

Has voucher work favoured unreported employment? An analysis of subsidiary employment in Tuscany

ALBERTO MAZZON

*Joint Doctoral Programme in Economics
Universities of Siena, Pisa and Firenze*

June 20, 2017

Abstract

In Italy, since 2008, *subsidiary employment* (or *voucher work*) spread throughout the economy, triggering criticism and concern from many economists and trade unionists. However, research on this phenomenon is still at an unsatisfactory level. In particular, it is not clear whether subsidiary work reached its objective of fighting irregular employment. According to critics, in fact, the recourse to vouchers might as well have favoured the hiring of unreported workers. Using a database on vouchers used in Italy between 2010 and 2017, combined with additional data on Tuscan workers and firms, I exploit a recent policy change to calculate a difference-in-difference estimator to assess whether vouchers have been used to conceal irregular employment. Results show that the introduction of a policy intended to control the use of this instrument caused the number of hours contracted in subsidiary employment to plunge after October 2016.

1 Introduction

In 2016, the impact of *subsidiary employment*¹ on the national labour market has given rise to an intense public debate in Italy. Often referred to as *voucher work*, subsidiary employment at the moment of its introduction had a purpose close to that of French *chèques emploi services (CES)* [22]. It was, in fact, meant to provide families and small businesses with a flexible instrument to regulate occasional or seasonal activities often confined in the shadow economy [19].

Subsidiary employment is just one example of the rise of alternative contractual arrangements in Europe and other developed economies. Other

¹Literal translation of *lavoro accessorio*.

examples include British zero-hour contracts and German mini-jobs. The spreading of these non-standard forms of work is argued to be the result of the increasing need for flexibility in the knowledge economy [9] [12]. These contractual arrangements can be a great accelerator for individuals who struggle to gain access to the formal labour market. However, non-standard work is often associated with less favourable conditions in terms of pay, training opportunities, and access to social security with respect to standard employment [10].

In Italy, the spreading of subsidiary employment prompted critiques and warnings from economists, trade unionists, and policy analysts fearing that this instrument was becoming a threat to workers' rights and job security. To understand why, consider that in the time span of just a few years the number of subsidiary workers became more than 70 times larger: from less than 25 thousand in 2008 to nearly 1.8 million in 2016. What was supposed to be an almost *niche* instrument threatened to become the "new frontier of precarious employment", as Prof. Boeri ² warned in May 2015 [16]. Since then, the debate has escalated to the point where CGIL, the country's biggest trade union, threatened to insert a bill abolishing subsidiary employment in an upcoming referendum on labour reforms [7]. To avoid a potential political loss, on April 2017 the government decided to repeal subsidiary employment starting from January 2018 [14].

The abolition of voucher work did not bring to an end the discussion concerning its impact on the Italian labour market. Little or no research has been published so far on the topic: the public debate, as well as legislative action, appears to be fuelled more by public opinion and rhetoric than by grounded evidence. For this reason, the real consequences of the introduction of vouchers are generally unknown. Given the success of this instrument, it is reasonable to assume that it addressed the need of some employers and workers for an arrangement capable of regulating flexible and non continuous activities. However, whether subsidiary employment provided a valuable instrument to regulate occasional work or crowded out the standard labour contract remains unclear. While the government is in the process of devising an instrument that can replace it [4], it is useful to shade a light on voucher work and how it succeeded or failed in improving the conditions of marginalised workers.

The relationship between vouchers and irregular employment is at the core of this research. Given how vouchers were originally designed, it is generally believed that in many cases they might have been used from employers to avoid sanctions when they employed irregular workers. For this reason, a regulation has been approved in October 2016, making the tracking of every voucher almost instantaneous. In this research, I exploit this policy change to investigate whether it significantly affected vouchers

²President of the National Social Security Institute (INPS).

sales. To do so, I exploit a database containing record of vouchers used in Italy in a period comprised between 2010 and 2017, combined with two additional datasets on Tuscan firms and workers.

Section two summarises subsidiary employment regulation and its evolution up to now. Section three shows how voucher work spread throughout the Italian labour market since 2008 and outlines the main research question. Section four describes the methodology adopted for the analysis and the characteristics of the datasets. Section five summarises the evolution of subsidiary employment in Tuscany. Section six contains the result of the empirical analysis. Conclusions follow.

2 How subsidiary employment works

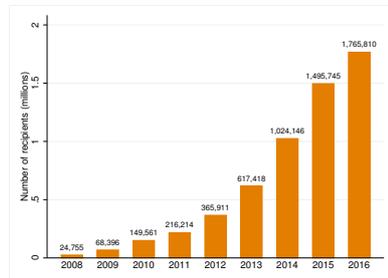
Subsidiary employment was first introduced in 2003, as part of a large reform of the national labour market (the so-called "*legge Biagi*") and was assigned specific goals. Its distinctive trait is the lack of a labour contract: it is based on the use of vouchers as means of payment for the workers' services. The use of vouchers was limited to *casual* and *ancillary* activities "performed by individuals at risk of social exclusion, not participating in the labour market or about to leave it".³ They were intended to provide a viable alternative to informal employment for a set of activities often confined to the shadow economy, while favouring the inclusion of peripheral and marginalised workers [20]. The activities in question included for instance: housework and care work, private tuition, small-scale gardening and cleaning, and the organisation of occasional events. The pool of eligible workers was limited to the long-term unemployed, housewives and retirees, as well as non-EU migrants with a regular residency permit. Hours of work were limited to 30 per month and earnings to €3,000 per year.

