Reconstruction Aid, Public Infrastructure, and Economic Growth*

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Abstract

This paper studies the effects of international reconstruction aid on long-term economic development. It exploits plausibly exogenous differences between Italian provinces in the amount of grants disbursed through the Marshall Plan for the reconstruction of public infrastructure. Provinces that received more reconstruction grants experienced a larger increase in the number of industrial firms and workers. Individuals and firms in these areas also started developing more patents. The same provinces experienced a faster mechanization of the agricultural sector. Motorized machines, such as tractors, replaced workers and significantly boosted agricultural production. Finally, we show how reconstruction grants induced economic growth by allowing Italian provinces to modernize their transportation and communication networks damaged during WWII.

JEL Classification: H84, N34, N44, O12, O33
Keywords: international aid, economic growth, reconstruction grants, Marshall Plan, innovation

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1 Introduction

International aid is one of the main sources of revenues for many developing countries. Starting in 1970, the United Nations prompted member countries of the OECD's Development Assistance Committee (DAC) to budget at least 0.7 percent of their national income for development assistance.[1] In recent years, the UN re-endorsed this target by including it in the 2005 Millennium Development Goals and the subsequent 2015 Sustainable Development Goals. Between 1960 and 2013, DAC members transferred at least $3.5 trillion (2009 USD) to poorer countries (Qian, 2014).

Does foreign aid help the growth process of developing countries? There are several challenges to empirically answer this question. The main issue is that foreign aid is often endogenously distributed across and within countries. Moreover, foreign aid usually includes a number of interventions, such as the construction of public or private infrastructure, the distribution of food or drugs, and the provision of health assistance. These elements might have different, even opposite consequences on growth. Finally, due to data availability, most studies focus only on the short term. Some interventions, however, might require several years to fully exert their positive influence. Possibly as a consequence of these issues, the existing empirical evidence has produced mixed results on the relationship between aid and economic outcomes (Qian, 2014).

This paper studies the long-run effects of reconstruction aid on agricultural and industrial development. Specifically, it uses evidence from the Marshall Plan in Italy to estimate the effect of the reconstruction and modernization of public infrastructure on a wide array of economic outcomes. The Marshall Plan was an economic and financial aid program sponsored by the US that transferred approximately $130 billion (2010 USD) to Western and Southern Europe between 1948 and 1952. Getting more than 10% of total aid, Italy was the third largest recipient (Fauri, 2006).

We estimate the causal effects of the Marshall Plan aid by exploiting the geographical distribution of Allied bombings in Italy during the last stages of World War II (March 1944-April 1945). Specifically, we instrument the amount of reconstruction grants received by each Italian province with the amount of bombings dropped by Allied forces against the invading Nazi troops. This variable has two features that make it suitable to be a good instrumental variable. First, the Allies dropped these explosives when Italy had already quit the war by signing the Armistice of Cassibile (September 3, 1943). The geographical distribution of these air attacks, therefore, mostly followed the land battles between Allied and German troops on the Italian soil, which were plausibly not correlated with other factors (such as

[1] Resolution 2625 adopted by the UN General Assembly during its twenty-fifth session on October 24, 1970.

prewar economic conditions) that might have affected postwar growth. Second, some of the preferred targets were railways and roads, because many of these bombings intended to stop reinforcements and supplies from Germany. By targeting public infrastructure, these air attacks drew a large amount of reconstruction grants from the Marshall Plan. However, other types of aid, such as food and drugs, did not increase significantly.

As an example, consider the case of the two adjacent provinces of Verona and Vicenza, which in 1937 had similar population size (585,893 vs. 559,375), population density (189 residents per squared km vs. 201), number of industrial firms (9,133 vs. 9,018), number of industrial workers (64,557 vs. 81,479), and number of agricultural workers (128,608 vs. 105,848). In addition, the two provinces were exposed to similar total war damages: 0.47 percent of population killed during WWII in Verona, relative to 0.46 percent in Vicenza. The province of Verona, however, connected central and southern Italy to the Brenner Pass, which the Third Reich used to deliver supplies to German troops stationed in Italy. After March 1944, the Allied air forces heavily bombed the transportation and communication networks in the province of Verona (5,928 tons against troops, railways, or roads), but not in the province of Vicenza (653 tons against troops, railways, or roads). Between 1948 and 1952, the province of Verona received $101 million (2010 USD) for reconstruction, while the province of Verona only $75 million. We will be able to compare industrial and agricultural outcomes across these two types of provinces to identify the effect of reconstructing and modernizing public infrastructure.

We first collected and digitized new data on the quantity of Marshall Plan aid received by each Italian province between 1948 and 1952. We then combined this dataset with province-level industrial and economic outcomes digitized from the Industrial Census, the Population Census, the Annals of Agricultural Statistics, and official lists of patents issued by the Italian Patent Office. Finally, we matched these sources with granular data on Allied bombings compiled by the US Air Force. In the resulting dataset, we can study how grants from the Marshall Plan and the reconstruction of public infrastructure affected industrial and agricultural growth.

We find three main results. First, in provinces that received more grants, industrial and agricultural outputs increased more after the disbursement of reconstruction grants. Second, growth in industry and agriculture had different characteristics. The Italian industry experienced the entry of many new firms and an expansion of its labor force. The agricultural sector, instead, increased production, but sustained a stark decrease in manual labor. Third, the adoption of newer technologies increased disproportionately in provinces with more grants and higher growth. In agriculture, for example, we observe a larger increase in the use of general-purpose tractors in provinces that received more international aid. Similarly, firms

and individuals in provinces that received more grants started developing more patents.

Did provinces with more grants merely recover faster from WWII? Or did they experience a larger economic expansion? We find that most outcomes surpassed their prewar levels between 1952 and 1971 (the second Census available after the conclusion of the Marshall Plan in 1952). The data also indicate that provinces in the top quintile of the bombing distribution experienced a quicker and larger economic expansion, well beyond recovery from the disruption generated by WWII.

Finally, we leverage the detailed data on the projects funded through the Marshall Plan to draw a tighter connection between international aid and growth. The data clearly indicate that the top priority was the reconstruction of the transportation network damaged during WWII. Provinces with more bombings during the Italian Campaign, however, could perform a more ambitious modernization of their transportation system. Due to widespread destruction in their territory, they could design and complete new projects, instead of merely rebuilding old infrastructure. We also exploit province-level variation in the completion of the first public works to estimate the effect of different types of transportation infrastructure. Compared with railways, roads are correlated with a larger increase in economic outcomes (between 2 percent and 11 percent).

This paper contributes to three strands of the literature. First, it is related to the literature that studies the effects of international aid on economic growth. Existing empirical analyses have found mixed results (Easterly, 2003; Qian (2014)). Burnside and Dollar (2000) described the existence of a positive correlation between growth and international aid in developing countries with sound economic policies. Easterly, Levine and Roodman (2004) and Roodman (2007), however, pointed out how this finding might change with slight variations in the empirical specification and in the estimating sample. In a recent paper, Galiani et al. (2017) compared countries around the World Bank's threshold for eligibility to receive international aid. Their results confirm the existence of a positive relationship between aid and economic growth. In addition to mixed evidence on the relationship between international grants and growth, several papers suggest that aid might have other unintended consequences on the economy of receiving countries. International aid, in fact, has been associated to a decrease in the level of democracy (Djankov, Montalvo and Reynal-Querol, 2008), an increase in conflicts (Nunn and Qian, 2014) and corruption level (Svensson, 2000), and negative effects on infrastructure (Rajan and Subramanian, 2011). Our paper contributes to this literature by proposing a new strategy to identify the effect of international aid. In the analysis we exploit plausibly exogenous differences in aid between Italian provinces. By analyzing a single country, we compare geographical units with similar unobservable factors that can affect the relationship between international aid

and growth. Moreover, we focus on one specific type of aid, grants for the reconstruction and modernization of infrastructure, instead of bundling multiple interventions. Finally, the historical setting allows us to track the effect of international aid in the long-run, for decades after the implementation of the policy.

Second, this paper contributes to the literature on the economic effects of the Marshall Plan. Defined as "history's most successful structural adjustment program" (De Long and Eichengreen, 1993), the Marshall Plan has been under the scrutiny of economists for many decades. Early work highlighted how the implementation of the Marshall Plan coincided with a long period of sustained growth in Europe (Jones, 1955; Mayne, 1970; Arkes, 1972). More recent papers, however, argued that the Marshall Plan alleviated the postwar shortage and created an environment in which free institutions could grow (opposite to the communist system), but its impact on investments in industrial capacity and infrastructure repairs was overall modest (Eichengreen et al., 1992; Casella and Eichengreen, 1994; De Long and Eichengreen, 1993). Our paper contributes to this set of findings by using newly-digitized data on grants for infrastructural development and by proposing a new identification strategy based on Allied bombings within one country.

Finally, this paper contributes to the literature on the economic consequences of bombings. Previous work examined the effects of aerial bombings on urban development (Davis and Weinstein, 2002), poverty rates (Miguel and Roland, 2011), military and political activities (Dell and Querubin, 2017), and education (Akbulut-Yuksel, 2014).[2] Our paper uses aerial attacks as an empirical tool to identify the effects of international aid on economic outcomes.

The rest of the paper is organized as follows: Section 2 describes the historical setting. Section 3 describes the data. Section 4 outlines the identification strategy, and Section 5 documents the effects of reconstruction grants on several economic outcomes. Section 6 presents several robustness checks. Section 7 analyzes whether international aid led to recovery from war destruction or expansion beyond prewar economic levels. Section 8 provides additional evidence on the relationship between the modernization of public infrastructure and economic growth. Section 9 concludes.

2 Historical Background

Nazi Germany's invasion of Poland on September, 1 1939 marked the beginning of World War II (Evans, 2009). Despite being an Axis power, Italy remained non-belligerent until

[2] In Italy, Fontana, Nannicini and Tabellini (2017) showed how a more prolonged Nazi occupation led to higher support for the Communist Party after the war. Atella, Di Porto and Kopinska (2017) measure long-term health consequences of in utero exposure to maternal stress from WWII.

June 10, 1940, when it declared war on France and Great Britain (Overy and Wheatcroft, 1989). The country experienced the first bombing episode the night between June 11 and 12, 1940, when Great Britain hit the northwestern city of Turin. The last bombing attack occurred in the first days of May 1945, when the Allied bombed the railways and roads near the Brenner pass, on the border with Austria, in order to destroy German troops fleeing the country (Baldoli, 2010).

Bombing in Italy can be divided into two periods: before and after the Italian armistice with the Allied forces. During the first phase of the war, between June 11, 1940 and September 3, 1943, air raids targeted industries in largely populated areas, "where the effects of air attack will be brought home to the largest portion of the population".[3] By destroying jobs and homes, in fact, the Allies wanted to depress the moral of the urban population, generate dissatisfaction against the Fascist regime, and wreck industrial firms that had been readapted to produce military equipments. The British War Cabinet was convinced that "even a limited offensive against Italy would have a big moral effect".[4]

On September 3, 1943, Italy signed the Armistice of Cassibile with the Allied forces (McGaw Smyth, 1948). The armistice, made public on September 8, 1943, dramatically changed the nature of the conflict on the Italian soil. First, Italy ceased to be a direct enemy of the Allied forces. Second, the Allies moved into mainland Italy from the southern island of Sicily. Third, Nazi troops, which had arrived in Italy in July 1943, military occupied the country and disarmed the Italian soldiers. As a consequence, the Italian Campaign, which refers to the successful Allied invasion of Italy, entered its most heated phase. In this period, the intense Allied bombing was directed to facilitate ground operations and to destroy the occupying Nazi troops. Preferred targets were troop concentrations, railways, and roads (Baldoli and Knapp, 2012).

The war in Italy formally ended on May 2, 1945 (Blaxland, 1979). In 1945, Italian GDP per capita was 38 percent lower than the value observed in 1938, while industrial production was 66 percent lower (Lombardo, 2000). Immediately after the end of the war, damages to public infrastructure represented the main challenge towards recovery: 70 percent of the roads had been damaged and 45 percent of the railroad system was no longer usable (Fauri, 2006). It was therefore difficult for firms to obtain raw materials from suppliers and to distribute their products to clients (Eichengreen et al., 1992; Fauri, 2006). By contrast, firm physical capital had been only marginally affected by bombing: estimates suggest that between 80 percent and 90 percent of the Italian industrial capacity survived the war (Grindrod, 1955; Zamagni, 1997; Fauri, 2006).

[3] TNA AIR 20/5304, Note by C.A.S., 29 April 1940.
[4] TNA CAB 65/6/50, War Cabinet conclusion, 27 April 1940.

In spite of an urgent need for new infrastructure, Italy and many other European countries did not have the funds to start reconstruction. This situation changed when the US Secretary of State George C. Marshall, in the commencement speech at Harvard University on June 5, 1947, announced a comprehensive program of assistance to Europe in the form of capital transfers, as well as financing for investment and import purposes (Boel, 2003). This program was formally passed by the US Congress on March 1948 through the approval of the Economic Cooperation Act and was named the European Recovery Program (E.R.P.), informally known as the Marshall Plan. The main goals of the E.R.P. were (1) rebuilding and repairing European infrastructure; (2) increasing production, expanding foreign trade, and controlling inflation; (3) facilitating European economic cooperation and integration; and (4) preventing the expansion of communism (Boel, 2003). The E.R.P. remained in operation between March 1948 and June 1952,[5] and granted $130 billion (in 2010 USD) to 17 Western and Southern European countries.[6] The countries that received more money from the program were France (20.8%), Germany (10.9%), and Italy (10.6%) (ECA, 1951).

3 Data

We collected and digitized data on the quantity of E.R.P. aid that each Italian province received from 1948 to 1952.[7] We also digitized data from the Population Census, the Industrial Census, annual agricultural statistics, and official bulletins of issued patents. We matched these sources with information on Allied bombings compiled by the US Air Force.

3.1 E.R.P. Aid

Between May 1948 and June 1952, Italy received around $1.2 billion from the US (in 2010 US dollars), making it the third largest European recipient after France and Germany (Boel, 2003). In total, E.R.P. aid accounted for 33.6 percent of Italian imports between March 1948 and June 1950, and 21.3 percent between July 1950 and June 1952 (Fauri, 2006).

[5] The end of the E.R.P. did not mean the end of US aid to Europe. In 1952, the Economic Cooperation Act was substituted by the Mutual Security Program (MSP), which pursued both economic and military goals. The MSP sponsored the US Technical Assistance and Productivity Program (USTA&P), a program designed to transfer US managerial and technological knowledge from the US to Europe. The long term effects of the USTA&P in Italy are analyzed in Giorcelli (2017).

[6] The participating countries were Austria, Belgium and Luxembourg, Denmark, France, West Germany, Greece, Iceland, Ireland, Italy and Trieste, Netherlands, Norway, Portugal, Sweden, Switzerland, Turkey, and United Kingdom. The participation to the program was voluntary. Soviet countries could have joined, but refused to participate.

[7] Provinces are Italian administrative divisions that are comparable to US counties.

Italy received three types of aid: in-kind subsidies, financial grants, and loans. We collected data on in-kind subsidies received by each Italian province from *"Missione Americana E.R.P. in Italia"* (American E.R.P Mission in Italy), a report compiled by the US Bureau of Labor Statistics that lists physical quantities and monetary value of the transferred goods. The in-kind subsidies shipped to Italy were food (mainly flour and wheat), medications, raw materials (coal, oil, and cotton), and machineries. They represented 27 percent of total E.R.P. aid received between March and December 1948 (in-kind subsidies stopped after this period).

Data on financial grants come from the "Mutual Security Agency" bulletins. In addition to the amount of grants paid to the Italian government, these reports describe the type, cost, and location of each reconstruction project financed through E.R.P. aid. Financial grants represented 45 percent of E.R.P. aid and were used to finance 14,912 different reconstruction projects.

Finally, we hand-collected and digitized data on loans received by each Italian firm from 1948 to 1952, whose records are stored at the historical archive of the *Istituto Mobiliare Italiano* (IMI).[8] For each grantee, the data specify the amount of the loan, the origination date, and the repayment schedule. Loans represented 10.4 percent of US aid and were allocated across 1,101 large Italian firms. Out of 1,101 loans granted, 89 percent were repaid within 15 years.

Each year the Economic Cooperation Administration (ECA) and the Italian government elaborated an annual program, divided in four quarters. Each quarter the ECA approved the projects to be financed with ERP funds and sent a letter of commitment (LOC) as a formal commitment to pay. Within 20 days from issuing the LOC, the ECA had to transfer the grants to the Italian government, which in turn had to start the projects within 4 months (Fauri, 2006). The average Italian province received $163 million through the Marshall Plan. Out of all E.R.P. funds, 48 percent or $79 million were directed to reconstruction of public infrastructure, 26 percent or $42 million were in the form of food or drugs, and 1.2 percent or $2 million were loans to private firms.

3.2 Italian Censuses

The *Censimento dell'Industria e dei Servizi* (Industrial Census) provides information on the number of firms and workers in different industries. In the analysis, we focus on 9 major

[8] The *Istituto Mobiliare Italiano* (IMI) was a public institution created in 1931 (Legge 11/13/1931, n. 1398) with the goal of providing financing to private firms for medium and long-term investment projects. After WWII, IMI played a central role in rebuilding Italy by managing and assigning the financial resources received through international aid.

industries in the Italian economy—food, paper, chemistry, construction, mining, mechanics, metallurgy, textile, clothing—, which employed 59 percent of the total industrial workforce in 1937. Two prewar observations in 1927 and 1937 indicate that on average each province and industry had 704 active firms and 3,969 employed workers per industry (Table 1, panel A, column 1). Six postwar observations (each 10 years between 1951 and 2001) indicate a large increase in the size of the Italian industry. Since 1951, in fact, each province and industry had on average 863 active firms (+23 percent) and 5,883 employed workers (+48 percent) per industry (Table 1, panel A, column 2). This growth was larger among smaller firms with at most 10 employees. In the analysis, we will study the relationship between these changes in the industrial sector and the reconstruction grants assigned through the Marshall Plan.

