

Evaluating the Youth Guarantee and Firms' behaviour: Evidence from employer-employee data

Irene Brunetti[±] – Andrea Ricci*
INAPP

ABSTRACT

This paper analyses the impact the Youth Guarantee incentive on firms' hiring decisions and, then, on the intensity of training investment and the adoption of I4.0 technologies at workplace. At this aim, we use a unique employer-employee linked dataset that merges information derived from the *Rilevazione Imprese e Lavoro* (RIL), a survey conducted by INAPP on a representative sample of Italian firms, with information on the events related to all job positions provided by the *Sistema Informativo Statistico delle Comunicazioni Obbligatorie* (SISCO). Applying a policy evaluation framework on the RIL-SISCO dataset, we show the following results. First, the use of the incentive to hire people enrolled in the Youth Guarantee programme causes - in the short-run - an increase of about 1 percentage point of the share of employee under-30 years, while it has no significant effect on the share of separated among younger cohorts, that is no displacement effect associated with the policy is found. Second, the Youth Guarantee incentive decreases both the amount of training investment and the probability to adopt digital technologies when we compare the treated firms with their most similar control group.

KEYWORDS: Hiring incentives, Youth Guarantee Programme, Policy evaluation, Firms

JEL CODES: D04, J08, J38

[±] i.brunetti@inapp.org;

* an.ricci@inapp.org;

1. Introduction

Young people are generally an at-risk population: they face a high risk of unemployment; they are more likely to switch between states of joblessness or to enter precarious types of employment or to face skills' mismatches and low levels of wage (Quintini *et al.* 2007). This condition is partly caused by the difficulties that many young individuals face after completing their education and training to get a first permanent job or a job that well match their qualifications and expectations (European Commission 2011). In addition, youth has been one of the groups hardest by the recession of 2008-09 inducing most of OECD countries to adopt many different policy interventions. During the financial and economic crisis, indeed, they have suffered severe consequences: in Italy, for instance, the youth unemployment rate has quickly increased from 20% in 2007 up to 44% in 2014. Most worrying is the phenomenon of young people 15-24 years old who are Not Engaged in any work activity or included in Educational or Training pathway (NEET) that is estimated at about 1.27 million, i.e. 21% of the European population of this age group¹. The coronavirus pandemic has emphasised this difficult situation: unemployment rose especially among youth: over one in six young people have stopped working, others, working in hard-hit sectors such as accommodation, food, arts, entertainment, lost their job or are now trying to enter the labour market when such sectors are no longer hiring. Consequently, to contrast this alarming situation, the European Commission has decided to reinforce the Youth Guarantee (YG) programme.

The YG programme is an active policy purposing to contrast youth unemployment and foster school-to-work transitions by promoting employment, education, or traineeship for young people between 16 and 25 years of age within a period of four months of becoming unemployed or leaving formal education. It was formally adopted by the EU's Council of Ministers on 22 April 2013 (Council Recommendation of 22 April 2013 (2013/C 120/01)) and the European Council consequently endorsed it on June 2013². The idea of YG style policies originated in the Nordic countries, where such initiatives were first implemented in Sweden in 1984, then elsewhere in the 1990s (see, e.g., Escudero and López Mourelo 2017), and it had become a reality across the EU starting from January 2014 (European Commission 2016). Just as YG entails an entitlement to a job, training or education of a defined group of young people, it also implies an obligation for the Public Employment Service (PES) or another public authority to provide the services and/or implement the programmes within a given period. The YG offers generally fall within the four categories identified in the Recommendation including employment open labour market employment (subsidised or not); self-employment; supported through start-up and dedicated subsidies; continued education; apprenticeships; traineeships. According to the monitoring of Member States' Youth Guarantee schemes, in 2016 about 67.2 % of young people across Europe that took up an offer within four months of registering in an YG programme, took up an employment opportunity (European Commission 2018).

¹ In Italy, NEETs are youngsters aged between 15 and 29 that are not engaged in working, training and education activities.

² European Council, Brussels, 28 June 2013 (EUCO 104/2/13).

To reduce the high level of unemployment among young people it is necessary to decrease the job fluctuation since the matching process takes some time. A possible instrument useful to increase the efficiency of the matching process and to overcome some of the specific employment barriers young people face, is represented by subsidised employment, one of the most common Active Labour Market Policy (ALMP) included in the YG plans. Employment subsidies aim at reducing part of the wage costs, encouraging private employers to hire new workers, and to allow young workers to build work experience and acquire job-relevant skills (Almeida *et al.* 2012; Centra and Gualtieri 2017)³. They can provide temporary incentives for firms to hire unemployed workers and, if sensibly targeted, it is a very cost-effective and efficient means of reducing unemployment. Thanks to their relative easier implementation, almost all European countries have indeed included this kind of measure in their YG plans (Escudero and López Mourelo 2017). Subsidised employment offers may fill a general lack of labour demand for young people creating new job opportunities for them in the private sector.

From the firm's point of view, the barriers to hirings may be related to different factors, for example, the reduced level of demand in times of recession, the employers' incomplete information about productivity and skills of young people, especially for those with little, or no, work experience (Bördös *et al.* 2015). Employers would be willing to hire young individuals only if they could pay them a wage lower than the expected marginal labour productivity. In this context, the hiring incentives, reducing *de facto* the wage costs, can compensate employers for the (supposed) lower productivity or no previous work experience of youth. Brown and Koettl (2015) discuss that the resulting higher labor demand can have as a consequence both higher wages and higher employment. At the same time, the increased demand for labor can encourage inactive workers to join the labour force, due to better employment prospects. However, hiring subsidies can have unintended indirect effects such as subsidized workers replacing unsubsidized ones ('substitution' effect) or employers hiring subsidized workers and laying them off once the subsidy period ends (Betcherman *et al.* 2004). In other words, a 'displacement' effect could arise. The last indirect effect is the deadweight loss one, especially among large firms and highly qualified individuals, which lowers the cost-effectiveness of incentives (for a detailed discussion see, European Commission 2018). They are often criticized also because their positive effects are only short-term effects and persist as long as the subsidy is paid. Nevertheless, it is possible to argue two additional longer-term positive effects: firstly, the period of subsidized work can act as a screening device, providing direct information on the young individual's productivity; secondly, the subsidized hiring can promote skill formation through training on the job, leading to increased productivity and subsequent improvement in employment prospects over the longer term.

