

Use of atypical work and firm's productivity: A regional study

Andrea Signoretti^{*}, Enrico Tundis[†], Enrico Zaninotto[‡]

SOMMARIO

L'uso di lavoro atipico è un fenomeno che influenza in modo determinante le dinamiche del mercato del lavoro odierno. L'aumento della flessibilità del lavoro, basato sulla tesi che fosse necessario per affrontare sia il problema occupazionale che quello della crescita economica, è stato alla base delle riforme del mercato del lavoro introdotte a partire dagli anni '90 in diversi Paesi. In Italia la nascita di un mercato del lavoro duale, con una componente di lavoro stabile e una flessibile, è stata, tuttavia, associata alla bassa crescita di produttività degli ultimi decenni. Non esiste però un'evidenza empirica definitiva riguardo al segno della relazione tra uso di lavoro flessibile e produttività. Il presente studio vuole analizzare la relazione tra l'uso di lavoro flessibile e produttività delle imprese in funzione dei diversi modi utilizzati per introdurre flessibilità (ovvero assunzione di lavoratori dipendenti con contratti temporanei, lavoratori esterni e lavoratori interinali). L'analisi si basa su un nuovo database contenente informazioni relative all'intera popolazione delle imprese operanti nella provincia di Trento. La fonte primaria dei dati è l'archivio ASIA-occupazione realizzato dall'Istat, un database di tipo LEED che lega le posizioni lavorative ed imprese. I dati riguardano l'occupazione dipendente, indipendente e l'occupazione esterna delle imprese. A questa base informativa sono state integrate una serie informazioni sulle caratteristiche delle imprese provenienti da vari archivi amministrativi.

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Use of atypical work and firm's productivity: A regional study[§]

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1. Introduction

Italy has been characterized in the last 20 years by a lower increase in labour productivity than other developed countries like France and Germany, which represents a relevant issue for the national economy (European Commission, 2012). Studies have looked into different aspects to understand the dynamic of Italian labour productivity.

One area of study focuses on the composition of the workforce according to the type of hiring contract to understand the Italian dynamic of labour productivity increase. Atypical contracts have increasingly diffused among countries since companies, under the pressure of globalization, have made recourse to these contracts to adjust to business cycles and/or to lower labour cost. Italy has a proportion of atypical contracts, out of the total workforce, which is not remarkable being equal to 13.6% in 2014 (Eurostat, 2015). Nevertheless, in the last years, the percentage has increased more than in the other European countries (OECD, 2012) and their usage also regards the majority of new hiring in big firms (Istat, 2012). This trend could reveal the development of companies' strategies

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aiming to employ atypical workers in order to reduce labor cost, whereon competing through price product rather than on its quality and originality (Tundis et al., 2012).

The aim of this research is that of shedding more light on the central issue of whether the use flexible contracts, and more generally the use of atypical work, exert an overall positive or negative effect on firm's productivity.

2. The influence of atypical workers on productivity

As to studies inquiring productivity levels looking into the contractual composition of the workforce, the literature has highlighted different channels through which atypical contracts can affect productivity, which are both positive and negative.

Starting with the positive mechanisms of influence, authors have explained that with flexible contracts firms can adjust to business cycles and fluctuations in demand, so achieving higher productivity by avoiding labour hoarding given that it is difficult to dismiss workers having open-ended contracts (Malgarini et al., 2013).

A second channel is constituted by the fact that atypical workers would assure higher performance than regular employees because they would be prone to meet company's requests and to be highly committed in order to be promoted into regular staff (Engellandt e Riphahn, 2005). Researches have shown that atypical workers perform a higher number of unpaid overtime (Ghignoni, 2008) and positively affect the absenteeism rate. The high commitment of atypical workers would derive from the fact that, for them, the missing renewal of their contract or their promotion into regular positions constitute real possibilities that firms can pursue with low costs (Jacob, 2010, Ichino e Riphahan, 2005).

Third, the use of flexible contracts could be associated with a higher level of turnover, with new employees bringing new useful ideas increasing company's innovation and productivity (Altuzarra e Serrano, 2010, Zhou et al., 2011). Nevertheless, the innovative contribution coming from

atypical workers should be more significant in the case of knowledge than ordinary employees, because the first would be more likely to fill competence gaps existing in firms with the knowledge and expertise developed at school and in other companies.

Fourth, firms can screen candidates before taking them on permanently by choosing people who turn out to be more aligned with the job they are required to cover. Companies could also replace people hired with atypical contracts who do not register appropriate productivity levels with more productive workers (Kleinchnecht et al., 2006). However, this strategy is limited by the possible presence of institutional constraints, for instance in terms of promotion schemes towards permanent positions established through collective bargaining (Pulignano and Signoretti, 2015).

