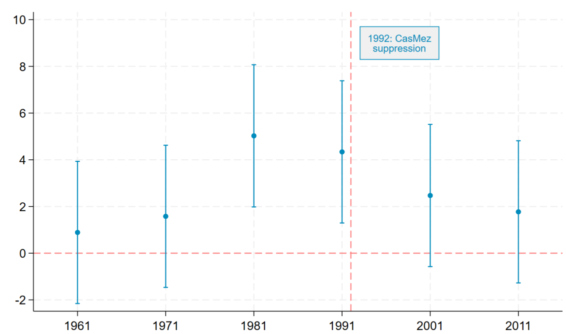

(d) Log Population




(e) Log Agriculture Employment

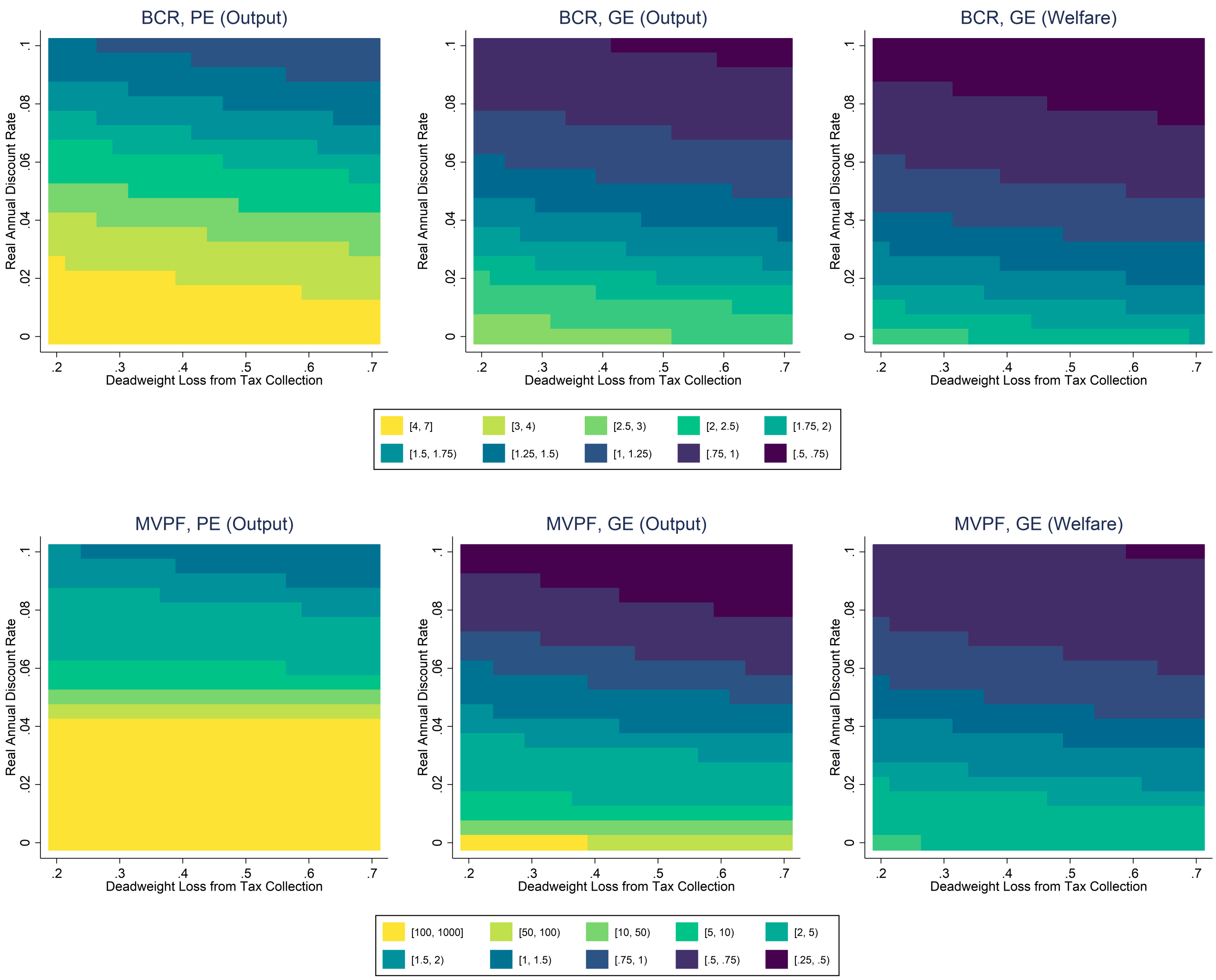



(f) Employment Rate




*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 6: Sensitivity of CasMez Cost-Benefit Measures to Real Annual Discount Factor and Deadweight Cost of Taxation ($\mu$)




