Assessment of Investment Incentives for Technologically Advanced Capital Goods (Industry 4.0)

Francesca Gastaldi[1]

Maria Grazia Pazienza[2]

Fiorenza Venturini[3]

1 Università Sapienza and Ufficio Parlamentare di Bilancio
2 Università di Firenze
3 Ufficio Parlamentare di Bilancio

upB ufficio parlamentare di bilancio

Outline of the presentation

1) Objective of the analysis
2) Recent investment incentive in Italy
3) Data and UPB MEDITA microsimulation model
4) The trasmission channels of investment incentives
5) Descriptive analysis
6) Ex post evaluation
7) Conclusions

Objective of this work

This paper is one of a number of studies that aim to evaluate the effectiveness of business incentives for Industry 4.0-related investment. This is a fairly new area of research for which there are currently few contributions

e.g. Bratta et al. (2023), Scientific Committee responsible for evaluating the economic impact of the "Transition Plan 4.0" interventions (2024)

We aim to contribute to this literature by using a large and rich dataset and trying to compare the effects of different incentive typologies

Recent investment incentives in Italy

In the last decade significant policy measures were introduced in Italy to stimulate business investment. In terms of the resources committed the most significant are those introduced since 2017 to stimulate technological and digital transformation processes

- Special depreciation allowance – introduced in 2017 and renewed in both 2018 and 2019

Hyperdepreciation (*iperammortamento*)

Software

- Tax credits – from 2020 onwards tax credits on the same assets commensurate with the cost of the investment

Recent investment incentives in Italy and the data exploited

Switching from one type of incentive to another makes it possible to assess the effects of each policy while comparing the results of the two policy measures as far as possible

To this end, we exploit a substantial dataset:

1) Administrative database of tax returns (2015-2022)
2) Bureau van Dijk balance sheet data on non-financial corporations (2011-2023)

condensed in the UPB MEDITA microsimulation model (85% of companies that submit tax returns-95% of companies benefiting from the two policy measures)

The use of the UPB MEDITA microsimulation model

1) The analysis does not require a specific simulation with regard to fiscal incentive variables: it is based on administrative data (available up to 2022)

2) The model allows us to calculate specific firm-level variables, as the cost of capital used to evaluate the transmission channel of the incentives

3) A specific simulation was carried out in order to compute the tax capacity of the incentive

The transmission channels of investment incentives (1)

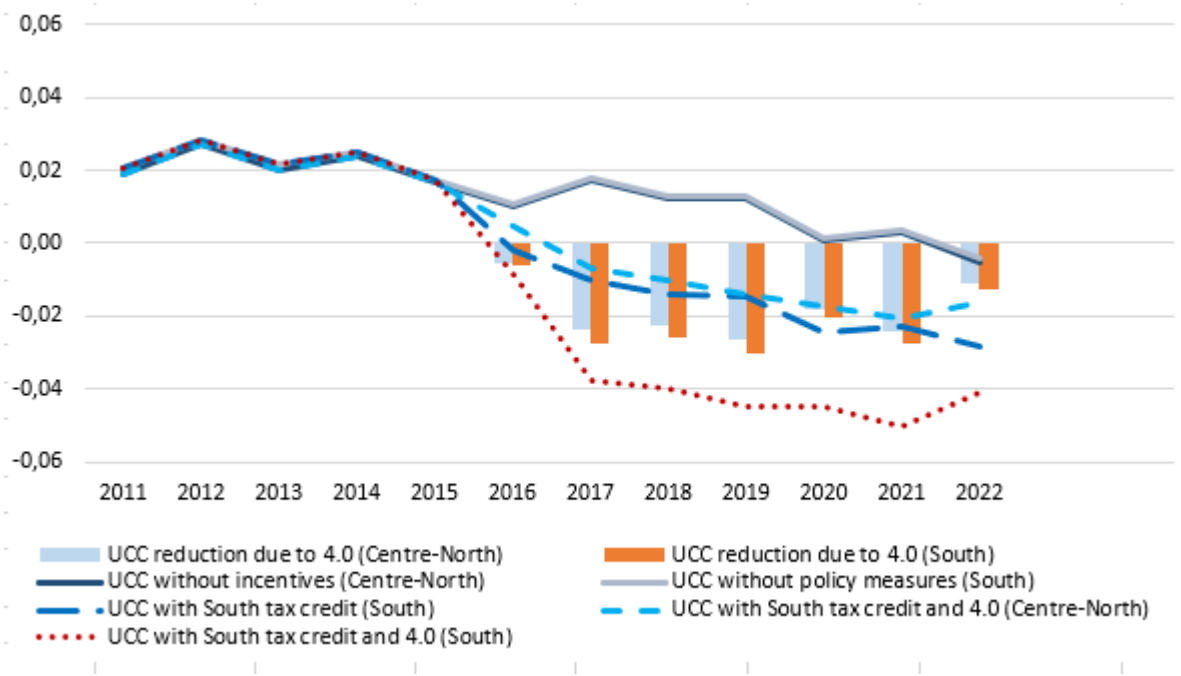
Incentives influence investment through two main channels

