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Unreported employment and tax evasion in mid-transition: Comparing developments and causes in the Baltic States

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Unreported employment and tax evasion in mid-transition: Comparing developments and causes in the Baltic States

Jaanika Meriküll and Karsten Staehr*

Abstract

This paper compares the prevalence and determinants of unreported employment in the three Baltic States in 1998 and 2002 using a hitherto little used dataset. The prevalence of unreported employment varies substantially across the three countries and across the two sampling years. Microeconometric estimations show that firm-related characteristics, such as sectoral activity, firm size and employment trends, are important determinants of unreported employment in all three countries, whereas the impact of individual factors varies across countries and time. It is shown that only 10–30 percent of the changes in unreported employment between 1998 and 2002 can be accounted for by changes in individual characteristics and firm-related factors. Provisional calculations suggest that the net gain for individuals undertaking unreported employment is modest, in particular among individuals who regularly engage in such activities.

JEL Code: H26, H24, D19

Keywords: Unreported employment, informal employment, envelope wages, tax evasion

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The views expressed are those of the authors and do not necessarily represent the official views of Eesti Pank.

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Non-technical summary

This paper compares the prevalence and the causes of unreported employment in the three Baltic States in 1998 and 2002, i.e. in the middle of the transition process. The analyses are based on data from the Working Life Barometer (WLB) surveys, which were conducted using a uniform survey methodology across the three Baltic States. The WLB dataset has not previously been used for analyses of unreported work and tax evasion in the Baltic States. The main advantage of the WLB dataset is that it allows comparisons across the three Baltic States and across time; the main drawback is the absence of information on a host of potentially important variables.

The prevalence of both occasional and regular unreported employment varies substantially across the three countries as well as the two sampling years. Estonia saw a marked drop in the prevalence of unreported employment from 1998 to 2002, while the opposite development is registered for Latvia and Lithuania.

Microeconometric estimations seeking to "explain" the prevalence of unreported employment show that firm-related characteristics, such as sectoral activity, firm size and employment growth, are principal factors explaining unreported employment in all three countries. The importance of personal factors, on the other hand, varies markedly across countries and time, and these factors are clearly of secondary importance. This may suggest that the decision not to report wage income to the authorities largely stems from the employers, while the employees have little influence on the decision, irrespective of personal characteristics such as gender, age and education. There are relatively minor differences between the factors explaining, respectively, occasional and regular unreported employment, especially for the firm-related variables.

The analysis also seek to assess to which extent the changes in the frequency of the unreported employment from 1998 to 2002 can be accounted for by changes in explanatory factors, such as industry structure, firm size and individual characteristics. The results showed that only 10 to 30 percent of the changes could be explained by these factors; the rest of the change must be attributed to other factors.

Exploratory calculations suggest that the net gain for individuals undertaking unreported employment is modest, in particular for those who regularly engage in such activities. Individuals receiving envelope wages are not significantly better off than law-abiding individuals. This result is very uncertain given that the income reported in the Working Life Barometer may understate income from unregistered employment.

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1. Introduction

Tax policies, tax evasion and unreported employment are intrinsically linked. A tax is a compulsory payment for which the taxpayer does not receive any specific benefit or service (Murphy and Higgins, 2004:4). The decoupling of payments and benefits comprises the underlying source of the incentive of individuals and firms to evade taxation. Evasion of any tax is possible, as long as the individual and/or firm concerned can hide information on the taxable activity from the authorities.

Labour income taxes levied on labour income earned by employees and the self-employed. Labour income taxes usually consist of payroll taxes, personal income taxes (on the labour income part of personal income) as well as various compulsory contributions, covering for instance unemployment and occupational accident insurance. Altogether these taxes generate a large share of the total tax revenue in most middle- and high-income countries, including the Baltic States (cf. below). Evasion of labour income taxes takes place when firms and individuals or refrain from report taxable labour income to the authorities. The facts that labour income taxes affect many individuals and generate much revenue suggest that the evasion of these taxes is of substantial societal importance.

Recent surveys of theoretical and empirical studies on tax evasion and unregistered work include Andreoni et al. (1998), Cowell (1990), Schneider and Enste (2000) and Slemrod (2007). The theoretical literature finds that the welfare consequences of labour income tax evasion depend on, *inter alia*, the prevalence of evasion, the amount of income left unreported, and the characteristics of individuals benefiting from the tax evasion. Indeed, the welfare effects of labour income tax evasion are tightly linked to the distribution of tax evasion. This finding rests on both efficiency and distribution arguments.

Tax evasion reduces the tax base and, thus, necessitates a higher tax rate given that the government has a revenue target. The higher tax rate, in turn, increases the excess burden. Alternatively, however, the excess burden can be reduced if taxation is evaded by individuals whose participation in productive activities would have been discouraged by the tax. Tax evasion may lead to an arbitrary distribution of the tax burden, but it may also benefit socially important individuals; for instance, the less advantaged. Income from unreported work may constitute an important "last resort" for marginalised groups of society (Kim, 2005; Danopoulos and Znidaric, 2007; Kriz et al., 2008).

This line of reasoning makes it expedient to examine the extent of evasion of labour income taxation, its development over time and factors explaining its prevalence. This paper addresses these issues through a comparative study

of the three Baltic States. Data availability compels us to focus specifically on *unreported employment* or employees receiving "envelope wages", i.e. wage income that is not reported to the authorities. We do not have information on the extent of the self-employed failing to report income from their business.[1]

The paper compares developments across the three countries in two years during the mid-transition phase, *viz.* 1998 and 2002. This phase is interesting to study. The Baltic States regained independence from the Soviet Union in 1991 and immediately set out to establish market-based economies. By the mid-1990s the main structural changes, including tax reforms, had been implemented and the Baltic economies had recovered from the deep downturns experienced after the collapse of the Soviet Union. Thus, by 1998, the first year of our sample, the Baltic States had *de jure* economic systems resembling those of most Western European countries, although uncertain property rights and questions concerning the administrative capacity at both the central and local levels prevailed (OECD, 2000). The Russian crisis hit the Baltic States hard and brought about sharp but short-lived downturns in all three countries in 1999. The Russian crisis led to large structural change in the Baltic States as trade and investment were reoriented towards western markets. The analyses of unreported employment and tax evasion in this paper span this time of change in the Baltic States.

Our main data source is the hitherto little used dataset of the Working Life Barometer (WLB), a survey undertaken in each of the Baltic States in 1998 and 2002. The survey was designed to examine the working and living conditions of people in the Baltic States, and the survey questions were essentially identical across the three countries and the two sample years. The WLB dataset is therefore uniquely suited for comparative studies of labour market behaviour across the three Baltic States and across time. The WLB, however, was not targeted to the analysis of unreported employment and tax evasion and, for instance, does not contain information on the amounts of wage income left unreported. Another shortcoming is that the dataset only comprises information for the two years 1998 and 2002.

The WLB allows for a direct comparison of the extent and "determinants" of unreported employment across the three Baltic States. Such a comparison is particularly pertinent as the systems of labour income taxation are fairly similar across the countries and have been relatively stable since the mid-1990s (see Section 2). All three countries have flat income tax systems, implying that the marginal tax rate is constant for all income above the basic exemption and possible personal exemptions.

[1] Self-employed individuals may, however, receive envelope wages if they are also employees (in addition to working in their own business).

The paper seeks to shed light on a number of issues concerning unreported employment and evasion of labour income taxation in the Baltic States. First, the (unconditional) WLB estimates of the prevalence of unreported employment in the three countries for 1998 and 2002 are reported and compared to estimates from other sources. Second, we use discrete choice regressions to "explain" the probability of unreported employment based on individual and workplace-specific characteristics. Third, we examine the extent to which changes in unreported employment can be explained by structural changes in the economy, such as changes in industry composition and the characteristics of the employed. Fourth, the paper seeks to provide estimates of the amount of unreported income earned by individuals who undertake unreported employment. These estimations are, *sui generis*, very uncertain.

The rest of the paper is organised as follows. Section 2 gives a brief introduction to the taxation systems in the Baltic States. Section 3 presents the dataset and provides descriptive statistics on the prevalence of unreported employment in the three countries. Section 4 gives the results of estimations "explaining" the prevalence of unreported employment by a number of individual and firm specific factors. Section 5 compares the earnings of individuals undertaking unreported employment with the earnings of law-abiding individuals. Section 6 summarises the results.

2. Personal income taxation and unreported employment in the Baltic States

The Baltic States regained independence from the Soviet Union in August 1991 and immediately introduced reforms establishing market-based economies. This also applied to the tax systems, where the turnover taxes of the planned economy were replaced by payroll, income, and commodity taxes at an early stage in the transition process (OECD, 2000). The initial tax reforms resulted in relative complex personal income tax systems with several tax brackets and many exemptions. In 1994, however, Estonia reformed its income taxes and introduced a flat (linear) income tax and removed numerous exemptions. Latvia and Lithuania followed suit and introduced flat income taxes in 1995. In general, the systems of labour income taxation are rather similar across the Baltic States.[2]

The taxation of labour income consists of payroll taxes (social security contributions), income taxes and a number of smaller charges, e.g. unemploy-

[2]The factual information in this section is based on the country chapters in Eurostat (2007:Part III).

ment insurance contribution. All three countries are applying relatively high payroll taxes. Since the mid-1990s the payroll tax has amounted to 33 percent in Estonia and 33.09 percent in Latvia. The payroll tax rate in Lithuania was 31 percent up to and including 1999 and 33 percent from 2000 to the end of 2005, when the tax rate was increased to 34 percent. In all three countries, the self-employed either pay a lower tax rate and/or only pay payroll tax for income up to a certain level.

