Training expenditures, agglomeration externalities and productivity: Firm level evidence from local labor markets

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Abstract

This paper investigates whether and how local agglomeration of training expenditures affects labor productivity. Starting from the existing literature, we argue that knowledge spillovers arising from the concentration of firm-provided training in local labor markets (LLMs) represent a potential factor affecting firm competitiveness. At this aim we use data derived from Rilevazione Imprese e Lavoro (RIL) survey conducted in 2010 and 2015 on a representative sample of Italian firms. Applying different regression models, we find the following results. First, the agglomeration of training expenditures increases labor productivity of firms operating in the same environment. Second, the positive externalities due to the agglomeration of training expenditures are reduced by the occurrence of a high worker turnover at firm level.

Introduction

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In recent years, policy makers, employers and trade unions have emphasized the important role of skill upgrading of workers and lifelong learning for withstanding the increased pressure induced by technological changes and globalization (e.g., European Commission, 2007; Percival et al., 2013). A large number of contributions has explored the role of firm provided and workplace training recognizing it as the leverage to obtain productivity gains and better economic performance (Blundell et al., 1999; Bartel, 2000; Collier et al., 2008).

According to the literature on human capital, given the transferability of the acquired skills, we can distinguish between general and specific training (Becker, 1964). General training consists in the acquisition of skills that are equally applicable at other firms, whereas specific training provides a worker with firm-specific skills that will increase his/her productivity only with the current employer. The amount of firm-provided training depends on the comparison between its marginal benefits, expressed in terms of higher labor productivity, and costs. In a perfectly competitive labor market, firm will not pay for training because the accumulated skills can be fully transferred to other firms. Therefore, workers should pay for training and recoup these costs by earning higher wagers. Under imperfect competition, firm will provide training bearing the entire cost because it is able to retain the trained worker, the transferability of acquired skills is low, and because of a compressed wage structure which creates the incentives to invest in training (see Acemoglu and Pischke, 1999).

In the literature on human capital less attention is devoted to the analysis of spatial factors in spite of the relevance of the knowledge externalities due to spatial agglomeration. Previous works on agglomeration suggest that knowledge spillovers can be generated by human capital embodied in labor supply located in an area and have a positive influence on local productivity and wages (Moretti, 2004; Rosenthal and Strange, 2004; Henderson, 2007). This evidence suggests that the firm's incentives to train could be affected by the raise of knowledge spillovers. Few papers investigated the relationship between training provided by firm and economic density finding a negative impact of local density (Brunello and De Paola, 2008; and Brunello and Gambarotto, 2007; Muehlemann and Wolter, 2011). This negative relationship could be ascribed to the prevalence of the negative effect of higher turnover and poaching of denser areas with respect to the positive effect deriving from knowledge spillovers.

This paper aims to study the relationship between labor productivity and the local agglomeration of training expenditure incurred by firms.[1] The effect of spatial agglomeration externalities on firm productivity is analyzed by controlling for firm-level determinants. Spatial externalities are measured at the local labour markets (LLMs) level, which is much more appropriate than the province level (see Basile et al., 2016). In particular, we want to verify whether the local agglomeration of training expenditure affects labor productivity of each firm located in a specific area. The sign of this relationship is not clear a priori since two different scenarios can arise. On one hand, the concentration of firm's expenditure for training may give rise to knowledge spillovers affecting positively labor productivity thanks to the fact that the proximity and interaction with trained workers play an

[1] Bassanini et al. (2007) review the main literature on training in Europe. In this paper we refer only to firm-specific training.

important role in transmitting knowledge (Audretsch and Feldman, 2004). On the other hand, the concentration of more trained workers may induce employers, which have paid for training, to fear of poaching by other employers. Therefore, the risk of poaching could reduce training expenditure (Brunello and De Paola, 2008; Stevens, 1996).