The initial price of a voucher was set at €7.5 gross, 5.8 of which accrued to the worker net of tax and social security while the remainder was divided between a small fee for operating costs, employer's contributions to a special pension fund and an occupational hazard insurance scheme. Hence, social security costs from the beginning were set to be much lower than for any other type of contract in Italy. The same is true for benefits, since vouchers recipients could not and still cannot claim any benefit other than insurance payments in case of accidents, and a very small pension income. From the start, therefore, Italian law set vouchers as something clearly apart from anything like a standard labour contract.

While the regulation was introduced in 2003, vouchers began to circulate only in 2008 [13]. Thereafter, the scheme was repeatedly revised and the most consequential changes were enforced at different dates between 2008

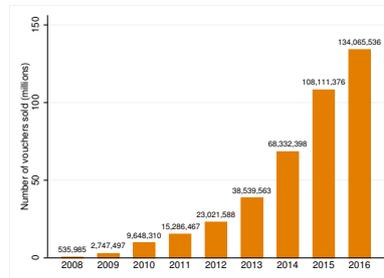
³Act 276/2003, art. 70.

Figure 1: Number of recipients per year, 2008-2016.



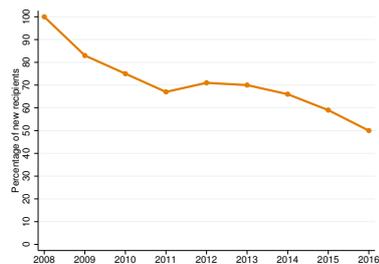
Source: [24]

Figure 2: Number of vouchers sold per year, 2008-2016.



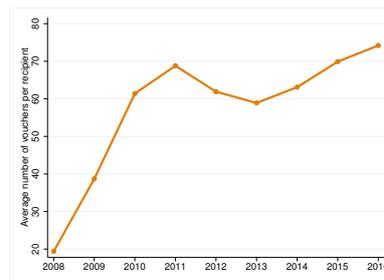
Source: [24]

Figure 3: Percentage of new recipients per year, 2008-2016.



Source: [24]

Figure 4: Average number of vouchers per recipient per year, 2008-2016.



Source: [24]

and 2015. Firstly, the range of admissible activities was expanded until eventually encompassing the whole economy, with a few specific exceptions within agriculture [23]. Secondly, eligible workers no longer needed to belong to groups on the margins of the labour market but comprised almost everybody, including full-time employees or self-employed workers wishing to supplement their earnings. Employers can be families, entrepreneurs, professionals, non-profit organisations and even public authorities. Thirdly, the price per voucher was eventually set at the current value of €10 and total earnings were capped higher: each worker can now cash vouchers for up to €2,000, net, per year from a single employer and for up to €7,000, net, per year from all his or her employers combined [18]. The selling of voucher was also made easier, for example by adding tobacconists to the list of authorised sellers.

3 Spreading of vouchers

During the period of progressive de-regulation, vouchers became increasingly popular. As noted above, the growth was exponential between 2008 and 2016, as measured by the number of vouchers sold and the number of persons involved. If we qualify as recipients all those who cashed at least one voucher in the reference year, their number grew from almost 25,000 in 2008 to almost 1.8 million in 2016 (Figure1). During the same period, the number of vouchers sold grew from about half a million in 2008 to more than 134 million in 2016 (Figure2).⁴

The use of vouchers spread across sectors, some more than others, but households remained peripherally involved [2]. In 2015, the number of employers doubled with respect to 2013, exceeding 473,000 units. About two thirds of them were firms operating in the secondary and tertiary sector, with the largest share accruing to tourism and manufacturing. Only 15% of all employers were families, while employers operating in agriculture accounted for less than 4%. In 2015, the average number of recipients per employer amounted to 3.5. However, only 3% of all employers hired more than five workers over the course of one year.

Turn over of recipients, despite a downward trend, remained high in 2016. Year after year, new entrants (or re-entrants) were and remained the majority (Figure3). The percentage of voucher workers not having performed subsidiary work in the previous year followed a decreasing trend since 2008, but always stayed above 50%. This figure reflects the fast spreading of vouchers in the period under consideration. However, it can also be interpreted as showing that for most recipients, subsidiary employment largely represented a temporary condition lasting less than one year.

