UNDECLARED WORK AND WAGE INEQUALITY

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Abstract

In this paper we illustrate how undeclared work affects the wages of undeclared and declared workers and, in particular, declared wage inequality. Using individual data on Italy for the years 2000-2004, we have computed an own- and cross-wage elasticity of labor demand for undeclared and declared work. We have provided a novel identification strategy based on three Italian tax amnesty laws brought out in 2002. Our results indicate that undeclared work: 1) leads to an increase in declared wages, 2) adversely affects undeclared wages and 3) leads to a decrease in wage inequality in the declared sector.

Keywords: elasticity of labor demand, undeclared labor, wage inequality.
JEL classification: H26, J23, J31.

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1 Introduction

Tax evasion is a fact which has been widely reported since antiquity, and one which has always been difficult to examine on both theoretical and empirical grounds. On the one hand, theoretical economic models based on taxpayer rationality are unable to comprehensively describe the behavior of agents involved in the tax evasion setting. If one applies a standard game theory, or any rational choice approach to the problem of tax compliance, the level of penalties and enforcement that we observe would appear to be insufficient to explain the degree of compliance with tax laws. In the last 15 years, behavioral and experimental economists have attempted to address the problems of traditional economics, correcting assumptions and evaluating the variety of psychological reasons affecting the motivations for paying taxes, e.g. honesty, fear, sense of group membership (Chorvat 2006, Alm et al. 1992).

Considering the empirical grounds, the lack of reliable data on tax evasion raises concerns about the validity of empirical results. Conventional data on evasion are obtained from administrative audit databases which are usually selected data. Moreover, we seldom have sufficient information to deal with such a selection. This happens mainly because audit authorities try to maintain secrecy on their audit strategies. Recently, some advances in this field have been made using ad hoc surveys (Almeida and Carneiro 2011, Kleven et al. 2011, Lacroix and Fortin 1992, Lemieux et al. 1994) and/or relying on individual audit data for which the source of information is detailed enough to perform a proper selection model (Di Porto, 2011 and Di Porto et al. 2011)[1]

This paper focuses on undeclared labor, which is a particular kind of evasion. As reported in Di Porto (2011), undeclared work is nothing more than labor tax evasion perpetrated by an employer against public institutions collecting social security contributions. In several countries, (e.g. Italy, France, Germany), employers are in charge of collecting the social security contributions for their workers. Evading these payments is just the same as under-

[1]In the case of Di Porto (2011), the dataset includes information on both audited and non-audited taxpayers allowing for a comparison between the two groups.

declaring a part of the hours worked. Therefore, evading social security taxes is the same as working in the undeclared sector. As well as other types of tax evasion, it is difficult to find a wide interest in the topic of undeclared work in economic literature; the rationale behind this is related to what is reported above. However, undeclared work is, in terms of size, one of the main ingredients of contemporaneous labor markets. In line with a recent study by OECD, we can assert that out of a global working population of 3 billion workers, nearly two-thirds (1.8 billion) are undeclared or informal workers (Jutting and Laiglesia, 2009). Schneider (2000) estimates that in the European area the number of persons working in the unofficial economy doubled from 1978 to 1998. In Italy in the last 10 years, the share of undeclared work amounts to over 15% of the labor force. According to a report of the Pew Hispanic Center, the number of illegal immigrants living in the United States was 11.9 million in March 2008, of which 8.3 million were part of the U.S. labor force (Passel and Cohn, 2009). Estimates of the number of illegal immigrants in Canada by police and immigration personnel range between 50,000 and 200,000 according to the Canadian Encyclopedia.[2] BRIC countries (Brazil, Russia, India, China) and eastern European countries are also involved, with similar or larger percentages.

Although a large share of the workforce of the most developed countries is made up of this type of labor, economists know relatively little about how undeclared work affects economies and which undeclared labor reducing-policies need to be undertaken. It is to be noted that economists still harbour concerns about whether an increment in undeclared work should be considered a sign of health or decline of a labor market (see Williams 2010 for a review of the main economic views on undeclared labor participation).

The issue of undeclared work becomes more and more important in a period of globalization and large migration flows such as the one we are living in. Indeed, undeclared labor is the port of entry for the majority of migrants. Furthermore, legislation on migration in developed countries (i.e. quotas for legal entrance) could worsen the undeclared phenomenon: immigrants exceed-

[2]See the article on Immigration Policy at www.thecanadianencyclopedia.com.

ing the inflow quotas become illegal undocumented individuals, and are *de facto* forced to search for a job in the undeclared layer of the labor market. Despite being strictly correlated, migrant and undeclared labor are distinct facets of the market, and as such probably acting as different labor inputs in a firm's production function

Improving our understanding of undeclared work might give new insights into the effects of migrants on native workers' labor market outcomes: documented and undocumented migrants could show different degrees of substitution with respect to native declared and undeclared workers, thus leading to novel results.[3]

This paper faces the challenge of building a reliable analysis of undeclared work, estimating a short-run elasticity of labor demand for undeclared and declared work in Italy. Furthermore, the aim of the paper is to investigate the impact of undeclared work on wage inequality, if any. We have performed our analysis using a micro-econometric approach and, as far as we know, this is the first attempt to do so in literature.

Dealing simultaneously with undeclared work and inequality seems to be an extremely interesting exercise for several reasons: 1) We usually study inequality relying only on the *declared* part of the workforce;[4] taking Italy as an example, this means leaving about 15% of the sample of workers out. Furthermore, for some Southern Italian regions the figures are higher, e.g. in Calabria about 30% of salaried employees are found in the undeclared sector. With these figures in mind, any empirical analysis concerning wage distribution might be seriously questionable. 2) By forgetting this large share, we also disregard that part of the labor force which is less skilled, has a higher turnover into and out of employment and is much more socially excluded (Boeri and Garibaldi, 2002; Cappariello and Zizza, 2010). As a consequence, by ignoring undeclared work, any inequality analysis would unambiguously lead to an underestimation of the phenomenon (simple descriptive statistics on SHIW data,

[3]So far, there is no consensus on the empirical impact of immigration (legal/illegal) on the employment and wages of natives. See Borjas et al. (2008).

[4]Datasets usually employed in the analysis of inequality report information only on workers declared to the authorities.

Figure 5, a source that will be explained in detail later on, shows how the distribution of wages changes if we include undeclared labor in the inequality analysis).

This paper is also a premise for discussing the effects of emersion policies on labor market outcomes; in particular, what happens if a large share of undeclared work emerges? Or, conversely, submerges? Does an emersion policy affect either *real* wage inequality or *declared* wage inequality, or both? Which group of workers is more affected by this emersion/immersion effect?

Our findings, based on a set of instrumental variables estimates, show a rise in undeclared work, leading to: i) an increase in declared wages, ii) adverse effects on undeclared wages and iii) a decrease in declared wage inequality. We also find q-complementarity between undeclared workers and low- and medium-skilled jobs. As a consequence, reducing undeclared work leads to an increased wage inequality in the declared sector

The paper proceeds as follows: Section 2 describes the institutional setting in which we developed our analysis, focusing in particular on the effect of three tax amnesty laws on undeclared work. This is useful to identify supply changes in the undeclared sector. Section 3 describes the theoretical framework in which we moved. Section 4 illustrates the empirical analysis and provides a novel identification strategy. Section 5 shows the results and several robustness checks. Section 6 concludes by suggesting the main policy implication of our findings.

2 Institutional Setting: Undeclared and Declared Work, uncommunicating vessels

2.1 The Tax Amnesty Laws

Looking at Figure 1, we can see the evolution of full time equivalent (FTE) undeclared and declared workers in Italy from 1990 to 2008 for the Italian economy and for three broad industry sectors. The plotted series are log transformations of the data and the source is the Italian Institute of Statistics

ISTAT.[5]

Panel a of Figure 1 shows the two series following a similar, increasing trend for the economy as a whole, except for the years 2002 and 2003, where the undeclared FTE dramatically drops. The same pattern is displayed by the three broad industry sectors (Panels b, c and d of Figure 1), even though the undeclared and declared FTE series in the industry and agriculture sector follow a secular decreasing trend. By looking at Figure 1, at least two facts emerge. First, undeclared and declared employment strictly correlate, suggesting that one does not substitute the other and that the two can be considered as distinct labor inputs. Secondly, irrespective of the sectors over the time period 2002-2003, the undeclared FTE series shows a remarkable shock, which causes a decrease in undeclared employment but does not change its trend. It is worth noting that even during the shock the two types of labor behaved as if they belonged to different markets, i.e. we do not observe a significant increase in declared labor after the drop in undeclared workers (Explanations provided hereinafter). Such a shock is the result of three different tax amnesty laws enacted by the Italian government in the year 2002. We refer to: 1) Law no. 383/2001; 2) Article 33 of Law no. 189/2002 and 3) Law no. 222/2002.

- Figure 1 about here -

The aim of these laws was to offer a tax evasion amnesty for social security payments as well as to let immigrants regularize their status as residents. Specifically, the aim of Law 383/2001 was to foster the emersion of undeclared workers irrespective of the their citizenship status, while Article 33 of Law 189/2002 and Law 222/2002 exclusively concerned migrants.[6]

Act 383/2001 provided a three-year fiscal and social security payment reduction to those employers declaring informal labor positions. In particular,

[5]ISTAT regularly provides estimates of the Italian underground GDP and employment disaggregated by region and industry sector, based on a very complex computation and using several sources of information from the points of view of both households and businesses See http://www.istat.it/it/archivio/39522.