The expansion of the industrial workforce came at the expenses of the agricultural sector. The average number of agricultural workers by province decreased by 53 percent from 96,447 individuals before the war to 45,206 individuals between 1951 and 2001. The yearly *Annuari di Statistica Agraria* (Annals of Agricultural Statistics) provide additional information on the production of different crops, as well as the adoption of various inputs. In spite of a decrease in the size of the workforce, the agricultural sector increased its production after the end of WWII. The production of wheat and corn increased by 7 percent from 123,424 thousand kilos (kg) per province between 1937 and 1939 to 132,325 thousand kg per province between 1946 and 1969. Similarly, the production of wine increased by 27 percent from 45,935 thousand liters (L) per province between 1937 and 1939 to 58,216 thousand L per province between 1946 and 1969. This increase in production was accompanied by the adoption of newer technology. The average number of tractors per province, for example, increased by more than 600 percent from 454 units between 1937 and 1939 to 3,420 units between 1946 and 1969. Obsolete tools such as steam-powered threshers, instead, were gradually abandoned in favor of tractor-powered machines that often combined the functionality of different tools (for example, tractor-powered combine harvester).

We also digitized the yearly *Bollettini della Proprietà Intellettuale* (Bulletins of Intellectual Property) from 1940 to 1955. These documents contain information about all patents issued by the Italian patent office to domestic and foreign investors. We utilize this dataset to test how the development of new technology responded to the assignment of reconstruction grants.

Finally, the *Censimento Generale della Popolazione* (Population Census) provides information on the number and characteristics of individuals living in each Italian province. The average number of residents in each Italian province increased by 27 percent from 461,828 individuals before the war (1931 and 1936) to 588,300 individuals after the war (one

observation each 10 years between 1951 and 2001).

3.3 Allied Bombing

We retrieved detailed information about Allied bombings in Italy from the Theater History of Operations Reports (T.H.O.R.; Lt Col Robertson, Burr and Barth, 2013) compiled by the Air Force Research Institute. For each Allied air strike executed in Italy during WWII, this database lists the location, the date, the type of target, and the amount of explosives.

Bombings affected most geographical areas, including the islands. Panel A of Figure 1 shows the distribution of air attacks across Italian provinces. The province of Rome, the Italian capital, received the maximum amount of explosives (25,748 tons), while the province of Vercelli in the northwestern region of Piemonte received the minimum amount (16 tons). Overall, the Allied forces used 402,045 tons of explosives against targets on Italian soil in 5,771 different attacks (Table 1, panel B, column 1). Considering that the conflict lasted 1,788 days, Italy was hit on average by 225 tons of explosives per day.

By using the date of the attack and the type of target, we could isolate the air strikes that were executed in support of ground operations against the German troops during the Italian Campaign. We first considered only attacks that took place after February 1944, because in this period support to land battles in Italy became the top priority of the Allied Tactical Air Forces.[9] We then selected target types linked to operations against the German Army: direct cooperation with ground forces; troop concentrations; radar installations; gun emplacements; weapon launching sites; tactical targets; supply dumps; tracks and marshaling yards; moving trains; highways and vehicles; transportation facilities.

The distribution of these bombings followed the land battles of the Italian campaign and the progressive retreat of the Nazi troops towards Austria. As shown in Panel C of Figure 1, the most heavily affected areas connect the central provinces in the Lazio region on the Gustav line (a series on German fortifications around the town of Monte Cassino), the provinces in the Toscana and Emilia Romagna regions on the Gothic line (a second German entrenchment), and the provinces leading to the Brenner pass on the Italian northeastern border. In the later stages of the Italian Campaign, the Allied air forces used 82,520 tons of explosives against targets on Italian soil in 1,332 different attacks (Table 1, panel B, column 2). Out of 57,722 total tons of explosives used in support of ground operations, 44,308 tons (77 percent) were dropped after February 1944. Similarly, out of 74,332 total tons of explosives against transport infrastructure, 38,212 tons (51 percent) were used during the Italian Campaign.

[9] TNA WO 204/ 930, Allied Force Headquarters, Inter-Services Supply Committee Paper, 3 March 1944.

4 Identification

We exploit the geographical distribution of Allied bombing during the Italian Campaign to measure the causal effect of E.R.P. aid on the Italian recovery. These air attacks have two important features for the empirical analysis. First, their geographical distribution was not driven by pre-existing economic conditions, but followed the confrontations between Allied and German troops. As a consequence, two adjacent provinces with similar economic conditions might have received vastly different amount of Allied air strikes during the later stages of the war, if one province hosted more prolonged land battles. Second, some of the preferred targets of these air attacks were railways and roads in order to stop reinforcements and supplies from Germany. By targeting public infrastructure, these bombings subsequently drew a large amount of reconstruction grants from the E.R.P.

4.1 The Distribution of Allied Bombing Across Italian Provinces

The Allied military strategy against Italy dramatically changed after the Armistice of Cassibile on September 3, 1943 (Figure 1, panel B and C). Before this date, US and British air forces mainly targeted factories in densely populated areas to destroy military production and to weaken the population's morale. As a consequence, these first air strikes focused on the richest and more economically developed Italian provinces.

There is a positive relationship between tons of explosives dropped before the armistice in each province and its prewar economic development. Out of 19 proxies for prewar economic characteristics, 15 variables are significantly correlated with the amount of explosives dropped by Allied forces before the armistice (Table 2, column 1). A one standard deviation (σ) difference in the number of industrial firms before the war (1,255 firms), for example, is associated with 583 (standard error=269) additional tons of explosives before the armistice. Similarly, a one σ difference in population before the war (341,561 individuals) correlates with 1,025 (se=342) more tons of explosives before the armistice.

Even if more bombings before the armistice brought more E.R.P. aid after the end of the war, we do not use this source of variation in the empirical analysis. The stark differences in prewar economic conditions between more and less bombed provinces would not allow us to isolate the role of the Marshall Plan on postwar recovery. Provinces that were more economically successful before the war, in fact, might have flourished after the end of the conflict for a variety of reasons, not only thanks to E.R.P. aid.

The empirical analysis, instead, exploits the change in military strategy that followed the Armistice of Cassibile. After the Italian surrender, the German troops militarily occupied the country to fight against the Allied forces, which had started their Italian Campaign by

invading Sicily in June 1943. When Italy became one of the most active warfronts of WWII, air strikes were employed to help ground operations against the German Army, instead of striking factories and urban areas. As a consequence, economic conditions did not drive the amount of explosives dropped in the later stages of conflict, differently from what observed for pre-armistice bombs. In column 2 of Table 2, we test whether prewar economic conditions are correlated with the amount of bombings used during the Italian Campaign. Several variables measuring population, size of the province, number of industrial firms, and agricultural output before the war cannot explain significant variations in the severity of air strikes.[10] In addition to similar economic conditions, provinces with different amount of bombings during the Italian Campaign also had similar levels of prewar political participation. Voter turnout in the 1934 elections, a variable that measures affinity with the Fascist dictatorship, is not correlated with war-related bombings.

4.2 The Correlation Between Allied Bombing and E.R.P. Aid

The data on the assignment of E.R.P. aid indicate that provinces with more bombings during the Italian Campaign received significantly larger amounts of reconstruction grants. This finding is not surprising if we consider that many of these air attacks were targeting public infrastructure, like railways and highways. A one σ increase in the tons of explosives correlates with additional \$16,992,619 (se=2,924,958) assigned for reconstruction projects, a 22 percent increase from the mean (Table 3, column 1, panel A; Figure A1, panel B). It is interesting to note that heavily bombed provinces received more reconstruction grants at the expenses of other forms of aid, such as in-kind subsidies (Figure A1, panel C). A one σ increase in the tons of explosives, for example, decreases the value of food and drugs received through E.R.P. by \$11,628,682 (se=7,172,042) (Table 3, column 2, panel A). This correlation becomes larger and statistically significant at the 5 percent level if we control for province characteristics (Table 3, column 2, panel B). The tons of explosives are also positively correlated with the amount of loans given to private firms, but the relationship is small and not robust to the inclusion of province characteristics (Table 3, column 3, panel A and B).

We conclude that the air strikes during the Italian Campaign raised the amount of reconstruction grants distributed between 1948 and 1952 through the E.R.P. This is the only form of aid that was disproportionately assigned to the most heavily bombed provinces. We will therefore be able to focus on the reconstruction projects funded by the E.R.P. in order to isolate the mechanisms behind the postwar Italian recovery.

[10] Out of 19 regressions, only in one case (number of tractors used in agriculture) the correlation between prewar output and tons of explosives is positive and statistically significant (Table 2).

4.3 Empirical Specifications

We first compare economic outcomes before and after the Marshall Plan between provinces that received different amount of bombings during the Italian Campaign. We employ the following difference-in-differences specification:

$$\begin{aligned} y_{pit} &= \alpha_p + \beta_i + \gamma_{rt} + \delta \text{IC Bombs}_p \times \text{Post } 1952_t \\ &\quad + \sum_{z=1}^{3} \text{trend}_t^z \times \text{Econ}_p + \sum_{z=1}^{3} \text{trend}_t^z \times \text{War}_p + \epsilon_{pit}, \end{aligned} \tag{1}$$

where the unit of observation is an industry i (either food, paper, chemistry, construction, mining, mechanics, metallurgy, textile, or clothing) in province p and census year t. The standard errors are clustered at the province level.

The dependent variable y_{pit} is one of many measures of industrial output from the Italian Industrial Census. For most outcomes, there are two prewar observations in 1927 and 1937 and six decennial postwar observations between 1951 and 2001. When the dependent variable measures an agricultural outcome, most outputs are observed every year between 1938 and 1969. The estimating sample drops provinces in the regions of Sicilia and Sardegna due to the lack of bombings during the Italian Campaign, but the results are robust to their inclusion (Table (A3), panel C).

The variable IC Bombs_p measures the tons of explosives dropped by Allied forces during the Italian Campaign in province p. As described in section 3.3, we isolate these air strikes using both the date of the attack (after February 1944) and the type of target (against troops, railways, roads, transportation facilities). The results are robust to extending the range of dates back to the announcement of the armistice (September 9, 1943) or to modifying the list of targets (Table A3, panel A and B). Post 1952_t is a dummy variable equal to 1 for every post-E.R.P. census year. If the coefficient of interest δ is positive, the data indicate that provinces with more bombings during the Italian Campaign experienced larger increases in industrial output after the implementation of the Marshall Plan.

The regressions control for non-linear differences in industrial outcomes by including fixed effects for provinces (α_p), industries (β_i, not included in the agricultural regressions), and region-census years combinations (γ_{rt}). In addition, equation (1) includes interactions between prewar provincial characteristics (population density, employment rate, industrial horsepower, share of industrial workers, and share of agricultural workers in 1937) and trends up to the third order. These variables (Econ_p) account for time-varying nonlinear output changes that are correlated with economic conditions observed before the start of the conflict. Finally, these regressions control for other possible war-induced effects (War_p) that are not

directly related to the destruction of public infrastructure. Specifically, equation (1) includes interactions between the share of war-related deaths in the province and trends up to the third order. The results are robust if we use alternative controls for war damages and for E.R.P. aid (Table A2).

We then directly estimate the effect of reconstruction grants on the industrial and agricultural recovery:

$$\begin{aligned} y_{pit} &= \alpha_p + \beta_i + \gamma_{rt} + \delta \text{Reconstruction grants}_p \times \text{Post } 1952_t \\ &\quad + \sum_{z=1}^{3} \text{trend}_t^z \times \text{Econ}_p + \sum_{z=1}^{3} \text{trend}_t^z \times \text{War}_p + \epsilon_{pit}. \end{aligned} \tag{2}$$

The OLS estimate of coefficient δ in equation (2) could be biased, because the amount of reconstruction grants assigned to a province could be related to unobservable characteristics in ϵ_{pit}. The level of political connection with the central government, for example, could be correlated with both the amount of reconstruction grants and its economic outcomes. We therefore instrument the amount of reconstruction grants in province p with the amount of explosives dropped by Allied forces in the same province during the Italian Campaign (IC Bombs$_p$). The exclusion restriction states that, after controlling for prewar characteristics (Econ$_p$) and total war-related damages in the province (War$_p$), the instrument IC Bombs$_p$ affects the outcome only through changes in reconstruction grants. Essentially, this specification exploits variation in the timing and in the target of Allied bombings between provinces with similar prewar conditions and total war-related deaths. Differences in the amount of bombings during the Italian Campaign are plausibly exogenous, because the air strikes followed the ground battles between German and Allied Armies. Moreover, IC Bombs$_p$ is a strong predictor for reconstruction grants during the Marshall Plan, because these bombs were directed in large part towards public infrastructure.

4.4 Pre-WWII Trends in Agricultural Outputs

The identification assumption of equation (1) requires the economic outcomes to follow a similar prewar trend between provinces with different level of bombing. In section (4.1), we found that the prewar level of many economic variables was not significantly different between provinces that were hit by a different amount of explosives during the Italian Campaign. In this section, we show the existence of parallel linear and non-linear prewar trends in economic outcomes. We focus on agricultural outputs because for these variables we have three consecutive observations before WWII in 1937, 1938, and 1939.

We first regress several agricultural variables on IC Bombs$_p$, a linear trend, and the interaction of these two variables (Table 4, panel A). The coefficient of the interaction indicates whether agricultural outputs in provinces with more bombings were on a different linear trend before the start of the conflict. In most cases, the agricultural outcomes followed a linear trend in the three years preceding WWII, but this trend was the same in provinces with different amount of bombing. The coefficient of the interaction between the treatment variable and the linear trend is always small and not statistically significant.

The situation does not change if we replace the linear trend with two dummy variables for years 1938 and 1939 (Table 4, panel B). The data indicate that agricultural outputs followed similar nonlinear trends in provinces with different amount of bombings during the Italian Campaign. Even in the case of tractors, the only variable that is correlated with the amount of bombings, the interactions between the treatment variable and the two year dummies are small and not statistically significant (Table 4, panel B, column 4).

5 The Effects of Reconstruction Grants on the Italian Recovery

Industrial and agricultural outcomes increased more after the implementation of the Marshall Plan in provinces that had been more heavily bombarded during the Italian Campaign. We also find evidence that the development and adoption of newer technologies increased disproportionately in the same provinces. Instrumental variable regressions suggest that the reconstruction grants distributed through the E.R.P. played a direct role in the Italian postwar recovery.

5.1 Industrial Outcomes

We first compare changes in industrial outcomes before and after the Marshall Plan, between provinces hit by a varying amount of explosives during the Italian Campaign (equation 1). The number of industrial firms per industry, province, and census year increased by 91 units (se=42) for each one σ increase in the tons of bombs (Table 5, panel A, column 1). Compared with a prewar mean of 704 firms per industry, province, and year, the estimated effect indicates a 13 percent increase. This change is mostly driven by small establishments with at most 10 employees, while larger firms did not change differentially (Table 5, panel A, column 2 and 3).

More firms translated into more industrial workers. A one σ difference in bombings increased the post-E.R.P. number of industrial employees by 1,076 (se=340) individuals or 27 percent per industry, province, and census year (Table 5, panel A, column 4). This

increase is more pronounced among white collar and managerial positions, relative to blue collar jobs (Table 5, panel A, column 5 and 6).

Difference-in-differences estimates for each census year provide more insights on the timing of the effects (Figure 2). In 1951, 3 years into the active implementation of the Marshall Plan, provinces with different amount of bombings during the Italian Campaign had similar levels of industrial outputs. In 1961, nine years after the full distribution of grants through the E.R.P., province with more bombings had significantly more industrial firms and workers. The effect peaked in 1971 and decreased in the following decades, suggesting that the initial divergence between provinces might have been only temporary.

The fact that the positive effects on the industrial outcomes started only after 1951 suggests that the Marshall Plan might have played a fundamental role in driving the observed economic growth. In the instrumental variable regressions, we further explore the direct link between reconstruction grants and industrial output (Table 5, panel B). As described in section 4.3, we instrument the amount of reconstruction grants received by each province through the E.R.P. with the tons of bombs dropped during the Italian Campaign. The data indicate that a one σ difference in reconstruction grants ($29 million) increased the number of firms by 203 (se=97) units or 29 percent per industry, province, and census year (Table 5, panel B, column 1). Similarly, a one σ difference in reconstruction grants is associated with 2,423 (se=820) additional workers or 61 percent per industry, province, and census year (Table 5, panel B, column 4).

5.2 Agricultural Outcomes

Provinces with more bombings during the Italian Campaign experienced a disproportionate increase in agricultural production after 1952 (Table 6, panel A). A one σ difference in the tons of explosives is associated with 11,972 thousand (se=4,279) additional kilos of wheat and corn per province and post-E.R.P. year (Table 6, panel A, column 1). This effect represents a 10 percent increase from a prewar average of 123,424 thousand kilos. Similarly, the production of wine increased by 10,716 thousand (se=5,589) liters or 23 percent for each one σ increase in the tons of explosives, while the production of grape increased by 13,376 thousand (se=6,637) kilos or 19 percent (Table 6, panel A, column 2 and 3).

The treatment variable is not able to predict increases in the production of crops that are concentrated in provinces with low exposure to bombings during the Italian Campaign. This result suggests that the regressions are not capturing economic growth driven by unobserved factors, but output changes related to the reconstruction and modernization of public infrastructure. The production of olive oil, for example, did not increase significantly

after 1952 in provinces with more bombs during the war. The coefficient indicates an increase of 169 thousand (se=169) kilos of olive oil for each one σ difference in the treatment, but is imprecisely estimated (Table 6, panel A, column 4). The three largest producers of olive oil before WWII were the provinces of Bari, Lecce, and Brindisi, all three in the southeastern region of Puglia. All these provinces received only small amount of explosives during the Italian Campaign: 213 tons were dropped in Bari, while 0 tons in both Lecce and Brindisi.

The increase in production was not accompanied by an increase in the size of the agricultural workforce, as we observed in the Italian industry. A one σ difference in the tons of explosives is associated with 9,022 (se=2,367) fewer individuals employed in agriculture, a 9-percent shrink in the prewar workforce (Table 6, panel A, column 5). In addition, a one σ difference in the tons of explosives did not change significantly the number of agricultural firms after WWII (Table 6, panel A, column 6).

