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Tackling Undeclared Work in the European Union: Beyond the Rational Economic Actor Approach

Abstract

To tackle the undeclared economy, an emergent literature has called for the dominant "rational economic actor" approach, which increases the sanctions and risk of detection, to be replaced and/or complemented by a "social actor" approach that fosters citizens' commitment to compliance. Reporting two waves of the Eurobarometer survey conducted in 2007 and 2013 across Europe, fixed-effects logistic regression analysis reveals that although both approaches reduce participation in undeclared work, the strength of the impact of deterrents on the likelihood of participation in undeclared work has weakened between 2007 and 2013, but has strengthened for vertical and horizontal trust. The paper concludes by discussing the policy implications of these findings.

Key words: undeclared work, rational economic actors, vertical trust, horizontal trust, public policy, European Union

Introduction

Across the member states of the European Union and beyond, paid transactions occur that are not declared to the state for tax, social security and/or labour law purposes when they should be declared. Schneider estimates this undeclared economy to be equivalent to 17.9 per cent of the EU-28 GDP in 2016 (Schneider 2016). Tackling the undeclared economy has thus become a core issue on the policy agendas of supra-national agencies and governments (European Commission 2016; ILO 2015; OECD 2012). How, therefore, can the undeclared economy be tackled? Reviewing the literature, two main distinct approaches can be identified, namely a "rational economic actor" approach that tackles undeclared work by ensuring that the payoff from undeclared work is outweighed by the costs, and a "social actor" approach grounded in a view that undeclared work arises when tax morale is low. However, Alm and Torgler (2011) identify three different administrative paradigms which can be used for encouraging tax

compliance, which require different policy measures. The first one, the "enforcement paradigm", views tax payers as potential criminals and uses deterrents (i.e., audits and penalties) to repress non-compliant behaviour similar to the "rational economic actor" view. In the second paradigm, the "service paradigm", although the role of deterrent measures is recognised, the emphasis is on administrative reforms to ensure a more "customer-friendly" tax administration, to simplify the process and to provide tax education and assistance to taxpayers. The third "trust paradigm" acknowledges the role of tax morale and social norms in tax compliance decisions, akin to the "social actor" approach (Alm and Torgler 2011). The evidence that increasing deterrents elicits reductions in undeclared work is less than conclusive with some studies revealing it is reduced and others not (Williams 2014a). Despite the wider academic literature questioning the effectiveness of deterrents, a survey in 2010 of policy stakeholders in 31 European countries shows that the perceived penalties and/or perceived sanctions are considered effective means of tackling undeclared work (i.e. 50% of stakeholders view the perceived penalties as effective and 64% share the same opinion about the improving the risk of detection) (Williams et al. 2013). A similar survey conducted in 2017 across 23 Member States of the European Union, reveals that the dominant view of the enforcement bodies has not changed; deterrence measures are viewed as the most important type of measure and the most effective measure for tackling undeclared work. However, the same survey also reveals little ex-ante and ex-post evaluation of policy measures used (Williams and Puts 2017). This paper starts to fill that gap. The aim is to evaluate whether there have been changes over time in the effectiveness of the main "rational economic actor" deterrence approach used across the Member States of the European Union, along with the emergent "social actor" approach.

To do this, the first section will briefly set the context by reviewing the policy approaches available for tackling undeclared work, outlining the main "rational economic actor" approach used by the enforcement bodies and the emergent "social actor" approach. Revealing the lack of evidence that a deterrence approach is more effective at reducing the likelihood of participating in undeclared work than a "social actor" approach, and that the enforcement bodies continue to pursue a deterrence approach, the second section then reports the methodology and the data sets employed to evaluate the effectiveness of these policy approaches, whilst the third section will report the findings. This will display that, while the impact of deterrents on reducing undeclared work has weakened in 2013 compared with 2007, the impact of vertical and horizontal trust, which is at the core of the "social actor" approach,

has strengthened over the same period. The fourth and final section then discusses the resultant implications for policy and further research.

Before commencing however, it is necessary to define undeclared work. In this paper, reflecting the widespread consensus in both the academic literature and policy circles, undeclared work is defined as paid work that is legal in all respects other than it is not declared to the authorities for tax, social security or labour law purposes (Aliyev 2015; Boels 2014; European Commission 2007; OECD 2012; Williams 2014a, 2014b). If there are additional differences, then it is not undeclared work. For example, if the goods and/or services exchanged are illegal (such as illegal drugs), then this is not undeclared work but part of the wider criminal economy.

Policy Approaches Towards Undeclared Work: Beyond the "Economic Rational Actor"

Conventionally, governments have adopted a rational economic actor approach when tackling undeclared work. In 1972, Allingham and Sandmo viewed participation in undeclared work as arising when the pay-off is greater than the expected cost of being caught and punished (Allingham and Sandmo 1972). This was subsequently widely adopted (Grabiner 2000; Job, Stout, and Smith 2007; Richardson and Sawyer 2001), resulting in governments seeking to deter participation by increasing the actual or perceived penalties and risks of detection. Until now, as Table 1 displays, the evidence that increasing deterrents elicits reductions in undeclared work is less than conclusive with some studies revealing that this reduces it and others not (Williams 2014a).

[INSERT TABLE 1 HERE]

Some earlier literature, based on surveys and experiments, supportive of the rational actor approach, found that increasing the probability of detection and/or the sanctions level reduces participation in the undeclared economy (Dubin and Wilde 1988; Feld and Frey 2002; Friedland 1982; Friedland, Maital, and Rutenberg 1978; Klepper and Nagin 1989; Mazzolini, Pagani, and Santoro 2017; Schwartz and Orleans 1967; Slemrod, Blumenthal, and Christian 2001; Webley and Halstead 1986; Witte and Woodbury 1985). Indeed, a meta-analysis of twenty laboratory experiments conducted mainly with students in the United States, Central America, Europe and Israel, concluded that increasing the penalty and the probability of audits increase the tax compliance (Blackwell 2010). Similarly, studies conducted at the macro level, analyzing secondary data at country or regional level, provide support to the

rational actor approach (Kluge and Libman 2017; Mas'ud, Manaf, and Saad 2015). However, the risk of detection seems to be more efficient than the severity of the sanction (Friedland 1982; Webley and Halstead 1986; Williams and Horodnic 2017a, 2017b). The results of a meta-analysis of the experimental results in the United States showed that in nearly all laboratory experiments, a higher audit rate led to an increase in compliance, but increasing penalties had only a marginal effect (Alm 1999). Other literature is only partially supportive of the "rational actor approach, calling for complementary policy approaches in order to obtain greater tax compliance (Alm, Sanchez, and De Juan 1995; Bernasconi 1998; Grasmick and Bursik 1990; Schwartz and Orleans 1967; Wenzel 2004; Williams and Horodnic 2017a, 2017b). However, yet other literature argues that increasing the level of deterrents has no effect (Hartl et al. 2015; Shaw, Slemrod, and Whiting 2008; Williams and Franic 2015, 2016) or even leads to increased noncompliance (Chang and Lai 2004; Hofmann et al. 2017; Kaplanoglou and Rapanos 2015; Kaplanoglou, Rapanos, and Daskalakis 2016; Mohdali, Isa, and Yusoff 2014; Murphy 2005, 2008; Murphy and Harris 2007) which might be a result of the breakdown of trust between the state and its citizens. Furthermore, no significant association was found between deterrent measures and an individuals` tax morale (Torgler 2005a). However, previous studies show that in low trust environments with perceived low power of the authorities, there is a high intention of evading taxes (Kaplanoglou and Rapanos 2015; Kogler et al. 2013). Furthermore, a high expected penalty for tax evasion even causes citizens to choose a low income redistribution policy (Solano-Garcia 2017). Meanwhile, a high interactional fairness and a low level of deterrents results in a high intention of compliance (Farrar, Kaplan, and Thorne 2017; Murphy 2008; Murphy and Harris 2007). These results support the view that there are different types of individuals who decide whether to comply taking into account different rationales. Drawing inspiration from Vogel (1974) work, Torgler (2003a) developed a typology comprising four types of taxpayers. According to this typology, only for the "tax evaders" which have a low tax morale and search ways to evade taxes by weighing the costs and benefits of being non-compliant, the most appropriate policy approaches are those related with the "rational economic actor" approach. The other three typologies, emphasize other reasons for compliance, namely "social taxpayers" are influenced by the social norms and the behavior of those close to them, "intrinsic taxpayers" are influenced by the behavior of the government and how the tax administration treat them and, "honest taxpayers", the opposite extreme to the "tax evaders", do not search ways to evade taxes regardless of the level of deterrence (Torgler 2003a).

However, the most important rebuttal of the use of deterrents is the evidence that many citizens voluntarily comply even when the level of penalties and risk of detection would suggest that they should not if they were truly rational economic actors (Murphy 2008). Therefore, the following hypothesis can be tested:

> *The rational economic actor hypothesis (H1):* The higher the perceived deterrents, the lower the likelihood of participation in undeclared work.
>
> > *H1a:* The higher the perceived sanctions, the lower the likelihood of participation in undeclared work.
> >
> > *H1b:* The higher the perceived risk of detection, the lower the likelihood of participation in undeclared work.

In recent years, drawing inspiration from a variant of institutional theory (Helmke and Levistky 2004; North 1990), a new social actor approach has emerged which focuses upon developing the social contract between the state and its citizens to engender a voluntary willingness to comply, rather than forcing citizens to comply using threats, and/or harassment. Thus, a new way of explaining and tackling undeclared work has been advanced (Williams and Horodnic 2015; Williams, Horodnic, and Windebank 2015). This attributes undeclared work to result from formal institutional imperfections that produce an asymmetry between the codified laws and regulations of a society's formal institutions ("state morale") and the socially shared unwritten rules of its informal institutions ("civic morale"). The greater the resultant institutional asymmetry due to these formal institutional failings, the higher is the likelihood of undeclared work. Participation in undeclared work thus emerges when "tax morale" (i.e. the intrinsic motivation to pay taxes) is low. The goal, therefore, is to engender a commitment of the population to self-regulate by improving their tax morale (Kirchler 2007; Torgler 2007, 2011). Indeed, studies using survey data, conducted in different countries in Europe (Williams and Franic 2015, 2016; Williams, Horodnic, and Burkinshaw 2016; Windebank and Horodnic 2017), regions of the European Union (Williams and Horodnic 2015, 2017b) or the whole European Union (Williams and Horodnic 2017a; Williams, Horodnic, and Windebank 2015), confirm that the higher the tax morale, the lower the individuals` likelihood to participate in undeclared work. The effect of tax morale on the wider shadow economy has been also confirmed when analysing data measured at country level rather than individual level (Torgler and Schneider 2007, 2009).

