



Regular Article

# Unreported Employment and Envelope Wages in Mid-Transition: Comparing Developments and Causes in the Baltic Countries

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This paper compares the prevalence and determinants of unreported employment in the three Baltic countries in 1998 and 2002 using a hitherto little used data set. The prevalence of unreported employment varies substantially across the three countries and across the two sampling years. Microeconomic estimations show that firm-related characteristics, such as sectoral activity, firm size and employment changes, are important determinants of unreported employment in all three countries. The impact of socio-demographic factors, such as gender, age and education, is generally less important and varies across countries and time. Only a small part of the changes in unreported employment between 1998 and 2002 can be accounted for by changes in firm-specific factors and socio-demographic characteristics. Exploratory calculations suggest that the gain for individuals undertaking unreported employment is modest or non-existent, in particular among individuals who engage regularly in such activities. This suggests that the many of the recipients of envelope wages may have few alternatives to accepting unreported employment.

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## INTRODUCTION

This paper discusses unreported employment in Estonia, Latvia and Lithuania based on surveys from 1998 and 2002. The main issues addressed are the extent of unreported employment, its development over the two time periods and factors explaining its prevalence. The study compares data and results across the three Baltic countries and across the two years in the middle of the transition process.

The main data source is the hitherto underutilised Working Life Barometer (WLB), which contains the results of surveys undertaken in each of the Baltic countries in 1998 and 2002. The survey was designed to examine the working and living conditions of people in the Baltic countries, and the survey questions were essentially identical across the three countries and the two sample years. The WLB data set is therefore well suited for comparative studies of labour market behaviour across the three Baltic countries and across the two time periods in which it was administered.

The WLB data set contains data on whether the survey respondent has received 'envelope wages' on a regular basis, occasionally or not at all. Envelope wages denote wage income that is not reported to the authorities and for which social security contributions and income taxes are typically not paid. We will generally equate the receipt of envelope wages and unreported employment as the wage income, and hence the employment generating the income, are both concealed from the authorities.<sup>1</sup>

The motives for leaving wage income and employment unreported are manifold (Schneider and Enste, 2000; Cowell, 1990). First, the main motive is arguably to avoid paying social security contributions and income taxes. Unreported employment and wage income may also allow firms to evade other taxes such as value-added taxes, excise duties and environmental taxes. Second, unreported employment may allow firms to neglect regulation and standards regarding employment protection, occupational health and the environment. Third, in countries where corruption and extraction of rents by government employees are widespread, the firms may choose not to report employment in order to avoid the attention and possible harassment by authorities. Fourth, employment in the informal economy may constitute a 'fall back option' for marginalised groups in society, which have difficulties obtaining employment and/or an appropriate after-tax income in the formal economy (Kim, 2005; Danopoulos and Znidaric 2007; Kriz *et al.*, 2008).

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<sup>1</sup> The WLB data set does not contain data on the reporting of the income from work undertaken on an own-account basis (self-employment).



The Baltic countries were re-established after the break up of the Soviet Union and emerged as some of the transition countries that most rapidly reformed their economies. The transition countries have in common a number of features, which arguably influence the extent and character of unreported employment. Most strikingly, the transition process entailed the rapid emergence of privately owned firms, while the authority of central and local government dwindled and the framework of regulation and enforcement in many cases remained weak. The transition process also increased income inequalities, in part because of higher unemployment, skills mismatches and limited social safety nets.

A number of studies have considered the prevalence and causes of unreported employment and other informal sector activity in the transition countries. To our knowledge, Schneider (2002) is the only study to span the entire region of transition countries. The study reports data from 1998 to 1999 on the share of working-age individuals undertaking work in the informal sector, computed using indirect estimation methodology based on indicators such as unemployment rates, tax rates and measures of cash use in the economy. The share of unreported work ranges from 13% in the Czech Republic to 53% in Georgia. The overall picture is that the prevalence of unreported work is larger in the countries emerging from the former Soviet Union (average 37%) than in Central and Eastern Europe (CEE) (average 23%), which again is higher than in most OCED countries. Studies based on indirect estimation methodologies cannot provide information as to the characteristics of individuals engaging in unreported activities.