Yearly difference-in-differences estimates provide a precise description of the timing behind the previous results, because agricultural outputs are observed every year between 1938 and 1969 (Figure 2). A one σ difference in bombings did not affect significantly the production of wheat and corn during the war or in the postwar years preceding the Marshall Plan. After 1952, the production of wheat and corn increased disproportionately in provinces with more bombings. More specifically, the estimates become positive and statistically significant at the 5 percent level only in 1952, the year following the full distribution of E.R.P. aid (Figure 2, panel D). The production of wine and grape followed a similar pattern (Figure A2, panel A and B). Yearly estimates for the changes in the number of workers in agriculture, which is observed only in the census years, suggest that the larger decrease of the agricultural workforce in provinces with more bombings during the Italian Campaign persisted at least throughout 2001 (Figure 2, panel E).

As seen for the industrial outcomes, the instrumental variable regressions are qualitatively consistent with the reduced form estimates (Table 6, panel B). A one σ difference in the amount of reconstruction grants increased wheat and corn production by 27,393 thousand (se=10,654) kilos, wine production by 24,408 thousand (se=14,701) liters, grape production by 30,468 thousand (se=17,387) kilos, and decreased the number of agricultural workers by 20,495 (se=6,199) individuals.

5.3 Development and Adoption of New Technology

In this section, we show evidence that provinces with more reconstruction grants invested more in the development and adoption of new technologies. There results can explain why reconstruction grants had long-lasting effects on economic growth. The previous results

indicated that more reconstruction grants are associated with a decrease in the the number of agricultural workers and an increase in the number of industrial workers. The mechanization of agricultural work might have played a direct role in this process. Large productivity gains through the adoption of newer technology allowed farmers to increase production with less labor. The workers who were not longer needed in agriculture might have moved to the growing industrial sector.

In support of this hypothesis, the data indicate that provinces with more bombings experienced a more widespread technological adoption after 1952. General-purpose tractors, for example, started played an increasingly important role in agriculture during the first half of the twentieth century (Gross, 2018). A one σ difference in the tons of explosives increased the number of tractors after 1952 by 866 (se=350) units per province and year, a 191 percent increase from the prewar baseline (Table 6, panel A, column 7, and Figure 2, panel F). The total number of motorized agricultural machines per province and year increased by 1,597 (se=489) units (Table A1, panel A, column 8, and Figure A2, panel D), a 207 percent increase from the baseline. It is interesting to notice how the data indicate a disproportionate increase only in the adoption of tools that were close to the technological frontier. Steam-powered threshers, for example, became obsolescent during the 20th century with the progressive introduction of tractor-powered harvester-combines (Hurt, 1982; Pingali, 2007). Not surprisingly, the number of threshers did not increase significantly after WWII in provinces with more bombings (Table 6, panel A, column 8, and Figure A2, panel F).[11]

In addition to measuring the adoption of existing tools, we use newly digitized patent data to study the creation of new intellectual property. Individuals and firms in provinces with more reconstruction grants invested more in the development of newer technologies. A one σ difference in the tons of explosives led to 8.74 (se=4.03) additional patents issued to domestic inventors per province and year, an 18 percent increase from the 1940 baseline (Table 7, panel A, column 1). In alternative specifications, we study how patenting changed in different technological areas (patent classes). In this case, a one σ difference in the tons of explosives led to 1.18 (se=0.50) additional patents issued to domestic inventors per province, patent class, and year, a 20 percent increase from the 1940 baseline (Table 7, panel A, column 2). We then isolate the effect of reconstruction grants on specific technological areas. A one σ difference in the tons of explosives led to 2.69 (se=1.18) additional agricultural patents (Table 7, panel A, column 3), and to 0.84 (se=0.34) additional industrial patents (Table 7, panel A, column 4). Relative to the baseline, the estimated increase in significantly larger in the field of agriculture: 34 percent, compared with only 14 percent for industrial patents.

[11] The amount of bombing does not predict any increase also in the number of cotton gins (Table A1, column 7, and Figure A2, panel E).

These results confirm the existence of a strong drive towards agricultural R&D in provinces that had a chance of modernizing their network of public infrastructure.

Yearly estimates show that the number of patents issued in provinces with more bombings decreased significantly during the conflict (Figure A3, panel A and B). In this period, the local patent offices were less likely to operate in areas that received more air attacks. Immediately after the end of WWII, however, the number of patents issued to domestic inventors increased in the same areas. This growth might be due to a longer queue of unprocessed patent applications that had gathered during the war. After this initial effect subsided, the number of patents issued in provinces with more reconstruction grants started raising again after 1952.

Finally, the instrumental variable regressions allows to link directly the amount of reconstruction grants to the adoption of new technology. A one σ difference in the amount of reconstruction grants led to 1,956 (se=902) additional tractors (Table 6, panel B, column 7), 3,609 (se=1,223) additional motorized agricultural machines (Table A1, panel B, column 8), and 5.83 (se=2.77) additional agricultural patents (Table 7, panel B, column 3), and 1.94 (se=0.93) additional industrial patents (Table 7, panel B, column 4).

6 Other Outcomes and Robustness Checks

6.1 Population and Education

In spite of a disproportionate increase in the industrial sector, we do not observe strong evidence suggesting that individuals migrated to provinces with more bombings after 1948. A one σ difference in the tons of bombs increased the provincial population by 32,183 (se=35,019) individuals or 7 percent (Table A1, panel A, column 1). The effect is sizable, but imprecisely estimated. We also do not observe a differential increase in average salaries, which might partially explain why more people did not move after 1952 into provinces with more bombings (Table A1, panel A, column 3).

Did the faster replacement of agricultural jobs with industrial positions induce more investment in education? We do not find evidence in support of this thesis. A one σ difference in the tons of bombs did not change significantly the number of illiterates, the only available measure of education (Table A1, panel A, column 4). Overall, these results do not conclusively rule out the possibility that individuals responded to the expansion of the industrial sector by investing more in education. Changes in the number of illiterates, in fact, can only capture new entries in schools (extensive margin), not different education choices among the individuals who were already inside the education system (intensive margin).

6.2 Alternative Controls for War-Related Damages and E.R.P. Interventions

The main specifications include the share of total war-related deaths in each province interacted with trends up to the third order. These variables control for changes in industrial and agricultural output that might stem from WWII, but are not directly related to the destruction and subsequent reconstruction of public infrastructure. In this section, we show that the results are robust if we include alternative controls for war-related damages and E.R.P. aid.

Specifically, we can replace the share of total war-related deaths in the province with the tons of bombs dropped by Allied forces before the armistice. In this case, all estimates are quantitatively unchanged (Table A2, panel A). A one σ difference in the tons of explosives is associated with 96 (se=44) additional firms, 1,155 (se=338) additional industrial workers, 9,743 thousand (se=4,209) additional kilos of wheat and corn, 8,829 (se=2,522) fewer agricultural workers, and 898 (se=296) additional tractors.

In a separate set of specifications, we include the difference between the total amount of E.R.P. aid received by each province and the amount of grants specifically assigned to reconstruct public infrastructure. We then interact it with Post 1952_t, which is equal to 1 for every post-E.R.P. census year. This variable captures any change in industrial and agricultural outcomes after 1952 that might be correlated with any E.R.P. intervention not directed to the reconstruction of infrastructure. Even after controlling for these factors, the results do not change significantly (Table A2, panel B). A one σ difference in the tons of explosives is associated with 99 (se=42) additional firms, 1,197 (se=340) additional industrial workers, 13,042 thousand (se=4,363) additional kilos of wheat and corn, 12,102 (se=3,639) fewer agricultural workers, and 1,121 (se=338) additional tractors.

Finally, the results are robust if we control simultaneously for war-related damages (share of war-related deaths) and other E.R.P. interventions (total grants not for reconstruction) (Table A2, panel C). In this case, a one σ difference in the tons of explosives is associated with 77 (se=40) additional firms, 1,066 (se=353) additional industrial workers, 10,637 thousand (se=4,485) additional kilos of wheat and corn, 9,783 (se=3,006) fewer agricultural workers, and 854 (se=361) additional tractors.

6.3 Alternative Specifications of Bombings

In this section, we show that the choices made in the construction of the treatment variable do not affect the results. First, we compute the tons of explosives dropped on targets related to the Italian Campaign from September 9, 1943—the day in which the Armistice of Cassibile was publicly announced—instead of March 1944 (Table A3, panel A). In the main results, we

selected March 1944 as the starting date, because in this period official documents formally ranked the Italian warfront against the German troops as the top priority for Allied Tactical Air Forces. The results suggest that including the air attacks since September 1943 does not change the main findings. A one σ difference in the tons of bombs dropped since the armistice (2,063 tons), for example, increased the number of industrial firms after WWII by 120 (se=45) units or 17 percent in the average industry, province, and census year (Table A3, panel A, column 1). This estimate is 32 percent larger than the baseline (Table 5, panel A, column 1). We observe similar differences for all the other outcomes.

Second, we can extend the amount of targets included in the treatment variable (Table A3, panel B). The original list isolates air attacks against targets that are closely related to land battles against German troops: direct cooperation with ground forces; troop concentrations; radar installations; gun emplacements; weapon launching sites; tactical targets; supply dumps; tracks and marshaling yards; moving trains; highways and vehicles; transportation facilities. We can add air strikes against bridges, tunnels, airdromes, and waterways. The results still indicate that the provinces with more bombings experienced larger increases in industrial and agricultural outputs. A one σ difference in the tons of bombs (3,074 tons), for example, increased the number of industrial firms after WWII by 129 (se=58) units or 18 percent (Table A3, panel B, column 1).

Third, we can include the provinces in the regions of Sardegna and Sicilia, even if the two regions did not receive any airstrike related to the Italian Campaign (Table A3, panel C). The results in this larger sample are quantitatively similar to the baseline estimates. A one σ difference in the tons of bombs (1,604 tons), for example, increased the number of industrial firms after WWII by 90 (se=40) units in this larger sample (Table A3, panel C, column 1) and by 91 units in the baseline regressions (Table 5, panel A, column 1).

6.4 Excluding War Years

The empirical analysis compares changes in agricultural outcomes between provinces with different amount of bombings, before and after the implementation of the Marshall Plan. In the pre-period, the estimating sample contains five war years (from June 1940 to May 1945). Because provinces with more bombings might have received a larger negative shock during the war, they could have also experienced a more pronounced recovery after WWII just as a form of mean reversion. The yearly estimates in Figure 2, however, seem to contradict this hypothesis. The increases in agricultural outputs, in fact, become large and statistically significant only after the full implementation of the Marshall Plan.

To provide additional proof that the inclusion of war years in the pre-period does not affect the results, we re-estimate equation (1) without the observations between 1940 and 1945 (Table A4). In this alternative specification, the results do not differ from the baseline. A one σ difference in the tons of bombs, for example, increased the production of wheat and corn after 1948 by 10,580 thousand (se=4,458) kilos in this sample without war years (Table A4, panel A, column 1) and by 11,972 thousand kilos in the baseline regressions (6, panel A, column 1).

7 Recovery and Expansion

Did provinces with more bombings during the Italian Campaign merely recover faster from WWII? Or did they experience a larger economic expansion? The previous difference-in-differences estimates cannot distinguish between the two scenarios. In this section, we show how the levels of industrial and agricultural outputs changed over time for provinces in the top and bottom quintile of the bombing distribution (Figure 3). Most outcomes surpassed their prewar levels by 1971. The data also indicate that provinces in the top quintile of the bombing distribution experienced a quicker and larger economic expansion, beyond recovery from the disruption generated by WWII.

Compared with agricultural outputs, industrial variables show a slower path to recovery and expansion, possibly as a result of a longer interval between observations and slight changes over time in census variables. In heavily bombed provinces, the number of industrial firms exceeded the 1937 level in 1971 (Figure 3, panel A). The provinces in the bottom quintile, instead, experienced a lack of growth in the number of industrial firms until 1991 and never reached their prewar average in the period under consideration. The number of industrial workers, instead, surpassed the 1937 level in the 1961 census for provinces in the top quintile of bombing distribution and in the 1971 census for provinces in the bottom quintile (Figure 3, panel B).

The agricultural variables show full recovery already during the implementation of the Marshall Plan between 1948 and 1952. After this period, they increased beyond their prewar levels for both provinces in the top and bottom quintile, although the increase is larger for the former. The production of wheat and corn, for example, reached the 1939 level by 1952 among provinces in the top quartile and by 1953 among provinces in the bottom quartile (Figure 3, panel C). After this period, it expanded significantly beyond the prewar level in provinces in the top quintile, while the trend stayed flatter in the other group of provinces. The adoption of tractors followed an increasing trend between 1948 and 1969 with a larger expansion among provinces in the top quintile (Figure 3, panel D).

8 The Projects Funded by E.R.P. Aid

In this section, we take a closer look at the projects funded through E.R.P. reconstruction grants. The "Mutual Security Agency" bulletins contain information on the 14,912 different reconstruction projects that were funded through the Marshall Plan. We exploit this rich dataset to show that provinces with more bombings during WWII and, therefore, more reconstruction grants during the Marshall Plan modernized their transportation network. Instead of just rebuilding pre-existing roads and railways, they received ample funding to design and deploy new infrastructure. In this sense, the widespread war destruction became an opportunity, because it decreased the cost to implement more radical changes. We then exploit the fact that the completion year of the first public works differed across Italian provinces to estimate the effect of different types of infrastructure on economic growth. Our results are consistent with previous studies that highlighted the importance of railways and roads in decreasing the cost of moving goods and labor (Michaels, 2008; Donaldson and Hornbeck, 2016; Donaldson, 2018; Morten and Oliveira, 2017).

8.1 The Characteristics of Funded Projects

Not all funds arrived immediately after the implementation of the Marshall Plan. Each year between 1948 and 1952, the ECA set a national quarterly budget and decided the projects to fund, based on the results of yearly "country studies" (ECA, 1951). Italian officials could not predict prospective budgets or the program duration in advance. By analyzing the characteristics and the timing of approved public works, we can then infer useful information about how the reconstruction of public infrastructure affected economic growth.

We first use information on E.R.P.-funded projects from the "Mutual Security Agency" bulletins to compare differences in approved public works between provinces with different levels of Allied bombings. The first important result is that all provinces employed the majority of their funds to reconstruct their transportation network. The average Italian province used 52 percent of the E.R.P. grants for transportation infrastructure, 32 percent for public buildings, and only 15 percent for hygiene infrastructure (Table 8).[12] The focus on transportation did not depend on the intensity of the bombings received during WWII and, therefore, on the total amount of reconstruction grants. This result is consistent with historians' accounts that identify in the damages to public infrastructure the main obstacle towards European growth (Fauri, 2006). Industrial and agricultural firms primarily needed a reliable way to reach customers and suppliers (Grindrod, 1955, page 157; Eichengreen et al., 1992, page 16).

[12]These results are available also in regression (Table A5) and graphical format (Figure A4).

Even if all provinces directed the same share of grants towards the reconstruction of transportation infrastructure, there were large differences in the total amount of resources. As a result, provinces that received more grants could fund a higher number of interventions. The average province in the top quintile of the distribution of Allied bombings completed 108 projects between 1948 and 1952, while the average province in the bottom quintile completed only 69 projects. The distance between the top and bottom quintiles increased over time and peaked in 1952. Provinces that received more Allied bombings during WWII completed a disproportionate amount of interventions aimed at reconstructing the transportation network. The average province in the top quintile completed 77 transportation projects (71 percent of the total) between 1948 and 1952, while the average province in the bottom quintile completed only 10 transportation projects (14 percent of the total). The average cost of completed interventions in provinces with more Allied bombings, however, was significantly lower. The average cost per project was equal to $1,325,225 (2010 USD) in the top quintile and to $2,152,764 in the bottom quintile. These results suggest that all provinces might have been able to fund some of their larger interventions. Provinces that received more grants, however, could also complete a higher number of projects with more limited scope.

These findings cannot necessarily explain why provinces with more reconstruction grants experienced faster economic growth after the Marshall Plan. Provinces in the top quintile completed more projects, especially aimed at reconstructing their transportation network, because their roads and railways were the target of heavier bombings during WWII. Widespread destruction, however, could have become an opportunity with the arrival of international aid. Due to the fact that WWII wrecked a larger portion of their infrastructure, provinces in the top quintile were able to carry out a deeper modernization of their transportation network. Instead of just rebuilding pre-existing roads and railways, they could redesign their transportation system by introducing new infrastructure.

In the data, we identify new infrastructure from the description of the projects. If the project description uses words such as "new construction", "extension", "modernization", "renewal", we classify the project as new infrastructure. By contrast, if it contains words like "reconstruction", "restoration", "reactivation", we consider the project as a repair of an already existing infrastructure.

The average province in the top quintile used 80 percent of their E.R.P. funds to build new projects, while the average province in the bottom quintile committed 98 percent of its budget to the reconstruction of old infrastructure. Almost all new projects aimed at modernizing the transportation network. Out of all funds for new infrastructure, the share used for transportation was equal to 96 percent in the top quintile and to 100 percent in the

bottom quintile. Moreover, provinces in the top quintile could fund new projects starting from 1948, while provinces in the bottom quartile had to wait until 1952. This result suggests that the ECA might have preferred to first fund the reconstruction of old infrastructure in geographic areas with limited damages.

8.2 Roads and Railways: An Event Study Analysis

There is significant geographical variation in the year in which the first important construction projects were completed. The first 5 large public works—each amounting to at least 5 percent of the total grants received by a province—were completed by 1953 in 37 provinces, by 1954 in 11 provinces, by 1955 in 34 provinces, by 1956 in 7 provinces, and by 1957 in 3 provinces (Figure A5, panel A). Although the overall distribution is similar across project type (Figure A5, panel B and C), the first roads and railways had a different execution year in 17 provinces (18 percent). We use this variation to explore whether different types of infrastructure have varying effects on economic outcomes.

We perform an event study analysis by estimating the following specifications:

$$\begin{aligned} y_{pk} &= \alpha_p + \beta_t + \gamma_{rk} + \delta \text{IC Bombs}_p \times \text{Post}_k \\ &\quad + \sum_{z=1}^{3} \text{trend}_t^z \times \text{Econ}_p + \sum_{z=1}^{3} \text{trend}_t^z \times \text{War}_p + \epsilon_{pk}, \end{aligned} \tag{3}$$

where the unit of observation is a province p in the event period k. The dependent variable y_{pk} is a measure of agricultural output from the Annals of Agricultural Statistics. We restrict the analysis to agricultural outputs because they are the only variables available every year between 1938 and 1969.[13]

The variable IC Bombs$_p$ measures the tons of explosives dropped by Allied forces during the Italian Campaign in province p. The dummy variable Post$_k$ is equal to 1 for every period after the completion of the first 5 large public works, each amounting to at least 5 percent of the total amount of E.R.P. grants assigned to a province.[14] Their interaction measures how the reconstruction of public infrastructure affected agricultural outcomes in provinces with more bombings during the Italian Campaign.