Despite the pace of growth in sales, until 2016 the average number of vouchers per worker per year was roughly stable between 60 and 70 (Figure4). This suggests that most work spells on vouchers tended to be short, sometimes even a few hours in the whole year.

Earnings per recipient were also low, consistently with the low number of vouchers per head. In 2015, annual average earning ranged from €554 for the youngest recipients to €700 for the oldest ones (Table1). Moreover, in 2015 more than three-fifth of all recipients totalled less than €500 each and more than one in seven recipients cashed less than 5 vouchers in the

⁴Figures concerning the evolution of subsidiary employment at a national level, as presented in this section, are mainly drawn from two sources. The first is the "basic figures" published by the National Social Security Institute [24], updated at December 2016 but providing very minimal information limited to voucher sales. The second is the paper by Anastasia et al. [2], the most comprehensive work published so far on vouchers, including many descriptive statistics and updated at December 2015. The figures presented in this section have always been drawn from the most updated source.

whole year (Table2).

In the light of this figure, it would be surprising if vouchers represented the only source of income for the majority of recipients. There are no clear official data on this respect, but it was estimated that in 2015, excluding very young workers who were still likely to be dependent on their families, the share of recipients for whom vouchers were the sole source of income may have been less than 25% [8].

How can the pervasive diffusion of subsidiary employment be reconciled with the evidence that vouchers represented a marginal source of income for most recipients? I believe there are several, non mutually exclusive, explanations. The purpose of this research is to analyse one of them, namely the possibility that vouchers have been used in a fraudulent way to conceal irregular employment relations.

Hiring shadow workers in Italy is a widespread practice [11], and vouchers were supposed to provide a viable alternative for casual, irregular activities. Nevertheless, for many years they might have had the opposite result of favouring unreported employment. The reason is that firms could pay fewer vouchers than the hours they contracted. Moreover, they could pay workers cash in hand as a rule and hold a certain amount of vouchers to be exhibited in the event of an inspection or when a worker injured himself or herself and needed insurance coverage. At present there is little or no information on the extent of this phenomenon. The segment of recipients at risk of fraudulent behaviour may coincide with those relying on vouchers as the only source of income [8].

From October 2016, subsidiary employment regulation changed in order to make the tracking of vouchers almost instantaneous⁵. Even before this regulation, the employer had to register each voucher by providing information on himself, the worker, and the activity (including the time and place where it was performed). However, the employer could register the voucher in the 30 days after the activity had been performed [6]. Since October 2016, the communication concerning the activity must be made via text message or e-mail to the National Social Security Institute at least one hour before the activity takes place. Non compliance may result in fines ranging from €400 to €2,400 for each non declared worker. Hence, in the last months fraudulent use is believed to have substantially reduced, although definitive evidence in support of this is still not available [5]. This policy change can be used in a difference-in-difference framework to assess whether it caused a decreased in the number of vouchers used by firms. The following section sets up this framework.

⁵Act 185/2016, art. 1.

Table 1: Annual earnings by age of voucher recipients.

Age	Number of recipients	%	Average annual earnings per recipient (€)
<25	431,613	31.0	554
26-59	849,968	61.0	660
60-65	57,483	4.1	762
>65	53,842	3.9	700

Source: [20]

Table 2: Number of recipients by number of vouchers cashed.

Number of vouchers cashed	Number of recipients	%
1-5	232,348	13.2
6-10	200,885	11.4
11-25	315,812	17.9
26-55	327,754	18.6
56-100	250,350	14.1
101-200	246,628	13.9
>200	191,933	10.9
Total	1,765,710	100

Source: [24]

4 Data and Methods

4.1 A general model for the difference-in-difference design

Difference-in-difference (DID) estimation is one of the most important identification strategies in applied economics [3][17]. The basic set up to apply difference-in-difference is the one in which two or more groups in a population are observed for two or more time periods. In some periods some groups are exposed to a new regime that is the object of the evaluation. The reason to apply DID derives from the concern that comparing different groups at the same point in time is potentially biased because the groups may differ systematically in unobserved ways. The comparison of the same group at different points in time is potentially biased because other changes may occur over time [15].

Let individual i belong to a group, $G_i \in \{0, 1\}$ (where group 1 is the treatment group), and be observed in time periods $T_i \in \{0, 1\}$. Letting the outcome be Y_i , the observed data are the triple (Y_i, G_i, T_i) .

