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INEQUALITY AND UNDERGROUND ECONOMY: A NOT SO EASY RELATIONSHIP

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Sintesi

Economic theory is paying increasing attention to non-observed economy (NOE) and its causes. Recently, a couple of works (Rosser et al. 2000, Rosser et al. 2003) have claimed that there is a positive relationship between income inequality and the size of NOE. This supposed relationship is not so clear and deserves in-depth analysis. There is a crucial aspect that has been completely avoided in these studies: income inequality is mainly measured using "regular" incomes and this fact could lead to some bias. The existence of a certain size of NOE implies some income evasion which can affect the inequality indexes used in the study of the relationship between NOE and inequality. Including the regional share of NOE in a wage equation I find that, in the specific case of the Italian private sector employees, the income evasion attached to NOE tends to reduce inequality measured by regular wages statistics.

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1 Introduction

Economic theory is paying increasing attention to non-observed economy (NOE) and its causes (Schneider, 2005).

This interest is justified by many different reasons. The size of underground economy negatively affects the collection of taxes to support public sectors, implying a low ability to provide public services that, in turn, can hit more agents in the non-observed sector (Johnson et al. 1997, Loayza 1996). This sector is obviously associated with criminal and corrupt activities and it may have a negative impact on social cohesion.

The first contributions in this field attributed to high taxation and large welfare states the main role in pushing firms and their workers into the non-observed sector (Tanzi 1980, Lemieux et al. 1994). Some of the recent studies still find these relations (Schneider and Enste, 2000), but others have found that taxes and public expenditure may actually be negatively related to the size of NOE (Friedman et al. 2000) and that more generous subsidies or more stringent regulation of labor market can attract workers to the regular market and discourage by hiding contracts (Fugazza and Jacques, 2003, Ahn and De la Rica, 1997). Corruption, over-regulation, legal system ineffectiveness are other relevant incentives to hide economic relationships (Cebula, 1997 and Andreoni et al. 1998).

Recently, a couple of works (Rosser et al. 2000, Rosser et al. 2003) have claimed that there is a positive relationship between income inequality and

the size of NOE in transition economies, and a third paper widens the theory using a global data set (Rosser et al. 2004). The study of this connection can have great implications, because it emphasizes the roles of social cohesion and social capital. Income inequality could enhance social alienation and the tendency to drop out of regular economy, while it undermines the will to finance public programs by paying taxes. These features can affect stability, equality and growth of the socio-economic system. But this supposed relationship is not so clear and deserves further analysis. There is a crucial aspect that has been completely avoided in these studies: income inequality is measured using "regular" incomes and this fact could lead to some bias.

When there is a growth in NOE, there has to be a corresponding income evasion (incomes undeclared to the authorities) and there are no reasons to suppose that this evasion is uniform along income distribution. It could be named an "evasion effect", whose direction is completely unknown to us: if income evasion is higher for the poorer we could have a positive relationship between NOE and income inequality, or viceversa. Furthermore, the capability to evade differs among categories (employees, self-employed workers, freelancers) even complicating any conjecture about the relationship between income evasion and the measured income inequality.

This "evasion effect" can interact with other possible sources or relationships indicated by Rosser et al. (2000, 2003, 2004), generating a number of different and controversial endogeneity problems and, finally, undermining the analysis carried out at aggregate levels (nations, regions).

In this paper I attempt to go deep into the relationship between underground economy and employees' regular wages (in Italy), including the size of NOE as a context variable in a traditional wage equation. Through this approach it is possible to study how the presence of a certain size of underground economy affects regular wages and their distribution.

A brief note on terminology: I use the term, "non-observed economy" (NOE), introduced by the United Nations System of National Acccounts (SNA) in 1993 and widely used by OECD and other international institutions.

Referring to the SNA, NOE includes: illegal, underground, and informal economies (Calzaroni and Ronconi , 1999).

The paper is organized as follow: section 2 introduces the methodology adopted, describes the data and shows the results; section 3 concludes.

2 An "extended" wage equation

The aim of this empirical analysis is to study how NOE affects annual wages and their distribution through the undeclared shares of wages. When there is a certain size of NOE there has to be a corresponding income(wage) evasion; if this income evasion is not uniform along income(wage) distribution, NOE can affect inequality through this "evasion effect".