[13] Outputs from the Industrial Census are observed only in 1927, 1937 1951, 1961, 1971, 1981, 1991, and 2001. For this reason, an event study analysis would lead to the same results described in Section 5.1. We also study the direct relationship between agricultural outputs and reconstruction grants by estimating the following IV specifications: $y_{pk} = \alpha_p + \beta_t + \gamma_{rk} + \delta \text{Reconstruction grants}_p \times \text{Post}_k + \sum_{z=1}^{3} \text{trend}_t^z \times \text{Econ}_p + \sum_{z=1}^{3} \text{trend}_t^z \times \text{War}_p + \epsilon_{pk}$. We instrument the amount of reconstruction grants in province p with the amount of explosives dropped by Allied forces in the same province during the Italian Campaign.

[14] The results are robust to alternative definitions of the Post$_k$ variable (Table A9).

The regressions control for confounding time-varying factors by including fixed effects for calendar years (β_t), fixed effects for region-event period combinations (γ_{rt}), prewar economic characteristics (Econ_p) interacted with trends up to the third order, and the share of war-related deaths (War_p) interacted with trends up to the third order. Fixed effects for provinces (α_p) capture permanent geographical differences in agricultural outputs. The standard errors are clustered at the province level.

As an additional test for the possible influence of omitted factors, we estimate placebo treatment effects starting from equation (3). Specifically, we restrict the sample to periods that preceded the completion of the first large public works in each province. We then create the variable Post_k by randomizing the first period in which this dummy variable takes value 1. The data indicate that the placebo treatment variable does not predict any significant change in the agricultural outcomes (Table A6 and Figure A7).

The event study analysis indicates that agricultural outputs increased after the initial reconstruction of large public works (Table A7, panel A). A one σ difference in the tons of explosives is associated with 9,648 thousand (se=3,230) additional kilos of wheat and corn, 9,995 thousand (se=5,128) additional liters of wine, 11,722 thousand (se=5,978) additional kilos of grape, and 857 (se=282) additional tractors per province and year. The event studies also confirm that the reconstruction grants did not have any significant effect on crops concentrated in provinces that were not heavily affected by air strikes during the Italian Campaign (like olive oil production), as well as on the adoption of obsolete tools such as manual threshers.

Compared with railways (Table A7, panel C), roads (Table A7, panel B) appear to have a larger impact on agricultural outputs. In the case of grape production, for example, a one σ difference in the tons of explosives is associated with 13,200 thousand (se=6,267) additional kilos per province and year after the completion of the first 5 large roads (Table A7, panel B, column 3), but only 11,671 thousand (se=5,920) additional kilos after the completion of the first 5 large railways (Table A7, panel C, column 3). The estimated effects for other variables are between 2 percent and 11 percent larger when Post_k flags the completion of the first 5 large roads (instead of railways).

Difference-in-differences estimates for single event periods show how most agricultural outputs increased only after the completion of the first public works (between 1953 and 1957), instead of immediately after receiving the E.R.P. grants between 1949 and 1952. This trend is especially clear for tractors (Figure A6, panel C and D) and all motorized agricultural machines (Figure A6, panel E and F).

We then assess the direct relationship between agricultural outputs and reconstruction grants by estimating instrumental variable regressions. The estimated effect of reconstruction

grants are between 13 percent and 46 percent larger than the baseline (Table 6, panel B). In the case of tractors, for example, a one σ difference in reconstruction grants increased units by 2,859 (se=1,070) per province and year after the completion of the first 5 large public works (Table A8, panel A, column 5). In the baseline specification, a one σ difference in reconstruction grants increased units only by 1,956 (se=902) after 1952 (Table 6, panel B, column 5).

Finally, we show how alternative definitions of project completion do not change the main findings. The results are robust, for example, if Post_k identifies the completion of the first large project (instead of the first 5) amounting to at least 5 percent of all funds assigned to a province (Table A9). A one σ difference in the tons of explosives is associated with 10,785 thousand (se=3,461) additional kilos of wheat and corn, 10,165 thousand (se=5,076) additional liters of wine, 12,069 thousand (se=5,950) additional kilos of grape, and 730 (se=301) additional tractors per province and year (Table A9, panel A).

9 Conclusions

In this paper, we use evidence from the Marshall Plan in Italy to examine the effects of reconstruction grants on long-run economic outcomes. Our causal estimates exploit variation in the geographical distribution of Allied bombings in Italy during the last stages of World War II (March 1944–April 1945).

Our findings indicate how the Marshall Plan shaped the economic development of postwar Italy. The construction and modernization of transportation infrastructure might have helped industrial and agricultural firms obtaining raw materials from suppliers and distributing their products to clients. Although we do not directly observe sales and input purchases, we show how provinces that received more grants could design and build new projects, instead of just reconstructing old infrastructure. Our event studies also indicate that increases in agricultural production happened only after the completion of the first large public works, especially roads.

In provinces that received more reconstruction grants, we observe a substantial expansion of the industrial sector and an increase in agricultural productivity. Firms became more likely to adopt new technologies, such as motorized tractors, and to develop patents. The mechanization of the agricultural production can explain the opposite growth pattern observed in industrial and agricultural firms. The newly adopted agricultural machines increased agricultural productivity and replaced manual work. Agricultural laborers, then, became cheap input for the booming Italian industry. These two elements—technological development and migration of workers from the agricultural fields to the industrial factories—characterize the

Italian postwar development, which historians often call the Italian "economic boom" or "economic miracle" (Castronovo, 2010).

In the longstanding debate over the effectiveness of international aid (Sachs, 2005; Easterly, 2006), our results corroborate the hypothesis that aid can be associated with long-term economic growth. There are, however, two important caveats. First, our analysis focuses on a specific type of aid, reconstruction grants, in a geographical setting that was in dire need of functioning transportation and communication networks. As a consequence, our results might be informative about the benefits of building new infrastructure in many developing countries with poor public assets, but cannot speak about the effectiveness of other types of interventions. Second, our empirical exercise uses within-country variation by comparing nearby provinces with different levels of reconstruction grants. This setting limits the influence of omitted factors, but cannot inform about the role of institutions in determining the effectiveness of international aid. By comparing Italian provinces in the same region, in fact, we examine geographical units with plausibly similar levels of corruption and political accountability.

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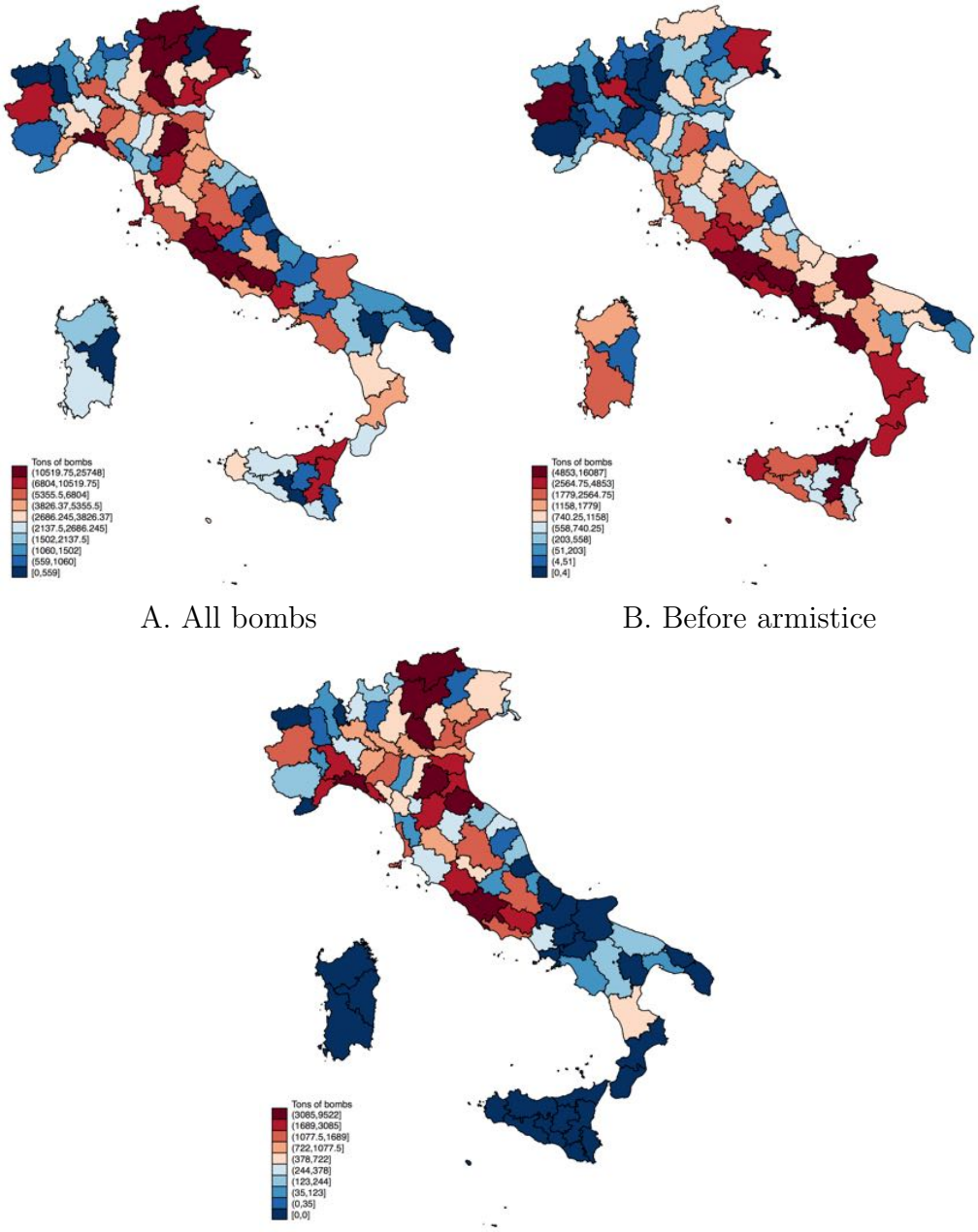
Figures and Tables

Figure 1: Maps of Allied Bombing



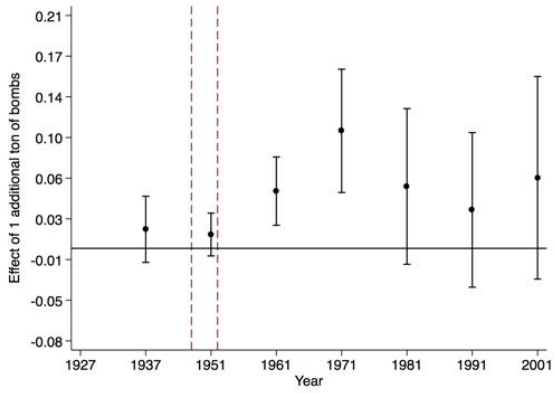
A. All bombs

B. Before armistice

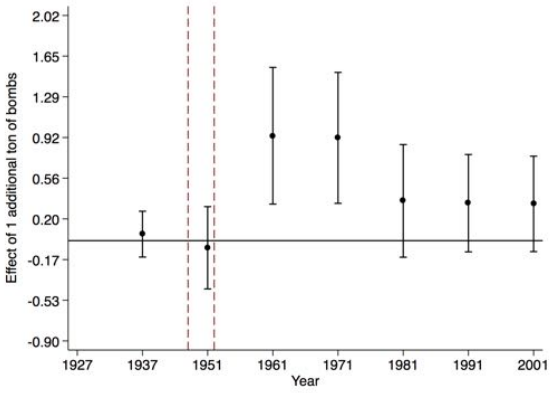
C. Italian Campaign

Notes: This figures shows the distribution of Allied bombings across Italian provinces. Panel A shows all bombings. Panel B shows the distribution of bombings before the Armistice of Cassibile on September 3, 1943. Panel C shows only the Allied bombings associated with the Italian Campaign: these air strikes happened after March 1944 and focused on targets related to the land battles against the German forces.
Sources: USAF Theater History of Operations Reports (THOR) Database, available at www.afri.au.af.mil/thor.

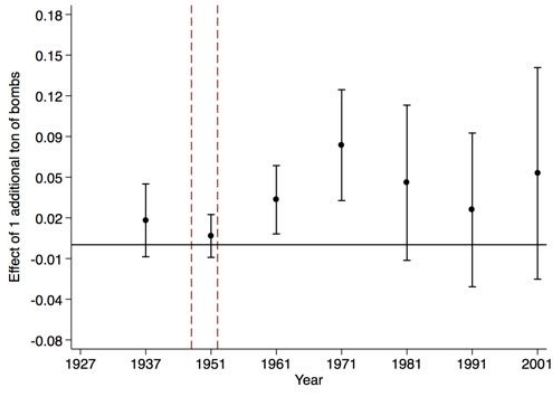
Figure 2: Effects of Reconstruction Grants on Industry and Agriculture



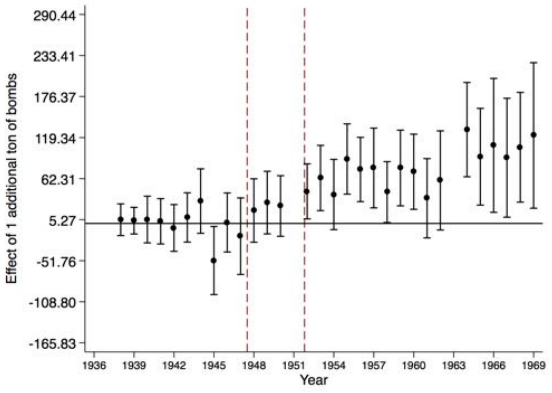
A. Industrial firms



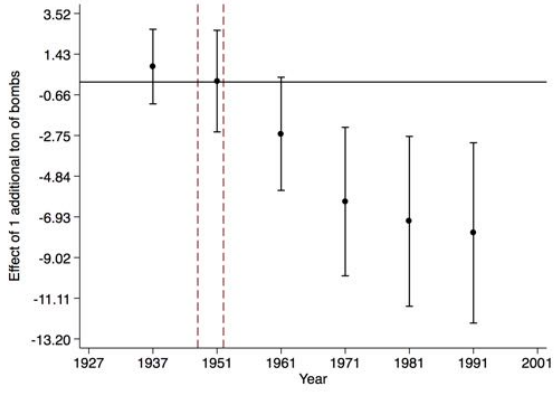
B. Industrial workers



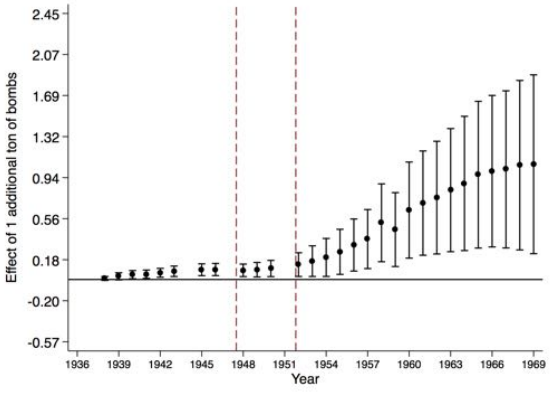
C. Industrial firms $\leq$ 10 employees



D. Wheat and corn



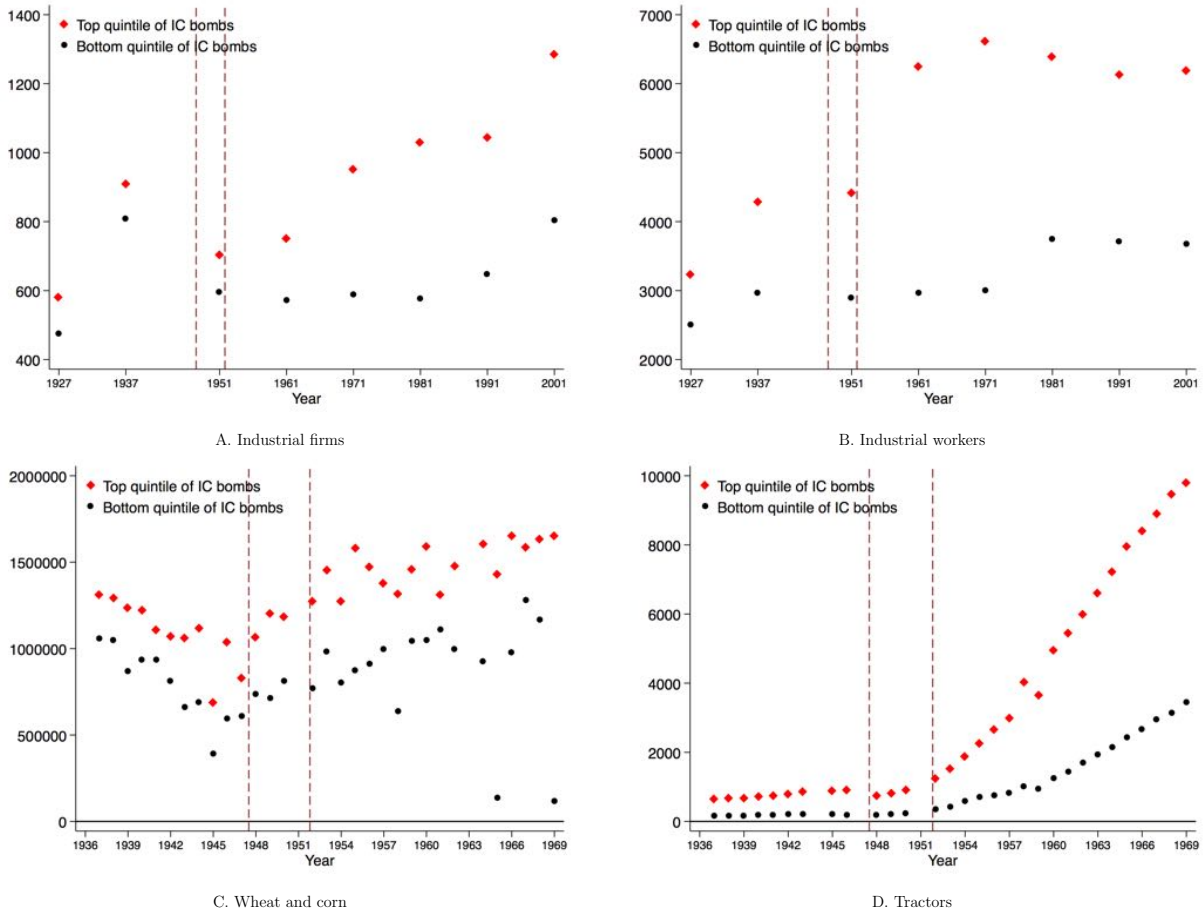
E. Agricultural workers



F. Tractors

Notes: These graphs show the effect of 1 ton of IC bombs on different outcomes. The regressions also include province fixed effects, industry fixed effects (in panels A, B, and C), region-year fixed effects, as well as linear, quadratic, and cubic trends in several baseline characteristics (population density, employment rate, horsepower, share of industrial workers, share of agricultural workers) and in the share of war-related deaths. Standard errors are clustered at the province level. The horizontal bars measure 95% confidence intervals. The outcomes are the amount of firms active in each province, industry, and year (panel A), the number of employed workers (panel B), the number of firms with less than 10 workers (panel C), the production of wheat and corn in each province, and year (100kg, panel D), the number of agricultural workers (panel E), and the number of tractors (panel F). Source: Censimento dell'Industria e dei Servizi, Istituto Nazionale di Statistica. USAF THOR Database, available at www.afri.au.af.mil/thor.