Turning to the countries emerging from the collapse of the Soviet Union, Abbott and Wallace (2009) present data from surveys undertaken in 2001 in eight of these countries. They stress that individuals or households in these countries face a whole range of options for coping and managing in the difficult economic circumstances facing the countries as well as most households (see also Smith and Stenning, 2006). The largest informal sectors were found in the least developed countries. Moreover, the elderly and those in the country side relied to a large extent on domestic production of food and other products. Many households attained income from both formal and informal sector activities, but there was also a significant share of households which had no income from the formal sector and these households were often not covered by social services, such as health, maternity leave and pension.

A number of studies have considered the informal economy and workplace practices in Ukraine based on surveys of 700 households and subsequent in-depth interviews undertaken between 2004 and 2006 (Rodgers *et al.*, 2008; Round *et al.*, 2008a, b). One striking feature is that jobs in the formal sector are often attractive in spite of very low salaries and individuals



resort to paying bribes to obtain such jobs; once employed in the formal sector, such employment can be used as a platform for work in the informal sector, for instance by using tools or materials acquired from the workplace.

The situation in CEE reflects a stronger economic development in this region. A number of insightful studies have been based on data from a 2007 Eurobarometer, which used a detailed and uniform survey to measure undeclared work across the EU27 countries (Commission, 2007a). Williams (2008a, 2009a, b) presents data for unreported employment, that is, the receipt of envelope wages, for all EU countries, including the new EU countries from CEE. The share of respondents stating that they have undertaken unreported employment during the last year is 11% for the CEE countries, but only 3% for the 15 'old' EU countries (unweighted averages). Romania had the largest share (23%) and the Czech Republic the lowest share (3%) among the CEE countries.

Besides the individuals having had unreported wage income during the last year, a substantial share also have undertaken paid work on their own account for which the income was not reported to the authorities. The share in the CEE countries was on average 18% of the respondents, that is, 7%-points higher than the share of respondents not reporting wage income (Williams, 2009d). The ranking of the countries based on the prevalence of unreported work is largely as the ranking based on unreported employment.

A recurrent theme is the complementarity of formal and informal employment in many CEE countries, where employees in many cases have both reported and unreported wage income from the same employer (Williams, 2009a, c). It is frequently found that the labour income reported to the authorities is at or just above the minimum required for the employee to retain health, unemployment and pension benefits. The reporting of some income makes it harder for the tax authorities to detect and prove that the labour income taxation is evaded through, for example, workplace inspections (OECD, 2008). Williams uses the term *underreported* wages to denote the unreported part of the total wages from an employer in the case where both reported and unreported wages are paid. Such kind of employment is not strictly in the informal sector, but can be seen as a hybrid case. The upshot is that it is not dichotomy between the formal and informal sectors of an economy, but rather a spectrum of degrees of formalisation (Williams, 2008b, 2009c; Smith and Stenning, 2006).<sup>2</sup>

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<sup>2</sup> OECD (2008) draws together information from a number of sources on informal employment in Poland, the Czech Republic, Slovakia and Hungary. In the Czech Republic, Slovakia and Hungary relatively few individuals are completely without formal income, while this is not the case in Poland.



Turning to the Baltic region, Williams (2009e) provides information on the prevalence of envelope wages across the three Baltic countries and Poland, again drawing on the 2007 Eurobarometer. The finding is that 7% of respondents in Estonia, 11% in Latvia and 17% in Lithuania state that they have received envelope wages within the last year. This prevalence of unreported wage income is in line with the finding for Poland (11%) but substantially above the EU27 average (5%). In the majority of cases, envelope wages have been paid for overtime work or both overtime and regular work. Williams (2009a, b, c, d, e) finds, when all four countries are aggregated, that envelope wages are most frequently paid in small firms and in the construction and service sectors. Receipt of envelope wages is more likely among men, the young, those with short education, low wages and short working hours. The overall picture may be that envelope wages are a means of supplementing income for those who might otherwise be relative disadvantaged and who can find work in sectors where such an income source is readily available.

To our knowledge there are no studies comparing unreported employment across the Baltic countries prior to 2007, although individual country studies do exist. Kriz *et al.* (2008) report data from a survey in Estonia in which 14% of the respondents declared that they received envelope wage either regularly or occasionally in 2004. The study found that people working in construction, services and agriculture and also those in small companies engaged most frequently in unreported employment. Interestingly, the elderly appeared to have a high frequency of unreported employment.