1) Reducing the cost of capital

2) Increasing the firm's self-financing capacity by reducing the tax burden

The transmission channels of incentives (2) – *cost of capital*

The effect on the first channel is estimated by using the UPB MEDITA microsimulation model which calculates the cost of capital at the company level



The overall effect of the policies, measured by the bars (difference in cost of capital with and without), is always incentivising

The transmission channels of incentives (3) – *cash flow effect*

Regarding the second channel the policies absorbed significant amounts of resources which impacted firms' liquidity

The table shows the total amount of resources used for the incentives on an accrual basis up to 2022

	Beneficiaries			Tax savings *(million euros)*		
	Total	Depreciation allowance	Tax credit	Total	Depreciation allowance	Tax credit
2017	25.902	25.902	-	152	152	-
2018	36.247	36.247	-	618	618	-
2019	45.909	45.909	-	1237	1237	-
2020	53.034	44.485	14.591	1.944	1.626	319
2021	82.324	42.108	55.779	4636	1662	2.974
2022	106.222	38.421	87.440	7.379	1.520	5.859
Total	-	-	-	**15.967**	**6.815**	**9.152**

Source: for actual tax savings, simulations conducted with UPB's MEDITA model.

approximately 16 billion of tax savings between 2017 and 2022

Descriptive analysis (1) - *beneficiaries*

Depreciation allowance

	N. of firms (%)		Percentage of subsidized companies	Tax reduction quota	Percentage of companies with tax capacity
	Total	Beneficiaries			
Sector					
Agricolture	2,1	0,7	1,6	0,6	62,6
Extraction	0,2	0,4	10,9	0,5	77,2
Manufacturing	13,3	44,5	15,4	78,2	77,2
Utilities	1,8	2,0	5,3	4,0	82,1
Construction	14,1	8,4	2,8	3,5	90,7
Trade	35,9	29,2	3,8	9,5	84,4
Real estate, professional	25,7	10,1	1,8	2,1	85,4
Personal care services	6,9	4,7	3,2	1,6	79,3
Total	**100,0**	**100,0**	**4,6**	**100,0**	**81,4**
Area					
Nord-West	27,9	35,2	5,8	42,2	80,9
Nord-East	20,0	31,5	7,3	36,6	79,0
Centre	24,1	17,6	3,4	12,4	82,2
South	27,9	15,7	2,6	8,7	86,3
Total	**100,0**	**100,0**	**4,6**	**100,0**	**81,4**
Size					
Micro	79,2	38,9	2,3	3,6	82,9
Small	14,9	39,0	12,1	21,1	81,1
Medium	2,5	12,9	23,5	25,0	81,6
Large	2,6	9,1	15,9	50,3	76,1
Total	**100,0**	**100,0**	**4,6**	**100,0**	**81,4**