[6]Law n. 189/2002 (the so-called "Bossi-Fini" law) is a large legislative package which establishes new rules regarding immigration and asylum issues.

only informal subordinate employment starting before 25th October 2001 and still ongoing at the date of application were allowed to apply. The new declared job could be temporary as well as permanent, and involving full- or part-time working hours.

The aim of the last two laws was mainly to prevent the illegal immigration phenomenon. The policies referred only to migrant workers employed informally. The application requirements were not at all stringent: the employers in charge of social security payments were permitted to declare informal workers who were employed three months prior to the law coming into force, and to regularly hire them for a period of at least one year. In addition, the employers had to pay a 700 EUR fine for each declared migrant worker.[7] The only difference between the two tax amnesty laws concerned the type of work legitimated for emersion: Law 189/2002 referred to housemaids and healthcare workers, while Law 222/2002 dealt with all kinds of subordinate labor. An additional and most important feature of Laws 189/2002 and 222/2002 applied to undocumented migrant workers: by regularizing their labor relationship, non-native people were also entitled to obtain their permit to stay documents (*permesso di soggiorno*) which allowed them to legally remain within the Italian (and consequently European) boundaries. Therefore, this latter case provided a strong social incentive for workers as well as an economic incentive for employers. Being recognized as a resident also solves several practical problems for undocumented migrants: it reduces stigma and, most importantly, it opens up the possibility of demanding provision of public services (i.e. healthcare, housing etc). The government promoted its campaign of emersion strongly by means of the media, advertisements and using social security auditors to inform companies and workers.

The dynamics induced by these laws can clearly be seen in Figure 1; the Italian labor market showed a roughly constant ratio between undeclared and declared FTE workers for several years, then in 2002-2003 this trend was inverted due to a decrease in undeclared workers. At the same time, the declared part of the workforce did not show any remarkable increase, although it was

[7]For the details on the payments see Stame (2004) or Anastasia et al. (2005)

expected to balance out the aforementioned reduction in undeclared work. Why do we not observe such a shift between the two types of employment? Undeclared workers only partially entered the declared sector and those emerging lasted in it for a very short time; the undeclared and declared sectors do not seem to be communicating vessels. As noticed in Anastasia et al. (2005), 70% of emerged workers disappeared from the labor market before 2004. Such dynamics disclose a very simple framework: a competitive labor market operating in equilibrium manages to return quickly to that equilibrium if all the other production factors remain unaltered. For the period 2002-2003 we do not observe any significant variation in capital, technology or wages that may persistently alter the long-run labor market equilibrium. The tax amnesty laws focused solely on recovering evaded taxes and on regularizing the status of immigrants as residents. Nothing was planned to keep this emerged employment attached to the labor market (i.e. active labor market policies). Some of the emerged workers simply never started working in the declared sector or did so for a very short time. Some migrants, satisfied with their new residential status, bargained with their employers for a simple way to "return to the shadows" after few months; others took advantage of their new legal status to reach different destinations in Europe.[8] Whatever the reason, the result is a short-run supply shock that did not alter anything else in the labor market. Hence, the supply shock of undeclared work is just a one-shot shift. We used this setting and this shock induced by the amnesties of 2002 to carry out a causal analysis on the implications of undeclared work on wage inequality. Before turning to the core analysis of the paper, the next section gives a taste of the labor market transitions in and out of employment in the years concerned in the policies. In doing so, we performed a time-to-event analysis on the labor turnover for declared and emerged workers. This exercise will give evidence of a higher labor turnover of emerged workers with respect to declared workers. After this analysis we will enter into the core of our inequality analysis, using

[8]It is well-known that the Italian labor market is a first port of call for migrants arriving from the Middle East and Africa who usually try to get to central Europe (i.e. France or Germany) which is a stronger welfare magnet (OECD, 2004).

the supply shock to build a novel identification strategy for our labor demand functions.

2.2 The Evolution of Emerged Employment

Figure 1 indicates that the tax amnesty laws caused a dramatic drop in undeclared work in the time period 2002-2003, while they did not affect declared work. As undeclared workers affected by the policies merely changed their legal status by becoming declared, we would expect a more evident reallocation between the undeclared and declared employment states. In the previous section we argued that the lack of this exact transfer is the result of a shorter term of employment of emerged workers, who simply became unemployed or even went back to the undeclared sector. In this section we give evidence of such a phenomenon by using a time-to-event analysis. We used a sample of working episodes drawn from the WHIP (Work Histories Italian Panel) dataset, which is a panel survey of individual work histories based on the INPS (National Social Security Institute) administrative archives.[9] We are interested in comparing the hazard rate of exiting employment (the survival rate of being employed) of emerged and declared workers, and also in showing how the two rates differ significantly. Unfortunately, we do not have exact information on emerged workers and, to the best of our knowledge, there is no available data reporting such details. As a consequence, we considered as emerged workers all those individuals starting a job for the first time in their lifetime in the period just after the implementation of these policies. In particular, as Law 383/2001 set the application deadline at 30th November 2002, and Law 189-222/2002 at 11th November 2002, we considered all jobs starting during the time interval September-November 2002 as emerged jobs. To put it another way, we assumed that many of the jobs emerging from the undeclared sector emerged close to the application deadline. We are aware

[9] The reference population is made up of all the people who have worked in Italy, even for only a part of their working career, and amounts to about 370,000 individuals. The workers for whom activity is not observed in WHIP are those who have worked in the public sector or as lawyers or notaries who have an autonomous security fund.

that this strategy may also have picked up jobs not related to the tax amnesty laws, therefore the estimated hazard has to be interpreted as a lower bound of the true hazard. We also performed the analysis with different time intervals but the result did not change substantially.[10]

As for the "before" period we considered those individuals who were employed for the first time in September-November 2001; by choosing jobs starting exactly one year before the emerged jobs, we were able to rule out any seasonal differences in the job creation rate. Furthermore, we considered temporary and permanent contracts as well as full- and part-time jobs. Figure 2 depicts the smoothed hazard function of exiting employment for jobs established in September-November 2001 (before the policies) and September-November 2002 (after the policies). The hazard function was estimated non-parametrically by taking the steps of the Nelson-Aalen cumulative hazard and smoothing them with the Epanechnikov kernel. The hazard rate of job spells after the policies' implementation is unambiguously higher than the hazard rate of the "before" job spells, suggesting that emerged jobs had a higher and increasing probability of being terminated compared to those of the "before" period. We reached the same conclusion by looking at the estimated survival functions. Figure 3 plots the Kaplan-Meier survival functions of the job spells for the "before" and the "after" periods: for the first ten months the probability of not having terminated the job considering the "before" period equals the probability of the "after" period; for the longer durations the former is clearly higher than the latter. The two survivor functions start diverging at the 10th-12th month of the time interval considered and we interpreted this shift as a consequence of the labor contract's minimum legal duration established by Law 383/2001. Thus, it is likely that the bulk of emerged jobs were temporary and had a duration of one year, just meeting the minimum legal limit.

The non-parametric analysis of Figures 2 and 3 makes no assumption about the functional form of the survival and the hazard functions, and provides findings regardless of the effects of individual characteristics. Because of these limi-

[10] We carried out specifications using bimonthly and quarterly groupings from January-to September 2002. The results are available on request.

tations, we performed a parametric analysis using a discrete time proportional hazard model with a fully non-parametric specification for duration dependence. We ran such a model separately for the "before" and "after" samples, after which we estimated the hazard functions. The model allows for the effect of some customary individual social characteristics such as age, gender, area of residence, as well as job characteristics such as industry sectors, type of contract (temporary or permanent), working hours (part- or full-time) and type of job (manual or non-manual). The baseline hazard was estimated by using duration-interval-specific dummy variables, in particular 38 dummy variables for the "before" sample and 26 for the "after" sample (the different number of time dummies depended on the different observed maximum survival time for the two groups). Table A.2 in the Appendix shows the maximum likelihood estimates of the two proportional hazard models. We avoid discussing the modelÕs coefficients because they are fairly standard and instead we turn our attention to the corresponding predicted hazards. Figure 4 plots the hazard functions of quitting the job, considering as our reference category a job filled by a man, aged 30, residing in the North-West of Italy, being a manual worker, employed full-time with a permanent contract in the manufacturing sector. At the onset of the job, up until the 8th month, the hazard rate of emerged workers was slightly lower than for the "before" group, while it increased in the time interval ranging from the 8th to the 15th month, showing a spike at the minimum legal duration of one year. At this point, both the hazard rates decreased. These findings, along with those of the non-parametric analysis, univocally suggest that emerged jobs have a higher turnover than declared jobs. It is worth pointing out that the predicted hazards are lower bound estimates, thereby the true hazard rate of exiting employment for emerged workers would be unambiguously higher. We consider this result as the evidence of a short-run negative shift in the supply of undeclared work.