Likewise, the literature has highlighted the channels through which atypical contracts could, on the contrary, negatively affect productivity.

First of all, enterprises are tempted to hire atypical workers in order to keep labour-intensive production which can favour the adoption of price-based competitive strategies on the parts of firms. This tendency is particularly relevant in the case of Italy, where a significant portion of companies is still active in traditional and labour-intensive production. As regards the comparative costs between regular and non-standard costs for firms, it should be however underlined that the two contractual categories are placed almost at the same level since both from the normative and salary point of view. The difference financial burden derives from the easy way and relative lower cost to dismiss non-standard workers than people hired with open-ended contracts.

The second channel is constituted by the issue of human capital and training. The level of firm-specific human capital is very important for companies' productivity and is bound to be inferior among atypical workers. As a matter of fact, companies are not prone to invest time and financial resources on people that are going to leave the firm and so unable to repay the investment. On the other hand, workers themselves would not be committed to develop firm-specific skills, since these skills will not be useful to find another job in other companies (Lucidi and Kleinknecht, 2010). Thereon, atypical workers would negatively affect productivity given their low level of firm-specific

human capital (Dolado e Stucchi, 2008). The situation is more complicated in the case of general human capital. In this case, while firms do not have incentives to increase its level among atypical workers the latter would be interested in developing it. General human capital is characterized by portability among companies, so increasing the probability of finding new jobs and of making career. Within this situation workers would be bound to invest their own resources to increase and adjourn their general human capital (Cappelli, 1999). Effectively, empirical data show that atypical workers receive less training than permanent colleagues while they are endowed with a higher level of general human capital allowing them higher transitions across sectors (Berton et al, 2016).

Third, the turnover associated with flexible contract can favour the introduction of new and innovative ideas in companies, but it produces a low development of tacit skills deriving from working in the same place for a long time. Tacit skills are crucial for productivity (Polany, 1966). Fourth, atypical workers could be characterized by low level of commitment if they perceive to have low possibilities of being promoted into permanent positions (Ghignoni, 2008), possibilities that decrease when the share of flexible contracts augments inside firms (Sánchez e Toharia, 2009). This low level of commitment can also result in the adoption of little collaborative behaviours with the management that, in turn, leads to the usage of tools of performance control increasing company's costs.

It is very complicated to assess the relative strength of the channels and mechanisms illustrated, hence to determine if flexible contracts exert an overall positive or negative effect on productivity. However, most studies support the existence of a negative relation (for instance Alonso-Borrego, 2010 and for Italy, Boeri and Garibaldi, 2007). Some analysis has also shown that the negative influence of atypical workers on labour productivity depends on their proportion out of the total workforce (Addessi, 2014).

Research conducted on this subject is often affected by two main limits. First, they rarely use firm-level data which would allow to better understand the relationship between atypical contracts and productivity. Second, studies take into account particular types of atypical contracts or do not

distinguish among them, which is a strong drawback for the Italian context being characterized by the presence of various forms of non-standard contracts differing significantly among each other. Western countries have been interested by a wave of legislative provisions that have made more flexible the functioning of the labour market. In the Italian context, the Law 196/1997 and the Legislative Decree 276/2003 have introduced different types of atypical contracts which can be classified under two different groups. The first one is constituted by non-standard contracts that entail a direct hiring relationship with companies, which are represented by apprenticeship and, above all, by temporary or fixed-term contracts.

The second group is shaped by atypical contracts that are not based on direct hiring on the part of employers and which are mainly constituted by temporary agency work and by employer-coordinated freelance contracts (Co.co.co and Co.co.Pro). Temporary agency work foresees a triangular relationship in which a worker is hired by the agency but works in another firm under its supervision. Instead, employer-coordinated freelance contracts (Co.co.co and Co.co.Pro) establish that employees are self-employed but coordinated by the employer, resulting to work in subordinated conditions. The features and costs of the atypical contracts are so different, and equally different can be the purposes for which firms use them and their consequences on productivity levels.

