Transition 4.0 Plan: An Assessment of Investment, Employment and Productivity Effects[1]

Joint work of a group of experts from

Bank of Italy and Italian Ministry of Economy and Finance

In collaboration with the Italian Ministry of Enterprises and Made in Italy

May 2026

[1] A decree of the Minister of Economy and Finance of 23rd November 2021 established a Scientific Committee to assess the economic impact of the measures contained in the 'Transition Plan 4.0', composed of representatives of the Ministry of Economy and Finance, the Ministry of Enterprises and Made in Italy, and the Bank of Italy. In May 2026 the Committee unanimously approved this final report. In developing its methodologies, the Committee also drew on the expertise of Confindustria and Istat.

EXECUTIVE SUMMARY

- Over the period 2020–2023, approximately 35 billion euros in tax credits were accrued under the Transition 4.0 Plan, of which around 27 billion euros (around 80 per cent) were related to investments in technologically advanced tangible capital goods (4.0 tangible assets).

- In the same period, more than 157,000 distinct investment initiatives (i.e. individual investment claims) in 4.0 tangible assets were undertaken by corporations, amounting to approximately 60 billion euros in total investment and generating nearly 22 billion euros in tax credits.

- The uptake of the incentive displays substantial heterogeneity across firm size, sector, and geographical location. Small and medium-sized enterprises account for more than 60 per cent of the total tax credit claimed for investments in 4.0 tangible assets, while manufacturing firms absorb approximately 62 per cent of the overall resources allocated to this measure. Around 70 per cent of the tax credit (approximately 14.7 billion euros) was accrued by firms located in Northern regions, compared with roughly 4 billion euros in the South and 3 billion in the Centre.

- The empirical analysis indicates that the Transition 4.0 tax credit had a positive and statistically significant impact on firms' investment rates across all size classes. The estimated increase in the investment rate ranges from approximately 0.4 percentage points for large firms to around 0.7 percentage points for medium-sized firms, 1.5 percentage points for small firms, and between 3.5 and 4 percentage points for micro-enterprises, depending on the cohort of beneficiaries (defined as the first year in which they uptake the incentive). Relative to a pre-policy baseline investment rate of around 5 per cent, these effects correspond to increases of between 12 and 71 per cent depending on the class size.

- Translating firm-level estimates into aggregate quantities, over the period 2020–2023 the tax credit is estimated to have generated additional investment equivalent to between 13 and 22 per cent of total observed tangible investment, with the higher estimate obtained when excluding firms that had already benefited from the hyper-depreciation regime. Overall, each euro of tax credit is estimated to have mobilised between 1.5 and 2 euros of total tangible investment, indicating that the measure played a non-negligible role in supporting capital accumulation beyond what would have occurred in the absence of the policy.

- The effects on labour market outcomes appear more limited and heterogeneous. A positive impact on employment growth is detected for micro and, to a lesser extent, small and medium-sized firms, with estimated increases ranging between 3 and 5 percentage points for micro firms and around 2 to 3 percentage points for small firms, depending on the cohort. By contrast, no statistically significant employment effects are observed for large firms. At the aggregate level, the policy is estimated to have increased employment among beneficiary firms by between 0.7 and 3.4 per cent over the period considered, with the range reflecting sample restrictions and alternative assumptions for firms with non-estimable treatment effects. Moreover, the analysis does not provide evidence of systematic changes in workforce composition following the adoption of 4.0 technologies.

- Consistent with the investment response and the more muted employment effects, beneficiary firms exhibit a substantial increase in capital intensity. Estimated effects on the capital-to-labour ratio range between 19 and 31 percentage points for micro-enterprises and between 11 and 16 percentage points for small firms, depending on the cohort. Among those firms we document also limited effects on labour productivity and revenue-based total factor productivity (TFPR). For bigger firms we do not find positive effects on productivity.

- Taken together, these findings suggest that the policy was effective in stimulating investment and increasing the stock of productive capital, but it did not generate widespread improvements in firm-level productivity over the observation period. These results are consistent with a well-established body of evidence on investment incentives, that underscore the fact that a tax credit directly targeting capital deepening can effectively stimulate investment, but does not necessarily generate broader productivity gains.

- From a fiscal perspective, the policy generated additional employment that is estimated to have partially offset its cost through increased personal income tax revenues, while no statistically significant effects are detected on corporate tax bases over the same time horizon. Over the period considered, between 4 and 8 per cent of the total fiscal cost of the measure is estimated to have been recouped through higher labour income taxation, corresponding to an estimated cost per additional job ranging between approximately 109,000 and 270,000 euros.

1 Introduction

The 2020 Italian Budget Law (No. 160/2019) introduced the "Transition 4.0 Plan", a set of incentives for companies, provided in the form of tax credits, to support and promote the digitalisation of the Italian production system through tangible and intangible investments in technologically advanced technologies, research and development activities and training of staff. The Transition 4.0 Plan aims to stimulate economic growth by providing incentives for tangible and intangible investments in digital technologies and by supporting high-quality training to improve the availability of skills and professional profiles capable of designing and managing the integration of 4.0 technologies.

By the decree law of the Minister of Economy and Finance of 23rd November 2021, a Scientific Committee was established with the task of assessing the economic impact, effectiveness and efficiency of the measures in the Transition 4.0 Plan. The Committee is required to prepare an interim report, published[2] in November 2024, and a final report by May 2026. This analysis constitutes the final report. In the first four years of the Plan's implementation, approximately 80 per cent of the allocated resources were directed toward investments in technologically advanced tangible capital assets (referred to as 4.0 tangible assets), which constitute the primary focus of the present evaluation.

Evaluating digital investment incentives requires distinguishing between their effectiveness in stimulating capital accumulation and their ability to translate such accumulation into productivity gains. While the former represents the direct and immediate objective of investment tax credits, the latter may or may not materialize depending on a broader set of complementary factors, such as skills, organizational capital and learning processes. Accordingly, in this report we evaluate the impact of the Transition 4.0 Plan along multiple dimensions.

This paper offers a concise overview of the regulatory evolution of the Transition 4.0 Plan and its operational framework (Section 2). Section 3 describes the dataset used in the analysis while Section 4 reports descriptive statistics on the use of tax credits included

[2] https://www.bancaditalia.it/pubblicazioni/altri-rapporti/2024-mef/Gli_incentivi_in_investimenti_4.0.pdf

in the Transition 4.0 Plan with a particular focus on the credit for investing in 4.0 tangible assets. The methodological approach adopted to evaluate the effects of the measure is detailed in Section 5, while Section 6 reports the main findings in terms of investment rate, employment, capital-to-labour ratio and productivity. Section 7 provides an assessment of the aggregate effect of the measure on additional investments and employment, as well as providing cost-benefit analyses. The paper concludes with a summary of key insights and implications in Section 8.

2 Legislative evolution

To stimulate companies' digital transformation, the 2020 Budget Law introduced the Transition 4.0 Plan, which provides a tax credit for expenses related to tangible and intangible capital goods, research and development, technological innovation, planning and design, and staff training. This incentive replaced hyper-depreciation allowances ("Industry 4.0" programme) established by the 2017 Budget Law and in force between 2016-2019 (for an evaluation of that incentive, see Bratta et al. (2023)). The subsidy scheme has been in place until the end of 2025, with an extension to June 2026 for investments for which a 20 per cent advance payment has been made within 2025. The incentive applies to certain specific types of capital goods, innovation and staff training:

1. investments in tangible capital goods (listed in Annex A attached to the 2017 Budget Law) functional to technological and digital transformation of companies according to the Industry 4.0 model (4.0 tangible assets);
2. investments in intangible assets (included in Annex B of the 2017 Budget Law) functional to the monitoring and visualisation of energy consumption or software connected with investments in tangible assets referred to in point 1;
3. standard capital goods (not included in Annexes A and B of the 2017 Budget Law);
4. research, development, innovation activities and design (R&D&I);
5. training activities (4.0 training).

The percentages of the tax credit and the associated spending limits have been revised over time. With reference to the measure examined in this paper (investments in tangible assets 4.0) when the scheme was first introduced, the credit was granted at a rate of 40 per cent for investments up to 2.5 million euros, and 20 per cent for investments up to 10 million euros, which represented the maximum threshold of eligible costs. With the 2021 budget law, these rates were raised to 50 per cent and 30 per cent respectively for investments made in 2021 (or until June 2022 in the case of investments planned with a deposit paid in 2021), and an increase in the threshold to 20 million euros with a rate of 10 per cent was introduced. The same budget law revised the rates for investments carried out in 2022 reducing the applicable percentages. The 2022 Budget Law further lowered the rates for the years 2023-25 as shown in the Table I. It should be noted that, for 2025, the tax credit is no longer automatic; instead, a spending cap of 2.2 billion euros has been introduced by the 2025 Budget Law. The frequent revisions of credit rates imply that firms faced changing incentives over time, which may have influenced their investment decisions.

TABLE I: Tax credit for 4.0 Tangible assets

		Tangible assets 4.0	
Year	% of credit	Max eligible investment	Yearly quotas
2020	40%	2,5 M	5
2020	20%	2,5-10 M	5
2021	50%	2,5 M	3
2021	30%	2,5-10 M	3
2021	10%	10-20 M	3
2022	40%	2,5 M	3
2022	20%	2,5-10 M	3
2022	10%	10-20 M	3
2023-25	20%	2,5 M	3
2023-25	10%	2,5-10 M	3
2023-25	5%	10-20 M	3

Note: In 2024 and 2025, an alternative tax credit was also in force, namely Transition 5.0 Plan, financed by NPRR-REPowerEU, with a max eligible investment of 50 million euros for investments aimed at achieving green transition objectives, specifically identified by a decree of the Ministry of Enterprises and Made in Italy, adopted in agreement with the Ministry for Ecological Transition and the Ministry of Economy and Finance.

The tax credit is available to all resident companies, including permanent establishments of non-resident entities, regardless of their legal form, sector, size and accounting regime (ordinary or simplified). Part of the funding comes from the National Recovery and Resilience Plan (NRRP) although some sectors are excluded from NRRP funding because of the DNSH (Do No Significant Harm) principle as no support is granted to measures that could harm European climate and environmental objectives. However, companies belonging to these sectors[3] are supported with resources from the National Complementary Fund. In order to be eligible for subsidies, investment goods must be "instrumental" to the beneficiary company's activity and "new", so that the incentive does not apply to assets already used in production processes. The tax credit can be used as compensation in three equal annual instalments starting from the year in which the assets were interconnected[4]. Tax credits can be combined with other incentives that relate to the same costs, provided that the combination does not exceed the cost incurred.

3 Data

For the purposes of this study, a comprehensive database was constructed by integrating information from multiple sources covering the period 2016–2023. The primary data source consists of corporate income tax returns for fiscal years 2016 to 2023 (with the latter year considered provisional). These returns include detailed information on Transition 4.0 tax credits accrued, the volume of subsidised investments, and the depreciation amounts for assets benefiting from the "super" and "hyper-depreciation" schemes

[3]These are the sectors of car and trailer manufacturing, manufacturing of other means of transport, manufacturing of rubber and plastic products, waste disposal, building construction, civil engineering, specialised construction works, mineral extraction, paper manufacturing, agricultural cultivation, oil refining, chemical manufacturing, air transport, land transport, maritime transport, electricity supply, metallurgy, and other non-metallic mineral products.

[4]Circular 4E of 30/03/2017 from the Italian Revenue Agency clarified that the requirement for interconnection to factory IT systems with remote uploading of instructions and/or part programs is met if i) the asset exchanges information with internal systems (e.g. management system, planning systems, product design and development systems, monitoring, including remote monitoring, and control, other machines in the factory, etc.) by means of a connection based on documented specifications that are publicly available and internationally recognised (e.g. TCP-IP, HTTP, MQTT, etc.); and ii) the asset must be uniquely identified.

in effect between 2017 and 2019. This dataset enables the identification of firms that invested in Transition 4.0 assets and had previously accessed incentives for advanced digital technology investments during the preceding three-year period.

Data on employment are from mandatory monthly pay and contributions report (UNIEMENS) provided by National Institute for Social Security (INPS). This database reports the number of employees for each company and tax year disaggregated by qualification, gender and age group. Further information is obtained from company financial statements provided by Orbis - Moody's Analytics and Cerved[5]. Finally, additional business characteristics were obtained from the Statistical Archive of Active Enterprises (ASIA) and from the Permanent Census of enterprises for the year 2019, both obtained by the Italian National Institute of Statistics (ISTAT).

4 Descriptive statistics

The Transition 4.0 Plan incentivises investments in tangible and intangible assets 4.0, investments in research and development, technological innovation and design (R&D&I) and expenditure on training activities (as described in Section 2). In the first four years of the application of the Plan 35 billion euros of tax credits were accrued (Figure I)[6], of which approximately 27 billion euros (around 80 per cent of the total) was related to investments in 4.0 tangible assets.