- Figures 2, 3 and 4 about here -

3 Theoretical Settings

In this section we briefly sketch the theoretical implications of an increased undeclared work supply. The aggregate production function we used is the very common and popular Cobb-Douglas aggregation:

$$Y = AK^{\alpha}N^{1-\alpha} \tag{1}$$

where A is exogenous total factor productivity, K is the physical capital and N is a CES aggregate of two different types of labor, undeclared and declared. The labor aggregate is defined as:

$$N = [\theta_U N_U^{\rho} + \theta_D N_D^{\rho}]^{1/\rho} \tag{2}$$

where ρ is a function of the elasticity of substitution σ_{DU} between the two types of labor ($\rho = 1 - 1/\sigma_{DU}$), θ_U and θ_D are the share parameters summing to 1. The competitive market imposes that all factors are paid their marginal product, then the undeclared and declared wages are given by

$$\ln w_U = \ln\left[A\left(\frac{K}{N}\right)^{\alpha}(1-\alpha)\right] + \ln\theta_U + \frac{1}{\sigma_{DU}-1}\ln\left[\theta_U + \theta_D\left(\frac{N_D}{N_U}\right)^{\rho}\right] \tag{3}$$

and

$$\ln w_D = \ln\left[A\left(\frac{K}{N}\right)^{\alpha}(1-\alpha)\right] + \ln\theta_D + \frac{1}{\sigma_{DU}-1}\ln\left[\theta_U\left(\frac{N_D}{N_U}\right)^{-\rho} + \theta_D\right] \tag{4}$$

Given these equations, it is then straightforward to show the effects of an increase in undeclared employment over declared and undeclared wages. Taking the partial derivative of 3 and 4, we obtain the wage effect of an increase in undeclared employment. The resulting expressions are as follows:

$$\frac{\partial \ln w_U}{\partial \ln N_U} \equiv \frac{1}{\sigma_U} = -\alpha S_U - \frac{1}{\sigma_{DU}}(1 - S_U) \quad (5)$$

$$\frac{\partial \ln w_D}{\partial \ln N_U} \equiv \frac{1}{\sigma_D} = -\alpha S_U + \frac{1}{\sigma_{DU}} S_U \quad (6)$$

where $S_U = w_U N_U / w_U N_U + w_D N_D$ is the share of overall wages paid to undeclared workers. In order to discuss these expressions we need to take into account the supply of physical capital, that is, whether it is supplied fixed or perfectly elastically. Let us first consider the case in which capital is fixed. An increased supply of undeclared workers reduces both declared and undeclared wages by lowering the capital-labor ratio of the economy. Furthermore, if undeclared and declared labor are perfect substitutes ($\sigma_{DU} \to \infty$), declared and undeclared wages decrease by the same amount αS_u. On the other hand, if undeclared and declared labor are imperfect substitutes (or q-complements), there will also be a positive effect on declared wages operating by the term $\frac{1}{\sigma_{DU}} S_u$. Which of the two effects on declared wages prevails is an empirical matter. Let us now consider that capital is supplied perfectly elastically, so that $\alpha \to 0$. Since capital can adjust freely to changes in labor, an undeclared supply does not affect the capital-labor ratio and if the two labor inputs are perfect substitutes, no changes in wages occur. However, if we consider imperfect substitutability, undeclared wages decrease and declared wages increase. The previous production function considers declared and undeclared labor as homogenous input. We can relax this assumption by taking into account different broad education groups of the workforce. In doing so, we allow for labor input to be comprised of high-skilled declared workers and the aggregate between un- declared and low-skilled declared workers. The choice for considering undeclared labor as an aggregate is merely practical, because in the empirical part we exploit a source of exogenous variation only in total full-time equivalent undeclared workers. The aggregate production function is still described by (1), while N is a CES aggregate of high-skilled declared labor and the composite input and it is defined as:

$$N = [\theta_H N_H^{\gamma} + \theta_A N_A^{\gamma}]^{1/\gamma} \tag{7}$$

where γ is a function of the elasticity of substitution σ_{HA} between the two types of labor ($gamma = 1 - 1/\sigma_{HA}$), θ_H and θ_A are the share parameters summing to 1. Further we assume that the labor composite N_A is itself the CES subaggregate of undeclared labor and low-skilled declared labor and it is defined as:

$$N_A \;=\; [\theta_U N_U^{\eta} + \theta_D N_{LD}^{\eta}]^{1/\eta} \tag{8}$$

where η is a function of the elasticity of substitution σ_{U-LD} between undeclared and declared low-skilled workers. θ_U and θ_D are the corresponding relative efficiency parameters.

In a competitive market, the marginal product for each labor supply equates to the corresponding wage. Thus the ratio of the wage rate of high-skilled declared workers to the wage of low-skilled declared workers equates to the ratio of the corresponding marginal products, satisfying the following equation:

$$\ln\left(\frac{w_H}{w_{LD}}\right) = \ln\frac{\theta_H}{\theta_{LD}} + (\gamma - 1)\ln N_H - (\gamma - \eta)\ln N_A - \ln\theta_D - (\eta - 1)\ln N_{LD} \tag{9}$$

Differentiating equation 9 with respect to N_U, we obtain the effect of an increase in undeclared employment over declared wage inequality. The resulting expression is

$$\frac{\partial \ln(w_H/w_{LD})}{\partial \ln N_U} = (\eta - \gamma)\frac{S_U}{1 - S_H} \tag{10}$$

or equivalently

$$\frac{\partial \ln(w_H/w_{LD})}{\partial \ln N_U} = \left(\frac{1}{\sigma_{HA}} - \frac{1}{\sigma_{U-LD}}\right)\frac{S_U}{1-S_H} \tag{11}$$

where S_U is the share of overall wages paid to undeclared workers and S_H is the share of overall wages paid to the high-skill declared workers. An increase in undeclared labor increases the declared wage skill premium if undeclared workers compete more with low-skilled declared than high-skilled declared workers, that is, when $\eta > \gamma$ or, equivalently, when the elasticity of substitution between un-declared and declared low-skilled workers is higher than the elasticity of substitution between high-skilled declared workers and the aggregate labor input.

4 Empirical Analysis

4.1 Empirical Models

We used a two-stage least square estimator (2SLS) to estimate the empirical counterpart of equation 3. A strategy close to the one we have used can be found in Acemoglu et al. (2005). The estimated labor demand is described by the following equation:

$$\ln w_{irt} = \alpha_r + \zeta_{2004} + b_i + X'_{irt}\beta^b_t + \gamma \ln\left(\frac{U_{rt}}{D_{rt}}\right) + \delta b_i \ln\left(\frac{U_{rt}}{D_{rt}}\right) + \varepsilon_{irt} \tag{12}$$

where w_{irt} is our dependent variable and represents the hourly net wage of individual Italian workers in 2000 and 2004, the periods before and after the policy shock. The data we used were taken from two sources: the Bank of Italy Household Survey SHIW (Survey on Household Income and Wealth) and ISTAT non-observed economy indicators, the source from which we obtained the graphs in Figure 1. Both sets of data will be explained in detail in section 4.3. w_{irt} varies among individuals in 20 Italian regions and during two time

periods, one before and one after the policy shock of 2002. On the right-hand side, α_r is the regional fixed effect while ζ_{2004} is a time dummy and X'_{irt} is a matrix of covariates that control for individual worker characteristics. We chose these covariates selecting what are usually called pre-choice characteristics, that is, determinants belonging to the worker before the choice of the job.[11] b_i is a dummy selecting undeclared workers. Section 4.3 explains how we identify undeclared workers in the SHIW dataset survey. γ and δ are the coefficients of major interest for our research. γ is the coefficient of the log of $\frac{U_{rt}}{D_{rt}}$ which is the ratio between regional FTE undeclared workers and regional FTE declared workers, and δ is the coefficient of the interaction term b_i times the log of $\frac{U_{rt}}{D_{rt}}$. The relative undeclared labor supply is obtained by the ISTAT's non-observed economy estimates. To take into account that undeclared labor supply is an aggregate measure we have applied robust standard errors throughout the analysis, clustered at the region-year level (Bertrand *et al.*, 2004).

This ratio clearly represents the labor market equilibrium value. As we were interested in estimating the labor demand of equation 12 we needed to solve the classical identification problem. Section 4.2 shows our novel identification strategy and explains in detail how we used the policy shock induced by the 2002 tax amnesty laws to construct a reliable instrumental variable. Once the identification problem was solved, we were able to interpret the γ and δ coefficients as follows: γ is the effect of a shift in relative undeclared labor supply on the wages of declared workers; while, the sum of γ and δ describes how a change in the relative supply of undeclared workers affects undeclared workers' wages and thus represents the inverse of the own-wage elasticity for undeclared labor. δ is the inverse of the cross wage elasticity between the two labor types.

The impact of an undeclared labor supply may not be uniform throughout the declared wage distribution: a greater undeclared labor supply will raise

[11] These are work experience and its square, educational level, the interaction between experience and education level, a dummy for part time job, a dummy for migrants and a dummy selecting workers living in urban areas. All these variables were interacted with a dummy for undeclared workers and the time dummy for 2004

(lower) declared earnings inequality if undeclared workers are closer substitutes (complements) for low-earning declared workers than for high-earning declared workers. We examined this relationship by estimating the following equation:

$$\begin{aligned} \ln w_{irt}^{D} &= \alpha_r + \zeta_{2004} + h_i + X'_{irt}\beta_t^h + \pi \ln\left(\frac{U_{rt}}{D_{rt}}\right) + \lambda h_i \ln\left(\frac{U_{rt}}{D_{rt}}\right) + \\ &\quad \theta \ln\left(\frac{H_{rt}}{L_{rt}}\right) + \lambda h_i \ln\left(\frac{H_{rt}}{L_{rt}}\right) + \varepsilon_{irt} \end{aligned} \tag{13}$$

Model 13 is very similar to model 12 but here we only use individual data on the declared side of the labor force. Thus, w_{irt}^{D} is now the wage of a declared worker in 2000 and 2004. We still allowed for regional and time fixed effect and a matrix of pre-choice covariates. All covariates are allowed to have different effects on the earnings of high- and low-skilled declared workers and to differ by year. h_i represents a dummy for the highest skilled group of workers.