Based on these arguments, this paper examines the impact of hiring incentives relating to the Youth Guarantee programme on different firm's outcomes. In doing so we exploit a unique information included in an employer employee linked dataset obtained by merging the *Rilevazione Imprese e Lavoro* (RIL), a survey drawn by Inapp, and two administrative archives (*Comunicazioni Obbligatorie* – SISCO; *ASIA-Imprese*). Then applying a policy evaluation framework, we show that

³ Hiring subsidies are quite different from wage subsidies. Orszag and Snower (2003) show that hiring subsidies are targeted at the unemployed and provided only for a limited period of time while wage subsidies are granted to all low-wage earners regardless of their employment history and are of limitless duration.

the use of the incentive to hire people enrolled in the Youth Guarantee Programme caused – in the short-run – an increase of about one percentage point on the share of newly hired under-30 years old, while it did not exert any significant effect on the share of young workers who separated from the firms in which they were employed, thus no displacement effect associated with the policy is found. Moreover, the Youth Guarantee incentive decreases both the amount of training investment and the probability to adopt digital technologies when we compare the treated firms with their most similar control group. Overall, the contribution of the paper to the literature is twofold. First, to the best of our knowledge, we provide the most update evidence of the effectiveness of the YG on firms' behavior in terms of hirings and separations. Second, we adopt a counterfactual empirical approach that - by exploiting a unique information contained in the RIL questionnaire - allows to infer the causal effect of hiring incentives on the Italian labor market taking into account both firms' time-invariant heterogeneity and endogeneity issues

The paper is structured as follow. Section 2 reviews the main literature and the institutional characteristics of the hiring incentive, focusing on the Youth Guarantee Program. Section 3 introduces the data, descriptive characteristics, and identification strategy. Section 4 outlines the main results. Section 5 concludes.

2. Background discussion

The Youth Guarantee plan is subject to continual monitoring and evaluation to document the number and characteristics of the beneficiaries of the scheme as well as the costs-effectiveness of the measures taken in terms of employment of the beneficiaries. Immervoll and Scarpetta (2012) stress, indeed, that a well-designed policy strategy can contribute to better labor market outcomes minimizing the possible interferences on work incentives for beneficiaries.

On the effectiveness of active policies for the youth there is not a consensus: Kluve *et al.* (2019) provide a meta-analysis on 113 evaluations showing that only slightly more than one on three evaluations found positive effect for youth programs. The analyses usually focus on specific action of YG programme such as the training activities or the services offered by Public Employment Service. Rinne *et al.* (2011) show, for instance, that vocational courses have positive impact on younger employment. Similar results are detected by Hardoy *et al.* (2018): training programs and employment incentives generally positively affect young people employment outcomes than internships. Moreover, also Bratti *et al.* (2018) provide evidence from the implementation of the Youth Guarantee initiative in Latvia. Focusing on vocational training program targeted at unemployed youths aged 15-29 who are not NEETs, they find little to no effect when these measures are not coupled with demand-driven interventions (e.g. tax rebates or firm-provided training). For the Italian case, several papers point to a positive and statistically significant effect of training courses on young people employment prospects (Duranti *et al.* 2018; Pastore and Pompili 2019), while Isfol *et al.* (2016) and Anpal (2019) contribute to this literature with a comprehensive evaluation for the YG implementation in Italy. Isfol *et al.* (2016) highlights a positive impact on the employment prospects of young people participating in active policies, more recently, Anpal (2019) confirms these results and provides evidence of more stable contracts for young people participating in Youth Guarantee measures, especially internship. Few papers

examine the effectiveness of active policies targeted to young people from the demand side. Alfonsi *et al.* (2020), for instance, compare the impact of vocational training for workers to the impact of wage subsidies to train workers on the employment. They suggest that the positive effect measured on the employment rate of treated workers is confirmed also looking at the firm-side and that this result is explained by a better match of these workers to more productive firms.

Our paper is related both to the literature on the evaluation of the impact of YG Programme, and to the one analyzing the effectiveness and the impact of incentives on firm's hiring decisions. Blasco and and Pertold-Gebicka (2013) argue that a firm's decision to hire is difficult and costly for many reasons. First, the frictions in the labor market make hiring more difficult, leading to a reduction in vacancies opened by firms (Pissarides 2000). Moreover, in presence of ex ante uncertainty about workers' ability and match quality, hiring firms are exposed to the risk of a mismatch, which is more costly when the employment protection legislation is stricter. Therefore, the establishment of incentives that reduce the cost of wages can represent a valid instrument to encourage hirings.

Theoretically, the employment effects of these incentives are well understood (Katz 1998). The empirical evidence, however, differs between programs, countries and time periods and is frequently plagued by data and estimation problems. Some studies, for example, highlight that private sector hiring subsidies can generally be more effective than other programmes such as training measures, or public works programs (Martina and Grubb 2001). Betcherman *et al.* (2004) point out that most evaluations of subsidies do not show positive impacts on post program employment or earnings. Other evaluations have demonstrated a positive employment effect although having little impact of firm's hiring decisions (European Employment Policy Observatory Review 2014). Sianesi (2008) demonstrates that the incentives for private sector firms have generally positive effects on employment of disadvantaged people. Others show that these incentives do better than other ALMPs in terms of post-program employability. In this regards, Neumark (2013) suggests that in US hiring subsidies are at least twice as effective in improving post-program employability as public job creation programs. Finally, focusing on Italy, Ciani and De Blasio (2015) show that only very few firms took advantage of the incentives. Sestito and Viviano (2018) analyse the reaction of firms to two policies introduced in the first part of 2015 by the Italian government, aimed at both reducing labour market dualism and favouring job creation. Their results suggest that both measures are effective.

2.1 The Youth Guarantee Employment programme

The Youth Guarantee Programme is implemented through supportive measures at national, regional and local level, taking into account the following guidelines: i) **mapping** that is identifying target groups, available services, skills needs and young people at risk of becoming a NEET; ii) **outreach** through targeted information campaigns among young people and reaching out to NEETs; iii) **preparation** for better profiling to match needs and responses, counselling and guidance, and improving digital skills; iv) **offer** employment incentives, quality and equity, and post-placement support.

In Italy, the Youth Guarantee has been carried out since April 2014 and its implementation is managed by Regions through the Public Employment Service (PES) network. The participation consists of different steps. First, each young people must register online to show their interest in the program. Second, he/she receives an appointment at the PES office where he/she is interviewed and can formally sign the Service Agreement, effectively becoming participants. Finally, some participants access active labour policies, e.g., specialized counselling, internships or vocational training. The *Decreto Direttoriale* n. 394 of 2 December 2016 establishes an employment incentive for young people enrolled in the Youth Guarantee. All employers, operating in the private sector, regardless of whether they are entrepreneurs or not, hiring new employees without being required, represent the target population of the incentive. A job-specific application must be submitted by firms to the National Social Security Institution (Inps). Therefore, the program, in addition to being targeted, it is also selective because each incentive must be approved by Inps.

The incentive concerns the hiring of young people aged between 16 and 29⁴ registered to the Youth Guarantee that is young people who are: unemployed, or do not seek actively for a job, or are not available to start work; or both, not enrolled in education and training (NEET). If the youth is a minor, she/he must have fulfilled her/his right and duty to education and training. The incentive is paid as a social contribution break (*sgravio contributivo*) and it is due for all hires made from 1 January 2017 up to 31 December 2017 with permanent contract; apprenticeship contract (also seasonal if provided by the collective agreement), and fixed-term contract whose initial duration is equal to or greater than six months. The benefit is enjoyed by adjusting the social security contributions paid by the employer within the maximum limit of € 8.060 (€ 4.030 if the worker is hired under a fixed-term contract) to be used over 12 months starting from the hiring date. This kind of incentive cannot be cumulated with other incentives. In the case of a professionalizing apprenticeship, the benefit concerns the reduced contribution paid by the employer. In more details, for the years following the first, the employer will be able to take advantage of the contribution rates already provided for these types of relationships.