Let $Y_i(0)$ denote the potential outcome for individual i if that individual does not receive the treatment, and let $Y_i(1)$ be the potential outcome for the same individual if he or she receives the treatment. $I_i = G_i \cdot T_i$ is an indicator for the treatment. The realised (or observed) outcome for individual i is:

$$Y_i = Y_i(0) \cdot (1 - I_i) + Y_i(1) \cdot I_i \quad (1)$$

In the standard DID model the outcome for individual i in the absence of the intervention satisfies:

$$Y_i(0) = \alpha + \beta T_i + \gamma G_i + \epsilon_i \quad (2)$$

The parameter β represents the time component. The parameter γ represents a group-specific, time-invariant component. The last term $\epsilon_i \perp (G_i, T_i)$, represents unobservable characteristics of the individual. The standard DID estimand is:

$$\begin{aligned} \tau^{DID} = & [E[Y_i|G_i = 1, T_i = 1] - E[Y_i|G_i = 1, T_i = 0]] \\ & - [E[Y_i|G_i = 0, T_i = 1] - E[Y_i|G_i = 0, T_i = 0]] \end{aligned} \quad (3)$$

The interpretation of τ^{DID} depends on assumption about how outcomes are generated in the presence of the intervention. It is often assumed that the treatment effect is constant across individuals, so that $Y_i(1) - Y_i(0) = \tau$. Combining this restriction with the standard DID model for the outcome without intervention this leads to a model for the realised outcome:

$$Y_i(0) = \alpha + \beta T_i + \gamma G_i + \tau I_i + \epsilon_i \quad (4)$$

More generally, the effect of the intervention might differ across individuals. Then, the standard DID estimand gives the average effect of the intervention on the treatment group. Given the model in (4), τ can be estimated using Ordinary Least Squares:

$$\hat{\tau} = \bar{Y}_{11} - \bar{Y}_{10} - (\bar{Y}_{01} - \bar{Y}_{00}) \quad (5)$$

Let N_{gt} be the number of observations in time period t and group g :

$$N_{gt} = \sum_{i=1}^N 1_{G_i=g, T_i=t} \quad (6)$$

Then, the average outcome in period t and group g is:

$$\bar{Y}_{gt} = \frac{1}{N_{gt}} \sum_{i|G_i=g, T_i=t} Y_i \quad (7)$$

Assuming that residuals are homoskedastic, then the variance of the DID estimator is given by:

$$V(\tau)_{homosk} = \sigma^2 \cdot \left(\frac{1}{N_{11}} + \frac{1}{N_{10}} + \frac{1}{N_{01}} + \frac{1}{N_{00}} \right) \quad (8)$$

The robust variance would be:

$$V(\tau)_{heterosk} = \frac{\sigma_{11}^2}{N_{11}} + \frac{\sigma_{10}^2}{N_{10}} + \frac{\sigma_{01}^2}{N_{01}} + \frac{\sigma_{00}^2}{N_{00}} \quad (9)$$

The within group/time-period variance σ_{gt}^2 is estimated as:

$$S_{gt}^2 = \frac{1}{N_{gt} - 1} \sum_{i|G_i=g, T_i=t} (Y_i - \bar{Y}_{gt})^2 \quad (10)$$

The model can be generalised in presence of covariates. If X_i is observed for unit i , the structure becomes:

$$Y_i = \alpha + \beta T_i + \gamma G_i + \tau I_i + \delta' X_i + \epsilon_i \quad (11)$$

The assumption in this case requires ϵ_i to be independent of both the time/group dummies and the covariates. OLS can again be used to estimate all parameters.

4.2 Data

To perform the analysis, the main dataset has been provided by the National Social Security Institute (INPS). It is composed by a record of vouchers sold and used in Italy between 2010 and March 2017⁶. The unit of measurement is a single activity (which can correspond to more than one voucher). For each entry, the database displays the type of activity performed, and the sector of the employer. Information on workers include their gender, their age, and the province or foreign country of birth. Finally, for each voucher are reported the dates in which it has been sold and cashed, and the dates in which the activity began and ended, together with the province where the voucher has been sold.

This database is matched to two additional sources. The first database is derived from *Registro Asia* which records Italian corporations with at least one employee and is collected by the National Statistical Institute (ISTAT), updated to 2014. It includes details on the firms' location, sector, number of employees, and revenues.

The second database is drawn from *Comunicazioni Obbligatorie*, a large information system in which firms communicate the relevant events relative

⁶The dataset tracks vouchers sold between 2009 and 2016. However, some information collected before 2014 may be unreliable. Hence, at this stage I will only take into account subsidiary employment relations that started after January 2014.

to every employment contract they begin or terminate. Using this record, each voucher worker is matched to his or her working history preceding or following his or her last subsidiary employment activity. Variables include the workers' tasks, the different types of contract, the reason of termination of each job, and the sectors of the employers.

While the database on voucher sales is a sample of all subsidiary employment relations that have taken place in Italy, the two additional datasets are limited to Tuscan firms. For this reason, the present research is limited to the case of Tuscany. My intention, however, is to broaden the scope of the analysis supplementing these data with others coming from different regions.