Sedlenieks' (2003) study is based on in-depth interviews with 25 persons in Riga in 2000. It is argued that corrupt practices and informal employment to some extent have been carried over from the Soviet period, where informal practices were required to obtain many products and to have homes, cars, white goods, etc maintained or repaired. The interviewed persons also expressed lack of trust in government institutions and their ability to spend for the common good and this was used as a justification of the receipt of envelope wages.

The 2007 Eurobarometer has opened for research which already has brought about important new insights by allowing cross-country comparison of unreported employment in the EU, including the new EU countries from CEE. There are, however, very few comparative studies of unreported employment and evasion of labour income taxation from the early stages of the transition process, in large part because of a lack of adequate data. This paper seeks to address this issue, by using the WLB data set to compare unreported employment and explore its determinants in the Baltic countries across two years during the mid-transition phase, that is, 1998 and 2002.

The paper contributes to the literature in four main areas. First, the paper provides new and comparable data on the (unconditional) prevalence of



unreported employment in the three Baltic countries for 1998 and 2002. Second, we use discrete choice regressions to ‘explain’ how different socio-demographic and workplace-specific characteristics affect the probability of unreported employment. The analyses consider each country separately and, thereby, allow comparisons across the three countries. Third, we examine to which extent changes in unreported employment from 1998 to 2002 can be explained by changes in the characteristics of the individuals in the sample, which again may be related to economic and social developments in the three countries. Fourth, the paper seeks to provide rough estimates of the gain to individuals undertaking unreported employment and receiving envelope wages. To our knowledge, the investigations outlined in points 2–4 have not previously been undertaken on a cross-country data set covering the Baltic countries.

The WLB facilitates a direct comparison of the extent and possible ‘determinants’ of unreported employment across the three Baltic countries. Such a comparison is particularly relevant as the systems of labour income taxation and tax administration are fairly similar across the three countries and exhibited a large degree of stability across the sample years (Commission, 2007b, part III; OECD, 2000, Ch. III). The tax systems were simplified in the middle of the 1990s when systems of flat (linear) income taxes in combination with relatively few deductions were introduced. In the sample period the social security contributions amounted to 31%–34% of personal income, while the income tax rates were 25%–33% of income above a tax-free threshold (Meriküll and Staehr, 2008). All three countries applied withholding of labour income taxes, where the employer is responsible for reporting the labour income to the tax authorities and for paying the liable social security contributions and income taxes.

The period of study includes many interesting events. The Baltic countries 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 countries 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 countries hard and brought about deep but short-lived downturns in all three countries in 1999. The Russian crisis led to large structural change in the Baltic countries as trade and investment were reoriented towards western markets.

The rest of the paper is organised as follows. The next section presents the data set and provides descriptive statistics on the prevalence of unreported



employment in the three countries. The subsequent section gives the results of estimations ‘explaining’ the prevalence of unreported employment by a number of socio-demographic and firm specific factors. The fourth section examines to which extent different developments in unreported employment can be explained by changes in socio-demographic and firm-specific characteristics. The penultimate section compares the earnings of individuals undertaking unreported employment with the earnings of individuals abiding to the tax laws. The last section summarises the results.

## DATA AND DESCRIPTIVE STATISTICS

The Finnish Ministry of Labour instigated the WLB surveys in order to gather information about working and living conditions in the three Baltic countries. Antila and Ylostalo (1999, 2003) document the surveys and provide a number of tabulations of the main results. Basically identical surveys were conducted in each of the three Baltic countries in 1998 and in 2002. In each round approximately 900 face-to-face interviews were carried out in each country. The survey results have been made available 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 countries.

The WLB survey requires the respondent to answer a large number of questions. We will discuss in some detail the questions concerning the total net wage income and the prevalence of envelope wages.

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, p. 194). This formulation of the question implies 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, p. 194): ‘Do you receive the “salary in envelope” or “black salary”?’. The term *envelope salary* or *envelope wages* is used to indicate that the income has not been reported to the authorities. 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’ (*ibid*, p. 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 never to have received envelope wages, 1 if the respondent has sometimes received envelope wages and 2 if the respondent has received envelope wages frequently, that is, every month.

The term *envelope wages* refers to unreported remuneration of *employed* persons. Self-employed respondents who fail to report fully the income from their own business are unlikely to state that they have received envelope wages. However, a self-employed individual might still receive envelope wages if he or she is employed besides working in his or her own business.<sup>3</sup>

There is no additional information available in WLB about the unreported employment beyond whether or not it has taken place. The survey contains a large number of questions regarding the respondent's *main workplace* as well as personal background information. The variables derived from the questions are listed and defined in Table 1.