Tax credit

	N. of firms (%)		Percentage of subsidized companies	Tax reduction quota	Percentage of companies with tax capacity
	Total	Beneficiaries			
Sector					
Agricolture	1,9	3,0	14,9	2,5	60,3
Extraction	0,2	0,6	34,9	0,9	71,5
Manufacturing	13,3	39,8	28,5	62,3	73,6
Utilities	1,9	2,4	11,9	4,0	78,3
Construction	14,4	13,7	9,1	8,9	88,5
Trade	34,9	27,7	7,6	14,5	75,7
Real estate, professional and rental	26,6	6,3	2,3	3,6	76,6
Personal care services	6,8	6,5	9,2	3,3	68,7
Total	**100,0**	**100,0**	**9,5**	**100,0**	**75,8**
Area					
Nord-West	29,1	29,2	9,6	35,4	74,3
Nord-East	20,8	26,4	12,1	31,7	72,9
Centre	23,3	16,9	6,9	14,0	75,1
South	26,8	27,5	9,8	18,9	80,7
Total	**100,0**	**100,0**	**9,5**	**100,0**	**75,8**
Size					
Micro	77,8	36,7	4,5	9,7	74,5
Small	16,2	42,4	25,0	32,0	77,8
Medium	3,0	13,2	42,2	27,8	76,8
Large	3,0	7,7	24,4	30,4	69,4
Total	**100,0**	**100,0**	**9,5**	**100,0**	**75,8**

- From the depreciation allowance to tax credits the percentages of the beneficiaries in manufacturing and services sectors appear to decrease to the benefit of the construction sector
- With the tax credit beneficiaries from the South increase while the percentage of beneficiaries from northern regions decreases
- Small companies increase their share of beneficiaries from depreciation allowance to the tax credit

Descriptive analysis (2) - *benefit*

Depreciation allowance

	N. of firms (%)		Percentage of subsidized companies	Tax reduction quota	Percentage of companies with tax capacity
	Total	Beneficiaries			
			Sector		
Agricolture	2,1	0,7	1,6	0,6	62,6
Extraction	0,2	0,4	10,9	0,5	77,2
Manufacturing	13,3	44,5	15,4	78,2	77,2
Utilities	1,8	2,0	5,3	4,0	82,1
Construction	14,1	8,4	2,8	3,5	90,7
Trade	35,9	29,2	3,8	9,5	84,4
Real estate, professional and	25,7	10,1	1,8	2,1	85,4
Personal care services	6,9	4,7	3,2	1,6	79,3
Total	**100,0**	**100,0**	**4,6**	**100,0**	**81,4**
			Area		
Nord-Ovest	27,9	35,2	5,8	42,2	80,9
Nord-Est	20,0	31,5	7,3	36,6	79,0
Centro	24,1	17,6	3,4	12,4	82,2
Sud	27,9	15,7	2,6	8,7	86,3
Totale	**100,0**	**100,0**	**4,6**	**100,0**	**81,4**
			Size		
Micro	79,2	38,9	2,3	3,6	82,9
Small	14,9	39,0	12,1	21,1	81,1
Medium	2,5	12,9	23,5	25,0	81,6
Large	2,6	9,1	15,9	50,3	76,1
Total	**100,0**	**100,0**	**4,6**	**100,0**	**81,4**

Source: elaborations with UPB's MEDITA model.