An attempt to distinguish between the possible different effects exerted by various type of atypical contracts has been recently made by Bardazzi and Duranti (2016) that have also separately analyzed the effects between large and small and medium-sized firms and between manufacturing and service sectors. The distinction of companies according to their size is also appropriate, since running a firm with 5 or 500 employees presents different issues (Cardon and Stevens, 2004). Results confirm the existence of a relationship between atypical workers and productivity but with variegated associations. External staff results to have a negative effect on productivity with negative coefficients turning out not to be significant only in small service firms. This outcome can be explained on the grounds of low effort and low investments in training for this workforce. In the case of temporary contracts, the relationship with productivity is negative for manufacturing firms, particularly within

small and medium-sized companies, and positive in the case of large services enterprises (while the coefficient is not significant for smaller firms). On the grounds of these findings, Bardazzi and Duranti argue that external staff is often used to pursue cost-cutting strategies. Temporary contracts, instead, have more positive effects in large firms probably because of higher promotion chances, linked to firms' competitive strategies relying on quality and innovation that positively affect employee effort and firms' investments on training.

4. Data

The data collected for this research are functional to empirically explore the relationship between the composition of workforce and firm's productivity.

The empirical analysis exploits an original database containing information on the firms operating in the Trentino province over the period 2012-2014. The database was obtained by merging several source of data. The first source was the "Asia-occupazione", a LEED (Linked Employer Employee Database) database maintained by the Italian National Institute of Statistics (ISTAT). This archive contains detailed information on the number of employees and the composition of workforce for the population of Italian firms. To gather information on firms' characteristics we merged the Asia-occupazione database with the statistical register on economic accounts of Italian firms developed at ISTAT in 2013. The register, which is called "Frame SBS", allows to annually estimate the main profit-and-loss accounts data on all companies active in Italy. Moreover, additional information was obtained from the "Asia-imprese" register.

A notable feature of the collected data is that there is no limitation on the legal status, no cut-off on annual turnover as well as on firm size, as frequently happens when dealing with data on firms. Table 1 displays description of the sample size.

Lastly, a regression analysis is performed on the balanced sample of continuing firms that were active for the entire period under analysis (2012-2014). Table 5 reports descriptive statistics on the regression sample.

5. Econometric approach

To investigate the effect of the use of the different types of workers on the user firm's productivity, we define the following empirical model:

$$LP_{it} = \beta_1 TE_{it} + \beta_2 OIW_{it} + \beta_3 TEE_{it} + \beta_4 TEA_{it} + \gamma' X_{it} + \epsilon_{it} \quad (1)$$

where we regress the level of labour productivity of firm i in period t (LP_{it}) on the composition of firm's workforce in terms of work types used. Specifically, TE_{it} is the share of employees with a fixed-term contract; OIW_{it} is the share of other internal workers, that is people, such as partners or family members, working within the firm without an employer-employee relationship; TEW_{it} is the share of workers with external fixed-term contracts, such as employer-coordinated freelance workers; and TAW_{it} represents the share of temporary agency workers used by the firm. Finally, a set of controls is also considered (X_{it}).

The coefficients of the model (1) are estimated by means of OLS estimator. In order to control for unobserved heterogeneity between firms, the model is also estimated by including firm fixed-effect. By means of FE estimator the problem of time-invariant heterogeneity between firms, such as difference in managerial quality or differences in flexibility due to different production technologies is taken into account.

6. Main (preliminary) findings

In this section we report the main preliminary findings of the analysis. As first step, it is worthwhile to look at the distribution of the aggregate workforce in the Province. Table 2a shows the number of workers employed in each sector of economic activity. As expected, workforce in the province is predominantly concentrated in the Trade, Transport and Hospitality sector, which is the sector with the highest number of active firms.

Table 3a displays, for each type of atypical contract, the percentage of user firms among all firms in the sector (the extensive margin). Notably, about one third of firms used permanent contracts (RE) and a quarter hired employees on fixed-term basis (TE). On average, less than 5% of firms employed temporary external workers and only 1% has resorted to temporary agency workers. There is, however, a certain heterogeneity across sectors. Around 60% of industrial firms used permanent workers; this percentage decreases dramatically in the service sectors. The resort to the external recruiting channels is also uneven across sectors. Only about 5% of firms in the service sectors made use of temporary external workers (TEW), while the share of firms with TEWs doubles in the industrial sector. Finally, the use of temporary agency workers (TAW) was largely concentrated in the industrial sector (about 7% of firms). As expected, the complexity of the structure of the workforce increases with firm size. In particular, the percentage of firms that employed all the different types of workers increases with firm size (see Table 3b).

Table 4a shifts the focus on the intensity with which firms used the different types of atypical contracts available in the labour market (the intensive margin). The values reported are the percentage of workers appointed in each category out of the total workforce. On average, industrial firms made the highest use of permanent workers (about 37% of the workforce), while the intensity of use of permanent workers was lower in the construction sector (about 22%) and services (around 22% in T.T.H. and 13% in other market services). The share of fixed-term contracts was generally around 6-7%, with the exception of the other market service sectors where the percentage decreases to about 3%. The distribution of the share of TEW and TAW is heavily skewed right in all sectors, meaning

that most firms made very modest use of this types of workers, but some firms relied more heavily on them.