To check whether, and eventually how, this "evasion effect" works, I include a measure of the underground economy at regional level in a traditional wage equation. In this way, NOE can be considered as a context variable able to affect the individual wage; this approach is the same as the one that is usually made to analyze the effect of unemployment rates on wages by the "wage curve" (Blanchflower et al., 1995). In general, in a Random Effects model, I adopt the following linear specification:

$$w_{ijt} = \alpha + \delta_j + \gamma_t + \beta \cdot X_{it} + \rho \cdot NOE_{jt(t-1)} + \phi \cdot U_{jt(t-1)} + \varepsilon_{ijt} \qquad (1)$$

where w_{ijt} is the wage declared by the individual i, in the region j at time t; α is a constant, while δ_j and γ_t are the fixed effects of region and year, respectively; NOE_{jt} is the underground economy share in the region j at time t (actually, I also use the lagged values of NOE); U_{jt} is the regional Unemployment Rate; X_{it} is a vector of individual controls that may influence wage, and ε_{ijt} is the error term.

Given that two explanatory variables have a regional dimension (unemployment and NOE), I chose a random effects model because I need to control for regional dummies, with the aim to avoid that almost all the regional effects pass through unemployment and NOE. Since most workers do not

change region during the four years considered, in the case of a fixed effects model there is a collinearity problem between regional and individual fixed effects[1].

I use the Regional Unemployment Rate as control among regressors because a higher Underground Economy could be associated to a higher Official Unemployment Rate, given that an irregular worker can be registered as unemployed in official statistics. Besides, including U_j I control for the "wage curve" effect (Blanchflower et al. (1995), Card (1995)).

Including NOE in the wage equation I simply obtain the mean effect of the presence of the underground economy on wages and the expected sign is negative: *ceteris paribus*, if underground economy grows, the regularly declared wages decrease. Then, I will split the sample in five categories considering wage distribution. Testing the marginal effects of NOE on mean wages of the five different categories, I will be able to say if the mentioned "evasion effect" on inequality really exists, hence if underground economy affects wage (and income) distribution by this channel.

This approach should allow to say whether income evasion attached to NOE is uniform along wage distribution. If it is not, any works attempting to study the relationship between inequality and NOE should at least take into account this issue, even if results presented here refer only to private sector employees in Italy.

2.1 Data

I use data from a database of individual histories, based on INPS (Italian Institute for National Social Security) administrative archives which collects *regularly declared* data on all Italian workers employed in the private sector (except agriculture) through an administrative procedure based on firms' declarations. Annual wages, weeks and days of work, gender, age, qualifica-

[1]With regard to equation 1, in case of a fixed effects specification α should become α_i but the low variability of region of work does not allow the estimation to distinguish α_i from δ_j.

tion, sector and region of work are available. The database does not regard those who work in the public sector or as freelancers (for example lawyers or notaries). It is relevant to note that I am not analyzing the relationship between NOE and the distribution of all incomes, but only between NOE and the distribution of employees' wages as regularly declared to authorities: if the "evasion effect" mentioned earlier turns out to be active in affecting wage distribution, the results will be strictly relevant only for employees in the private sector.

In particular, I use a sample of the whole dataset rearranged by ISFOL[2]. This sample collects information on all workers born the 10th of March, June, September and December of each year, so that 1 worker out of about 91 is included in the sample[3]. The longitudinal structure of the database allows to analyze permanent and transitory components of the total variability of wages.

For each worker, in each year, I will include in the wage curve the following regressors: qualification (white or blue collar), sector (ateco 2digit), age, gender and tenure (in years)[4].

Then, I attribuite to each worker the estimates of Underground Economy and the unemployment rate supplied by ISTAT for the region when the worker is employed[5]. It is relevant to briefly explain how ISTAT estimates the Underground Economy. The method is based on a comparison between the "working positions" regularly declared by the firms to the public administrations and the number of "working positions" obtainable from some large surveys conducted on families (i.e. the one of the Bank of Italy). The "working positions" are not the number of physical workers. A worker employed in a firm might be engaged in some other productive activity, and therefore

[2] *Istituto per lo Sviluppo della Formazione professionale dei Lavoratori*, Institute for Training Workers.

[3] For a detailed description of the dataset, see Centra and Rustichelli (2005)

[4] Obviously, there are workers who change occupation within one or more years; in that case I assign to the worker the features related to the longest contract of each year and we obtain the total annual wage by summing up the wages collected in each contract.

[5] I drop out who have worked in different regions within a year.