*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 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 2: 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 Per Capita | .0233***<br>(.009) | .0215**<br>(.010) | .0104*<br>(.0063) | -.0065<br>(.0052) | .0168**<br>(.0085) | .0112**<br>(.0053) | .0088*<br>(.0051) | .0024<br>(.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 3: 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*** | .0018 | - |
| | (.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 4: Structural Parameters and Measured Quantities

| | Parameter | Meaning | Value | Method | Source |
|---|---|---|---|---|---|
| | $\phi$ | 10-year discount factor | 0.77 | Calibration | - |
| $\rightarrow$ | $\rho$ | Real annual discount rate | 0.03 | Calibration | - |
| | $\alpha$ | Capital share of income | 0.3 | Calibration | Griliches (1967) |
| | $(1-\alpha)/\beta$ | Regional labor demand elasticity | 1.5 | Calibration | Kline and Moretti (2014) |
| | $\gamma$ | Agglomeration elasticity | 0.31 | Estimation/Calibration | Table E.1 |
| | $\eta_S/G_S$ | Semi-elasticity of regional productivity | 0.0059 | Estimation/Calibration | Tables 1 and 3 |
| | $\chi$ | Inverse regional labor supply elasticity | 0.084 | Estimation | Tables 2 and 3 |
| | $\iota$ | Aggregate labor supply elasticity | 0.3 | Estimation/Calibration | Tables 1, 2, and 3 |
| | $\tau$ | Effective tax rate | 0.3 | Calibration | - |
| | $\mu$ | Deadweight cost of taxation | 0.5 | Calibration | Heckman et al. (2010) |
| | **Quantity** | **Meaning** | | **Method** | **Source** |
| | $dG_S$ | CasMez investments | | Measurement | ASET |
| | $y_S$ | VA in the South | | Measurement | Istituto Tagliacarne |
| | $y_N$ | VA in the Center-North | | Measurement | Istituto Tagliacarne |
| | $\ell_S$ | Employment in the South | | Measurement | Decennial Census |
| | $\ell_N$ | Employment in the Center-North | | Measurement | Decennial Census |

*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 5: 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 | . | +9.9% | -1.1% | . | +1.5% | +2.3% | . | +8.2% | - |
| - Public capital | . | +6.3% | - | . | +2.4% | +1.6% | . | +6.3% | - |
| - Agglomeration | . | +3.6% | -1.1% | . | -0.9% | +0.7% | . | +1.9% | - |
| Value-added | +1.9% | +19.0% | -2.7% | +3.3% | +0.8% | +3.9% | +3.0% | +14.0% | - |
| - Direct | +2.1% | +9.8% | - | +0.7% | +3.4% | +2.3% | +1.9% | +9.0% | - |
| - Crowding In/Out | -0.2% | +9.2% | -2.7% | +2.5% | -2.6% | +1.6% | +1.1% | +5.0% | - |
| Wage Gap (North vs. South) | -2.3% | | | -0.3% | | | -8.4% | | |

| *Cost-benefit analysis* | BCR | MVPF | BCR | MVPF | BCR | MVPF |
|---|---|---|---|---|---|---|
| PE South: Output | 3.53 | $\infty$ | . | . | 2.61 | $\infty$ |
| GE: Output | 1.80 | 3.69 | 2.63 | $\infty$ | 2.61 | $\infty$ |
| GE: Welfare | 1.34 | 1.71 | 1.68 | 2.97 | 1.24 | 1.46 |

*Notes.* The upper panel of the table reports the percentage effects of the regional development program on 2011 TFP, value added, and the ratio between output per worker in the Center-North and output per worker in the South (Wage Gap). 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). The effect on the wage gap in Panel 3 is computed assuming an aggregate labor supply elasticity of 0.5. 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).

