

The Impact of Part-time Work on Firm Total Factor Productivity: Evidence from Italy

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Aim of the Paper

Research Question

What is the impact of part-time work on firm total factor productivity?

- **Part-time work:** is a non-standard work relation in which the number of working hours (or days/weeks/months) is fewer than normal.
- **Total Factor Productivity:** is a measure of firm productivity \Rightarrow think of it as a box containing several aspects of the firm such as the organizational and logistic efficiency and the production efficiency.

Theory

Part-time work may affect firms wrt:

- **Individual productivity of labor:** labor productivity differentials between part-timers and full-timers [Barzel, 1973].
 - ▶ Depending on the nature of the relationship between labor productivity and number of working hours, part-timers maybe more or less productive than full-timers.
 - ▶ We assume that it is constant \Rightarrow full-timers and part-timers are equally productive in the hours they work.
- **Productivity of the firm as a whole:** the total factor productivity (our object of interest).
 - ▶ Higher communication and organizational costs associated with part-time work \Rightarrow lower TFP [Lewis, 2003].
 - ▶ Gains in organizational efficiency for firms with daily demand peaks and/or long opening hours and/or high volatility of demand \Rightarrow higher TFP [Owen, 1978].

Empirical findings: review

- No paper explicitly focusing on the impact of part-time on TFP (except ours!).
- Three papers focusing on individual labor productivity differentials between part-timers and full-timers - in the context of the framework proposed by Hellerstein et al. [1999].
 - ▶ [Garnero et al. \[2014\]](#): panel dataset for Belgium for the period 1999-2010 \Rightarrow part-timers more productive than full-timers.
 - ▶ [Specchia and Vandenberghe \[2013\]](#): panel dataset for Belgium for the period 2002-2009 \Rightarrow part-timers less(!) productive than full-timers.
 - ▶ [Künn-Nelen et al. \[2013\]](#): Dutch pharmacy sector, year 2007 \Rightarrow part-timers more productive than full-timers (limited scope).

The Italian Situation: main facts

- In Italy 15% of employed people was working on a part-time basis in 2010 *versus* 19.2% in the EU-27 (Eurostat, 2011).
- Part-time jobs are usually covered by women \Rightarrow incidence of part-time: 29% among women *versus* 5.5% among men in Italy in 2010 (Eurostat, 2011).
- Segregation also by age, education, occupations and industries (ISFOL, 2008).
- Involuntary part-time widespread in Italy: 39.3% (OCSE, 2011).
- At the same time, about 60% of firms uses part-time in order to accommodate for workers' requests (ISFOL, 2010).

The Italian Situation: legislative framework

- Three possible models:
 - ▶ **Horizontal**: *daily* reduction of working hours.
 - ▶ **Vertical**: work on *some* days/week/months full-time.
 - ▶ **Mixed**: combination between horizontal and vertical model.
- Possibility to render part-time more flexible with flexible/elastic clauses:
 - ▶ **Flexible clauses**: modify the *collocation* of daily working hours (horizontal part-time only).
 - ▶ **Elastic clauses**: extend the number of working hours (vertical part-time only).

Empirical Model and Identification

Two-step approach

- 1 **First step:** recovers TFP estimates as the residual from a (log transformed) Cobb-Douglas production function:

$$y_{it} = a_{it} + \beta_l l_{it} + \beta_k k_{it}$$

where:

$$TFP_{it} \equiv a_{it} = \alpha + \nu_t + \mu_j + \sigma_r + \omega_{it} + \epsilon_{it}$$

hence:

$$\widehat{TFP}_{it} = y_{it} - \hat{\beta}_l l_{it} - \hat{\beta}_k k_{it}$$

- 2 **Second step:** estimates the impact of part-time on TFP:

$$\widehat{TFP}_{it} = \beta + \theta PT_{it} + \gamma V_{it} + \delta D_{it} + u_{it}$$