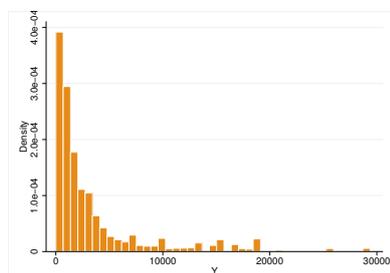
4.3 The model to be estimated

The objective of this analysis is to assess to what extent the October 2016 regulation affected the use of vouchers by employers of subsidiary workers. As noted above, to calculate the DID estimator I need to identify in the data the triple (Y_i, T_i, G_i) , possibly integrated with a set of covariates X_i . For what concerns the time period, I choose to aggregate data on a monthly basis, hence the pre-treatment period goes from January 2015 to September 2016. The post-treatment period starts on October 2016 and ends on December 2016.

The allocation of observations into treatment and control groups is less straightforward. In standard applications, a control group would be composed by employers who were not affected by the 2016 regulation and had no incentive in changing their behaviour as voucher purchasers. However, the legislation under analysis was enforced at national level and applies to all employers, leaving the control group virtually empty. A way to overcome this problem is to take public and private employers as representing the control group and the treated group, respectively. De facto, public employers cannot resort to irregular employment, hence they should not have been affected by the 2016 reform. Given that the public sector is a relevant employer of subsidiary workers, the control group is not small in comparison to the treatment group.

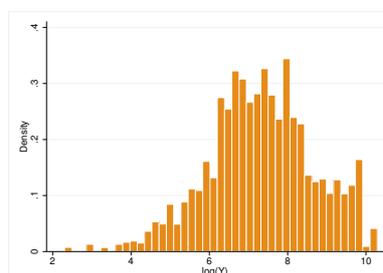
Finally, the choice of the outcome variable presents two possibilities. I could consider the number of vouchers purchased by each employer or, alternatively, the number of hours that each employer contracted in a specific month. In order to make the most appropriate choice, I consider the fact that the government already during summer 2016 had announced that a regulation on voucher traceability was about to be proposed to the parliament. For this reason, I believe that voucher purchases might have decreased in anticipation of this change of policy even before the implementation. However, there is no reason why the number of hours contracted had to change in anticipation of the law. Employers, even those using vouchers in

Figure 5: Distribution of Y.



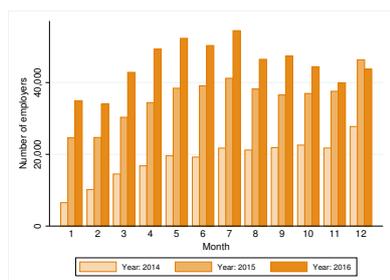
Source: INPS [2017], own calculations.

Figure 6: Distribution of log(Y).



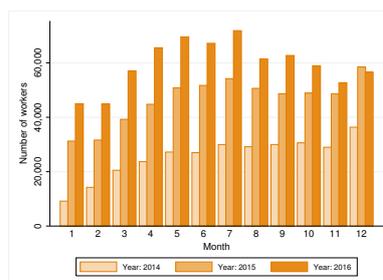
Source: INPS [2017], own calculations.

Figure 7: Number of voucher employers per month in Tuscany, 2014-2016.



Source: INPS [2017], own calculations.

Figure 8: Number of recipients per month in Tuscany, 2014-2016.



Source: INPS [2017], own calculations.

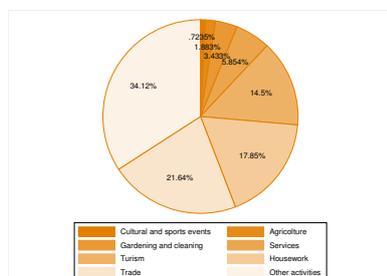
a fraudulent way, are likely to have maintained business as usual as long as possible, and to have changed their behaviour only when forced to do so.

The dependent variable, therefore, is the number of vouchers used (or, equivalently, of hours contracted) by a single employer in a month. The period of observation ranges from January 2015 to March 2017. I will employ the log of the number of hours, given the positively skewed distribution of the linear variable. The two distributions can be compared in Figure5 and Figure6.

5 Subsidiary employment in Tuscany

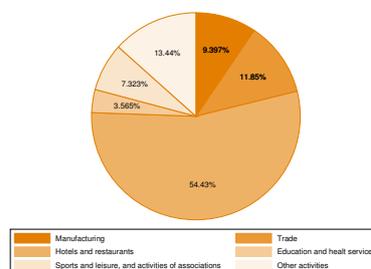
Before proceeding with the analysis let's consider the evolution of subsidiary employment in the region of Tuscany. Between 2008 and 2016, in Tuscany more than 27 million vouchers have been sold, approximately 7% of all vouchers sold in Italy in the same period [24]. Following the same pattern

Figure 9: Main activities performed by voucher workers in Tuscany, 2016.



Source: INPS [2017] and Asia [2014], own calculations.

Figure 10: Main sectors of activity of firms purchasing vouchers in Tuscany, 2016.



Source: INPS [2017] and Asia [2014], own calculations.