However, the scholarship based on institutional asymmetry theory has until now focused almost entirely upon the relationship between participation in undeclared work and the level of "vertical trust" (between government and citizens). An important facet of the social actor approach that has been less investigated is the relationship between participation in undeclared work and the level of "horizontal trust" (between citizens). While previous studies failed to identify a relationship between generalised trust (i.e. a trust in other people) and non-compliant behaviours (for an extensive review see Chan, Supriyadi, and Torgler 2018), horizontal trust in the form of trusting other individuals to be tax compliant is linked to participation in undeclared work. It can be argued, for example, that individuals are more likely to evade tax if they live in a community where tax evasion is considered widespread, not least because they might then be less worried about the formal and informal sanctions, but also because they might consider that everybody else does it so why should they be compliant. Indeed, although not using the institutional asymmetry framework, previous studies, using laboratory experiments, reveal that taxpayers' inclination to comply depends on the behaviour of their fellow citizens (Alm 2017; Ajzen 1991; Chang and Lai 2004; Traxler 2010) and that individuals comply if tax compliance is the social norm (Alm 1999, 2012; Alm, McClellan, and Schulze 1999). Moreover, a link between tax compliance and the psychic stress of breaking a social norm has been identified (Dulleck et al. 2016). For example, a laboratory experiment conducted in three European countries (Belgium, France, and the Netherlands) reveals that for participants who received information about low compliance identified in previous studies, tax evasion increased significantly, but those who received information about high compliance did not increase their subsequent tax evasion (Lefebvre et al. 2015). Furthermore, although there is little evidence based on surveys, two experiments conducted in the UK (Hallsworth et al. 2017) and in Austria (Fellner et al. 2013) confirm that tax compliance is influenced by information on the level of compliance of other citizens. In both field experiments, the level of tax compliance was increased after the experimental groups received a letter informing them about the high compliance of their peers. Thus, the individuals' behaviour is conditionally cooperative, they are willing to be compliant conditioned by the behaviour of others (Traxler 2010). Similar results were obtained when investigating the effect of vertical trust and horizontal trust on tax morale namely, a strong effect of vertical trust or the perceived tax evasion of other individuals and a lack or inconsistent relationship with generalised trust (Chan, Supriyadi, and Torgler 2018; Frey and Torgler 2007; Torgler et al. 2008). Therefore, the following hypothesis can be evaluated:

The social actor hypothesis (H2): The lower the horizontal trust and vertical trust, the higher is the likelihood of participation in undeclared work.

H2a: The lower the vertical trust, the higher the likelihood of participation in undeclared work.

H2b: The lower the horizontal trust, the higher the likelihood of participation in undeclared work.

Analysing the policy approaches employed by the governments across the European Union, it becomes quickly apparent not only that the deterrents represent the most common policy approach but also that the importance attributed to this approach has increased over time. Indeed, a survey conducted in 2010 amongst stakeholders in 31 European countries shows that both increasing the perceived penalties and risk of detection are considered effective means of tackling undeclared work. While 100 per cent of governments use policy measures that seek to improve the risk of detection and 93 per cent use penalty measures, only 90 per cent use preventive measures, 69 per cent measures aimed to foster commitment to declared work and 64 per cent curative measures. The views of the stakeholders regarding the effectiveness of these policy measures place the measures for improving the risk of detection in first place, followed by curative measures, penalties, preventive measures and lastly, measures aimed to foster commitment to declared work (Williams et al. 2013).

A similar study conducted in 2017 in 23 Member State of the European Union, reveals that the perceived effectiveness of deterrence measures is higher in 2017 compared with 2010. As such, the rank order from the perceived most effective to the least effective measure for tackling undeclared work reveals that senior government officials perceive penalties as the most effective policy measure, followed by measures to improve detection, awareness raising campaigns (i.e., fostering commitment to declared work), incentives to operate in the declared economy (i.e., curative measures) and least effective are the measures related to changing the formal institutions (i.e., preventive measures) (Williams and Puts 2017). Therefore, in 2017, the measures related to the "rational economic actor" deterrence approach are perceived as the top two most effective policy measures for tackling undeclared work, while measures related to curative measures, preventive measures and measures aimed to foster commitment to declared work (i.e., the "social actor" approach) are considered less effective than in 2010. Thus, despite the widespread recognition that deterrents need to be complemented by measures that foster trust between citizens and between government and citizens in order to

increase the voluntary compliance, many member states of the European Union remain entrenched in a deterrence approach towards undeclared work. According to the European Platform for Tackling Undeclared Work members and observers, and confirmed by a 2017 survey on them, the dominance of deterrence measures is for two main reasons, namely the lack of a short-term quantifiable outcome from non-deterrents and few evaluations existing of the effect of non-deterrence measures, which hinder their adoption (Williams and Puts 2017).

[INSERT TABLE 2 HERE]

As Table 2 displays, in many countries the share of the shadow economy increased and in those countries where it decreased, this reduction is rather marginal. Similarly, the results of the two waves of the Eurobarometer on undeclared work show that the reported participation in undeclared work in the European Union decreased by 1 per cent in 2013 compared with 2007. Thus, the phenomenon seems to be persistent. If these senior stakeholders are correct in their views, then the effectiveness of deterrents in reducing the likelihood of participation in undeclared work should have increased over time, and the effectiveness of improving vertical and horizontal trust in reducing the likelihood of participation should have decreased over time. As such, the following hypotheses can be tested:

The increasing effectiveness of deterrents hypothesis (H3): the relationship between deterrents and the likelihood of participation in undeclared work is stronger in 2013 compared with 2007.

H3a: The relationship between the perceived sanctions and the likelihood of participation in undeclared work is stronger in 2013 compared with 2007.

H3b: The relationship between the perceived risk of detection and the likelihood of participation in undeclared work is stronger in 2013 compared with 2007.

The decreasing effectiveness of vertical and horizontal trust hypothesis (H4): the relationship between vertical and horizontal trust and the likelihood of participation in undeclared work is weaker in 2013 compared with 2007.

H4a: The relationship between vertical trust and the likelihood of participation in undeclared work is weaker in 2013 compared with 2007.

H4b: The relationship between horizontal trust and the likelihood of participation in undeclared work is weaker in 2013 compared with 2007.

Methodology

Data and analytical approach

To analyse the relationship between the likelihood of engaging in undeclared work and the "rational economic actor" approach (which uses deterrents to ensure that the costs of undeclared work outweigh the benefits) on the one hand, and the complementary "social actor" approach (which focuses upon improving both vertical trust and horizontal trust) on the other hand, a pooled data set is reported. The dataset is built by combining two special Eurobarometer surveys on undeclared work conducted in 2007 and 2013. In 2007, the Special Eurobarometer No.284 involved 26,659 face-to-face interviews over the 27 member states of the European Union (EU-27). In 2013, this survey was repeated, with Special Eurobarometer survey No. 402 involving 27,563 face-to-face interviews across the 28 member states of the European Union. We here exclude Croatia from the analysis and analyse the 26,563 interviews conducted in the EU-27 level to enable comparison with the 2007 wave.

Both waves used a multi-stage random (probability) sampling methodology which ensured that on the issues of gender, age, region and locality size, each country as well as each level of sample was representative in proportion to its population size. Here therefore, for univariate analysis we employ the sample weighting scheme as recommended in both the wider literature (Sharon and Liu 1994; Solon, Haider, and Wooldridge 2013; Winship and Radbill 1994) and the Eurobarometer methodology, to obtain meaningful descriptive results. For the multivariate analysis however, debate exists over whether to use a weighting scheme (Pfeffermann 1993; Sharon and Liu 1994; Solon, Haider, and Wooldridge 2013; Winship and Radbill 1994). Reflecting the majoritarian view, the decision has been taken here not to do so. For both the descriptive statistics and the multivariate analysis, we analysed all cases available for each analysed variable (don't know and refusal were excluded). However, as a robustness check, and to avoid exclusion of some individuals because they did not provide answers to each and every question related to their participation in undeclared work, the main variables of interest (related with the economic and social actor hypotheses) and/or the socio-demographic characteristics, we used multiple imputations (Bartlett and Carpenter 2013;

Rubin 1987). Twenty imputations were simulated through a system of chained equations for every missing value (details about the number of missing values are provided in Table A8). We provide in the Appendix the results of the robustness check, namely additive models in Table A1, models using recoded data for the main variables in Table A2, results using imputed data in Table A3 and results using two alternative types of estimation with both crude and imputed data in Tables A4 to A7.

Variables

To evaluate the association between the likelihood of participation in undeclared work in the EU-27 and the policy approaches, the dependent variable used is a dummy variable with recorded value 1 for persons carrying out undeclared work in the last 12 months prior to survey. For the policy approaches, four explanatory variables are used. Firstly, to evaluate the "rational economic actor" approach, two deterrents are investigated, namely the perceived risk of detection and the expected sanctions. The perceived risk of detection when engaging in undeclared work is measured as a dummy variable, with value 0 for a very small or fairly small perceived risk of detection and value 1 for a fairly high or very high risk. To evaluate how the expected sanctions if caught doing undeclared work are associated with the likelihood to participate in undeclared work, a dummy variable was used, with value 0 for those asserting that the normal tax or social security contributions would be due and value 1 for those stating that the normal tax or social security contributions due, plus there would be a fine or imprisonment.

Secondly, to evaluate the association between participation in undeclared work and the "social actor" approach, two variables measuring both vertical and horizontal trust are investigated. View through an institutionalist lens (Helmke and Levitsky 2004; North 1990), participation in undeclared work emerges when tax morale is low due to an institutional asymmetry caused by formal institutional failings. As such, a lack of trust in formal institutions is reflected in low tax morale. For measuring the vertical trust between citizens and government institutions, we thus use the tax morale of citizens as a proxy. Indeed, an extensive literature review on the factors that affect tax morale (Horodnic 2018) shows that the most salient factor that shapes tax morale is the trust in formal institutions, such as government, parliament, trust in the courts and legal system, trust in the tax authority and tax officials or other formal institutions (Alm and Torgler 2006; Andriani 2016; Chan, Supriyadi, and Torgler 2018; Filippin, Fiorio, and Viviano 2013; Frey and Torgler 2007; Ibrahim, Musah, and Abdul-Hanan 2015; Kondelaji et al. 2016; Leonardo 2011; Li 2010; Martinez-

Vazquez and Torgler 2009; Ristovska, Mojsoska-Blazevski, and Nikolov 2013; Torgler 2003a, 2003b, 2003c, 2004a, 2004b, 2005a, 2005b, 2012; Torgler and Murphy 2004; Torgler, Schneider, and Schaltegger 2010; Torgler et al. 2008; Vythelingum et al. 2017). As such, although the intrinsic motivation to pay taxes is also shaped by other elements beyond vertical trust, tax morale represents a potent proxy for measuring vertical trust, between citizens and government. The tax morale is a continuous variable representing an index of self-reported attitudes towards the acceptability of six noncompliant behaviours based on a 10-point Likert scale ("1" means absolutely unacceptable and "10" means absolutely acceptable). The index is represented here as a mean. The lower the index value, the higher is the tax morale. The questions used are: (1) someone receives welfare payments without entitlement; (2) an individual is hired by a household for work and s/he does not declare the payment received to the tax or social security authorities even though it should be declared; (3) A firm is hired by a household for work and it does not declare the payment received to the tax or social security authorities; (4) a firm is hired by another firm for work and it does not declare its activities to the tax or social security authorities; (5) a firm hires an individual and all or a part of the wages paid to him\her are not officially declared and (6) someone evades taxes by not declaring or only partially declaring their income.