Two issues

- **Simultaneity problem** in production function estimation \Rightarrow inputs may be correlated with unobservable productivity level ω_{it} . We need to account for it in order to get consistent TFP estimates.
 - ▶ Solution: **ACF-FE** method.
 - ▶ Follows Akerberg et al. [2006] plus accounts for FE \Rightarrow accounting for FE gives more chance to the productivity proxy for working better.
- **Endogeneity** in the second step:
 - ▶ Unobserved firm-specific fixed-effects: e.g. managerial ability may influence TFP *and* part-time level \Rightarrow FE estimation.
 - ▶ Simultaneity: productivity shocks may influence part-time level, e.g. period of booms may increase use of part-time work \Rightarrow IV estimation.

Data

- **RIL** is the main dataset:
 - ▶ Survey provided by ISFOL for years 2005, 2007 and 2010 covering a representative sample of Italian firms.
 - ▶ Contains comprehensive information on firms' labor policies.
- **Problem:** RIL does not provide balance sheet information \Rightarrow necessary for PF estimation and hence for obtaining TFP estimates.
- **Solution:** we recover TFP estimates for the (matched) RIL firms from the **AIDA** dataset.
- The AIDA dataset (on which we perform PF estimation):
 - ▶ Collects balance sheet information for all corporations in Italy for the period 2000-2010 (about 2.4 million observations).
 - ▶ In order to account for industry structural differences we estimate 40 different production functions.
- The matched **RIL-AIDA** dataset (on which we assess the impact of part-time on TFP) contains 13,860 observations for 9,405 firms.

- Some **d-stat** on part-time:
 - ▶ On average, 8.4% of workers into a firm are part-timers.
 - ▶ The great majority are female (79%) and horizontal (86.8%) part-timers.
 - ▶ 68.1% of firms employs at least one part-timer.
 - ▶ 36.8% of them uses clauses.
 - ▶ 68% of them uses it for accommodating for workers' requests.

Results

Main finding

- Part-time work is **harmful** for firm productivity.
- One standard deviation increase in the firm part-time share (0.14) decreases productivity by 2.03%.
- This result comes from an OLS regression on:

$$\widehat{TFP}_{it} = \beta + \theta PT_{it} + \gamma V_{it} + \delta D_{it} + u_{it}$$

where:

- 1 \widehat{TFP}_{it} is ACF-FE estimate of the TFP obtained from the first step.
- 2 PT_{it} is part-time share defined as the number of part-time employees over the total number of employees.
- 3 V_{it} includes: females and migrants shares and temporary, blue-collar and white-collar workers shares.
- 4 D_{it} includes: year, region, industry and year interacted with industry dummies, identifying respectively 3, 20, 199 and 3x199 categories.

Results: Robustness Checks

Age and Education

- Possibly correlated with TFP and part-time.
- Only for year 2010.

Firm-specific fixed-effects

- Possibly correlated with part-time.
- FE estimation.
- Problem: loses about 50% of observations.

Management characteristics

- Possibly correlated with TFP and part-time.
- We control for type, sex, age and education.
- Only for year 2010.

Reverse causality

- Productivity shocks may influence the use of part-time.
- IV estimation.
- Problem: loses about 75% of observations.

Results: Robustness Checks

- Robustness checks confirm that part-time work is harmful for firm productivity.
- Very similar estimates wrt OLS \Rightarrow unobserved heterogeneity and reverse causality not real threats in identification in our case.
- OLS specification defined above is chosen as reference for extensions.

Results: Extensions

1) Types of part-time

- **Horizontal**: negative and significant impact.
- **Vertical**: virtually no impact (-0.013) \Rightarrow not significantly different from zero.
- **Mixed**: negative and significant \Rightarrow probably driven by horizontal component.
- What really hurts firm productivity is *daily* reduction of working hours.

Results: Extensions

2) Reasons

- Firms declaring to use part-time for accommodating for workers' requests suffer about **twice** from its use wrt firms declaring to willingly use it.
- Also firms willingly using part-time suffer from it:
 - ▶ Management myopia?
 - ▶ Or wage discrimination?
 - ▶ Good question: maybe next paper!