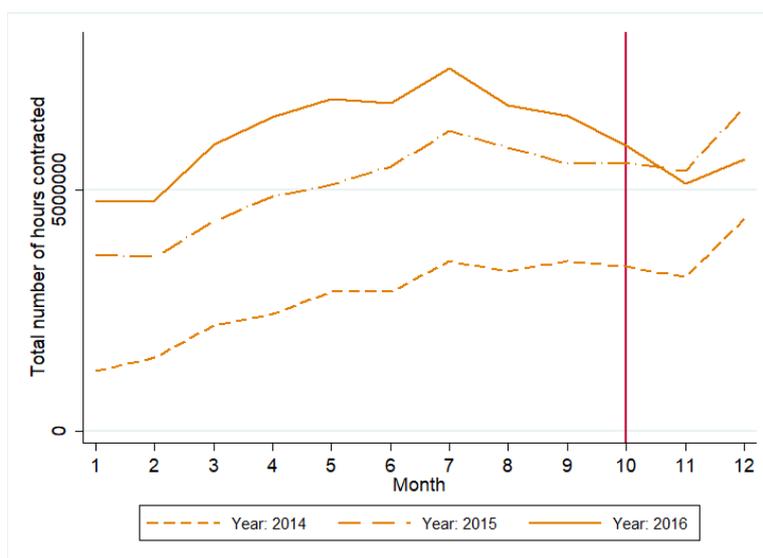
witnessed on a national level, the number of voucher activities has been growing in the recent years, reaching 7.3 million in 2016.

The number of recipients and employers do not grow constantly over the year, as shown by Figure 7 and 8. In fact, although at different levels, they show a similar trend in every year. In particular they exhibit a higher growth in summer and december with respect to the other months. This observation is consistent with the results reported in Figure 9, showing the relevance of activities related to tourism for subsidiary workers.

Figure 10 shows the main sectors of activity of firms who employ subsidiary workers. More than half of these are hotels, restaurants, or other tourism-related facilities. Consistently with what is shown by national data, also manufacturing and trade are relevant.

Figure 11 shows the number of vouchers used by month in Tuscany in the three years under consideration. As noted above, the relevance of subsidiary employment has been growing year after year. However, in the last months of 2016 the growth slowed down and eventually the trend reversed with respect to the same months of the previous years. Even more, in November and December 2016 the number of hours contracted has been lower than in November and December 2015. At a first glance, therefore, the graph seems to suggest that the policy introduced in September 2016 had the effect of reducing the recourse to vouchers. If the relation of causality between the two events were proven to be true, then we could affirm that until September 2016 voucher had been often used in a fraudulent way by firms employing irregular workers.

Figure 11: Number of hours contracted in subsidiary employment in Tuscany by month, 2014-2016.



Source: INPS [2017], own calculations.

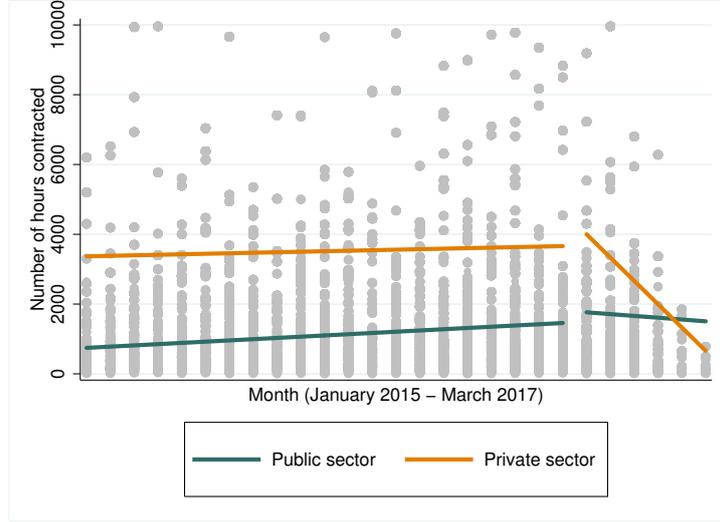
6 Analysis

As Figure 11 suggested, the introduction of the 2016 regulation on voucher traceability might have decreased the number of vouchers sold. This evidence would suggest that in the previous periods vouchers were often used in a fraudulent way, in order to avoid sanctioning in case of hiring of irregular workers.

To provide more robust evidence I will use the DID estimator explained in Section 4. To do so, I divide the population into treatment and control group. The treatment group is composed by employers in the private sector and the control group by employers in the public sector. As noted above, the basic steps to calculate a DID estimator are two. The first consists in calculating the difference between the post-treatment value and the pre-treatment value of the outcome variable for the treatment and the control groups. Then, the difference calculated for the control group is subtracted to the one calculated for the treatment group.

A naive DID estimate can be calculated by simply subtracting the difference in the average outcome for the treatment group before and after treatment from the difference in the average outcome for the control group before and after the treatment:

Figure 12: Linear trends in the number of hours contracted, before and after October 2016.