$\frac{H_{rt}}{L_{rt}}$is the relative supply of highest skilled versus lowest skilled declared labor. π and λ are our coefficients of interest. Following the same reasoning as the previous model, once we took into account the identification problem, π revealed the effect of a relative supply shift on the wages of low-skilled declared workers. Keeping the employment levels of high- and low-skilled declared workers constant, π is also an estimate of the inverse of the cross-wage elasticity of demand between undeclared labor and low-skilled declared labor. Similarly, the sum of π and λ measures the impact of the undeclared labor supply on the earnings of high-skilled declared workers, and therefore its inverse is an estimate of the cross elasticity of demand between undeclared and high-skilled labor. Finally, the ratio between the two cross-wage elasticities $\pi + \lambda/\pi$is instructive of which education group undeclared labor supply is a closer substitute for. Specifically, if $\pi + \lambda/\pi < 1$, it implies that undeclared labor has a larger wage impact on the least skilled group; therefore undeclared workers are closer substitutes for the least skilled group than for the highest skilled group of declared workers, and the opposite holds if $\pi + \lambda/\pi > 1$.

4.2 Identification Strategy

We identified our labor demand function by using the policy shock provided by the tax amnesty laws in 2002. As mentioned above, this event induced an exogenous contraction of the undeclared sector. In the short-run we easily assumed no salary adjustment (this finding is also confirmed empirically, see 5.3). As discussed in section 2.2, the fall in undeclared labor was not entirely offset by the rise in declared employment; rather the emerged jobs ended after a short time and emerged workers returned to their unemployed status. Such a process suggests that the labor market does not adjust correspondingly in the short-run. By saving its peculiarity in terms of capital, factor shares and technology, the labor market does not absorb such emerged workers. Therefore, most undeclared workers either never enter the declared sector or quickly return to the undeclared sector.

In order to identify the labor demands 12 and 13, we needed a valid instrument $Z_{r,t}$ for the relative supply of undeclared work. The instrument had to be correlated with the log of $\frac{U_{rt}}{D_{rt}}$ and be exogenous, implying: $E(\varepsilon_{irt}|Z_{i,t}) = 0$. Given a reliable instrument $Z_{r,t}$ for $\frac{U_{rt}}{D_{rt}}$, it follows that $b_i * Z_{r,t}$ is a reliable instrument for $b_i * \frac{U_{rt}}{D_{rt}}$.

We set

$$Z_{r,t} = \zeta_{2004} * A_{r,2002} \tag{14}$$

where $A_{r,2002} = (\widehat{FTE}_{und} - FTE_{und})_{r,2002}$. We computed $A_{r,t}$ from the ISTAT regional time series of undeclared FTE, available from 1995. By using a simple autoregressive model of order one, we predicted the value of undeclared FTE in 2002. Such procedure can be seen as a sort of synthetic counterfactual, namely the amount of undeclared FTE workers in the labor market would have prevailed in the absence of policy intervention.[12] By subtracting the real FTE value from the predicted value, we obtained a proxy of the workers who registered for the amnesties. We then multiplied this undeclared labor proxy

[12]Card (2010) uses predicted inflows of immigrants in a very similar setting in order to instru- ment the relative supply of migrants versus native workers in US.

by a time dummy which took on the value of one after the policy shock.

We claim $Z_{r,t}$ to be a pure supply-side shock.The peculiarity of the emersion process supports this intuition: undeclared workers became declared workers once the amnesty had been applied for, thus the undeclared labor supply shrank in the very short-run. On the demand-side, the level of labor input actually participating in production did not change (keeping other things constant); the same individual participated both before and after the policies intervention. All that changed is the legal status of the worker.

Moreover, as shown in Di Porto et al. (2011) the number of audits carried out by the Italian Social Security Institute (INPS) does not show any increasing rate from 2000 to 2005. In this framework there was no incentive for employers to declare workers, while there was a stronger one for the immigrants, as a result of their desire to attain legal residential status. Indeed, it is documented that migrants usually paid the application fee in place of their employers who should have done so according to the laws.

4.3 Data

We set up our investigation by merging two sources of data: the Survey on Household Income and Wealth (SHIW) and ISTAT non-observed economy indicators. SHIW provides information about individual characteristics such as hourly wages, education, years of potential work experience, as well as socio-demographic traits, while ISTAT furnishes data on undeclared and declared FTE workers by region and year. As we are interested in exploiting the temporal as well as cross-sectional variation implied by the 2002 policy shock, we chose the 2000 wave of SHIW for the "before" period and the 2004 wave of SHIW for the "after" period.

We were able to identify undeclared individuals by matching two sets of information from the SHIW dataset: wage and payment of social security contributions.[13] We defined as undeclared workers those individuals reporting a

[13]We are confident that measurement errors about the social security contribution question is not a concern for two reasons: first, the households were interviewed over a long period of time, during which a good level of trust was built up with the interviewer; second,

positive wage without receiving paid social security contributions. The latter information was obtained through a specific question in the SHIW asking whether the interviewee had ever received paid social security contributions throughout their working career.[14] A negative reply to this question, along with a positive wage, is thus the evidence of undeclared work. We refer to this as a strict definition of undeclared work. SHIW also reports the cumulative number of years of social security contributions paid by the employer to the worker. We exploited such information too by considering as undeclared workers those people residing below the 10th percentile of the distribution of years of social contributions over the years of potential work experience (a similar strategy can be found in Cappariello and Zizza 2010). We call such measure a broad definition of undeclared work. The main results of the paper are based on the estimates calculated using this broad definition. As a robustness check, we also performed the analysis applying the strict definition of undeclared work.

The sample consists of 11965 individuals, evenly distributed across the two waves. Table A.1 in the Appendix depicts descriptive statistics of the main covariates. The average work experience of declared workers is about 20 years , while it is about 15 years for undeclared ones. Undeclared workers are less educated than declared ones (56% and 54% of undeclared workers had primary level education in 2000 and 2004 respectively). The sample reveals a greater share of non-native workers in undeclared employment, 8% and 15% respectively in 2000 and 2004. . The share of women is very similar between the two types of employment (about 40%), showing a slight increase from 2000 to 2004. In addition, the Italian southern regions report the highest level of undeclared employment, with figures of about 55% and 45% in the two years considered.

the Bank of ItalyÕs interviewers are trusted because they do not belong to the tax agency. Moreover, The Bank of Italy does not share private information with the tax authorities.

[14]The exact question is: Considering the employment history of...(name), did he/she ever pay, or his/her employer pay, the social security contributions even for a short period?

5 Results

In this section we show the results of the empirical models outlined above. Sections 5.1 and 5.2 describe the estimates using the sample of male workers employed in the private sector. The focus on male wages is standard in wage inequality literature and it is meant to abstract from relative trends in female wages that are driven by changes in the relative selectivity of female workers. In addition, the attention paid to the private sector is prompted by the fact that the FTE undeclared and declared employment is only calculated for the private sector. However, section 5.3 shows the models fitted by pooling female and male workers and including individuals working in the public sector. The main conclusions are not affected by the choice of sample. As a final robustness check, we also fitted all models using the strict definition of undeclared workers, and the results (reported in section 5.3) are very similar to those of the broad definition.

5.1 Own-wage Elasticity of Labor Demand

Table 2 depicts the results from OLS estimates of equation 12. The point estimates in the first two rows of table 2 correspond to γ and δ. The estimated models in column I to V differ in the covariates we controlled for. The model in column I is the baseline estimate; it only allows for the relative supply of undeclared workers, a 2004 time dummy and the regional fixed effects. The models in columns II and III include a set of human capital and social characteristics covariates and interactions with the undeclared worker dummy. Model IV allows for the 2000 regional share of undeclared migrants, the 2000 regional share of undeclared young workers, the 2000 regional average education, the 2000 regional share of undeclared workers in agriculture, construction and manufacturing, all interacting with the 2004 dummy. Model V controls for lagged regional mean undeclared wages and the 2000 regional share of undeclared workers in the public sector. Furthermore, models III, IV, V add interactions of the covariates with a year 2004 dummy. All the models are weighted by the sample weights.

Summing γ and δ to obtain an estimate of the inverse elasticity of undeclared labor demand, we find that a 10% increase in the relative supply of undeclared work lowers undeclared wages by 0.6-1% in model I, II, III. The remaining estimates show the opposite result: a 10% increase in undeclared employment raises declared wages by 0.6%. Despite being informative, OLS estimates are biased owing to the identification issue discussed above. For this reason we do not consider the findings in Table 2 to be highly reliable.

- Table 2 about here -

To obtain reliable estimates, we estimated equation 12 using a two-stage least square (2SLS) using the instruments discussed in section 4.2. Table 3 shows the 2SLS estimates of the empirical model 12, using the same control variables as in Table 2. At the bottom of Table 3 we also report the customary F-test and Shea's partial R^2 to check the reliability of the chosen instrument. The F statistics are in all but one case greater than the threshold value of 10, and Shea's partial R^2 takes values from 0.32 to 0.60. Taken together, these checks suggests that the instruments are strong and highly significant in explaining the variance of the endogenous variables.

The point estimates in the first row of Table 3, corresponding to γ in equation 12 are in all cases negative and significantly different from zero. While, the point estimates of δ are positive and significantly different from zero in the models of column IV and V. Summing δ and γ we obtain the effect of an increase in the relative supply of undeclared workers on undeclared wages. Models IV and V suggest that a 10% increase in relative supply lowers undeclared wages by 2 - 7%. These wage effects correspond to a highly elastic undeclared labor demand of a magnitude between -14 and -35. They are much greater than the estimates of elasticity of the declared male labor demand (Hamermesh, 1987). Our findings are also greater than the ones reported by Fortin et al. (1994), who obtained a wage effect of undeclared working hours equal to 0.70 - 0.72%.