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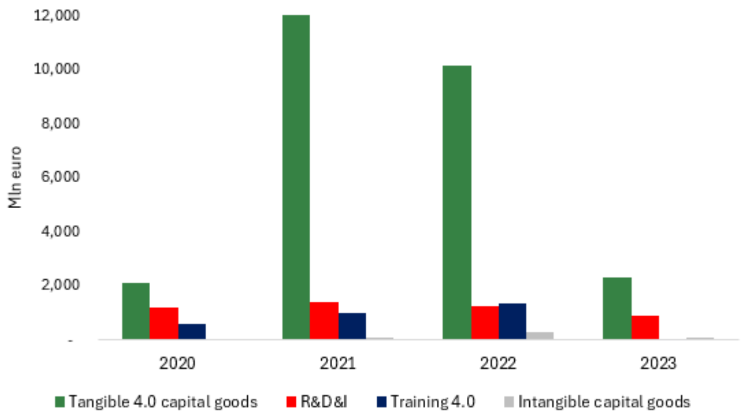
[5]We would like to thank the Cerved Group for kindly providing some variables taken from the financial statements of the corporations used in the analysis.

[6]The analysis does not include tax credits for traditional tangible assets, which are not included in Annex A of the reference standard.

FIGURE I: Total amount of credit (mln of euro)



Source: Tax Return (Individuals, Corporations, Partnerships and Non-Commercial Entities), 2023 is provisional

Corporations are the primary beneficiaries of tax credits: 82 per cent for 4.0 tangible investments, 89 per cent for 4.0 intangible investments, 96 per cent for R&D&I and 91 per cent for 4.0 training [7], for this reason in the rest of the analysis we are focusing only on corporations for which tax data could be matched with financial statement data.

4.1 Tax credits for investments in tangible 4.0 assets

Between 2020 and 2023 (2023 data is provisional), more than 157,000 investments in Transition 4.0 tangible assets were undertaken, for a total value of approximately 60 billion euros and corresponding tax credits amounting to nearly 22 billion euros in tax credits (see Table II)[8]. The maximum aggregate uptake of tax credits was observed in 2021, approximately 9 billion euros. This peak is attributable to the simultaneous increase in statutory credit rates and the cyclical recovery of investment activity following the pandemic-induced contraction.

Over 60 per cent of the total tax credit was claimed by small and medium-sized

[7] It is worth mentioning that the amount of tax credit accrued for investments in 4.0 tangible assets may refer to the combined purchase of tangible and intangible assets, such as software necessary for the operation of devices (embedded software). In this case, intangible assets 4.0 can be subsidised together with the cost of the device, but the data available does not allow for the separation of the two types of investment.

[8] The analysis includes only corporations for which tax data could be matched with financial statement data.

enterprises[9], amounting to 6.6 billion and 6.9 billion euros, respectively. Large enterprises accrued over 5 billion euros, while micro-enterprises claimed 3.2 billion euros. Taken together, micro, small and medium enterprises account for 77 per cent of the total tax credit. The average credit amount increased with company size: large enterprises received an average of approximately 573,000 euros, more than twice the average for medium-sized enterprises (262,000 euros). In contrast, micro and small enterprises received significantly lower average credits: 47,000 euros and 121,000 euros, respectively.

The geographic allocation of tax credits is based on firms' fiscal residence and therefore does not provide information on the actual location of the underlying investments. Consequently, tax credits assigned to firms headquartered may reflect investments undertaken at production facilities located elsewhere. This issue is especially relevant for large, multi-plant firms. Approximately 70 per cent of the tax credit (14.7 billion euros) was accrued by companies based in the North of Italy, reflecting both the higher number of beneficiary companies and larger investments: the average tax credit for companies in the North-West is about 80 per cent higher than that for companies in the South. The high share of tax credits recorded in Northern regions should be interpreted cautiously, as it may partly reflect firm-level compositional effects: larger firms, disproportionately headquartered in the North, are more likely to operate multi-plant structures across regions, and tax credits are claimed at the level of the firm's legal headquarters. As a result, credits attributed to Northern regions may include investments undertaken elsewhere, potentially overstating the effective regional concentration of investment. Firms headquartered in the South account for approximately 4 billion of euros in tax credits, while those located in the Centre account for roughly 3 billion.

Manufacturing companies accounted for over 60 per cent of the total tax credit for 4.0 tangible assets, amounting to approximately 13.5 billion euros. Firms in the energy sector recorded the highest average tax credit, approximately 208,000 euros. Manufacturing firms followed closely, with an average credit of about 205,000 euros, while transport companies received comparatively lower amounts, averaging around 150,000 euros.

[9] The size of firms is defined according to revenue.

TABLE II: Distribution of tax credits for investments in 4.0 tangible assets

	Credit amount (mln euro)	**% credit on Total**	**Number of Investment**	**Investment (mln euro)**	**Avg credit Euro**
Year					
2020	1,857	8.5%	14,729	4,984	126,069
2021	9,560	43.9%	54,903	20,704	174,131
2022	8,414	38.6%	60,366	23,249	139,375
2023	1,962	9.0%	27,026	11,275	72,603
Total	**21,793**	**100%**	**157,024**	**60,212**	**138,787**
Size					
Micro	3,214	14.7%	67,391	8,265	47,688
Small	6,654	30.5%	54,599	17,175	121,872
Medium	6,895	31.6%	26,260	18,811	262,566
Large	5,030	23.1%	8,774	15,960	573,293
Geographical areas					
North West	6,929	31.8%	46,388	18,894	163,944
North East	7,780	35.7%	42,264	21,529	167,707
Centre	3,078	14.1%	26,096	8,355	117,952
South and Islands	4,006	18.4%	42,276	11,433	94,765
Sector					
Manufacturing	13,522	62.0%	65,756	37,306	205,644
Construction	1,943	8.9%	21,816	5,224	89,063
Trade	2,094	9.6%	26,762	5,776	78,233
Services	1,140	5.2%	18,802	3,261	60,649
Energy	853	3.9%	4,090	2,473	208,612
Transport	874	4.0%	5,788	2,546	150,952
Others	1,367	6.3%	14,010	3,626	97,547

To quantify the incidence of tax credits across the Italian productive system, the share of beneficiary firms relative to the total population of Italian firms is computed, disaggregated by firm size, geographic area, and sector of activity. Additional incidence measures are constructed using firms' revenues and employment as alternative bases. Beneficiary firms represent between 1.6 per cent of the total firm population in 2020 and 6.3 per cent in 2022 (Table III). Marked heterogeneity emerges when the analysis is disaggregated by firm size. As expected, the proportion of beneficiary firms in the total population decreases with firm size. Over the entire sample period, around 30 per cent of large firms undertook eligible investments, compared to close to 2 per cent of micro-enterprises. Similar evidence emerges when incidence is measured using revenues and employment: among large firms, beneficiaries account respectively for 29 and 33 per cent of the total revenues and employment. This marked and expected heterogeneity in the uptake of incentives by firm size is reflected across the other classifications.

TABLE III: Incidence of 4.0 tangible assets tax credit

	Share of Firms on Total	**Share of Revenues on Total**	**Share of Employees on Total**
Year			
2020	1.6%	18.1%	11.6%
2021	5.8%	28.3%	24.1%
2022	6.3%	28.7%	26.4%
2023	2.9%	17.4%	16.1%
Size			
Micro	2.1%	4.6%	4.3%
Small	12.7%	14.1%	13.8%
Medium	23.0%	24.2%	23.4%
Large	29.7%	28.5%	32.5%
Geographical areas			
North West	4.3%	24.5%	19.6%
North East	5.5%	31.4%	25.8%
Centre	2.9%	15.7%	17.3%
South and Islands	4.2%	20.9%	14.5%
Sector			
Manufacturing	12.8%	40.6%	35.4%
Construction	4.3%	16.9%	15.7%
Trade	3.4%	18.9%	22.3%
Services	1.2%	7.0%	8.3%
Energy	7.0%	8.9%	21.3%
Transport	4.4%	19.8%	16.9%
Others	6.8%	26.8%	12.6%

4.1.1 Investment Size

Figure II shows the distribution of total investment amount in 4.0 tangible assets by firm size, based on the thresholds defined in the tax legislation for the application of tax credit rates. Across all years considered, the largest share of investments is concentrated in the first size class, corresponding to projects below 2.5 million euros. For micro and small enterprises almost the total investment amount is lower than 2.5 million euros. Also for medium enterprises, investments lower than 2.5 million euros account for more than 75 per cent. For large enterprises, investments between 2.5 million and 10 million euros account for more than 50 per cent of the total investment amount; investments below 2.5 million euros still represent almost 40 per cent of the total and comprise the vast majority of projects (around 80 per cent).

FIGURE II: Distribution of total investment amount by size

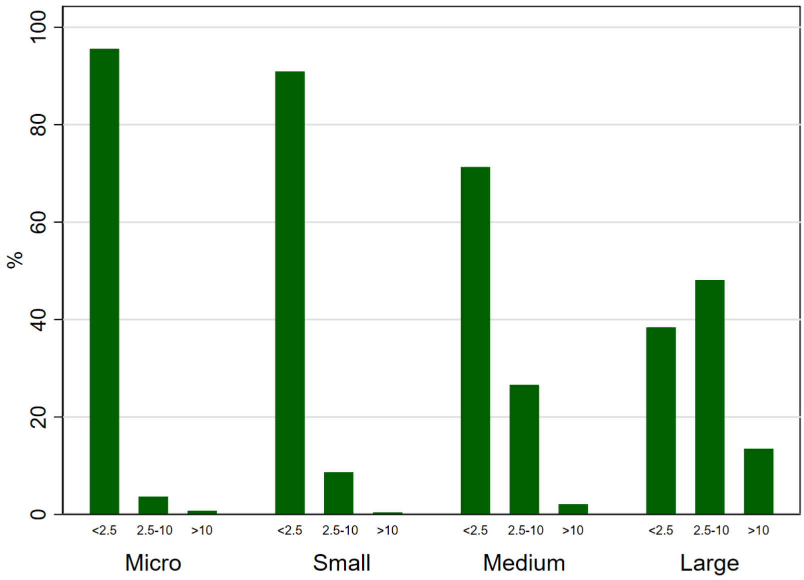
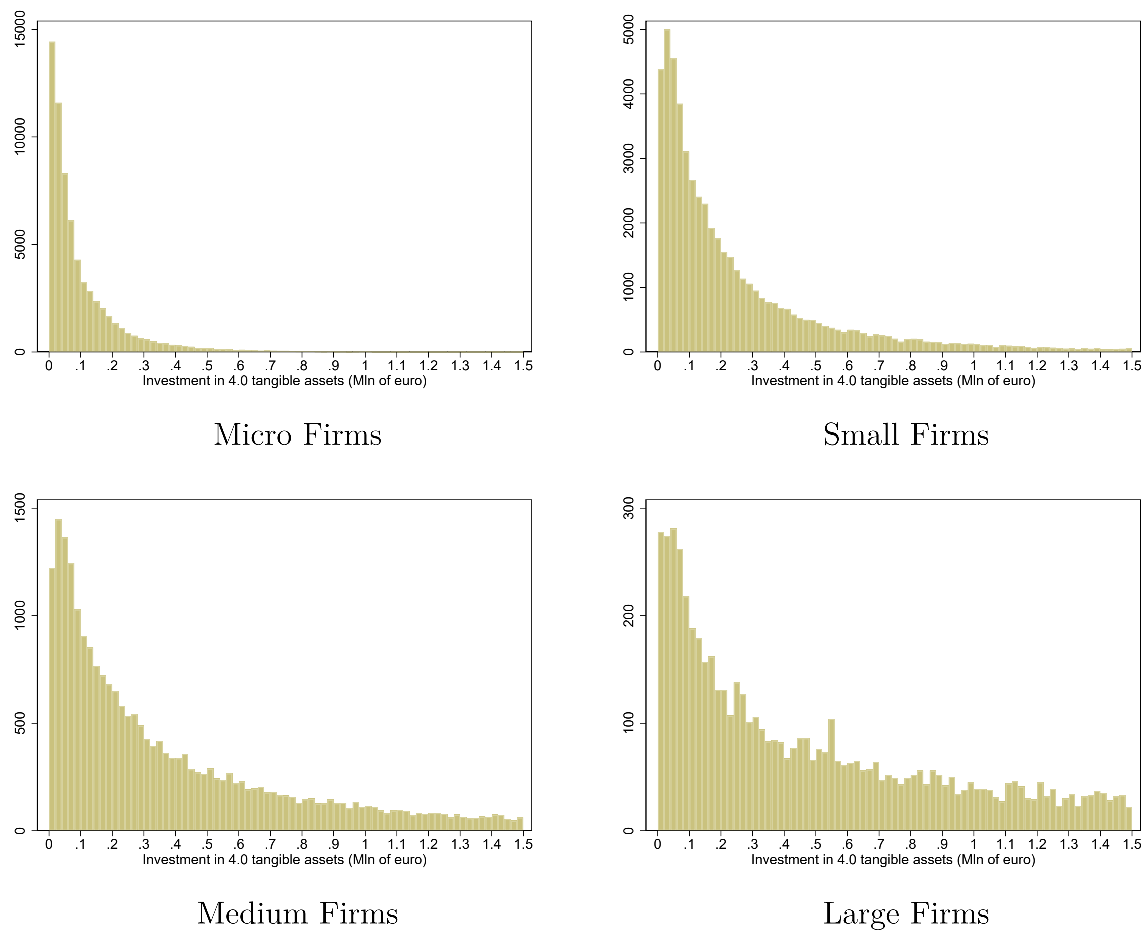


Figure III shows the distribution of investments below 1.5 million euros for micro, small, medium and large firms. For micro-enterprises, the highest concentration of investments is observed in the 0–20,000 euros range. Among small and medium-sized enterprises, investments are most frequently concentrated between 20,000 and 40,000 euros, while for large firms between 40,000–60,000 euros. Overall, investments are concentrated at the lower end of the distribution across all firm sizes, including medium-sized and large enterprises. However, for the latter two groups, the frequency distribution declines more gradually as investment amounts increase, indicating a non-negligible presence of higher-value investments. These differences in the distribution of investment amounts across firm sizes are also reflected in median values for the full sample: 58,000 euros for micro-enterprises, 150,255 euros for small firms, 303,442 euros for medium-sized firms, and 755,239 euros for large enterprises.