Source: INPS [2017] and C. O. [2017], own calculations.

$$(\bar{Y}_{11} - \bar{Y}_{10}) - (\bar{Y}_{01} - \bar{Y}_{00}) = \hat{\tau}^{DID}$$

$$(3,184.9 - 3,534.1) - (1,839.5 - 1,168.7) = -1,020$$

The result is negative and large compared to pre-treatment values of the outcome variables. However, to obtain the DID estimator with standard errors I have to run a regression on the form of Equation (11):

$$\log(Y_i) = \alpha + \beta T_i + \gamma G_i + \tau T_i \cdot G_i + \delta'_1 M_i + \delta'_2 H_i + \delta'_3 X_i + \epsilon_i \quad (12)$$

Where $\log(Y_i)$ is the logarithm of the number of hours paid with vouchers by a certain firm in a month. T_i , G_i are the familiar time and treatment dummy variables. M_i is a monthly dummy variable, to account for seasonal trends. H_i is a yearly dummy, to account for year-specific differences. X_i is a set of covariates controlling for the type of activity the voucher worker has performed, and the sector in which the employer operates. The coefficient associated with the interaction term, $\hat{\tau}$ is the DID estimator. The result can be summarised in Table 3.

The DID estimator is significant at the conventional 5% level. As the *naive* estimate calculated by hand, it has a negative sign showing that in the post treatment period the number of vouchers used in the private sector decreased in response to the new policy. This result should not be considered

final, rather a tentative approach derived from a first rough manipulation of the data. It can, indeed, be refined in countless ways including the following ones.

First, the DID relies on the fundamental assumption that the trends in the outcome variable experienced by the treatment and the control group are the same. While Figure 12 suggests that the increase in the number of vouchers used by the private and public sector followed a similar positive trend before October 2016, the equality between the two must be proven in a more robust way.

Second, the DID is sensitive to change in the specification of the outcome variable. A model with linear dependent variable is not directly comparable to a model in logs, given they make assumptions about independence of residuals based on two different specifications of the dependent variable. Often there is no theoretical reason why one should prefer one model instead of the other. A different way to estimate $\hat{\tau}$ could be resorting to the linear variable and a Tobit model to account for its left truncation. Non-linear difference-in-difference models have already been used in the literature [1] [3]. In the context of Tobit and other latent variable models, the treatment effect cannot be constant across the treated population, making the interpretation of DID coefficients non straightforward [21].

Other extensions of this analysis include the use of an improved database. Because of limited information, so far I have only managed to partially match firms in the three databases resulting in a rather small and possibly selected sample. Increasing the precision of the matching of the datasets would result also in the inclusion of other relevant variables such as the number of employees of each firm, or its profits in the year. Another way to improve the data would be to obtain the same information for different regions, in particular those where irregular work is more widespread.

Despite the many fallacies, I believe that the result of this analysis still shows the existence of a negative effect on voucher sales of the implementation of the regulation. A decrease that apparently cannot be explained if we do not consider the possibility of fraudulent use of subsidiary employment.

7 Conclusions

This research focussed on the relation between subsidiary employment and the shadow economy. By means of a difference-in-difference estimator, I wish to convince the reader that, instead of preventing informal employment, vouchers may as well have favoured it. The decrease in the number of vouchers used by firms, as shown both by the descriptive statistics and by the results of the regression, provides evidence in favour of this hypothesis.

This analysis may be refined in several ways, and some of those have been listed in the previous section. However, I believe that this provisional

Table 3: Difference-in-difference treatment effect estimation with covariates, OLS regression with robust standard errors.

Number of observations: 20854				
	<i>Before</i>	<i>After</i>		
<i>Control</i>	345	110	455	
<i>Treated</i>	17485	2914	20399	
	17830	3024		
Outcome variable	log(Y_i)	S.E.	 t 	P> t
Before				
-Control	5.765			
-Treated	5.939			
Diff (T-C)	0.174	0.060	2.90	0.004***
After				
-Control	5.776			
-Treated	5.643			
Diff (T-C)	-0.133	0.119	1.12	0.263
Diff-in-diff	-0.307	0.132	2.32	0.020**
R-square: 0.11				
*Means and standard errors estimated by linear regression				
**Robust standard errors				
Inference: *p<0.01; **p<0.05; *p<0.1				

result still raises many questions concerning, for instance, the relation between the formal and the shadow economy. While irregular employment is in general deplorable, as any form of tax evasion, we can wonder whether it really makes sense for the State to try to provide a legal framework for genuinely occasional activities, mainly performed in the boundaries of domestic work. Moreover, given the failure of vouchers in preventing undeclared employment, the implementation of a more efficient strategy must be taken into consideration by the competent authorities.

Other questions can be raised when we consider subsidiary unemployment as a whole. As reported in this article, voucher sales increased sharply in the last years. What we witness, however, is that subsidiary employment has been a very marginal experience in the working career of most workers, both in terms of earnings and in terms of duration. How is possible that, despite the progressive deregulation, a very flexible and cheap form of employment did not manage to take over the whole labour market? These questions, and many more, are clearly way beyond the scope of this research, but they are listed here to provide the reader with food for thought.