Table 6 reports the regression estimates obtained by fitting the empirical model on the balanced sample of continuing firms. Columns 1-5 in the table report the estimated coefficients obtained by means of OLS estimator. Column 1 refers to the estimates obtained on the full sample; in columns 2-5 the model (1) is estimated separately for each sector. Overall, an increase in the use of atypical work is associated with lower levels of productivity. The coefficients on the different types of atypical work are negative and significant, with the exception of TEW in the Industrial and construction sectors. The Fixed-effect estimates (Columns 6-10) are consistent with the OLS estimates, with the exception of the coefficient on OIW that turn out to be positive when firm fixed-effect is introduced.

TABLES

Tab 1a. Number of firms across sectors. Full sample

Sector	2012	2013	2014
Industrial	3476	3413	3360
Construction	6242	5985	5950
Trade, Transport and Hospitality	13642	13611	13543
Other market services	10416	10347	10512
Non-market Services	4678	4648	4746
Total	38454	38004	38111

NOTE: Sector are defined with respect to Ateco2007 classification, In particular Industrial sector refers to section B to E; Construction refers to section E; Trade, Transport and Hospitality refers to sections from G to I; Other market services refers to sections from J to N; Non-market services refers to sections from P to S.

Tab 1b. Number of firms across firm size. Full sample

Sector	2012	2013	2014
<10	35,996	35,600	35,798
10-49	2,150	2,074	2,016
50-250	275	292	258
>250	33	38	39
Total	38454	38004	38111

Tab. 2a. Distribution of workforce across sectors and years. Number of workers, Full sample

Sector	year	Internal employment			External employment		Total
		Regular employees (RE)	Temporary employees (TE)	Other internal workers (OIW)	Temporary external workers (TEW)	Temporary agency workers (TAW)	
All sectors	2012	108211	61503	51413	5631	4411	231169
	2013	118700	65092	51834	4817	4373	244816
	2014	106363	61837	50991	4271	4184	227646
Industrial	2012	30187	4629	5022	915	2411	43164
	2013	32106	4257	4952	832	2292	44439
	2014	30353	4523	4831	780	2532	43019
Construction	2012	14036	4472	8074	257	179	27018
	2013	14613	4175	7841	218	146	26993
	2014	13241	3830	7696	224	138	25129
Trade, Transport and Hospitality	2012	35928	39917	20518	1647	1201	99211
	2013	38245	41670	20975	1045	1136	103071
	2014	33925	41122	20628	1016	948	97639
Other market services	2012	18836	5761	11789	1569	345	38300
	2013	21965	5508	11977	1437	394	41281
	2014	20192	6246	12089	1311	332	40170
Non-market services	2012	9224	6724	6010	1243	275	23476
	2013	11771	9482	6089	1285	405	29032
	2014	8652	6116	5747	940	234	21689

NOTE: Sector are defined with respect to Ateco2007 classification, In particular Industrial sector refers to section B to E; Construction refers to section E; Trade, Transport and Hospitality refers to sections from G to I; Other market services refers to sections from J to N; Non-market services refers to sections from P to S.

Tab. 2b. Distribution of workforce across firm sizes and years. Number of workers, Full sample

Firm size	year	Internal workforce			External workforce		Total
		Regular employees (RE)	Temporary employees (TE)	Other internal workers (OIW)	Temporary external workers (TEW)	Temporary agency workers (TAW)	
<10	2012	32126	29597	46205	2328	396	110652
	2013	35869	29738	46128	1911	431	114077
	2014	31175	29096	45823	1810	433	108337
10-49	2012	31433	20914	4490	2170	1164	60171
	2013	32487	20552	4585	1581	1187	60392
	2014	30306	19013	4313	1447	1193	56272
50-250	2012	25089	8235	688	886	1686	36584
	2013	27919	10936	1068	1092	1654	42669
	2014	23578	8570	800	798	1521	35267
>250	2012	19563	2757	30	247	1165	23762
	2013	22425	3866	53	233	1101	27678
	2014	21304	5158	55	216	1037	27770

Tab 3a. Extensive use of work types. Shares (%) of user firms among all firms by sectors and years