Additional analysis focuses on large firms to assess whether the high prevalence of low-value investments is influenced by a documentation threshold set by law. To be eligible for the tax credit, firms must provide a certified technical appraisal or certificate of conformity attesting that the 4.0 assets meet the required technical specifications. However, for assets with a unit cost not exceeding 300,000 euros, this requirement can be satisfied through a self-declaration by the firm's legal representative. A bunching analysis around this threshold has been performed, to investigate if some large firms have chosen to limit the value of individual investments in order to reduce the associated documentation burden. However, this analysis has not found evidence of bunching below 300,000 euros, so the administrative threshold does not seem to have influenced the amount of investments of large firms.

FIGURE III: Distribution of number of firms by investment size - (investments up to 1.5 million euros)



Note: Y-axis scale optimised for each size class. Histograms represent 20,000 euros intervals.

4.1.2 Investment Frequency

Firms may undertake investments in each year in which the policy is in force. To examine whether investment activity tends to be repeated over time, firms benefiting from the tax credit for investments in 4.0 tangible assets are grouped according to the number of years, between 2020 and 2023, in which they carried out subsidized investments. Table IV reports the distribution of accrued tax credits by the number of investment years and the size of the firm. Across all size classes, firms investing in a single year represent the predominant group, although their prevalence is substantially higher among micro-enterprises and markedly lower among large firms. Approximately 74 per cent of micro-enterprises invested only once, accounting for about 50 per cent of the total tax credit accrued by this group. In contrast, the corresponding shares decline to around 32 per cent and 10 per cent, respectively, for large enterprises.

TABLE IV: Distribution of 4.0 tangible assets tax credit by number of years in which enterprises have invested and enterprise size

N. of years	Tax credit (4.0 tangible)		Beneficiary firms	
	mln euro	% credit	N.	% on Total
Micro firms				
1	1,623	50.5%	38,096	74.3%
2	1,092	34.0%	10,597	20.7%
3	404	12.6%	2,317	4.5%
4	96	3.0%	288	0.6%
Total	**3,214**		**51,297**	
Small firms				
1	1,830	27.5%	18,802	55.6%
2	2,515	37.8%	10,106	29.9%
3	1,710	25.7%	3,998	11.8%
4	599	9.0%	898	2.7%
Total	**6,654**		**33,804**	
Medium firms				
1	1,037	15.0%	5,573	40.9%
2	2,174	31.5%	4,459	32.8%
3	2,177	31.6%	2,553	18.8%
4	1,507	21.8%	1,028	7.6%
Total	**6,895**		**13,612**	
Large firms				
1	505	10.0%	1,250	31.8%
2	1,082	21.5%	1,144	29.1%
3	1,623	32.3%	915	23.3%
4	1,820	36.2%	623	15.8%
Total	**5,030**		**3,932**	

In evaluating the Transition 4.0 plan, it is important to account for the fact that, between 2017 and 2019, the hyper-depreciation scheme already provided tax incentives for the same technologically advanced tangible assets later supported under Transition 4.0. As a result, the impact of 4.0 investments on firm performance may differ between first-time adopters and firms that had previously expanded their stock of advanced digital capital by exploiting earlier incentives. Table V reports the distribution of tax credits for investments in 4.0 tangible assets by the number of years in which investments were undertaken, also accounting for the 2017-2019 period. The table further presents this information by cohort.

A distinct pattern emerges for the 2020 cohort, which differs markedly from subsequent cohorts. For this group, the share of tax credits accrued by firms investing over multiple years exceeds that of firms investing in fewer years. In contrast, the importance of single-year investors increases steadily across later cohorts. When comparing the 2020 and 2021 cohorts, only 2.1 per cent of the tax credit accrued by firms entering in 2020 is attributable to firms investing in a single year; this share rises to 15.2 per cent for the 2021 cohort and to nearly 50 per cent and 80 per cent for the 2022 and 2023 cohorts, respectively. Consistently, the prevalence of firms investing in only one year increases among later cohorts. This pattern is partly mechanical, since firms entering the scheme in later years are observed over a shorter time horizon, and partly compositional, as later cohorts include relatively smaller firms that tend to invest less frequently.

TABLE V: Distribution of 4.0 tangible assets tax credit by number of investment years, firm size, and cohort (including hyper-depreciation investments; 2017–2023)

	Tax credit (4.0 tangible)		**Beneficiary firms**		**Tax credit (4.0 tangible)**		**Beneficiary firms**	
N. of years	**mln euro**	**% credit**	**N.**	**% on Total**	**mln euro**	**% credit**	**N.**	**% on Total**
	Cohort 2020				**Cohort 2021**			
1	177	2.1%	2,983	20.3%	1,502	15.2%	20,075	43.3%
2	546	6.6%	2,975	20.2%	2,910	29.4%	14,765	31.9%
3	1,146	13.9%	2,939	20.0%	2,574	26.0%	7,034	15.2%
4	1,656	20.0%	2,451	16.6%	1,526	15.4%	2,802	6.0%
5	1,590	19.2%	1,567	10.6%	976	9.9%	1,246	2.7%
6	1,606	19.4%	1,126	7.6%	412	4.2%	401	0.9%
7	1,549	18.7%	688	4.7%	-	-	-	-
Total	**8,270**		**14,729**		**9,900**		**46,323**	
	Cohort 2022				**Cohort 2023**			
1	1,600	49.8%	23,938	73.0%	328	79.9%	7,992	91.0%
2	1,035	32.2%	6,839	20.8%	49	11.9%	570	6.5%
3	355	11.0%	1,430	4.4%	21	5.0%	170	1.9%
4	162	5.0%	494	1.5%	13	3.2%	54	0.6%
5	61	1.9%	106	0.3%	-	-	-	-
Total	**3,212**		**32,807**		**411**		**8,786**	

The table VI reports the descriptive statistics for employment, revenues, assets, and investment rates of the beneficiary firms for 2019, i.e. the year prior to the policy introduction. Firms that benefited from the tax credit for investing in tangible 4.0 assets but had not previously accessed hyper-depreciation exhibit distinct characteristics: on average, they are smaller in terms of employment, revenues, and total assets, and they display lower investment rates than firms that benefited from both the Transition 4.0 tax credit and hyper-depreciation. Although they represent roughly 75 per cent of all beneficiaries, they accounted for only 47 per cent of the total tax credit claimed for investments in tangible 4.0 assets.

TABLE VI: Descriptive statistics by sample composition

Year 2019	**25th pct**	**Average**	**50th pct**	**75th pct**	**N. of firms**
Employees (numbers)					
Both transition 4.0 and hyper-depreciation	10.0	85.9	22.0	52.0	22,144
Only transition 4.0	3.0	26.5	9.0	19.0	58,659
Only transition 4.0 (Balanced panel of firms 2016-2023)	6.0	34.9	12.0	25.0	43,980
Revenues (Euro)					
Both transition 4.0 and hyper-depreciation	1,811,134	27,652,596	4,747,802	14,132,064	22,144
Only transition 4.0	500,304	7,214,582	1,347,277	3,737,578	58,659
Only transition 4.0 (Balanced panel of firms 2016-2023)	850,744	9,060,554	2,094,852	5,283,269	43,980
Total assets (Euro)					
Both transition 4.0 and hyper-depreciation	1,740,911	35,554,539	4,715,603	13,967,514	22,144
Only transition 4.0	465,041	7,083,572	1,296,749	3,661,468	58,659
Only transition 4.0 (Balanced panel of firms 2016-2023)	832,957	8,543,149	1,927,889	4,941,999	43,980
Investment rate (%)					
Both transition 4.0 and hyper-depreciation	1.0%	6.9%	3.2%	7.9%	22,144
Only transition 4.0	0.0%	5.8%	1.3%	5.1%	58,659
Only transition 4.0 (Balanced panel of firms 2016-2023)	0.3%	4.7%	1.5%	4.8%	43,980

4.1.3 Complementarity with other incentives

As described in Section 2, the Transition 4.0 Plan also provides tax incentives for investments in Industry 4.0 intangible assets, as well as for research and development, technological innovation and design (R&D&I), and training expenditures. The distribution of the corresponding tax credits is reported in Table VII.

Between 2020–2023 period, approximately 4.5 billion of tax credits for research and development were accrued (columns 1 and 2) with a relatively even distribution across the four years. The distribution by firm size exhibits a pronounced asymmetry between scale and participation. Large firms account for 34 per cent of total tax credit but represent only 9 per cent of investment initiatives, pointing to a substantially higher average project size. By contrast, micro and small enterprises jointly account for 67 per cent of all investment initiatives while absorbing only 40 per cent of total resources, consistent with a more fragmented pattern of smaller-scale projects. The geographical allocation is skewed towards Northern regions. Firms located in the North-West and North-East jointly receive about 60 per cent of total R&D&I tax credits and account for 68 per cent of total of investment initiatives. By comparison, firms in the South and Islands account for a smaller share of investment initiatives (14 per cent) but a higher share of total amounts (20 per cent), indicating fewer but relatively larger projects. Manufacturing firms are the primary beneficiaries of the measure, accounting for 57 per cent of total tax credit and 58 per cent of investment initiatives, followed by services, which account for one quarter of both dimensions. Overall, R&D&I tax credits appear to be characterized by strong concentration in capital-intensive firms and regions, combined with widespread but shrinking participation among smaller enterprises.

The patterns observed for Training 4.0 and intangible capital goods differ substantially from those of R&D&I. Training 4.0 accounts for 2,646 million euros across 60,139 investment initiatives and displays a sharply concentrated temporal profile: almost the entire measure was implemented in 2021 and 2022, which together account for 80 per cent of total resources and 79 per cent of investments. Unlike R&D&I, Training 4.0 is predominantly taken up by smaller firms: micro and small enterprises absorb 78 per cent of total funding and 86 per cent of investment initiatives, with micro firms alone accounting for over half of all investments. This configuration points to a highly diffused uptake of relatively small training projects. From a territorial perspective, Training 4.0 exhibits a pronounced Southern concentration (43 per cent of both total expenditure and investment initiatives). Sectoral participation is more evenly distributed than in R&D&I, with manufacturing remaining the largest recipient (28 per cent of euros and investment initiatives), but with sizeable contributions from services and trade.

Support for intangible capital goods is more limited in scale (414 million; 23,445 investment initiatives) and characterized by a pronounced spike in 2022, which represents 59 per cent of total euros and 43 per cent of investments. Large firms receive 25 per cent of total resources but account for only 8 per cent of investment initiatives, while micro and small firms dominate participation. The geographical allocation again favors the North, which accounts for around 65 per cent of both the value and the number of investments. The sectoral composition is even more strongly centered on manufacturing, which accounts for 52 per cent of funding and 60 per cent of projects. This suggests that, relative to Training 4.0, intangible capital goods support remains more capital-intensive, geographically concentrated, and closely aligned with manufacturing-oriented production structures.