A rise in the relative supply of undeclared workers also affects declared wages; the impact is positive but significantly different from zero for models

IV and V only. The point estimates of column IV and V suggest that a 10% increase in relative undeclared labor supply raises declared earnings by an amount of 3.4 -3.9%. We recovered an estimate of the elasticity of substitution between undeclared and declared labor by looking at the coefficient in the second row, corresponding to δ in equation 12. This coefficient tells that a 10% positive shift in relative supply lowers undeclared wages with respect to declared wages by nearly 4%; this value corresponds to an estimate of the elasticity of substitution, σ_{DU}, of 2.4 in absolute value. Fortin et al. (1994) found a lower value for cross-wage elasticity even though it was not significantly different from 1. The difference is most likely explained by the different approach of Fortin et al. (1994); more specifically, they focused on a sample of Canadian workers employed in both the regular and non-regular sectors, and they were mainly interested in understanding the individual choice of also supplying non-regular hours of work in response to changes in the labor tax rate. While our sample probably includes this kind of worker, it is largely comprised of people being stuck in the underground sector. This should lead to higher value of the elasticities. Taken all together, these findings suggest that when the undeclared sector expands, *real* wage inequality - comprised of undeclared and declared wage inequality - increases.

- Table 3 about here -

5.2 The Effect of Undeclared Work on Regular Wage Inequality

The estimates in Table 3 show that changes in undeclared labor supply affect the average wage of declared workers by a remarkable amount. However, the wage effect may involve different segments of declared wage distribution. If undeclared workers are a closer substitute for declared workers at the bottom end of wage distribution, a greater undeclared labor supply will raise declared wage inequality. We explored this issue by estimating equation 13. We asked how an increase in the relative supply of undeclared labor affects declared wage

distribution at different educational levels. We split our declared workers sample into three broad education groups: college (CLG), high school (HS) and lower than high school (LHS). More specifically, college includes all those individuals who get a college or higher education degree; high school are workers with a high school diploma; and lower than high school are all those workers with a primary education degree and or no education. We then ran separate estimates for the HS-LHS and CLG-HS wage premium. The estimates are shown respectively in Table 4 and Table 5.

The college-high school (high school-lower than high school) labor supply also affects relative declared wages directly, thus, in estimating equation 13 we needed to take into account these relative supplies. As a result, we also controlled for the high school relative supply in the models of columns I to VI of Table 4, treating it as exogenous. Furthermore, we considered the case of no correlation between HS relative supply and the instrumented undeclared relative supply. The models of columns VI to X of Table 4 take this latter approach. We applied the same strategy in estimating model 13 for the CLG-HS declared workers sample.

Table 4 presents instrumental variable estimation results for the HS-LHS sample. All the models control for human capital, social characteristics and regional fixed effects, as well as interactions with a 2004 time dummy and a high school dummy. Models I-III and VI-VIII are fitted using male earnings of the private sector, while the models in columns IV and IX, and in columns V and X include women and workers employed in the public sector, respectively. At the bottom of Table 4 we show the F-statistics and Shea's partial R^2 as well as the Wald test of the joint significance of parameters π and λ.

A growth in the undeclared relative supply exerts a positive wage effect on LHS workers and a positive effect on HS-LHS wage inequality. More specifically, a 10% increase in the undeclared relative supply raises LHS wages by 3-6%, consequently raising the HS-LHS wage ratio by 3-4%. The results remained unchanged, though smaller, when we included women and people working in the public sector. By taking the ratio of the cross elasticities of undeclared labor for high-school and lower than high school, we obtained a value

ranging from 1.7 to 2.2 in all cases, implying that undeclared and least skilled declared labor are q-complements. The q-complementary effect is stronger for HS declared workers than for the LHS declared workers.

Table 5 displays analogous estimates of equation 13 for the college-high school wage premium. The estimates are arranged as in Table 4. The point estimates for college graduate wages are not significantly different from zero (see the Wald test p-value at the bottom of Table 5), while the positive effect on HS declared wages is still evident, ranging from 1.7 to 3.4%.

In conclusion, the effect of an increase in undeclared labor seems to affect the less than high school and high school declared wages to a greater degree in comparison with college graduates. As a result, an upsurge of the aggregate undeclared labor leads to a) an inflation of overall, *real* wage inequality, and b) a decrease in the wage differential between the top and the bottom of the education distribution in the declared sector. Conversely, when undeclared labor shrinks, *declared* wage inequality widens.

- Tables 4 and 5 about here -

5.3 Robustness Checks

In this section we investigate whether the estimates of Table 3 are robust to different samples and different definitions of undeclared workers. The focus here is only on the empirical model 12; some robustness checks for model 13 have already been shown in Table 4 and 5. We address whether our results generalize beyond men employed in the private sectors in Table 6 and 7. The instrumental variable estimation results of Tables 6 and 7 are performed including women and individuals working in the public sector respectively. The point estimates are very similar to those of Table 3. In particular, we obtained slightly smaller point estimates but this is not surprising since women earn lower wages than men on average. The main conclusions are unchanged: the own wage effect of undeclared labor is negative while the wage effect of undeclared work on declared labor is positive.

- Tables 6 and 7 about here -

A second concern may arise from the proxy for undeclared work. To explore this issue, we fitted analogous models of equation 12 using the strict definition of undeclared work. We then varied the sample as above. Tables 8-10 present such checks. The results are consistent with those obtained using the broad definition of undeclared work. We found statistically significant and slightly larger point estimates. Once more, this is not striking since the narrow group of undeclared workers shows lower wages than the broad group.

- Tables 8, 9 and 10 about here -

One may argue that the findings could be driven by different trends in the wages of undeclared and declared work between 2000 and 2004. We provide a check on this conjecture based on a regression between the pooled 2000-2004 residuals wages and a 2004 time dummy using men only, pooling men and women and including public sector earnings. We predicted residuals from wage equations controlling for 2 dummies for education, square in potential experience, interactions between two educational levels and 4 dummies of potential experience, dummy for migrant, dummy for living in metropolitan area, dummy for female (where applicable) and dummy for working in the public sector (where applicable). If the different wage trends of undeclared and declared work do not matter, after controlling for individual characteristics, we should obtain a coefficient on the time dummy not statistically different from zero. Table 11 shows the results of such a check. Irrespective of the sample used, it unambiguously predicts no differential trend between 2000 and 2004.

- Table 11 about here -

6 Discussion and Policy Implications

6.1 The hidden Inequality

We have shown that undeclared labor behaves as a complement input to low- and medium-skilled labor while not showing any relationship with high-

skilled labor. Such a framework can be explained by different theoretical ideas. For example, undeclared labor might have an impact on the labor supply of declared workers through interactions in market production: undeclared workers, who are less skilled and, in the case of immigrants, partially segregated, can supply labor for the production of intermediate goods or services, increasing the productivity of the medium- and low-skilled group of declared workers. Some examples are undeclared services for childcare or long-term care, that lead declared workers to be freer, less tired and therefore more productive in their main job (i.e. the same applies for dish-washers or shampoo girls, who are generally undeclared workers). This is very close to the results of Cortes and Tessada (2011), who found a positive causal relationship between less skilled immigrants and the female labor supply in the US. Undeclared labor can also affect declared workers' decisions related to time-use: leaving less productive tasks to undeclared workers, declared workers can focus on more productive ones which offer better salaries.

The Trade Union's economic rent may help to explain the differential impact of undeclared work on skill groups of the workforce. By definition, trade unions represent declared workers (Lemieux et al. 1994 use degree of unionization as an instrument for the supply of undeclared working hours in the wage equation) and are more representative of less skilled workers. As such, trade unions protect declared jobs. The insider-outsider framework may strongly predict both the complementary and the no-impact effects on the highest skilled declared workers.

The lack of substitution between undeclared and declared labor is not so strange, at least for the Italian labor market. Indeed, apart from the years of the external policy intervention, the pattern of the two series in Table 1 is constant over time, suggesting that the two types of labor walk side by side.

Our results lead to a variety of interesting consequences. The first is that any wage inequality focusing on the declared sector only, turns out to be very partial and misleading in term of policy implications. This paper demonstrates that a less marked declared wage inequality can coexist with a wider overall inequality. The extent of the undeclared market plays a crucial role on how

deceptive the picture can be.

An idea of declining inequality can be found in the very interesting analysis provided by Jenkins et al. (2011). They investigated household income distribution during the so called "great recession" (2007-2009). The analysis carried out for several European countries concludes that household incomes during the recession preserved their purchasing power thanks to public transfers. Moreover, they did not find any wider inequality, no matter what inequality index was used. However, the analysis does not take into account the undeclared workers, who in principle do not benefit from public transfers. Hence, in the light of our results (a reduction in declared inequality co-exists with a raise in overall inequality) some of the conclusions of Jenkins et al. may even be reversed if undeclared work is also considered, at least in those countries showing a large share of the undeclared phenomenon (i.e. Ireland, Spain etc).

Another important field which our analysis can contribute to is tax evasion. Despite important progress witnessed in tax compliance literature, the question about who benefits from tax evasion is still being debated. The standard assumption underlying the incidence of tax evasion is that the beneficiaries are those who successfully evade their taxes. However, Alm and Sennoga (2011) claim that this assumption is likely to be incorrect, or at least incomplete. They show that those who benefit from tax evasion are not necessarily the individuals actually engaging in evasion. Our findings seem to be consistent with such a proposition. They suggest that gainers are not only evaders but are workers who, presumably, pay taxes regularly. In our analysis these gainers are the low- and medium-skilled workers: their wages rise in response to the increase in labor tax evasion (undeclared work).