Figure 3: Recovery versus Expansion



Notes: These graphs show the trends in average outcomes between provinces in the top and bottom quintile of bombing during the Italian Campaign. The outcomes are the amount of industrial firms (panel A), the number of industrial workers (panel B), the production of wheat and corn (100kg, panel C), and the number of tractors (panel D). Source: Censimento dell'Industria e dei Servizi, Annuario di Statistica Agraria, Censimento Generale della Popolazione, Istituto Nazionale di Statistica. USAF Theater History of Operations Reports (THOR) Database, available at www.afri.au.af.mil/thor.

Table 1: Summary Statistics

Panel A: Census Data

	Before WWII	After WWII
	(1)	(2)
Number of industrial firms	704	863
Number of industrial workers	3,969	5,883
Industrial firms $\leq$ 10 employees	667	747
Industrial firms $>$ 10 employees	36	42
Number of agricultural workers	96,447	45,206
Wheat and corn production (100kg)	1,234,237	1,323,251
Wine production (100L)	459,347	582,161
Grape production (100kg)	694,159	857,406
Oil production (100kg)	27,196	34,835
Olive production (100kg)	167,829	187,694
Tractors	454	3,420
Threshers	383	323
Population	461,828	588,300

Panel B: Bombings

	All bombs	Italian Campaign
	(1)	(2)
Number of attacks	5,771	1,332
All attacks (tons of explosives)	402,045	82,520
Support to ground operations (tons)	57,722	44,308
Transport infrastructures (tons)	74,332	38,212

Notes: Panel A shows summary statistics on the Italian industry and agriculture. Column 1 shows averages per province and industry before WWII (1927 and 1937 for industrial census; 1937, 1938, 1939 for agricultural annals), while column 2 shows averages after WWII (every 10 years from 1951 to 2001 for industrial census; every year from 1946 to 1969 for agricultural annals). Panel B shows summary statistics of Allied bombings (all bombings in column 1 and the Italian Campaign bombings in column 2). The air strikes associated with the Italian Campaign happened after March 1944 and focused on targets related to the land battles against the German forces.
Sources: Censimento dell'Industria e dei Servizi, Annuario di Statistica Agraria, Censimento Generale della Popolazione, Istituto Nazionale di Statistica (panel A). USAF Theater History of Operations Reports (THOR) Database, available at www.afri.au.af.mil/thor (panel B).

Table 2: Correlation between Pre-War Characteristics and Bombing

	Pre-armistice bombs	IC bombs	Standard deviation	Source
	(1)	(2)	(3)	(4)
Industrial firms	0.476**	0.207	1,255	Industrial census: 1927, 1937
	(0.214)	(0.134)		
Industrial workers	0.037**	0.014	9,856	Industrial census: 1927, 1937
	(0.018)	(0.012)		
Industrial firms $\leq$ 10 employees	0.481**	0.210	1,216	Industrial census: 1927, 1937
	(0.216)	(0.134)		
Industrial firms > 10 employees	4.356*	1.889	89	Industrial census: 1927, 1937
	(2.301)	(1.621)		
Blue collar workers	0.040*	0.015	8,574	Industrial census: 1927, 1937
	(0.020)	(0.013)		
Management and white collar	0.399*	0.171	1,481	Industrial census: 1927, 1937
	(0.209)	(0.142)		
Horsepower	0.019***	0.006	16,663	Industrial census: 1927, 1937
	(0.006)	(0.005)		
Horsepower from electrical eng.	0.022***	0.006	14,628	Industrial census: 1927, 1937
	(0.008)	(0.005)		
Agricultural area (ha^2)	0.006***	0.001	148,878	Agricultural statistics: 1938-1939
	(0.002)	(0.001)		
Agricultural firms	0.032***	-0.003	24,259	Agricultural census: 1929, 1961, 1971
	(0.011)	(0.006)		
Wheat and corn production (100kg)	0.016***	0.000	844,060	Agricultural statistics: 1937-1939
	(0.005)	(0.000)		
Wine production (100L)	0.002	0.001	342,153	Agricultural statistics: 1937-1939
	(0.001)	(0.001)		
Grape production (100kg)	0.001	0.001	507,567	Agricultural statistics: 1937-1939
	(0.001)	(0.000)		
Tractors	0.246	1.242**	484	Agricultural statistics: 1937-1939
	(0.612)	(0.540)		
Agricultural workers	0.019***	0.006	43,959	Population census: 1931, 1936
	(0.007)	(0.005)		
Size (km^2)	0.522**	0.163	1,691	Population census: 1931, 1936
	(0.227)	(0.125)		
Population density	3.244*	1.504	113	Population census: 1931, 1936
	(1.632)	(1.505)		
Population	0.003**	0.001	341,561	Population census: 1931, 1936
	(0.001)	(0.001)		
Voter turnout	6.174	73.859	2.027	Electoral statistics: 1934
	(110.61)	(94.596)		
Tons of bombs - mean	1,533	1,045		
Tons of bombs - std. dev.	2,419	1,681		

Notes: Each row-column combination shows the coefficient β_1 from a different regression of the tonnage of bombs in a province on a pre-war variable: $\text{Tons}_p = \beta_0 + \beta_1 \cdot \text{Pre-war characteristic}_{pt} + \varepsilon_{pt}$, where $t < 1940$. Column 1 uses the tons of explosive dropped by Allied forces before the armistice of September 8, 1943 as dependent variable. Column 2 uses the tons of explosives launched during the Italian campaign as dependent variable. When the independent variable comes from the Industrial census, the regression also includes industry fixed effects. Standard errors clustered by province in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Source: Censimento dell'Industria e dei Servizi, Annuario di Statistica Agraria, Censimento Generale della Popolazione, Istituto Nazionale di Statistica, Statististica delle Elezioni Generali Politiche per la XXIX Legislatura . USAF Theater History of Operations Reports (THOR) Database, available at www.afri.au.af.mil/thor.

Table 3: Bombings and E.R.P. Aid

	Reconstruction grants	Food & drugs	Loans	All grants
	(1)	(2)	(3)	(4)
Panel A: Italian Campaign bombs, No controls				
Tons of IC bombs	10,108.637***	-6,917.717	323.085**	-3,667.318
	(1,740.011)	(4,266.533)	(154.548)	(9,866.659)
Observations	79	78	79	78
R^2	0.341	0.018	0.031	0.001
Panel B: Italian Campaign bombs, Province controls				
Tons of IC bombs	6,776.236***	-11,589.643**	37.339	-16,078.844
	(1,327.345)	(5,051.757)	(94.113)	(10,196.982)
Observations	75	74	75	74
R^2	0.736	0.698	0.864	0.722
Mean outcome	78,745,789	41,623,094	1,910,392	162,751,795
Tons of IC bombs - mean	1,045	1,045	1,045	1,045
Tons of IC bombs - std. dev.	1,681	1,681	1,681	1,681

Notes: Data on funding from the Marshall Plan come from *"Missione Americana E.R.P. in Italia",* "Mutual Security Agency" bulletins, and the historical archive of the *Istituto Mobiliare Italiano.* Province controls in Panel B include region fixed effects, population density, employment rate, industrial horsepower, share of industrial workers, share of agricultural workers. Standard errors clustered by province in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Table 4: Pre-War Trends in Agricultural Output

	Wheat and corn production	Wine production	Grape production	Tractors	Other machines	Wheat and corn area
	(1)	(2)	(3)	(4)	(5)	(6)
			Panel A: Linear trend			
Tons of IC bombs	59.501	26.673	43.631	0.091***	0.009	0.801
	(53.598)	(24.039)	(37.468)	(0.022)	(0.015)	(2.238)
Linear trend	-57,734.244***	31,831.162***	41,687.428***	8.973	43.342***	428.589
	(16,307.483)	(8,965.873)	(12,537.358)	(6.489)	(11.016)	(315.455)
Tons of IC bombs x Linear trend	4.942	2.203	3.307	0.006	0.000	-0.022
	(5.409)	(4.141)	(4.956)	(0.007)	(0.003)	(0.162)
Observations	235	235	235	235	235	235
R^2	0.022	0.030	0.033	0.129	0.009	0.001
			Panel B: Year dummies			
Tons of IC bombs	62.632	28.677	45.676	0.099***	0.009	0.812
	(49.578)	(25.216)	(39.396)	(0.021)	(0.016)	(2.263)
Year 1938	-85,301.160**	45,604.113**	37,813.019	14.862	31.377***	-836.149**
	(38,694.574)	(21,702.114)	(29,380.180)	(9.633)	(9.508)	(361.584)
Year 1939	-115,532.845***	63,712.104***	83,381.896***	17.934	86.646***	852.373
	(32,764.730)	(18,010.045)	(25,188.877)	(13.035)	(22.123)	(632.460)
Tons of IC bombs x Year 1938	10.375	2.800	7.093	-0.000	0.000	-0.121
	(10.241)	(7.235)	(9.340)	(0.007)	(0.004)	(0.141)
Tons of IC bombs x Year 1939	9.869	4.418	6.616	0.012	-0.000	-0.045
	(10.861)	(8.316)	(9.952)	(0.013)	(0.007)	(0.325)
Observations	235	235	235	235	235	235
R^2	0.037	0.031	0.033	0.129	0.009	0.001
Mean outcome	1,234,237	459,348	694,159	454	319	69,992
Tons of IC bombs - mean	1,045	1,045	1,045	1,045	1,045	1,045
Tons of IC bombs - std. dev.	1,681	1,681	1,681	1,681	1,681	1,681

Notes: Panel A estimates linear trends in agricultural outputs before WWII. Panel B estimates non-linear trends by including dummy variables for year 1938 and 1939. Tons of IC bombs measures the tons of explosives dropped by Allied air forces against targets related to the Italian Campaign against German troops. The dependent variables are the production of wheat and corn in 100kg (column 1), the production of wine in 100L (column 2), the production of grape in 100kg (column 3), the number of tractors (column 4), the number of other agricultural machines (column 5), the hectares used for wheat and corn production (column 6). Standard errors clustered by province in parentheses, *** p<0.01, ** p<0.05, * p<0.1.
Source: Censimento dell'Industria e dei Servizi, Annuario di Statistica Agraria, Censimento Generale della Popolazione, Istituto Nazionale di Statistica. USAF Theater History of Operations Reports (THOR) Database, available at www.afri.au.af.mil/thor.

Table 5: Effects on Industrial Outcomes

	Industrial firms	Firms $\leq$ 10 employees	Firms $>$ 10 employees	Industrial workers	Blue collar	Mgmt & white
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: OLS with province controls						
Tons of bombs x Post 1952	0.054**	0.041*	0.001	0.640***	0.135	0.170**
	(0.025)	(0.022)	(0.003)	(0.202)	(0.085)	(0.070)
Observations	5,454	5,443	5,443	5,443	2,709	2,025
R^2	0.391	0.356	0.245	0.477	0.415	0.448
Panel B: IV with province controls						
Reconstr. grants (M) x Post 1952	6.992**	5.378*	0.105	83.551***	19.986	26.587**
	(3.348)	(2.908)	(0.340)	(28.260)	(12.822)	(12.125)
Observations	5,454	5,443	5,443	5,443	2,709	2,025
R^2	0.391	0.356	0.244	0.477	0.415	0.447
F-statistic	47.29	47.05	47.05	47.05	27.71	22.39
Mean outcome	704	667	36	3,969	3,068	782
Tons of IC bombs - mean	1,045	1,045	1,045	1,045	1,045	1,045
Tons of IC bombs - std. dev.	1,681	1,681	1,681	1,681	1,681	1,681
Reconstr. grants (M)- mean	79	79	79	79	79	79
Reconstr. grants (M)- std. dev.	29	29	29	29	29	29

Notes: Regressions include province fixed effects, industry fixed effects, region-year fixed effects, pre-war characteristics (population density, employment rate, industrial horsepower, share of industrial workers, share of agricultural workers) interacted with a trend up to the third order, and the share of war-related deaths interacted with a trend up to the third order. Panel B shows instrumental variable regressions in which the reconstruction grants received by a province (in millions) are instrumented with the amount of explosives dropped during the Italian Campaign. The dependent variables are the number of firms in a province, industry, and census year (column 1), the number of firms with less than 10 employees (column 2), the number of firms with more than 10 employees (column 3), the number of employees (column 4), the number of blue collar workers (column 5), and the number of managers and white collar workers (column 6). The industries are food, paper, chemistry, construction, mining, mechanics, metallurgy, textile, and clothing. The estimating sample does not include provinces in Sardegna and Sicilia, because these regions were not affected by bombings related to the Italian Campaign. Standard errors clustered by province in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Table 6: Effects on Agricultural Outcomes

	Wheat & corn production (1)	Wine production (2)	Grape production (3)	Oil production (4)	Agricultural workers (5)	Agricultural firms (6)	Tractors (7)	Threshers (8)
				Panel A: OLS with province controls				
Tons of bombs x Post 1952	71.220***	63.747*	79.573**	1.007	-5.367***	2.442	0.515**	-0.003
	(25.453)	(33.246)	(39.480)	(1.007)	(1.408)	(2.795)	(0.208)	(0.009)
Observations	2,244	2,341	2,341	2,368	516	222	2,218	1,998
R^2	0.949	0.895	0.896	0.895	0.954	0.751	0.908	0.863
				Panel B: IV with province controls				
Reconstr. grants (M) x Post 1952	9,445.833**	8,416.682	10,506.190*	132.559	-706.710***	341.844	67.456**	-0.421
	(3,673.788)	(5,069.177)	(5,995.360)	(137.567)	(213.760)	(375.848)	(31.098)	(1.172)
Observations	2,244	2,341	2,341	2,368	516	222	2,218	1,998
R^2	0.950	0.875	0.879	0.895	0.942	0.765	0.906	0.864
F-statistic	36.01	36.61	36.61	36.66	41.03	26.96	37.27	34.34
Mean outcome	1,234,237	459,348	694,159	27,196	96,445	45958	454	383
Tons of IC bombs - mean	1,045	1,045	1,045	1,045	1,045	1,045	1,045	1,045
Tons of IC bombs - std. dev.	1,681	1,681	1,681	1,681	1,681	1,681	1,681	1,681
Reconstr. grants (M)- mean	79	79	79	79	79	79	79	79
Reconstr. grants (M)- std. dev.	29	29	29	29	29	29	29	29
Source	Yearly statistics	Yearly statistics	Yearly statistics	Yearly statistics	Decennial census	Decennial census	Yearly statistics	Yearly statistics

Notes: Regressions in Panel A include province fixed effects, region-year fixed effects, pre-war characteristics (population density, employment rate, industrial horsepower, share of industrial workers, share of agricultural workers) interacted with a trend up to the third order, and the share of war-related deaths interacted with a trend up to the third order. Panel B shows instrumental variable regressions in which the reconstruction grants received by a province (in millions) are instrumented with the amount of explosives dropped during the Italian Campaign. The dependent variables are the production of wheat and corn in 100kg (column 1), the production of wine in 100L (column 2), the production of grape in 100kg (column 3), the production of oil in 100kg (column 4), the number of agricultural workers (column 5), the number of agricultural firms (column 6), the number of tractors (column 7), the number of threshers (column 8). The estimating sample does not include provinces in Sardegna and Sicilia, because these regions were not affected by bombings related to the Italian Campaign. Standard errors clustered by province in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Table 7: Effects on Patents

	All classes (1)	All classes (2)	Agriculture (3)	Industry (4)
Panel A: OLS with province controls				
Tons of bombs x Post 1948	0.0052**	0.0007**	0.0016**	0.0005**
	(0.0024)	(0.0003)	(0.0007)	(0.0002)
Observations	1,184	9,728	1,184	8,512
R^2	0.9519	0.4241	0.9345	0.3691
Panel B: IV with province controls				
Reconstr. grants (M) x Post 1948	0.6666**	0.0836**	0.2009**	0.0668**
	(0.3304)	(0.0368)	(0.0954)	(0.0319)
Observations	1,184	9,728	1,184	8,512
R^2	0.9518	0.4241	0.9341	0.3691
F-statistic	39.77	50.06	39.77	49.82
Mean outcome	49	6	8	6
Tons of IC bombs - mean	1,045	1,045	1,045	1,045
Tons of IC bombs - std. dev.	1,681	1,681	1,681	1,681
Reconstr. grants (M)- mean	79	79	79	79
Reconstr. grants (M)- std. dev.	29	29	29	29
Sample	Prov–year	Prov–class–year	Prov–class–year	Prov–class–year

Notes: Regressions include province fixed effects, patent class fixed effects (columns 2-4), region-year fixed effects, pre-war characteristics (population density, employment rate, industrial horsepower, share of industrial workers, share of agricultural workers) interacted with a trend up to the third order, and the share of war-related deaths interacted with a trend up to the third order. Panel B shows instrumental variable regressions in which the reconstruction grants received by a province (in millions) are instrumented with the amount of explosives dropped during the Italian Campaign. The dependent variables are the number of patents issued between 1940 and 1955 to Italian firms and individuals by province and year (column 1) or by province, patent class, and year (columns 2 to 5). Column 3 isolates agricultural patents, and column 4 industrial patents. The estimating sample does not include provinces in Sardegna and Sicilia, because these regions were not affected by bombings related to the Italian Campaign. Standard errors clustered by province in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Table 8: Characteristics of Funded Projects