Tax credit

	N. of firms (%)		Percentage of subsidized companies	Tax reduction quota	Percentage of companies with tax capacity
	Total	Beneficiaries			
			Sector		
Agricolture	1,9	3,0	14,9	2,5	60,3
Extraction	0,2	0,6	34,9	0,9	71,5
Manufacturing	13,3	39,8	28,5	62,3	73,6
Utilities	1,9	2,4	11,9	4,0	78,3
Construction	14,4	13,7	9,1	8,9	88,5
Trade	34,9	27,7	7,6	14,5	75,7
Real estate, professional and rental	26,6	6,3	2,3	3,6	76,6
Personal care services	6,8	6,5	9,2	3,3	68,7
Total	**100,0**	**100,0**	**9,5**	**100,0**	**75,8**
			Area		
Nord-Ovest	29,1	29,2	9,6	35,4	74,3
Nord-Est	20,8	26,4	12,1	31,7	72,9
Centro	23,3	16,9	6,9	14,0	75,1
Sud	26,8	27,5	9,8	18,9	80,7
Totale	**100,0**	**100,0**	**9,5**	**100,0**	**75,8**
			Size		
Micro	77,8	36,7	4,5	9,7	74,5
Small	16,2	42,4	25,0	32,0	77,8
Medium	3,0	13,2	42,2	27,8	76,8
Large	3,0	7,7	24,4	30,4	69,4
Total	**100,0**	**100,0**	**9,5**	**100,0**	**75,8**

Source: elaborations with UPB's MEDITA model.

- The benefit for the tax credit is more evenly distributed
- There is a rebalancing of the disproportion between North and South also in the amount of benefit
- The percentage benefit for micro and small companies increases from depreciation allowance to tax credit

Descriptive analysis (3) – *firms' performace*

1) Firms benefiting from these incentives are mainly mature companies

2) The indicators confirm the relatively better health of the beneficiary companies, particularly those that benefit from special depreciation allowance

3) The group using the depreciation allowance shows higher profitability

Ex post evaluation (1)

We take advantage of the fact that both incentives have been changed yearly

Therefore, each year has been considered separately as a cohort. Each cohort includes firms deciding to invest in accordance with the incentive regulations in force in that year

		4.0 asset	*4.0 tangible asset*	*4.0 intangible asset*
Depreciation allowance	I cohort	63.685	*26.467*	*44.022*
	II cohort	36.343	*21.585*	*18.622*
	III cohort	24.157	*19.069*	*7.389*
	Total	**92.675**	***49.165***	***59.072***
Tax credit	IV cohort	14.583	*13.239*	*2.515*
	V cohort	51.439	*49.721*	*6.001*
	VI cohort	61.665	*58.315*	*9.648*
	Total	**93.843**	***89.842***	***16.105***

Source: elaborations on data from tax returns and UPB's MEDITA model.

Three cohorts for depreciation allowance: the first, second and third cohorts, respectively 2017, 2018 and 2019

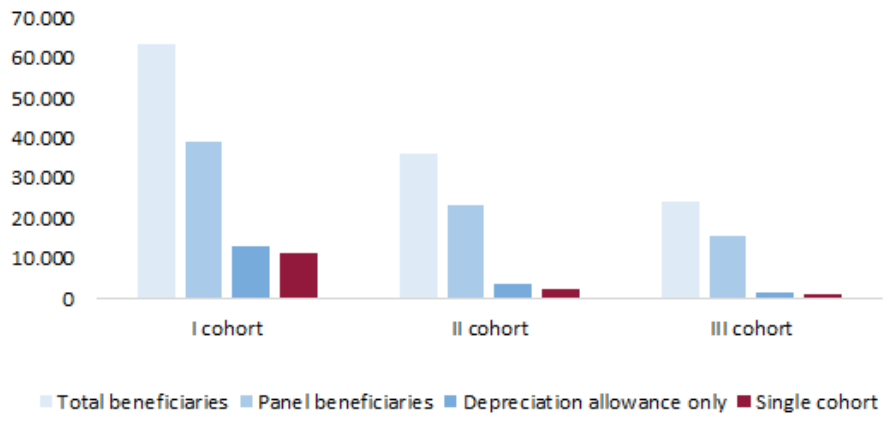
Three cohorts for tax credit: the fourth, fifth and sixth cohorts respectively 2020, 2021 and 2022