3) Clauses

- Using clauses **reduces** the negative impact of part-time on TFP by about 43%.
- Clauses are effective in reducing productivity losses associated with part-time \Rightarrow good for firms.
- Clauses may be good for workers too (until they do not make part-time a full-time work in disguise): they render part-time work more attractive to firms making them more prone to concede part-time.
- What is the 'optimal' amount of power to be given to firms? Good question for researchers in policy evaluation and welfare analysis!

4) Industry differentials

- Part-time work damages TFP in **all** the macro-categories of industries:
 - ▶ Manufacturing
 - ▶ Construction
 - ▶ Trade
 - ▶ Transportation and communication
 - ▶ Services.
- We only find a plus sign for the **retail** industry: coherent with theory.
- However: not statistically significant \Rightarrow we have few observations.

Conclusions

- Part-time work **damages** firm productivity.
- We interpret this finding in terms of **coordination and communication costs** it imposes on firms.
- This effect is driven by **horizontal** part-time: firms, use vertical part-time if possible!
- **Clauses** represent a good instrument in cushioning the negative effect of part-time: firms, use them!

Ideas for future research

- Is there any wage discrimination against part-timers, such that productivity losses may be compensated for by costs savings?
- What is the optimal level of firms' power wrt clauses?

Table 1: RIL-AIDA data set: distribution of observations by industry and number of observations

Industry	Frequence	Percentage
Manufacturing	6,897	49.76
Construction	2,002	14.44
Trade	1,46	10.58
Transportation and communication	1,111	8.02
Services	2,383	17.19
Total	13,860	100
Number of observations	Firms	Observations
1	5,967	5,967
2	2,421	4,842
3	1,017	3,051
Total	9,405	13,860

Source: RIL-AIDA data set (years: 2005, 2007 and 2010)

Table 2: RIL-AIDA data set: sample summary statistics

Variable	Mean	Std. Dev.	1st Q.	Median	3rd Q.
<i>Information from AIDA data set</i>					
Revenues	33,123,111	207,185,847	2,072,153	4,984,099	15,364,193
Value added	7,611,426	33,644,799	680,148	1,445,422	4,015,138
Personnel costs	4,596,118	18,639,319	483,370	1,001,541	2,604,675
Wages	3,179,241	12,991,786	340,868	700,014	1,823,686
Capital*	6,067,997	41,796,696	163,482	663,540	2,615,590
Raw materials	17,784,712	146,538,303	444,044	1,539,676	6,046,541
Profit	795,510	16,413,536	152	32,194	214,378
<i>Information from RIL data set</i>					
Employees	103.709	396.895	15	29	69
Female share	0.306	0.245	0.105	0.233	0.462
Non-EU share	0.058	0.110	0	0	0.068
Temporary share	0.105	0.153	0	0.055	0.140
Blue-collar share	0.593	0.299	0.400	0.692	0.822
White-collar share	0.361	0.279	0.152	0.268	0.533
Managers share	0.046	0.078	0	0.009	0.066
College share**	0.088	0.139	0	0.042	0.101
High-school share**	0.418	0.253	0.214	0.370	0.600
Middle-school share**	0.495	0.297	0.24	0.545	0.750
Under-25 share**	0.056	0.087	0	0.020	0.083
25-34 share**	0.244	0.179	0.118	0.208	0.333
35-49 share**	0.510	0.192	0.400	0.514	0.629
Over-50 share**	0.189	0.148	0.081	0.167	0.273
<i>Information from RIL data set: part-time work</i>					
Part-time share	0.084	0.141	0	0.040	0.098
Female part-time share	0.065	0.115	0	0.026	0.081
Male part-time share	0.019	0.058	0	0	0.009
Horizontal part-time share	0.070	0.126	0	0.029	0.083
Vertical part-time share	0.006	0.035	0	0	0
Mixed part-time share	0.008	0.051	0	0	0