Table 1: Dataset Description

Variable	Mean	Std. Dev.	Min	Max
Annual Wage (euros)	15417.81	11565.55	500	145727
Age	35.7467	10.80796	16	90
Age-squared	1394.638	828.974	256	8100
Female	.3543863	.4783275	0	1
Tenure (years)	4.782198	4.225799	0	14
Tenure-squared	40.72675	57.74212	0	196
White Collar	.3579399	.4793949	0	1
Regional NOE Rate	13.50911	4.129551	10.2	28.3
Regional Unemployment Rate	9.48535	4.424493	5.21	21.47

n (individuals)=155458, N(observations)=445748

The description of sectorial and regional dummies is not reported

one worker can correspond to more than one working position. ISTAT transforms the various working positions into equivalent units of labor (ULA), which may be regular or non regular. After the estimation of the non regular units, the NOE value is calculated by assigning to them the same productivity of the regular ones. This estimation procedure does not include illegal activities[6].

The whole sample I use is made of $155,458$ individuals, for four years (1995-1998) with gaps (the panel is not balanced) for a total of 445748 observations[7]. I choose to consider the annual wage as dependent variable of the equation, supposing that for employees income hiding would be not to declare some days or hours of work. If this is the case, the hourly or daily

[6]For a detailed description of the "Italian approach" for NOE estimation, see Calzaroni, 2000.

[7]In addition to those who have worked in different regions within a year, I drop out the last permillile of the wage distribution, those who declare to be under 15, and those who have an annual wage less than 500 euro.

Table 2: Wage Equation + Underground Economy

Dependent variable: Annual Wage

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Age	732.6***	602.5***	602.7***	603.8***	603.7***	603.8***
Age-squared	−6.7***	−5.2***	−5.2***	−5.2***	−5.2***	−5.2***
Female	−5025.2***	−5707.5***	−5707.8***	−5712.7***	−5712.6***	−5712.7***
Tenure	1328.6***	1060.7***	1060.8***	1057.3***	1057.3***	1057.3***
Tenure-squared	−69.7***	−53.4***	−53.4***	−53.1***	−53.1***	−53.1***
White Collar	5435.3***	6256.2***	6256.2***	6252.6***	6252.7***	6252.7***
Regional NOE	−207.2***	−29.2			−19.5	
Regional NOE(t-1)		−389.9***	−392.9***	−230.6***	−228.3***	−230.6***
Regional Unem.				−0.6	13.2	
Regional Unem.(t-1)				−196.7***	−198.4***	−196.9***
Constant	yes	yes	yes	yes	yes	yes
Regional Dummies	yes	yes	yes	yes	yes	yes
55 Sectorial Dummies	yes	yes	yes	yes	yes	yes
Year Dummies	yes	yes	yes	yes	yes	yes
N (observations)	445748	284640	284640	284640	284640	284640
n (individuals)	155458	118787	118787	118787	118787	118787
R-squared (overall)	0.45	0.43	0.43	0.43	0.43	0.43

Significance: ⋆: 10%, ⋆⋆: 5%, ⋆⋆⋆: 1%

Note: Standard Errors estimation robust to Heteroskedasticity; I tested the null hypothesis of no first-order serial correlation in the residuals using the Baltagi-Wu locally best invariant test statistics (*xtregar* in Stata), which suggests that accounting for autocorrelation is not necessary.

wage distribution is probably not dependent on evasion levels.

2.2 Results

Table 2 shows the results of some different specification of the analysis.

In the first estimation I found that an endogeneity problem between annual wage and NOE appears. On the other hand, the relationship between

NOE and fiscal evasion can be considered endogenous *in se*, since these two facts are the two sides of the same phenomenon. What I would like to emphasize in this paper is that merging microdata (individual) with the regional share of NOE could be a good way to avoid the endogeneity problem which can occur at an aggregate level. A regional variable can be assumed exogenous with respect to the single individual, since is hard to think that a single individual can significantly affect a regional variable while it is plausible to suppose the opposite. Anyway, I found that the lag of annual wage does not affect NOE (result not reported here), while the contrary occurs, as estimations in table 2 confirm. Under a technical econometric point of view, it is arguable that the causality of the relation goes from regional NOE to individual wages.

In table 2, all the regressors have the well known effects: age influences wage with a U-shape effect, as does tenure; to be a "white collar" and/or a male implies a greater wage. All the regional dummies and almost all the sector dummies are highly significant.