TABLE VII: Distribution of tax credits in the Transition 4.0 Plan

	R&D&I				**Training 4.0**				**Intangible capital goods**			
	mln euro	**% of total**	**N. of investment**	**% of total**	**mln euro**	**% of total**	**N. of investment**	**% of total**	**mln euro**	**% of total**	**N. of investment**	**% of total**
Year												
2020	1,158	26%	18,436	32%	514	19%	12,211	20%	20	5%	2,758	12%
2021	1,347	30%	15,473	26%	909	34%	20,738	34%	68	16%	6,175	26%
2022	1,198	26%	13,763	24%	1,223	46%	27,190	45%	245	59%	10,125	43%
2023	822	18%	10,799	18%	0	0%	0	0%	81	20%	4,387	19%
Total	4,526	100%	58,471	100%	2,646	100%	60,139	100%	414	100%	23,445	100%
Size												
Micro	694	15%	18,890	32%	910	34%	30,603	51%	75	18%	8,164	35%
Small	1,117	25%	20,573	35%	1,157	44%	21,112	35%	124	30%	8,621	37%
Medium	1,185	26%	13,494	23%	481	18%	7,133	12%	114	27%	4,887	21%
Large	1,530	34%	5,514	9%	98	4%	1,291	2%	101	25%	1,773	8%
Geographical areas												
North West	1,591	35%	21,970	38%	602	23%	13,013	22%	151	37%	8,280	35%
North East	1,157	26%	17,477	30%	311	12%	8,180	14%	114	28%	7,139	30%
Centre	881	19%	10,674	18%	589	22%	13,207	22%	68	16%	4,201	18%
South and Islands	896	20%	8,350	14%	1,145	43%	25,739	43%	80	19%	3,825	16%
Sector												
Manufacturing	2,595	57%	33,882	58%	748	28%	17,054	28%	215	52%	14,060	60%
Construction	108	2%	1,543	3%	350	13%	7,083	12%	22	5%	920	4%
Trade	265	6%	4,732	8%	466	18%	12,186	20%	50	12%	3,000	13%
Services	1,163	26%	15,707	27%	630	24%	15,897	26%	67	16%	3,116	13%
Energy	102	2%	519	1%	49	2%	860	1%	11	3%	394	2%
Transport	173	4%	846	1%	261	10%	3,843	6%	23	6%	670	3%
Others	119	3%	1,242	2%	142	5%	3,216	5%	26	6%	1,285	5%

To quantify the degree of overlap between investment in tangible 4.0 assets and other subsidised forms of investment, we compute the amount of tax credits accrued under alternative policy measures by firms investing in tangible Industry 4.0 assets. In addition to the Transition 4.0 incentives, we examine the extent of overlap with the *Bonus Sud*. The cumulatability of the two measures is of particular relevance, as they partially apply to the same set of eligible assets and may therefore jointly shape firms' investment decisions. Specifically, *Bonus Sud* is an incentive targeting all capital goods allocated to production facilities located in Southern Italy, with tax credit rates and ceilings varying according to firm size[10], therefore it also covers highly technological tangible assets.

Tables VIII report the amount of tax credits accrued under other policy measures by firms investing in tangible Industry 4.0 assets. Columns 1 and 2 indicate that approximately 70 per cent of total *Bonus Sud* is allocated to firms that have invested in highly technological tangible assets. Given the cumulatability of the two measures, a small firm investing in tangible 4.0 assets in the Southern regions in 2021 could receive a combined tax credit covering up to 95 per cent of the investment value. The geographical breakdown indicates that nearly the entire amount of the credit was claimed by firms located in Southern Italy. The small residual share is attributable to firms headquartered in other regions but undertaking investments in production facilities located in the South. Manufacturing, construction, and trade together accounted for more than 70 per cent of the *Bonus Sud* tax credit. In addition, in the manufacturing, construction, and energy sectors, close to 80 per cent of the total credit was concentrated among firms that benefited from 4.0-related incentives. By contrast, the services sector exhibits a markedly lower overlap between beneficiaries of the two schemes, suggesting that *Bonus Sud* resources were predominantly used to finance investments in lower-technology capital goods, which were incentivized under this scheme but excluded from Transition 4.0.

Columns 3 and 4 indicate that, in each year, roughly half of the tax credit for R&D&I expenditures was claimed by firms that also invested in 4.0 tangible assets. The overlap increases as firm size grows: 68 per cent of the R&D&I tax credit was obtained by large firms that also invested in 4.0 tangible assets, whereas only 15 per cent was claimed by

[10]In particular, the tax credit is equal to 45 per cent of the amount of the investment, up to a maximum of 3 million euros, for micro and small enterprises; 35 per cent for medium-sized enterprises (for investments up to 10 million euros); and 25 per cent for large enterprises (for investments up to 15 million euros).

micro-enterprises. The geographical distribution shows a greater relevance of firms jointly using R&D&I incentives and 4.0 tangible assets in Northern regions. Around 80 per cent of the R&D&I tax credit was accrued by firms operating in manufacturing, and nearly 70 per cent of this amount was claimed by firms that also invested in 4.0 tangible assets.

While a limited degree of overlap is observed between firms investing in tangible 4.0 assets and those accessing Training 4.0 support (Columns 5–6), the results indicate a markedly stronger complementarity between Intangible 4.0 and Tangible 4.0 investments (Columns 7–8)[11].

TABLE VIII: Distribution of tax credits obtained by firms that have invested in 4.0 tangible assets

	Bonus Sud		**R&D&I**		**Training 4.0**		**Intangible 4.0**	
	mln euro	**% of total**	**mln euro**	**% of total**	**mln euro**	**% of total**	**mln euro**	**% of total**
Year								
2020	685	67.4%	539	46.5%	191	37.0%	16	78.1%
2021	1,194	71.9%	672	49.9%	344	37.8%	49	71.9%
2022	1,803	73.9%	625	52.2%	470	38.4%	176	71.6%
2023	1,271	64.8%	411	50.0%	0	-	56	69.0%
Total	4,953	70.0%	2,247	49.6%	1,004	38.0%	296	71.5%
Size								
Micro	1,309	54.5%	108	15.6%	188	20.6%	35	47.0%
Small	1,891	74.6%	420	37.6%	471	40.7%	83	67.3%
Medium	1,269	82.8%	671	56.7%	282	58.7%	90	78.9%
Large	484	79.8%	1,048	68.5%	63	64.0%	88	86.5%
Geographical areas								
North West	164	60.9%	861	54.1%	238	39.6%	107	71.0%
North East	84	81.0%	692	59.8%	144	46.4%	93	80.9%
Centre	158	58.7%	346	39.3%	170	28.9%	46	67.8%
South and Islands	4,547	70.7%	349	38.9%	452	39.4%	50	62.1%
Sector								
Manufacturing	1,782	79.2%	1,777	68.5%	450	60.2%	183	85.2%
Construction	978	78.7%	47	43.4%	156	44.4%	13	61.0%
Trade	806	63.9%	116	43.9%	153	32.9%	30	59.7%
Services	489	42.3%	169	14.6%	107	17.0%	28	41.1%
Energy	255	78.9%	36	35.6%	28	56.5%	9	80.9%
Transport	158	67.0%	27	15.7%	62	23.8%	15	67.6%
Others	485	79.8%	74	61.7%	49	34.2%	17	67.5%

[11] It is worth mentioning that the amount of tax credit accrued for investments in 4.0 tangible assets may refer to the combined purchase of tangible and intangible assets, such as software necessary for the operation of devices (embedded software). In this case, intangible assets 4.0 can be subsidised together with the cost of the device, but the data available does not allow for the separation of the two types of investment.

5 Methodology

To evaluate the impact of the Transition 4.0 Plan on firms, this report employs the Synthetic Difference-in-Differences (SDID) estimator introduced by Arkhangelsky et al. (2021), which combines the synthetic control method and the difference-in-differences framework to construct a credible counterfactual for treated firms, i.e. firms that use the Plan.

The strategy is motivated by the fact that the Transition 4.0 Plan was accessible to all eligible firms, its design does not allow the identification of a group excluded from the incentive on the basis of exogenous characteristics or factors beyond their control. This self-selection into the policy poses a threat to identification, as the decision to invest in 4.0 technologies may be driven by unobservable firm-level characteristics — such as managerial quality, investment opportunities, or productivity dynamics — that simultaneously affect the outcome variables of interest.

To evaluate the impact of the Transition 4.0 incentives on the behavior of beneficiary companies, the first empirical approach follows a widely recognized approach in economic literature: comparing the group of companies that benefited from the measure (treated companies) with a control group of companies that did not. In particular the analysis employs an estimator recently introduced in the literature by Arkhangelsky et al. (2021). The estimation procedure consists of two steps. In the first step, to each firm not benefiting from the incentives is assigned a weight to construct a synthetic control group. This group is calibrated so that, in the period prior to the policy's introduction, the dynamics of the outcome variable matches that of the treated companies. In the second step, a difference-in-differences estimator is used to compare the trends of the treated companies and the synthetic control group before and after the policy implementation. The key assumption for the validity of this approach is that of parallel trends: in the absence of the policy, treated companies (those that received the tax credit) and the synthetic control group would have followed similar trajectories. Under this assumption, any divergence in trends observed after the policy's adoption can be attributed to the effect of the policy.

In practice, the synthetic control group is constructed by assigning each company a fixed weight that remains constant over time. Consequently, the empirical analysis includes only companies for which data are available across all years under consideration (i.e. a balanced panel). Since the weighting scheme is derived through an optimization process that ensures parallel trends prior to the policy's introduction, some companies in the control group may be assigned a weight of zero, while others may receive large weights. One of the key advantages of this estimator is its ability to guarantee the presence of parallel trends in the pre-treatment period, an essential condition that is often difficult to achieve in empirical evaluations.

To interpret the estimates as causal effects, it is essential that firms' decisions to invest in 4.0 technologies are not influenced by unobservable, time-varying factors that also affect the outcome of interest. The SDID estimator is robust to self-selection based on unobservable time-invariant characteristics, such as managerial quality, but assumes that such factors remain constant over time. If, for example, an unexpected and positive productivity shock occurs after the policy's introduction, it may independently increase the likelihood that a company invests in advanced technologies and experiences growth in employment or turnover. In such a scenario, the estimated effect would capture both the impact of the Transition 4.0 Plan and the productivity shock, leading to an overestimation of the policy's effect.

To address potential threats to identification, we complement the SDID estimates with a series of weighted OLS regressions that progressively introduce additional controls not directly incorporated in the SDID. In all specifications, we apply the unit weights derived from the SDID estimation, so as to preserve the comparability between treated firms and the synthetic control group established in the first stage. This approach follows the logic of Zwick and Mahon (2017), who validate their baseline difference-in-differences estimates against a battery of alternative specifications — including firm-level cash flow controls, industry-level measures of Tobin's Q, and flexible industry time trends — showing that their main findings are robust across a wide range of identifying assumptions.

The baseline weighted OLS specification includes firm and year fixed effects, with standard errors clustered at the firm level. This specification closely mimics the results of the SDID. As a first robustness check, we re-estimate the baseline specification clustering standard errors at the three-digit sector level, which is more conservative and accounts for the possibility that residuals are correlated across firms operating in the same industry — a relevant concern given that investment decisions within narrowly defined sectors tend to co-move in response to common demand or technological shocks.

In the second specification, we augment the model with 3 digit sector-year fixed effects. These absorb any time-varying shocks common to firms in the same sector, including industry-specific demand fluctuations or technological developments that may have coincided with the rollout of the Transition 4.0 plan and differentially affected the propensity to invest in eligible capital goods. Another concern relates to the possibility that firms self-selected into the policy along observable pre-treatment characteristics associated with differential growth trajectories. To address this, the third specification introduces firm-age-by-year interactions, which allow firms at different stages of their life cycle to follow distinct time paths for the outcome variable, independent of the policy. The fourth and fifth specifications further control for pre-treatment revenue and pre-treatment total factor productivity, each interacted with year dummies, so as to allow firms that differed in size and productivity at the onset of the policy to evolve along different baseline trajectories. This is motivated by the concern that more productive or larger firms may have been both more likely to adopt 4.0 technologies and on a steeper growth path for reasons unrelated to the incentive. The sixth specification adds interactions between size and year dummies, allowing firms of different size classes to follow heterogeneous time trends.

Finally, the last and most demanding specification adds lagged total factor productivity as a direct control for time-varying productivity shocks. This addresses the concern that an unanticipated improvement in firm-level productivity after the introduction of the policy could independently increase both the likelihood of investing in advanced technologies and the growth of the outcome variables, leading to an upward bias in the estimated treatment effect. Across all specifications, standard errors are clustered at the three-digit sector level. The stability of the estimated coefficients as controls are progressively added provides evidence that the results are not driven by omitted time-varying confounders, and lends support to a causal interpretation of the baseline SDID estimates.

In our empirical analysis we are interested in evaluating the effect of the policy on several firm level outcomes, for this reason the estimation proceeds in two stages. In the first stage, we apply the SDID estimator using the investment rate as the outcome variable — the primary margin along which firms are expected to respond to Transition 4.0 incentives, given that the policy directly subsidizes investment expenditure in eligible capital goods. This first stage yields both a baseline estimate using SDID of the policy effect on investment and, crucially, a set of unit weights that ensure pre-treatment parallel trends between treated firms and the synthetic control group with respect to this outcome. In the second stage, we employ these same weights in the weighted OLS framework described above to estimate the effects of the policy on a broader set of firm-level outcomes, including among others total factor productivity and employment.