# Online Appendix

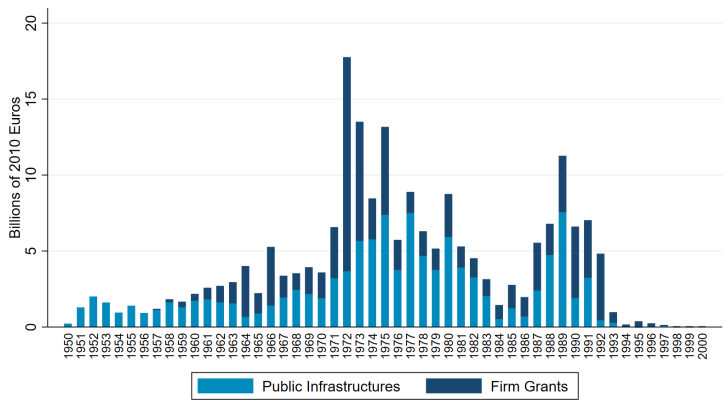
## A Additional Figures and Tables

Figure A.1: CasMez's Jurisdiction

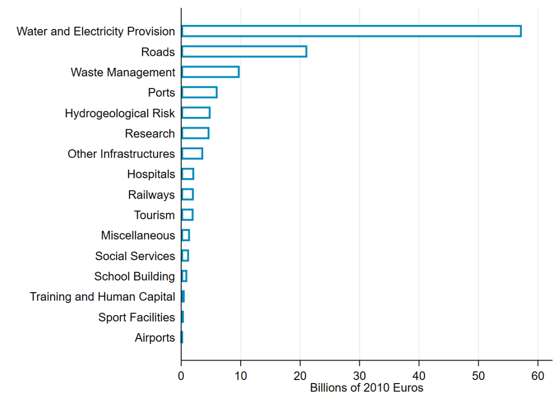

*Notes*. The figure shows a map of Italy divided into municipal territories. The dark blue areas denote municipalities belonging to CasMez's jurisdiction. CasMez's jurisdiction includes the regions of Abruzzo, Molise, Campania, Apulia, Basilicata, Calabria, Sicily, and Sardinia, the provinces of Latina 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 A.2: CasMez's Activity

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

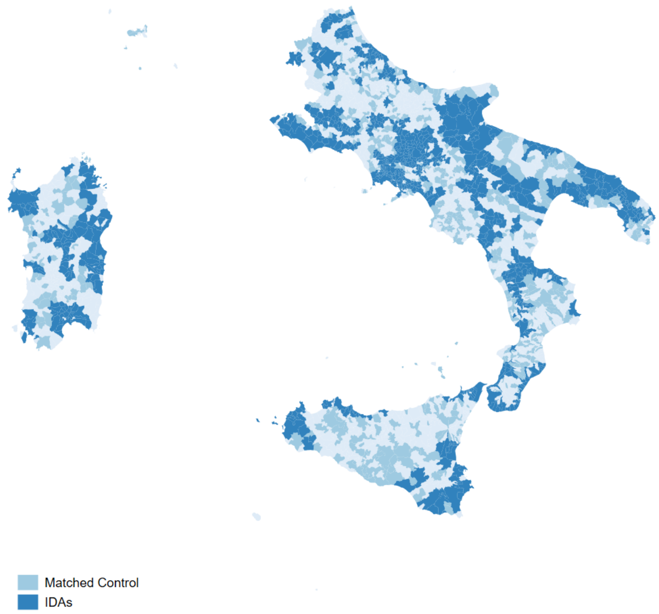



(b) Public Infrastructures Investments, by type




*Notes.* Figure A.2a 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 A.2b 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 A.3: IDA Municipalities vs. Matched Non-IDA Municipalities



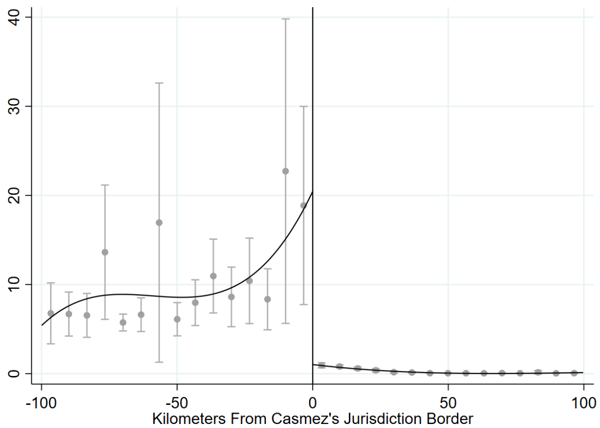

*Notes.* The figure shows a map of CasMez's jurisdiction. The dark blue areas indicate municipalities belonging to IDAs, while light blue areas indicate 1-to-1 matched control municipalities not belonging to any IDA. Treated and control municipalities are matched on a set of 1951 characteristics and 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.4: Municipalities North vs. South of CasMez's Jurisdiction Border