Sector	year	Internal workforce			External workforce	
		Regular employees (RE)	Temporary employees (TE)	Other internal workers (OIW)	Temporary external workers (TEW)	Temporary agency workers (TAW)
All sectors	2012	34.81	24.48	94.42	5.02	1.29
	2013	34.55	23.26	94.77	4.44	1.31
	2014	32.91	22.89	94.56	4.17	1.25
Industrial	2012	59.61	31.93	88.49	11.28	6.73
	2013	59.95	28.95	88.60	10.78	7.00
	2014	59.23	30.39	87.65	10.18	7.26
Construction	2012	37.23	20.27	95.67	2.71	0.50
	2013	36.66	19.93	95.89	2.36	0.70
	2014	34.77	19.34	95.39	2.27	0.57
Trade, Transport and Hospitality	2012	40.49	39.28	95.46	4.62	0.97
	2013	40.06	37.59	96.05	3.73	0.90
	2014	38.11	37.55	95.81	3.67	0.92
Other market services	2012	20.77	9.25	93.89	4.89	0.56
	2013	20.73	8.12	94.19	4.51	0.49
	2014	19.99	8.06	94.09	4.25	0.49
Non-market services	2012	27.83	15.37	95.25	4.90	0.86
	2013	27.82	15.10	95.42	4.37	0.95
	2014	25.71	13.04	95.83	3.54	0.44

NOTE: Sector are defined with respect to Ateco2007 classification. In particular Industrial sector refers to section B to E; Construction refers to section E; Trade, Transport and Hospitality refers to sections from G to I; Other market services refers to sections from J to N; Non-market services refers to sections from P to S.

Tab 3b. Extensive use of work types. Shares (%) of user firms among all firms by firm size and years

Sector	year	Internal workforce			External workforce	
		Regular employees (RE)	Temporary employees (TE)	Other internal workers (OIW)	Temporary external workers (TEW)	Temporary agency workers (TAW)
<10	2012	30.77	20.53	95.74	3.20	0.38
	2013	30.54	19.40	96.05	2.75	0.40
	2014	28.97	19.17	95.77	2.69	0.41
10-49	2012	93.12	80.28	78.47	26.14	10.28
	2013	93.11	77.97	80.52	22.85	10.27
	2014	92.91	78.17	79.76	20.83	10.32
50-250	2012	99.64	97.09	53.82	67.27	41.82
	2013	99.32	95.55	47.95	68.84	40.75
	2014	99.61	94.96	51.16	67.83	37.21
>250	2012	100.00	96.97	24.24	93.94	69.70
	2013	100.00	100.00	36.84	89.47	65.79
	2014	100.00	100.00	33.33	79.49	66.67

Tab 4a. Intensive use of work types. Firm workforce composition (%) by sectors and years

Sector	year		mean	sd	p10	p25	p50	p75	p90	min	max	skewness	kurtosis
Industrial	2012	RE	37.182	34.702	0	0	40	66.667	84.615	0	100	0.18953	1.5127
		TE	7.7749	15.584	0	0	0	9.0909	28.571	0	100	2.5452	9.9603
		OIW	51.906	40.102	0	13.333	50	100	100	0	100	0.11395	1.354
		TEW	2.0338	10.351	0	0	0	0	1.9802	0	100	7.4518	64.011
		TAW	1.1037	5.6687	0	0	0	0	0	0	77.663	7.3297	68.387
	2014	RE	37.838	35.41	0	0	40	70	85.714	0	100	0.17586	1.4797
		TE	7.5507	15.653	0	0	0	8.1494	27.273	0	100	2.6512	10.67
		OIW	51.314	40.729	0	12.5	40	100	100	0	100	0.13654	1.3222
		TEW	2.0324	11.164	0	0	0	0	0.66778	0	100	7.4896	62.113
		TAW	1.2643	6.243	0	0	0	0	0	0	92.771	6.8695	59.992
	Average	RE	37.963	35.296	0	0	40	70	85.714	0	100	0.16422	1.4728
		TE	7.4145	15.407	0	0	0	7.6923	27.273	0	100	2.6524	10.615
		OIW	51.439	40.447	0	12.5	42.857	100	100	0	100	0.1344	1.3361
		TEW	2.034	10.844	0	0	0	0	1.2821	0	100	7.529	63.644
		TAW	1.1498	5.8164	0	0	0	0	0	0	92.771	7.1853	66.116
Constr.	2012	RE	22.061	31.376	0	0	0	50	75	0	100	0.99277	2.462
		TE	6.5187	15.768	0	0	0	0	28.571	0	100	2.8023	11.09
		OIW	70.644	37.425	11.111	33.333	100	100	100	0	100	-0.67848	1.7578
		TEW	0.67378	6.4962	0	0	0	0	0	0	100	12.859	182.73
		TAW	0.10211	1.8279	0	0	0	0	0	0	62.5	22.934	612.37
	2014	RE	21.072	31.372	0	0	0	50	75	0	100	1.0718	2.5991
		TE	6.3675	16.012	0	0	0	0	25	0	100	2.9699	12.147
		OIW	71.796	37.246	12.5	33.333	100	100	100	0	100	-0.74334	1.8405
		TEW	0.66418	6.8719	0	0	0	0	0	0	100	12.984	180.29
		TAW	0.09977	1.9025	0	0	0	0	0	0	100	33.604	1484.5
	Average	RE	21.828	31.584	0	0	0	50	75	0	100	1.0152	2.4778
		TE	6.4338	15.809	0	0	0	0	27.273	0	100	2.8613	11.444
		OIW	70.973	37.49	11.765	33.333	100	100	100	0	100	-0.69657	1.769
		TEW	0.65095	6.6021	0	0	0	0	0	0	100	13.149	187.67
		TAW	0.11424	1.9814	0	0	0	0	0	0	100	24.404	761.73
T.T.H.	2012	RE	22.061	31.376	0	0	0	50	75	0	100	0.99277	2.462
		TE	6.5187	15.768	0	0	0	0	28.571	0	100	2.8023	11.09
		OIW	70.644	37.425	11.111	33.333	100	100	100	0	100	-0.67848	1.7578
		TEW	0.67378	6.4962	0	0	0	0	0	0	100	12.859	182.73
		TAW	0.10211	1.8279	0	0	0	0	0	0	62.5	22.934	612.37
	2014	RE	21.072	31.372	0	0	0	50	75	0	100	1.0718	2.5991