An alternative strategy would have been to estimate separate SDID models for each outcome of interest, deriving outcome-specific weights in each case. However, this alternative approach would not guarantee that treated and control firms followed parallel pre-treatment trajectories in investment — the variable most directly targeted by the policy and the natural benchmark for assessing its internal validity. By anchoring the weighting scheme to the investment rate, we ensure that the control group is constructed to be comparable to treated firms along the dimension most relevant to the policy design, and that any estimated effects on secondary outcomes are identified using the same counterfactual. As described above, for each outcome we perform both the baseline regression and then a series of robustness to address endogeneity concerns.

The analysis considers a range of firm-level outcome variables that capture distinct margins along which firms may respond to the Transition 4.0 incentives. The primary outcome is the investment rate, measured as investment in year t divided by total assets in year $t-1$, which represents the most direct channel through which the policy is expected to operate. To assess whether the incentives generated broader effects on firm performance and factor allocation, we also examine a broader set of outcomes. On the labour market side, we consider the growth rate of employment and the age composition of the workforce, measured as the ratio of young workers (aged under 35) to older workers (aged over 35), which allows us to assess whether the adoption of advanced technologies was accompanied by a shift in labour demand. To capture changes in the intensity of capital use, we examine the growth rate of capital intensity, defined as the ratio of capital stock to employment. Finally, we consider two measures of firm productivity: labour productivity, measured as revenue per employee, and revenue-based total factor productivity (TFPR), estimated from a production function in revenues using the control function approach of Wooldridge (2009) with a second-order polynomial approximation, and materials as the proxy variable for unobserved productivity.

Given that the policy remains active for several years and firms could access the incentives across multiple years, we allow for heterogeneous treatment effects along two dimensions. First, we estimate the effects separately for each treatment cohort — firms that first claimed the tax credit in 2020, 2021, 2022, and 2023 respectively — so as to account for the possibility that the policy environment, the composition of adopting firms, and the macroeconomic context differed meaningfully across cohorts. Second, we stratify the analysis by firm size class — micro, small, medium, and large firms — recognizing that the capacity to invest in 4.0 technologies, the degree of financial constraints, and the expected returns to adoption may vary substantially along the size distribution. This approach deliberately avoids the assumption of a homogeneous average treatment effect, and instead allows the data to reveal the extent to which the impact of the Transition 4.0 plan was concentrated among specific firm types or adoption cohorts.

6 Results

This section presents the results of the SDID estimating the impact of the tax credit for 4.0 tangible assets on firms' investment rates[12].

6.1 Effects on investment rate

Table IX presents the estimated effects with the SDID of the Transition 4.0 incentives on firms' investment rates[13]. The results indicate a positive and statistically significant effect across all size classes and treatment cohorts, with a pattern of heterogeneity that is consistent with the common view that small, hence financially constrained, firms react more to investment incentives.

The magnitude of the effect declines monotonically with firm size. Large firms exhibit an increase in the investment rate of approximately 0.4 percentage points, while the estimated effect for medium-sized firms ranges between 0.69 and 0.72 percentage points depending on the cohort. Small firms show a substantially larger response, with estimates clustering around 1.5 percentage points, and micro-enterprises display the most pronounced reaction, with increases ranging from 3.5 to 3.9 percentage points. To appreciate the economic significance of these magnitudes, it is useful to benchmark them against the pre-policy baseline: in the year before the introduction of Transition 4.0, the average investment rate stood at approximately 5 per cent across the sample of beneficiary firms used in the empirical analysis (Table VI), implying that the estimated effects correspond to increases of between 12 and 18 per cent of the baseline for large and medium firms, respectively; and to an increase of one third and above two thirds of the baseline rate for small and micro enterprises.[14]

[12] For econometric analyses, the 'sdid' command and STATA software were used. For further details, see Arkhangelsky et al. (2021)

[13] As discussed in Section 5 investment rate is defined as the ratio between investment, as reported in the balance sheet, and the value of assets recorded in the previous year. Outlier values were excluded from the analysis. Balance sheet assets were adjusted for write-ups, as described in Section 4. Companies that reported investment rates above the 95th percentile of the overall distribution in at least one of the six years under observation were excluded.

[14] The average investment rate in the period prior to the introduction of Transition 4.0 was 5.2 per cent for micro-enterprises, 4.4 per cent for small enterprises, and 3.9 and 3.4 per cent for medium and large enterprises, respectively.

TABLE IX: Average treatment effect on Investment rate

	Firms size			
	Large	Medium	Small	Micro
	Dep var: Investment Rate			
Cohort 2020	0.3820**	0.6945***	1.5237***	3.8461***
	(0.0016)	(0.0009)	(0.0018)	(0.0022)
Cohort 2021	0.4147***	0.7247***	1.4840***	3.5303***
	(0.0008)	(0.0005)	(0.0021)	(0.0025)
Cohort 2022	0.4506***	0.7063***	1.5112 ***	3.7366 ***
	(0.0008)	(0.0006)	(0.0012)	(0.0031)
Cohort 2023	0.4155	0.7089***	1.6856***	3.9815***
	(0.0030)	(0.0023)	(0.0014)	(0.0018)

Standard errors in parenthesis

*p<0.10, **p<0.05, ***p<0.01.

The estimated effects across the firm size distribution are consistent with the view that smaller firms, which typically face tighter financial constraints and higher costs of external finance, are more sensitive to policies that generate immediate reductions in the after-tax cost of investment. This pattern mirrors the findings of Zwick and Mahon (2017), who document that small firms respond approximately twice as strongly as large firms to bonus depreciation incentives in the United States. The estimates are also broadly stable across treatment cohorts — firms that first claimed the tax credit in 2020, 2021, 2022, and 2023 exhibit responses of comparable magnitude within each size class — suggesting that the investment effect of the policy was not confined to any particular phase of its implementation and was not affected by the macroeconomic shocks, including the recovery from the Covid-19 shock and the subsequent energy price crisis.

Table X shows for micro firms that invest in 4.0 technologies in 2020 the robustness described in Section 5. The SDID estimates indicate an increase of 3.8 percentage points in the investment rate. As the table reports, the point estimates are remarkably stable across all specifications and in the most demanding one yields an average point estimate of 3.9 percentage points.[15]

[15]For reasons of space, we report the results for a single firm size and cohort; the results for all firm sizes and cohorts, available upon request, are remarkably robust and stable.

TABLE X: OLS Robustness

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
−3	0.000367	0.000367	0.00230	0.00324	0.00245	0.00266	0.00269	0.00165
	(0.00222)	(0.00200)	(0.00238)	(0.00250)	(0.00298)	(0.00295)	(0.00296)	(0.00303)
−2	0.000491	0.000491	0.00159	0.00371	0.00455	0.00463	0.00457	0.00582*
	(0.00220)	(0.00227)	(0.00258)	(0.00273)	(0.00300)	(0.00297)	(0.00297)	(0.00306)
−1	0.000422	0.000422	0.00181	0.00276	0.00288	0.00291	0.00292	0.00269
	(0.00210)	(0.00235)	(0.00273)	(0.00279)	(0.00291)	(0.00295)	(0.00293)	(0.00306)
—	—	—	—	—	—	—	—	—
+1	0.0559***	0.0559***	0.0549***	0.0557***	0.0575***	0.0577***	0.0578***	0.0574***
	(0.00223)	(0.00228)	(0.00250)	(0.00265)	(0.00274)	(0.00276)	(0.00274)	(0.00284)
+2	0.0366***	0.0366***	0.0364***	0.0373***	0.0382***	0.0384***	0.0384***	0.0372***
	(0.00204)	(0.00228)	(0.00245)	(0.00262)	(0.00292)	(0.00294)	(0.00295)	(0.00278)
+3	0.0328***	0.0328***	0.0336***	0.0336***	0.0342***	0.0345***	0.0345***	0.0341***
	(0.00214)	(0.00215)	(0.00247)	(0.00259)	(0.00279)	(0.00280)	(0.00281)	(0.00277)
+4	0.0292***	0.0292***	0.0292***	0.0288***	0.0290***	0.0291***	0.0291***	0.0293***
	(0.00201)	(0.00187)	(0.00210)	(0.00212)	(0.00218)	(0.00219)	(0.00219)	(0.00220)
Obs.	89880	89880	89702	89702	89702	89037	89037	85844
Adjusted R^2	0.133	0.133	0.153	0.155	0.155	0.155	0.155	0.167
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Clustered at firm	YES	NO	NO	NO	NO	NO	NO	NO
Clustered at 3-digit sec.	NO	YES	YES	YES	YES	YES	YES	YES
3-digit sec × year FE	NO	NO	YES	YES	YES	YES	YES	YES
Firm age × year	NO	NO	NO	YES	YES	YES	YES	YES
Pre-revenue × year	NO	NO	NO	NO	YES	YES	YES	YES
Pre-TFP × year	NO	NO	NO	NO	NO	YES	YES	YES
Size × year	NO	NO	NO	NO	NO	NO	YES	YES
Lagged TFP	NO	NO	NO	NO	NO	NO	NO	YES
Pre-trend F	0.0301	0.0280	0.276	0.987	1.182	1.241	1.211	1.803
Post-trend F	175.0	183.8	163.3	151.7	144.8	145.2	146.1	137.0
ATT	0.0386	0.0386	0.0385	0.0388	0.0397	0.0399	0.0399	0.0395
ATT (SE)	(0.00164)	(0.00162)	(0.00178)	(0.00188)	(0.00204)	(0.00204)	(0.00205)	(0.00202)

Note: The dependent variable is the investment rate. Results are reported for micro firms treated in 2020. Standard error are clustered at firm level. Significance: $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

6.2 Effects on firm employment

The primary objective of the Transition 4.0 Plan was to support the digital transformation of the Italian production system by encouraging business investment in advanced technologies. Such investments at the firm level may also influence employment outcomes. On one hand, investments in advanced technologies can lead to productivity gains that reduce the need for labour inputs to produce the same level of output, an effect commonly associated with labour-saving technologies. On the other hand, efficiency improvements may positively affect employment if they enable firms to expand their production scale as a result of increased competitiveness[16].

This section presents the estimated effects of the Transition 4.0 incentives on employment growth, measured as the log-difference in the number of employees. The choice of this outcome variable in growth rather than level terms reflects the fact that treated and control firms did not exhibit parallel pre-treatment trends in employment levels. This is consistent with the self-selection mechanism discussed in Section 5 — firms that opted into the policy differed systematically from non-adopters in ways that affected their absolute scale. Expressing the outcome as a growth rate effectively removes these time-invariant differences in firm size and allows the parallel trends assumption to be assessed on a more credible basis. It should be noted, however, that the SDID weights are calibrated to ensure parallel trends with respect to the investment rate — the primary outcome of the policy — and do not mechanically guarantee comparability in the pre-treatment dynamics of secondary outcomes such as employment growth. As a result, the validity of the parallel trends assumption for all the firm level outcomes other than investment rate are assessed separately.

[16]For a review of the literature on this topic, see Aghion et al. (2021)

FIGURE V: Results on employment growth

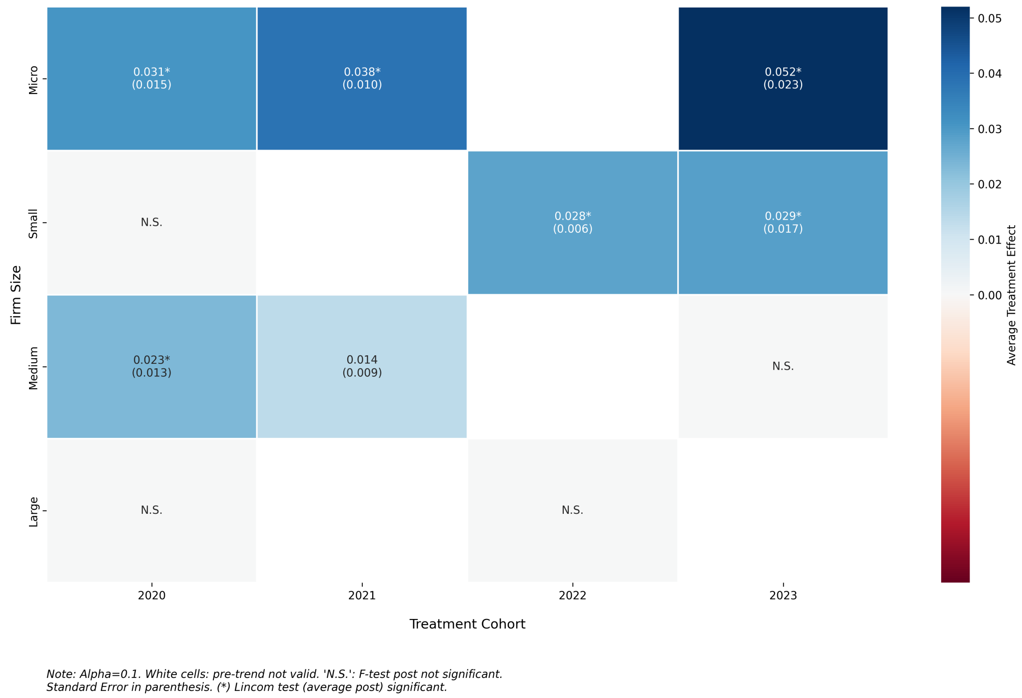


Figure V summarizes the results across cohorts and size classes using a heatmap representation. The interpretation of each cell requires distinguishing between two distinct sources of non-significant results. In some cases, the pre-treatment parallel trends test is not satisfied, which prevents a causal interpretation of the post-treatment coefficients altogether; these cells are left blank in the figure.[17] In other cases, parallel trends hold but the average post-treatment effect is not statistically distinguishable from zero, indicating that the policy did not generate a detectable impact on employment growth for that cohort-size combination; these are reported as "N.S.".[18] The distinction between the two cases is empirically relevant: the former reflects a limitation of the identification strategy for that specific sub-group, while the latter constitutes genuine evidence of a null effect.