Table 4: Results; basic model (part-time work); estimation methods: OLS, FE, IV

<i>Dependent variable: \widehat{TFP}_{it} (ACF-FE estimates)</i>											
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	OLS1	OLS2	OLS2010a	OLS2010b	OLS2010c	FE1	FE2	OLS-comp1	IV1	IV2	OLS-comp2
Part-time share	-0.219*** (0.030)	-0.146*** (0.031)	-0.182*** (0.049)	-0.182*** (0.049)	-0.192*** (0.049)	-0.115* (0.063)	-0.117* (0.066)	-0.169*** (0.055)	-0.273*** (0.104)	-0.252*** (0.095)	-0.195** (0.078)
Female share		-0.089*** (0.022)	-0.137*** (0.037)	-0.128*** (0.037)	-0.115*** (0.037)		0.017 (0.039)	-0.126*** (0.028)	-0.144*** (0.041)	-0.148*** (0.040)	-0.158*** (0.040)
Non-EU workers share		-0.123*** (0.033)	-0.102* (0.059)	-0.080 (0.059)	-0.094 (0.059)		0.008 (0.046)	-0.117*** (0.044)	-0.099 (0.064)	-0.099 (0.064)	-0.100 (0.067)
Temporary share		-0.049* (0.025)	-0.027 (0.039)	-0.018 (0.039)	0.026 (0.039)		0.161*** (0.042)	0.068 (0.042)	0.140** (0.057)	0.140*** (0.057)	0.141** (0.059)
Blue-collars share		-0.682*** (0.063)	-0.600*** (0.106)	-0.550*** (0.105)	-0.781*** (0.106)		-0.072 (0.068)	-0.931*** (0.103)	-0.854*** (0.140)	-0.856*** (0.140)	-0.861*** (0.146)
White-collars share		-0.526*** (0.065)	-0.433*** (0.111)	-0.392*** (0.111)	-0.542*** (0.114)		-0.074 (0.069)	-0.772*** (0.107)	-0.554*** (0.149)	-0.556*** (0.150)	-0.563*** (0.156)
Under-25 share			0.166** (0.0787)	0.184** (0.079)							
25-34 share			0.094** (0.044)	0.107** (0.044)							
35-49 share			0.062 (0.044)	0.073* (0.044)							
High-school share			0.011 (0.026)	0.005 (0.026)							
College-share			0.351*** (0.066)	0.334*** (0.067)							
Manager type				-0.058*** (0.017)							
Manager sex				-0.047*** (0.017)							
Manager age				0.060*** (0.021)							
Manager education				0.003 (0.014)							
10-19 Employees	-0.920*** (0.017)	-0.895*** (0.017)	-0.908*** (0.027)	-0.878*** (0.028)	-0.919*** (0.028)			-0.802*** (0.023)	-0.802*** (0.031)	-0.802*** (0.030)	-0.802*** (0.032)
20-49 Employees	-0.726*** (0.017)	-0.699*** (0.016)	-0.706*** (0.026)	-0.684*** (0.027)	-0.715*** (0.027)			-0.625*** (0.022)	-0.625*** (0.030)	-0.625*** (0.030)	-0.625*** (0.031)
50-249 Employees	-0.412*** (0.017)	-0.392*** (0.017)	-0.403*** (0.028)	-0.388*** (0.028)	-0.405*** (0.028)			-0.364*** (0.022)	-0.342*** (0.030)	-0.342*** (0.030)	-0.341*** (0.031)
Year dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry dummies	yes	yes	yes	yes	-	-	yes	yes	yes	yes	yes
Region dummies	yes	yes	yes	yes	-	-	yes	yes	yes	yes	yes
Year * Industry dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	13,860	13,860	5,216	5,216	5,216	6,989	6,989	6,989	3,536	3,536	3,536
Number of firms	9,405	9,405	5,216	5,216	5,216	3,089	3,089	3,089	2,738	2,738	2,738

Source: RIL-AIDA data set (years: 2005, 2007 and 2010)