The variables concerning the main workplace include 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 in which the respondent was interviewed. In addition to the variables in Table 1, the region in which the respondent resides is also available in the data set.<sup>4</sup>

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, it is difficult to assess whether or not the respondents answer the questions truthfully (Tanzi, 1999). It is noteworthy 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.

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<sup>3</sup> See also the discussions of the difference between unreported work and unreported employment in Williams (2009d) and Commission (2007a, Sec. 4).

<sup>4</sup> The data set also contains information as to whether the firm is foreign-owned, the marital status of the respondent and the size of the respondent's household, but only for 1998. However, approximately half of the observations are missing for these variables. When we added these variables in baseline estimations in Tables 3–5 for 1998, most of the marginal effects became statistically significant, possibly because of the small sample size. Among the additional variables, the only significant effect was observed for the foreign ownership variable in Latvia, where employment by a foreign-owned company reduced the probability of unreported employment by 14%. Moreover, the use of the variables would rule out the pooling of data for the two survey years. We therefore decided against including the variables in the regressions presented in the section 'Determinants of Unreported Employment'.



**Table 1:** Definition of explanatory variables

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

<sup>a</sup> The age in years has been divided by 100 to avoid an excessive number of decimal places in the estimation result presented in the sections 'Determinants of unreported employment', 'Explaining developments in unreported Employment', 'Estimates of income from unreported employment'.

<sup>b</sup> Information concerns the main job of the respondent.

Source: Antila and Ylostalo (1999, 2003), own calculations



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

		Estonia	Latvia	Lithuania
1998	No unreported employment (%)	80.5 [77.7, 83.0]	83.4 [80.8, 85.7]	92.8 [90.9, 94.4]
	Unreported employment (%)	19.5 [17.0, 22.3]	16.6 [14.3, 19.2]	7.2 [5.6, 9.1]
	Occasionally (%)	10.3 [8.4, 12.5]	8.1 [6.4, 10.1]	3.9 [2.7, 5.4]
	Regularly (%)	9.2 [7.4, 11.3]	8.5 [6.8, 10.6]	3.3 [2.3, 4.7]
	Number of observations	911	921	901
	Do not wish to say	0	19	1
2002	No unreported employment (%)	89.7 [87.5, 91.7]	75.8 [72.8, 78.7]	87.6 [85.2, 89.7]
	Unreported employment (%)	10.3 [8.3, 12.5]	24.2 [21.3, 27.2]	12.4 [10.3, 14.8]
	Occasionally (%)	7.3 [5.6, 9.3]	10.2 [8.3, 12.5]	7.5 [5.8, 9.5]
	Regularly (%)	3.0 [1.9, 4.4]	13.9 [11.7, 16.5]	4.9 [3.6, 6.6]
	Number of observations	900	904	909
	Do not wish to say	63	64	56

*Notes:* The coding of unreported employment is based on the question: ‘Do you receive the “salary in envelope” or “black salary”?’ Data in square brackets [ ] indicate the limits of the 95% confidence interval.

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

In the case of Estonia, the share of respondents stating that they had income from unreported employment fell from 19.5% in 1998 to 9.6% in 2002. In Latvia, the share of respondents with unreported employment rose from 16.3% to 22.5% in the same period. Lithuania saw a corresponding increase but from a much lower starting point; the share of respondents with unreported employment was 7.2% in 1998 and 11.7% in 2002. In 1998 in all three countries the share of respondents receiving envelope wages regularly, that is, every month, amounted to approximately half of all envelope wage recipients. In 2002 this share had fallen in Estonia and Lithuania, but had increased in Latvia.

Williams (2009a, c) finds that a large share of envelope wages is paid for employment at the employee’s regular workplace. The WLB data set does not allow us to assess this directly in the case of the Baltic countries. However, among respondents stating not to have any second job (that is, respondents with only one job), the shares of respondents indicating that they have received envelope wages are almost as large as those reported in Table 2 for the whole sample. For example in 2002, the share of unreported employment was 9.4% among Estonian respondents with only one job, and 15.3% among respondents with (at least one) additional job.<sup>5</sup>

The question is whether the statistics in Table 2 relate only to the survey sample or can be seen as reflecting the broader population. To our knowledge, the only survey-based study of the prevalence of unreported employment in the