Ex post evaluation (2) – *subset of beneficiary companies*

This set of beneficiaries is narrowed down for the estimates:

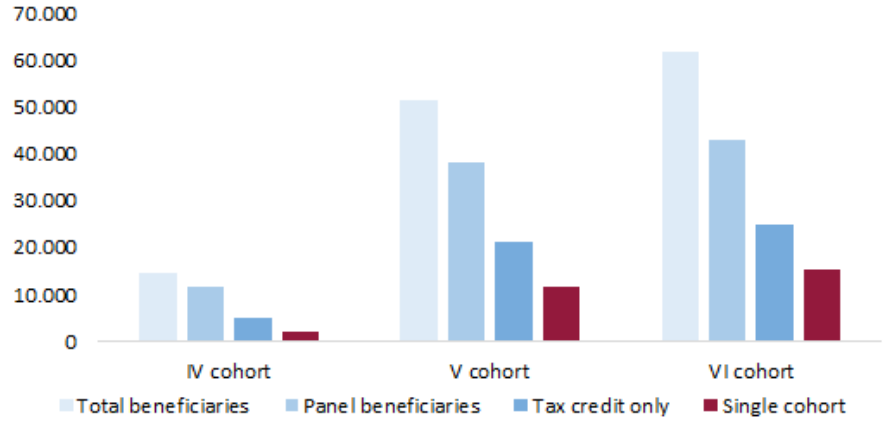
1) Only panel companies are considered (2012-2022 for depreciation allowance and 2016-2022 for tax credit)
2) Companies that also benefit from the other policy measure are excluded
3) Only companies benefiting from the incentive in that cohort, and not in others, are considered in each cohort

Depreciation allowance



Source: elaborations with UPB's MEDITA model.

Tax credit



Source: elaborations with UPB's MEDITA model.

Ex post evaluation (3) – *the estimation technique*

The regulatory framework does not define any characteristic excluding companies from the policy measure ⟶ the only reason companies are treated or not is their own decision to use the incentive

We use a matching strategy to find a suitable control group

(firm age, spatial location and business sector, investment rate, number of employees, value added, turnover, ROA for all available pre-treatment years, cash flow, tangible and intangible assets, wages and salaries, and growth rate of employees)

Once similar companies are identified, we estimate the average treatment effect on the treated by comparing the results of the two groups

Ex post evaluation (4) – *the estimation results: investment rate*

Companies that benefit from incentives have a higher investment rate compared to non-beneficiaries

	I cohort	II cohort	III cohort	IV cohort	V cohort	VI cohort
t	0,726*** (0,229)	n.s.	1,375*** (0,456)	4,708*** (0,475)	4,842*** (0,275)	4,867*** (0,528)
t+1	2,142* (0,117)	0,831** (0,346)	1,537** (0,658)	0,990*** (0,321)	1,325*** (0,191)	2,170*** (0,155)
t+2	0,457*** (0,141)	n.s.	1,424*** (0,620)	0,643* (0,345)	0,955*** (0,156)	-
			Micro and small enterprises			
t	0,776*** (0,249)	n.s.	1,426*** (0,501)	5,268*** (0,533)	5,080*** (0,290)	5,339*** (0,612)
t+1	n.s.	0,793** (0,379)	1,547** (0,729)	1,247*** (0,362)	1,380*** (0,211)	2,280*** (0,175)
t+2	0,450*** (0,148)	n.s.	1,400** (0,642)	n.s.	0,983*** (0,171)	-
			Medium and large enterprises			
t		-		2,526*** (0,886)	3,185*** (0,841)	2,524*** (0,452)
t+1		-		n.s.	n.s.	1,549*** 0,286
t+2		-		0,911* (0,479)	n.s.	-
			South			
t	n.s.	2,725** (1,194)	4,347*** (1,336)	5,152*** (1,045)	4,901*** (0,386)	5,239*** (0,386)
t+1	1,153*** (0,332)	n.s	3,713** (1,536)	2,268*** (0,813)	1,748*** (0,282)	1,903*** (0,352)
t+2	0,710** (0,298)	n.s.	2,202* (1,207)	1,509* (0,858)	1,138*** (0,372)	-

Source: elaborations with UPB's MEDITA model.