The horizontal trust among citizens is measured using a dummy variable which displays if the respondent personally knows other persons engaged in undeclared work, coded with 1 if respondents know such persons and 0 if they do not know other persons engaged in undeclared work. This proxy for measuring the horizontal trust has been used in previous studies of participation in undeclared work (Stefanov, Williams, and Rodgers 2017; Williams and Horodnic 2017c; Williams, Radvansky, and Stefanik 2017).

The socio-demographic and socio-economic control variables used in the study are selected based on previous studies which have determined the characteristics significantly associated with engagement in undeclared work (Williams and Franic 2015, 2016; Williams and Horodnic 2017a, 2017b) and are as follows:

- *Gender:* a dummy variable with value 1 for males and 0 for females.
- *Age*: an interval variable indicating the exact age of a respondent and *age squared* (the squared value).
- *Occupation*: a categorical variable for the occupational status of the respondent with value 1 for not working, value 2 for self-employed, value 3 for employed.

- *Household size*: a categorical variable measuring the number of people 15+ years in respondent`s household (including the respondent) with value 1 for one person, value 2 for two persons, value 3 for 3 persons or more.
- *Community type*: a categorical variable for the community type where the respondent lives with value 1 for rural area or village, value 2 for small or middle sized town, and value 3 for large towns.

Below we report the findings.

Findings

Comparing the descriptive findings, Figures 1 and 2 display a slight decrease in 2013 compared with 2007 in the proportion of participants reporting engagement in undeclared work during the 12 months prior to the survey. In 2013, 4 per cent of respondents reported engagement in undeclared work compared with 5 per cent in 2007. Considering that participation in undeclared work is a sensitive issue, these figures represents a lower-bound estimate of the level of participation. Even so, 1 in 25 citizens of EU-27 reported engaging in undeclared work in the year prior to survey.

[INSERT FIGURE 1 HERE]

[INSERT FIGURE 2 HERE]

In order to analyse the relationship between the different policy approaches and the likelihood to participate in undeclared work, Figures 1 and 2 reveal the differences between those respondents engaged in undeclared work and those who did not, regarding their perceptions of the risk of detection and the expected sanctions ("rational economic actor" approach), and their tax morale and awareness about other persons engaged in undeclared work ("social actor" approach).

Starting with the "rational economic actor" approach, Figure 1 displays that those engaged in undeclared work perceive the expected sanctions and risk of detection as lower than those not doing undeclared work. In 2007, 28 per cent of those doing undeclared work consider that only the normal tax or social security contributions will be due if caught compared with just 21 per cent of those not engaged in undeclared work. However, as Figure 2 reveals, in 2013, this increased with 31 per cent of those doing undeclared work considering

that only the normal tax or social security contributions will be due if caught compared with just 25 per cent of those not engaged in undeclared work. Same trend is revealed when analysing the risk of detection. In 2007, 78 per cent of those doing undeclared work perceive the risk of being detected as very small or fairly small, compared with 63 per cent of those not engaged in undeclared work. In 2013, the share of respondents considering that the risk of detection is small or very small is lower, but a gap between those engaged in undeclared work and those not engaged is maintained. 71 per cent of those engaged in undeclared activities find the risk of detection small or very small as compared with 59 per cent of those not engaged in such activities. Both the level of perceived penalties and risk of detection, therefore, appear from these descriptive statistics to influence the likelihood of participation in both 2007 and 2013; the lower is the perceived penalties and risk of detection, the greater is the likelihood of participation in undeclared work.

Turning to the "social actor" approach, the results reveal that those engaging in undeclared work have a lower level of tax morale (3.58 in 2007 and 3.55 in 2013) compared with those not engaging in undeclared work (2.36 in 2007 and 2.23 in 2013). Furthermore, a larger share of those engaged in undeclared work personally know other people engaged in undeclared work (87 per cent in 2007 and 84 per cent in 2013) compared with those not engaged in undeclared work (38 per cent in 2007 and 31 per cent in 2013). Both the level of vertical trust and horizontal trust, therefore, seem from these descriptive statistics to influence the likelihood of participation in both 2007 and 2013; the lower is the level of both vertical and horizontal trust, the greater is the likelihood of participation in undeclared work.

To analyse whether these differences remain significant when a range of control variables are taken into account and held constant, Table 3 reports the results of a fixed-effects logistic regression analysis. Model 1 analyses both waves and includes as an additional control variable the year dummy, Model 2 includes the same variables except the year dummy, while Model 3 and Model 4 analyse separately the two waves (2007 and 2013) in order to ensure a comparative perspective.

Starting with the relationship between the likelihood of engagement in undeclared work and the perceived level of deterrents (i.e., "rational economic actor" approach), when other variables are introduced and held constant, a statistically significant association is identified. Those perceiving the expected sanctions as high (i.e. tax or social security contributions plus a fine or prison) are less likely to engage in undeclared work compared with those perceiving the sanctions as low (only the tax and security contributions due) (confirming H1a). Examining the relationship between the likelihood of engagement in

undeclared work and the perceived level of risk of being detected, a similar trend is identified. Those viewing the risk of being caught as fairly high or very high are less likely to engage in undeclared work compared with those who consider the risk of being caught as fairly small and very small (confirming H1b). These results, therefore, support the deterrence approach adopted by many governments; increasing the actual or perceived penalties and risks of detection is associated with reductions in the likelihood of engaging in undeclared work.

As a robustness check of these results, various specifications of the models are reported in the Appendix. Table A1 shows that the association between the variables related with the two policy approaches and the likelihood of participation in undeclared work does not change when an additive fashion approach is employed, and the additional control variables are added in turn. Table A2 reports the estimates using different coding for the perceived risk of detection and tax morale while Table A3 provides the results obtained by analysing the imputed data. Despite the difference in the sample size (53,222 respondents compared with 38,413 individuals for both waves; 26,659 compared with 19,245 for the 2007 wave and 26,563 compared with 19,168 for the 2013 wave), the results remain the same. The only notable difference is the significance of the association between the expected sanctions and the likelihood of participating in undeclared work for the 2013 wave, which can be explained by the high number of the imputations for the "expected sanction" variable (see Table A8 in the Appendix). However, the direction of the association remains the same. Also, the results remain similar when two different types of regression are employed, namely multilevel logistic regression and logistic regression with country dummies, for both crude and imputed data, showing the robustness of the findings (Tables A4-A7).

[INSERT TABLE 3 HERE]

Turning to the "social actor" approach, the finding again is that engagement in undeclared work is significantly associated with both the level of vertical trust (i.e., level of tax morale) and horizontal trust (i.e., knowing personally other persons engaged in undeclared work). The higher the tax morality, the lower is the likelihood of participation in undeclared work (confirming H2a). Additionally, those knowing other persons engaging in undeclared work are more likely to do the same compared with those who do not have acquaintances working undeclared (confirming H2b).

Analysing the registered changes over time in the effectiveness of these two distinct policy approaches, as Models 3 and 4 display, the rank based on their effectiveness is

different in 2013 compared with 2007, but not in the direction suggested by the policy makers. In 2007, the highest marginal effect is reported for knowing other persons working undeclared, followed by the perceived risk of detection, tax morale and the lowest marginal effect is reported for the perceived severity of the sanction. Indeed, looking at the two most effective measures, knowing other persons working undeclared work increases the probability of working undeclared by 32.1 percentage points while perceiving the risk of detection as being fairly high or very high rather than fairly small or small reduces the likelihood of engaging in undeclared work only by 7.2 percentage points. In 2013, meanwhile, as opposed to the view of the stakeholders, the highest marginal effect is reported for the two variables related to the "social actor" approach, refuting the hypotheses H3a, H3b and H4a, H4b. Put another way, the relationship between vertical and horizontal trust and the likelihood of participation in undeclared work has become stronger in 2013 compared with 2007. Figures A1 and A2 provide a visual view of the marginal effects in 2007 and 2013. This display that the effect of horizontal trust in form of social norms is far larger than the effect of the other variables in both years, and that the effectiveness of the horizontal and vertical trust is higher in 2013, placing these measures as the two most effective ones.

In sum, this fixed-effect logistic regression analysis reveals a significant association between the likelihood of engaging in undeclared work and not only the "rational economic actor" but also the "social actor" approach. Meanwhile, comparing the two waves of the Special Eurobarometer survey on undeclared work, it is revealed that, in 2013 compared with 2007, the deterrents are less effective than the vertical and horizontal trust. These results support the need to complement the conventional rational approach, which is heavily used by governments, with the social actor approach which recognises the role of improving vertical and horizontal trust in tackling the undeclared economy.

Discussion and Conclusions

Since the turn of the millennium, both academic scholarship and supra-national institutions have recognised the need for governments to transform undeclared work into declared work rather than simply repress it and thus, for a deterrence policy approach to be complemented by a social actor approach. From the perspective of the European Commission, this was first recognised at the Lisbon Summit of the European Council. As Employment Policy Guideline no. 9 (2003) states:

> Member states should develop and implement broad actions and measures … which combine simplification of the business environment, removing disincentives and providing appropriate incentives in the tax and benefits system, improved law enforcement and the application of sanctions (European Commission 2003, 9).

Following this, and in its second communication on undeclared work, the European Commission (2007) again explicitly called for member states to transform undeclared work into declared work by using alongside deterrence measures a range of new innovative policy measures, including awareness raising campaigns to improve tax morale. This was further reinforced in 2016 when the European Platform Tackling Undeclared Work was created following European Parliament legislation. In article 1 of Decision (EU) 2016/3441 establishing the Platform, it is stated that "'tackling', in relation to undeclared work, means preventing, deterring and combating undeclared work as well as promoting the declaration of undeclared work" (Williams and Puts 2017). Thus, and as the first policy paper produced by the Platform recognise, there is a need for a holistic approach which uses both the rational economic actor and social actor policy approaches (Williams 2017).

On the other hand, academic scholarship has also questioned the effectiveness of deterrents in tackling undeclared work, as discussed in the review of the literature. The current paper contributes to this body of work. It reveals that at the EU-27 level, while both types of policy approach are significantly associated with reducing the likelihood of engaging in undeclared work, the strength of the impact differs. The impact is stronger for the "social actor" approach which examines the influence of improving both vertical (tax morale) and horizontal trust (knowing other people that engage in undeclared work) on the likelihood participation in undeclared work. Furthermore, the strength of the impact of deterrents on the likelihood of participation in undeclared work has weakened between 2007 and 2013, but has strengthened for vertical and horizontal trust. This provides support for the calls made by the European Commission to national governments to complement deterrence measures with other policy measures focused on improving vertical and horizontal trust.

However, despite this strengthening of the relationship between the likelihood of participation in undeclared work and the level of vertical and horizontal trust, and weakening of the relationship between participation and deterrents, national governments have continued to heavily rely on the use of deterrence measures and the view that deterrents are the most effective approach has even increased over time (Williams and Puts 2017). This sits in stark

contrast to the evidence presented in this paper that the likelihood of participation in undeclared work has become less affected by the perceived level of deterrents, and more influenced by perceptions of the level of vertical and horizontal trust.