All three countries have introduced comprehensive pension reforms based on the 3-pillar principle and gradually phased in since the late 1990s. The reforms imply that taxpayers accumulate pension rights based on their payroll tax contributions, so that future pension payouts are a function of lifetime payroll tax contributions. This implies that part of the payroll tax revenue cannot be considered tax revenue using the classical definition of a tax, as the taxpayer receives a future partly specified benefit from the payroll tax payment.

The personal income tax is levied at a fixed rate on income in excess of basic and personal exemptions. The basic and personal exemptions are relatively low compared to other European countries. The tax rate on personal income was 26 percent in Estonia up to and including 2004, but the rate has since been gradually lowered. Latvia has applied a flat rate of 25 percent since 1995. Lithuania initially applied a flat income tax rate of 33 percent from 1995 until mid-2006, but at the same time allowed more exemptions than Estonia and Latvia. The tax rate was reduced to 27 percent in the middle of 2006 and to 24 percent at the beginning of 2008.

Figure 1 shows the revenue intake from labour income taxation as a share of total taxes and as a share of GDP for each of the three Baltic States. In 1998 the labour income taxes in Estonia comprised a larger share of total tax revenue and of GDP than in the other two countries, but this difference has since fallen markedly. The figure confirms the impression that the taxation of labour income is relatively similar across the three Baltic States.

All three countries apply withholding of labour income taxes. For an employee, this implies that the employer is responsible for reporting the labour income to the tax authorities and for transferring to the authorities the liable payroll tax. The employee can, however, report the income to the authorities (e.g. when filing his or her income tax return). In other words, both the employer and the employee, in principle, need to consent in order for work to be left unreported and taxation evaded.[3] Still, in many instances employment is only offered if the employee accepts to receive all or part of the salary as "en-

[3]Generally, no statistical information is available concerning the economic incidence of the evasion of taxation, i.e. how the "surplus" or non-paid tax revenue is distributed between the employer and the employee.

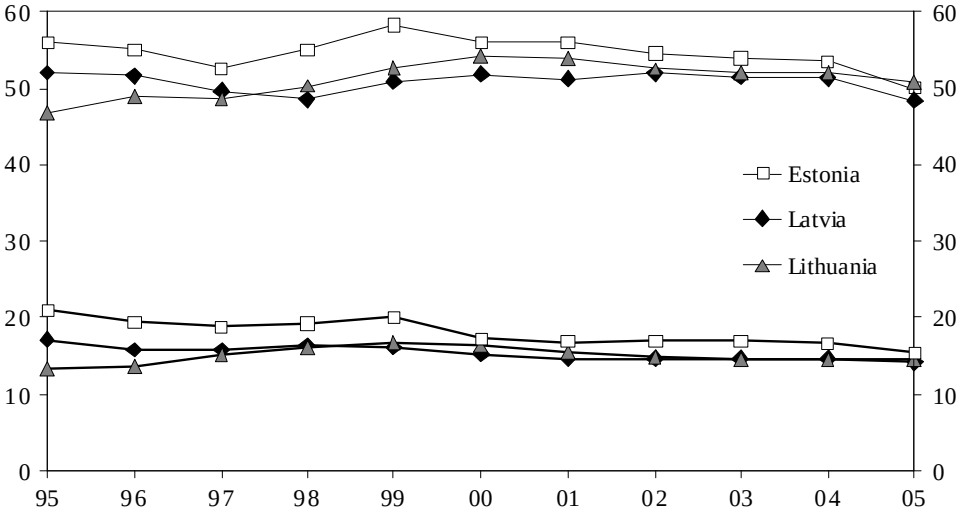

Figure 1: Taxes on labour, percentage of total tax revenue and percentage of GDP (bold)

Note: The upper group of lines shows the labour tax revenue as a percentage of total tax revenue; the lower group of bold lines shows the labour tax revenue as a percentage of GDP.
Source: Eurostat (2008)

velope wages", i.e. without the income being reported to the authorities. In a survey undertaken in Estonia in 2004, a majority of the respondents receiving envelope wages stated that they would lose their job if they did not accept to be paid in this way (EKI, 2005).

Sole proprietors are responsible for reporting and paying taxes on their proprietary taxable income. Hence for the sole proprietor, only one person will be involved in the evasion of labour income taxation. There is, furthermore, the intermediate case where a person having one (main) employer sells products or services outside the control of the main employer and omits to declare the income from these activities. In this case, only the person undertaking unreported employment is responsible for the evasion of labour income taxation.

There are many similarities across the economies, tax systems, and tax administrations in the three Baltic States (Eurostat, 2007:Part III; OECD, 2000: Ch.III). This does not, however, imply that the extent of unreported employment and the factors affecting such activities cannot differ across the countries. Societal norms and values may affect individuals' tax morale and, hence, the incidence of unreported employment. Indeed, based on a dataset of Western countries, Alm and Togler (2006) show that individuals' tax morale differs substantially across otherwise comparable countries — also when controls are included for different factors that could affect tax morale. Moreover, culture

variables appear to explain part of the differences in tax morale across countries.

According to the World Values Survey for 1999, the inhabitants in the Baltic States have quite diverse attitudes towards cheating on taxes. On a scale between never justified (1) and always justified (10), the mean scores were 3.15 for Estonia, 2.36 for Latvia and 3.77 for Lithuania. Only Latvians found tax evasion less justified than the EU25 average (score 2.57), while the Lithuanians were the most tolerant on tax evasion in the whole EU25 (World Values Survey, 1999).

3. Data and descriptive statistics

The Finnish Ministry of Labour instigated the Working Life Barometer surveys in the three Baltic States, which were undertaken in order to gather information about working and living conditions. Antila and Ylostalo (1999, 2003) document the surveys and provide a number of tabulations of the main results. Essentially, identical surveys were conducted in each of the three Baltic States in 1998 and 2002.[4] In each round approximately 900 individuals face-to-face interviews were carried out in Estonia, Latvia and Lithuania. The surveys comprised a wide range of questions and were not specifically aimed at analysing tax evasion and unreported employment. The survey results have been made available to us by the Finnish Ministry of Labour and have, to our knowledge, not hitherto been used for detailed comparative analyses of unreported employment in the Baltic States.

The WLB survey requires the respondent to answer a large number of questions. We will discuss in some detail the questions concerning total net wage income and the prevalence of unreported income. Question no. 49 asks the respondent to state his or her total net wage income: "What was your net salary in the last month? Under net salary we mean the money you received after tax, considering all your jobs as well as all the bonuses and rewards received from them" (Antila and Ylostalo, 1999:194). This formulation of the question suggests that the net income from all jobs held should be included and thus, by implication, also the income from unreported employment. We take the logarithm to the net monthly wage income and label it *log net wage income*.

Question no. 50 deals with unreported employment using this formulation (Antila and Ylostalo, 1999:194): "Do you receive the "salary in envelope" or "black salary"?". The term *envelope salary* or *envelope wages* is

[4]The Estonian authorities undertook a round of the WLB in 2005 for which data has also been made available, but we do not use this data since no corresponding surveys were carried out in Latvia and Lithuania for 2005.

used to indicate that the salary has not been reported to the authorities, implying that taxation is evaded. To encourage the respondent to answer truthfully, the following information is provided: "The answer is absolutely confidential. There is no way that the authorities would get the information" (Antila and Ylostalo, 1999:194). The respondent is given three different answer possibilities: "never", "sometimes" and "every month". The variable *unreported employment* has been coded as 0 if the respondent answers that unreported employment is "never" undertaken, 1 if unreported employment is "sometimes" undertaken, and 2 if unreported employment is undertaken frequently, i.e. every month.[5]

Notice that the term *envelope wages* refers to unreported remuneration of the *employed*. Self-employed respondents who fail to report fully the (labour) income from their own business are unlikely to state that they have received envelope wages. A self-employed individual might, however, receive envelope wages if he or she also works as an employee outside his or her own business. (See also the discussion of the difference between unreported work and unreported employment in EC, 2007:Sec.4.)

There is no additional information available in WLB about the unreported employment beyond whether or not it took place. However, the dataset contains a large number of variables concerning the respondent's *main workplace* as well as some personal background information. The variables are listed and defined in Table 1. The variables concerning the main workplace indicate whether the respondent has more than one job; the position of the respondent in the occupational hierarchy; the number of persons employed; the sector of activity; and changes in the number of employees during the last year. The personal characteristics include the respondent's ethnicity, education, gender and age. Finally, there is also a variable indicating the year when the respondent was interviewed. In addition to the variables in Table 1, the region of the respondent is also reported.[6]

[5]The respondents were also asked whether they worked according to a written or a verbal contract. Work according to a verbal contract is generally not allowed in the Baltic States (except for very short durations of work) and may thus suggest that the work is unreported. We have decided against using the verbal contract variable as an unreasonably large number of individuals indicate to work according to a verbal contract.

[6]The dataset also contains information as to whether the firm is foreign-owned, the marital status of the respon-dent and the size of the respondent's household, but only for 1998. The use of these variables would rule out pooling of data for the two survey years, and these variables have therefore not been used.