Another factor that has an impact on labor productivity and that could affect the positive effects due to knowledge spillover is the worker turnover. Serafinelli (2015) finds strong evidence that worker turnover acts as a mechanism of knowledge transfer. If labor mobility is a source of productivity advantages through agglomeration, geographic proximity should play a role in the process of knowledge diffusion. From the firm point of view, the existence of labor mobility and the process of knowledge diffusion could induce them to reduce the expenditure on training.

This possible scenario drives us to analyze in more detail the relationship between worker turnover and labor productivity considering the interaction between the concentration of training expenditure and turnover, and in particular we focus on the excess worker turnover. Following Davis and Haltiwanger (1992) and Davis et al. (1996), excess worker turnover is defined as the amount of worker turnover (hires plus separations) over and above the level of worker turnover naturally needed to accommodate job creation or destruction. It measures the extent to which the firm changes the composition of its workforce, replacing separated workers, that is, those who either quit or are fired, with new workers. The resource management literature has traditionally viewed excess worker turnover in a negative light. Human capital theories of labour turnover point to loss of firm-specific human and social capital (Dess and Shaw, 2001). For example, Sheehan (1993) claims that high worker turnover entails a loss of human capital that causes the loss of output and the cost of searching for a new employee.

According to the economic literature, two are the main economic theories modeling the productivity effect of replacing workers: the firm-specific human capital theory, and the matching theory. The firm-specific human capital theory, first proposed by Becker (1964), predicts that excess worker turnover negatively affects productivity because it entails the loss of productive firm-specific human capital acquired by those who are leaving and, at the same time, the "waste of time" to acquire it for new entrants. An opposite evidence is highlighted by the matching theory: excess worker turnover allows firms to reach an efficient allocation of employer-employee matches, when the quality of the match is not known a priori and is only revealed over time (Burdett 1978; Jovanovic, 1979).

The contribution of this paper to the literature is threefold: first, unlike previous papers, it focuses on the effects of concentration of the amount of training expenditure as a source of agglomeration externalities rather than on other local features such as economic density or population size, and of the worker turnover. Second, it exploits a new data set providing an extensive list of firm's variables and information on training which allows one to distinguish if the cost of training was supported by the employer or not. Third, it verifies if the excess worker turnover affects the positive effects of knowledge spillovers on labor productivity or not.

In order to conduct a robust empirical analysis, we exploit a unique set of firm-level information derived from the Rilevazione Imprese e Lavoro (RIL) survey conducted by the National Institute for the Analysis of Public Policy (INAPP) in 2010 and 2015 on a representative sample of Italian firms operating in extra-

agricultural private sector. We merge the RIL data on training expenditures and other workplace characteristics with information on accounting variables from the AIDA archive and we use municipality codes to identify the local labor markets (LLMs) from ISTAT in order to obtain our agglomeration variables.

In this framework, the regression analysis allows us to find the following results. First, the agglomeration of training expenditures increases labor productivity of firms operating in the same environment. Second, the positive externalities due to the agglomeration of training expenditures are reduced by the occurrence of an high worker turnover at firm level. These findings take into account potential problems related to firms' unobserved heterogeneity and endogeneity issues.

The article is arranged as follows. First, we review some related literature. Second, we describe the sample. Third, we present the micro-econometric methodology implemented to estimate the impact of training on labor productivity. Forth, we show the estimation results. Finally, we conclude by suggesting some further developments and discussing the policy implications implied by the empirical analysis.

Related Literature

A skilled and educated workforce is a key factor for productivity and it is critical for a country's long-term economic growth and development (Romer, 1987, 1996; Lucas, 1988; Mankiw et al., 1992; and Acemoglu and Pischke, 1998). Empirical studies generally tend to focus on formal education when investigating the impact of human capital on wages and labor productivity. However, a significant amount of human capital accumulation takes place after an employee enters the labor market through firm-provided training. Firm-provided training, in fact, complements formal education and it is as important a component of human capital as formal education, or may be of even greater importance, in contributing to productivity (OECD, 2010).