<sup>5</sup> Indicating that respondents with a second job are somewhat more prone to receive envelope wage, cf. also the estimation results in the section ‘Determinants of Unreported Employment’.



three Baltic countries is a Eurobarometer survey reporting data from 2007 (Commission, 2007a). According to this survey, the share of respondents stating that they have received envelope wages amounts to 18% in Latvia, 11% in Lithuania and 8% in Estonia (Commission, 2007a, p. 30; Williams, 2009e). The Eurobarometer results are broadly in line with the WLB results for 2002 in particular when the sampling errors of the two surveys are taken into account (see the 95% confidence intervals of the WLB survey in Table 2 and various confidence intervals of the Eurobarometer survey in Williams, 2009b, p. 152).

Schneider (2002) estimates the share of working-age individuals undertaking unreported *work* in 1998–1999, based on indicators such as unemployment, tax rates and measures of cash use in the economy. Schneider (2002) finds that the share of unreported work was 33% in Estonia, 30% in Latvia and 20% in Lithuania. The numbers relate to unreported *work*, not employment, but nevertheless appear rather large as frequently seen when indirect methods are used to estimate unreported economic activities (Schneider and Enste, 2000; Tanzi, 1999).

Overall, we do not find the results of WLB incompatible with other cross-country studies of unreported employment in the Baltics, in particular the 2007 Eurobarometer survey. Moreover, the reliability of the WLB survey is enhanced by a relatively large number of respondents.

## DETERMINANTS OF UNREPORTED EMPLOYMENT

In this section we use the WLB data set to link the likelihood of an individual being engaged in unreported employment with various characteristics of the individual and the main employer. We use discrete choice multiple regression analysis in which the dependent variable in most cases is binary, although categorical or ordered dependent variables are used in robustness checks (cf. also Kim, 2005 and Kriz *et al.*, 2008). The estimations are carried out using logit; experiments using probit and other estimation methods have generally produced results which are qualitatively similar to those obtained using logit.<sup>6</sup>

The use of multiple regression analysis has the advantage that the estimated marginal effects are conditional on the other variables in the regression. This eases the interpretation of the results relatively to the more standard cross

<sup>6</sup> Comparing the logit and probit models, the logit model predicts slightly higher probabilities for the lower and higher end of the distribution, while the probit model predicts slightly higher probabilities for the middle part of the distribution. We have examined the importance of using logit instead of probit in the main results presented in Table 6. For all three countries, the Hosmer and Lemeshow goodness of fit test does not reject the null hypothesis that there are no differences between the observed and predicted probabilities for logit or probit models. The estimated marginal effects are also qualitatively similar.

**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 <sup>2</sup>		0.120			0.188	
Log likelihood		-337.2			-170.3	
Observations		786			598	

Note: Regional dummies are also included in the regressions, but the results are not reported. The omitted sectoral dummy is *public administration*.

\*\*\*, \*\*, \* denote that the marginal effect is statistically significant at the 1%, 5% and 10% level of significance.

tabulations of unreported employment and different explanatory factors, for which the effects are not conditioned on other variables. 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. The interpretation of the marginal effects is discussed in more detail in the subsection ‘Comparison across the Baltic countries’.

### Logit estimates for the two years separately

In the logit regressions the dependent variable is 1 if the respondent reports to have received envelope wages regularly or occasionally, and 0 if the respondent has not received envelope wages. As explanatory variables, we use a large number of the variables listed in Table 1, reflecting the personal characteristics and the employment situation of the respondent as well as various characteristics of the main employer.

The results of the logit regressions for the three countries, undertaken separately for 1998 and 2002, are shown in Tables 3–5. The coefficient estimates



**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	
Log likelihood		-284.2			-327.3	
Observations		750			709	

Note: Regional dummies are also included in the regressions, but the results are not reported. The omitted sectoral dummy is *public administration*.

\*\*\*, \*\*, \* denote that the marginal effect is statistically significant at the 1%, 5% and 10% level of significance.

in logit estimations 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). For continuous variables, the marginal effect exhibits the effect of a one-unit increase in the dependent variable from its average value. For dummy variables, the marginal effect shows the effect of the dummy variable increasing from 0 to 1.

In all regressions, five regional dummy variables are included for each country to control for possible regional heterogeneity. The estimated marginal effects to these variables are, however, insignificant in almost all cases and are not reported in the tables in order to save space.