	TE	6.3675	16.012	0	0	0	0	25	0	100	2.9699	12.147
	OIW	71.796	37.246	12.5	33.333	100	100	100	0	100	-0.74334	1.8405
	TEW	0.66418	6.8719	0	0	0	0	0	0	100	12.984	180.29
	TAW	0.09977	1.9025	0	0	0	0	0	0	100	33.604	1484.5
Average	RE	21.828	31.584	0	0	0	50	75	0	100	1.0152	2.4778
	TE	6.4338	15.809	0	0	0	0	27.273	0	100	2.8613	11.444
	OIW	70.973	37.49	11.765	33.333	100	100	100	0	100	-0.69657	1.769
	TEW	0.65095	6.6021	0	0	0	0	0	0	100	13.149	187.67
	TAW	0.11424	1.9814	0	0	0	0	0	0	100	24.404	761.73
Other serv. 2012	RE	12.297	26.052	0	0	0	0	55.556	0	100	1.9655	5.5971
	TE	3.4661	13.236	0	0	0	0	0	0	100	4.6299	26.219
	OIW	82.187	33.181	20	100	100	100	100	0	100	-1.5272	3.7035
	TEW	1.986	11.077	0	0	0	0	0	0	100	6.7902	52.856
	TAW	0.06345	1.2246	0	0	0	0	0	0	70.833	31.024	1328.9
2014	RE	12.291	26.559	0	0	0	0	60	0	100	1.9906	5.6205
	TE	3.0229	12.338	0	0	0	0	0	0	100	4.9008	28.947
	OIW	83	32.671	20	100	100	100	100	0	100	-1.6013	3.9386
	TEW	1.6098	10.006	0	0	0	0	0	0	100	7.7126	67.577
	TAW	0.07628	1.6232	0	0	0	0	0	0	80	31.195	1190.3
Average	RE	12.501	26.605	0	0	0	0	60	0	100	1.9519	5.4662
	TE	3.1656	12.643	0	0	0	0	0	0	100	4.8129	28.053
	OIW	82.496	33.036	20	100	100	100	100	0	100	-1.5533	3.7755
	TEW	1.766	10.439	0	0	0	0	0	0	100	7.2714	60.361
	TAW	0.07172	1.4989	0	0	0	0	0	0	81.25	32.165	1301.8

NOTE: Sector are defined with respect to Ateco2007 classification, In particular Industrial sector refers to section B to E; Construction refers to section E; Trade, Transport and Hospitality refers to sections from G to I; Other market services refers to sections from J to N; Non-market services refers to sections from P to S.

Tab 4b. Intensive use of work types. Firm workforce composition (%) by firm size and years.