Turning to the results, the evidence points to a positive but heterogeneous effect of

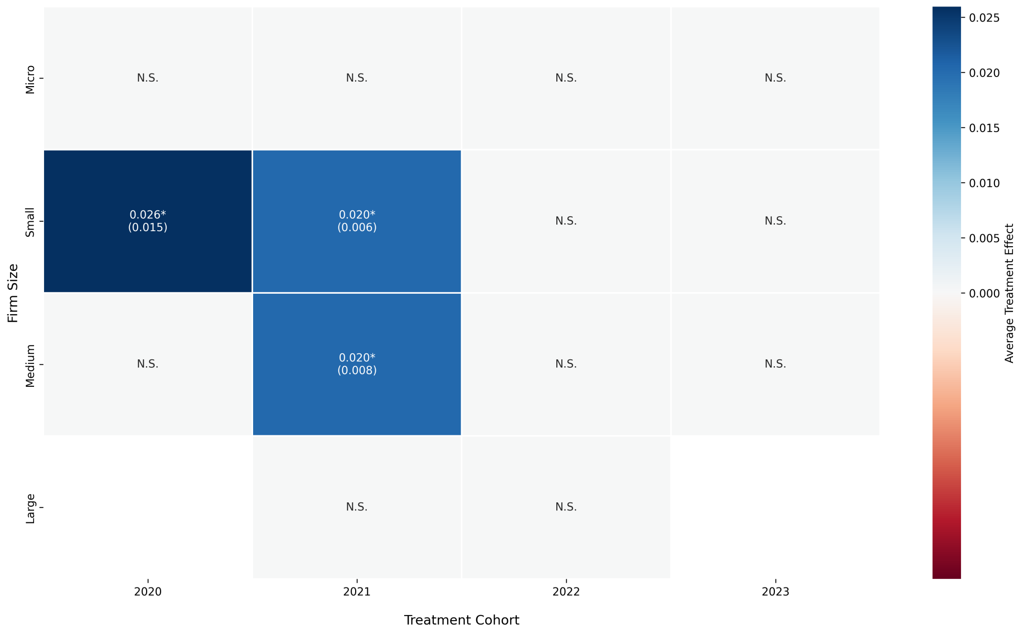
[17] Pre-trend validity is assessed through an F-test on the joint significance of the pre-treatment dummies. Estimates are considered valid only if the null hypothesis that all pre-treatment coefficients are jointly equal to zero cannot be rejected.

[18] Statistical significance of post-treatment effects is assessed using both an F-test on the full set of post-treatment coefficients to evaluate their joint significance, and a linear combination of post-treatment coefficients to test whether the average post-treatment effect differs from zero by constructing its confidence interval.

the Transition 4.0 incentives on employment growth, concentrated among smaller firms. Micro-enterprises exhibit statistically significant effects across almost all treatment cohorts, with estimated increases in employment growth ranging from approximately 3 to 5 percentage points. Small and medium-sized firms show significant effects in two out of four cohorts, with estimates of around 2 to 3 percentage points for small firms and somewhat lower magnitudes for medium-sized ones. By contrast, large firms display no significant employment response in any of the cohort-size cells for which parallel trends are satisfied. This pattern is broadly consistent with the investment results discussed above: capital accumulation increased proportionally more among smaller firms, which may have been operating below their optimal scale prior to the policy. Among large firms, instead, despite high absolute investment levels, the increase was more limited relative to the existing capital stock, thus generating a weaker employment response.

We now turn to examining the effect on labour composition. Figure VI presents the estimated effects of the Transition 4.0 incentives on the composition of the workforce, measured as the ratio of young workers (aged under 35) to older workers (aged over 35). The evidence is sparse: statistically significant effects emerge only for small and medium-sized firms in the 2021 cohort, with estimated increases in the young-to-old ratio of approximately 0.02 percentage points respectively. In all remaining cohort-size cells for which parallel trends are satisfied, the post-treatment effect is not distinguishable from zero. Large firms display no significant response across any cohort. Moreover, the effect found for the 2021 cohort might have been influenced by the increase in the social contribution rebate for all firms hiring young workers with permanent contracts, from 50 per cent in year 2020 to 100 per cent as of year 2021 (Budget law for 2021, art. 1 co. 10-15). These results are consistent with complementary evidence on the white-collar to blue-collar ratio, not reported here, which similarly fails to detect systematic shifts in workforce composition following the adoption of 4.0 technologies.

FIGURE VI: Results on labour composition: young/old



Note: Alpha=0.1. White cells: pre-trend not valid. 'N.S.': F-test post not significant. Standard Error in parenthesis. (*) Lincom test (average post) significant.

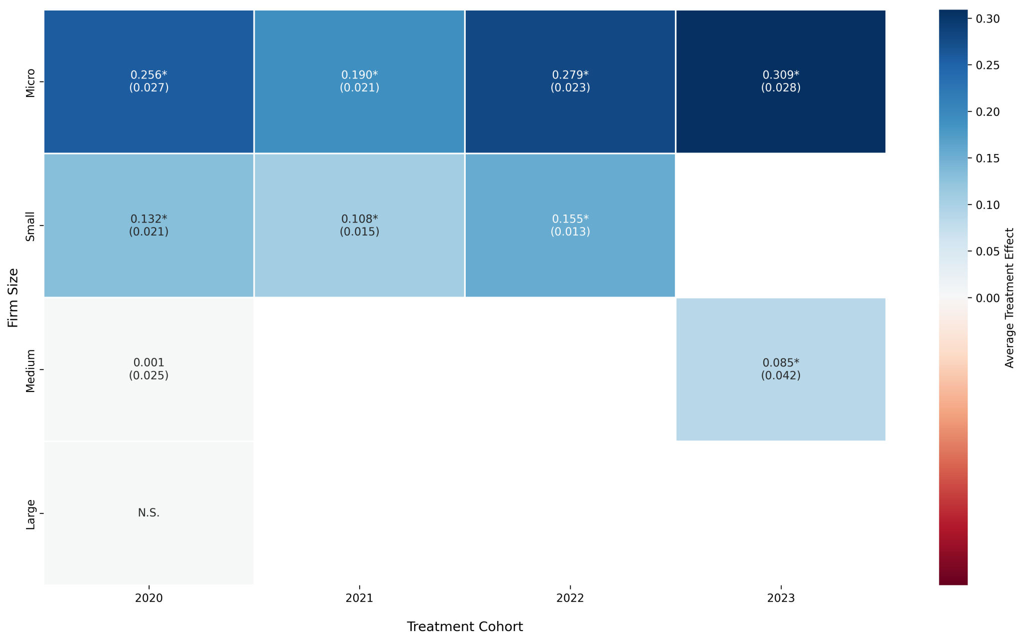
The absence of detectable effects on workforce composition is not necessarily surprising and admits at least two interpretations. On the one hand, changes in the age or skill composition of the workforce driven by new hiring or separations may materialize only gradually and remain difficult to detect in our data as we observe the stock of the entire workforce, particularly for firms that expand employment at the margin rather than restructuring their existing labour force. On the other hand, a more definitive assessment would require data on hiring and separation flows disaggregated by worker type, which are not available for the purpose of this report. Whether the adoption of 4.0 technologies induces a reallocation toward younger or more skilled workers through the extensive margin of employment adjustment remains hence an open question.

6.3 Effects on capital-to-labour ratio

Figure VII presents the estimated effects of the Transition 4.0 incentives on the growth rate of capital intensity, measured as the log-difference of the capital-to-labour ratio between the pre- and post-treatment periods. As in the case of employment, the parallel trends assumption is satisfied in growth rates but not in levels, reflecting the fact that treated and control firms differed systematically in their stock of capital per worker prior to the policy — a pattern consistent with the self-selection mechanism discussed in Section 5. The results are considerably more clear-cut than those observed for employment growth and workforce composition. Micro-enterprises exhibit large and statistically significant increases in capital intensity across all four treatment cohorts, with estimated effects ranging from approximately 19 to 31 percentage points. Small firms display similarly robust effects in three out of four cohorts, with estimates of around 11 to 16 percentage points. Evidence for medium-sized firms is more limited, with a significant effect emerging only for the 2023 cohort, while large firms show no detectable response.

These findings are internally consistent with the broader pattern of results documented so far in the report. The strong investment response documented in Table IX, combined with the more muted and selective effects on employment growth, implies that treated firms increased their capital stock faster than their workforce, mechanically raising the capital-to-labour ratio. The capital intensity results provide indirect corroboration of the investment estimates and suggest that the Transition 4.0 incentives facilitated an upgrading of the productive capital endowment of adopting firms, with each worker operating alongside a larger stock of physical capital after the policy.

FIGURE VII: Results on capital-to-labour ratio



Note: Alpha=0.1. White cells: pre-trend not valid. 'N.S.': F-test post not significant. Standard Error in parenthesis. (*) Lincom test (average post) significant.

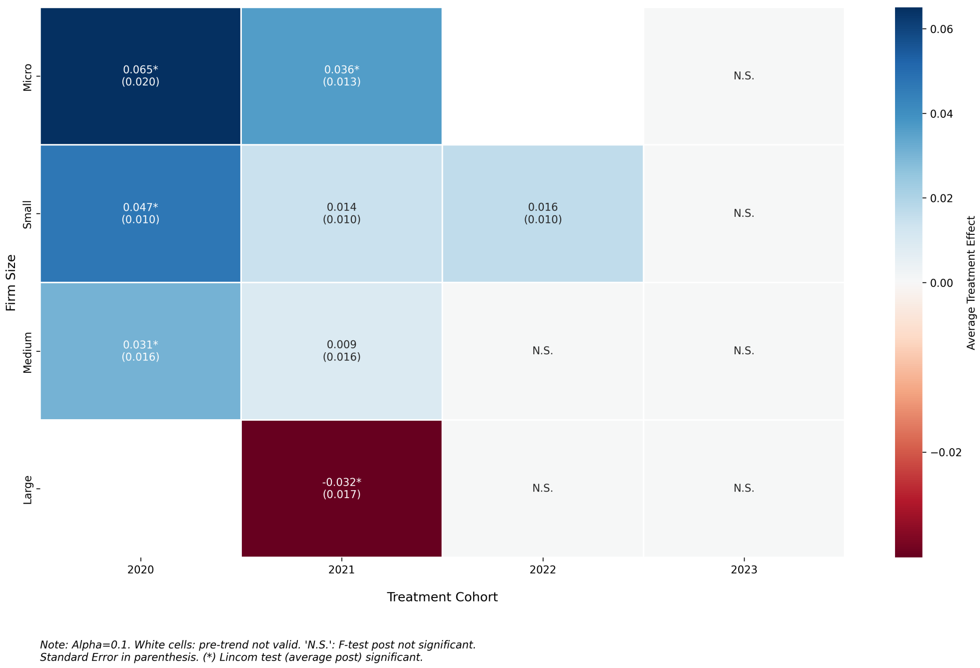
The concentration of significant effects among micro and small firms and the fact that parallel trends hold in growth rates but not in levels is itself informative in this regard. The failure of parallel trends in levels reflects the existence of persistent, pre-treatment differences in capital intensity across firms — differences that are likely the product of lumpy investment episodes rather than smooth continuous accumulation. For smaller firms in particular, capital adjustment is more likely to occur in discrete steps, with long periods of inaction followed by large investment spikes. The tax credit may therefore have represented the marginal incentive needed to trigger such an episode for firms that were already approaching an adjustment threshold, generating a sharp and visible increase in the growth rate of capital intensity within the post-treatment period. Larger firms, which tend to invest more continuously and whose capital intensity evolves more smoothly over time, show no analogous response — consistent with the prediction of models of non-convex capital adjustment costs in which the policy effect is concentrated among firms induced across an investment threshold, as discussed by Zwick and Mahon (2017).