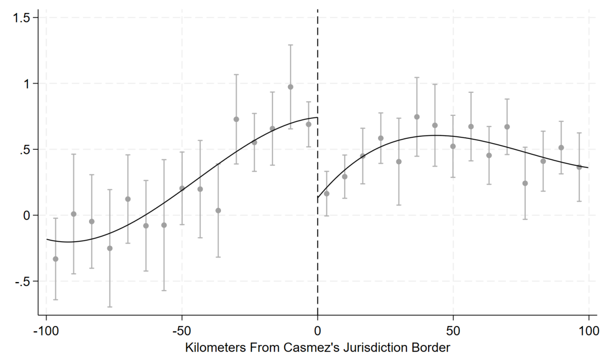

*Notes.* The figure shows a map of the municipalities 100 km North vs. South of CasMez's jurisdiction border. The light blue areas indicate municipalities located North of the border, while the dark blue areas indicate municipalities located South of the border.

Figure A.5: 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.6: 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:* | | |
| | 1.34 | 1.71 |
| *Place-neutral:* $\frac{\eta_S/G_S}{\eta_N/G_N}$ | | |
| 0.5 | 4.20 | $\infty$ |
| 0.67 | 3.23 | $\infty$ |
| 1 | 2.30 | 13.92 |
| 1.5 | 1.68 | 2.97 |
| 2 | 1.37 | 1.79 |
| 2.5 | 1.18 | 1.34 |

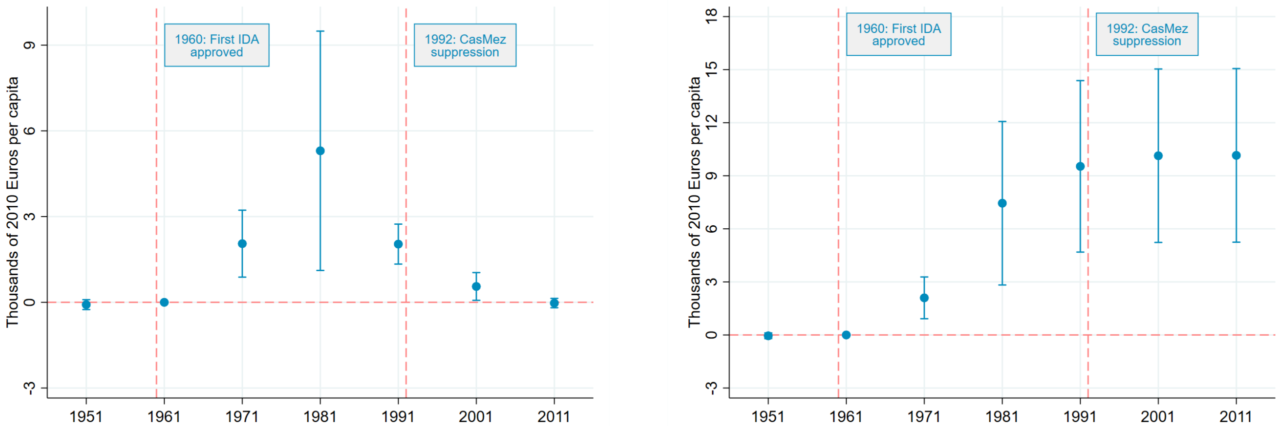
*Notes.* The upper panel reports the general-equilibrium Benefits-to-Costs (BCR) ratio and Marginal Value of Public Funds (MVPF) implied by the estimated aggregate effects of the actual CasMez, which focused on the South only. The lower panel reports the counterfactual estimates when CasMez funds are allocated to regions proportionally to their population (*place-neutral program*), under different assumptions about the ratio of long-run semi-elasticities of regional productivity to cumulative investments, $\frac{\eta_S/G_S}{\eta_N/G_N}$, which governs the direct impact of public funds on productivity in the South relatively to the Center-North.

## 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

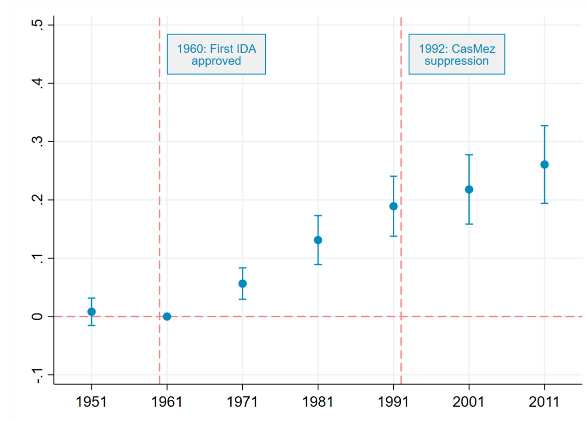



*Notes.* The figure shows the coefficients $\hat{\beta}_k$ estimated from Equation (1). Recall that the unit of observation is a municipality and this dynamic difference-in-differences design compares each municipality belonging to IDAs with one municipality not belonging to IDAs, matched on 1951 characteristics 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.