Table 1: Definition of explanatory variables

Variable name		Definition
Log net wage income	=	Logarithm to monthly income net of taxes of all jobs of respondent, incl. unreported employment
Unreported employment	=	0 if respondent never receives envelope wages, 1 if respondent receives envelope wages sometimes, 2 if respondent receives envelope wages every month
Male	=	1 if respondent is a male
Age	=	Age of respondent in years *divided by 100*
Titular ethnicity	=	1 if respondent is of titular ethnicity
Education	=	Highest education level of respondent; 1 = pre-primary, 2 = primary, 3 = incomplete secondary or professional, 4 = technical secondary, 5 = general secondary, 6 = tertiary
Second job	=	1 if respondent has one or more jobs in addition to the main job
Self-employed	=	1 if respondent is self-employed[a]
Occupational position	=	Position of respondent in occupational hierarchy; 1 = manager, 2 = specialist, 3 = clerk, 4 = manual worker, 5 = other[a]
Agriculture	=	1 if respondent works in agricultural sector[a]
Manufacturing	=	1 if respondent works in manufacturing sector[a]
Construction	=	1 if respondent works in construction sector[a]
Trade	=	1 if respondent works in trade or transport sectors[a]
Services	=	1 if respondent works in services sector[a]
Public	=	1 if respondent works in government sector[a]
Other sectors	=	1 if respondent works in other sectors than above[a]
Workplace size	=	The number of persons employed in the respondent's workplace; 1 = 1-4, 2 = 5-9, 3 = 10-19, 4 = 20-49, 5 = 50-99, 6 = 100-499, 7 = 500 or more[a]
Employment up	=	1 if employment in the respondent's workplace has increased within the last 12 months[a]
Employment down	=	1 if employment in the respondent's workplace has decreased within the last 12 months[a]
Year02	=	1 for year 2002

[a] Information concerns the main job of the respondent.
Source: Antila and Ylostalo (1999, 2003), own definitions.

Table 2 shows the prevalence of unreported employment for each of the three countries for 1998 and 2002. As always in surveys dealing with unreported employment and tax evasion, it is difficult to assess whether or not the respondents answer the questions truthfully. It is noteworthy, however, that the number of respondents refusing to answer the question on unreported wage income increased substantially from 1998 to 2002 in all three countries. Among the respondents answering the question, there is substantial variation across countries as well as the two time periods analysed in the share of respondents admitting to have received envelope wages.

In the case of Estonia, the share of respondents stating that they have received envelope wages fell from 19.5 percent in 1998 to 9.6 percent in 2002. In Latvia, the share of respondents with unreported employment rose from 16.3 to 22.5 percent in the same period. Lithuania saw a similar increase but from a much lower starting point. In 1998 a total of 7.2 percent of the respon-

Table 2: Prevalence of unreported employment in the Baltic States, 1998 and 2002

		Estonia	Latvia	Lithuania
1998	No unreported employment (%)	80.5	81.7	92.7
	Unreported employment (%)	19.5	16.3	7.2
	– Occasionally (%)	10.3	7.9	3.9
	– Regularly (%)	9.2	8.4	3.3
	Number of observations	911	921	901
	– Do not wish to say	0	19	1
2002	No unreported employment (%)	83.4	70.5	82.2
	Unreported employment (%)	9.6	22.5	11.7
	– Occasionally (%)	6.8	9.5	7.0
	– Regularly (%)	2.8	12.9	4.6
	Number of observations	900	904	909
	– Do not wish to say	63	64	56

The coding of unreported employment is based on the question: "Do you receive the "salary in envelope" or "black salary"?"
Source: WLB (1998, 2002), own calculations.

dents were evading taxes, whereas by 2002 the share had increased to 11.7 percent. In 1998 in all three countries the share of respondents receiving envelope wages regularly, i.e. every month, amounted to approximately half of all envelope wage recipients. In 2002 this indicator had fallen in Estonia and Lithuania, but had increased in Latvia.

It is difficult to assess whether the statistics in Table 2 only relate to the chosen sample or whether the results can be seen as reflecting the broader population. To our knowledge, the only survey-based study of the prevalence of unreported employment in the three Baltic States is a Eurobarometer survey reporting data from 2007 (EC, 2007). According to this survey, the share of respondents stating that they have received envelope wages amounts to 18 percent in Latvia, 11 percent in Lithuania and 8 percent in Estonia (EC, 2007:30). The Eurobarometer results are broadly in line with the WLB results for 2002.

Renoy et al. (2004) is a European Commission study which collected *official* national data for the share of unofficial production in total GDP in 27 EU countries. Clearly, the measures of unreported activity in Renoy et al. (2004) are entirely different from the measures of the receipt of envelope wages in WLB. Renoy et al. (2004:Sec.5.1) report that around year 2000 the official unreported share of total GDP amounted to 8–9 percent in Estonia, 18 percent in Latvia and 15–19 percent in Lithuania, and with a declining trend in all three Baltic States. The relatively high estimate for Lithuania is noticeable in light of the results in Table 2 and EC (2007:30).

Finally, Schneider (2007) reports data on the *total* share of the unofficial production in total GDP estimated indirectly from indicators such as unem-

ployment, tax rates and measures of cash use in the economy. The indirect estimation method should, in principle, be comprehensive and cover all unregistered production activities. Schneider (2007) estimates that in 2001–2002 the *total* unreported economy amounted to 39 percent of official GDP in Estonia, 41 percent of official GDP in Latvia and 31 percent of official GDP in Lithuania. Using the same indirect estimation methodology, Schneider (2002) finds that the share of working-age individuals undertaking unregistered work in 1998–1999 was 33 percent in Estonia, 30 percent in Latvia and 20 percent in Lithuania. There is a close correspondence between the estimates of unreported GDP and unreported employment. The lower shares of unreported GDP and employment in Lithuania, compared to Estonia and Latvia, are not necessarily inconsistent with the findings in the two rounds of the WLB, but do not concur with the results in Renoy et al. (2004).

It is, as always with estimates of unreported employment and production, difficult to obtain a full picture of the prevalence and trends. Still, there appears to be some correspondence between the unconditional measures of the share of individuals with unreported employment obtained from the WLB surveys and the 2007 Eurobarometer survey, whereas direct comparison of the WLB results with the studies of unreported production is difficult because of their different measures of unreported activity.

4. Determinants of unreported employment

In this section we seek to link the likelihood of an individual being engaged in unreported employment with various characteristics of the individual and the main employer. We generally associate the estimated marginal effects with the determinants or drivers of unreported employment, although not all the explanatory variables are necessarily (weakly) exogenous. This interpretation of the marginal effects is discussed in more detail in Subsection 4.2. Most of the estimations are carried out using binary logit, but multinominal and ordered logit estimations are used in some robustness checks.

4.1. Logit estimations for the two years separately

In the logit regressions the dependent variable is 0 if the respondent reports never to have received unreported wage income, and 1 if the respondent has received unreported wage income occasionally or regularly.[7] As explanatory variables, we use a large number of the variables listed in Table 1, reflecting

[7]Thus, the dependent variable is 1 if *Unreported work* is equal to 1 or 2 and 0 if *Unreported work* is 0.

the personal characteristics and the employment situation of the respondent as well as various characteristics of the main employer.

The logit estimations for the three countries (undertaken separately for 1998 and 2002) are shown in Tables 3–5. The coefficient estimates of a logit estimation have no direct interpretation. Instead, we provide the marginal effects (Marg. eff.) along with the robust standard error (R.S.E.) and the average of the explanatory variable for the specific year (Mean). Regional dummy variables are included in all regressions to control for possible regional heterogeneity, but the estimated coefficients to these variables are insignificant in almost all cases and are not reported in the tables in order to save space.

Table 3: Determinants of unreported employment in Estonia, binary logit estimation, 1998 and 2002

	1998			2002		
	Marg. eff.	**R.S.E.**	**Mean**	**Marg. eff.**	**R.S.E.**	**Mean**
Male	0.017	(0.029)	0.483	0.014	(0.017)	0.438
Age	–0.046	(0.118)	0.399	–0.010	(0.072)	0.409
Titular ethnicity	–0.018	(0.031)	0.668	–0.049**	(0.025)	0.711
Education	0.028**	(0.012)	4.386	–0.004	(0.007)	4.416
Second job	0.147***	(0.051)	0.136	0.063*	(0.037)	0.144
Self-employed	–0.024	(0.078)	0.025	–0.031*	(0.019)	0.062
Occupational position	0.027***	(0.010)	3.266	0.006	(0.006)	3.201
Agriculture	0.167*	(0.088)	0.107	0.361**	(0.178)	0.074
Manufacturing	0.149*	(0.089)	0.108	..	..	0.000
Construction	0.367***	(0.105)	0.083	0.557***	(0.155)	0.085
Trade	0.239***	(0.081)	0.160	0.218**	(0.109)	0.191
Services	0.231***	(0.087)	0.142	0.163	(0.103)	0.179
Other sectors	0.135*	(0.069)	0.181	0.244**	(0.109)	0.216
Workplace size	–0.025***	(0.008)	3.393	–0.021***	(0.007)	2.998
Employment up	0.129***	(0.046)	0.170	0.027**	(0.032)	0.144
Employment down	–0.034	(0.031)	0.293	0.004	(0.023)	0.227
Predicted share (%)		15.4			5.9	
Actual share (%)		19.1			11.2	
Pseudo R^2		0.120			0.192	
Observations		786			598	

Note: Regional variables are also included in the regressions, but the results are not reported. The omitted sectoral variable is *Public*.
***, **, * denote that the coefficient estimate is different from 0 at the 1, 5 and 10 percent level of significance, respectively.