Firm size	Year		mean	sd	p10	p25	p50	p75	p90	min	max	skewness	kurtosis
<10	2012	RE	16.472	27.259	0	0	0	33.333	63.636	0	100	1.4054	3.673
		TE	10.213	22.592	0	0	0	0	50	0	100	2.2508	7.0173
		OIW	71.951	36.269	14.286	33.333	100	100	100	0	100	-0.72399	1.8563
		TEW	1.2695	8.7153	0	0	0	0	0	0	100	8.6113	84.929
		TAW	0.09374	1.8059	0	0	0	0	0	0	70.833	25.043	734.02
	2014	RE	16.013	27.495	0	0	0	33.333	66.667	0	100	1.4752	3.843
		TE	9.9226	22.691	0	0	0	0	50	0	100	2.3221	7.3017
		OIW	72.827	36.22	14.286	33.333	100	100	100	0	100	-0.77884	1.9276
		TEW	1.1229	8.4589	0	0	0	0	0	0	100	9.3494	98.272
		TAW	0.11477	2.1109	0	0	0	0	0	0	100	25.246	774.76
	Average	RE	16.536	27.711	0	0	0	33.333	66.667	0	100	1.4179	3.6609
		TE	9.9568	22.532	0	0	0	0	50	0	100	2.3041	7.2437
		OIW	72.237	36.36	14.286	33.333	100	100	100	0	100	-0.74228	1.8695
		TEW	1.1661	8.4889	0	0	0	0	0	0	100	9.1035	93.981
		TAW	0.10463	1.9657	0	0	0	0	0	0	100	25.205	764.78
10-49	2012	RE	61.364	28.637	7.6923	48.649	70	82.609	91.667	0	100	-0.89214	2.6856
		TE	26.23	29.228	0	4.5455	14.286	37.037	81.818	0	100	1.1752	3.123
		OIW	8.9369	9.3601	0	2.7027	6.6667	12.5	20	0	100	2.7272	19.336
		TEW	2.0387	5.4518	0	0	0	0	7.0175	0	76.786	5.3208	46.405
		TAW	1.4303	5.8894	0	0	0	0	2.5	0	67.857	6.213	50.967
	2014	RE	61.327	29.308	5.6624	47.619	70.362	83.333	91.667	0	100	-0.88463	2.6296
		TE	26.205	29.576	0	3.7037	14.286	37.143	83.333	0	100	1.1833	3.134
		OIW	9.2598	10.987	0	2.7027	6.4516	13.043	20	0	100	3.7447	26.006
		TEW	1.683	4.8006	0	0	0	0	5.8824	0	63.366	4.7917	35.703
		TAW	1.5253	6.3077	0	0	0	0	2.3533	0	69.048	5.9268	44.216
	Average	RE	61.636	28.956	6.6667	47.777	70.588	83.333	91.667	0	100	-0.90836	2.6839
		TE	26.059	29.454	0	3.8462	14.286	37.09	82.759	0	100	1.1864	3.1408
		OIW	9.0518	10.115	0	2.7027	6.4516	12.5	20	0	100	3.3901	24.418
		TEW	1.8066	4.9966	0	0	0	0	6.25	0	79.279	5.2681	47.025
		TAW	1.4466	5.9983	0	0	0	0	2.1739	0	69.048	6.0238	46.578
50-250	2012	RE	74.468	18.56	51.22	66.667	78.117	88.406	93.333	4.7244	100	-1.4276	5.183
		TE	17.035	16.833	2.5362	6.015	12.471	21.469	36.029	0	94.488	2.0914	8.059
		OIW	1.8098	3.137	0	0	0.70936	2.2222	5.0228	0	18.644	2.9437	12.698
		TEW	2.5789	4.462	0	0	1.3246	2.994	6.6667	0	37.398	4.2309	26.644
		TAW	4.1088	9.0824	0	0	0	3.2895	16.111	0	77.663	3.8661	24.039
	2014	RE	72.882	21.873	43.519	62.745	78.395	89.381	94.545	1.8519	100	-1.3	4.2699