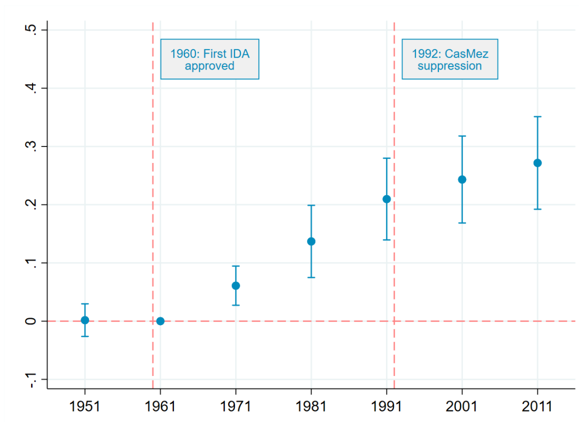
Figure B.2: IDAs vs. non-IDAs - Reduced Form

(a) Log Manufacturing Employment

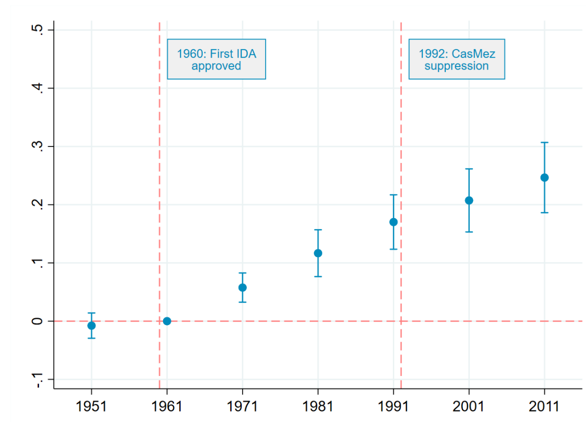

(b) Log Services Employment



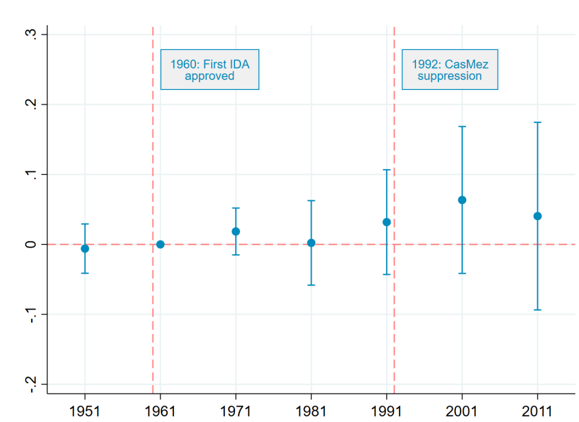

(c) Log Employment



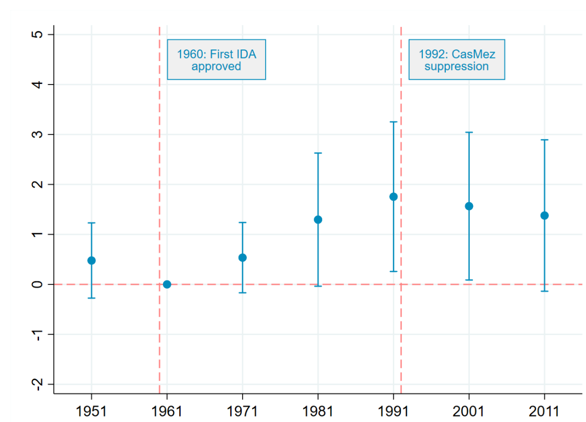

(d) Log Population




(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.