In recent years, as detailed firm-level data sets have become available, a number of studies have investigated the effect of training on labor productivity. Schonewille (2001) uses a small dataset of British industries to estimate a production function and reports significant effects when using the variable hours in training. Moretti (2004) focuses on plant level productivity gains from education, but he has no data on firm provided training. He shows an increase in the productivity in those cities that experience an increase in the share of college graduates, but this productivity gain is offset by wage increases. Furthermore, Dearden et al. (2006) analyze the relationship between training, wages and productivity at the sector level using a panel of British industries. They find that raising the proportion of workers in an industry who receive training increases value added per worker in the industry by 0.6%. The analysis of training impact on firm's productivity in Italy is slightly behind with respect to other countries (Angotti, 2011). Conti (2005), using a panel of Italian industries for the years 1996-1999, provides longitudinal evidence of training effects on productivity. She finds that training, measured as a stock of accumulated human capital, significantly boosts industries' value-added. Guerrazzi (2016) explores the effect of training on the productivity of a sample of Italian firms suggesting that firm-provided training has a positive and significant effect on the main firm performance indexes.

Taking into account this empirical evidence it seems important to verify if the firm expenditure for training positively affect labor productivity. Moreover, the theoretical results on agglomeration economies suggest

hypothesizing that the labor productivity could be affected by agglomeration externalities caused by the concentration of the amount of firm expenditure for training. The interest in studying the role of agglomeration economies in determining firm productivity goes back at least to Marshall (1890) who proposed a number of reasons for existence of agglomeration externalities. In the modern terminology, Marshallian externalities may arise because of (i) knowledge spillovers between firms, (ii) highly specialized labor force based on the accumulation of human capital, (iii) backward and forward linkages associated with large local markets.

The positive relationship between agglomeration and productivity is extensively documented. Helsley and Strange (1990) maintain that labor pooling improves the matching quality between firms and workers. Furthermore, knowledge spillover positively affects labor productivity (Ciccone and Hall, 1996; Ciccone, 2002; Rice et al., 200; and Brülhart and Mathys, 2008). Firms can therefore reach higher productivity only if they have a skilled workforce able to adopt new knowledge and technologies (e.g., Acemoglu, 2002). Finally, knowledge spillovers positively affect the firm's propensity to train (Croce and Ghignoni, 2017; Croce et al., 2016).

Despite these positive effects, other research shows the existence of negative effects. Stevens (1996) develops a theoretical model where the threat of poaching has an adverse impact on firm-provided training. Moen and Rosén (2004) show that search frictions can lead to higher turnover and lower investment in training if employers and employees are unable to coordinate efficiently, i.e., by using long-term contracts. Almazan et al. (2007) show that firms prefer to locate in clusters when the training costs are borne by the employee, whereas an incentive exists for firms to move to isolated locations when employers have to bear a substantial part of the training costs. Therefore, their model provides a direct link between the density of a labor market, the share of training costs borne by the firm, and the firm's training decision. In addition, Matouschek and Robert-Nicoud (2005) conclude that firms providing training will locate in more isolated clusters. Combes and Duranton (2006) show that firms face a trade-off between the positive effects of labor market pooling and the negative effect of labor poaching, and, depending which effect is larger, they decide either to locate close to their competitors and to invest in training or move to more isolated labor markets. Brunello and De Paola (2008), and Muehlemann and Wolter (2011) stress the presence of a negative relationship between firm-provided training and spatial concentration explaining that it could be due to the prevalence of the negative effect of high turnover.