As the subject investigated is related to a sensitive topic, limitations exist due to this fact (Feld and Larsen 2012). The face-to-face interviews assured the respondents that the collected information would be handled in strict confidentiality and anonymity and adopted a gradual approach towards the more sensitive issues. As such, the attitudinal questions about undeclared work, were followed by questions on whether respondents purchased undeclared goods and/or services, received envelope wages and only then, questions related with engagement in undeclared work in the 12 months prior to the survey. Nevertheless, the survey may not capture the total amount of undeclared work and potential biases could appear due to respondent`s honesty when answering questions related to illegitimate issues. As for example, in these two waves of the Eurobarometer survey, a larger share of persons from Nordic countries reported engagement in undeclared work compared with other European regions. Although in 91% of the interviews, the interviewers reported good or excellent cooperation from the participant, and average cooperation in 8% of cases, the level of excellent and good cooperation was found to be higher in Nordic nations (96% of cases) and lowest in Southern Europe (87% of cases). This intimates that the sincerity of respondents when answering the survey might have been lower in Southern Europe. This might explain firstly why the participation was reported higher in Nordic countries despite the fact that previous research showed a higher tax morale in Nordic countries compared with Southern Europe (Alm and Torgler 2006) and secondly why there is a lack of correlation between the share of reported undeclared work and the macro level estimates of the shadow economy (listed in Table 2).

Another limitation of this study is that it covers only EU countries. One should therefore be cautious when extrapolating the results for other countries and contexts. For instance, the perception of risk of being caught vary from country to country and from culture to culture. Whether the results are valid for other countries and contexts other than those directly analyzed now needs to be evaluated.

In the Eurobarometer series, the topic of undeclared work was investigated only in 2007 and 2013. To trace the transformations over time, similar items were administrated. However, not all items administrated in 2007 are found in the survey conducted in 2013 (e.g., gross income per month from formal employment), making them unusable in this analysis. Moreover, considering that the respondents are different in each wave, Eurobarometer surveys

do not meet the prerequisites of a true panel. Thus, the paper uses cross-sectional data and the comparison between 2007 and 2013 waves should be cautiously interpreted.

Lastly, due to the data set limitations, this study uses two proxies for investigating the relationship between the vertical and horizontal trust and undeclared work. Future studies could investigate this relationship further by measuring the trust in formal institutions directly and various forms of horizontal trust beyond the one used in this study (i.e., generalized trust).

In sum, this paper has for the first time revealed that the association between the likelihood of participation in undeclared work and the perceived level of deterrents has weakened over time, while the association with the perceived level of horizontal and vertical trust has strengthened. However, national governments still seek to eradicate undeclared work using deterrents, and their view that this is the most effective method has increased over time. There is thus a need for not only academic scholarship but also the European Commission to be more active in drawing to the attention of national governments the growing gap between their perceptions of what is effective, and what is in lived practice effective, in tackling undeclared work. If this paper helps to bridge that gap, then its main intention will have been achieved. The danger of course, as this paper has shown, is that unless an evidence-based approach to policy-making is pursued, the gap between what is used to tackle the problem, and what is most effective, will continue to diverge.

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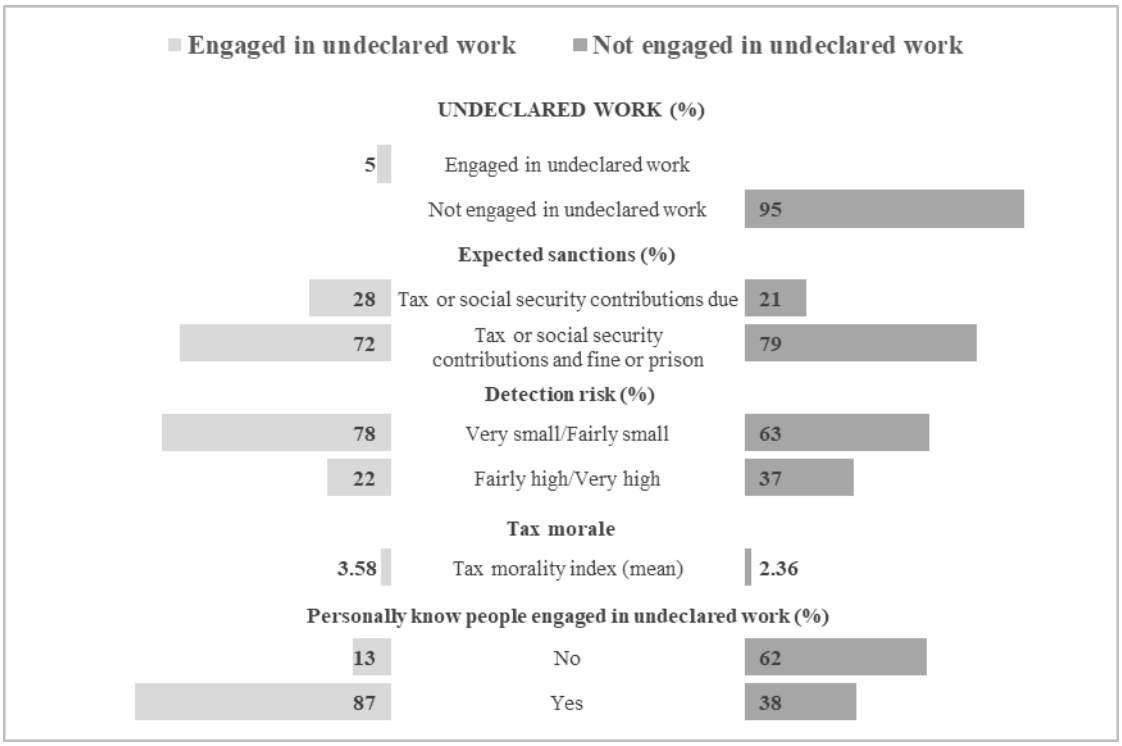

Figure 1. Supply of undeclared work: expected sanctions, detection risk, tax morale and knowing persons engaged in undeclared work, 2007

Source: own calculations based on the Special Eurobarometer 284/Wave 67.3

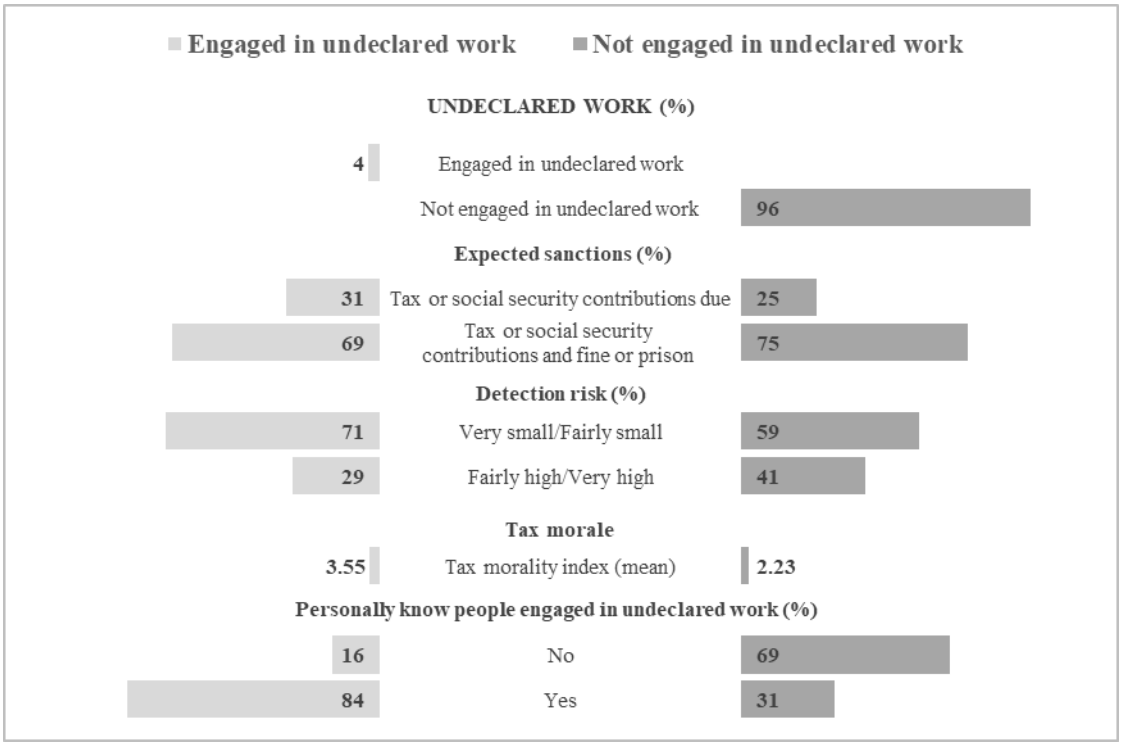

Figure 2. Supply of undeclared work: expected sanctions, detection risk, tax morale and knowing persons engaged in undeclared work, 2013

Source: own calculations based on the Special Eurobarometer 402/Wave 79.2

Table 1. Evaluations of the "rational economic actor" approach: evidence from previous studies

Study	Region	Method/ Source of data	Sample	Findings
Supportive of the rational economic actor approach				
Dubin and Wilde, 1988	US	Secondary data from Internal Revenue Service and Annual Report of the Commissioner of Internal revenue	5,580 observations	Significant effect of deterrents (audits) on tax noncompliance.
Feld and Frey, 2002	Switzerland	Survey	tax authorities of the 26 Swiss cantons	Increased fines reduce tax evasion.
Friedland, 1982	NA	Experimental design	16 participants (law students)	Both the risk of detection and fines reduce tax noncompliance with the risk of detection having a higher effect than the value of the sanctions.
Friedland, Maital and Rutenberg, 1978	Israel	Experimental design	15 participants (psychology students)	Penalties represents more effective deterrents than the risk of detection in reducing the tax noncompliance.
Klepper and Nagin, 1989	US	Experimental design	489 observations	Both, risk of detection and sanction reduce the tax noncompliance.
Kluge and Libman, 2017	Russia	Secondary data on taxi market (taxi licences)	76 regions	For the formal market, the higher the sanctions the smaller the shadow economy.
Mas'ud, Manaf and Saad, 2015	Sub-Saharan Africa	Secondary data (macro level indicators)	37 countries	Increasing power of detection and penalty might be able to enhance tax compliance.
Mazzolini, Pagani and Santoro, 2017	3 regions in Italy (on third of Italian population)	Secondary data from Italian Revenue Agency	2,642,700 observations (528,540 taxpayers observed for the 2007-2011 period)	The risk of detection (audit) has a positive effect on the declared income.
Slemrod, Blumenthal and Christian, 2001	Minnesota/ US	Experimental design	1,724 observations (taxpayers)	The increased probability of detection (audit) increase the tax compliance.
Witte and Woodbury, 1985	US	Secondary data extracted from Internal Revenue Service	657 observations	The increased probability of detection (audit), information reporting and tax withholding increase the tax compliance.