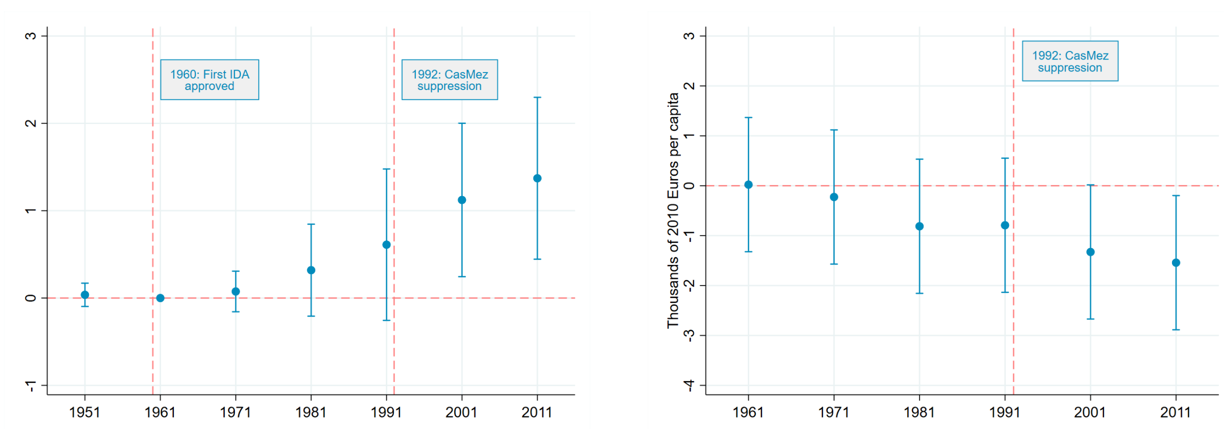
# C Results on Municipality-Level Human Capital

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 $\ell_{it}$ employment. Regional productivity $z_{it}$ is further defined as follows:

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

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, $\frac{\ell_{it-1}}{A_i}$ denotes lagged employment density, and $\omega_{it}$ 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 $\gamma$ denotes the elasticity of regional productivity to lagged employment density, 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 $\pi_{it}$ 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 $\varepsilon_{it}$ 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 $\varepsilon_{it}$, 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 $\varepsilon_{it}$ 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 $\varepsilon_{it}$ 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 $\theta$ of workers willing to relocate can do that. As a consequence, we can derive the law of motion of regional employment as follows:

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

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

Finally, the aggregate labor supply takes the following form:

$$\ell_{it} + \ell_{jt} = \ell_t = \bar{w}_t^{\iota}, \tag{D.19}$$

where $\bar{w}_t = \lambda_{it}w_{it} + \lambda_{jt}w_{jt}$ denotes the average national wage rate and $\iota$ denotes the aggregate labor supply elasticity.

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

$$\upsilon_t^k = E_t \sum_{s=0}^{\infty} \phi^{t+s} \frac{(c_{t+s}^k)^{1-\psi}}{1-\frac{1}{\psi}}, \tag{D.20}$$

where $\phi$ denotes the discount factor, $c_t^k$ denotes capital owner's consumption, and $\psi$ 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 $\delta$ denotes the depreciation rate of capital.[46] After defining $R_t = r_t + 1 - \delta$, the gross return on capital, the capital owners' problem takes the following form:

$$\max_{c_{t+s}^k, k_{t+s+1}} \frac{(c_t^k)^{1-\psi}}{1-\frac{1}{\psi}} + \phi E_t \upsilon(k_{t+1}, t+1) \tag{D.21}$$

subject to

$$c_t^k + k_{t+1} = R_t k_t \tag{D.22}$$

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

$$c_t^k = \xi_t R_t k_t \tag{D.23}$$

$$k_{t+1} = (1-\xi_t) R_t k_t \tag{D.24}$$

where $\xi_t$ is defined recursively as follows:

$$\xi_t^{-1} = 1 + \phi^{\psi} (E_t[R_{t+1}^{\frac{\psi-1}{\psi}} \xi_{t+1}^{-\frac{1}{\psi}}])^{\psi} \tag{D.25}$$

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 $\phi$, and the inter-temporal elasticity of substitution $\psi$. In the particular case of log-utility ($\psi = 1$), capital owners have a constant saving rate $\phi$, 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: $c_{it}^w$, $c_{jt}^w$, $c_t^k$, $c_t$, $z_{it}$, $z_{jt}$, $y_{it}$, $y_{jt}$, $y_t$, $k_{it}$, $k_{jt}$, $k_t$, $\lambda_{it}$, $\lambda_{jt}$, $\ell_{it}$, $\ell_{jt}$, $\ell_t$, $w_{it}$, $w_{jt}$, $r_{it}$, $r_{jt}$, $r_t$, $R_t$, $\xi_t$.