3. Data and identification strategy

3.1 The linked Employer-Employee dataset

The empirical analysis uses an original dataset built linking three datasets deriving from different sources: *Comunicazioni Obbligatorie* (COB-SISCO), an administrative dataset provided by the Ministry of Labor and Social Policies, *Archivio Statistico delle Imprese Attive* (ASIA-Imprese), the archives of Italian firms provided by National Institute of Statistic (Istat), and the sample survey *Rilevazione Imprese e Lavoro* (RIL) supplied by the National Institute for Public Policies Analysis (Inapp).

⁴ Through the YG, countries were committed to assisting young people under the age of 25 within four months of becoming unemployed or leaving education. Relative to this commitment, 11 countries, among which Italy, followed the EC's recommendation and targeted the under-25s, 15 countries extended the eligible group and implemented YG aimed at people under 30 years of age (Escudero and López Mourelo 2017).

The *Comunicazioni Obbligatorie* dataset tracks from 2009 all events related to a job position (hiring, contractual transformation – e.g. from a fixed-term to an open-ended arrangement –, firing, dismissal) for all individuals working in Italy as an employee or through apprenticeship, temporary agency work arrangements, and para-subordinate collaborations⁵. Crucial to our objective, for each job relationship, the COB dataset records the fiscal code of the firm, allowing to merge a firm's features with the characteristics of each worker who had a job relationship with a firm each year. For each job relationship experienced by the individuals from 2009, the COB dataset records, in addition to several individual characteristics, the contractual arrangement (i.e., open-ended employment, fixed-term employment, apprenticeship, temporary agency work, para-subordinate collaboration), the part-time versus full-time dichotomy and the date of activation and termination of the relationship. This two last information allowing to compute the total number of workers hired and fired for each firm and year, distinguishing for age, gender, educational attainment, and citizenship.

Rilevazione Imprese e Lavoro (RIL) is a survey conducted periodically by Inapp on a large representative sample of partnerships and limited liability firms operating in the non-agricultural private sector. A subsample of the included firms followed over time, making the RIL dataset partially panel over the period under study⁶. The RIL data collects a rich set of information on management and the corporate governance, firms' productive characteristics and competitive behaviour, the internal labor market organization and the asset of industrial relations at workplace as well as workforce composition and other dimensions of personnel policies.

What is worth to our scope the RIL survey contains two important questions that allow us to identify the hypothetical behavior of the firms that have hired in 2017 using the incentives associated to the youth guarantee scheme if such an incentive had not been implemented. In particular, the first question is: "In 2017 did you hire new employees using public incentives? 1. Yes; 2. No". To recover the counterfactual situation, the wording of the second one is the following: "In the absence of hiring incentives, your firm: 1. would have hired the same amount of people; 2. would have hired less people; 3. would not have hired".

To evaluate the Youth Guarantee incentive, we also develop on an employer-employees linked database which merges – by using the VAT number – the information on the firms' characteristics and behavior derived from RIL sample, with data on hirings, separations and all other job position events drawn from the SISCO archive. Further we add the RIL-SISCO dataset with information on total amount of workforce employed in each firm from *ASIA-Imprese* archives. Once we developed this employer-employee linked database, we collapsed individual records by firms and year to compute for each firm the total number of hirings distinguishing by age and selecting the group of younger than 30 years old, and the total amount of employment⁷.

The complex matching procedure of the various sources described allowed us to create an employer-employee longitudinal dataset that records information of hiring behaviour, the use of

⁵ In Italy, all occurrences concerning a job position must be electronically transmitted to the Regional agencies in charge of active labour market policies (and made accessible to the Italian social security institute, Inps).

⁶ The RIL Survey sample is stratified by size, sector, geographical area and the legal form of firms. For more details on RIL questionnaire, sample design and methodological issues see: <http://www.inapp.org/it/ril>.

⁷ We thank the Servizio Statistico INAPP and Michelangelo Filippi for having contributed to create the dataset.

YG incentives as well as several firms, managerial and workplace characteristics. Therefore, we estimate the following linear relationship:

$$[1] \quad Y_i = \beta_0 + \beta_1 \cdot YG_i + \gamma \cdot M_i + \delta \cdot W_i + \lambda \cdot F_i + \text{municipality}_i + \varepsilon_i$$

where Y_i indicates alternatively i) - the share of newly hired under 30 years old, ii) the share of separated under 30 for each i firm, iii) the (log) training costs per employee, and iv) the probability to adopt digital technologies. The key explanatory variable, YG_i is a dummy indicator equal to 1 whether the firm hired by using the incentive in 2017, 0 otherwise. As for other controls, the vector M_i includes managerial and corporate governance characteristics, W_i represents the workforce composition, F_i formalizes a rich set of firms' productive characteristics, geographical location and sectorial specialization. The complete set of the explanatory variables is reported in Table A1 (see the appendix), where a short description is also provided. Finally, we include municipality fixed effects to control for local unobserved heterogeneity while the parameter ε_i is an idiosyncratic error term with zero mean and finite variance.

Then we use standard OLS models to estimate the equation [1]. However, the OLS estimates of the effect of YG incentive, measured by coefficient β_1 , may be biased due to confounding factors related to firm's time invariant unobserved heterogeneity, self-selection into the policy intervention and/or other endogeneity issues. To minimize/overcome these problems we exploit the RIL information on the counterfactual scenario that allow us to develop the hypothetical prediction of what would have happened in the absence of the fiscal incentives and thus permits to control for potential OLS biases.

Notice that, in this specification, we do not need to rely on sophisticated econometric analysis as we assume to know how firms would have behaved in the relevant counterfactual scenario. In more detail, we replace the YG dummy variable with the counterfactual one equals to one if firm is treated and 0 if it is a control. Thanks to the RIL question, indeed, we can distinguish two groups of firms according to their hypothetical behavior in the absence of the incentives. The treated firms are those whose behavior was affected by the presence of incentives: they would have hired less, or not hired at all, in their absence (answers (2) or (3) of the survey question). Following Leuven and Oosterbeek (2003; 2008), as control group we use two different definitions: the *control group I* is composed by firms that chose not to hire despite the availability of the incentives, by firms that have hired but without using the incentive, and by firms whose behavior was not affected by the incentive (answering (1) to the survey question). *Control group II* identifies only other hiring firms: those that did not used incentive and those whose behavior was not affected by the incentive. Notice that control group II is a subsample of control group I, thus is arguably a more suitable control group than the first one as it singles out all firms who were motivated to hire. Hence, it is more like the group of treated in terms of observed individual characteristics⁸. As for

⁸ Since one may argue that this cross-sectional strategy is based on the truthfulness of the firms' answers to the questionnaire one we could rely on a *Difference-in-Difference approach* to estimate the eq. [1], that is by exploiting the three-period setting of the COB-ASIA-RIL longitudinal data (2010, 2015, 2018) and on the circumstance that the policy change occurred in this interval (2017). In this case the treated group consists in all firms declaring to have used YG incentives in 2017 ($YG=1$) while the control units are all firms that did not use incentive ($YG=0$) in 2017. Further, for both treated and control group we exploit (i) the existence of data for the pre- and post-policy change periods and

sample selection, we consider firms with at least one employee. After imposing this selection criterion, deleting observations with missing values for variables used in the analysis and the subgroup of firms that in 2015 have used YG incentives. Our final cross sectional sample counts over 16,000 firms.