Both the human resources management literature and the economic literature have been concerned with investigating the effects of worker turnover on labor productivity. The theories proposed are contrasting, suggesting that the impact of interest is not trivial, and it is possibly the result of the interaction of many contrasting forces. Sutherland (2002) highlights that from separations, firms suffer the loss of human capital investments and the cost of hiring substitute workers. High excess worker turnover is likely to cause indirect negative effects: output forgone during the vacancy period and diminished productivity during the training process of new workers and loss of social capital (Dess and Shaw, 2001). Yet, there is a strand of literature suggesting that a positive, though small, amount of excess worker turnover can be beneficial. For example, Adelson and Baysinger (1984) suggest that excess worker turnover is not dysfunctional per se, but that it should be evaluated on the basis of the costs and benefits it brings to the firm. Moreover, the firm-specific human capital theory states that excess worker turnover negatively affects productivity (Becker, 1964; Yanadori and Kato, 2007; Shaw, 2011), whereas the job matching theory conceives excess worker turnover as the mechanism

through which employer-employee matches can be reallocated in a more efficient way (Ilmakunnas et al. 2005, Grinza, 2016).

Given these possible different outcomes, both regarding to the agglomeration externalities and the worker turnover, we consider the firm's training expenditure measured at the local labour markets and its interaction with the excess worker turnover measured at firm level to better identify the impact of concentration of firm's training expenditure on labor productivity. In this way we want verify if the negative effects due to the excess worker turnover reduce or not the positive effects due to knowledge spillover.

Data

The empirical analysis is based on data drawn from the last two waves of the Rilevazione Imprese e Lavoro (RIL) survey conducted by INAPP for 2010 and 2015 on a representative sample of partnerships and limited liability firms. Each waves of the survey interviews over 30.000 firms operating in non-agricultural private sector. A subsample of the included firms (around 35%) are followed over time, making the RIL dataset partially panel over the period under study.

The RIL data collects a rich set of information about the composition of the workforce, including the amount of training investments, the asset of the industrial relations and other workplace characteristics. In particular, the survey provides unique data on the total amount of training expenses and the source of its financing that may be related to other dimensions of personnel policies (such as the amount of hirings and separations, the use of flexible contractual arrangements, the age and education distribution of the workforce, etc). Moreover, the data contains an extensive set of firm level controls, including the managerial and corporate governance characteristics, productive specialization and other firm strategies (such as innovation and export activities).

On the other hand, the RIL survey contains incomplete information on financial and accounting variables, which had to be recovered from another source. For this purpose, we use the national tax number (*codice fiscale*) to merge RIL data with AIDA archive provided by the Bureau Van Dijk. The AIDA data offers comprehensive information on the balance sheets of almost all the Italian corporations operating in the private sector, except for the agricultural and financial industries. In particular, this dataset contains yearly values of such variables as revenues, value added, net profits, book value of physical capital, total wage bill and raw-material expenditures. Then, we are able to use indicators of labour productivity (value added per employee) and fixed capital (the total amount of physical asset per employees) and other balance sheet variables. All these financial variables have been deflated according to specific deflators provided by the national statistics institute (ISTAT).

The resulting "RIL-AIDA" merged sample was the restricted to limited liability firms that disclose detailed accounts in accordance with the scheme of the 4th Directive CEE.

Moreover, we consider the Local Labour Market (LLMs) as our geographical units of analysis in order to assess the impact of local human capital externalities derived from the agglomeration of the training expenses. The LLMs are sub-regional geographical areas where the majority of labour force lives and works. As determined by the National Statistical Institute (NSI) in the LMAs establishments could find the necessary workforce. LSMs

are individuated by ISTAT through an allocation process based on the analysis of commuting patterns and they are 611 distinct areas created identified through the allocation process developed in 201. Following Basile et al. (2016) we consider such a geographical breakdown particularly useful for the analysis of labour productivity since it makes it easier to control for agglomeration forces at the local level.[2]

Finally, we excluded firms with less than five employees to retain firms characterized by a minimum level of organizational structure. That is, we retain only those firms characterized by structured personnel policies, such as second level bargaining and complex personnel policies. After excluding also firms with missing information for the key variables, the final sample used to perform the empirical analysis is a panel of approximately 5.000 firms for 2010 and 2015.

Descriptive Statistics

The descriptive statistics for some training measures related to the pooled RIL-AIDA sample over the period 2010-2015 are displayed in Table 1.