List of parameters and pre-determined variables: $\alpha$, $\beta$, $\eta_i$, $\gamma$, $\bar{z}_i$, $\bar{z}_j$, $F_i$, $F_j$, $\chi$, $\iota$, $\theta$, $\psi$, $\phi$, $\delta$.

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

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

List of equations:

1. Region $i$'s workers' consumption: $c^w_{it} = w_{it}$
2. Region $j$'s workers' consumption: $c^w_{jt} = w_{jt}$
3. Aggregate capital owners' consumption: $c^k_t = \xi_t R_t k_t$
4. Aggregate consumption: $c_t = c^w_{it} + c^w_{jt} + c^k_t$
5. Definition of region $i$'s productivity: $z_{it} = \bar{z}_i \bar{z}_t G_{it}^{\eta_i} \left(\frac{\ell_{it-1}}{A_i}\right)^{\gamma} \omega_{it}$
6. Definition of region $j$'s productivity: $z_{jt} = \bar{z}_j \bar{z}_t G_{jt}^{\eta_j} \left(\frac{\ell_{jt-1}}{A_j}\right)^{\gamma} \omega_{jt}$
7. Region $i$'s production function: $y_{it} = z_{it} k^{\alpha}_{it} F^{\beta}_i \ell^{1-\alpha-\beta}_{it}$
8. Region $j$'s production function: $y_{jt} = z_{jt} k^{\alpha}_{jt} F^{\beta}_j \ell^{1-\alpha-\beta}_{jt}$
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. Aggregate labor supply: $\ell_t = (\lambda_{it} w_{it} + \lambda_{jt} w_{jt})^{\iota}$
20. Region $i$'s capital demand: $k_{it} = \left[\frac{\alpha z_{it} F^{\beta}_i \ell^{1-\alpha-\beta}_{it}}{r_{it}}\right]^{\frac{1}{1-\alpha}}$
21. Region $j$'s capital demand: $k_{jt} = \left[\frac{\alpha z_{jt} F^{\beta}_j \ell^{1-\alpha-\beta}_{jt}}{r_{jt}}\right]^{\frac{1}{1-\alpha}}$
22. Optimal saving/consumption of capital owners: $\xi^{-1}_t = 1 + \phi^{\psi} (E_t[R_{t+1}^{\frac{\psi-1}{\psi}} \xi_{t+1}^{-\frac{1}{\psi}}])^{\psi}$
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: $c^w_{i,ss} = w_{i,ss}$
2. Region $j$'s workers' consumption: $c^w_{j,ss} = w_{j,ss}$
3. Aggregate capital owners' consumption: $c^k_{ss} = \xi_{ss} R_{ss} k_{ss}$
4. Aggregate consumption: $c_{ss} = c^w_{i,ss} + c^w_{j,ss} + c^k_{ss}$
5. Definition of region $i$'s productivity: $z_{it} = \bar{z}_i \bar{z}_{ss} G^{\eta_i}_{i,ss} \left(\frac{\ell_{i,ss}}{A_i}\right)^{\gamma}$
6. Definition of region $j$'s productivity: $z_{j,ss} = \bar{z}_j \bar{z}_{ss} G^{\eta_j}_{j,ss} \left(\frac{\ell_{j,ss}}{A_i}\right)^{\gamma}$
7. Region $i$'s production function: $y_{i,ss} = z_{i,ss} k^{\alpha}_{i,ss} F^{\beta}_i \ell^{1-\alpha-\beta}_{i,ss}$
8. Region $j$'s production function: $y_{j,ss} = z_{j,ss} k^{\alpha}_{j,ss} F^{\beta}_j \ell^{1-\alpha-\beta}_{j,ss}$
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 $i$ : $\lambda_{i,ss} = \frac{w^{\frac{1}{\chi}}_{i,ss}}{w^{\frac{1}{\chi}}_{i,ss} + w^{\frac{1}{\chi}}_{j,ss}}$
14. Frictionless share of total employment in region $j$: $\lambda_{j,ss} = \frac{w^{\frac{1}{\chi}}_{j,ss}}{w^{\frac{1}{\chi}}_{i,ss} + w^{\frac{1}{\chi}}_{j,ss}}$
15. Region $i$'s labor demand: $\ell_{i,ss} = \left[\frac{(1-\alpha-\beta)}{w_{i,ss}}\right]^{\frac{1-\alpha}{\beta}} \left[\frac{\alpha}{r_{i,ss}}\right]^{\frac{\alpha}{\beta}} z^{\frac{1}{\beta}}_{i,ss} F_i$
16. Region $j$'s labor demand: $\ell_{j,ss} = \left[\frac{(1-\alpha-\beta)}{w_{j,ss}}\right]^{\frac{1-\alpha}{\beta}} \left[\frac{\alpha}{r_{j,ss}}\right]^{\frac{\alpha}{\beta}} z^{\frac{1}{\beta}}_{j,ss} F_j$
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. Aggregate labor supply: $\ell_{ss} = (\lambda_{i,ss} w_{i,ss} + \lambda_{j,ss} w_{j,ss})^{\iota}$
20. Region $i$'s capital demand: $k_{i,ss} = \left[\frac{\alpha z_{i,ss} F^{\beta}_i \ell^{1-\alpha-\beta}_{i,ss}}{r_{i,ss}}\right]^{\frac{1}{1-\alpha}}$
21. Region $j$'s capital demand: $k_{j,ss} = \left[\frac{\alpha z_{j,ss} F^{\beta}_j \ell^{1-\alpha-\beta}_{j,ss}}{r_{j,ss}}\right]^{\frac{1}{1-\alpha}}$
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:

$$y_{i,ss} = \left[\frac{\alpha^{\alpha} z_{i,ss} F^{\beta}_i \ell^{1-\alpha-\beta}_{i,ss}}{r^{\alpha}_{ss}}\right]^{\frac{1}{1-\alpha}}, \tag{D.26}$$

where the subscript $SS$ indicates steady-state values. Since

$$z_{i,ss} = \bar{z}_i \bar{z}_{ss} G_{i,ss}^{\eta_i} \ell_{i,ss}^{\gamma}, \tag{D.27}$$

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

$$\ln(y_{i,ss}) = C_{1i} + \frac{\eta_i}{1-\alpha} \ln(G_{i,ss}) + \frac{1-\alpha-\beta+\gamma}{1-\alpha} \ln(\ell_{i,ss}) \tag{D.28}$$

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

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

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:

$$\frac{dy_{ss}}{dG_{j,ss}} = \frac{\eta_i}{1-\alpha} \frac{y_{j,ss}}{G_{j,ss}} + \frac{1-\alpha-\beta+\gamma}{1-\alpha} \left( \frac{d\ell_{j,ss}}{dG_{j,ss}} \frac{y_{j,ss}}{\ell_{j,ss}} + \frac{d\ell_{i,ss}}{dG_{j,ss}} \frac{y_{i,ss}}{\ell_{i,ss}} \right). \tag{D.30}$$

**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:

$$\frac{w_{i,ss}}{w_{j,ss}} = \left( \frac{z_{i,ss}}{z_{j,ss}} \right)^{\frac{\chi}{\beta+(1-\alpha)\chi}} \left( \frac{F_i}{F_j} \right)^{\frac{\beta\chi}{\beta+(1-\alpha)\chi}}. \tag{D.31}$$

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 $\beta$ and $\alpha$ and increasing in $\chi$. 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 $(w_{i,ss}/w_{j,ss})$:[47]

$$\frac{d\left(\frac{w_{i,ss}}{w_{j,ss}}\right)}{dG_j} = -\frac{\chi}{\beta-\gamma+(1-\alpha)\chi} \frac{\eta_i}{G_{j,ss}} \frac{w_{i,ss}}{w_{j,ss}}. \tag{D.32}$$

The effectiveness of public investments in reducing steady-state real wage differentials increases in $\frac{\eta_i}{G_{j,ss}}$ (i.e.,

[47] 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 $\ln(G_{j,ss})$.

the semi-elasticity of regional productivity to public funds), $\chi$ (i.e., the inverse elasticity of regional labor supply), and $\gamma$ (i.e., the elasticity of regional productivity to regional employment or *agglomeration elasticity*).

## 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, $\gamma$. 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 $\nu_i$ denotes a region-specific constant term, $\delta_t$ 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 $(\gamma/\beta)$. Conveniently, $\nu_i$ is absorbed by unit fixed effects, and $\delta_t$ 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 $\nu_i$ denotes unit fixed effects, $\delta_t$ controls for time trends, $dG_i$ are cumulative investments per capita, $(\gamma/\beta)$ is the coefficient of interest, $(\ell_{it-1}/A_i)$ measures lagged employment density, $(y_{it}/\ell_{it})$ is output per worker, $\mathbf{X}'_{i1951}$ is a vector of baseline characteristics interacted with time dummies, $\Gamma_t$, to control for heterogeneous trends induced by differences in education levels, industry mix, and regions, and $\omega_{it}$ 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 $\gamma/\beta$ 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.