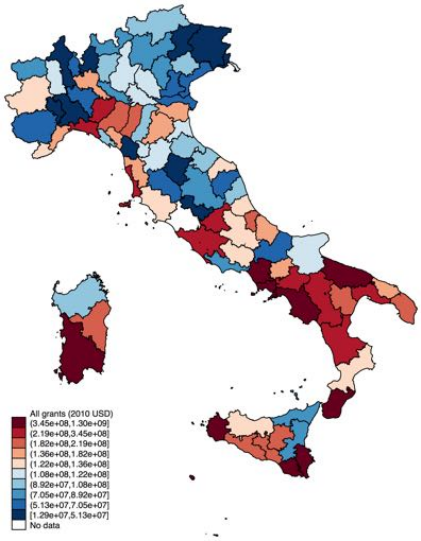
	All Provinces (1)	Quintile 1 (2)	Quintile 2 (3)	Quintile 3 (4)	Quintile 4 (5)	Quintile 5 (6)
Share of grants used for transportation network						
1948-1952	0.52	0.52	0.52	0.53	0.53	0.53
Share of grants used for hygiene infrastructure						
1948-1952	0.15	0.16	0.12	0.16	0.16	0.16
Share of grants used for public buildings						
1948-1952	0.32	0.31	0.36	0.31	0.32	0.32
Number of projects						
1948-1952	77.04	69.19	47.70	81.84	63.89	108.39
1948	5.72	6.12	4.10	6.11	4.39	7.17
1949	21.79	20.06	13.40	24.16	18.56	28.72
1950	23.04	20.25	14.60	23.47	19.33	33.44
1951	18.58	17.06	11.40	19.32	15.50	26.22
1952	7.91	5.69	4.20	8.79	6.11	12.83
Number of transportation projects						
1948-1952	37.80	9.56	9.60	37.37	40.22	76.61
1948	3.78	1.12	1.20	3.68	3.44	8.00
1949	9.65	2.69	2.50	9.21	11.22	18.72
1950	11.80	2.31	2.60	12.42	11.83	24.67
1951	7.88	2.38	2.20	6.89	9.28	15.56
1952	4.69	1.06	1.10	5.16	4.44	9.67
Cost per project (2010 USD)						
1948-1952	1,773,641	2,152,764	3,250,024	1,403,558	1,455,489	1,325,225
1948	1,931,482	2,437,761	1,977,405	1,491,806	2,039,555	1,811,973
1949	1,212,103	1,636,102	1,974,165	853,719	968,976	1,033,270
1950	1,872,237	2,316,338	3,549,321	1,508,780	1,502,903	1,298,750
1951	2,822,649	3,296,138	5,269,323	2,124,647	2,425,477	2,176,457
1952	1,065,244	1,468,733	2,176,459	873,366	804,586	552,443
Share of of grants used for new infrastructure						
1948-1952	0.48	0.02	0.17	0.50	0.74	0.80
1948	0.43	0.00	0.00	0.32	0.74	0.87
1949	0.41	0.00	0.00	0.35	0.66	0.81
1950	0.52	0.00	0.21	0.53	0.81	0.84
1951	0.47	0.00	0.19	0.53	0.72	0.73
1952	0.61	0.24	0.42	0.74	0.69	0.83
Share of grants used for new transportation infrastructure						
1948-1952	0.47	0.02	0.17	0.48	0.72	0.77
1948	0.42	0.00	0.00	0.31	0.71	0.84
1949	0.39	0.00	0.00	0.34	0.64	0.78
1950	0.50	0.00	0.21	0.51	0.78	0.82
1951	0.46	0.00	0.18	0.52	0.70	0.71
1952	0.59	0.24	0.42	0.71	0.67	0.80
Observations	81	16	10	19	18	18

Notes: This table shows statistics on the projects funded through E.R.P. reconstruction aid in all provinces not in the regions of Sardegna or Sicilia (column 1), provinces in the first quintile of the distribution of explosives dropped during the Italian Campaign (column 2), in the second quintile (column 3), third quintile (column 4), fourth quintile (column 5), and fifth quintile (column 6). The variables named "Share of grants" divide the amount of grants used for a specific purpose by the total amount of grants received between 1948 and 1952 or in a given year. Costs are expressed in 2010 USD. "New infrastructure" identifies public works that did not reconstruct public infrastructure that was present before WWII. Source: *"Missione Americana E.R.P. in Italia",* "Mutual Security Agency" bulletins, and the historical archive of the *Istituto Mobiliare Italiano.*

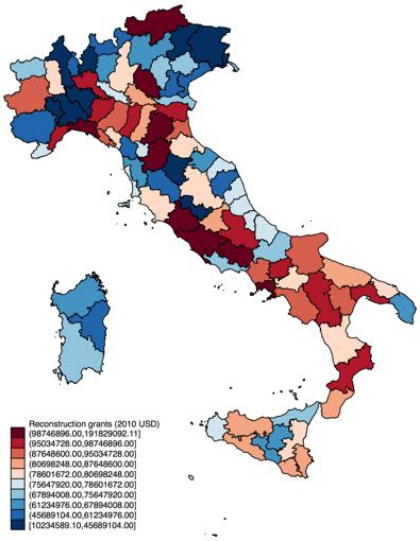
Online Appendix - Not For Publication

A Additional Figures and Tables

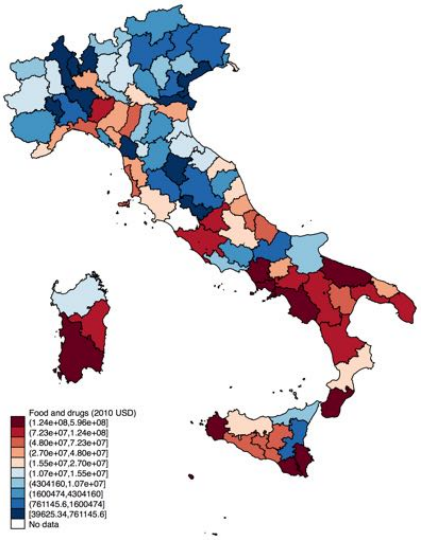
Figure A1: Maps of Reconstruction Grants



A. All E.R.P. aid



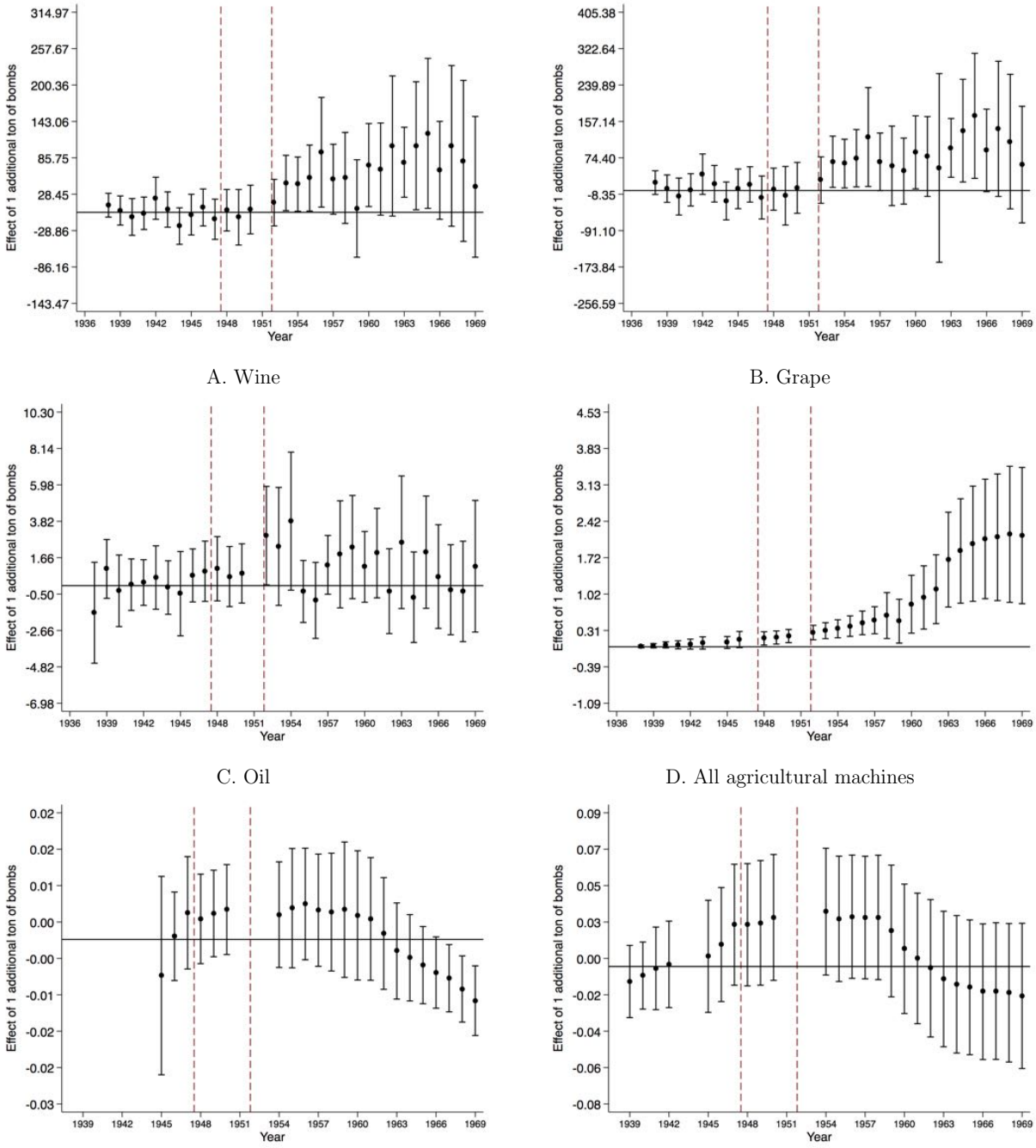
B. Reconstruction grants



C. Food and drugs

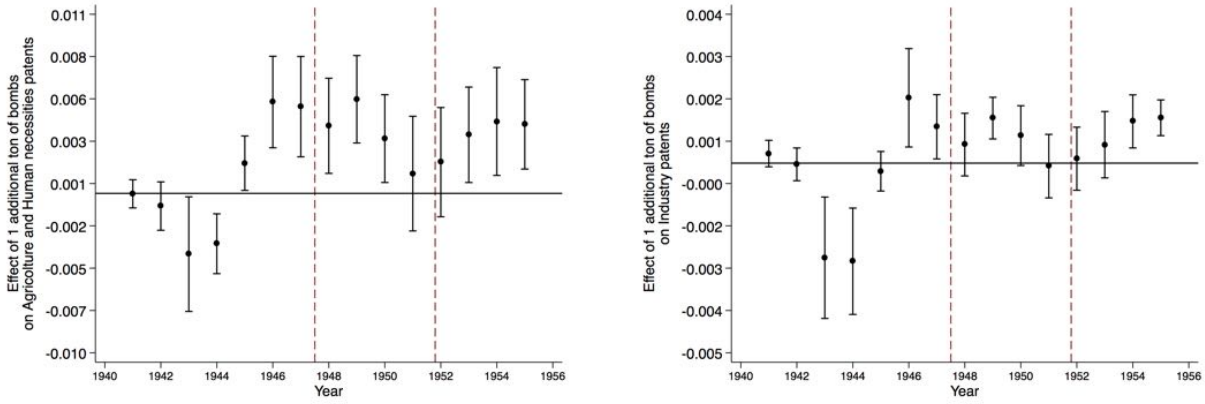
Notes: This graph shows the distribution of E.R.P. aid across the Italian provinces. Panel A shows all E.R.P. aid. Panel B focuses on reconstruction grants. Panel C shows the value of food and drugs assigned to each province.
Source: *"Missione Americana E.R.P. in Italia",* "Mutual Security Agency" bulletins, and historical archive of the *Istituto Mobiliare Italiano.*

Figure A2: Other Graphs on Italian Recovery



Notes: These graphs show the effect of 1 ton of IC bombs on different outcomes. The regressions also include province fixed effects, region-year fixed effects, as well as linear, quadratic, and cubic trends in several baseline characteristics (population density, horsepower, employment rate, share of industrial workers, share of agricultural workers) and in the share of war-related deaths. Standard errors are clustered at the province level. The horizontal bars measure 95% confidence intervals. The outcomes are the production of wine (100L, panel A), the production of grapes (100kg, panel B), the production of oil (100L, panel C), the number of all agricultural machines (panel D), the number of gins (panel E), and the number of threshers (panel F). Source: Annuario di Statistica Agraria, Istituto Nazionale di Statistica. USAF Theater History of Operations Reports (THOR) Database, available at www.afri.au.af.mil/thor.

Figure A3: Development of Intellectual Property

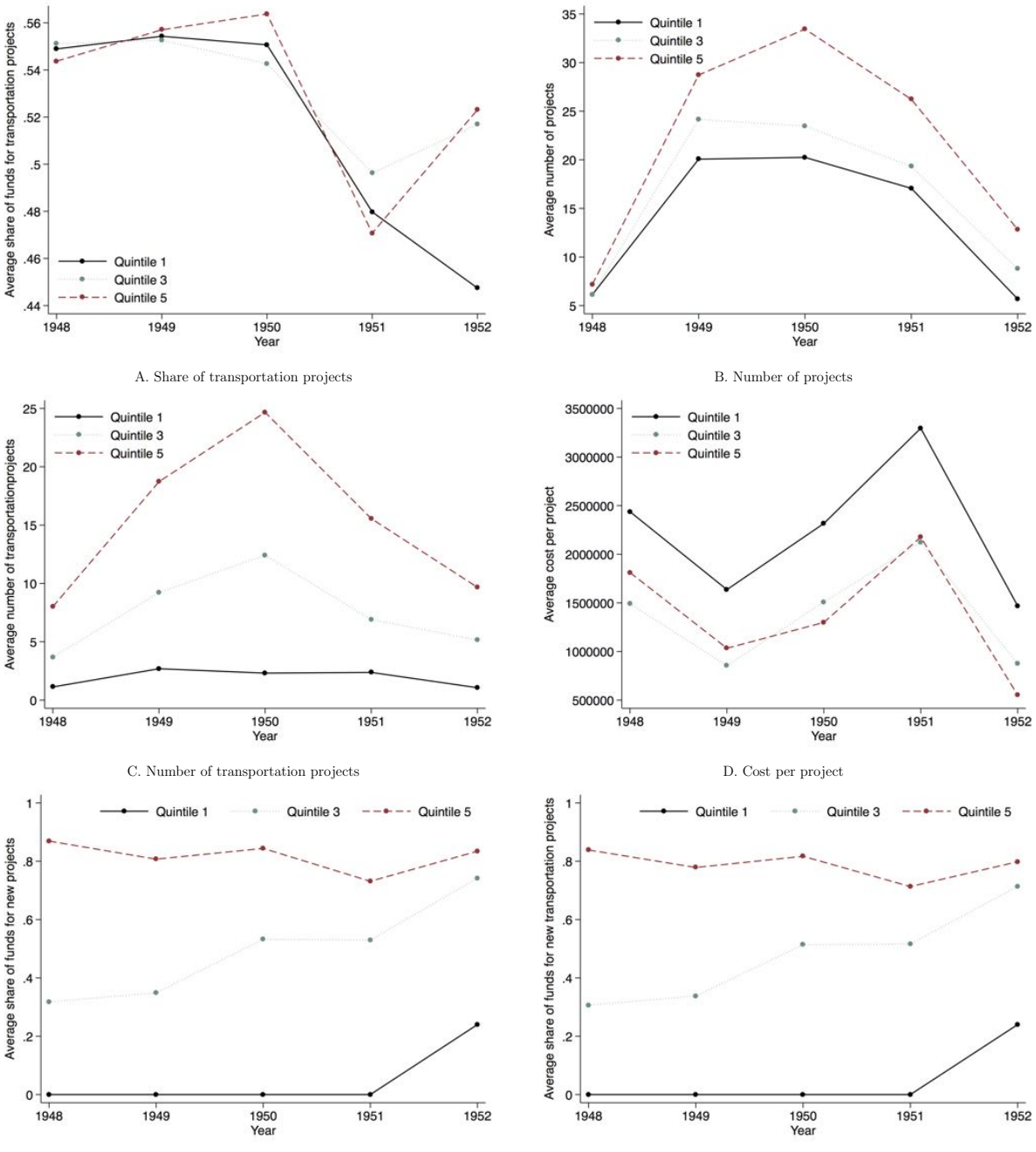


B. Agriculture

C. Industry

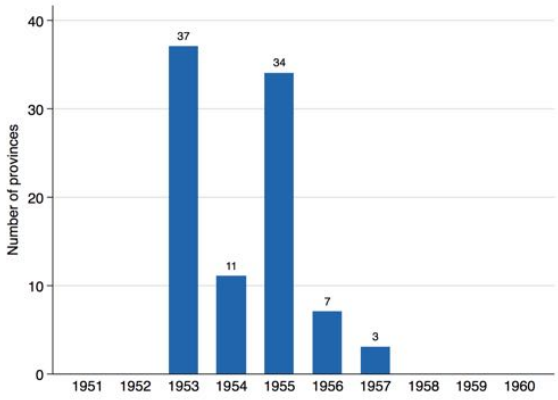
Notes: These graphs show the effect of 1 ton of IC bombs on different types of patents. The regressions also include province fixed effects, region-year fixed effects, as well as linear, quadratic, and cubic trends in several baseline characteristics (population density, employment rate, horsepower, share of industrial workers, share of agricultural workers) and in the share of war-related deaths. Standard errors are clustered at the province level. The horizontal bars measure 95% confidence intervals. The outcomes are the number of patents per province, class, and year. Panel A isolates agricultural patents, while panel B focuses on industrial patents. Source: Bollettino della Proprietà Intellettuale, Ministero dell'Agricoltura, dell'Industria, e del Commercio. USAF Theater History of Operations Reports (THOR) Database, available at www.afri.au.af.mil/thor.