After specification (5) I found that the contemporary values of Unemployment Rate and NOE are jointly not significant[8]. Results provided by the six specifications suggest that it is the lagged value of NOE and unemployment that capture the causal relationship between these two variables and wages. The regional size of unemployment reduces wages and regional NOE has the expected effect: *ceteris paribus*, if underground economy grows, the regularly declared wages decrease.

As stated in the introduction, to thoroughly analyze if wage evasion affects wage distribution I split the sample in five quantiles and consider them as income classes. I estimate five wage equations using the specification numbered with (6) in table 2. In this analysis there is an obvious problem of sample truncation. I present it only as a "logical" step to come to the final analysis on wage differentials between white and blue collars[9].

[8]The test's results are: $\chi^2 = 0.50$, $P > \chi^2$=0.7791.

[9]Unfortunately, at the moment there is not a method to implement a quantile regression with panel data.

Table 3: NOE Effects Along Wage Distribution

	Regional NOE (lag)	Regional Unemployment (lag)
First Class (3731)	-14.81	-6.09
Second Class (9903)	1.51	$-22.58^{\star}$
Third Class (14340)	-2.12	$-26.92^{\star\star\star}$
Fourth Class (18454)	-1.95	$-37.82^{\star\star\star}$
Fifth Class (32346)	$-346.97^{\star\star\star}$	-139.29

Significance: $\star$: 10%, $\star\star$: 5%, $\star\star\star$: 1%

The five estimated equations refer to the same model, specification and controls that are in previous analysis. The dependent variable is the annual wage and the other regressors are age, age-squared, gender, tenure, tenure-squared, white or blue collar, region, sector, year.

In brackets: mean wage of the class.

The quantile partition refers to each year. One worker can be in class i one year and in class j the following year: in that case the first observation contributes to the estimation of the i class wage equation, while the second observation is used to estimate the wage equation of the j class. This fact does not undermine the analysis, since the panel is not balanced even in the general specification. The results are shown in table 3.

The first classes of wages are not significantly affected by the size of NOE. The highest class presents a strong reduction in the declared wages. Unemployment seems to mainly affect the median classes of wages.

The growth in the underground economy is reflected by an income evasion concentrated in the highest class of wages. It is important to notice that in the highest class 73% of the individuals are white collars, while this share is 37% in the fourth class, 26%, 24% and 20% in the other groups, respectively.

Among the white collars, all the non manual workers are considered, including managers, executives, business agents and so on. In the Italian institutional context, these figures have contractual features allowing to evade incomes because of their variability, such as "production premiums", profit

Table 4: Wage Equations for White and Blue Collars

Dependent variable: Annual Wage

	White Collars Mean Wage=22718	**Blue Collars** Mean Wage=13299
Age	915.1^{***}	599.3^{***}
Age-squared	-5.6^{***}	-6.8^{***}
Female	-8496.2^{***}	-3945.9^{***}
Tenure	1123.3^{***}	1172.1^{***}
Tenure-squared	-62.2^{***}	-55.9^{***}
Regional NOE(t-1)	-510.0^{***}	-94.6^{***}
Regional Unemployment(t-1)	-372.1^{***}	-160.3^{***}
Constant	yes	yes
Regional Dummies	yes	yes
Sectorial Dummies (9)	yes	yes
Year Dummies	yes	yes
N (observations)	106552	177963
n (individuals)	43783	77368
R-squared (overall)	0.33	0.39

Significance: $\star$: 10%, $\star\star$: 5%, $\star\star\star$: 1%

The two estimated equations refer to the same model, specification and controls of the previous analysis.

sharing and various types of benefits, while the blue collars wages are almost fixed. To check whether this could be an explanation of previous results, I estimate two wage curves, for blue collars and white collars, whose results are presented in table 4.

Unemployment seems to have the same effect on white and blue collar wages: on average, an increase of one percent in the unemployment rate causes a wage decrease of 1.6% for white collars and of 1.2% for blue collars.

On the contrary, the NOE percentage impacts differently: an increase in the regional NOE is reflected by a decrease in the regular declared wages of 0.7% for blue collars and of 2.2% for white collars.

These results suggest that different contractual forms affect the capacity of evasion and, through this channel, change the "official" wages inequality, as we can say on the basis of previous results.

3 Conclusions

In this paper I have tried to make an in-depth analysis of the relationship between NOE and inequality, stressing an issue that until now has been neglected in literature: the existence of a certain size of NOE implies some income evasion which can affect inequality indexes used in the study of the relationship between NOE and inequality.