Table 3 shows the logit estimations for *Estonia*. Among the individual characteristics, only a few variables are statistically significant. Gender or age does not appear to influence the probability of tax evasion. For 2002, the ethnicity variable is significant and negative, implying that ethnic Esto-

nians have lower probability of evasion than other ethnic groups, which for Estonian mainly comprise of Russian-speakers. For 1998, a higher education level increases the probability of evasion, but this effect is not present in 2002. Having a second job increases the probability of tax evasion; possibly because income from the second job is reported less frequently. The occupational position in the firm is significantly related with evasion in 1998; a high position in the hierarchy (e.g. specialist or manager) reduces the probability of unreported employment. The coefficient to the variable capturing the occupational position is not statistically significant in the 2002 sample.

In terms of employer-related variables, the sectoral variables are generally significant and with positive signs, implying that respondents working in other sectors than the public sector have a higher probability of receiving unreported wages than public employees. (The dummy for the manufacturing sector has been excluded for 2002, as there is no variability in that variable across evasion decisions; all the workers in the manufacturing sector claimed not to have received envelope wages.) The marginal effect for respondents in the construction sector is very large, particularly for 2002. The estimated coefficients for the company size variable are negative and statistically significant; respondents employed in large companies receive less frequently envelope wages. Interestingly, a respondent working in a firm with expanding employment has higher probability of receiving unreported wage income than a respondent working in a firm with constant or falling employment. Expanding firms appear to meet part of their increased labour requirement by letting existing workers work more or by employing new ones — and pay them envelope wages in both cases.

Overall, the logit estimation for Estonia seems reasonable. The model's pseudo R^2 is relatively high given the type of dataset. The model underpredicts the share of evading respondents for both 1998 and 2002, but this is a common feature for discrete choice models with an "unbalanced sample", i.e. a sample with proportionately few occurrences of a given choice (Cramer, 1999). Note that the evasion shares in Table 3 are different from those in Table 2, since some respondents are excluded from the regressions due to missing observations of the model's explanatory variables.

The results of the logit estimations for *Latvia* are presented in Table 4. The share of respondents receiving envelope wages increased between 1998 and 2002, but the models predict a corresponding increase in the share of tax evaders. It is noticeable that the model of unreported employment performs better for 2002 than for 1998, as measured by the pseudo R^2 and the number of significant coefficients.

As regards the individual characteristics of the respondents, it is noticeable

Table 4: Determinants of unreported employment in Latvia, binary logit estimation, 1998 and 2002

	1998			2002		
	Marg. eff.	**R.S.E.**	**Mean**	**Marg. eff.**	**R.S.E.**	**Mean**
Male	0.058***	(0.025)	0.448	0.096***	(0.035)	0.450
Age	–0.338***	(0.101)	0.396	–0.609***	(0.140)	0.400
Titular ethnicity	–0.008	(0.024)	0.556	–0.008	(0.033)	0.573
Education	0.012	(0.011)	4.649	0.012	(0.014)	4.709
Second job	0.043	(0.036)	0.156	0.151***	(0.054)	0.151
Self-employed	0.029	(0.072)	0.029	–0.063	(0.060)	0.037
Occupational position	0.007	(0.009)	3.168	0.040***	(0.012)	3.243
Agriculture	0.090	(0.100)	0.036	0.317***	(0.113)	0.090
Manufacturing	0.128**	(0.063)	0.195	0.222**	(0.104)	0.147
Construction	0.221**	(0.098)	0.061	0.452***	(0.118)	0.055
Trade	0.112*	(0.061)	0.176	0.271***	(0.097)	0.168
Services	0.055	(0.056)	0.159	0.238***	(0.092)	0.164
Other sectors	0.105	(0.075)	0.112	0.150*	(0.091)	0.155
Workplace size	–0.024***	(0.008)	3.680	–0.044***	(0.010)	3.441
Employment up	0.104**	(0.040)	0.188	0.098*	(0.050)	0.196
Employment down	–0.001	(0.032)	0.241	0.074*	(0.044)	0.186
Predicted share (%)		12.0			19.0	
Actual share (%)		15.5			24.5	
Pseudo R^2		0.120			0.172	
Observations		750			709	

Note: Regional variables are also included in the regressions, but the results are not reported. The omitted sectoral variable is *Public*.
***, **, * denote that the coefficient estimate is different from 0 at the 1, 5 and 10 percent level of significance, respectively.

that male respondents and young respondents, *ceteris paribus*, receive envelope wages more frequently than other groups. Having a second job seems to matter only in 2002 whereas self-employment does not seem to have any effect on the receipt of envelope wages neither in 1999 or 2002. Many of the employer-related variables are statistically significant. The sectoral variables enter with positive signs, but relatively few of them are significant for 1998. The increase from 1998 to 2002 in the (numerical values of the) estimated coefficients of many of the sectoral variables is noticeable. The coefficient of the firm size variable is negative and significant for both years, implying that respondents working in large firms have a lower probability of tax evasion than employees in small firms. Respondents employed in expanding firms received, like in the Estonian case, envelope wages more frequently than others.

The results for *Lithuania* are shown in Table 5. The unconditional share of recipients of envelope wages increased from 7 percent in 1998 to 13 percent

in 2002, but also the predicted share increases markedly. It is noticeable that there are more significant coefficients for 1998 than for 2002.

Table 5: Determinants of unreported employment in Lithuania, binary logit estimation, 1998 and 2002

	1998			2002		
	Marg. eff.	**R.S.E.**	**Mean**	**Marg. eff.**	**R.S.E.**	**Mean**
Male	0.015	(0.014)	0.445	–0.005	(0.021)	0.476
Age	–0.122**	(0.057)	0.398	–0.207**	(0.101)	0.401
Titular ethnicity	0.024	(0.015)	0.868	0.017	(0.030)	0.877
Education	0.009	(0.006)	4.465	–0.007	(0.010)	4.571
Second job	0.022	(0.026)	0.080	0.029	(0.034)	0.145
Self-employed	–0.027	(0.017)	0.055	–0.050**	(0.022)	0.074
Occupational position	0.005	(0.005)	3.400	0.014*	(0.008)	3.450
Agriculture	0.035	(0.049)	0.094	0.064	(0.084)	0.074
Manufacturing	0.074	(0.052)	0.168	0.123*	(0.065)	0.177
Construction	0.074	(0.068)	0.065	0.286**	(0.113)	0.068
Trade	0.161**	(0.063)	0.142	0.249***	(0.089)	0.117
Services	–0.027	(0.025)	0.104	0.150**	(0.075)	0.134
Other sectors	0.096*	(0.055)	0.132	0.107	(0.070)	0.128
Workplace size	–0.006	(0.004)	4.007	–0.015***	(0.006)	4.043
Employment up	0.048*	(0.028)	0.187	0.069*	(0.039)	0.159
Employment down	0.037	(0.024)	0.271	0.016	(0.024)	0.363
Predicted share (%)		4.4			8.6	
Actual share (%)		7.2			12.7	
Pseudo R^2		0.139			0.140	
Observations		733			725	

Note: Regional variables are also included in the regressions, but the results are not reported. The omitted sectoral variable is *Public*.
***, **, * denote that the coefficient estimate is different from 0 at the 1, 5 and 10 percent level of significance, respectively.

Older respondents in Lithuania receive unreported employment income less frequently than younger ones, although the marginal effect is relatively small.[8] Self-employed respondents apparently had a lower propensity — or willingness — to engage in unreported employment in 2002, but this result should be interpreted with care. An individual can only receive envelope wages when employed by an employer, so the negative coefficient must stem from individuals who, in addition to being self-employed, are employed elsewhere.

Only a few of the sectoral variables are statistically significant for 1998. It is also remarkable that respondents working in agriculture do not appear

[8]The evasion probability is 4 percent lower for a 60-year-old respondent than for a 25-year-old respondent in 1998, and 7 percent lower in 2002.

to receive unreported wage income more frequently than those employed in the public sector. Respondents working in larger workplaces seem to evade labour income taxation less frequently, at least in 2002, whereas respondents working in expansion firms evade more frequently (although the effect is only marginally significant).

In general, the results in Tables 3–5 indicate that the marginal effects of different explanatory variables on the probability of tax evasion among the employed are relatively similar across the two sampling years. This is particularly evident when the standard errors of the estimated marginal effects are taken into account. Considering the point estimates, the main differences relate to ethnicity, education and occupational position in the case of Estonia; a second job, the occupational position and some sectoral variables in the case of Latvia, and to the sectoral variables in the case of Lithuania. The relative constancy of the effects of different explanatory variables is noticeable, given the large changes in the unconditional evasion rates and the substantial structural changes taking place in the Baltic States during the period from 1998 to 2002, cf. Sections 1–2.

4.2. Comparison of the Baltic States

Given the relative constancy of the marginal effects across the two sample years, we have merged the 1998 and 2002 samples for each country in order to facilitate a comparison of the determinants of unreported employment across the three Baltic States. The results are shown in Table 6. The dummy variable *Year02* controls for additive heterogeneity across the two sampling years.

As regards the personal characteristics, there are noticeable differences in the marginal effects across the three countries. Male respondents are more prone than women to evade wage income taxation in Latvia, whereas this is not the case in the other two countries. The prevalence of unreported employment is a decreasing function in the respondent's age in Latvia and (less pronounced) Lithuania, but not in Estonia. The ethnicity of the respondent does not appear to be of importance, and the same applies to the education level. Respondents with a second job have a larger probability of receiving unreported wage income, although this effect is only statistically significant for Estonia and Latvia. The self-employed have a lower probability of evasion, but this effect is only statistically significant for Lithuania. Respondents on the lower steps of the corporate hierarchy are more likely to receive unreported wage income than those holding higher positions in the hierarchy.