3.2 Descriptive statistics

Table 1 reports the descriptive statistics for the outcome variables (share of newly hired, share of separated under 30, (log) training costs per employee and the probability to adopt digital technologies) as well as the average incidence of firms using YG incentives – both for whole cross-sectional data and different subgroups⁹. In the second part of the table 1, we report the main explanatory variables used in the analysis.

The first column shows that the average share of hired under 30 years old is equals to 6.3%, this percentage is higher in the treated group and lower if we look at the control group (respectively 6.9% and 6.2%). Differently, the mean share of separated under 30 is the same for all groups. Moreover, we observe that both the mean value of the probability to adopt digital technologies and of the training costs per employee are higher for the treated group suggesting a positive relation between the use of the incentive and these two firm's outcomes. Table 1 highlights also that 5.6% of firms of our sample uses the hiring YG incentive.

Looking at the explanatory variables, table 1 shows that the two groups – treated and control - are different, in particular according to management and firms characteristics. This evidence suggests the use of a more appropriate control group in the econometric estimates.

Table 1: Descriptive statistics.

	Whole sample		YG=1		YG=0	
	Mean	Std dev	Mean	Std dev	Mean	Std dev
key variables						
Share hired<30	0.063	0.150	0.069	0.124	0.062	0.151
Share separated<30	0.049	0.135	0.049	0.097	0.049	0.137
I4.0 investment	0.411	0.492	0.614	0.487	0.399	0.490
Training costs pc*	129.2	246.8	168.5	244.5	126.9	246.8
YG incentive	0.056	0.229				
Management characteristics						
Graduated	0.300	0.458	0.375	0.484	0.295	0.456
Female	0.152	0.359	0.131	0.338	0.153	0.360
Age>49	0.350	0.477	0.351	0.477	0.350	0.477
34<age<50	0.218	0.413	0.238	0.426	0.217	0.412
Age<35	0.064	0.245	0.070	0.255	0.064	0.244
Family firm	0.815	0.389	0.736	0.441	0.819	0.385
External management	0.051	0.219	0.071	0.257	0.049	0.217

(ii) the availability of a rich set of covariates that control for observable characteristics of the firms. Overall, the diff in diff estimates support the cross sectional ones with proper control groups, ad are available upon request.

⁹ YG=1 refers to the group of firms declaring to have used the hiring YG incentive (treated group), YG=0 refers to the group of firms declaring to did not have used the hiring YG incentive (control group).

Workforce characteristics						
Share of graduated	0.142	0.232	0.183	0.225	0.140	0.232
Share of upper sec	0.502	0.321	0.503	0.260	0.502	0.325
Share of lower sec	0.356	0.336	0.314	0.283	0.358	0.339
Share temporary	0.136	0.211	0.173	0.176	0.133	0.212
Share immigr	0.045	0.119	0.050	0.108	0.045	0.119
Share female	0.356	0.307	0.335	0.251	0.358	0.310
Share executive	0.042	0.110	0.042	0.081	0.041	0.111
Share white collar	0.387	0.341	0.391	0.300	0.387	0.344
Share bleu collar	0.571	0.357	0.567	0.320	0.572	0.360
Share of separated	0.172	0.246	0.154	0.184	0.173	0.249
Firms characteristics						
Log (sales per emp)	11.835	1.271	11.92	1.27	11.83	1.27
Number of vacancies	1.065	8.265	3.763	14.905	0.907	7.670
Foreign market	0.300	0.458	0.497	0.500	0.289	0.453
Multinationals	0.041	0.199	0.067	0.249	0.040	0.195
R&d	0.130	0.337	0.281	0.450	0.121	0.327
Firms' age	26.639	16.428	28.445	18.686	26.533	16.280
N of employee<10	0.380	0.485	0.104	0.305	0.396	0.489
9< n of employee<50	0.374	0.484	0.350	0.477	0.376	0.484
49< n of employee<250	0.197	0.398	0.403	0.491	0.185	0.389
N of employee>249	0.048	0.214	0.143	0.351	0.043	0.202
N of obs	22,736		1,263		21,473	

Source: our elaborations on RIL-COB data 2018. Note: sampling weights applied

4. Main results

Table 2 reports the OLS estimates for different cross-sectional specifications of the eq. [1]. To begin with, column [1] of table 2 shows a positive association between the use of YG subsidy and the share of newly hired workers with age less than 30 years: + 0.6 percentage points. As argued before, correlation does not imply causality and result in column [1] may be biased in the case – for instance – high performance firms select themselves into the policy intervention. Then we turn the attention to the counterfactual indicators that allow distinguishing different control groups according to their hypothetical behaviour in the absence of the incentives. In more details, the Counterfactual I is a dummy variable equals to 1 if firm claims that it used the incentive to hire and that, in the absence of it, it either would not have hired or would have done so but for a lower amount, while is equal to 0 if the firm has not hired, or it has hired but without using an incentive, or the hiring firm declares that its behaviour is not affected by the presence of incentive programme. In other words, the OLS estimate of the coefficient associated with Counterfactual I is supposed to be “cleaned” by the increase in employment in firms that would have hired also in absence of the incentives.

As for the variable Counterfactual II, it formalises a dichotomous indicator which is equal to 1 if firm claims that it used the YG hiring incentive to hire and that, in the absence of such a subsidy,

it either would not have hired or would have done so but for a lower amount, while assumes value 0 if the firm have hired but without incentives.

The OLS estimates reported in column [2] suggests that the introduction of YG incentive has induced an increase of the share of newly hired under-30 years old by 1.1 percentage points – for that group of firms that declare that in absence of YG programme would not have hired (or hired less workers) – with respect to all other firms. Similar results are obtained if we restrict further the control groups: estimates associated with the variable Control group II in column [3] indicates that YG incentive leads to an increase of the share of young hired by about 1.7 percentage points. Overall, the estimates are quietly stable in magnitude and statistical significance for all the specifications of eq. [1] suggesting that use of YG hiring incentive has a weak positive impact on the employment perspective of younger cohorts - in the short-run.