Including the regional share of NOE in a wage equation I found that, in the specific case of the Italian private sector employees, the wage evasion attached to NOE tends to reduce the inequality measured by the regular wages. I must remind that the results presented in table 3 are biased by a sample truncation. But table 4 suggests, in a more robust way, that the differentials between white and blue collars are actually affected by income evasion and it is obvious that this fact influences inequality indexes.

It is interesting to note, by the way, that these results seem to favor the theories of Rosser et al. (2000, 2003, 2005): if through the evasion effect NOE tends to diminish the inequality recorded by official statistics, the positive relationship they found at aggregate level between inequality and NOE is stronger.

It is important to note that here I am not analyzing the relationship between NOE and the distribution of all incomes, but only between NOE and the distribution of private employees' wages. Besides, if the afore mentioned "evasion effect" affects wage distribution, it could exists with respect to other types of income too. The last contribution of this paper consists in point-

ing out that the "evasion effect" on income (and its distribution) is most likely related to the opportunities of evasion offered by the various types of incomes and contracts, as showed by the fact that the NOE rate has different consequences on white or blue collars wages.

References

[1] Ahn N. - De La Rica S. (1997), The Underground Economy in Spain: an Alternative to Unemployment?, *Applied Economics*, 29.

[2] Andreoni J. - Erard B. - Feinsten J. (1998), Tax Compliance, *Journal of Economic Literature*, 36 (2).

[3] Blanchflower D.G, and A.J. Oswald (1995), An introduction to the wage curve, *Journal of Economic Perspectives*, 9, pp. 153-169.

[4] Card, D. (1995), The wage curve: A review, *Journal of Economic Literature*, 33, pp. 785-799.

[5] Calzaroni M. - S. Ronconi (1999), Introduction to the non-observed economy: The conceptual framework and main methods of estimation, Chisinau Workshop Document NOE/02.

[6] Calzaroni M. (2000), The Exhaustiveness of Production Estimates: New Concepts and Methodologies, Paper presented at the International Conference of Establishment Surveys II, Buffalo

[7] Cebula R. J. (1997), An Empirical Analysis of the Impact of Government Tax and Auditing Policies on the Size of the Underground Economy: The Case of United States 1993-94, *American Journal of Economics and Sociology*, 56 (2).

[8] Centra M. - Rustichelli E. (2005), La costruzione del panel longitudinale ISFOL su microdati INPS (1985-1999).

[9] Friedman E. - Johnson S. - Kaufmann D. - Zoido-Lobaton P. (2000), Dodging the Grabbing Hand: the Determinants of Unofficial Activity in 69 Countries, *Journal of Public Economics*, 76.

[10] Fugazza M. - Jacques F. (2003), Labor Market Institutions, Taxation and the Underground Economy, *Journal of Public Economics*, 88.

[11] Johnson S. - Kaufmann D. - Schleifer A. (1997), The Unofficial Economy in Transition, *Brookings Papers on Economic Activity*, 0 (2).

[12] Lemiuex T. - Fortin, B. - Fréchette P. (1994), The Effect of Taxes on Labor Supply in the Underground Economy, *American Economic Review* 84, 231-254.

[13] Rosser J.B. - Rosser M.V. - Ahmed E. (2000), Income Inequality and The Informal Economy in Transitions Economies, *Journal of Comparative Economics*, 28(1), pp. 156-171.

[14] Rosser J.B. - Rosser M.V. - Ahmed E. (2003), Multiple Unofficial Economy Equilibria And Income Distribution Dynamics in Systemic Transition, *Journal of Post Keynesian Economics*, 25(3), pp. 425-447.

[15] Rosser J.B. - Rosser M.V. - Ahmed E. (2004), Income Inequality, Corruption, and the Non-Observed Economy: a Global Perspective, presented at the conference: New Economic Windows 2004: Complexity Hints for Economic Policy, Salerno, Italy.

[16] Schneider F. - Enste D.H., Shadow Economies: Size, Causes and Consequences (2000), *Journal of Economic Literature*, 38 (1), 77-114.

[17] Schneider F., Shadow Economies Around the World: What do We Really Know? (2005), *European Journal of Political Economy*, 21(3), pp. 598-642.

[18] Tanzi V. (1980), The underground economy in the United States: Estimates and implications. Banca Nazionale del Lavoro Quarterly Review, 135, pp. 427-53.