As regards the firm characteristics, respondents employed in the public sector receive unreported wage income less frequently than respondents em-

Table 6: Determinants of unreported employment in the Baltic States, binary logit estimation, 1998 and 2002 merged

	Estonia		Latvia		Lithuania	
	Marg. eff.	**R.S.E.**	**Marg. eff.**	**R.S.E.**	**Marg. eff.**	**R.S.E.**
Male	0.018	0.017	0.081***	0.021	0.007	0.013
Age	–0.036	0.069	–0.473***	0.082	–0.167***	0.056
Titular ethnicity	–0.027	0.019	–0.011	0.020	0.022	0.016
Education	0.012*	0.007	0.013	0.009	0.002	0.006
Second job	0.101***	0.032	0.094***	0.031	0.032	0.023
Self-employed	–0.034	0.031	–0.015	0.044	–0.037**	0.015
Occupational position	0.015***	0.006	0.023***	0.007	0.009*	0.005
Agriculture	0.204***	0.076	0.211***	0.075	0.062	0.051
Manufacturing	0.074	0.057	0.168***	0.058	0.117***	0.045
Construction	0.407***	0.084	0.316***	0.081	0.206***	0.075
Trade	0.209***	0.060	0.181***	0.055	0.231***	0.058
Services	0.191***	0.062	0.131**	0.052	0.076*	0.043
Other sectors	0.165***	0.054	0.109**	0.055	0.117**	0.047
Workplace size	–0.023***	0.005	–0.034***	0.006	–0.010***	0.003
Employment up	0.075***	0.027	0.097***	0.031	0.055**	0.024
Employment down	–0.014	0.019	0.034	0.026	0.025	0.017
Year02	–0.079***	0.016	0.081***	0.019	0.044***	0.012
Predicted share (%)	10.6		15.1		6.8	
Actual share (%)	14.8		19.9		10.0	
Pseudo R^2	0.143		0.148		0.128	
Observations	1468		1459		1458	

Note: Regional variables are also included in the regressions, but the results are not reported. The omitted sectoral variable is *Public*.
***, **, * denote that the coefficient estimate is different from 0 at the 1, 5 and 10 percent level of significance, respectively.

ployed in other sectors. There are also other interesting findings. The estimated coefficient for the agricultural sector is not statistically significant for Lithuania, although, *a priori*, one would expect farmers in Lithuania to have the same incentives and possibilities to evade taxation as their counterparts in Estonia and Latvia. The coefficient to the manufacturing sector dummy is not statistically significant for Estonia, but significant for Latvia and Lithuania. A possible explanation for this finding is that the manufacturing sector is dominated by foreign owners in Estonia, whereas the sector has substantial domestic ownership in Latvia and Lithuania.

It holds for all three Baltic States that unreported employment is more common among individuals working in small firms than among individuals in larger firms. This likely captures the fact that smaller firms generally have less formalised management, contract and accounting procedures generally are less formalised in smaller firms than in larger firms. Another result that

applies to all three countries is that a respondent working in a firm, where the number of employees has increased in the previous year, is more likely to receive unreported wage income. This would suggest that expanding firms meet part of their personnel requirements through unreported employment of existing and/or new employees.[9]

The dummy for 2002 is highly significant for all three countries, but it is negative for Estonia and positive for Latvia and Lithuania. The different signs mean that it is unlikely that a common external factor has affected the extent of unreported employment during the period from 1998 to 2002.

Overall, the estimations in Table 6 reveal several interesting results. The marginal effects related to the *individual characteristics* of the respondents varies across the three countries, the exception being that in all three countries manual workers and clerks are more likely to receive envelope wages than specialists and managers. The marginal effects are, however, relatively similar across the *employer-related variables* used in the regressions. The sectoral association of respondents is very important for the probability of an individual receiving unreported wage income. Although the signs and statistical significance of the marginal effects to the sectoral variables are generally similar across the three countries, the size of the marginal effects varies greatly, with the exception that the marginal effects of the workplace size and the past employment trend are of the same magnitude across the three countries.

The results in Table 6 constitute the main findings of this paper. In the following we will therefore discuss the interpretation of the statistical results in more detail and provide analyses to examine the robustness and limitations of the results. The first issue regards the possibility of reverse causality. Clearly, variables like *Male, Age* and *Titular ethnicity* are unequivocally exogenous. Other variables may, however, depend on whether or not the individual seek to avoid paying taxes by taking up unreported employment. This applies in particular to *Second job*, but also variables like *Education, Occupational position, Workplace size, Employment up, Employment down* and the sector of employment. For instance, an individual wishing to evade labour income taxation may seek work in a small, but growing firm in the construction sector. Given the limited data availability, it is impossible to address the issue of reverse causality directly. Still, the possibility of reverse causality might be relatively unimportant. For most individuals the decision on education is taken relatively early in life and probably with little consideration to future possibilities of tax evasion. The choice of education will subsequently have an important effect on the employment and career possibilities of the individual.

[9] Another possibility is reverse causality, implying that firms that pay envelope wages to many of their employees are thriving and therefore expand their employment.

Another issue concerning the interpretation of the marginal effects is the possibility that omitted variables are correlated with the explanatory variables, so that the estimated coefficients to the explanatory variables "pick up" the impact of omitted variables. Possible candidates for such omitted variables include the values and social norms of the individual, the unemployment situation and the availability of formal sector employment. These variables may affect both the tax morale *and* the education and workplace decisions of the individual. We have sought to reduce the risk of such omitted variable biases by including sectoral dummies. We have also undertaken some experimentation with additional variables, but they have in all cases been insignificant and have not affected the results in a discernable way. A Link-test (not shown) does not point to an omitted variables bias, but the power of the test is limited.

Turning now to the robustness checks, the first issue to be addressed is whether it is admissible to merge the respondents receiving envelope wages occasionally and those receive envelope wages regularly into one group. In principle, different factors could lie behind each of the two options. For instance, regular tax evaders might, to a large extent, rely on income from unreported employment, whereas this need not necessarily be the case with respondents undertaking occasional unreported employment. Moreover, occasional tax evaders might simply refrain from reporting their income due to the bureaucracy of doing so, whereas this consideration might be of limited importance for the regular tax evaders.

Table 7 shows the results for each of the three countries when multinominal logit regressions are employed, i.e. occasional unreported employment and regular unreported employment have been treated as separate events. Standard errors have been omitted to avoid cluttering of the table.

The results are relatively difficult to interpret. As expected, the sum of the marginal effects for occasional and regular evasion in Table 7 is, in all cases, essentially equal to the corresponding marginal effect in Table 6. In most cases, the marginal effects for occasional and regular evasion take the same sign; in many cases, the marginal effects are also of the same magnitude, especially for the firm-related variables. It is noticeable that the variable *occupational position* primarily affects the prevalence of regular evasion in all three countries, whereas its effect on occasional evasion is statistically insignificant.

Another interesting result is that for Estonia and Lithuania, the dummy variable *employment up* primarily affects the propensity to engage in occasional evasion of wage income taxation, whereas the effect on regular evasion is statistically insignificant. This may suggest that expanding firms ask their (long-time or newly hired) employees to work overtime work and be paid partly in the form of envelope wages.

Table 7: Determinants of occasional and regular unreported employment in Estonia, Latvia and Lithuania, multinominal logit estimation, 1998 and 2002 merged

	Estonia		Latvia		Lithuania	
	Occasional	**Regular**	**Occasional**	**Regular**	**Occasional**	**Regular**
Male	0.030**	–0.010	0.045***	0.030**	0.013	–0.005
Age	–0.013	–0.020	–0.193***	–0.252***	–0.0011**	–0.0005*
Titular ethnicity	0.002	–0.032**	–0.016	0.001	0.020**	0.0002
Education	0.004	0.007*	0.009	0.004	0.0003	0.001
Second job	0.052**	0.049**	0.020	0.069***	0.011	0.017
Self-employed	–0.029	–0.000	–0.055***	0.041	–0.016	–0.018**
Occupational position	0.007	0.008**	–0.002	0.021***	0.0018	0.006**
Agriculture	0.097*	0.096	0.049	0.167**	0.015	0.058
Manufacturing	0.030	0.053	0.058	0.121**	0.030	0.102**
Construction	0.255***	0.135*	0.116*	0.225**	0.060	0.174*
Trade	0.156***	0.052	0.085**	0.102**	0.073**	0.181**
Services	0.165***	0.027	0.002	0.147**	0.026	0.055
Other sectors	0.081*	0.075**	0.037	0.081	0.024	0.115*
Workplace size	–0.013***	–0.009***	–0.015***	–0.017***	–0.006**	–0.004*
Employment up	0.052**	0.020	0.047**	0.047**	0.047**	0.007
Employment down	0.002	–0.016	0.023	0.009	0.022*	0.002
Year02	–0.030	–0.047***	0.026*	0.047***	0.033***	0.009
Predicted share (%)	6.0	4.0	7.4	6.8	3.7	2.5
Actual share (%)	8.5	6.3	9.0	10.9	5.6	4.3
Pseudo R^2	0.131		0.135		0.123	
Observations	1468		1459		1458	

Note: Regional variables are also included in the regressions, but the results are not reported. The omitted sectoral variable is *Public*.
***, **, * denote that the coefficient estimate is different from 0 at the 1, 5 and 10 percent level of significance, respectively.

Given that the separate treatment of occasional and regular tax evaders did not change the results much, we could raise the question whether one could attain more efficient results (smaller estimated standard errors) if the dependent variable was retained as an ordered variable. The dependent variable *unreported employment* would then take the values 0, 1 or 2, and the explanatory variables would be expected to affect the dependent variable monotonously.