Table 2: OLS estimates. Dep var: share of hired<30

	[1]	[2]	[3]
YG	0.006* [0.004]		
Counterfactual I		0.011** [0.005]	
Counterfactual II			0.017* [0.009]
share of separations	0.162*** [0.008]	0.158*** [0.008]	0.234*** [0.041]
ln (sales per empl)	-0.001 [0.001]	-0.001 [0.001]	0.000 [0.004]
Management characteristics	Yes	Yes	Yes
Workforce characteristics	Yes	Yes	Yes
Firms characteristics	Yes	Yes	Yes
constant	0.027*** [0.010]	0.027** [0.011]	-0.029 [0.058]
Obs	21327	19306	899
R2	0.268	0.268	0.358

Source: our elaborations on RIL-ASIA-COB data 2018. Note: Managerial characteristics include level of education, age and gender of entrepreneurs, family ownership, external management; workforce characteristics controls for the composition of occupation by education, age, professional status, gender, contractual arrangements, citizenship; firms' characteristics include R&D, firms' age, foreign markets, foreign trade agreement. All regressions controls for 2-digit sectors of activity and municipality fixed effects. Clustered standard errors in parentheses: *statistical significance at 10%, ** at 5%, *** at 1%.

Now we investigate whether a deployment effect of the policy is at play that is whether the positive impact of the YG incentive on the share of hired under 30 was offset by an induced increase of the share of young workers who separate from the firms - for any reason: quits, lay-offs, expiration of the temporary contracts, etc). This may happen for instance if YG subsidised positions replace no subsidised jobs. To analyse this concern, Table 3 reports the OLS estimates of the eq. [1] when the dependent variable is defined by the ratio between the number of young workers under 30 years old who leave the firm and the total number of employees in that firm. Note then that the estimates displayed from column [1] and column [2] suggests that the YG incentive is associated

to a tiny - not statistically significant – positive effect on the share of young workers that leave their workplace; as well OLS estimates reported in column [3] is not significant even though in this case the sign of the coefficient is negative.

Table 3: main estimates. Dep var: share of separated<30

	[1]	[2]	[3]
YG	0.005 [0.003]		
Counterfactual I		0.007 [0.005]	
Counterfactual II			-0.003 [0.008]
ln (sales per empl)	0.001 [0.001]	0.001 [0.001]	-0.001 [0.004]
Management characteristics	Yes	Yes	Yes
Workforce characteristics	Yes	Yes	Yes
Firms characteristics	Yes	Yes	Yes
constant	0.023** [0.011]	0.019 [0.012]	0.037 [0.058]
Obs	21327	19306	899
R2	0.181	0.178	0.232

Source: our elaborations on RIL-ASIA-COB data 2018. Note: Managerial characteristics include level of education, age and gender of entrepreneurs, family ownership, external management; workforce characteristics controls for the composition of occupation by education, age, professional status, gender, contractual arrangements, citizenship; firms' characteristics include R&D, firms' age, foreign markets, foreign trade agreement. All regressions controls for 2-digit sectors of activity and municipality fixed effects. Clustered standard errors in parentheses: *statistical significance at 10%, ** at 5%, *** at 1%..

Comparing the picture emerging from the table 2 with that found in table 3, one may argue then that the introduction of the YG incentive has had a positive (and weak) influence on the employment perspectives of younger cohorts – at least in the short run.

4.1. Other outcomes: training investment and adoption of new technologies

Turning the attention to the implications of the YG incentives (and related “net” increase of the share of young workers) on human resource management and adoption of new technologies at workplace, we exploit two other valued information provided by the RIL questionnaire: the amount of training investment and the probability to invest in at least one Industry 4.0 technologies. Thus, table 4 reports the OLS estimates of different specifications of the equation [1] when the dependent variables is the (log of) training costs per employee and the set of controls is the same used previously. Here, column 1 indicates that YG is positively correlated with the amount of training costs (+ 0.53); column 2 confirms that such a hiring incentive acts as a training-enhancing policy also if control group I is considered to reduce sample selection issues, even though the estimated coefficient is halved in magnitude (+0.21). These results seem to support the hypothesis that subsidised hires may induce firms to invest in specific skills of younger cohorts or, more in general, to increase the human capital endowment at workplace. This picture changes

markedly in column [3] where we observe that the YG leads to a significant decrease of the amount of training once the most stringent control group II is considered (-0.45). To rationalize this finding, it is possible to recover traditional arguments about the relationship that links firms' investment in human capital and the hiring of workers with temporary contracts in an environment characterised by incomplete information (Ricci and Waldmann, 2015)

Typically, young workers enrolled in the YG program are hired under temporary contracts: in this case, employers may have little incentive to invest in the workers' human capital over the short period if they are aware that the returns of training investment are realized in the medium run. On the other hand, the amount of training has a sizable sunk cost component, and it often cannot be contracted between firms and workers, because of the unverifiable nature of firm specific human capital investment (Hashimoto 1981 Arulampalam et al., 2004). This contractual incompleteness in turn may be associated with a hold up problem, as firms maximize their expected profits without considering the share of initial cost sustained by newly hired workers through an implicit wage cut (Grout, 1984): such a situation implies an under-investment in on-the job training and inefficiencies in human resource management with respect to the social optimum

A specular hold up problem may also emerge from the workers perspective: newly hired workers under YG program are induced to invest in firm-specific skills when the employment relationship is expected to last; conversely, workers tend to invest in general skills when they perceive a high risk of losing their jobs (Wasmer, 2006). To put it differently, the estimates reported in column (3) in Table 5 support the hypothesis that the active policies under study has been relatively successful in favoring the labor market participation of the younger cohorts - in the short period - but it seems relatively ineffective in stimulating the skills accumulation of the new hired at workplace or, to some extent, the quality of jobs in which the workers enrolled in the YG program are employed¹⁰.

Table 4: main estimates. Dep var: (log of) training costs per employee

	[1]	[2]	[3]
YG	0.539*** [0.083]		
Counterfactual I		0.215* [0.113]	
Counterfactual II			-0.450* [0.249]
share of separations	-0.137 [0.092]	-0.167* [0.095]	-0.326 [0.672]
ln (sales per empl)	0.005 [0.017]	0.001 [0.018]	0.112 [0.102]
Management characteristics	Yes	Yes	Yes
Workforce characteristics	Yes	Yes	Yes
Firms characteristics	Yes	Yes	Yes
constant	2.452*** [0.217]	2.456*** [0.230]	2.265* [1.339]

¹⁰ For a more general discussion on factors behind training investment at workplace see also Bassanini et al (2007); Brunello and Wruuk, (2018), Dostie (2018).

Obs	17774	16120	703
R2	0.175	0.166	0.167

Source: our elaborations on RIL-ASIA-COB data 2018. Note: Managerial characteristics include level of education, age and gender of entrepreneurs, family ownership, external management; workforce characteristics controls for the composition of occupation by education, age, professional status, gender, contractual arrangements, citizenship; firms' characteristics include R&D, firms' age, foreign markets, foreign trade agreement. All regressions controls for 2-digit sectors of activity and municipality fixed effects. Clustered standard errors in parentheses: *statistical significance at 10%, ** at 5%, *** at 1%.