The Italian experience of voucher work constitutes an interesting source of information for many reasons. The main one is that, despite its repeal, it can still provide us with useful insight on the effect that extreme forms of flexibilisation of labour contracts can produce on the labour markets. A better understanding of the dynamics that occurred in Italy during the brief implementation period of vouchers could help us figure out the answer to some questions concerning the future of work in developed economies. While many other countries introduced non-standard labour contracts in their labour markets, it is still unclear whether these constitute a trap or a stepping stone for marginalised workers. I believe this is a relevant problem that can inspire future research on the topic.

References

- [1] C. Ai and E. C. Norton. "Interaction terms in logit and probit models". In: *Economics letters* 80.1 (2003), pp. 123–129.
- [2] B. Anastasia, S. Bombelli, and S. Maschio. "Il lavoro accessorio dal 2008 al 2015. Profili dei lavoratori e dei committenti". In: *WorkInpsPaper* 2/2016 (2016).
- [3] S. Athey and G. W. Imbens. "Identification and inference in nonlinear difference-in-differences models". In: *Econometrica* 74.2 (2006), pp. 431–497.
- [4] F. Barbieri. "Lavoro occasionale, famiglie e imprese con più limitazioni". In: *Il Sole 24 Ore* (June 5, 2017).

- [5] P. Baroni. "La tracciabilità frena la corsa dei voucher". In: *La Stampa* (Jan. 19, 2017).
- [6] G. Carosielli. "Dalla comunicazione preventiva alla tracciabilità: é questa la via per evitare l'abuso dei voucher?" In: *BollettinoAdapt* (Sept. 5, 2016).
- [7] CGIL. *Referendum: prosegue la campagna referendaria*. Mar. 9, 2017. URL: www.cgil.it (visited on 06/06/2017).
- [8] R. CiccioMessere. *Il lavoro occasionale di tipo accessorio*. 2015. URL: www.robertociccioMessere.eu (visited on 06/06/2017).
- [9] C. Codagnone, F. Abadie, and F. Biagi. "The Future of Work in the Sharing Economy. Market Efficiency and Equitable Opportunities or Unfair Precarisation?" In: *Institute for Prospective Technological Studies* (2016).
- [10] European Commission. "The future of work. Skills and resilience in a world of change". Brussels, 2016.
- [11] C. De Gregorio and A. Giordano. "The heterogeneity of irregular employment in Italy: some evidence from the Labour force survey integrated with administrative data". In: *ISTAT Working Papers* 1 (2015).
- [12] V. De Stefano. "The Rise of the 'Just-in-Time Workforce': On-Demand Work, Crowd Work and Labour Protection in the 'Gig-Economy'". In: *Conditions of work and employment series* 71 (2015).
- [13] A. Guglielmo and V. Lippolis. "Lavoro occasionale di tipo accessorio". In: *Diritto e Pratica del Lavoro* 8 (2012).
- [14] IlPost. *I referendum della CGIL non si fanno più*. Mar. 17, 2017. URL: www.ilpost.it (visited on 06/06/2017).
- [15] G. W. Imbens and J. M. Wooldridge. "Recent developments in the econometrics of program evaluation". In: *Journal of economic literature* 47.1 (2009), pp. 5–86.
- [16] LaRepubblica. "Boeri: i voucher lavoro". 2015. URL: www.repubblica.it.
- [17] M. Lechner et al. "The estimation of causal effects by difference-in-difference methods". In: *Foundations and Trends in Econometrics* 4.3 (2011), pp. 165–224.
- [18] A. Natali. "Lavoro accessorio: condizioni e limiti operativi". In: *Diritto e Pratica del Lavoro* 1 (2016).
- [19] M. Pala. "Cariticità del lavoro accessorio (voucher) dopo la legge 99/2013". In: *Il Sole 24 Ore* (July 16, 2014).
- [20] Ministero del Lavoro e delle Politiche Sociali. *L'utilizzo dei voucher per le prestazioni di lavoro accessorio*. 2016. URL: www.lavoro.gov (visited on 06/06/2017).

- [21] P. A. Puhani. "The treatment effect, the cross difference, and the interaction term in nonlinear difference-in-differences models". In: *Economics Letters* 115.1 (2012), pp. 85–87.
- [22] A. M. Sansoni. "Limits and potential of the use of vouchers for personal services". In: *European Trade Union Institute, Brussels* (2009).
- [23] INPS (Istituto Nazionale Previdenza Sociale). *Le novità normative previste dal D.Lgs. n. 81 del 15 Giugno 2015*. 2016. URL: www.inps.it (visited on 06/06/2017).
- [24] INPS (Istituto Nazionale Previdenza Sociale). *Statistiche in breve - Lavoro accessorio*. 2017. URL: www.inps.it (visited on 06/06/2017).