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EXECUTIVE SUMMARY OF

"ECONOMIC RECOVERY AND THE DETERMINANTS OF PRODUCTIVITY AND INNOVATION: EVIDENCE FROM POST-WWII ITALY"

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This dissertation explores the process of economic development of Italy that, between the late 1940s and the early 1970s, moved from being a war-ravaged agricultural country to the seventh most industrialized power of the world.[2] Specifically, I first analyze the process of Italian post-WWII physical capital reconstruction and the extent to which it was affected by the

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[2] During these years Italian GDP grew at the unprecedented annual rate of 6.3 percent (Fauri, 2006).

Marshall Plan - the program of aid sponsored by the US to help Europe between 1948 and 1952. Second, I examine the long-term impact of the US transfer of managerial and production technologies on productivity of Italian firms between 1952 and 1970, using evidence from the Marshall Plan Technical Assistance and Productivity (USTA&P) program. Finally, I investigate the effects on innovation of a series of reforms to the college system that Italy implemented between 1961 and 1969 with the goal of increasing STEM (science, technology, engineering, maths) human capital accumulation.

When WWII came to an end, on April 25, 1945, Italian GDP per capita was 38 percent lower than in 1938 and the industrial production represented 34 percent of that in 1938 (Lombardo, 2000).

In Chapter 2, entitled "The Role of the Marshall Plan on Italian Post-WWII Recovery", I investigate the extent to which the Marshall Plan affected the Italian economic recovery from WWII and its subsequent industrial production expansion. I use newly

collected data on the types of aid (in-kind subsidies, free grants, and loans to firms) received and their allocation across Italian regions and sectors, which I combine with the regional monthly industrial production index (IPI) and the industrial production growth rates.

I first document that the Marshall Plan's money was used to recover and strengthen the already existing production system. For instance, free grants were used to rebuild infrastructures and were given to the most damages areas, while loans were almost uniquely granted to large companies in the most industrialized regions.

Second, I quantify the separate effects of grants and loans on Italian industrial production. Using a pre-post estimator, I estimate that, after receiving the US grants, the IPI increased by 20% and reached the pre-war level by 1950, before Italian firms received any loan. To estimate the effects of loans on industrial production growth rates, I exploit that fact that Italy lost the war and, therefore, only industries not related to war were subsidized by the US. In a difference-in- differences analysis, I show that subsidized industries had a 2.3 monthly higher growth rate than not subsidized ones.

Despite Italy, as well the rest of Western Europe, recovered relatively fast from WWII,[3] there was an increasing productivity gap between US firms and European plants (Boel, 2003). As a consequence, during the 1950s, as part of the Marshall Plan, the US administration sponsored the Technical Assistance and Productivity program, which offered management-training trips for European managers to US firms and granted state-of-the-art machines to European firms.

In Chapter 3, entitled "The Marshall Plan Productivity Program and the Long-Term Effects of Management and Technology Transfer", I examine the long-run effects of such management and technology transfer on Italian firm performance. I use newly assembled data on the population of Italian firms eligible to participate in this program, tracked over a twenty-year period. By exploiting an unexpected cut in the US budget, I compare firms that eventually participated in the program with firms that were initially

[3] The production indexes of almost all Western European countries were at their 1938 level by 1950 (Boel, 2003).

eligible to participate, but were excluded after the budget cut.

I find that management transfer significantly increased Italian firms' survivorship, sales, employment and productivity. These positive effects continued to grow for at least fifteen years after the program, a finding that can be explained by the increased investment rates, capital-to-labor ratio, more educated managers' hires, and employees training expenditures in such firms.

Companies that received new machines also improved their performance, but the effects did not continue to increase over time. Finally, management and technology were complementary in bolstering firm performance.

As the Italian industrial sector expanded in the post-WWII period, the demand for highly skilled STEM workers increased significantly (Felice and Vecchi, 2015). The growth in university STEM degrees, however, was constrained by the fact that, due to the college access regulations, only 30.9 percent of all Italian high school graduates could enroll in university STEM majors (ISTAT, 1986).

To increase the amount of STEM skills in the economy, a series of reforms were gradually implemented between 1961 and 1969. Their key content was allowing a group of high-school students, who were trained in STEM, but historically denied access to scientific university studies, to enroll in STEM majors.

Chapter 4, entitled "The University STEM Education Reforms and Their Effects on Innovation" and joint with Nicola Bianchi, studies the extent to which the innovative activity of this group of students was affected by the reforms. Administrative data on education, patents, and labor market outcomes of 46,473 Italian students suggest that the propensity to innovate decreased, when the targeted students received a university STEM education.

This result is likely to be driven by a shift from patent-intensive jobs to other occupations. Conditional on becoming inventors, however, the new university STEM graduates became more likely to patent in the fields in which the incumbent university STEM graduates patented.

The contribution of this dissertation to the existing literature is

threefold. First, it provides a close analysis of the Italian so called "economic miracle" that marked the development of Italy from an agriculture-based economy to an industry-based one. The use of newly-assembled microeconomic data sheds new light of the mechanisms behind this unprecedented industrial expansion, not possible by only relying on macroeconomic data.

Second, this research measurable contributes to answer broad economic ques- tions that, despite being currently relevant, are hard to tackle with modern data. For instance, recent empirical research investigates the role of management and technology in explaining the large and persistent productivity spread across firms and countries. While it has been shown that that better management practices have a causal impact on firm performance and organization (e.g., Ichniowski et al., 1997; Bloom et al., 2013; Bruhn et al., 2013) and that the access to new technologies embodied in capital goods increases firm-level productivity (Goldberg et al., 2009; Pavcnik, 2002), little is known on whether these effects persist in the long run. This historical context sheds new light on the long-

term effects of management and technology, by following the same firms over a 20-year period and providing plausible exogenous variation in order to estimate the causal impact. Similarly, the promotion of STEM (Science, Technology, Engineering, and Mathematics) education is considered paramount to bolster scientific and technological innovation and to spur long-term economic growth. However, analyzing the causal effect of STEM education on innovation is challenging, because individuals education choices are endogenous and it requires detailed data on both students' college choices and their innovative activity, usually unavailable. The Italian college access reforms offer exogenous shocks to scientific majors self-selection and the possibility of assembling such student-inventor matched data.

Third, this work contributes to the literature about foreign aid, business training and technology transfer, which nowadays are among the most common forms of active support for developing countries. In fact, Italy at the end of WWII was comparable to some developing countries today. Italian GDP per capita in 1951 was

$4,813 (Felice and Vecchi, 2015), close to that for 2010 in China and Peru - $4,514 and $5,056 respectively.[3] Between 1951 and 1955, Italian GDP per capita grew at a yearly rate of 6.5 percent, while, between 2010 and 2014, India GDP per capita grew at 6.1 percent and that of other East Asian and Pacific developing countries 6.9 percent per year.

The advantage of this research framework is that it captures longer-term effects of such programs on a relatively large sample of firms and industries, while the evaluations of these policies are usually made over a limited number of months or years and on relatively small samples through randomized control trials (RCTs).