Robust standard errors in parentheses; ***, **, and * denote, respectively, the 1%, 5%, and 10% significance level. The reference group for blue- and white-collar workers' share is managers' share; for the age distribution it is the over-50-years-old share; for education distribution it is the middle-school share; and for the size dummies it is more than 250 employees. The region dummies consist of 20 dummies, 1 for each administrative region in Italy; the industry dummies account for 199 dummies, 1 for each 3-digit Ateco 2002 industry; and the year * industry dummies are the interactions between year and industry dummies, as previously defined. 'Manager type' is a dummy that takes the value 0 if the manager is the owner and 1 if he/she is an internal/external manager; 'manager sex' is a dummy that equals 1 if the manager is a female; 'manager age' is a dummy that equals 1 if the manager is aged over 40; and 'manager education' is a dummy that takes the value of 1 if the manager has a college degree or more.

Table 5: **Results; extensions: types of part-time work; estimation method: OLS**

Dependent variable: \widehat{TFP}_{it} (ACF-FE estimates)

Horizontal part-time share	-0.148***	(0.033)
Vertical part-time share	-0.013	(0.101)
Mixed part-time share	-0.197**	(0.081)

Number of firm-year observations: 13,860
Number of firms: 9,405

Source: RIL-AIDA data set (years: 2005, 2007 and 2010)

All the estimations include the same set of controls as in Specification (2) of Table 4. See the footnote of Table 4.

Table 6: **Results; extensions: reasons for the use of part-time work; estimation method: OLS**

Dependent variable: \widehat{TFP}_{it} (ACF-FE estimates)

	Workers' requests	Firms' willingness
Part-time share	-0.254*** (0.065)	-0.134*** (0.050)
Number of firm-year observations	6,411	2,828

Source: RIL-AIDA data set (years: 2005, 2007 and 2010)

The estimates are performed on sub-samples of firm-year observations using part-time work (9,434). To split the sample on the basis of the reasons for part-time use (i.e. either workers' or firm's willingness), we have to remove those observations (amounting to 195) for which the item 'other reasons' has been chosen, since we do not know whether they belong to the first or the second group. All the estimations include the same set of controls as in Specification (2) of Table 4. For the rest, see the footnote of Table 4.

Table 7: **Results; extensions: flexible and/or elastic clauses; estimation method: OLS**

<i>Dependent variable: \widehat{TFP}_{it} (ACF-FE estimates)</i>		
	Flexible and/or elastic clauses	No clauses
Part-time share	-0.108** (0.051)	-0.191*** (0.058)
Number of firm-year observations	3,467	5,967
Only years 2005 and 2007		
Part-time share	-0.055 (0.078)	-0.103* (0.062)
Number of firm-year observations	2,014	3,123
Only year 2010		
Part-time share	-0.170** (0.068)	-0.271*** (0.089)
Number of firm-year observations	1,453	2,844

Source: RIL-AIDA data set (years: 2005, 2007 and 2010)

The estimates are performed on sub-samples of firm-year observations using part-time work (9,434). All the estimations include the same set of controls as in Specification (2) of Table 4. For the rest, see the footnote of Table 4.

Table 8: **Results; extensions: industry differentials; estimation method: OLS**

<i>Dependent variable: \widehat{TFP}_{it} (ACF-FE estimates)</i>				
Industry	Part-time share	Observations	Mean	Std. Dev.
Manufacturing	-0.122** (0.050)	6,897	0.062	0.089
Construction	-0.228* (0.118)	2,002	0.049	0.075
Trade	-0.215** (0.091)	1,467	0.106	0.140
of which: Retail	0.006 (0.141)	346	0.173	0.189
Transportation and communication	-0.467** (0.186)	1,111	0.055	0.094
Services	-0.203*** (0.048)	2,383	0.177	0.245
Number of firm-year observations: 13,860				
Number of firms: 9,405				

Source: RIL-AIDA data set (years: 2005, 2007 and 2010)

All the estimations include the same set of controls used as in Specification (2) of Table 4. For the rest, see the footnote of Table 4.