As for firm level variables, note that both the share of trained and the (log of) amount of training costs per employee increases significantly over the period under study; as a consequence, this increasing pattern is confirmed when these variables are calculated at local labor markets.

Table 1: descriptive statistics on training variables

	2010			2015			2010-2015		
	N of Obs	Mean	Std dev	N of Obs	Mean	Std dev	N of Obs	Mean	Std dev
Firm level									
training incidence	4,693	0.39	0.49	4,572	0.50	0.50	9,265	0.46	0.50
share of trained	4,693	0.21	0.34	4,572	0.4	0.4	9,265	0.29	0.39
ln (training costs pc +1)	4,395	1.66	2.45	3,845	2.1	2.6	8,240	1.90	2.55
Local labor markets									
training incidence _sll	4,706	0.41	0.12	4,572	0.6	0.1	9,278	0.50	0.14
share of trained_sll	4,704		0.17	4,533	0.5	0.1	9,237	0.43	0.17
ln (training costs pc +1)_sll	4,326	4.92	1.10	3,811	4.9	0.8	8,137	4.90	0.96

Source: RIL-AIDA 2010- 2015. Sampling weights applied.

[2] Basile et al. (2016) uses the 2001 ISTAT classification which identifies 686 LLMs. They define LLMs as groupings of municipalities showing an high degree of self-containment of commuting workers

The Econometric analysis

To investigate the relationship between the agglomeration of training expenses and the labor productivity, we estimate the following equation:

$$(1) \quad Ln(prodl)_{i,t} = \alpha \cdot TRC_{i,t} + \beta \cdot DTRC_{llm,t} + \delta \cdot DTRC_{llm,t} \cdot EWT_{i,t} + \chi \cdot EWT_{i,t} + \phi \cdot W_{i,t} + \gamma \cdot W_{llm,t} + \varepsilon_{i,t}$$

where the dependent variable ln(prodl) denotes the (log) of value added per employees, *i* is the firm subscript, *s* is the LLMs subscript, and t is the time subscript for years 2010 and 2015. As for our key explanatory variable, $TRC_{i,t}$ is the (log of) training expenses per employees at firm level, $DTRC_{lls,t}$ is the average of the training expenses measured at LLMs, and $DTRC_{lls,t}$*$EWT_{i,t}$ is the interaction between the average of training expenses measured at LLM and the excess worker turnover at firm level. The vector $W_{i,t}$ includes a wide set of firm level control variables including managerial and corporate governance characteristics, the workforce composition, the nature of industrial relations at workplace and other firms productive and competitive characteristics. Analogously, $W_{lls,t}$ includes a set of LLM variables measuring the incidence of various entrepreneurial and corporate governance characteristics as well as other potential local confounding factors. Finally, ε_i is an idiosyncratic error term.

Main Estimation Results

Table 2 reports the pooled OLS estimates for different specification of Equation (1). Columns [1]-[2] and [3] indicates that the positive estimates associated to the agglomeration of training expenses at local labor markets remain quite stable when we add progressively a wider set of controls for firms and managerial characteristics, as well as workforce composition and other potential local drivers of labor productivity. Moreover, the local training externalities pairs with a positive association between productivity and the amount of training expenses finance and/or organized by firms, while no significant effect is detected for the excess worker turnover.

On the other hand, columns [4]-[5] and [6] suggest that the excess worker turnover plays a key role in reducing the positive externalities that a firm gain from being localized in areas when a high level of training expenses is invested. In particular we observe that the interaction terms the estimates associated to the interaction term ln(tr costr pc)_LLM*ex wor turnover is about -0.033 across specifications while that related to the variable ln(tr costs pc)_LLM, once netting out such a dimension of personnel policies, is quite doubled with respect the estimates found in columns [1]-[2] and [3].

Pooled OLS estimates reported in Table 2 are not well suited to control for omitted variables and/or potential reverse causality issues. At this aim we proceed in two steps. First, we run a within FE regressions to verify whether time-invariant firm-specific unobserved heterogeneity affects previous findings. Second, we adopt an IV 2SLS approach in order to deal with the potential *endogeneity* of the relationship between the amount of training investment and labor productivity, throughout the role of the excess worker turnover.