To analysing further the implications of the YG incentive on firms' behaviour, we turn our attention on the probability to adopt digital technologies. In doing so, we exploit the information collected by the V RIL survey on investment in industry 4.0 technologies over the period 2015-2017. The wording of the question is as follows: *"In the period 2015-2017 did the firm invest in these new technologies?"*. The respondent was presented with the following options: Internet of things (IoT), Robotics, Big data analytics, Augmented reality and Cybersecurity. As already specified in Cirillo et al (2019), the data were collected right after the implementation of the 'National Enterprise Plan 4.0', an incentives scheme that was designed by the Italian Government to accelerate the diffusion of I4.0 technologies. All firms were eligible to the scheme and received the fiscal incentive if they invested. Indeed, this information allow also to investigate whether the design of the active labour market policies (for example the YG) in recent years has been implemented in such a way to be complementary or substitutive to those industrial and innovation policies settled in the same period. Then table 5 shows the OLS estimates of equation [1] when the Y_i variable is a dichotomous indicator taking value 1 if the firm i has invested in at least one I4.0 technology over the period 2015-2017, and 0 otherwise. It is straightforward to observe that YG incentives apparently is associated to an increase of the probability to adopt digital technologies: the estimates range from +9.9% in column [1] to +5.5% in column [2], where the comparison group I is used. These findings however reflects sample selection and endogeneity issues: in fact using the more stringent control group (column 3), one finds that hiring young workers enrolled in the YG program causes a significant reduction in the probability to adopt at least one I4.0 technologies (-9,1%) over the period 2015-2017.

Table 5: main estimates. Dep var: probability to invest in I4.0 technologies

	[1]	[2]	[3]
YG	0.099*** [0.015]		
Counterfactual I		0.055*** [0.020]	
Counterfactual II			-0.091** [0.044]
share of separations	-0.078*** [0.015]	-0.080*** [0.015]	-0.084 [0.120]
ln (sales per empl)	0.006* [0.003]	0.004 [0.003]	0.010 [0.024]
Management characteristics	Yes	Yes	Yes
Workforce characteristics	Yes	Yes	Yes
Firms characteristics	Yes	Yes	Yes

constant	0.222*** [0.039]	0.229*** [0.041]	0.300 [0.312]
Obs	21327	19306	899
R2	0.136	0.127	0.132

Source: our elaborations on RIL-ASIA-COB data 2018. Note: Managerial characteristics include level of education, age and gender of entrepreneurs, family ownership, external management; workforce characteristics controls for the composition of occupation by education, age, professional status, gender, contractual arrangements, citizenship; firms' characteristics include R&D, firms' age, foreign markets, foreign trade agreement. All regressions controls for 2-digit sectors of activity and municipality fixed effects. Clustered standard errors in parentheses: *statistical significance at 10%, ** at 5%, *** at 1%.

In sum, the empirical results displayed in Tables 4 and 5 point out that hiring young workers enrolled in YG – typically under temporary contracts – reduces the amount of training at workplace, validating the argument that YG program is not successful in stimulating the accumulation of knowledge and firm-specific skills, i.e the quality of job positions. Further given the well-established relationship of functional complementarity between skills and digital technologies within firms helps us to understand why the YG incentive also reduces the probability to invest in I4.0 technologies (see Bresnahan et al (2002); Brynjolfsson and McAfee A. (2014), Bugamelli et al. (2012). In other words, our results confirm indirectly that the adoption of I4.0 is facilitated by the accumulation of knowledge through longer-term work relationships rather than by the expectation of efficiency gains derived from the use of short-term contracts (Cirillo et al. 2020; 2021).

4. Conclusions

To contrast the alarming situation faced by young people in the labour market, the European Commission, during the coronavirus pandemic has reinforced the Youth Guarantee (YG) programme. In this paper we analyse the impact of the YG hiring incentive programme on both the employment opportunities of young cohorts in Italian labour market and firms investment behaviour.

Taking advantage of a unique employer-employee linked and relying on a simple policy evaluation framework, we have showed that the hiring of people enrolled in the YG program caused a weak increase the share of newly hired under-30 - in the short run. Moreover, the YG incentive did not cause a significant increase of the share of under 30 who separated from the firms, suggesting that the Program have reached its main objective of promoting the employment opportunities of younger cohorts in the short run (for details see also Brunetti and Ricci, 2020). At the same time, our estimates make it evident that hiring young workers enrolled in YG – typically under temporary contracts – reduces both the amount of training and the propensity to adopt digital technologies at workplace: such a circumstance induces some doubts on the real effectiveness of the YG program to create stable employment perspectives and “good jobs” in a longer time horizon.

To put it differently, our paper defines a short run empirical picture that confirms the opportunity to design the active labor market policies in such a way to be complementary rather than substitutive to those industrial and structural policies aimed to favor the quality of the labor

demand, human capital accumulation, the investment in new technologies and, consequently, the productivity growth (Brunetti and Ricci, 2021). In this perspective our analysis may also contribute to the current political and institutional debate on Recovery Plan. Of course, our findings should be interpreted with caution having been obtained in a short run framework – which did not allow to infer any robust results about the long run impact of the hiring incentives - and in a firm-level analytical perspective. They then encourage further research that will be useful to provide information for programming future phases of the Youth Guarantee - especially in a period characterized by a serious crisis due to the coronavirus pandemic that has negatively affect the employment prospects of younger cohorts. On this ground, we will devote future research.

References

Alfonsi L., Bandiera O., Bassi V., Burgess R., Rasul I., Sulaiman M., Vitali A. (2020), Tackling Youth Unemployment. Evidence from a Labour Market Experiment in Uganda, *Econometrica*, 88, n.6, pp.2369-2414

Almeida R., Behrman J., Robalino D. (2012), *The right skills for the job? Rethinking training policies for workers*, Washington DC, World Bank <<https://bit.ly/3ghrD6j>>

Anpal (2019), *Secondo Rapporto di valutazione della Garanzia Giovani e del programma operativo nazionale Iniziativa occupazione giovani*, Roma, Anpal <<https://bit.ly/3uW7APc>>

Bassanini, A., Booth, A., Brunello, G., De Paola, M. and Leuven, E. (2007) “Workplace training in Europe”, in G. Brunello, P. Garibaldi and e. Wasmer (eds.) “Education and training in Europe”, Oxford: Oxford University Press

Betcherman G., Olivas K., Dar A. (2004), *Impacts of active labor market programs. New evidence from evaluations with particular attention to developing and transition countries*, Social Protection discussion paper series n.0402, Washington DC, World Bank

Blasco S., Pertold-Gebicka B. (2013), Employment policies, hiring practices and firm performance, *Labour Economics*, 25, special issue, pp.12-24

Bloom N., Van Reenen J. (2007), Measuring and explaining management practices across firms and countries, *The Quarterly Journal of Economics*, 122, n.4, pp.1351-1408