Partially supportive of the rational economic actor approach (calling for inclusion of complementary approaches)				
Alm, Sanchez and De Juan, 1995	Spain and US	Experimental design	11 sessions of 9 to 10 participants	Detection and punishment needs to be complemented by positive rewards for obtaining greater tax compliance.
Bernasconi, 1998	-	Hypothetical model	-	The standard expected utility model cannot explain the rate of tax compliance, unless individuals' aversion to risk is far higher than the conventional hypothesis.
Grasmick and Bursik, 1990	US city	Survey	1,985 face to face interviews	Includes the significant others (socially imposed costs) and conscience (self-imposed costs) along with legal sanctions for measuring the deterrents and reveals that for tax cheating the highest direct effect is represented by shame (affecting conscience) and not the legal sanctions.
Kaplanoglou and Rapanos, 2015	Greece	Experimental design	320 participants (students)	In high trust conditions, power of tax authorities is perceived as legitimate whilst in low trust environments the power of authorities is perceived coercive and has a negative influence on tax compliance.
Kogler, Batrancea, Nichita, Pantya Belianin and Kirchler, 2013	Austria, Hungary, Romania and Russia	Experimental design	1, 319 participants (students)	Participants in the group of low trust and low power display the lowest intention to comply and the highest intention to evade taxes.
Schwartz and Orleans, 1967	US	Experimental design	273 participants	Both sanctions and appeals to conscience are effective for reducing tax non-compliance. Yet, the punishment appears, to produce some resistance to compliance.
Webley and Halstead, 1986	UK	Experimental design	76 participants (students)	The increased probability of detection (audit) increase the tax compliance while the severity of penalties has no significant impact.
Wenzel, 2004	Australia	Survey	1, 406 participants	Deterrents are effective only when individual ethics are weak.
Williams and Horodnic, 2017a	EU-28	Survey	27,563 face-to-face interviews	Deterrence measures have little impact on reducing the probability of participation in undeclared work when tax morale is high. Only when tax morale is low that raising the level of deterrents has greater impacts, with increasing the perceived risks of detection in such contexts leading to higher reductions in participation in undeclared work than increasing the perceived punishments.
Williams and Horodnic, 2017b	11 East-Central European countries	Survey	7,141 face-to-face interviews	Deterrence measures reduce participation in undeclared work only when tax morale is low and have little impact when tax morale is high.
Not supportive of the rational economic actor approach				
Chang and Lai, 2004	-	Theoretical model	-	Increasing fines results rather in increasing the tax noncompliance. Also, the social norms have decisive role on determining the tax compliance.
Farrar, Kaplan and Thorne, 2017	US	Experimental design	204 participants	Tax compliance intentions are highest when quality of the treatment provided to individuals from authority figures (interactional fairness) is higher and detection

				salience is lower.
Hartl, Hofmann, Gangl, Hartner-Tiefenthaler and Kirchler, 2015	Austria	Experimental design	726 participants (students)	The amount of fines does not influence the taxpayers behavior, while participants' beliefs regarding tax authority's power significantly influence the compliance.
Hofmann, Hartl, Gangl, Hartner-Tiefenthaler and Kirchler, 2017	-	Experimental design	120 participants (students)	Strict audits and severe fines might alienate individuals and reduce the cooperative behavior of taxpayers.
Kaplanoglou, Rapanos and Daskalakis, 2016	Greece	Survey	710 small and medium-size enterprises	The trust in tax authorities and individual morality foster voluntary compliance and taxpaying behavior. Coercive power of tax authorities has a negative effect on both intended tax compliance and voluntary tax compliance and positive effect on enforced tax compliance.
Mohdali, Isa and Yusoff, 2014	Malaysia	Survey	302 auto-administered questionnaires	Punishment not only have an insignificant impact on compliant taxpayers but also represents a trigger for a less compliant behaviour.
Murphy, 2005	Australia	Longitudinal survey data	2,292 participants in the first study and 659 in the follow up study	Coercive measures and threaten undermine the legitimacy of the tax authority and consequently reduce compliance behaviour.
Murphy and Harris, 2007; Murphy, 2008	Australia	Survey	652 participants (tax offenders)	Punitive measures are rather counterproductive in reducing the tax non-compliance. Feelings experienced during an enforcement event (i.e. reintegration, stigmatization) are related to repeating the offending behaviour.
Shaw, Slemrod and Whiting, 2008	UK	Secondary data from various budgets*	-	Increasing the probability of detection does not bring positive results to the economy.
Solano-Garcia, 2017	-	Theoretical model	-	A high expected penalty for tax evasion determine the voters to choose a low income redistribution policy.
Williams and Franic, 2015	Croatia	Survey	1000 face-to-face interviews	No association between participation in undeclared work and the perceived level of penalties and risk of detection, but a strong association between participation in undeclared work and the level of tax morality.
Williams and Franic, 2016	Bulgaria	Survey	1018 face-to-face interviews	No association between participation in undeclared work and the perceived level of penalties and risk of detection, but a strong association between participation in undeclared work and the level of tax morale.

Note: * protecting revenues, protecting tax revenues, anti-avoidance measures.
Source: authors own work.

Table 2. Size of Shadow Economy/ Undeclared Work (UDW), by country (2007-2015)

	2007	2008	2009	2010	2011	2012	2013				2014	2015
	a)	a)	a)	a)	a)	a)	a)	b1)	b2)	b3)	a)	a)
Austria	7.69	7.78	9.65	9.07	8.47	8.40	8.68	8.7	6.0	10	8.39	9.01
Belgium	18.27	18.28	18.74	18.8	17.71	18.28	18.81	11.9	7.2	15.4	18.06	17.8
Bulgaria	23.70	22.77	24.08	23.42	22.39	22.12	22.37	17.8	13.2	19.2	21.60	20.83
Cyprus	29.03	28.77	31.64	31.39	32.71	33.32	34.66	13.8	8.4	17.9	32.69	32.20
Czech Rep	11.53	11.18	13.52	12.97	11.68	11.5	11.79	7.7	5.5	16.9	10.76	10.47
Denmark	12.51	13.01	16.33	16.17	15.26	15.48	15.24	9.6	5.5	14.3	14.13	14.70
Estonia	17.84	19.42	24.60	22.99	19.67	18.34	17.97	14.8	10.4	21.3	17.52	18.49
Finland	10.98	10.95	13.11	12.54	12.19	12.59	13.08	9.3	5.8	11.8	12.12	13.30
France	12.88	11.61	13.89	13.11	11.81	12.08	12.41	8.8	5.3	11	12.12	11.65
Germany	10.56	9.59	11.69	10.88	9.05	8.85	9.22	4.4	2.9	7.1	8.17	7.75
Greece	24.23	23.2	25.32	26.15	27.08	28.39	27.78	12.5	7.2	22.5	27.11	26.45
Hungary	21.40	20.58	23.18	22.82	21.87	22.26	21.63	17.3	11.3	23.2	20.78	20.49
Ireland	12.55	12.45	13.36	11.78	12.49	11.4	11.14	8.6	5.4	13	9.93	9.58
Italy	22.43	23.51	27.31	26.13	24.54	25.53	24.49	12.9	9.1	17.2	24.33	22.97
Latvia	17.04	18.27	21.16	20.41	18.67	17.32	16.68	18.3	12.3	22.3	15.92	16.62
Lithuania	20.58	20.28	24.29	23.13	20.86	19.32	18.30	19.8	13.6	25.2	17.62	18.65
Luxembourg	9.37	9.65	11.01	10.37	10.34	10.80	10.65	5.4	3.2	9.1	10.39	10.38
Malta	26.96	27.30	30.55	29.19	28.06	27.25	27.15	n.a.	n.a.	n.a.	28.08	29.43
Netherlands	10.55	9.58	8.9	8.6	8.09	8.11	8.44	5.2	3.0	11.9	8.75	7.83
Poland	23.51	21.65	21.56	20.93	19.33	19.04	18.86	20.8	14.6	27.3	18.09	16.67
Portugal	22.05	20.74	21.67	20.79	20.37	20.24	20.38	6.6	4.1	15.5	19.29	17.82
Romania	27.03	25.44	28.23	26.76	25.41	25.14	23.97	18.9	14.5	26.2	22.73	22.94
Slovakia	12.15	11.52	13.47	12.84	11.96	11.81	11.75	13.2	9.6	16.4	11.64	11.18
Slovenia	17.96	17.58	22.24	22.54	22.18	22.89	23.02	13.4	9.1	14.7	21.49	20.21
Spain	22.67	21.53	24.24	23.91	23.65	24.08	24.35	8.8	6.0	17.9	24.04	22.01
Sweden	10.12	10.3	12.71	11.45	11.08	11.89	12.31	7.8	3.2	9.7	11.88	11.74
UK	10.78	9.83	11	10.33	10.06	9.91	9.57	2.7	1.7	9.6	8.81	8.32

Notes:
a) – MIMIC, % of GDP (Medina and Schneider, 2018)

b) – Labour Input Method (LIM) (Williams et al., 2017): b1) % of total labour input in the private sector; b2) minimum % of total labour input in the economy; b3) % of GVA in the private sector

Table 3. Fixed-effects logistic regression of the likelihood of engaging in undeclared work (crude data)