Figure A4: Funded Projects

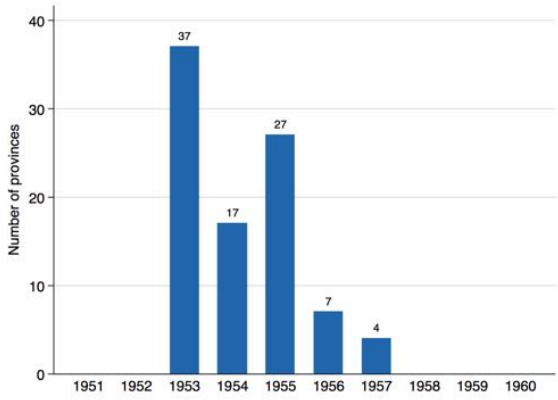


Notes: These graphs show shows statistics on the projects funded through E.R.P. reconstruction aid for provinces in different quintiles of the distribution of explosives dropped during the Italian Campaign. The variables are the share of grants used for transportation projects (panel A), the number of projects (panel B), the number of transportation projects (panel C), the average cost per project (panel D), the share of funds used for new projects (panel E), the share of funds used for new transportation projects (panel F). Costs are expressed in 2010 USD. "New projects" identifies public works that did not reconstruct public infrastructure that was present before WWII. Source: *"Missione Americana E.R.P. in Italia",* "Mutual Security Agency" bulletins, and the historical archive of the *Istituto Mobiliare Italiano.*

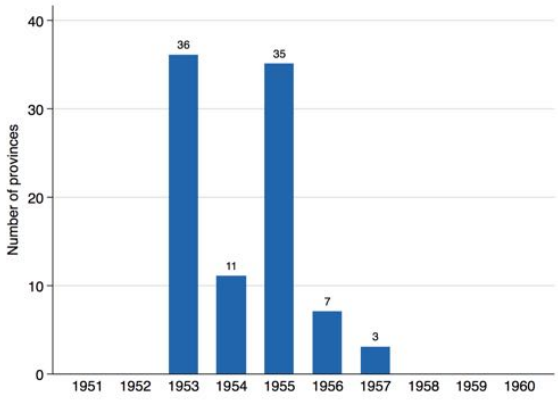
Figure A5: Year of Completion of Large Infrastructure Projects



A. Year of completion top 5 projects



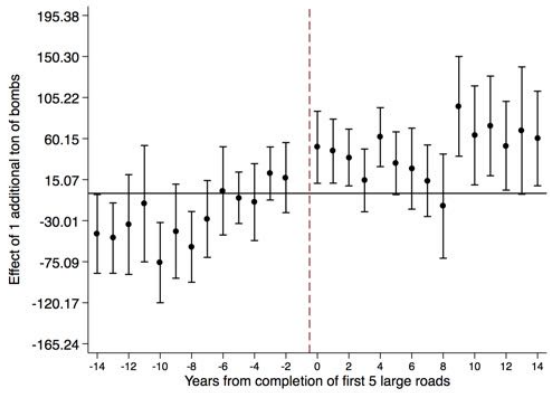
B. Year of completion top 5 roads



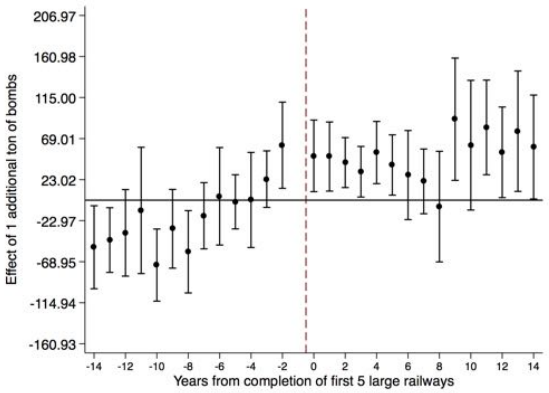
C. Year of completion top 5 railways

Notes: This graph shows the distribution of the completion year of the first 5 large infrastructure projects funded by E.R.P aid across the 92 Italian provinces. Panel A shows the completion year of the first 5 projects, each amounting to at least 5 percent of total funds assigned to a province. Panel B shows the completion year of the first 5 roads, each amounting to at least 5 percent of total funds assigned to a province. Panel A shows the completion year of the first 5 railways, each amounting to at least 5 percent of total funds assigned to a province.
Source: *"Missione Americana E.R.P. in Italia",* "Mutual Security Agency" bulletins, and historical archive of the *Istituto Mobiliare Italiano.*

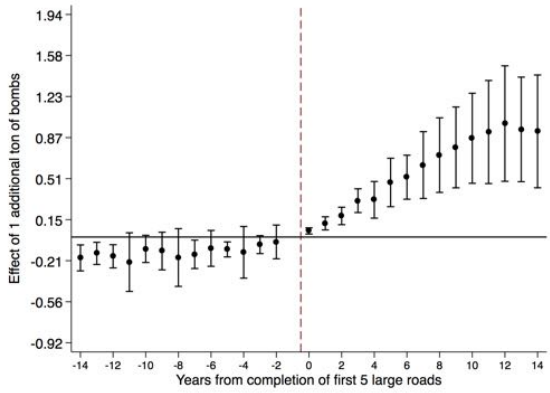
Figure A6: Completion of Large Infrastructure Projects



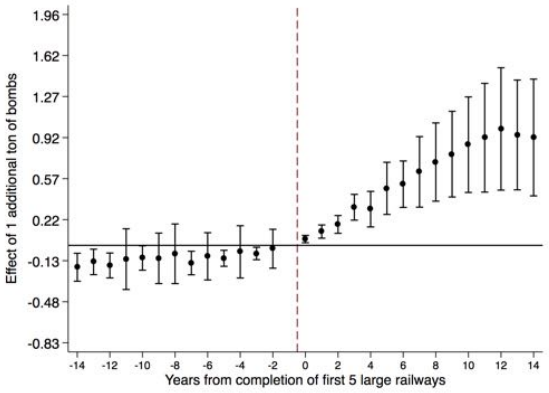
A. Wheat and corn - top 5 roads



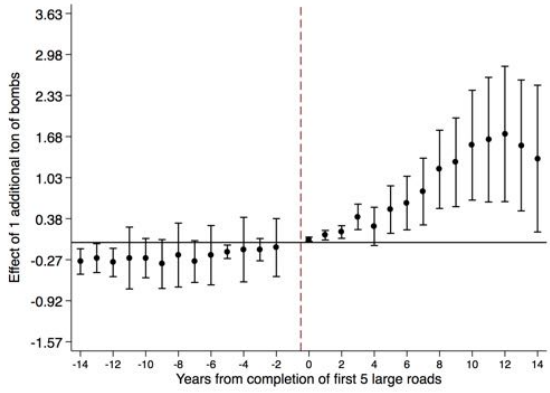
B. Wheat and corn - top 5 railways



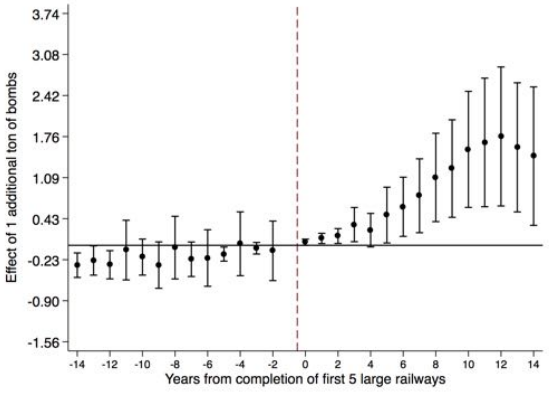
C. Tractors - top 5 roads



D. Tractors - top 5 railways



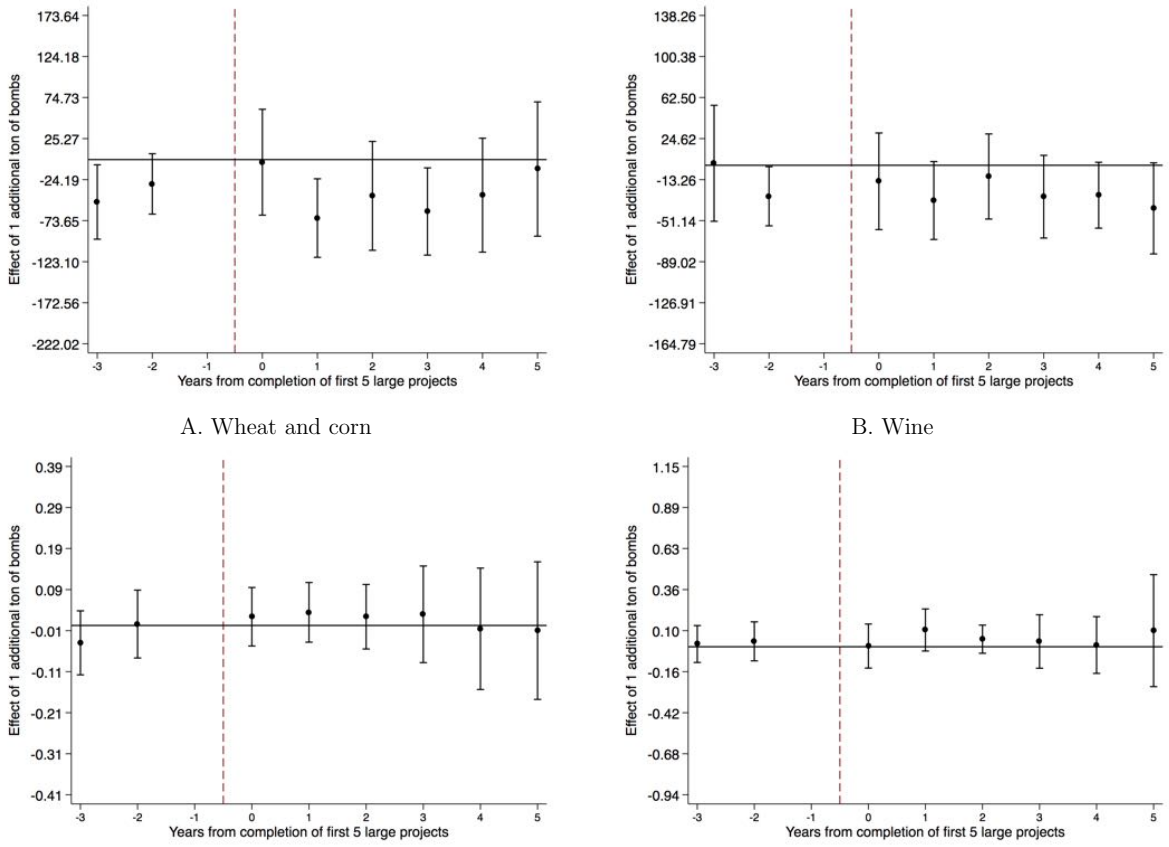
D. All Machines - top 5 roads



F. All Machines - top 5 railways

Notes: The regressions are event studies in which period 0 is the completion year of the first 5 large infrastructures (roads in panels A, C, and E; railways in panels B, D, and F), each amounting to at least 5 percent of total funds assigned to a province, funded by E.R.P aid. Regressions also include province FEs, region-event period FEs, calendar year FEs, as well as linear, quadratic, and cubic trends in several baseline characteristics (population density, horsepower, employment rate, share of industrial workers, share of agricultural workers) and in the share of war-related deaths. Standard errors are clustered at the province level. The horizontal bars measure 95% confidence intervals. The outcomes are the production of wheat and corn (100kg, panel A and B), the number of tractors (panel C and D), and the number of all motorized agricultural machines (panel E and F). Source: Annuario di Statistica Agraria, Censimento Generale della Popolazione. USAF THOR Database.

Figure A7: Completion of Large Infrastructure Projects, Placebo Treatments



A. Wheat and corn

B. Wine

C. Tractors

D. All Machines

Notes: These regressions are placebo event studies. The estimating sample includes only periods before the actual completion of large infrastructures. In each province, period 0 is chosen randomly among the pre-treatment periods. Regressions also include province fixed effects, region-event period fixed effects, calendar year fixed effects, as well as linear, quadratic, and cubic trends in several baseline characteristics (population density, horsepower, employment rate, share of industrial workers, share of agricultural workers) and in the share of war-related deaths. Standard errors are clustered at the province level. The horizontal bars measure 95% confidence intervals. The outcomes are the production of wheat and corn in each province, and year (100kg, panel A), the production of wine (100L, panel B), the number of tractors (panel C), and the number of all motorized agricultural machines (panel D). Source: Annuario di Statistica Agraria, Censimento Generale della Popolazione, Istituto Nazionale di Statistica. USAF Theater History of Operations Reports (THOR) Database, available at www.afri.au.af.mil/thor.

Table A1: Other Outcomes

	Population	Total wage	Average wage	Illiterates	Non-agri area	Wheat and corn area	Gins	All machines
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: OLS with province controls								
Tons of bombs x Post 1948	19.145	4,724.488**	-4.518	0.019	0.050	0.127	-0.002	0.950***
	(20.832)	(1,915.477)	(4.532)	(1.657)	(0.430)	(0.468)	(0.002)	(0.291)
Observations	588	2,736	2,635	368	1,628	2,247	1,702	2,218
R^2	0.978	0.399	0.090	0.968	0.970	0.984	0.958	0.928
Panel B: IV with province controls								
Reconstr. grants (M) x Post 1948	2,539.306	650,582.865***	-627.841	2.589	6.307	16.876	-0.250	124.444***
	(2,884.964)	(215,754.828)	(648.509)	(221.400)	(54.696)	(61.436)	(0.273)	(42.172)
Observations	588	2,736	2,635	368	1,628	2,247	1,702	2,218
R^2	0.978	0.399	0.090	0.968	0.970	0.985	0.958	0.927
F-statistic	39.30	36.24	35.04	36.96	40.95	36.24	35.62	37.27
Mean outcome	461,828	11,339,233	2294	73,733	27,142	69,992	78	773
Tons of IC bombs - mean	1,045	1,045	1,045	1,045	1,045	1,045	1,045	1,045
Tons of IC bombs - std. dev.	1,681	1,681	1,681	1,681	1,681	1,681	1,681	1,681
Reconstr. grants (M)- mean	79	79	79	79	79	79	79	79
Reconstr. grants (M)- std. dev.	29	29	29	29	29	29	29	29
Source	Decennial census	Decennial census	Decennial census	Decennial census	Yearly statistics	Yearly statistics	Yearly statistics	Yearly statistics

Notes: Regressions include province fixed effects, industry fixed effects (first 4 columns), region-year fixed effects, pre-war characteristics (population density, employment rate, industrial horsepower, share of industrial workers, share of agricultural workers) interacted with a trend up to the third order, and the share of war-related deaths interacted with a trend up to the third order. Panel B shows instrumental variable regressions in which the reconstruction grants received by a province (in millions) are instrumented with the amount of explosives dropped during the Italian Campaign. The dependent variables are the residential population (column 1), the wage bill in an industry, province, and year (column 2), the average wage (column 3), the number of illiterates (column 4), the hectares not used for agriculture (column 5), the hectares used for wheat and corn (column 6), the number of gins (column 7), and the number of all motorized agricultural machines (column 8). The estimating sample does not include provinces in Sardegna and Sicilia, because these regions were not affected by bombings related to the Italian Campaign. Standard errors clustered by province in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Table A2: Different Controls for WWII and Marshall Plan

	Industrial firms	Firms ≤ 10 employees	Industrial workers	Wheat & corn production	Agricultural workers	Tractors
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Controls for tons of bombs before armistice						
Tons of bombs x Post 1948	0.057**	0.044*	0.687***	57.957**	-5.252***	0.534***
	(0.026)	(0.022)	(0.201)	(25.039)	(1.500)	(0.176)
Observations	5,526	5,515	5,515	2,270	523	2,245
R^2	0.391	0.356	0.477	0.952	0.954	0.909
Panel B: Controls for other MP grants						
Tons of bombs x Post 1948	0.059**	0.045**	0.712***	77.583***	-7.199***	0.667***
	(0.025)	(0.022)	(0.202)	(25.955)	(2.165)	(0.201)
Observations	5,526	5,515	5,515	2,270	523	2,245
R^2	0.391	0.356	0.477	0.949	0.949	0.902
Panel C: Controls for other MP grants and war-related deaths						
Tons of bombs x Post 1948	0.046*	0.034	0.634***	63.278**	-5.820***	0.508**
	(0.024)	(0.021)	(0.210)	(26.683)	(1.788)	(0.215)
Observations	5,454	5,443	5,443	2,244	516	2,218
R^2	0.391	0.356	0.477	0.949	0.952	0.908
Mean outcome	704	667	3,969	1,234,237	96,445	454
Tons of IC bombs - mean	1,045	1,045	1,045	1,045	1,045	1,045
Tons of IC bombs - std. dev.	1,681	1,681	1,681	1,681	1,681	1,681

Notes: Regressions include province fixed effects, region-year fixed effects, pre-war characteristics (population density, employment rate, industrial horsepower, share of industrial workers, share of agricultural workers) interacted with a trend up to the third order. In addition, panel A includes the tons of bombs dropped in each province before the armistice interacted with a trend up to the third order; panel B includes the amount of grants (not for reconstruction of public infrastructures) assigned through the Marshall Plan interacted with a dummy equal to 1 starting from 1952; panel C includes the amount of grants (not for reconstruction of public infrastructures) assigned through the Marshall Plan interacted with a dummy equal to 1 starting from 1952, as well as the share of war-related deaths interacted with a trend up to the third order. The dependent variables are the amount of firms active in each province, industry, and year (column 1), the number of industrial workers (column 2), the number of firms with less than 10 workers (column 3), the production of wheat and corn in each province, and year (column 4), the number of agricultural workers (column 5), and the number of tractors (column 6). The estimating sample does not include provinces in Sardegna and Sicilia, because these regions were not affected by bombings related to the Italian Campaign. Standard errors clustered by province in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Table A3: Alternative Specifications of Bombings and Larger Sample