Tables A.1 and A.2 in Appendix A show the results of using ordered logit regressions. The results are generally very similar to those of the binary logit model. The standard errors are essentially unchanged and no additional variables become significant when the ordered logit model is used. We therefore conclude that there are no discernable efficiency gains from estimating an ordered logit model instead of a binary one.

The last robustness check relates to the use of the ordered variables *occupational position* and *education* as explanatory variables. The implicit assumption is that there is a linear relationship between the ordered variable and the explanatory variable, i.e. unreported employment. (The ordered explanatory variables were used to increase the number of degrees of freedom and to make it easier to present the results.) To examine whether the use of ordered explanatory variables is reasonable, we split the two variables, *occupational position* and *education*, into a number of dummy variables and then repeated the estimations in Table 6 with the dummy variables instead of the original ordered variables. The results are shown in Table B.1 in Appendix B. It follows that there is a broadly linear relationship between the variable and the prevalence of unreported employment in the case of both the *occupational position* and *education*.[10] In other words, the use of ordered variables does not affect our results in any substantial way.

4.3. Explaining divergent developments in unreported employment

Table 2 showed that unreported wage income changes substantially across the two time periods analysed. Therefore, it is interesting to examine the extent to which these changes can be explained by changes in the economy (or the way the economy affects the prevalence of evasion) and to which extent other factors are of importance. In light of the substantial uncertainty concerning the determination of unreported employment, we address this issue keeping the analysis very simple.

In terms of the econometric analysis presented in Table 6, the question is to which extent changes in the frequency of unreported employment from 1998 to 2002 can be explained by changes in the explanatory variables and to which extent the changes are "picked up" by the dummy *Year02*. The results are shown in Table 8. The unconditional rates of unreported employment differ across Tables 2 and 8, because some respondents were excluded from the regression analyses in Table 8 due to missing observations.

In the case of Estonia, the unconditional evasion rate dropped by 8.9 percentage points from 1998 to 2002. Around 1 percentage point of this drop can be attributed to changes in the explanatory variables, while the rest is picked up by the dummy variable for 2002.[11] Latvia saw a 9 percentage point

[10] A joint Wald test cannot reject the hypothesis that the constraints implied by the use of *occupational position* and *education* instead of the dummies are valid.

[11] The estimations in Table 6 assume constant coefficients across the two sample years. Therefore, it is not possible to isolate the effect on the prevalence of evasion of changes in the coefficients to the explanatory variables across the two years analysed.

Table 8: Unreported employment: rates, changes and unexplained parts, % of sample populations, 1998 and 2002

	Estonia	Latvia	Lithuania
Unconditional rate of unreported employment, 1998	19.1	15.5	7.2
Unconditional rate of unreported employment, 2002	11.2	24.5	12.7
Change in unconditional rate of unreported employment, 1998-2002	–8.9	9.0	5.7
– Unexplained part (constants from Table 6)	–7.9	8.1	4.4
– Explained part	–1.0	0.9	1.3

Source: WLB (1998, 2002), own calculations.

increase in the rate of unreported employment and again, changes in explanatory variables explain around 1 percentage point of the increase. In the case of Lithuania, the unconditional rate of unreported employment increased by almost 6 percentage points from 1998 to 2002, and the explained part is 1.3 percentage points.

All in all, the changes in the evasion rate from 1998 to 2002 are very large in all three Baltic States. The model presented in Table 6 can explain 10–30 percent of the changes in the evasion rates by changes in the explanatory variables, while the rest must be attributed to other factors. These results should be seen in light of logit models generally having relatively weak fit to data. In this case, the pseudo R^2 is below 0.15 for all three countries. This suggests that changes in, for instance, sectoral composition, firm size and employment developments can be used to predict the developments of the prevalence of tax evasion in society. Meanwhile, many factors beyond the narrow set of individual and employer background variables play an important role in shaping evasion trends.

5. Estimates of income from unreported employment

Table 2 in Section 2 showed the unconditional frequency or *prevalence* of unreported employment in the Baltic States according to the WLB dataset. The previous section considered the importance of different individual and employment characteristics for the *prevalence* of unreported employment. The analyses, however, did not provide information on the amount of envelope wages paid for unreported employment.

The WLB dataset does not contain information on the amount of wage income left unreported by a respondent undertaking unreported employment, either occasionally or regularly. Therefore, the only way to get an idea of the

economic importance of unreported employment is to compute an estimate based on the answers to question no. 49 in the WLB: "What was your net salary in the last month?". In principle, the answer should contain the net income from all jobs held, including income from unreported employment. The idea is to compare the income of respondents who occasionally or regularly receive envelope wages with that of respondents stating never to receive envelope wages, taking into account any heterogeneity across the groups.

The methodology is related to the one used by Pissarides and Weber (1989) who produce estimates of the "true" income of the self-employed in the UK based on reported income and consumption from household budget surveys. The underlying assumption is that the self-employed are particularly likely to underreport their income, but less so their consumption. Pissarides and Weber (1989) estimate the spending on food consumption as a share of reported income for the *employees* and then use this regression and the consumption stated by the self-employed to estimate the income of the latter group. The conclusion is that the predicted income of the self-employed is substantially higher than the income they report in the household budget surveys.

We estimate a standard Mincer wage regression for each of the two years, 1998 and 2002, based on a sub-sample comprising only the individuals *without* unreported employment. The predicted net wage income from this equation, given various personal (and employer) characteristics, is then a proxy for the after-tax wage earnings potential if the individual has reported only registered employment. For those engaged in unreported employment, we compare the actual net wage income with the predicted net wage income if they had not been engaged in unreported employment. In this way we get a measure of the gain (or loss) of an individual who undertakes unreported employment instead of only registered employment — conditional on various individual and employer characteristics.

We estimate two different versions of the Mincer wage regressions — one with and one without the main employer characteristics. In the first version of the wage regression for individuals without unreported employment, *log net wage income* is explained only by the personal characteristics of the respondent, i.e. *male, age, titular ethnicity, education* and *second job*. The wage regressions for 1998 and 2002, respectively, are reported in Tables C.1–C.2 in Appendix C. The estimated wage regressions are used to predict the *log net wage income* of individuals with occasional and regularly unreported employment, respectively. The percentage differences between the mean income of individuals with and without unreported employment are shown in Table 9 for each of the two years, 1998 and 2002.

A number of results follow from Table 9. First, the difference between the

reported net income of individuals with and without unreported employment is modest; the gain from unreported employment ranges from –6 percent to 12 percent of the mean income of individuals without unreported employment. These modest gains may be surprising in light of the relatively high tax rates in the Baltic States. The finding may be an artefact of the data collection of the WLB survey, where respondents stating to receive envelope wages do not truthfully reveal their total net income from all sources of employment. Alternatively, however, the finding may reflect reality, revealing that the "surplus" from not paying taxes does not to a large extent benefit the employees receiving envelope wages.

Table 9: Net wage income gain from unreported employment, percent of mean income of individuals without unreported employment. Predicted income based on characteristics of individuals, 1998 and 2002

		Estonia	Latvia	Lithuania
1998	Occasional unreported employment	9.1	11.6	5.6
	Regular unreported employment	–0.3	8.6	5.1
2002	Occasional unreported employment	5.6	6.8	–0.8
	Regular unreported employment	0.3	5.8	–5.6

Source: WLB (1998, 2002), own calculations.

The result that employees gain little in monetary terms from unreported employment is consistent with surveys showing that employees are often displeased with receiving envelope wages. In a survey undertaken in Estonia in 2004, a total of 45 percent of the respondents receiving envelope wages were not pleased with the situation; 55 percent of them said that they would lose their job if they did not accept to receive all or part of their income as envelope wages (EKI, 2005).

Second, the difference between the income of individuals with and without unreported employment has decreased over time in all three countries. This may reflect weakened earning potential in unreported employment, but it could also stem from a selection bias, if individuals with the highest wage income potential have moved from unregistered to registered employment along the process of transition.

Third, among the evasion categories, the income gain from tax evasion is largest for individuals who receive envelope wages occasionally, and this holds for all three countries and in both time periods. According to Table 8, those engaged in occasional tax evasion have even higher wage potential than non-evaders.

Table 9 is based on a Mincer regression in which only the individual characteristics of the respondent have been entered. As a robustness check we

have also estimated the regression using the characteristics of the individual *and* the current main employment as explanatory variables. In other words, the explanatory variables in the Mincer regression comprise all the explanatory variables from the models in Section 4. The results of the net log wage income regressions with the large set of explanatory variables are shown in Tables C.3–C.4 in Appendix C.

Table 10 shows the gain to the individual from unreported employment, based on the extended Mincer regressions including both the individual and employer-related variables. The main conclusions remain unchanged. The gain for individuals engaged in unreported employment is modest (in fact, often negative if the results are taken literally). The gain is somewhat bigger for individuals engaged in occasional unreported employment (compared to those in regular unreported employment). The gain from unreported employment is smaller in 2002 than in 1998.

The results in Tables 9 and 10 should be interpreted with great caution. First of all, the results rely on self-reported net of tax wage income in the WLB surveys, and it is debatable whether such information is provided with any degree of precision. Second, the computation methodology is relatively complex with several possible sources of inaccuracy. Third, no standard errors or confidence intervals are reported, but they are bound to be very large given the complex computation methodology.