6.4 Effects on firm productivity

Figures VIII and IX present the estimated effects of the Transition 4.0 incentives on two measures of firm productivity: labour productivity, measured as the logarithm of revenue per employee, and revenue-based total factor productivity (TFPR), estimated via the control function approach described in Section 5. The two measures tell a partially different story and, read jointly, allow for a more nuanced interpretation of the productivity effects of the policy.

With respect to labour productivity, significant positive effects are detected for micro-enterprises in the 2020 and 2021 cohorts, with estimated increases of approximately 6.5 and 3.6 log points respectively, and for small and medium-sized firms in the 2020 cohort, with effects of around 4.7 and 3.1 log points. These results are broadly consistent with the capital intensity findings discussed above: firms that experienced the largest increases in their capital-to-labour ratio are precisely those for which labour productivity also improved. To the extent that the increase in output per worker reflects a higher capital endowment per employee rather than an improvement in the efficiency with which inputs are combined, this result is encouraging but not unexpected — it is, in a sense, the natural complement of the investment and capital intensity responses already documented.

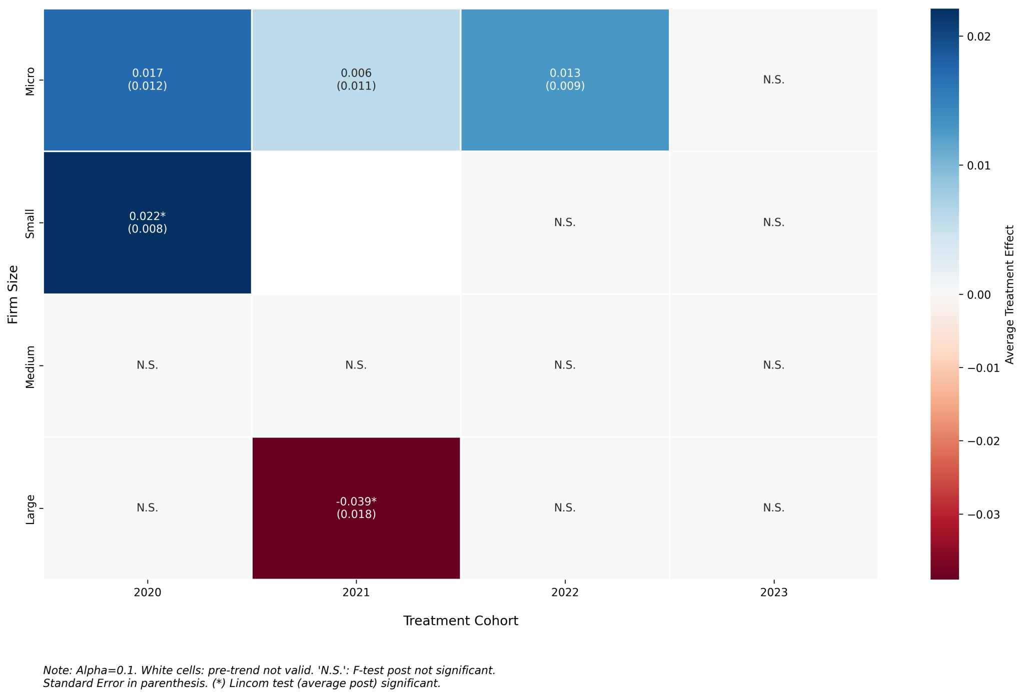
FIGURE VIII: Results on labour productivity



The TFPR estimates, however, point to a considerably more limited picture. Statistically significant effects on TFPR are confined to small firms in the 2020 cohort, with an estimated increase of approximately 2.2 log points, while all remaining cohort-size cells either show no significant effect or fail the parallel trends test. Notably, large firms in the 2021 cohort exhibit a negative effect on both productivity measures — a pattern that is difficult to interpret causally given the limited number of significant cells and the absence of a consistent directional signal across cohorts and size classes.

The overall absence of detectable TFPR gains is an important finding in this section, and one that deserves careful discussion. While the policy was explicitly designed to accelerate the digital transition of Italian firms with the expectation of generating productivity improvements, the evidence available does not allow us to confirm that such effects have materialised. To assess whether this null result conceals heterogeneous effects concentrated among particular subgroups of firms, we conducted a series of additional analyses, none of which are reported here for brevity. Specifically, we examined whether productivity gains were detectable among firms with a more skilled workforce, on the grounds that human capital complementarity is often identified in the literature as a precondition for the productive adoption of advanced technologies. We also investigated whether effects were stronger among firms that had simultaneously undertaken other forms of digital investment, so as to capture the role of complementary intangible capital. In both cases, and across a range of alternative sample splits and specifications, we found no statistically significant effects on productivity.

FIGURE IX: Results on revenue total factor productivity



Taken together, these results suggest that the absence of productivity effects is not easily attributable to the masking of gains within specific firm subgroups. It remains possible, of course, that the post-treatment period available in the present dataset is insufficient to capture gains that materialise only after a more extended period of organizational adjustment and learning (movement along the productivity J-curve; Brynjolfsson et al. (2021)). However, we are cautious about placing excessive weight on this interpretation in the absence of supporting evidence.

A further consideration concerns the scope of the estimation sample and its implications for the external validity of the results discussed above. As described in Section 4, the SDID analysis is conducted on a sample of firms that had not previously invested in eligible 4.0 technologies — so-called never adopters prior to treatment. This restriction is necessary to ensure that the estimated effects capture the causal impact of a first adoption episode rather than a continuation of an ongoing investment trajectory, but it implies that the results may not directly be informative about the effects of the policy on the broader population of beneficiaries, which includes firms with prior experience of 4.0 investment. The null results on TFPR documented above should therefore be interpreted in light of this sample restriction: they pertain specifically to late or first-time adopters, a subgroup that may differ in relevant ways from earlier adopters in terms of technological readiness, absorptive capacity, and the returns to digital investment. The absence of productivity gains among this group does not preclude the possibility that the policy generated meaningful productivity effects among firms that had already begun their digital transition and were using the incentive to deepen or extend an existing investment program. While estimating such effects within the SDID framework is more challenging, as the treatment for firms that already benefited from previous Industry 4.0 plans is not well defined, we re-estimated the SDID model on the full sample of firms and still do not find any productivity effect.[19]

The absence of significant productivity effects is consistent with a well-established body of evidence on investment incentive schemes. Studies exploiting quasi-experimental variation in investment subsidies — including Zwick and Mahon (2017) for the United States and Criscuolo et al. (2019) for the United Kingdom — document positive effects on capital accumulation without corresponding gains in firm-level productivity. Similar findings emerge in the Italian context, where Cingano et al. (2025) document significant effects on investment and employment but not on productivity. These results are not surprising in light of how the Transition 4.0 incentives were actually used. While the plan included provisions for training, intangible assets, and R&D — the complementary investments typically associated with productivity gains — firms made very limited use

[19]In this specification, which relaxes the restriction to previously untreated units, we do not find statistically significant productivity effects, in line with the baseline results.

of these components, concentrating their take-up almost exclusively on physical capital. The evidence thus suggests that capital deepening alone, in the absence of meaningful investment in organizational, human, and innovation-related complementarities, is unlikely to translate into productivity improvements. This points to the importance of ensuring a more balanced uptake of the available incentive mix in future policy interventions.

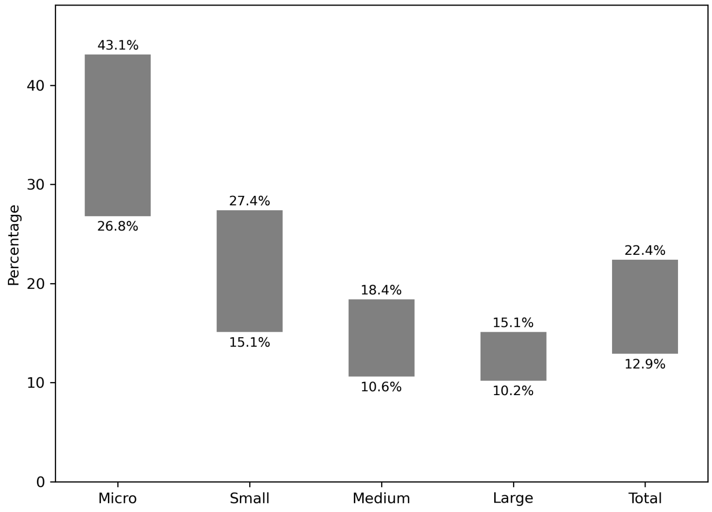
7 Aggregate effects and cost effectiveness

7.1 Aggregate effects

Once the causal effects of the policy have been estimated at the firm level, it is possible to quantify its aggregate impact on capital accumulation by translating the estimated changes in investment rates into volumes of additional investment. This step is essential for policy evaluation, as it allows to measure the total amount of investments that was effectively induced by the tax credit (investment additionality).

The microeconometric estimates of Table IX provide, for each cohort and firm size class, the average policy-induced change in the annual investment rate over the post-policy period. To translate these estimated effects into amounts of additional investment, we proceed as follows. For each cohort–size group, we multiply the estimated increase in the annual investment rate by the group-specific total pre-policy stock of tangible fixed assets. This yields the total annual additional investment per group attributable to the policy. We then cumulate this annual amount over the number of post-reform years during which the cohort is exposed to the tax credit (four years for the 2020 cohort, three for the 2021 cohort, two for the 2022 cohort, and one for the 2023 cohort). Finally, aggregation across cohorts yields the total additional investments for each firm size class. Figure X reports these numbers relative to the total tangible investment observed over the period 2020–2023.

FIGURE X: Aggregate additional investment, by firm size



Note: For each firm size class, the lower bound of the bars indicates the share of additional investment relative to total observed investment for the full population of beneficiary firms; the upper bound indicates the corresponding share calculated using only the estimation sample.

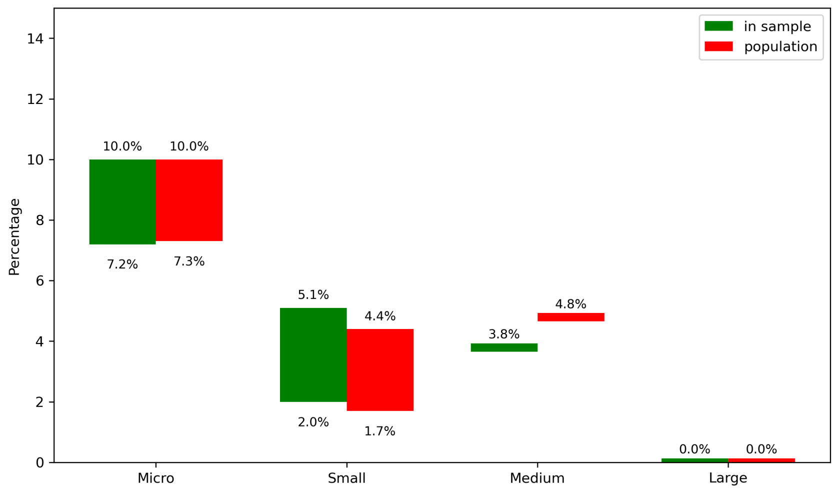
For each firm size class, we report a range of estimates reflecting alternative assumptions regarding the extension of the estimated effects beyond the sample used for identification. Specifically, the lower bound is obtained by applying the estimated investment additionality to the full population of beneficiary firms, including those excluded from the estimation sample because they had already benefited from pre-existing investment support schemes (the hyper-depreciation regime). This approach implicitly assumes that the marginal effect of the new tax credit on investment was the same for both first-time beneficiaries and firms with prior exposure to similar incentives. By contrast, the upper bound is based on the estimated additionality calculated using only the subset of firms included in the estimation sample.

Applying this methodology, we estimate that the tax credit generated additional investment equivalent to between 13 and 22 per cent of total observed tangible investment over the period 2020–2023. Investment additionality is strongly heterogeneous across firm size classes and is highest among smaller firms, consistent with their higher sensitivity to the policy. Overall, these results indicate that the tax credit played a significant role in supporting capital accumulation in the Italian productive system, contributing to a substantial increase in the stock of productive capital relative to the counterfactual scenario without the policy.

The second step of the analysis consists of quantifying the aggregate impact of the policy on employment. This exercise allows assessing the extent to which the additional investment induced by the tax credit translated into higher labour demand.

To derive aggregate employment effects, we translate the estimated firm-level treatment effects on employment growth into changes in the number of workers. The microeconometric estimates (see figure V) provide, for each cohort and firm size class, the average policy-induced increase in the annual employment growth rate relative to the pre-policy period. For each cohort–size group, we apply this estimated incremental growth rate to the group-specific average pre-policy level of employment per firm. This yields the average annual number of additional workers per firm attributable to the policy. We then cumulate these annual effects over the number of years during which each cohort is exposed to the tax credit, and multiplying by the number of treated firms in each cohort–size group yields the total number of additional jobs created within each group. Aggregating across cohorts provides total additional employment for each firm size class, expressed in figure XI relative to total pre-policy employment.