	Model 1 – *Both waves*				Model 2 – *Both waves*				Model 3 – *2007 wave*				Model 4 – *2013 wave*			
Variables	β	se(β)	Exp(β)	Marg.	β	se(β)	Exp(β)	Marg.	β	se(β)	Exp(β)	Marg.	β	se(β)	Exp(β)	Marg.
Gender (Female)																
Male	0.641 ***	0.051	1.898	0.135	0.635 ***	0.051	1.888	0.130	0.702 ***	0.068	2.018	0.124	0.557 ***	0.079	1.745	0.130
Age	0.030 ***	0.010	1.031	-0.008	0.029 ***	0.010	1.030	-0.008	0.039 ***	0.013	1.039	-0.007	0.017	0.015	1.018	-0.009
Age squared	-0.001 ***	0.000	0.999		-0.001 ***	0.000	0.999		-0.001 ***	0.000	0.999		-0.001 ***	0.000	0.999	
Occupation (Not working)																
Self-employed	0.103	0.091	1.108	0.020	0.106	0.091	1.111	0.020	0.104	0.123	1.110	0.016	0.122	0.137	1.130	0.027
Employed	-0.490 ***	0.061	0.613	-0.106	-0.482 ***	0.061	0.617	-0.102	-0.491 ***	0.082	0.612	-0.091	-0.478 ***	0.094	0.620	-0.113
Household size (one person)																
Two	-0.355 ***	0.064	0.701	-0.074	-0.354 ***	0.064	0.702	-0.072	-0.276 ***	0.087	0.759	-0.049	-0.459 ***	0.097	0.632	-0.105
Three and more	-0.266 ***	0.071	0.767	-0.054	-0.262 ***	0.071	0.770	-0.052	-0.186 *	0.095	0.831	-0.032	-0.363 ***	0.109	0.696	-0.082
Community type (Rural or village)																
Small/middle town	-0.043	0.059	0.958	-0.009	-0.048	0.059	0.953	-0.010	-0.041	0.078	0.960	-0.007	-0.028	0.091	0.973	-0.006
Large town	-0.059	0.064	0.943	-0.013	-0.061	0.064	0.941	-0.013	-0.054	0.085	0.947	-0.010	-0.057	0.100	0.945	-0.013
Expected sanctions (Tax or social security contributions due)																
Tax/ social security contributions + fine, prison	-0.266 ***	0.055	0.767	-0.055	-0.255 ***	0.055	0.775	-0.052	-0.289 ***	0.076	0.749	-0.050	-0.245 ***	0.083	0.782	-0.057
Detection risk (Very small/Fairly small)																
Fairly high/Very high	-0.339 ***	0.060	0.713	-0.074	-0.346 ***	0.060	0.707	-0.074	-0.387 ***	0.083	0.679	-0.072	-0.276 ***	0.087	0.759	-0.066
Tax morality index	0.325 ***	0.014	1.384	0.070	0.326 ***	0.014	1.386	0.068	0.307 ***	0.018	1.360	0.056	0.355 ***	0.022	1.426	0.084
Personally know people engaged in undeclared work (No)																
Yes	1.916 ***	0.070	6.791	0.371	1.928 ***	0.070	6.877	0.364	1.850 ***	0.097	6.359	0.321	1.978 ***	0.101	7.229	0.410
Year dummy 2013	-0.136 ***	0.051	0.873	-0.029												
Observations			38,413				38,413				19,245				19,168	
Number of countries			27				27				27				27	
Pseudo R-squared			0.210				0.210				0.199				0.221	
AIC			11984.84				11990.09				6723.65				5110.50	
BIC			12104.62				12101.32				6825.89				5212.69	
LR chi2			3183.64				3176.39				1662.16				1446.61	
Prob. > chi2			0.0000				0.0000				0.0000				0.0000	

Notes: Significant at *** p<0.01, ** p<0.05, * p<0.1; All coefficients are compared to the benchmark category, shown in brackets.
Source: own calculations based on the Special Eurobarometer 284/ Wave 67.3 and Special Eurobarometer 402/ Wave 79.2.

Appendix

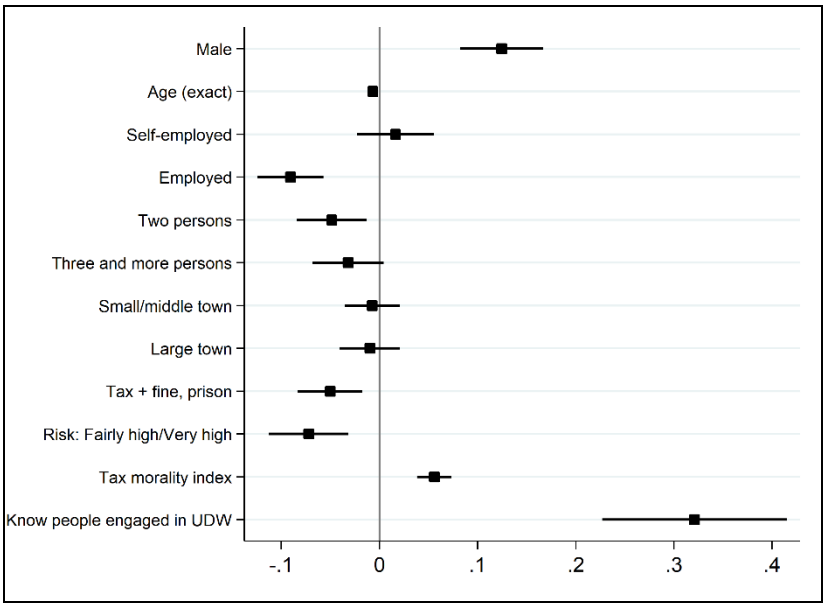

Figure A1. Marginal effects (2007)

Note: UDW - undeclared work.
Source: own calculations based on the Special Eurobarometer 284/ Wave 67.3 and Special Eurobarometer 402/ Wave 79.2.

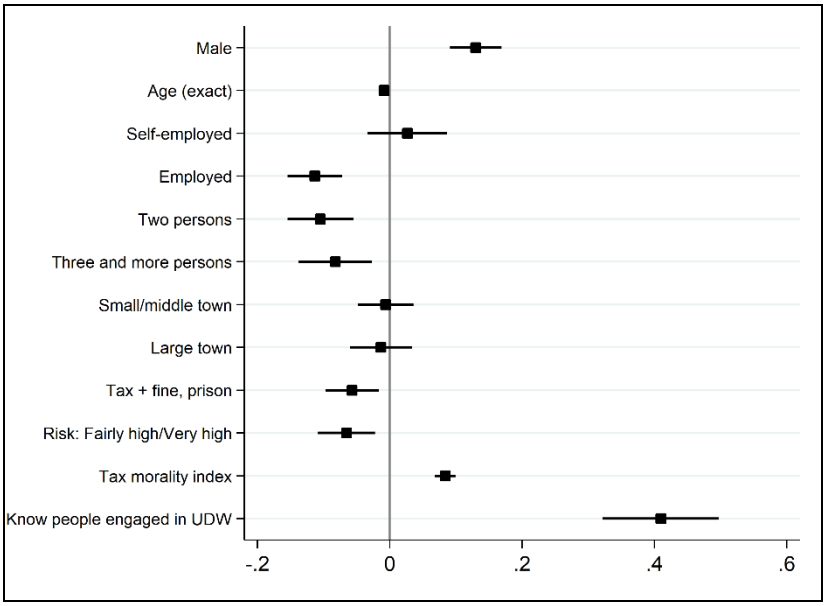

Figure A2. Marginal effects (2013)

Note: UDW - undeclared work.
Source: own calculations based on the Special Eurobarometer 284/ Wave 67.3 and Special Eurobarometer 402/ Wave 79.2.

Table A1. Fixed-effects logistic regression of the likelihood of engaging in undeclared work (crude data, additive models)

	Model 1 – *Both waves*			Model 2 – *Both waves*		
Variables	Model 1a	Model 1b	Model 1c	Model 2a	Model 2b	Model 2c
Expected sanctions (Tax or social security contributions due)						
Tax/ social security contributions + fine, prison	-0.219*** (0.054)	-0.268*** (0.055)	-0.266*** (0.055)	-0.208*** (0.054)	-0.257*** (0.055)	-0.255*** (0.055)
Detection risk (Very small/Fairly small)						
Fairly high/Very high	-0.307*** (0.059)	-0.333*** (0.060)	-0.339*** (0.060)	-0.315*** (0.059)	-0.341*** (0.060)	-0.346*** (0.060)
Tax morality index	0.366*** (0.013)	0.325*** (0.014)	0.325*** (0.014)	0.367*** (0.013)	0.327*** (0.014)	0.326*** (0.014)
Personally know people engaged in undeclared work (No)						
Yes	2.048*** (0.069)	1.915*** (0.070)	1.916*** (0.070)	2.060*** (0.069)	1.928*** (0.070)	1.928*** (0.070)
Year dummy	Yes	Yes	Yes	No	No	No
Gender (Female)						
Male		0.643*** (0.051)	0.641*** (0.051)		0.637*** (0.051)	0.635*** (0.051)
Age		0.031*** (0.010)	0.030*** (0.010)		0.030*** (0.010)	0.029*** (0.010)
Age squared		-0.001*** (0.000)	-0.001*** (0.000)		-0.001*** (0.000)	-0.001*** (0.000)
Occupation (Not working)						
Self-employed		0.101 (0.091)	0.103 (0.091)		0.104 (0.091)	0.106 (0.091)
Employed		-0.490*** (0.061)	-0.490*** (0.061)		-0.482*** (0.061)	-0.482*** (0.061)
Household size (one person)						
Two		-0.347*** (0.064)	-0.355*** (0.064)		-0.346*** (0.064)	-0.354*** (0.064)
Three and more		-0.256*** (0.070)	-0.266*** (0.071)		-0.252*** (0.070)	-0.262*** (0.071)
Community type (Rural or village)						
Small/middle town			-0.043 (0.059)			-0.048 (0.059)
Large town			-0.059 (0.064)			-0.061 (0.064)
Observations	38,473	38,473	38,413	38,473	38,473	38,413
Number of countries	27	27	27	27	27	27
LR chi2	2551.12	3183.43	3183.64	2544.03	3175.92	3176.39
Prob. > chi2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Notes: Significant at *** p<0.01, ** p<0.05, * p<0.1; Standard errors in parentheses.
Source: own calculations based on the Special Eurobarometer 284/ Wave 67.3 and Special Eurobarometer 402/ Wave 79.2.

Table A1. Fixed-effects logistic regression of the likelihood of engaging in undeclared work (crude data, additive models) - continued

	Model 3 – *2007 wave*			Model 4 – *2013 wave*		
Variables	Model 3a	Model 3b	Model 3c	Model 4a	Model 4b	Model 4c
Expected sanctions (Tax or social security contributions due)						
Tax/ social security contributions + fine, prison	-0.244*** (0.074)	-0.292*** (0.076)	-0.289*** (0.076)	-0.204** (0.081)	-0.247*** (0.083)	-0.245*** (0.083)
Detection risk (Very small/Fairly small)						
Fairly high/Very high	-0.332*** (0.081)	-0.378*** (0.083)	-0.387*** (0.083)	-0.263*** (0.086)	-0.274*** (0.087)	-0.276*** (0.087)
Tax morality index	0.348*** (0.017)	0.308*** (0.018)	0.307*** (0.018)	0.391*** (0.021)	0.355*** (0.022)	0.355*** (0.022)
Personally know people engaged in undeclared work (No)						
Yes	1.993*** (0.096)	1.848*** (0.097)	1.850*** (0.097)	2.097*** (0.100)	1.979*** (0.101)	1.978*** (0.101)
Year dummy	No	No	No	No	No	No
Gender (Female)						
Male		0.707*** (0.068)	0.702*** (0.068)		0.555*** (0.079)	0.557*** (0.079)
Age		0.040*** (0.013)	0.039*** (0.013)		0.018 (0.015)	0.017 (0.015)
Age squared		-0.001*** (0.000)	-0.001*** (0.000)		-0.001*** (0.000)	-0.001*** (0.000)
Occupation (Not working)						
Self-employed		0.100 (0.122)	0.104 (0.123)		0.124 (0.137)	0.122 (0.137)
Employed		-0.491*** (0.082)	-0.491*** (0.082)		-0.478*** (0.094)	-0.478*** (0.094)
Household size (one person)						
Two		-0.266*** (0.086)	-0.276*** (0.087)		-0.453*** (0.097)	-0.459*** (0.097)
Three and more		-0.176* (0.094)	-0.186* (0.095)		-0.354*** (0.107)	-0.363*** (0.109)
Community type (Rural or village)						
Small/middle town			-0.041 (0.078)			-0.028 (0.091)
Large town			-0.054 (0.085)			-0.057 (0.100)
Observations	19,294	19,294	19,245	19,179	19,179	19,168
Number of country	27	27	27	27	27	27
LR chi2	1298.94	1662.46	1662.16	1176.97	1446.21	1446.61
Prob. > chi2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Notes: Significant at *** p<0.01, ** p<0.05, * p<0.1; Standard errors in parentheses.
Source: own calculations based on the Special Eurobarometer 284/ Wave 67.3 and Special Eurobarometer 402/ Wave 79.2.