Bloom N., Van Reenen J. (2011), Human Resource Management and Productivity, in Card D., Ashenfelter O. (eds.), *Handbook of Labor Economics Vol. 4B*, Amsterdam, Elsevier, pp.1697-1767

Bördös K., Csillag M., Scharle A. (2015), *What works in wage subsidies for young people. A review of issues, theory, policies and evidence*, EMPLOYMENT Working Paper n.199, Geneva, ILO <<https://bit.ly/3ghK4YD>>

Bratti M., Ghirelli C., Havari E., Santangelo G. (2018), *Vocational training and labour market outcomes. Evidence from Youth Guarantee in Latvia*, IZA Discussion Paper n.11870, Bonn, IZA <<https://bit.ly/2QDtWpx>>

Bresnahan T.F., Brynjolfsson E., Hitt L.M. (2002), Information technology, workplace organization, and the demand for skilled labor. Firm-level evidence, *The Quarterly Journal of Economics*, 117, n.1, pp.339-376

Brown A.J.G., Koettl J. (2015), Active labor market programs. Employment gain or fiscal drain?, *IZA Journal of Labor Economics*, 4, n.12, pp.1-36 <<https://bit.ly/3dqGfhV>>

Brunello, G. and Wruuck, P. (2020) "Employer-provided training in Europe: determinants and obstacles", IZA Discussion Paper no. 12981

Brunetti I. Ricci A. (2020), Le Politiche per le imprese e il lavoro: il ruolo degli incentivi Incentivi, *Menabò Etica ed Economia*, <https://www.eticaeconomia.it/le-politiche-per-le-imprese-e-il-lavoro-il-ruolo-degli-incentivi>

Brunetti I. Ricci A. (2021), Incentivi, imprese e lavoratori: la necessità di una prospettiva, *Menabò Etica ed Economia*, <https://www.eticaeconomia.it/incentivi-imprese-e-lavoratori-la-necessita-di-una-prospettiva>

Brynjolfsson E., McAfee A. (2014), *The second machine age: Work, progress, and prosperity in a time of brilliant technologies*, New York, W.W. Norton

Bugamelli M., Cannari L., Lotti F., Magri S. (2012), The innovation gap of Italy's production system. Roots and possible solutions, *Questioni di Economia e Finanza* n.121, Roma, Banca d'Italia

Centra M., Gualtieri V. (2017), Incentivi al lavoro permanente e contratto a tutele crescenti. Una stima dell'impatto sulle nuove assunzioni nel 2015, *Sinapsi*, VII, n.1, pp.71-93

Ciani E., De Blasio G. (2015), Getting Stable. An Evaluation of the Incentives for Permanent Contracts in Italy, *IZA Journal of European Labor Studies*, 4, n.6, pp.1-29

Cirillo V., Fanti L., Mina A., Ricci A. (2021). Digital technologies and firm performance: Industry 4.0 in the Italian economy, INAPP Working Paper n. 61

Cirillo V., Fanti L., Mina A., Ricci A. (2021). "Digitalizing Firms: Skills, Work Organization and the Adoption of New Enabling Technologies," LEM Papers Series 2021/04, Sant'Anna School of Advanced Studies.

Dostie, B. (2018), "The impact of training on innovation", *ILR review*, 71(1): 64-87.

Duranti S., Maitino M.L., Patacchini V., Rampichini C., Sciclone N. (2018), What Training for the Unemployed? An Impact Evaluation for Targeting Training Courses, *Politica economica - Journal of Economic Policy*, n.3, pp.241-272

Escudero V., López Mourelo E. (2017), *The European Youth Guarantee. A systematic review of its implementation across countries*, Research Department Working Paper n.21, Geneva, ILO <<https://bit.ly/3mVFeS8>>

European Commission (2016), *The Youth Guarantee and Youth Employment Initiative three years on. Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions*, Strasbourg, COM(2016) 646 final <<https://bit.ly/3tvWH6a>>

European Commission (2018), *Employment and entrepreneurship under the Youth Guarantee. Experience from the ground*, Brussels, European Commission

European Employment Policy Observatory Review (2014), *Stimulating job demand. The design of effective hiring subsidies in Europe*, Luxembourg, Publications Office of the European Union

Gautier E., Tsybakov A., Rose C. (2018), *High-dimensional instrumental variables regression and confidence sets*, Ithaca NY, Cornell University <<https://bit.ly/3duI4KT>>

Grout, P.A. (1984), “Investment and wages in the absence of binding contracts: a Nash-bargaining approach”, *Econometrica*, 52(2): 449-460

Hardoy I., Røed K., von Simson K., Zhang T. (2018), Initiatives to combat the labour market exclusion of youth in northern Europe. A meta-analysis, in Malo M.A., Mínguez A.M. (eds.), *European Youth Labour Markets. Problems and Policies*, Cham, Springer, pp.235-251

Hashimoto, M. (1981). Specific human capital as a shared investment. *American Economic Review*, 3, 476–482.

Hashimoto, M., & Yu, B. T. (1980). Specific capital, employment contracts, and wage rigidity. *The Bell Journal of Economics*, 2, 536–549.

Immervoll H., Scarpetta S. (2012), Activation and employment support policies in OECD countries. An overview of current approaches, *IZA Journal of Labor Policy*, 1, article n.9, pp.1-20

Isfol, Ciampi S., Lion C., Stocco P. (a cura di) (2016), *Primo rapporto di valutazione del programma operativo nazionale Iniziativa occupazione giovani al 31 dicembre 2015. Previsto dal Regolamento (Ue) n. 1304, art. 19, comma 6*, Roma, Isfol

Istat (2017), *Il mercato del lavoro. Verso una lettura integrata*, Roma, Istat <<https://bit.ly/3ghfpea>>

Kluve J., Puerto S., Robalino D., Romero J.M., Rother F., Stöterau J., Weidenkaff F., Witte M. (2019), Do Youth Employment programs Improve Labor Market Outcomes? A Systematic Review, *World Development*, 114, pp.237-253

Leuven E., Oosterbeek H. (2008), An Alternative Approach to Estimate the Wage Returns to Private-Sector Training, *Journal of Applied Econometrics*, 23, n.4, pp.423-434

Martin J.P., Grubb D. (2001), What works and for whom. A review of OECD countries' experiences with active labour market policies, *Swedish Economic Policy Review*, 8, n.2, pp.9-56

Neumark D. (2013), Spurring job creation in response to severe recessions. Reconsidering hiring credits, *Journal of Policy Analysis and Management*, 32, n.1, pp.142-171

Orszag J.M., Snower D.J. (2003), Designing employment subsidies, *Labor Economics*, 10, n.5, pp.557-572

Pastore F., Pompili M. (2019), *Assessing the Impact of Off- and On-The-Job Training on Employment Outcomes. A Counterfactual Evaluation of the PIPOL Program*, IZA Discussion Paper n.12074, Bonn

Pissarides C. (2000), *Equilibrium unemployment theory*, Cambridge, MIT Press

Quintini G., Martin J.P., Martin S. (2007), *The Changing Nature of the School-to-Work Transition Process in OECD Countries*, IZA Discussion Papers n.2582, Bonn, IZA <<https://bit.ly/3drFHsi>>