Table 10: Net wage income gain from unreported employment, percentage of mean income of individuals without unreported employment. Predicted income based on characteristics of individuals and main employers, 1998 and 2002

		Estonia	Latvia	Lithuania
1998	Occasional unreported employment	11.9	17.2	10.5
	Regular unreported employment	–0.1	5.4	–7.0
2002	Occasional unreported employment	–6.1	3.3	–5.4
	Regular unreported employment	–10.8	–2.4	–10.7

Source: WLB (1998, 2002), own calculations.

6. Summary

This paper has compared the prevalence and causes of unreported employment in the three Baltic States in 1998 and 2002. This was facilitated by the use of the hitherto little used WLB dataset, which is based on a uniform survey methodology across the three Baltic States. The main advantage of the WLB dataset is that it allows comparisons across time as well as the three Baltic

States, whereas the main drawback is the absence of information on a host of potentially important variables.

The prevalence of both occasional and regular unreported employment varies substantially across the three countries as well as the two sampling years. Estonia saw a marked drop in the prevalence of unreported employment from 1998 to 2002, while the opposite was the case for Latvia and Lithuania.

Microeconometric estimations seeking to "explain" the prevalence of unreported employment showed that firm-related characteristics, like sector, firm size and employment growth, are important factors in all three countries. The importance of personal factors, on the other hand, varies markedly across countries and time, and these factors are clearly of secondary importance. This suggests that the decision not to report wages to the authorities largely stems from the employers, while the employees have little influence on the decision, irrespective of personal characteristics such as gender, age and education. There are relatively minor differences between the factors explaining, respectively, occasional and regular unreported employment, especially for the firm-related variables.

We also sought to assess to which extent the changes in the frequency of the unreported employment from 1998 to 2002 could be accounted for by changes in explanatory factors, such as industry structure, firm size and individual characteristics. The results showed that only 10 to 30 percent of the changes could be explained by these factors; the rest must be attributed to other factors.

Tentative calculations suggest that the net gain for individuals undertaking unreported employment is modest, in particular for those who regularly engage in such activities. Individuals receiving envelope wages are not significantly better off than law-abiding persons.

The results of this paper may be used for devising tax policies, tax administration and auditing procedures. Improved knowledge of tax evasion and unreported employment may allow more "targeted" policies aiming to restrain tax evasion where such a policy will have a positive effect on social welfare. The results should, however, be treated with caution, as they are subject to substantial uncertainty — partly because tax evasion, *sui generis*, is difficult to measure and partly because the dataset lacks potentially important variables. Hopefully, new detailed surveys will be undertaken in the Baltic States, which will directly address the structure of unreported activities and the private gains attained. More specific and comprehensive surveys would provide a more detailed picture of the nature of tax evasion and unreported employment.

References

Alm, J., Torgler, B., 2006. Culture Differences and Tax Morale in the United States and in Europe. Journal of Economic Psychology, Vol. 27, No. 2:224–246.

Andreoni, J., Erard, B., Feinstein, J.S., 1998. Tax Compliance. Journal of Economic Literature, Vol. 36, No. 2:818–860.

Antila, J., Ylostalo, P., 1999. Working Life Barometer in the Baltic States 1999. Labour Policy Studies, No. 214, Ministry of Labour, Helsinki, Finland.

Antila, J., Ylostalo, P., 2003. Working Life Barometer in the Baltic States 2002. Labour Policy Studies, No. 247, Ministry of Labour, Helsinki, Finland.

Cowell, F., 1990. Cheating the Government: The Economics of Evasion. Cambridge, M.A.: MIT Press.

Cramer, J. S., 1999. Predictive Performance of the Binary Logit Model in Unbalanced Samples. The Statistician, Vol. 48, No. 1:85–94.

Danopoulos, C., Znidaric, B., 2007. Informal Economy, Tax Evasion, and Poverty in a Democratic Setting: Greece. Mediterranean Quarterly, Vol. 18, No. 2:67–84.

EKI, 2005. Varimajandus Eestis [The Estonian Shadow Economy]. Estonian Institute of Economic Research, http://www.ki.ee/publikatsioonid/valmis/Varimajandus_Eestis_2004(elanike_hinnangute_alusel).pdf.

Eurostat, 2007. Taxation Trends in the European Union. Data for the EU Member States and Norway. Eurostat Statistical books, European Commission, http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-DU-07-001/EN/KS-DU-07-001-EN.PDF.

Eurostat, 2008. Electronic database, http://ec.europa.eu/eurostat. (Data → Government statistics → Annual government finance statistics → Derived tax indicators → Structure of taxes by economic function → Taxes on Labour – Total (variable tx_lab_tot)).

Kim, B.-Y., 2005. Poverty and Informal Economy Participation. Evidence from Romania. Economics of Transition, Vol. 13, No. 1:163–185.

Kriz, K., Merikull, J., Paulus, A., Staehr, K., 2008. Why Do Individuals Evade Payroll and Income Taxation in Estonia?. In Pickhardt, M., Shinnick, E. (eds.). Shadow Economy, Corruption and Governance. Edward Elgar Publishing, Cheltenham.

Murphy, K., Higgins, M., 2004. Concepts in Federal Taxation 2004. Thomson South-Western. 11th ed.

OECD, 2000. Baltic States. A Regional Economic Assessment. OECD Economic Surveys, Organisation for Economic Co-operation and Development.

Pissarides, C., Weber, G., 1989. An Expenditure-Based Estimate of Britain's Black Economy. Journal of Public Economics, Vol. 39, No. 1:17–32.

Renoy, P., Ivarsson, S., van der Wusten-Gritsai, O., Meijer, E., 2004. Undeclared Work in an Enlarged Union. An Analysis of Undeclared Work: An In-Depth Study of Specific Items. European Commission, Directorate-General for Employment and Social Affairs, http://europa.eu.int/comm/employment_social/employment_analysis/work/undecl_work_final_en.pdf.

Schneider, F., Enste, D.H., 2000. Shadow Economies: Size, Causes and Consequences. Journal of Economic Literature, Vol. 38, No. 1:77–114.

Schneider, F., 2002. The Size and Development of the Shadow Economies of 22 Transition and 21 OECD Countries. IZA Discussion Paper, No. 514.

Schneider, F., 2007. The Size of the Shadow Economies of 145 Countries all over the World: First Results over the Period 1999 to 2003. Journal of Population Economics, Vol. 20, No. 3:495–526.

WLB, 1998. Working Life Barometer dataset for 1998.

WLB, 2002. Working Life Barometer dataset for 2002.

World Values Survey, 1999. http://www.worldvaluessurvey.org/ (Online Data Analysis → 1999–2004 → Estonia [1999], Latvia [1999], Lithuania [1999] → 7. Religion and morale → Justification of social behaviours → Cheating on taxes (F116)).

Appendix A.

Table A.1: Determinants of unreported employment in the Baltic States, ordered logit, occasional evasion, *Unreported employment* = 1, 1998 and 2002 merged

	Estonia		Latvia		Lithuania	
	Marg. eff.	**R.S.E.**	**Marg. eff.**	**R.S.E.**	**Marg. eff.**	**R.S.E.**
Male	0.009	0.010	0.038***	0.010	0.004	0.007
Age	–0.024	0.040	–0.231***	0.042	–0.095**	0.033
Titular ethnicity	–0.017	0.011	–0.005	0.009	0.008	0.010
Education	0.008*	0.004	0.006	0.004	0.002	0.003
Second job	0.061***	0.018	0.046***	0.014	0.019	0.012
Self-employed	0.005	0.018	–0.002	0.024	–0.021***	0.008
Occupational position	0.010***	0.003	0.013***	0.003	0.006**	0.003
Agriculture	0.108***	0.036	0.088***	0.025	0.023	0.024
Manufacturing	0.047	0.032	0.074***	0.022	0.059***	0.023
Construction	0.177***	0.028	0.112***	0.020	0.106***	0.036
Trade	0.111***	0.030	0.072***	0.021	0.105***	0.026
Services	0.099***	0.031	0.063***	0.021	0.038*	0.021
Other sectors	0.093***	0.028	0.047**	0.023	0.053**	0.022
Workplace size	–0.013***	0.003	–0.017***	0.003	–0.005***	0.002
Employment up	0.040***	0.015	0.042***	0.013	0.030**	0.013
Employment down	–0.010	0.011	0.015	0.012	0.012	0.009
Year02	–0.054***	0.018	0.038***	0.009	0.021***	0.007
Predicted share (%)	6.6		7.8		3.6	
Actual share (%)	8.5		9.0		5.6	
Pseudo R^2	0.115		0.122		0.130	
Observations	1468		1459		1458	

Note: Regional variables are also included in the regressions, but the results are not reported. The omitted sectoral variable is *Public*.
***, **, * denote that the coefficient estimate is different from 0 at the 1, 5 and 10 percent level of significance, respectively.