To begin with, Table 3 displays the FE estimates. Note that the estimates associated to the agglomeration of training expenses in no more statistically significant even though training expenses financed by firms continue to

exert a slightly positive impact on productivity (see columns [1]-[2]-[3]). This finding is not so surprisingly given that aggregate amount of training expenses at local market has a little within variability over time. On the other hand, columns [1]-[2] and [3] indicates that the excess worker turnover damages significantly the potential productive externalities deriving by the agglomeration of training expenses, even in the case the unobserved heterogeneity is taken into account.

Turning the attention to 2SLS-IV approach we consider to potential instruments: the lagged (average) incidence of employers' association registered at local labor markets and the lagged percent value of population with tertiary education (derived from Census data 2001 and 1991). The rationale behind this choice is twofold: i) the local average incidence of employer's association is expected to affect the propensity to invest in on the job training by firms localized in the same areas while it is not related with labor productivity; ii) for the second instrument see Croce et al. (2016). Overall Table 4 confirms previous pooled OLS results and, as for the interaction term, also the FE findings.

Table 2: Pooled OLS estimates

	[1]	[2]	[3]	[4]	[5]	[6]
ln(tr costs pc)_LLM	0.022***	0.015**	0.012*	0.030***	0.023***	0.020***
	[0.007	[0.006	[0.006	[0.007	[0.007	[0.006
ln(tr costr pc)_LLM*ex wor turn				-0.033***	-0.037***	-0.037***
				[0.011	[0.012	[0.012
ln(tr costr pc)	0.019***	0.013***	0.013***	0.018***	0.013***	0.013***
	[0.003	[0.003	[0.003	[0.003	[0.002	[0.002
excess worker turnover	0.010	0.014	0.013	0.173***	0.199***	0.197***
	[0.008	[0.009	[0.009	[0.056	[0.061	[0.061
year 2014	-0.040***	-0.063***	-0.066***	-0.038***	-0.061***	-0.063***
	[0.010]	[0.010]	[0.011]	[0.009]	[0.01	[0.011
management controls	yes	yes	yes	yes	yes	yes
firms controls	yes	yes	yes	yes	yes	yes
workforce controls	no	yes	yes	no	yes	yes
local labor market controls	no	no	yes	no	no	yes
constant	9.580***	9.190***	9.221***	9.546***	9.147***	9.182***
	[0.131	[0.087	[0.137	[0.127	[0.086	[0.134
N of Obs	7695	7353	7353	7695	7353	7353
R2	0.277	0.331	0.333	0.28	0.334	0.337

Source: RIL-AIDA 2010-2015. **Note**: Management controls include employers' educational level and dynastic governance; firms controls include product innovation, process innovation, foreign markets, firms' age, sector of activity, macro-region, size, ln(physical capital per employee); workforce controls include gender, age, education, professions, contractual arrangement of the employees, local labor market controls include the average of the managerial and firms characteristics measured at lls, an index of the quality of institutions calculated at province level. Robust (bootstrapped) standard errors in parentheses are calculated for each LLM; *** p<0.01, ** p<0.05, * p<0.1

Table 3: FE estimates

	[1]	[2]	[3]	[4]	[5]	[6]
ln(tr costs pc)_LLM	0.001	0.000	-0.002	0.005	0.003	0.001
	[0.006	[0.006	[0.007	[0.006	[0.007	[0.007
ln(tr costr pc)_LLm*ewt				-0.018***	-0.014**	-0.014**
				[0.006	[0.006	[0.006
ln(tr costr pc)	0.005*	0.005*	0.005*	0.004*	0.005	0.005*
	[0.003	[0.003	[0.003	[0.003	[0.003	[0.003
excess worker turnover	0.012***	0.012***	0.012***	0.105***	0.083***	0.082***
	[0.003	[0.003	[0.003	[0.032	[0.03	[0.031
year 2014	-0.029***	-0.037***	-0.040***	-0.028***	-0.036***	-0.040***
	[0.008	[0.009	[0.011	[0.008	[0.009	[0.011
management controls	yes	yes	yes	yes	yes	yes
firms controls	yes	yes	yes	yes	yes	yes
workforce controls	no	yes	yes	no	yes	yes
local labor market controls	no	no	yes	no	no	yes
constant	11.065***	11.091***	11.163***	11.051***	11.058***	11.137***
	[0.286	[0.304	[0.323	[0.285	[0.304	[0.323
Obs	7757	7411	7411	7757	7411	7411
R2	0.153	0.156	0.158	0.155	0.157	0.159