		TE	17.876	19.816	1.6129	4.3478	12.736	22.43	44.681	0	97.531	1.9029	6.5882
		OIW	2.8175	6.4232	0	0	0.5848	2.3529	6.7901	0	51.064	4.2642	25.662
		TEE	2.3724	3.6857	0	0	1.2346	2.8037	6.3063	0	29.167	3.3856	18.924
		TAE	4.0521	8.1622	0	0	0	2.9851	17.73	0	39.773	2.3132	7.7692
	Average	RE	73.856	20.463	44.912	66.265	78.706	88.484	93.597	0	100	-1.4534	4.9161
		TE	17.132	18.192	1.9049	4.9578	11.923	21.545	41.827	0	97.753	2.0054	7.2817
		OIW	2.5542	6.246	0	0	0.56499	2.2347	5.8824	0	75.758	5.6474	47.244
		TEW	2.4911	4.0452	0	0	1.2821	2.9499	6.3966	0	37.398	3.8062	23.142
		TAW	3.9672	8.1808	0	0	0	3.7037	15.44	0	77.663	3.1121	16.711
>250	2012	RE	83.287	12.978	65.23	78.88	86.533	92.016	92.93	38.551	96.815	-1.7603	6.076
		TE	9.7473	11.277	2.3059	3.6212	6.0983	11.684	22.332	0	55.204	2.6247	10.339
		OIW	0.14296	0.36156	0	0	0	0	0.55136	0	1.4911	2.7552	9.4808
		TEW	1.3327	1.1474	0.12814	0.31496	1.2349	2.1008	2.9851	0	4.534	0.91948	3.2854
		TAW	5.4897	7.4674	0	0	2.7374	7.3171	15.891	0	33.533	2.0701	7.7221
	2014	RE	77.57	21.081	40.637	71.75	84.45	91.954	96.591	15.391	97.72	-1.6127	4.922
		TE	16.295	22.457	0.81081	2.1642	5.9976	21.104	56.653	0.25	83.333	1.8511	5.4142
		OIW	0.20709	0.48459	0	0	0	0.18939	0.81081	0	1.8801	2.599	8.5206
		TEW	0.89851	0.90833	0	0.17921	0.7431	1.3158	2.0175	0	3.8314	1.3002	4.6819
		TAW	5.0301	6.3061	0	0	3.3131	6.7708	13.262	0	25.537	1.6675	5.4836
	Average	RE	81.697	16.541	63.732	76.002	86.44	92.257	96.075	15.391	97.72	-1.9319	6.9769
		TE	11.854	16.494	0.87464	2.4289	5.1091	13.17	29.211	0	83.333	2.5392	9.5552
		OIW	0.186	0.42079	0	0	0	0.14508	0.81081	0	1.8801	2.5987	8.7765
		TEW	1.0679	1.0285	0	0.21885	0.92628	1.4852	2.7254	0	4.534	1.1712	3.9195
		TAW	5.195	6.7716	0	0	2.8581	7.5127	13.703	0	33.533	2.0544	7.98

Tab 5. Descriptive statistics and correlation matrix. Balanced sample od continuing

Variable	obs.	mean	sd	min	max	LP	TE	OIW	TEW	TAW	export/revenue	firm_age
LP	36558	26494.13	17598.55	455.2989	130990.2	1						
TE	36558	19.70006	28.34348	0	100	-0.3333	1					
OIW	36558	41.89267	33.87817	0	100	-0.0466	-0.4557	1				
TEW	36558	0.9017847	4.74202	0	79.27928	0.0228	-0.048	-0.1453	1			
TAW	36558	0.3810024	3.229187	0	80	0.0347	-0.0332	-0.113	0.0188	1		
export/revenue	36558	0.0112244	0.0783763	0	1	0.1444	-0.0487	-0.1121	0.052	0.1288	1	
firm_age	36558	20.26785	13.33247	0	119	0.0828	-0.0077	-0.054	-0.0255	0.018	0.0436	1

Tab 6. Estimated effect of workforce composition on labour productivity.

Dep.var: ln(LP)		OLS					FE				
		All sectors (1)	Industrial (2)	Construction (3)	T.T.H. (4)	Oth. market serv. (5)	All sectors (6)	Industrial (7)	Construction (8)	T.T.H. (9)	Oth. market serv. (10)
Full sample	TE	-0.0070***	-0.0068***	-0.0055***	-0.0070***	-0.0106***	-0.0030***	-0.0029***	-0.0022***	-0.0031***	-0.0036***
	OIW	-0.0031***	-0.0037***	-0.0014***	-0.0035***	-0.0037***	0.0115***	0.0121***	0.0092***	0.0118***	0.0139***
	TEE	-0.0054***	-0.0002	0.003	-0.0036***	-0.0098***	-0.0053***	-0.0018	-0.0098***	-0.0068***	-0.0034***
	TAE	-0.0057***	-0.0051***	-0.0113***	-0.0053**	-0.0122***	-0.0058***	-0.0073***	-0.0004	-0.0050**	-0.0089***

NOTE:

All specifications include export intensity (export/revenue), firm age, firm size and 2digit sectors, and time dummies as controls;

Sector are defined with respect to Ateco2007 classification, In particular Industrial sector refers to section B to E; Construction refers to section E; Trade, Transport and Hospitality refers to sections from G to I; Other market services refers to sections from J to N; Non-market services refers to sections from P to S.

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