Table A2. Fixed-effects logistic regression of the likelihood of engaging in undeclared work (crude data, detection risk and tax morality recoded)

Variables	Model 1 Both waves	Model 2 Both waves	Model 3 2007 wave	Model 4 2013 wave
Gender (Female)				
Male	0.631*** (0.052)	0.626*** (0.052)	0.696*** (0.068)	0.548*** (0.079)
Age	0.030*** (0.010)	0.029*** (0.010)	0.039*** (0.013)	0.016 (0.015)
Age squared	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)
Occupation (Not working)				
Self-employed	0.104 (0.091)	0.107 (0.091)	0.101 (0.123)	0.136 (0.138)
Employed	-0.488*** (0.061)	-0.481*** (0.061)	-0.492*** (0.082)	-0.469*** (0.094)
Household size (one person)				
Two	-0.354*** (0.064)	-0.353*** (0.064)	-0.275*** (0.087)	-0.456*** (0.097)
Three and more	-0.263*** (0.071)	-0.259*** (0.071)	-0.184* (0.095)	-0.362*** (0.109)
Community type (Rural or village)				
Small/middle town	-0.042 (0.059)	-0.047 (0.059)	-0.040 (0.078)	-0.030 (0.091)
Large town	-0.058 (0.064)	-0.060 (0.064)	-0.052 (0.085)	-0.068 (0.100)
Expected sanctions (Tax or social security contributions due)				
Tax/ social security contributions + fine, prison	-0.261*** (0.055)	-0.250*** (0.055)	-0.286*** (0.076)	-0.241*** (0.083)
Detection risk (Very high)				
Fairly high	-0.007 (0.133)	-0.012 (0.133)	0.120 (0.190)	-0.156 (0.188)
Fairly small	0.266** (0.127)	0.268** (0.127)	0.456** (0.180)	0.035 (0.181)
Very small	0.485*** (0.132)	0.494*** (0.132)	0.553*** (0.187)	0.409** (0.189)
Tax morality index	0.324*** (0.014)	0.325*** (0.014)	0.307*** (0.018)	0.353*** (0.022)
Personally know people engaged in undeclared work (No)				
Yes	1.907*** (0.070)	1.919*** (0.070)	1.845*** (0.097)	1.967*** (0.101)
Year dummy	Yes	No	No	No
Observations	38,413	38,413	19,245	19,168
Number of countries	27	27	27	27
LR chi2	3196.46	3190.07	1664.12	1461.63
Prob. > chi2	0.0000	0.0000	0.0000	0.0000

Notes: Significant at *** p<0.01, ** p<0.05, * p<0.1; Standard errors in parentheses.
Source: own calculations based on the Special Eurobarometer 284/ Wave 67.3 and Special Eurobarometer 402/ Wave 79.2.

Table A2. Fixed-effects logistic regression of the likelihood of engaging in undeclared work (crude data, detection risk and tax morality recoded) – continued

Variables	Model 1 Both waves	Model 2 Both waves	Model 3 2007 wave	Model 4 2013 wave
Gender (Female)				
Male	0.653*** (0.051)	0.647*** (0.051)	0.711*** (0.068)	0.574*** (0.078)
Age	0.032*** (0.010)	0.031*** (0.010)	0.039*** (0.013)	0.022 (0.015)
Age squared	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)
Occupation (Not working)				
Self-employed	0.101 (0.090)	0.103 (0.090)	0.125 (0.122)	0.095 (0.136)
Employed	-0.495*** (0.061)	-0.487*** (0.061)	-0.483*** (0.081)	-0.501*** (0.093)
Household size (one person)				
Two	-0.360*** (0.064)	-0.360*** (0.064)	-0.278*** (0.086)	-0.460*** (0.096)
Three and more	-0.292*** (0.071)	-0.289*** (0.071)	-0.199** (0.094)	-0.394*** (0.107)
Community type (Rural or village)				
Small/middle town	-0.050 (0.058)	-0.055 (0.058)	-0.053 (0.077)	-0.023 (0.090)
Large town	-0.079 (0.064)	-0.081 (0.064)	-0.065 (0.084)	-0.095 (0.099)
Expected sanctions (Tax or social security contributions due)				
Tax/ social security contributions + fine, prison	-0.294*** (0.055)	-0.282*** (0.055)	-0.313*** (0.075)	-0.270*** (0.082)
Detection risk (Very small/Fairly small)				
Fairly high/Very high	-0.334*** (0.059)	-0.343*** (0.059)	-0.384*** (0.083)	-0.264*** (0.086)
Tax morality (Below average)				
Above average	1.115*** (0.056)	1.117*** (0.056)		
Tax morality (Below 2007 average)				
Above 2007 average			1.108*** (0.073)	
Tax morality (Below 2013 average)				
Above 2013 average				1.169*** (0.090)
Personally know people engaged in undeclared work (No)				
Yes	1.929*** (0.070)	1.944*** (0.070)	1.852*** (0.097)	1.996*** (0.101)
Year dummy	Yes	No	No	No
Observations	38,413	38,413	19,245	19,168
Number of countries	27	27	27	27
LR chi2	3069.32	3059.77	1618.00	1376.25
Prob. > chi2	0.0000	0.0000	0.0000	0.0000

Notes: Significant at *** p<0.01, ** p<0.05, * p<0.1; Standard errors in parentheses.
Source: own calculations based on the Special Eurobarometer 284/ Wave 67.3 and Special Eurobarometer 402/ Wave 79.2.

Table A3. Fixed-effects logistic regression of the likelihood of engaging in undeclared work (imputed missing data)

Variables	Model 1 Both waves	Model 2 Both waves	Model 3 2007 wave	Model 4 2013 wave
Gender (Female)				
Male	0.616*** (0.046)	0.614*** (0.046)	0.715*** (0.063)	0.495*** (0.067)
Age	0.039*** (0.009)	0.038*** (0.009)	0.042*** (0.012)	0.033*** (0.013)
Age squared	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)
Occupation (Not working)				
Self-employed	0.042 (0.082)	0.042 (0.082)	0.079 (0.112)	0.019 (0.118)
Employed	-0.448*** (0.054)	-0.446*** (0.054)	-0.436*** (0.075)	-0.447*** (0.079)
Household size (one person)				
Two	-0.343*** (0.057)	-0.342*** (0.057)	-0.305*** (0.079)	-0.396*** (0.084)
Three and more	-0.257*** (0.063)	-0.255*** (0.063)	-0.202** (0.086)	-0.313*** (0.093)
Community type (Rural or village)				
Small/middle town	-0.019 (0.053)	-0.021 (0.053)	-0.041 (0.072)	0.021 (0.078)
Large town	-0.042 (0.056)	-0.042 (0.056)	-0.034 (0.077)	-0.047 (0.084)
Expected sanctions (Tax or social security contributions due)				
Tax/ social security contributions + fine, prison	-0.177*** (0.052)	-0.174*** (0.051)	-0.254*** (0.073)	-0.113 (0.074)
Detection risk (Very small/Fairly small)				
Fairly high/Very high	-0.364*** (0.055)	-0.366*** (0.055)	-0.404*** (0.077)	-0.305*** (0.076)
Tax morality index	0.320*** (0.012)	0.320*** (0.012)	0.304*** (0.016)	0.341*** (0.018)
Personally know people engaged in undeclared work (No)				
Yes	1.993*** (0.061)	1.997*** (0.061)	1.929*** (0.090)	2.052*** (0.087)
Year dummy	Yes	No	No	No
Observations	53,222	53,222	26,659	26,563
Number of countries	27	27	27	27
Imputations	20	20	20	20
F	197.44	212.07	107.53	103.13
Prob. > F	0.0000	0.0000	0.0000	0.0000

Notes: Significant at *** p<0.01, ** p<0.05, * p<0.1; Standard errors in parentheses.
Source: own calculations based on the Special Eurobarometer 284/ Wave 67.3 and Special Eurobarometer 402/ Wave 79.2.

Table A4. Logistic regression of the likelihood of engaging in undeclared work (crude data)

Variables	Model 1 Both waves	Model 2 Both waves	Model 3 2007 wave	Model 4 2013 wave
Gender (Female)				
Male	0.642*** (0.052)	0.636*** (0.051)	0.704*** (0.068)	0.559*** (0.079)
Age	0.030*** (0.010)	0.029*** (0.010)	0.039*** (0.013)	0.017 (0.015)
Age squared	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)
Occupation (Not working)				
Self-employed	0.103 (0.091)	0.106 (0.091)	0.105 (0.123)	0.123 (0.138)
Employed	-0.490*** (0.061)	-0.483*** (0.061)	-0.493*** (0.082)	-0.479*** (0.094)
Household size (one person)				
Two	-0.355*** (0.064)	-0.354*** (0.064)	-0.276*** (0.087)	-0.460*** (0.097)
Three and more	-0.266*** (0.071)	-0.262*** (0.071)	-0.186** (0.095)	-0.364*** (0.109)
Community type (Rural or village)				
Small/middle town	-0.043 (0.059)	-0.048 (0.059)	-0.041 (0.078)	-0.027 (0.091)
Large town	-0.059 (0.064)	-0.061 (0.064)	-0.054 (0.085)	-0.057 (0.100)
Expected sanctions (Tax or social security contributions due)				
Tax/ social security contributions + fine, prison	-0.266*** (0.055)	-0.255*** (0.055)	-0.290*** (0.076)	-0.246*** (0.083)
Detection risk (Very small/Fairly small)				
Fairly high/Very high	-0.339*** (0.060)	-0.347*** (0.060)	-0.388*** (0.083)	-0.277*** (0.087)
Tax morality index	0.325*** (0.014)	0.327*** (0.014)	0.308*** (0.018)	0.356*** (0.022)
Personally know people engaged in undeclared work (No)				
Yes	1.918*** (0.070)	1.930*** (0.070)	1.853*** (0.097)	1.983*** (0.101)
Year dummy	Yes	No	No	No
Country dummies	Yes	Yes	Yes	Yes
Constant	-4.256*** (0.240)	-4.319*** (0.239)	-4.361*** (0.317)	-4.238*** (0.368)
Observations	38,413	38,413	19,245	19,168
Pseudo R2	0.2451	0.2447	0.2390	0.2552
LR chi2	3932.64	3925.38	2146.66	1786.50
Prob. > chi2	0.0000	0.0000	0.0000	0.0000

Notes: Significant at *** p<0.01, ** p<0.05, * p<0.1; Standard errors in parentheses.
Source: own calculations based on the Special Eurobarometer 284/ Wave 67.3 and Special Eurobarometer 402/ Wave 79.2.