Table A.2: Determinants of unreported employment in the Baltic States, ordered logit, regular evasion, *Unreported employment* = 2, 1998 and 2002 merged

	Estonia		Latvia		Lithuania	
	Marg. eff.	**R.S.E.**	**Marg. eff.**	**R.S.E.**	**Marg. eff.**	**R.S.E.**
Male	0.006	0.007	0.043***	0.011	0.003	0.005
Age	–0.016	0.028	–0.256***	0.043	–0.068**	0.023
Titular ethnicity	–0.012	0.008	–0.005	0.010	0.006	0.007
Education	0.005*	0.003	0.007	0.005	0.001	0.002
Second job	0.047***	0.015	0.057***	0.018	0.013	0.009
Self-employed	0.004	0.012	–0.002	0.027	–0.014***	0.005
Occupational position	0.007***	0.002	0.014***	0.004	0.004**	0.002
Agriculture	0.094**	0.041	0.131**	0.052	0.016	0.018
Manufacturing	0.035	0.026	0.098***	0.036	0.044**	0.020
Construction	0.210***	0.061	0.197***	0.059	0.091**	0.041
Trade	0.094***	0.031	0.095***	0.033	0.088***	0.030
Services	0.082***	0.030	0.081**	0.032	0.028	0.017
Other sectors	0.075***	0.027	0.059*	0.032	0.039**	0.020
Workplace size	–0.009***	0.002	–0.018***	0.003	–0.004***	0.001
Employment up	0.029**	0.012	0.051***	0.017	0.021**	0.009
Employment down	–0.006	0.008	0.017	0.014	0.009	0.006
Year02	–0.037***	0.013	0.043***	0.010	0.014***	0.005
Predicted share (%)	4.0		7.2		2.3	
Actual share (%)	6.3		10.9		4.3	
Pseudo R^2	0.115		0.122		0.130	
Observations	1468		1459		1458	

Note: Regional variables are also included in the regressions, but the results are not reported. The omitted sectoral variable is *Public*.
***, **, * denote that the coefficient estimate is different from 0 at the 1, 5 and 10 percent level of significance, respectively.

Appendix B.

Table B.1: Determinants of unreported employment, Baltic States compared, 1998 and 2002, occupation and education variables split

	Estonia		Latvia		Lithuania	
	Marg. eff.	**R.S.E.**	**Marg. eff.**	**R.S.E.**	**Marg. eff.**	**R.S.E.**
Male	0.032*	0.018	0.086***	0.022	0.007	0.013
Age	–0.025	0.070	–0.472***	0.084	–0.166***	0.056
Titular ethnicity	–0.026	0.019	–0.011	0.019	0.022	0.016
Primary education	–0.019	0.045	–0.039	0.067	–0.001	0.073
Incomplete secondary or professional education	–0.031	0.040	0.017	0.091	0.013	0.081
Technical secondary education	0.019	0.047	–0.005	0.077	0.003	0.071
General secondary education	0.014	0.049	–0.027	0.072	0.010	0.076
Tertiary education	0.037	0.056	0.045	0.086	0.008	0.075
Second job	0.098***	0.032	0.091***	0.032	0.031	0.022
Self-employed	–0.030	0.032	–0.010	0.045	–0.035**	0.015
Manager	–0.061***	0.019	–0.082***	0.023	–0.034**	0.017
Specialist	–0.038**	0.019	–0.073***	0.025	–0.021	0.016
Clerk	0.027	0.035	0.023	0.036	–0.006	0.019
Manual worker	0.011	0.027	–0.023	0.029	–0.016	0.016
Agriculture	0.205***	0.076	0.219***	0.076	0.061	0.052
Manufacturing	0.078	0.057	0.178***	0.060	0.120**	0.047
Construction	0.399***	0.084	0.318***	0.081	0.208***	0.076
Trade	0.188***	0.060	0.191***	0.059	0.246***	0.061
Services	0.176***	0.060	0.131**	0.052	0.078*	0.043
Other sectors	0.167***	0.054	0.114**	0.057	0.122**	0.049
Workplace size	–0.023***	0.005	–0.034***	0.006	–0.011***	0.004
Employment up	0.078***	0.028	0.096***	0.031	0.055**	0.024
Employment down	–0.016	0.019	0.036	0.026	0.025	0.016
Year02	–0.079***	0.016	0.075***	0.019	0.044***	0.012
Predicted share (%)	10.4		14.9		6.7	
Actual share (%)	14.8		19.9		10.0	
Pseudo R^2	0.150		0.153		0.130	
Observations	1468		1459		1458	

Note: Regional variables are also included in the regressions, but the results are not reported. The omitted sectoral variable is *Public*.
***, **, * denote that the coefficient estimate is different from 0 at the 1, 5 and 10 percent level of significance, respectively.

Appendix C.

Table C.1: Log net wage income of individuals without unreported employment, only characteristics of individual, 1998

	Estonia		Latvia		Lithuania	
	Marg. eff.	**R.S.E.**	**Marg. eff.**	**R.S.E.**	**Marg. eff.**	**R.S.E.**
Male	0.453***	0.041	0.397***	0.043	0.247***	0.036
Age	–0.100	0.185	–0.312*	0.179	0.052	0.164
Titular ethnicity	0.130***	0.045	0.063	0.044	0.113**	0.053
Education	0.138***	0.015	0.105***	0.017	0.131***	0.015
Second job	0.128**	0.061	0.085	0.057	0.200***	0.070
Constant	6.664***	0.141	3.722***	0.111	5.604***	0.127
R^2	0.247		0.208		0.166	
Observations	687		690		787	

Note: Regional variables are also included in the regressions, but the results are not reported.
***, **, * denote that the coefficient estimate is different from 0 at the 1, 5 and 10 percent level of significance, respectively.

Table C.2: Log net wage income of individuals without unreported employment, only characteristics of individual, 2002

	Estonia		Latvia		Lithuania	
	Marg. eff.	**R.S.E.**	**Marg. eff.**	**R.S.E.**	**Marg. eff.**	**R.S.E.**
Male	0.411***	0.040	0.370***	0.047	0.205***	0.036
Age	–0.205	0.178	–0.747***	0.195	–0.293*	0.166
Titular ethnicity	0.097**	0.048	0.083*	0.048	0.030	0.052
Education	0.114***	0.018	0.181***	0.019	0.171***	0.015
Second job	0.103*	0.060	0.073	0.057	0.119**	0.053
Constant	7.248***	0.146	3.475***	0.133	5.643***	0.111
R^2	0.243		0.304		0.230	
Observations	619		570		679	

Note: Regional variables are also included in the regressions, but the results are not reported.
***, **, * denote that the coefficient estimate is different from 0 at the 1, 5 and 10 percent level of significance, respectively.

Table C.3: Log net wage income of individuals without unreported employment; characteristics of individual and main employer, 1998

	Estonia		Latvia		Lithuania	
	Marg. eff.	**R.S.E.**	**Marg. eff.**	**R.S.E.**	**Marg. eff.**	**R.S.E.**
Male	0.406***	0.044	0.377***	0.044	0.234***	0.043
Age	–0.082	0.197	–0.294	0.182	–0.038	0.182
Titular ethnicity	0.084*	0.046	0.042	0.041	0.101*	0.055
Education	0.075***	0.017	0.046**	0.018	0.067***	0.018
Second job	0.143**	0.057	0.021	0.061	0.200***	0.072
Self-employed	0.259	0.232	0.164	0.169	0.103	0.112
Occupational position	–0.099***	0.016	–0.137***	0.016	–0.113***	0.015
Agriculture	–0.010	0.082	–0.021	0.142	–0.126*	0.065
Manufacturing	0.173**	0.075	0.105*	0.062	0.051	0.058
Construction	0.280**	0.112	0.326***	0.100	0.073	0.091
Trade	0.129	0.082	–0.0004	0.067	–0.004	0.063
Services	0.199***	0.066	0.187***	0.064	0.125*	0.067
Other sectors	0.164**	0.064	–0.058	0.067	0.051	0.068
Workplace size	0.056***	0.013	0.038***	0.011	0.060***	0.011
Employment up	0.196***	0.072	0.166***	0.061	0.074	0.061
Employment down	–0.065	0.044	–0.016	0.046	–0.053	0.043
Constant	7.047***	0.183	4.315***	0.136	6.104***	0.172
R^2	0.346		0.356		0.286	
Observations	597		590		647	

Note: Regional variables are also included in the regressions, but the results are not reported.
***, **, * denote that the coefficient estimate is different from 0 at the 1, 5 and 10 percent level of significance, respectively.

Table C.4: Log net wage income of individuals without unreported employment; characteristics of individual and main employer, 2002

	Estonia		Latvia		Lithuania	
	Marg. eff.	**R.S.E.**	**Marg. eff.**	**R.S.E.**	**Marg. eff.**	**R.S.E.**
Male	0.360***	0.045	0.363***	0.048	0.181***	0.039
Age	–0.340*	0.175	–0.685***	0.192	–0.124	0.167
Titular ethnicity	0.060	0.050	0.056	0.046	0.065	0.054
Education	0.071***	0.019	0.098***	0.021	0.108***	0.017
Second job	0.049	0.062	0.042	0.054	0.100*	0.054
Self-employed	–0.006	0.121	–0.253	0.185	0.109	0.098
Occupational position	–0.123***	0.019	–0.148***	0.018	–0.127***	0.016
Agriculture	0.021	0.098	–0.143	0.096	–0.079	0.092
Manufacturing	0.137*	0.072	0.150**	0.066	0.115**	0.051
Construction	0.100	0.099	0.249	0.183	0.280***	0.084
Trade	–0.009	0.067	0.093	0.076	0.006	0.071
Services	0.092	0.080	0.239***	0.074	0.170***	0.057
Other sectors	–0.048	0.070	0.063	0.066	0.136**	0.065
Workplace size	0.044***	0.013	0.052***	0.014	0.051***	0.012
Employment up	0.031	0.062	0.106	0.067	0.076	0.055
Employment down	0.086*	0.049	0.011	0.053	–0.043	0.041
Constant	7.775***	0.186	4.165***	0.175	6.022***	0.157
R^2	0.360		0.453		0.376	
Observations	558		483		592	

Note: Regional variables are also included in the regressions, but the results are not reported.
***, **, * denote that the coefficient estimate is different from 0 at the 1, 5 and 10 percent level of significance, respectively.

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