(1) * p<0.10, ** p<0.05, *** p<0.01, n.s. non-significant estimates.

- The effect is weaker for the depreciation allowance cohorts
- It appears to strengthen when transitioning from the first to the third cohort
- The effect increases significantly when considering the tax credit cohorts
- The effect of depreciation allowances is slightly higher for micro-small companies but the greater impact of the policy measure on micro-small companies is more evident in the case of the tax credit
- The effect is higher in the South

Ex post evaluation (5) – *the estimation results: employment*

The incentives also appear to have an impact on employment

	I cohort	II cohort	III cohort	IV cohort	V cohort	VI cohort
t	1,100** (0,428)	1,876** (0,791)	n.s.	4,793*** (1,046)	6,020*** (0,479)	5,284*** (0,422)
t+1	1,964*** (0,531)	2,785** (1,102)	4,589** (1,933)	9,223*** (1,394)	7,938*** (0,627)	8,132*** (0,816)
t+2	2,683*** (0,637)	5,128*** (1,299)	6,044*** (2,231)	10,636*** (1,582)	9,209*** (1,042)	-
			Micro and small enterprises			
t	0,903** (0,452)	2,252*** (0,830)	n.s.	5,618*** (1,142)	5,965*** (0,520)	6,117*** (0,472)
t+1	1,627*** (0,566)	3,319*** (1,166)	4,582** (2,035)	10,729*** (1,554)	8,498*** (0,681)	8,091*** (0,906)
t+2	2,312*** (0,675)	5,652*** (1,366)	6,617*** (2,393)	13,022*** (1,753)	9,147*** (1,125)	-
			Medium and large enterprises			
t		-		n.s.	5,521*** (1,144)	3,497*** (0,824)
t+1		-		n.s.	4,356*** (1,387)	9,186*** (1,751)
t+2		-		n.s.	8,032*** (2,694)	-

Source: elaborations with UPB's MEDITA model.

(1) * p<0.10, ** p<0.05, *** p<0.01, n.s. non-significant estimates.

- The effect is weaker for the first cohort, stronger for the second and third cohort, particularly in t+1 and t+2
- The effects are more pronounced in the case of the tax credit
- The effect for smaller companies is slightly lower than the baseline estimates for the first cohort but it strengthens in the second and third cohorts. The effect tends to be higher for the fourth cohort
- In contrast, for medium-sized and large companies the effect is non-significant in the fourth cohort and lower than the baseline specification in subsequent cohorts

Ex post evaluation (6) – *robustness checks*

1) The estimates are replicated considering all the companies benefiting from the specific incentive in any cohort as treated, without excluding those that also receive it in other cohorts

2) We consider that many companies that benefit from the 4.0 incentives also take advantage of the incentives for investing in non-4.0 assets (superdepreciation)

3) We assess whether the effects on the investment rate change for firms in financial distress by repeating the estimates separately for companies with negative cash flow

Conclusions and further developments

The analysis shows that:

1) Shifting from depreciation allowance to tax credits led to changes in the beneficiaries and benefits distribution

2) Companies that took advantage of at least one of the two incentives have higher investment rate and growth rate of employees' number compared to non-subsidised companies

3) The effect was more pronounced in the case of tax credit

It is reasonable to assume that these incentives may have also affected the profitability and productivity of firms. Preliminary analysis does not yield clear, unambiguous results. Further investigation in this regard is therefore needed

Thank you for your attention