6.2 Different Categories of Migrants

Labor literature is still debating the existence of substitutability between migrant workers and different classes of native workers. So far, there is no consensus on the empirical impact of immigration (legal/illegal) on native employment and wages (amongst others see Borjas et al. 2008, Card 2009, Ottaviano

and Peri 2008). Undeclared labor is mainly comprised of migrants and, moreover, a non-negligible portion of them do not have regular documents. Hence, a thorough analysis on migrants should not neglect undeclared labor. This paper could introduce new insights into the immigration debate. We think that considering declared and undocumented migrants separately could be crucial in understanding interactions across different skill categories. While declared migrants can be imperfect substitutes for low-skilled workers (e.g. Card, 2010; Ottaviano and Peri, 2008), undocumented migrants who are unable to enter the declared sector and are therefore segregated, may reveal complements to native low-skilled employment. The competitive effects of additional undocumented immigrant inflows could become concentrated among undocumented immigrants themselves in the black market, increasing the rents of low-skilled declared native people. Future research should focus on this point and our contribution seems to be moving in this direction.

6.3 The Emersion/Immersion Effect

Policy makers deal with the challenging issue on how to obtain the emersion of undeclared labor. So far, governments have implemented several policies to deter labor tax evasion. However, as noted by Boeri and Garibaldi (2002) and Schneider (2002), in recent years undeclared activity has flourished. This suggests that shadow activities are tolerated to some extent.

The picture is complicated and this paper would like to give a contribution to a better understanding of the difficulties related to an emersion programme.

We distinguish *pure* emersion from *partial* emersion effects. By *pure* emersion we mean the shift of a worker from a state of activity in the undeclared sector to a state of activity in the declared sector. Immersion clearly occurs with the opposite shift. An emersion shift should be seen as a contraction in the undeclared work supply, corresponding to even expansion in the declared work supply. In such framework, the elasticities of labor demand in the declared and undeclared market plays a crucial role on the consequences that emersion has on earnings. Our results can help to explain the emersion/immersion effect,

at least in the short run.

However, in the light of the evidence shown by our paper, especially in section 2.2, it would be better to move back a step and rethink our concept of emersion. In section 2, we show that the shift in the supply of declared work followed by an offsetting shift in undeclared work is a myth. Boeri and Garibaldi (2002) noticed the same pattern and in their paper describe that increasing the detection probability (repression) of shadow employment means increasing job destruction and reducing job creation in the shadow segment. While this repression is followed by an increase in total employment in the declared sector, it also increases unemployment.

In our case the contraction in undeclared labor originates in short-run shock of the tax amnesty laws, keeping repression constant. Furthermore, the amnesties were not followed by any active labor market policies to preserve the jobs that emerged. As a result, the labor market immediately sent the new and costly declared workers back to shadow employment. Taken together with Boeri and Garibaldi's suggestion, this pattern leads us to believe that *pure* emersion is hard to achieve. Other policies should be implemented alongside the emersion program, supporting and supervising the increased declared employment.

Our analysis tells more in the *partial* emersion framework. We have shown that reducing the undeclared labor supply, while leaving the declared labor supply unchanged, induces important changes in wages and inequality; it improves undeclared wages and decreases low- and medium-skilled workers' wages. Given that this group of workers represents the largest share of the workforce, *partial* emersion effects conflict with their interests. Hence, emersion policies may encounter resistance if politicians are aware of the welfare loss incurred by such a group (majority of voters), leading to a preservation of the *status quo* ((i.e. it does not appear accidental that the emersion policies discussed in this paper were planned at the beginning of a mandate and not near an election). Our conclusions remain unchanged, even considering the pure emersion framework; the relative supply of undeclared workers, $\frac{U_{rt}}{D_{rt}}$, decreases even when declared labor expands by an amount equal to the con-

traction of undeclared workers . Therefore, the direction of the wage effect of the relative supply would not change.

7 Conclusion

In this paper we have studied how undeclared work affects the wages of undeclared and declared workers and, in particular, declared wage inequality. Using individual data on Italy for the years 2000-2004, we have computed an own- and cross-wage elasticity of labor demand for undeclared and declared work. Such empirical investigation requires a source of variation in undeclared labor in order to identify the labor demand. We have provided a novel identification strategy based on three Italian tax amnesty laws brought out in 2002. These laws altered the undeclared sector pattern, causing a rapid partial emersion of undeclared workers in the short-run. Our results, based on a set of 2SLS regressions, indicate that undeclared work: 1) leads to an increase in declared wages, 2) adversely affects undeclared wages and 3) leads to a decrease in wage inequality in the declared sector. While undeclared work does not affect high-skilled earnings, it positively affects low- and medium- skilled wages. We have interpreted the latter result as the evidence of complementarity. As a consequence, reducing undeclared work leads to an increase in declared wage inequality. A first clear consequence of our findings is that undertaking an inequality analysis looking at just the declared side of the labor market can produce very misleading results.

Taking into account the welfare loss of low- and medium-skilled workers, these findings could explain why policies aimed at repressing undeclared labor are hard to undertake. Finally, our analysis seems to confirm that those who benefit from tax evasion are not only those who evade. This is in line with the new literature on tax compliance. Labor tax evasion can create benefits (higher wages) for individuals who presumably do not evade (low- and medium-skilled declared workers). We have also made other minor considerations, which are in any case not negligible: first pure emersion is a myth, and undeclared and declared labor seem to behave as uncommunicating vessels. Therefore, it would

appear much more credible to investigate partial emersion frameworks, at least in the short-run. Secondly, migrants are usually considered as a homogeneous labor market input; we claim that the undeclared work perspective induces us to think that there are different categories of migrants, some of them are declared some of them not, and this status can influence other categories of workers differently. Given the widespread diffusion of the undeclared work phenomenon in recent years, the advances made in collecting information and new data sources, a more in-depth interest in economic analysis in this field would appear to be necessary.

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Table 1: OLS estimates of own- and cross-wage labor demand elasticities.

	I	II	III	IV	V
$\ln(\frac{U}{D})$	0.18***	0.19***	0.14**	0.31***	0.30***
	(0.06)	(0.06)	(0.06)	(0.08)	(0.09)
$\ln(\frac{U}{D})*$Undeclared	-0.17**	-0.25**	-0.24**	-0.24**	-.24**(.07)
	(-0.08)	(0.10)	(0.09)	(0.09)	(0.09)
Regional controls	no	no	no	yes	yes
Lagged regional dependent variable, share in public sector	no	no	no	no	yes
No. of observations	5309			5289	

*** Significant at 1%, ** Significant at 5%, * Significant at 10%. Standard errors (in brackets) account for clustering in the region and year of observation. Model I is a baseline estimate; it controls for time effect and regional fixed effect. The models in columns II and III include a set of human capital and social characteristics covariates, all interacting with an undeclared worker dummy. Models III, IV and V add interactions of the covariates with a year 2004 dummy. Model IV allows for the 2000 regional share of undeclared migrants, 2000 regional share of undeclared young workers, 2000 regional average education, 2000 regional share of undeclared workers in agriculture, construction and manufacturing, all interacting with a 2004 dummy. Model V also allows for lagged regional mean undeclared wages and the 2000 regional share of undeclared workers in the public sector. All the models are weighted by sample weights. Sample: male workers employed in the private sector.

Table 2: Two stage least squares estimates of own- and cross-wage labor demand elasticities.

	I	II	III	IV	V
$\ln(\frac{U}{D})$	0.091	0.048	0.002	0.340***	0.393***
	(0.150)	(0.138)	(0.141)	(0.113)	(0.104)
$\ln(\frac{U}{D})$*Undeclared	-0.405**	-0.431**	-0.416**	-0.413**	-0.418**
	(0.190)	(0.180)	(0.168)	(0.169)	(0.169)
Regional controls	no	no	no	yes	yes
Lagged regional dependent variable, share in public sector	no	no	no	no	yes
$\sigma_U = 1/\gamma + \delta$	-3.22	-2.61	-2.5	-14.2	-35.7
$\sigma_{DU} = 1/\delta$	-2.5	-2.32	-2.4	-2.4	-2.4
F-test	24; 7.5	22.14; 11.85	22; 11	18; 18	32.6; 30
Shea's Partial R^2	0.48; 0.32	0.48; 0.32	0.48; 0.32	0.50; 0.32	0.60; 0.32
No of observations	5309		5289		

** Significant at 5%, * Significant at 10%. Standard errors (in brackets) account for clustering in the region and year of observation. The relative supply of undeclared labor is instrumented by the difference between predicted and actual FTE undeclared workers multiplied by a 2004 dummy. See the note to table 2 for models' description. Sample: male workers employed in the private sector.