FIGURE XI: Aggregate additional employment, by firm size



Note: The upper bound is obtained by assigning to firms for which the treatment effect cannot be estimated, due to the absence of valid pre-treatment trends, the average effect estimated for firms in the same size class. The lower bound is calculated by assuming a zero effect for these firms.

As in the case of investment, we report a range of estimates reflecting alternative assumptions regarding the extrapolation of the estimated effects. First, consistent with the investment aggregation, the red and green bars reflect the different choice in terms of extension of the estimated treatment effects beyond the estimation sample. Second, the range of the bars reflects alternative treatments of cohorts for which the parallel trend assumption required for causal estimation is not satisfied. The upper-bound assigns to these cohorts the average effect estimated for the other cohorts in the same size class. The lower-bound assigns a zero effect, a much more conservative approach.

Applying this methodology, we estimate that the tax credit increased total employment among beneficiary firms by between 0.7 and 3.4 per cent over the period 2020–2023. The employment response is highly heterogeneous across firm size classes. Micro firms experienced the largest proportional increase in employment, estimated between 7.2 and 10 per cent, while the effects are smaller for small and medium-sized firms and not statistically significant for large firms.

7.2 Cost effectiveness analysis

A synthetic measure of the effectiveness of the policy in stimulating capital accumulation is provided by the investment multiplier, defined as the ratio between additional investment generated by the policy and its fiscal cost. The latter is measured using administrative corporate tax return data, while the numerator corresponds to the additional investment induced by the tax credit, computed as described in the previous section by aggregating the estimated firm-level treatment effects reported in Table IX. To fix a benchmark, consider for example a tax credit rate of 40 per cent. An eligible investment of 100 implies a fiscal cost of 40, corresponding to a multiplier of 2.5 in case the entire investment is additional. Lower values indicate that part of the subsidised investment would have occurred even in the absence of the policy. For example, if the entire investment had occurred even in the absence of the policy (no additionality), the multiplier would have been equal to zero.[20]

[20]Higher values may arise in two cases. First, when the policy sets a ceiling on eligible expenditure, but the firm undertakes a larger investment in the same type of assets. However, this mechanism appears

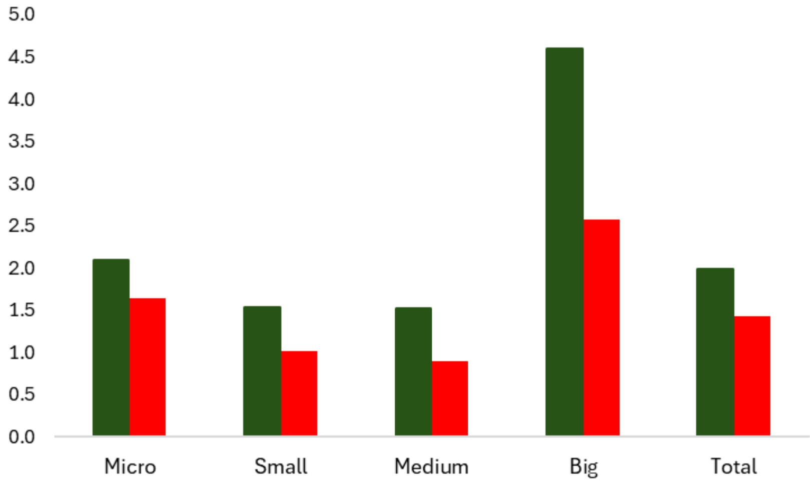
The results indicate that, for firms in the estimation sample, each euro of tax credit generated approximately 2 euros of total tangible investment (green bar in Figure XII). When the calculation is extended to the full population of beneficiary firms, the multiplier is estimated at around 1.5 (red bar) which implies that, on average, not all investments carried out by firms are additional. Overall, these findings indicate that the policy was effective in mobilizing private investment and amplifying the impact of public support.

The investment multiplier varies substantially across firm size classes. Within the estimation sample (green bar in Figure XII), it is estimated to be slightly above 2 for small firms and around 4.6 for large firms. This heterogeneity reflects differences in the nature of firms' investment responses. While the estimated impact of the policy on investments in terms of the capital stock is smaller for larger firms, for these firms the tax credit appears to have stimulated not only the acquisition of eligible Industry 4.0 equipment, but also complementary investment in other tangible assets necessary to expand productive capacity. For example, the adoption of new advanced machinery may require additional investment in production facilities, logistics infrastructure, or supporting equipment. Larger firms are more likely to undertake these complementary adjustments, reflecting their greater financial capacity, easier access to external financing, and ability to implement large-scale investment projects.

These estimates are broadly consistent with other recent empirical literature evaluating investment incentives and business support schemes. Cingano et al. (2025) and Cingano et al. (2023) study a large Italian program of capital grants (Law 488/92), exploiting a regression discontinuity design based on project scores and funding cutoffs. They find that subsidies raise firms' investment and employment over a multi-year horizon and emphasise substantial heterogeneity by firm size. They computed an investment multiplier between 1 and 3.5, depending on firm size and localization.

to be quantitatively limited in our setting, as fiscal records rarely show eligible investment amounts close to the policy thresholds. Second, higher multipliers may reflect additional complementary investment in tangible assets not directly eligible for the tax credit, as firms expand productive capacity in response to the acquisition of subsidised Industry 4.0 capital. This interpretation is consistent with our empirical specification, which captures the effect on total tangible investment rather than only eligible expenditure.

FIGURE XII: Investment multiplier, by firm size



Note: For each firm size class, the red bar indicates the multiplier computed for the full population of beneficiary firms; the green bar indicates the corresponding measure calculated using only the estimation sample.

Another widely used indicator in the literature to assess the efficiency of investment support policies is the cost per additional job, defined as the ratio between the fiscal cost of the measure and the number of jobs created. Applying this approach, we estimate that the cost per additional job associated with the tax credit ranges between 109,000 euros and 270,000 euros per worker, depending on the assumptions used to compute aggregate employment creation (see section above).

These values are broadly consistent with others reported in the literature. For example, Cingano et al. (2025) estimate a cost per job of approximately 180,000 euros at constant 2010 prices (around 248,000 at 2023 prices) for a capital grant program implemented in disadvantaged areas of Italy. The effect is decreasing with firm size (see Cingano et al. (2023)). For the same policy intervention, but using a different estimation approach, Cerqua and Pellegrini (2014), find a smaller effectiveness between: 80,000 euros and 140,000 euros per new job.

It is important to emphasize that this metric captures only the direct, short-term effects on employment and does not account for potential longer-term impacts or spillover effects on other firms and sectors.

Finally, it is possible to assess the extent to which the fiscal cost of the measure is offset by the increase in tax revenues generated by higher employment. For each cohort and firm size class, we use the average worker wage observed in our dataset as a reference. To this wage level, we apply the corresponding effective average personal income tax (PIT) rate derived from the OECD Taxing Wages model. The resulting additional PIT revenues are computed only for the years covered by our analysis, i.e. up to 2023. Based on this approach, we estimate that between 4 and 8 per cent of the total fiscal cost of the measure was recouped in the form of higher PIT revenues over the period 2020–2023.

This estimate should be regarded as conservative. First, it does not account for the potential persistence of employment effects beyond 2023 and the associated future PIT revenues. Second, additional social security contributions have not been included in the calculation. While higher employment would mechanically increase social security revenues, these contributions entitle workers to future social benefits (e.g. pensions, occupational injury insurance), which would require a structural modelling framework to assess net fiscal effects. For this reason, they are excluded from the present exercise.

As regards corporate income tax and IRAP (the regional tax on productive activities), simple regression analyses do not indicate a statistically significant impact of the measure on the dynamics of the corresponding tax bases over the observation period. The absence of a detectable short-run effect is likely related to differences between accounting income and taxable income, which arise from tax adjustments embedded in the tax code. Such adjustments may be upward or downward, permanent (e.g. partial non-deductibility of interest expenses) or temporary (e.g. differences between accounting and tax depreciation schedules). Owing to their complexity, these mechanisms may weaken or delay the transmission of higher productivity or profitability into the tax base. Other potential indirect effects on additional tax bases have not been analysed.

Overall, these results suggest that a non-negligible fraction of the fiscal cost of the policy was offset through increased labour income taxation, while broader fiscal feedback effects remain subject to uncertainty and merit further investigation.

8 Conclusions

In order to stimulate the digital transformation of firms, the 2020 Italian Budget Law introduced the Transition 4.0 plan, which provided a tax credit for expenses made for investments in tangible and intangible assets 4.0, research and development, technological innovation, design and 4.0 training.

This report provides an empirical assessment of the impact of the tax credit for investments in technologically advanced tangible assets introduced under the Plan. Drawing on a rich administrative dataset covering the period 2016–2023 and applying a synthetic difference-in-differences methodology, the analysis offers new evidence on the effectiveness of automatic investment incentives in supporting firms' capital accumulation and on their broader economic and fiscal implications.

Over the period 2020–2023, firms accrued approximately 35 billion euros in tax credits under the Plan, of which around 80 per cent were related to investments in technologically advanced tangible assets. In terms of firm characteristics, micro and small enterprises account for a large share of the number of investments undertaken. When the distribution is assessed in terms of the total amount of tax credits accrued, the incentives appear more concentrated among larger firms, given the larger average size of individual investment projects undertaken.

From a sectoral perspective, manufacturing emerges as the primary beneficiary of the policy, reflecting both its higher capital intensity and its stronger exposure to technological upgrading needs. Geographically, the distribution of incentives broadly mirrors the territorial structure of the Italian productive system, with a larger share of investments concentrated in Northern regions, though a significant number of beneficiary firms are located in the Centre and South. The descriptive evidence further highlights that a substantial proportion of firms undertook investment in only one year during the observation period, while repeated investment episodes are more frequent among larger firms.

The analysis also suggests a non-negligible overlap between the Transition 4.0 tax credit and other investment support measures, particularly regionally targeted incentives (*Bonus Sud*), implying that a subset of firms benefited from multiple policy instruments over the same period.

The econometric analysis indicates that the policy had a clear and statistically significant effect on the investment behavior of firms. Across all firm size classes, beneficiary firms increased their investment rates relative to a counterfactual trajectory constructed using non-beneficiary firms with similar pre-policy dynamics. The magnitude of the response was strongly heterogeneous along the size distribution, with particularly pronounced effects among micro and small enterprises.

When translated into aggregate quantities, the estimated range indicates that between roughly one eighth and one fifth of total observed tangible investment can be attributed to the incentive. Moreover, the investment multiplier associated with the tax credit, defined as the ratio between additional investment and fiscal cost, suggests that the measure mobilised private resources, contributing to a strengthening of firms' capital stock, beyond what would likely have occurred in the absence of the policy.

The effects on labour market outcomes appear more unevenly distributed. Positive and statistically significant increases in employment growth are detected primarily among micro enterprises and, to a lesser extent, among small and medium-sized firms. By contrast, no robust employment effects emerge for large firms. At the aggregate level, the policy is estimated to have increased employment among beneficiary firms by between 0.7 and 3.4 per cent over the period considered.

The analysis further shows that the increase in capital accumulation translated into higher capital intensity, particularly among smaller firms. However, the available evidence does not point to widespread improvements in labour productivity or revenue-based total factor productivity within the observation period. These results are consistent with a well-established body of evidence on investment incentives: tax credit directly targeting capital deepening can effectively stimulate investment, but does not necessarily generate widespread productivity gains.

From a fiscal standpoint, the analysis indicates that the employment effects generated by the policy partially offset its budgetary cost through increased personal income tax revenues. Nonetheless, no statistically significant short-term effects are detected on corporate tax bases. Overall, the estimated cost per additional job falls within the range documented in the international literature on investment incentives: an estimated cost per additional job ranging between approximately 109,000 and 270,000 euros.

Taken together, the evidence presented in this report suggests that the effects of the policy vary systematically with firm size. Large firms exhibit the highest investment multiplier, yet show no significant response in employment or productivity. Smaller firms, by contrast, display lower investment multipliers but statistically significant gains in both employment and productivity. These heterogeneous results point to the potential benefits of more targeted policy designs, calibrated to the specific goal pursued — whether capital accumulation or productivity growth. At the same time, the relatively muted productivity effects across the firm size distribution underscore the need for a broader policy framework, one capable of fostering the diffusion and effective adoption of digital technologies throughout the production system. Investment incentives alone appear insufficient to unlock sustained productivity gains. Future research might extend the analysis along several dimensions: the measurement of spillover effects across firms, sectors, and regions; and the interaction between investment subsidies and complementary policy instruments that may be necessary to translate capital investment into economy-wide productivity improvements.

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