	Industrial firms	Firms ≤ 10 employees	Industrial workers	Agricultural workers	Wheat & corn production	Tractors
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: IC bombings since Armistice of Cassibile						
Tons of bombs x Post 1948	0.058**	0.046**	0.613***	-5.894***	61.318***	0.413**
	(0.022)	(0.019)	(0.165)	(1.441)	(22.852)	(0.168)
Observations	5,454	5,443	5,443	516	2,244	2,218
R^2	0.391	0.356	0.477	0.953	0.949	0.907
Tons of bombs - mean	1,486	1,486	1,486	1,486	1,486	1,486
Tons of bombs - std. dev.	2,063	2,063	2,063	2,063	2,063	2,063
Panel B: More targets during Italian Campaign						
Tons of bombs x Post 1948	0.042**	0.034**	0.371***	-4.798***	60.789***	0.444***
	(0.019)	(0.016)	(0.116)	(1.140)	(17.271)	(0.108)
Observations	5,454	5,443	5,443	516	2,244	2,218
R^2	0.391	0.356	0.477	0.957	0.951	0.914
Tons of bombs - mean	2,490	2,490	2,490	2,490	2,490	2,490
Tons of bombs - std. dev.	3,074	3,074	3,074	3,074	3,074	3,074
Panel C: All Italian Provinces						
Tons of bombs x Post 1948	0.056**	0.044**	0.613***	-5.224***	60.992**	0.492**
	(0.025)	(0.022)	(0.194)	(1.588)	(24.933)	(0.201)
Observations	6,246	6,235	6,235	593	2,598	2,578
R^2	0.389	0.355	0.476	0.950	0.937	0.909
Tons of bombs - mean	907	907	907	907	907	907
Tons of bombs - std. dev.	1,604	1,604	1,604	1,604	1,604	1,604
Mean outcome	704	667	3,969	96,445	1,234,237	454
Source	Decennial census	Decennial census	Decennial census	Yearly statistics	Yearly statistics	Yearly statistics

Notes: In Panel A, the treatment variable measures the amount of explosives related to the Italian Campaign between the signing of the Armistice of Cassible on September 3, 1943 (instead of March 1944) and the end of the war. In Panel B, the treatment variable measures the amount of explosives used during the Italian Campaign against a longer lists of targets: direct cooperation with ground forces; troop concentrations; radar installations; gun emplacements; weapon launching sites; tactical targets; supply dumps; tracks and marshaling yards; moving trains; highways and vehicles; transportation facilities; tunnels and bridges; waterways; airdromes. Panel C includes all Italian provinces, instead of dropping provinces in Sardegna and Sicilia. All regressions include province fixed effects, region-year fixed effects, pre-war characteristics (population density, employment rate, industrial horsepower, share of industrial workers, share of agricultural workers) interacted with a trend up to the third order, and the share of war-related deaths interacted with a trend up to the third order. The first three columns also include industry fixed effects. The dependent variables are the number of firms in an industry, province, and year (column 1), the number of firms with less than 10 employees (column 2), the number of industrial workers (column 3), the number of agricultural workers (column 4), production of wheat and corn in 100kg (column 5), and the number of tractors (column 6). Standard errors clustered by province in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Table A4: Effects on Agricultural Outcomes Without War Years

	Wheat & corn production (1)	Wine production (2)	Grape production (3)	Oil production (4)	Tractors (5)	Threshers (6)	Gins (7)	All machines (8)
				Panel A: OLS with province controls				
Tons of bombs x Post 1948	62.938**	62.065*	78.093**	1.337	0.490**	-0.006	-0.004*	0.880***
	(26.517)	(32.320)	(38.573)	(1.110)	(0.203)	(0.008)	(0.002)	(0.295)
Observations	1,800	1,897	1,897	1,924	1,848	1,702	1,628	1,848
R^2	0.952	0.901	0.900	0.899	0.917	0.869	0.959	0.932
				Panel B: IV with province controls				
Reconstr. grants (M) x Post 1948	8,177.181**	8,029.297*	10,102.900*	172.440	62.730**	-0.750	-0.477*	112.650***
	(3,669.234)	(4,804.137)	(5,713.480)	(148.970)	(29.546)	(1.007)	(0.268)	(41.173)
Observations	1,800	1,897	1,897	1,924	1,848	1,702	1,628	1,848
R^2	0.954	0.886	0.888	0.898	0.916	0.869	0.958	0.931
F-statistic	38.54	39.13	39.13	39.19	40.26	35.67	36.28	40.26
Mean outcome	1,234,237	459,348	694,159	27,196	454	383	78	773
Tons of IC bombs - mean	1,045	1,045	1,045	1,045	1,045	1,045	1,045	1,045
Tons of IC bombs - std. dev.	1,681	1,681	1,681	1,681	1,681	1,681	1,681	1,681
Reconstr. grants (M)- mean	79	79	79	79	79	79	79	79
Reconstr. grants (M)- std. dev.	29	29	29	29	29	29	29	29

Notes: These regressions exclude the observations between 1940 and 1945. Regressions include province fixed effects, region-year fixed effects, pre-war characteristics (population density, employment rate, industrial horsepower, share of industrial workers, share of agricultural workers) interacted with a trend up to the third order, and the share of war-related deaths interacted with a trend up to the third order. Panel B shows instrumental variable regressions in which the reconstruction grants received by a province (in millions) are instrumented with the amount of explosives dropped during the Italian Campaign. The dependent variables are the production of wheat and corn in 100kg (column 1), the production of wine in 100L (column 2), the production of grape in 100kg (column 3), the production of oil in 100kg (column 4), the number of tractors (column 5), the number of threshers (column 6), the number of gins (column 7), and the number of all motorized agricultural machines (column 8). The estimating sample does not include provinces in Sardegna and Sicilia, because these regions were not affected by bombings related to the Italian Campaign. Standard errors clustered by province in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Table A5: Correlation between Characteristics of Funded Projects and Bombing

	IC bombs	Mean	Standard deviation	Observations
	(1)	(2)	(3)	(4)
Share of grants used for transp. network (1948-1952)	-0.000	0.525	0.0168	79
	(0.002)			
Share of grants used for hygiene infrastr. (1948-1952)	0.007	0.155	0.0776	79
	(0.008)			
Share of grants used for public buildings (1948-1952)	-0.007	0.321	0.0780	79
	(0.007)			
Number of projects (1948-1952)	21.531***	77.04	58.73	79
	(7.955)			
Number of projects in 1948	1.302**	5.716	4.217	79
	(0.526)			
Number of projects in 1949	5.357**	21.79	17.20	79
	(2.356)			
Number of projects in 1950	6.910***	23.04	18.64	79
	(2.536)			
Number of transp. projects (1948-1952)	20.262***	37.80	41.63	79
	(6.173)			
Number of transp. projects in 1948	2.091**	3.778	5.045	79
	(0.854)			
Number of transp. projects in 1949	4.257***	9.654	9.393	79
	(1.328)			
Number of transp. projects in 1950	6.871***	11.80	14.12	79
	(2.021)			
Cost per project (1948-1952)	-218,724.424*	1,773,641	1,880,658	79
	(118,601.445)			
Cost per project in 1948	-204,466.826*	1,931,482	1,967,943	79
	(116,268.907)			
Cost per project in 1949	-102,277.500	1,212,103	1,295,238	79
	(92,640.737)			
Cost per project in 1950	-220,747.402*	1,872,237	2,046,273	79
	(119,923.682)			
Share of grants used for new infrastructure (1948-1952)	0.096***	0.484	0.340	79
	(0.031)			
Share of grants used for new infrastructure in 1948	0.126***	0.432	0.437	79
	(0.041)			
Share of grants used for new infrastructure in 1949	0.113***	0.408	0.373	79
	(0.036)			
Share of grants used for new infrastructure in 1950	0.096***	0.518	0.380	79
	(0.035)			
Share of grants used for new transp. infrastr. (1948-1952)	0.092***	0.469	0.329	79
	(0.030)			
Share of grants used for new transp. infrastr. in 1948	0.121***	0.416	0.419	79
	(0.039)			
Share of grants used for new transp. infrastr. in 1949	0.109***	0.394	0.360	79
	(0.035)			
Share of grants used for new transp. infrastr. in 1950	0.092***	0.501	0.368	79
	(0.034)			

Notes: Each row-column combination shows the coefficient β_1 from a different regression of the characteristics of projects funded through E.R.P. reconstruction grants and the tonnage of bombs in a province (*in thousands of tons*): $\text{Projects}_p = \beta_0 + \beta_1 \cdot \text{IC bombs}_p + \gamma_r + \varepsilon_p$. The "Share of grants" divide the amount of grants used for a specific purpose by the total amount of grants received between 1948 and 1952 or in a given year. Column 2 shows the mean of each dependent variable, while column 3 shows the standard deviation. The regression also includes region fixed effects (γ_r). Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Source: Censimento dell'Industria e dei Servizi, Annuario di Statistica Agraria, Censimento Generale della Popolazione, Istituto Nazionale di Statistica. USAF Theater History of Operations Reports (THOR) Database, available at www.afri.au.af.mil/thor.

Table A6: Event Study on Infrastructure Development, Placebo Treatments

	Wheat & corn production (1)	Wine production (2)	Grape production (3)	Oil production (4)	Tractors (5)	Threshers (6)
Tons of bombs x Post event	-4.224	-11.094	-19.134	-0.202	-0.010	-0.008
	(17.467)	(12.657)	(17.054)	(0.947)	(0.025)	(0.006)
Observations	452	453	453	453	366	288
R^2	0.971	0.947	0.947	0.868	0.973	0.990
Mean outcome	1,234,237	459,348	694,159	27,196	454	383
Tons of IC bombs - mean	1,045	1,045	1,045	1,045	1,045	1,045
Tons of IC bombs - std. dev.	1,681	1,681	1,681	1,681	1,681	1,681

Notes: This table shows results from placebo event studies. The estimating sample includes only periods before the actual completion of large infrastructures. The dummy variable Post event turns from 0 to 1 randomly in each province. Regressions also include province fixed effects, region–event period fixed effects, calendar year fixed effects, pre-war characteristics (population density, employment rate, industrial horsepower, share of industrial workers, share of agricultural workers) interacted with a trend up to the third order, and the share of war-related deaths interacted with a trend up to the third order. The dependent variables are the production of wheat and corn in 100kg (column 1), the production of wine in 100L (column 2), the production of grape in 100kg (column 3), the production of oil in 100kg (column 4), the number of tractors (column 5), and the number of threshers (column 6). The estimating sample does not include provinces in Sardegna and Sicilia, because these regions were not affected by bombings related to the Italian Campaign. Standard errors clustered by province in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Table A7: Event Study on Infrastructure Development

	Wheat & corn production	Wine production	Grape production	Oil production	Tractors	Threshers
	(1)	(2)	(3)	(4)	(5)	(6)
			Panel A: Top 5 projects			
Tons of bombs x Post event	57.393***	59.459*	69.731*	0.073	0.510***	-0.008
	(19.214)	(30.504)	(35.561)	(1.188)	(0.168)	(0.009)
Observations	1,938	2,041	2,041	2,055	1,895	1,728
R^2	0.952	0.872	0.888	0.856	0.918	0.894
			Panel B: Top 5 roads			
Tons of bombs x Post event	58.247***	65.938**	78.527**	0.213	0.511***	-0.008
	(19.210)	(31.909)	(37.280)	(1.216)	(0.160)	(0.009)
Observations	1,939	2,041	2,041	2,054	1,892	1,725
R^2	0.950	0.873	0.886	0.855	0.918	0.895
			Panel C: Top 5 railways			
Tons of bombs x Post event	56.796***	59.190*	69.430*	0.095	0.502***	-0.007
	(18.708)	(30.225)	(35.215)	(1.156)	(0.164)	(0.009)
Observations	1,937	2,041	2,041	2,055	1,893	1,730
R^2	0.952	0.872	0.887	0.879	0.919	0.894
Mean outcome	1,234,237	459,348	694,159	27,196	454	383
Tons of IC bombs - mean	1,045	1,045	1,045	1,045	1,045	1,045
Tons of IC bombs - std. dev.	1,681	1,681	1,681	1,681	1,681	1,681

Notes: This table shows results from event studies that isolate the completion of large infrastructures funded by E.R.P. aid. Post event in panel A is 1 after the first 5 large projects, each costing at least 5 percent of the total reconstruction budget, were completed. Post event in panel B is 1 after the first 5 large roads, each costing at least 5 percent of the total reconstruction budget, were completed. Post event in panel C is 1 after the first 5 large railways, each costing at least 5 percent of the total reconstruction budget, were completed. Regressions also include province fixed effects, region–event period fixed effects, calendar year fixed effects, pre-war characteristics (population density, employment rate, industrial horsepower, share of industrial workers, share of agricultural workers) interacted with a trend up to the third order, and the share of war-related deaths interacted with a trend up to the third order. The dependent variables are the production of wheat and corn in 100kg (column 1), the production of wine in 100L (column 2), the production of grape in 100kg (column 3), the production of oil in 100kg (column 4), the number of tractors (column 5), and the number of threshers (column 6). The estimating sample does not include provinces in Sardegna and Sicilia, because these regions were not affected by bombings related to the Italian Campaign. Standard errors clustered by province in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Table A8: Event Study on Infrastructure Development, IV

	Wheat & corn production	Wine production	Grape production	Oil production	Tractors	Threshers
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Top 5 projects						
Reconstr. grants (M) x Post event	10,677.909***	10,963.212*	12,857.245*	13.481	98.583***	-1.167
	(3,903.050)	(6,321.661)	(7,345.798)	(218.478)	(36.906)	(1.371)
Observations	1,938	2,041	2,041	2,055	1,895	1,728
R^2	0.952	0.843	0.867	0.856	0.900	0.894
F-statistic	30.75	31.46	31.46	31.53	32.49	29.71
Panel B: Top 5 roads						
Reconstr. grants (M) x Post event	10,846.143***	12,151.265*	14,471.117*	39.091	98.253***	-1.231
	(3,957.860)	(6,742.170)	(7,874.598)	(223.593)	(35.040)	(1.372)
Observations	1,939	2,041	2,041	2,054	1,892	1,725
R^2	0.950	0.836	0.859	0.855	0.900	0.894
F-statistic	29.38	29.64	29.64	29.90	32.72	30.39
Panel C: Top 5 railways						
Reconstr. grants (M) x Post event	10,603.712***	10,939.745*	12,832.320*	17.495	97.776***	-1.122
	(3,847.406)	(6,314.698)	(7,332.643)	(213.207)	(36.690)	(1.388)
Observations	1,937	2,041	2,041	2,055	1,893	1,730
R^2	0.953	0.843	0.867	0.879	0.901	0.893
F-statistic	30.85	31.61	31.61	31.67	32.44	29.44
Mean outcome	1,234,237	459,348	694,159	27,196	454	383
Reconstr. grants (M)- mean	79	79	79	79	79	79
Reconstr. grants (M)- std. dev.	29	29	29	29	29	29

Notes: This table shows results from event studies that isolate the completion of large infrastructures funded by E.R.P. aid. Post event in panel A is 1 after the first 5 large projects, each costing at least 5 percent of the total reconstruction budget, were completed. Post event in panel B is 1 after the first 5 large roads, each costing at least 5 percent of the total reconstruction budget, were completed. Post event in panel C is 1 after the first 5 large railways, each costing at least 5 percent of the total reconstruction budget, were completed. The reconstruction grants received by a province (in millions) are instrumented with the amount of explosives dropped during the Italian Campaign. Regressions also include province fixed effects, region–event period fixed effects, calendar year fixed effects, pre-war characteristics (population density, employment rate, industrial horsepower, share of industrial workers, share of agricultural workers) interacted with a trend up to the third order, and the share of war-related deaths interacted with a trend up to the third order. The dependent variables are the production of wheat and corn in 100kg (column 1), the production of wine in 100L (column 2), the production of grape in 100kg (column 3), the production of oil in 100kg (column 4), the number of tractors (column 5), and the number of threshers (column 6). The estimating sample does not include provinces in Sardegna and Sicilia, because these regions were not affected by bombings related to the Italian Campaign. Standard errors clustered by province in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Table A9: Event Study on Infrastructure Development, First Project

	Wheat & corn production	Wine production	Grape production	Oil production	Tractors	Threshers
	(1)	(2)	(3)	(4)	(5)	(6)
			Panel A: First project			
Tons of bombs x Post event	64.156***	60.472**	71.795**	1.316	0.434**	-0.003
	(20.586)	(30.195)	(35.393)	(1.113)	(0.179)	(0.008)
Observations	1,963	2,065	2,065	2,067	1,907	1,756
R^2	0.951	0.876	0.891	0.854	0.907	0.906
			Panel B: First road			
Tons of bombs x Post event	60.684***	64.225**	77.446**	1.155	0.473***	-0.005
	(21.198)	(27.684)	(32.377)	(1.128)	(0.164)	(0.009)
Observations	1,965	2,066	2,066	2,068	1,910	1,758
R^2	0.951	0.876	0.891	0.854	0.908	0.905
			Panel C: First railway			
Tons of bombs x Post event	64.621***	59.863**	71.077**	1.566	0.435**	-0.003
	(20.465)	(30.017)	(35.151)	(1.081)	(0.179)	(0.008)
Observations	1,961	2,063	2,063	2,066	1,907	1,752
R^2	0.952	0.876	0.891	0.858	0.907	0.906
Mean outcome	1,234,237	459,348	694,159	27,196	454	383
Tons of IC bombs - mean	1,045	1,045	1,045	1,045	1,045	1,045
Tons of IC bombs - std. dev.	1,681	1,681	1,681	1,681	1,681	1,681

Notes: This table shows results from event studies that isolate the completion of large infrastructures funded by E.R.P. aid. Post event in panel A is 1 after the first large project, costing at least 5 percent of the total reconstruction budget, was completed. Post event in panel B is 1 after the first large road, costing at least 5 percent of the total reconstruction budget, was completed. Post event in panel C is 1 after the first large railway, costing at least 5 percent of the total reconstruction budget, was completed. Regressions also include province fixed effects, region–event period fixed effects, calendar year fixed effects, pre-war characteristics (population density, employment rate, industrial horsepower, share of industrial workers, share of agricultural workers) interacted with a trend up to the third order, and the share of war-related deaths interacted with a trend up to the third order. The dependent variables are the production of wheat and corn in 100kg (column 1), the production of wine in 100L (column 2), the production of grape in 100kg (column 3), the production of oil in 100kg (column 4), the number of tractors (column 5), and the number of threshers (column 6). The estimating sample does not include provinces in Sardegna and Sicilia, because these regions were not affected by bombings related to the Italian Campaign. Standard errors clustered by province in parentheses, *** p<0.01, ** p<0.05, * p<0.1.