Table 3: Two stage least squares estimates of the impact of undeclared work on regular wage inequality

	I	II	III	IV	V	VI	VII	VIII	IX	X
	High school-Less than high school									
$\ln(\frac{U}{D})$	0.350*	0.514**	0.654***	0.563***	0.259**	0.045	0.403**	0.456***	0.271**	0.079
	(0.182)	(0.242)	(0.226)	(0.212)	(0.127)	(0.180)	(0.172)	(0.149)	(0.134)	(0.079)
$\ln(\frac{U}{D})$*High school	0.382	0.394	0.402	0.407	0.340	0.271*	0.272*	0.265*	0.247*	0.239*
	(0.246)	(0.249)	(0.264)	(0.263)	(0.226)	(0.153)	(0.153)	(0.153)	(0.144)	(0.128)
$\ln(\frac{HS}{LHS})$	0.134*	0.165	0.289**	0.359***	0.210**					
	(0.075)	(0.102)	(0.117)	(0.132)	(0.103)					
$\ln(\frac{HS}{LHS})$*High school	0.205	0.214	0.224	0.296	0.195					
	(0.132)	(0.135)	(0.148)	(0.190)	(0.172)					
Regional controls	no	yes	yes	yes	yes	no	yes	yes	yes	yes
Lagged regional dependent variable, share in public sector	no	no	yes	yes	yes	no	no	yes	yes	yes
$\sigma_{u-hs}/\sigma_{u-lhs}=\pi+\lambda/\pi$	2.1	1.7	1.6	2.3	2.3	7	1.6	1.6	1.9	4
p-value H_0: $\pi+\lambda=0$	0.000	0.000	0.000	0.000	0.000	0.11	0.000	0.000	0.000	0.000
F-test	15; 10	16.7; 19.4	31; 32	19; 26	20; 20	24; 14	20.2; 16.4	35; 24	33; 26.5	32.6; 21.5
Shea's Partial R^2	0.36;0.14	0.46; 0.14	0.57; 0.13	0.46; 0.12	0.48; 0.12	0.47; 0.21	0.50; 0.21	0.60; 0.21	0.57;0.20	0.60; 0.21
No of observations		4425		6800	9375		4425		6800	9375

** Significant at 5%, * Significant at 10%. Standard errors (in brackets) account for clustering in the region and year of observation. The relative supply of undeclared labor is instrumented by the difference between predicted and actual FTE undeclared workers multiplied by a 2004 dummy. All the models include a set of human capital and social characteristics covariates all interacting with a high school dummy and a year 2004 dummy. Models IV an IX include female workers, while models V and X also consider employees in the public sector. All the models are weighted by sample weights.

Table 4: Two-stage least squares estimates of the impact of undeclared work on regular wage inequality

	I	II	III	IV	V	VI	VII	VIII	IX	X
					College-High school					
$\ln(\frac{U}{D})$	-0.276	0.345**	0.343**	0.258***	0.180***	0.220	0.362**	0.343***	0.302***	0.211***
	(0.242)	(0.165)	(0.135)	(0.100)	(0.062)	(0.232)	(0.165)	(0.131)	(0.100)	(0.072)
$\ln(\frac{U}{D})$*College	-0.250	-0.236	- 0.232	-0.122	-0.182	-0.282	-0.268	-0.268	-0.078	-0.162
	(0.348)	(0.350)	(0.346)	(0.225)	(0.176)	(0.446)	(0.445)	(0.444)	(0.276)	(0.186)
$\ln(\frac{CLG}{HS})$	-0.080*	-0.032	-0.044	0.025	0.024					
	(0.064)	(0.035)	(0.038)	(0.053)	(0.040)					
$\ln(\frac{CLG}{HS}) * College$	-0.055	- 0.050	-0.054	0.056	0.032					
	(0.170)	(0.170)	(0.173)	(0.148)	(0.083)					
Regional controls	no	yes	yes	yes	yes	no	yes	yes	yes	yes
Lagged regional dependent variable, share in public sector	no	no	yes	yes	yes	no	no	yes	yes	yes
$\sigma_{u-clg}/\sigma_{u-hs}=\pi+\lambda/\pi$	1.9	0.3	0.3	0.5	0	-0.3	0.2	0.2	0.7	0.2
p-value H_0: $\pi+\lambda=0$	0.176	0.788	0.778	0.610	0.984	0.267	0.853	0.872	0.473	0.802
F-test	14.3; 10	14.7; 8.06	43.4; 8.5	41; 7	35; 8	20; 5.4	16.7; 4.4	36.3; 3.7	34; 5	36; 8
Shea's Partial R^2	0.46;0.19	0.46; 0.14	0.70; 0.20	0.64; 0.17	0.63; 0.18	0.50 ; 0.13	0.45; 0.13	0.60; 0.13	0.60;0.16	0.60; 0.19
No of observations		2377		3911	6675		2377		3911	6675

** Significant at 5%, * Significant at 10%. Standard errors (in brackets) account for clustering in the region and year of observation. The relative supply of undeclared labor is instrumented by the difference between predicted and actual FTE undeclared workers multiplied by a 2004 dummy. All the models include a set of human capital and social characteristics covariates, all interacting with a college dummy and a year 2004 dummy. Models IV an IX include female workers, while models V and X also consider employees in the public sector. All the models are weighted by sample weights.

Table 5: Two-stage least squares estimates of own- and cross-wage labor demand elasticities. Male and female workers

	I	II	III	IV	V
$\ln(\frac{U}{D})$	-0.006	-0.033	-0.063	0.297***	0.254**
	(0.118)	(0.127)	(0.123)	(0.103)	(0.100)
$\ln(\frac{U}{D})$*Undeclared	-0.295*	-0.354**	-0.360**	-0.352**	-0.352**
	(0.156)	(0.152)	(0.146)	(0.145)	(0.146)
Regional controls	no	no	no	yes	yes
Lagged regional dependent variable, share in public sector	no	no	no	no	yes
$\sigma_U = 1/\gamma + \delta$	-3.3	-2.6	-2.3	-18	-10
$\sigma_{DU} = 1/\delta$	-3.3	-2.8	-2.8	-2.8	-2.8
F-test	24; 7.5	22.14; 11.85	22; 11	18; 18	32.6; 30
Shea's Partial R^2	0.48; 0.32	0.48; 0.32	0.48; 0.32	0.50; 0.32	0.60; 0.32
No of observations	8255		8222		

** Significant at 5%, * Significant at 10%. Standard errors (in brackets) account for clustering in the region and year of observation. See the note to table 3 for models' description and additional details. Sample: male and female workers employed in the private sector.

Table 6: Two-stage least squares estimates of own- and cross-wage labor demand elasticities. Male and female workers in public and private sectors.

	I	II	III	IV	V
$\ln(\frac{U}{D})$	0.145	0.105	0.085	0.166**	0.092*
	(0.095)	(0.069)	(0.062)	(0.066)	(0.050)
$\ln(\frac{U}{D})$*Undeclared	-0.344**	-0.355***	-0.363***	-0.361***	-0.362***
	(0.143)	(0.130)	(0.124)	(0.124)	(0.124)
Regional controls	no	no	no	yes	yes
Lagged regional dependent variable, share in public sector	no	no	no	no	yes
$\sigma_U = 1/\gamma + \delta$	-5	-4	-3.6	-5.1	-3.7
$\sigma_{DU} = 1/\delta$	-3	-2.8	-2.7	-2.7	-2.7
F-test	23.5; 9	23; 14	23.5; 12.5	18; 38	32.6; 56.3
Shea's Partial R^2	0.48; 0.32	0.48; 0.32	0.48; 0.32	0.51; 0.33	0.60; 0.33
No of observations	12014		11965		

** Significant at 5%, * Significant at 10%. Standard errors (in brackets) ac- count for clustering in the region and year of observation. See the note to table 3 for models' description and additional details. Sample: male and female workers employed in the private and public sectors.

Table 7: Two-stage least squares estimates of own- and cross-wage labor demand elasticities. Strict definition of undeclared worker.

	I	II	III	IV	V
$\ln(\frac{U}{D})$	0.154	0.102	0.051	0.258**	0.248
	(0.155)	(0.145)	(0.146)	(0.115)	(0.231)
$\ln(\frac{U}{D})$*Undeclared	-0.673*	-0.575**	-0.558**	-0.546**	-0.551**
	(0.377)	(0.228)	(0.221)	(0.222)	(0.224)
Regional controls	no	no	no	yes	yes
Lagged regional dependent variable, share in public sector	no	no	no	no	yes
$\sigma_U = 1/\gamma + \delta$	-1.9	-2.1	-2	-3.5	-3.3
$\sigma_{DU} = 1/\delta$	-1.5	-1.7	-1.8	-1.8	-1.8
F-test	22; 10.2	23; 17.6	27.5; 16.6	44; 24	10; 21
Shea's Partial R^2	0.48; 0.41	0.48; 0.41	0.48; 0.41	0.61; 0.41	0.28; 0.40
No of observations	5309		5289		

** Significant at 5%, * Significant at 10%. Standard errors (in brackets) account for clustering in the region and year of observation. See the note to table 3 for models' description and additional details. Sample: male workers employed in the private sector.

Table 8: Two-stage least squares estimates of own- and cross-wage labor demand elasticities. Male and female workers, strict definition of undeclared worker.

	I	II	III	IV	V
$\ln(\frac{U}{D})$	0.048	0.013	-0.017	0.097	-0.082
	(0.118)	(0.124)	(0.128)	(0.100)	(0.195)
$\ln(\frac{U}{D})$*Undeclared	-0.614*	-0.558***	-0.553***	-0.540***	-0.536**
	(0.327)	(0.212)	(0.207)	(0.209)	(0.212)
Regional controls	no	no	no	yes	yes
Lagged regional dependent variable, share in public sector	no	no	no	no	yes
$\sigma_U = 1/\gamma + \delta$	-1.7	-1.8	-1.7	-2.2	-1.6
$\sigma_{DU} = 1/\delta$	-1.6	-1.8	-1.8	-1.8	-1.8
F-test	20; 10.7	19.8; 18.5	21; 18	42; 26	10; 18
Shea's Partial R^2	0.48; 0.38	0.48; 0.40	0.48; 0.38	0.60; 0.38	0.30; 0.40
No of observations	8255		8222		

** Significant at 5%, * Significant at 10%. Standard errors (in brackets) account for clustering in the region and year of observation. See the note to table 3 for models' description and additional details. Sample: male and female workers employed in the private sector.