Source: RIL-AIDA 2010-2015. **Note**: Management controls include employers' educational level and dynastic governance; firms controls include product innovation, process innovation, foreign markets, firms' age, sector of activity, macro-region, size, ln(physical capital per employee); workforce controls include gender, age, education, professions, contractual arrangement of the employees, local labor market controls include the average of the managerial and firms characteristics measured at llm, an index of the quality of institutions calculated at province level. Robust (bootstrapped) standard errors in parentheses are calculated for each LLM; *** p<0.01, ** p<0.05, * p<0.1.

Table 4: IV 2SLS estimates. Second stage estimates

	[1]	[2]	[3]	[4]	[5]	[6]
ln(tr costs pc)_LLM	0.203**	0.134**	0.133*	0.149**	0.149**	0.150*
	[0.09	[0.064	[0.081	[0.065	[0.065	[0.083
ln(tr costr pc)_LLM*ewt				-0.073***	-0.073***	-0.073***
				[0.025	[0.025	[0.026
ln(tr costr pc)	0.013***	0.010***	0.009***	0.009***	0.009***	0.009**
	[0.004	[0.003	[0.004	[0.003	[0.003	[0.004
excess worker turnover	0.011	0.014	0.013	0.377***	0.377***	0.380***
	[0.008	[0.009	[0.009	[0.126	[0.126	[0.129
year 2014	-0.042*	-0.063***	-0.070***	-0.059***	-0.059***	-0.067***
	[0.024	[0.017	[0.018	[0.017	[0.017	[0.018
management controls	yes	yes	yes	yes	yes	yes
firms controls	yes	yes	yes	yes	yes	yes
workforce controls	no	yes	yes	no	yes	yes
local labor market controls	no	no	yes	no	no	yes
constant	8.749***	9.084***	9.315***	9.009***	9.009***	9.159***
	[0.366	[0.273	[0.302	[0.279	[0.279	[0.31
N of Obs	7669	7327	7304	7327	7327	7327
R2	0.19	0.294	0.3	0.295	0.295	0.296

Source: RIL-AIDA 2010-2015. **Note**: Management controls include employers' educational level and dynastic governance; firms controls include product innovation, process innovation, foreign markets, firms' age, sector of activity, macro-region, size, ln(physical capital per employee); workforce controls include gender, age, education, professions, contractual arrangement of the employees, local labor market controls include the average of the managerial and firms characteristics measured at llm, an index of the quality of institutions calculated at province level. Robust (bootstrapped) standard errors in parentheses are calculated for each LLS; *** p<0.01, ** p<0.05, * p<0.1

Concluding Remarks

According to results from recent research, education and training gives rise to externalities, increasing productivity in the economy. As emphasized by the literature knowledge diffusion are strengthened by proximity. Based on a unique dataset containing information on the personal profile of employers, firms' characteristics and firm-sponsored training, this paper investigates the effects of the agglomeration of training expenditure's firm at local labor market on labor productivity.

The key results are consistent with the prediction that the agglomeration of training expenditure increases labor productivity of firms operating in the same environment. Moreover, this analysis focuses on the effects deriving from the interaction between excess worker turnover and the agglomeration of training expenditure showing that the positive externalities due to agglomeration are reduced by the occurrence of a high worker turnover.

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