Rinne U., Schneider M., Uhlendorff A. (2011), Do the Skilled and Prime-Aged Unemployed Benefit More from Training? Effect Heterogeneity of Public Training Programmes in Germany, *Applied Economics*, 43, n.25, pp.3465-3494

Rosholm M. (2008), *Experimental Evidence on the Nature of the Danish Employment Miracle*, IZA Discussion Paper n.3620, Bonn, IZA <<https://bit.ly/3dvrgTZ>>

Sestito P., Viviano E. (2018), Firing costs and firm hiring. Evidence from an Italian reform, *Economic Policy*, 33, n.93, pp.101-130

Sianesi B. (2008), Differential effects of active labour market programs for the unemployed, *Labor Economics*, 15, n.3, pp.370-399

Wasmer, E. (2006). General versus specific skills in labor markets with search frictions and firing costs. *American Economic Review*, 96(3), 811–831

Appendix

Table A1. Explanatory variables definition and description

Variables	Description
Management and corporate governance	
Educational	three dummy variables that equals to 1 whether the educational level of the employers /managers who run the firm is, respectively: i) tertiary; ii) upper secondary; iii) lower secondary or no education (0 otherwise).
Age	three dummy variables that equals to 1 whether the age coorth to which the employer/managers who run the firm belong to is respectively: i) <35 years; ii) 34< years<55; iii) >54 years.
Female	dummy variable that equals to 1 if the manager/employer who run the firm is female, 0 otherwise.
Family owner	dummy variable that equals to 1 if the ownership of the firm is held by a family, 0 otherwise.
External managment	dummy variable that equals to 1 if firm is run by an external manager which has been recruited on the labor market, i.e outside dynastic ties of firms ownership, 0 otherwise.
Workforce characteristics	
Educational composition	three variables indicating the share of employees (on the firms' total number of employees) with: i) tertiary education; ii) upper secondary education; iii) lower secondary, primary or no education.
Age composition	three variables indicating the share of employees (on the firms' total number of employees) with: i) less than 35 years old; ii) between 34 and 50 years old; iii) more than 49 years old.
Professional composition	three variables indicating the share of employees (on the firms' total number of employees) who are: i) executives; ii) white collars; iii) blue collars.
Sh temporary	share of employees with fixed term contract (on the firms total number of employees).
Sh female	share of female employees (on the firms' total number of employees).
Firms characteristics	
Productivity	(log of) the total sales per employees. The amount of sales is derived from RIL and is deflated relying on sectoral (2-digit NACE) deflators of production prices.
Firms' size	(log of) the total number of employees.
Foreign trade	dummy variable that equals to 1 if firm operates (selling or buying products/services) on international trade markets, 0 otherwise.
Foreign trade agreement	dummy variable that equals to 1 if firm has signed a foreign trade agreement with other firms, 0 otherwise.
Multinational	dummy variable that equals to 1 if firm is a multinational, 0 otherwise.
R&D	dummy variable that equals to 1 if the firm has invested R&D activities, 0 otherwise.
Industry 4.0	dummy variable that equals to 1 if the firm has invested in alt last Industry 4.0 technologies over the period 2015-2017, 0 otherwise.
Firms' age	number of years since the firm' entry in the market, 0 otherwise.
Geographical localization	110 dummies indicators for each of the 110 nuts3 Italian provinces.
Sector of activity	14 dummies variables derived from 2 digit NACE classification: electricity, gas water distribution, food, textile, tobacco; chemistry, metallurgy mechanics and other manufacturing goods; construction; retail and wholesale, tourism, hotels and restaurants transportation; insurance and financial intermediation, information and communication; other business services; healthcare, educational and social services, others.

Source: RIL data

Table A2. Descriptive statistics for control variables

	Counterfactual sample I				Counterfactual sample II			
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
	key variables							
share hired<30	0.078	0.147	0.061	0.151	0.078	0.147	0.064	0.112
share separated<30	0.058	0.133	0.049	0.137	0.058	0.133	0.046	0.092
I4.0 inv	0.489	0.500	0.392	0.488	0.489	0.500	0.635	0.482
training costs pc*	139.0	250.2	125.2	244.6	139.0	250.2	177.6	246.3
	managment characteristics							
graduated	0.309	0.463	0.292	0.455	0.309	0.463	0.381	0.486
female	0.148	0.356	0.155	0.362	0.148	0.356	0.122	0.327
age>49	0.340	0.474	0.350	0.477	0.340	0.474	0.362	0.481
34<age<50	0.263	0.440	0.217	0.412	0.263	0.440	0.223	0.417
age<35	0.083	0.277	0.063	0.242	0.083	0.277	0.066	0.249
family firm	0.788	0.409	0.824	0.381	0.788	0.409	0.728	0.445
external managment	0.052	0.223	0.049	0.216	0.052	0.223	0.079	0.270
	workforce characteristics							
share of graduated	0.156	0.228	0.137	0.231	0.156	0.228	0.193	0.228
share of upper sec	0.488	0.289	0.505	0.327	0.488	0.289	0.501	0.257
share of lower sec	0.355	0.315	0.357	0.341	0.355	0.315	0.305	0.280
share temporary	0.177	0.187	0.130	0.213	0.177	0.187	0.167	0.175
share immigr	0.049	0.117	0.045	0.120	0.049	0.117	0.048	0.100
share female	0.350	0.282	0.359	0.312	0.350	0.282	0.327	0.244
share executive	0.035	0.087	0.042	0.113	0.035	0.087	0.043	0.075
share white collar	0.341	0.304	0.389	0.346	0.341	0.304	0.412	0.301
share bleu collar	0.625	0.321	0.569	0.362	0.625	0.321	0.545	0.321
share separated	0.171	0.222	0.171	0.250	0.171	0.222	0.150	0.175
	firms characterisitcs							
log (sales per emp)	11.746	1.190	11.832	1.267	11.746	1.190	11.996	1.272
number of vacancies	1.799	6.860	0.907	7.518	1.799	6.860	4.401	17.272
foreign market	0.360	0.480	0.287	0.453	0.360	0.480	0.537	0.499
multinationals	0.037	0.188	0.038	0.191	0.037	0.188	0.074	0.263
R&D	0.202	0.402	0.114	0.318	0.202	0.402	0.301	0.459
firms' age	25.54	16.96	26.65	16.36	25.54	16.96	29.36	18.98
n of employee<10	0.196	0.398	0.410	0.492	0.196	0.398	0.100	0.301
9< n of employee<50	0.403	0.491	0.372	0.483	0.403	0.491	0.339	0.474
49< n of employee<250	0.305	0.461	0.178	0.383	0.305	0.461	0.410	0.492
n of employee>249	0.096	0.295	0.040	0.195	0.096	0.295	0.150	0.357
N of obs	708		19,988		708		846	

Source: our elaborations on RIL-COB data 2018. Note: sampling weights applied