Table 9: Two-stage least squares estimates of own- and cross-wage labor demand elasticities. Male and female workers in private and public sectors, strict definition of undeclared worker.

	I	II	III	IV	V
$\ln(\frac{U}{D})$	0.178*	0.125*	0.103	-0.010	-0.170*
	(0.105)	(0.073)	(0.070)	(0.062)	(0.100)
$\ln(\frac{U}{D})$*Undeclared	-0.655**	-0.532***	-0.536***	-0.530***	-0.529***
	(0.295)	(0.183)	(0.180)	(0.181)	(0.182)
Regional controls	no	no	no	yes	yes
Lagged regional dependent variable, share in public sector	no	no	no	no	yes
$\sigma_U = 1/\gamma + \delta$	-2.1	-2.4	-2.3	-1.8	-1.4
$\sigma_{DU} = 1/\delta$	-1.5	-2	-1.8	-1.8	-1.9
F-test	22; 11	22; 17.5	24; 17.5	44; 44	12; 31
Shea's Partial R^2	0.48; 0.41	0.48; 0.42	0.48; 0.41	0.60; 0.41	0.30; 0.41
No of observations	12014		11965		

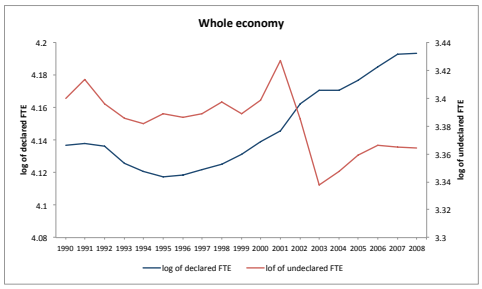
*** Significant at 1%, ** Significant at 5%, * Significant at 10%. Standard errors (in brackets) account for clustering in the region and year of observation. See the note to table 3 for models' description and additional details. Sample: male and female workers employed in the private and public sectors.

Table 10: Correlation between residual log hourly wages and the dummy 2004.

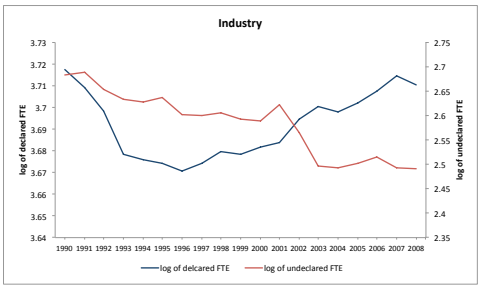
	males	males & females	male & females plus public
ζ_{2004}	0.000	-0.005	-0.000
	(0.007)	(0.006)	(0.005)
constant	-0.001	-0.000	0.000
	(0.005)	(0.004)	(0.003)
No of observations	5289	8222	11965

$***$ Significant at 1%, $**$ Significant at 5%, $*$ Significant at 10%. Standard errors (in brackets) account for clustering in the region and year of observation. Residuals come from wage equations controlling for 2 dummies for education, square in potential experience, interactions between two educational levels and 4 dummies of potential experience, dummy for migrants, dummy for living in a metropolitan area, dummy for females (where applicable) and dummy for working in the public sector (where applicable); furthermore, all the covariates are interacted with an undeclared worker dummy.

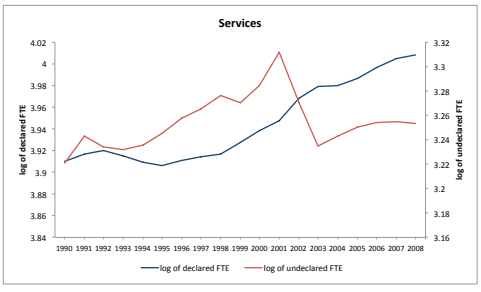
Figure 1: Evolution of declared and undeclared full time equivalent workers, 1990-2008.



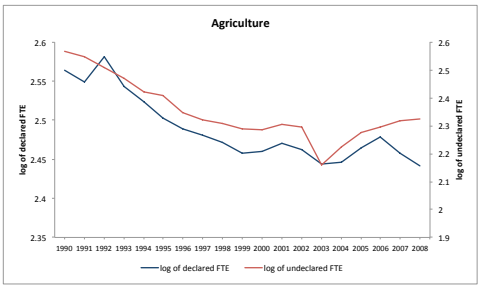
(a) Whole economy



(b) Industry sector



(c) Services sector



(d) Agriculture sector

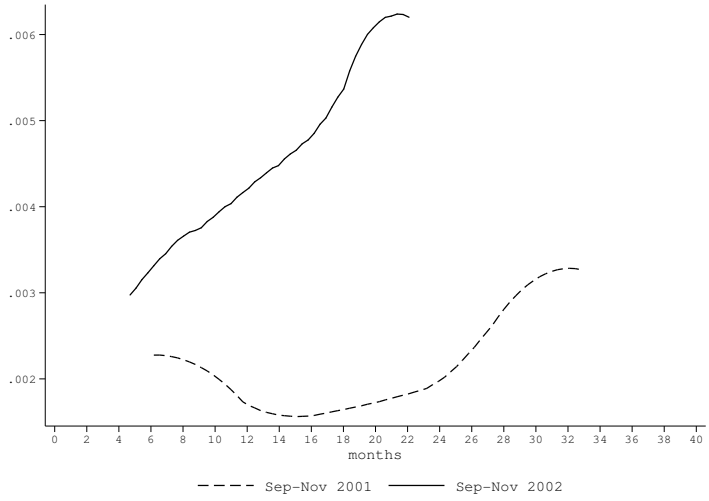


Figure 2: Smoothed hazard functions for exiting employment, pre- and post-reform.

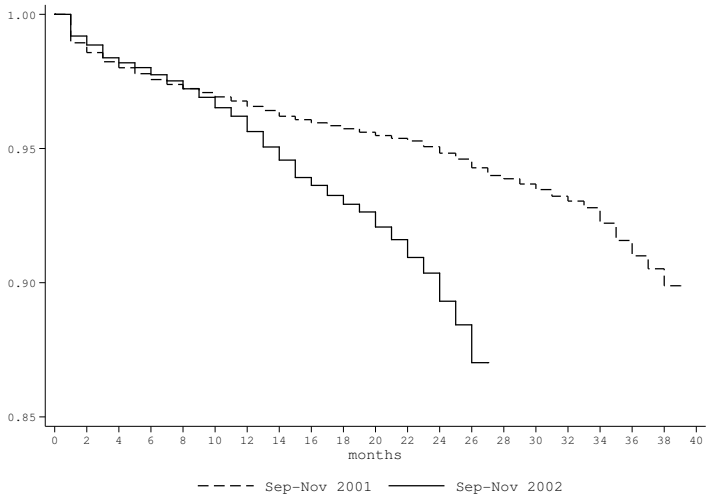


Figure 3: Kaplan-Meier survival functions for being employed, pre- and post-reform.

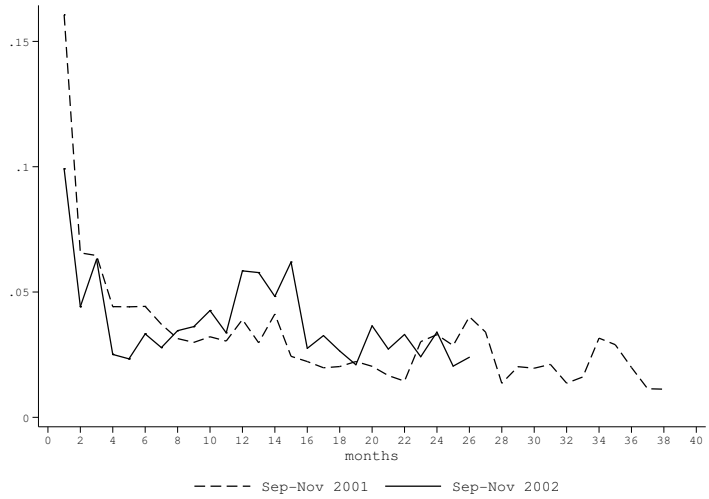
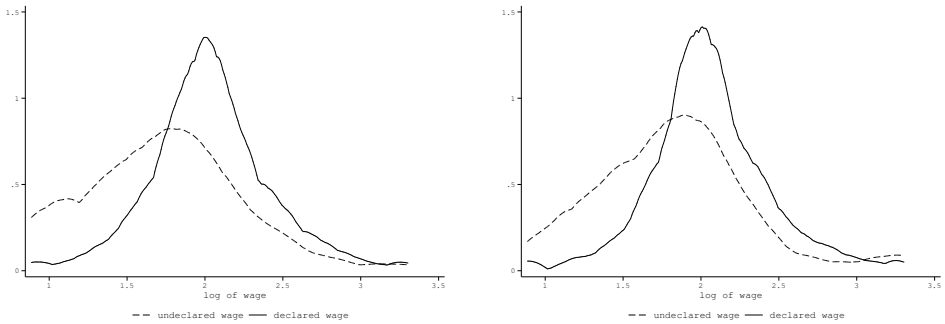


Figure 4: Predicted hazard functions for exiting employment, pre- and post-reform. Reference category: male, aged 30, manual worker, with permanent contract, employed full-time, living in the North-West, working in the manufacturing sector.



(a) 2000 (b) 2004

Figure 5: Estimated kernel density for undeclared and declared wages in 2000 and 2004.