Table A5. Logistic regression of the likelihood of engaging in undeclared work (imputed missing data)

Variables	Model 1 Both waves	Model 2 Both waves	Model 3 2007 wave	Model 4 2013 wave
Gender (Female)				
Male	0.617*** (0.046)	0.615*** (0.046)	0.716*** (0.063)	0.496*** (0.067)
Age	0.039*** (0.009)	0.038*** (0.009)	0.042*** (0.012)	0.033*** (0.013)
Age squared	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)
Occupation (Not working)				
Self-employed	0.042 (0.082)	0.042 (0.082)	0.079 (0.112)	0.019 (0.118)
Employed	-0.449*** (0.054)	-0.446*** (0.054)	-0.437*** (0.075)	-0.448*** (0.079)
Household size (one person)				
Two	-0.343*** (0.057)	-0.343*** (0.057)	-0.306*** (0.079)	-0.397*** (0.084)
Three and more	-0.257*** (0.063)	-0.255*** (0.063)	-0.202** (0.086)	-0.314*** (0.093)
Community type (Rural or village)				
Small/middle town	-0.019 (0.053)	-0.021 (0.053)	-0.041 (0.072)	0.021 (0.078)
Large town	-0.042 (0.056)	-0.042 (0.056)	-0.034 (0.077)	-0.047 (0.084)
Expected sanctions (Tax or social security contributions due)				
Tax/ social security contributions + fine, prison	-0.177*** (0.052)	-0.174*** (0.052)	-0.255*** (0.073)	-0.113 (0.075)
Detection risk (Very small/Fairly small)				
Fairly high/Very high	-0.364*** (0.055)	-0.366*** (0.055)	-0.404*** (0.077)	-0.306*** (0.077)
Tax morality index	0.320*** (0.012)	0.320*** (0.012)	0.305*** (0.016)	0.342*** (0.018)
Personally know people engaged in undeclared work (No)				
Yes	1.995*** (0.061)	1.998*** (0.061)	1.931*** (0.090)	2.056*** (0.087)
Year dummy	Yes	No	No	No
Country dummies	Yes	Yes	Yes	Yes
Constant	-4.692*** (0.216)	-4.711*** (0.215)	-4.652*** (0.292)	-4.751*** (0.319)
Observations	53,222	53,222	26,659	26,563
Imputations	20	20	20	20
F	82.31	84.35	44.40	40.54
Prob. > F	0.0000	0.0000	0.0000	0.0000

Notes: Significant at *** p<0.01, ** p<0.05, * p<0.1; Standard errors in parentheses.
Source: own calculations based on the Special Eurobarometer 284/ Wave 67.3 and Special Eurobarometer 402/ Wave 79.2.

Table A6. Multilevel logistic regression of the likelihood of engaging in undeclared work (crude data)

Variables	Model 1 Both waves		Model 2 Both waves		Model 3 2007 wave		Model 4 2013 wave	
Gender (Female)								
Male	0.640 ***	(0.051)	0.635 ***	(0.051)	0.700 ***	(0.068)	0.559 ***	(0.079)
Age	0.030 ***	(0.010)	0.029 ***	(0.010)	0.038 ***	(0.013)	0.016	(0.015)
Age squared	-0.001 ***	(0.001)	-0.001 ***	(0.001)	-0.001 ***	(0.001)	-0.001 ***	(0.001)
Occupation (Not working)								
Self-employed	0.105	(0.091)	0.107	(0.091)	0.110	(0.122)	0.122	(0.137)
Employed	-0.486 ***	(0.061)	-0.479 ***	(0.061)	-0.485 ***	(0.082)	-0.473 ***	(0.093)
Household size (one person)								
Two	-0.358 ***	(0.064)	-0.357 ***	(0.064)	-0.280 ***	(0.087)	-0.462 ***	(0.097)
Three and more	-0.274 ***	(0.071)	-0.270 ***	(0.071)	-0.199 **	(0.095)	-0.373 ***	(0.108)
Community type (Rural or village)								
Small/middle town	-0.048	(0.059)	-0.053	(0.059)	-0.049	(0.078)	-0.041	(0.091)
Large town	-0.062	(0.064)	-0.064	(0.064)	-0.055	(0.084)	-0.067	(0.100)
Expected sanctions (Tax or social security contributions due)								
Tax/ social security contributions + fine, prison	-0.264 ***	(0.055)	-0.253 ***	(0.055)	-0.285 ***	(0.076)	-0.239 ***	(0.083)
Detection risk (Very small/Fairly small)								
Fairly high/Very high	-0.339 ***	(0.060)	-0.347 ***	(0.060)	-0.384 ***	(0.083)	-0.280 ***	(0.087)
Tax morality index	0.326 ***	(0.014)	0.327 ***	(0.014)	0.309 ***	(0.018)	0.354 ***	(0.022)
Personally know people engaged in undeclared work (No)								
Yes	1.923 ***	(0.070)	1.936 ***	(0.070)	1.862 ***	(0.097)	1.997 ***	(0.101)
Year dummy		Yes		No		No		No
EU-27 region (East-Central Europe)								
Southern Europe	-0.754 ***	(0.213)	-0.753 ***	(0.213)	-0.676 ***	(0.227)	-0.860 ***	(0.272)
Western Europe	-0.057	(0.182)	-0.056	(0.182)	-0.115	(0.189)	0.023	(0.221)
Nordic Nations	0.554 **	(0.249)	0.561 **	(0.249)	0.667 ***	(0.253)	0.393	(0.306)
Constant	-4.431 ***	(0.249)	-4.496 ***	(0.247)	-4.572 ***	(0.315)	-4.366 ***	(0.359)
Observations		38,413		38,413		19,245		19,168
Number of countries		27		27		27		27
χ^2		2274.71		2270.41		1200.94		1058.99
p>		0.0000		0.0000		0.0000		0.0000
Random part								
Country-level variance		0.1289		0.1280		0.1247		0.1750
(Standard error)		0.0408		0.0405		0.0437		0.0631
Variance at country level (%)		3.77		3.74		3.65		5.05

Notes: Significant at *** p<0.01, ** p<0.05, * p<0.1; Standard errors in parentheses.
Source: own calculations based on the Special Eurobarometer 284/ Wave 67.3 and Special Eurobarometer 402/ Wave 79.2.

Table A7. Multilevel logistic regression of the likelihood of engaging in undeclared work (imputed missing data)

Variables	Model 1 Both waves		Model 2 Both waves		Model 3 2007 wave		Model 4 2013 wave	
Gender (Female)								
Male	0.616 ***	(0.046)	0.614 ***	(0.046)	0.713 ***	(0.063)	0.497 ***	(0.067)
Age	0.038 ***	(0.009)	0.038 ***	(0.009)	0.041 ***	(0.012)	0.032 **	(0.013)
Age squared	-0.001 ***	(0.001)	-0.001 ***	(0.001)	-0.001 ***	(0.001)	-0.001 ***	(0.001)
Occupation (Not working)								
Self-employed	0.043	(0.081)	0.043	(0.081)	0.085	(0.112)	0.015	(0.118)
Employed	-0.446 ***	(0.054)	-0.443 ***	(0.054)	-0.431 ***	(0.075)	-0.445 ***	(0.079)
Household size (one person)								
Two	-0.346 ***	(0.057)	-0.345 ***	(0.057)	-0.310 ***	(0.079)	-0.398 ***	(0.084)
Three and more	-0.264 ***	(0.062)	-0.263 ***	(0.062)	-0.216 **	(0.086)	-0.322 ***	(0.093)
Community type (Rural or village)								
Small/middle town	-0.024	(0.053)	-0.026	(0.053)	-0.046	(0.072)	0.010	(0.078)
Large town	-0.044	(0.056)	-0.045	(0.056)	-0.036	(0.076)	-0.053	(0.084)
Expected sanctions (Tax or social security contributions due)								
Tax/ social security contributions + fine, prison	-0.177 ***	(0.052)	-0.175 ***	(0.051)	-0.252 ***	(0.073)	-0.112	(0.074)
Detection risk (Very small/Fairly small)								
Fairly high/Very high	-0.364 ***	(0.055)	-0.366 ***	(0.055)	-0.403 ***	(0.077)	-0.308 ***	(0.076)
Tax morality index	0.320 ***	(0.012)	0.321 ***	(0.012)	0.306 ***	(0.016)	0.341 ***	(0.018)
Personally know people engaged in undeclared work (No)								
Yes	1.999 ***	(0.061)	2.003 ***	(0.061)	1.939 ***	(0.089)	2.065 ***	(0.087)
Year dummy		Yes		No		No		No
EU-27 region (East-Central Europe)								
Southern Europe	-0.571 ***	(0.196)	-0.571 ***	(0.196)	-0.591 ***	(0.215)	-0.543 **	(0.226)
Western Europe	-0.059	(0.171)	-0.058	(0.171)	-0.072	(0.180)	-0.032	(0.194)
Nordic Nations	0.536 **	(0.235)	0.539 **	(0.235)	0.704 ***	(0.244)	0.313	(0.271)
Constant	-4.846 ***	(0.223)	-4.866 ***	(0.223)	-4.859 ***	(0.287)	-4.842 ***	(0.309)
Observations		53,222		53,222		26,659		26,563
Number of countries		27		27		27		27
Imputations		20		20		20		20
Model F test		166.74		176.89		91.12		86.29
Prob. > F		0.0000		0.0000		0.0000		0.0000
Random part								
Country-level variance		0.3394		0.3392		0.3435		0.3696
(Standard error)		0.0527		0.0526		0.0586		0.0630
Variance at country level (%)		9.35		9.35		9.45		10.10

Notes: Significant at *** p<0.01, ** p<0.05, * p<0.1; Standard errors in parentheses.
Source: own calculations based on the Special Eurobarometer 284/ Wave 67.3 and Special Eurobarometer 402/ Wave 79.2.

Table A8. The number of missing values for the variables used in the regression modelling for robustness check of the results*

Variables	Complete	Incomplete	Imputed
Gender	53,222	0	0
Age/ Age squared	53,222	0	0
Occupation	53,222	0	0
Household size	53,222	0	0
Community type	53,114	108	108
Undeclared work	51,497	1,725	1,725
Expected sanctions	44,743	8,479	8,479
Detection risk	47,125	6,097	6,097
Tax morality index	49,278	3,944	3,944
Personally know people engaged in undeclared work	50,037	3,185	3,185
Year dummy	53,222	0	0
EU-27 region	53,222	0	0

*Notes**: The highest number of missing values is reported for the two questions related with the perceived risk of detection and the perceived level of penalties. However, it is important to notice that for the risk of detection, 5,316 respondents out of 6,097 which have missing values, declared that they do not know which is the risk of being caught if working undeclared and only 781 respondents refused to answer. Similarly, 6,120 respondents out of the 8,479 respondents with missing values for the variable measuring the expected sanction, declared that they do not know what is the expected penalty for someone if caught doing undeclared work. This suggest a low tax education of the citizens in the European Union member states.

Source: own calculations based on the Special Eurobarometer 284/Wave 67.3 and Special Eurobarometer 402/Wave 79.2