Table 3 shows the logit estimates for *Estonia*.<sup>7</sup> Among the socio-demographic characteristics, only a few variables are statistically significant.

<sup>7</sup>The actual shares of unreported employment in Table 3 are different from those in Table 2, since some respondents are excluded from the regressions because of missing observations of the explanatory variables used in the model.



**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 <sup>2</sup>		0.139			0.140	
Log likelihood		-163.9			-237.3	
Observations		733			725	

Note: Regional dummies are also included in the regressions, but the results are not reported. The omitted sectoral dummy is *public administration*.

\*\*\*, \*\*, \* denote that the marginal effect is statistically significant at the 1%, 5% and 10% level of significance.

Gender or age does not appear to influence the probability of unreported employment.<sup>8</sup> For 2002, the ethnicity variable is significant and negative, implying that ethnic Estonians have lower probability of unreported employment than other ethnic groups, which for Estonian mainly comprise of Russian-speakers. For 1998, a higher education level increases the probability of unreported employment, but this effect is not present in 2002.

Having a second job increases the probability of unreported employment and the marginal effect is large (particularly in 1998), which suggest that second jobs are often jobs for which envelope wages are paid. The occupational position in the hierarchy of the firm affects the propensity of unreported employment in 1998; a high position (eg specialist or manager)

<sup>8</sup> We have experimented with the inclusion of non-linearities of the age variable. In one estimation both a linear and a quadratic term was included, and in another estimation the logarithmic age was included. The results are, however, similar in the sense that the age variables do not attain statistical significance in the case of Estonia.



reduces the probability of unreported employment. The marginal effect of 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 administration sector have higher probabilities of receiving envelope wages than public administration employees. (The dummy for the manufacturing sector has been excluded for 2002, as there is no variability in that variable across the two values of the dependent variable; 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 marginal effects for the company size variable are negative and statistically significant; respondents employed in large companies receive envelope wages less frequently than respondent in smaller companies. 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 unchanged or falling employment (unchanged employment is the omitted variable).<sup>9</sup> Expanding firms may meet part of their increased labour requirement through unreported employment.

The logit estimations for Estonia seem reasonable. The models pseudo  $R^2$  are relatively high given the type of data set. The models under-predict the share of respondents with unreported employment for both 1998 and 2002, but this is a common feature for discrete choice models with an 'unbalanced sample', that is, a sample with proportionately few occurrences of a given choice (Cramer, 1999).

The results of the logit estimates for *Latvia* are presented in Table 4. The share of respondents receiving envelope wages increased between 1998 and 2002. 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 marginal effects.

As regards the socio-demographic characteristics of the respondents, it is noticeable that male respondents and young respondents, *ceteris paribus*, receive envelope wages more frequently than other groups.<sup>10</sup> Having a second

<sup>9</sup> The shares of firms experiencing increasing or decreasing employment are relatively large. It is noticeable, however, that the region experienced rapid structural change in the period considered. Masso *et al.* (2006) found for the same period and countries that 25%–30% of all jobs were reallocated annually.

<sup>10</sup> If both the age and the quadratic age are included, the quadratic age does not become statistically significant. The logarithmic age is statistically significant if it is included instead of the linear age, but the overall estimation results do not change to any noticeable extent.



job seems to matter only in 2002, whereas self-employment does not 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 marginal effects of many of the sectoral variables is noticeable. The marginal effect of the firm size variable is negative and significant for both years, implying that respondents working in large firms have a lower probability of unreported employment than respondents in smaller 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% in 1998 to 13% in 2002. It is noticeable that there are more significant marginal effects for 1998 than for 2002.

Older respondents in Lithuania receive unreported employment income less frequently than younger ones, although the marginal effect is relatively small.<sup>11</sup> 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 marginal effect 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 to receive unreported wage income more frequently than those employed in the public administration sector. Respondents working in larger workplaces seem to receive envelope wages less frequently than respondents in smaller workplaces, at least in 2002. The share of respondents with unreported employment is higher among respondents working in expanding firms than among respondents in firms with stable or diminishing employment (although the effect is only significant at the 10% level).

In general, the results in Tables 3–5 indicate that the marginal effects of different explanatory variables on the probability of unreported employment among the employed are relatively similar across the two sampling years. This is particularly evident when the standard errors of the estimated

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<sup>11</sup> The probability of unreported employment is 4% lower for a 60-year-old respondent than for a 25-year-old respondent in 1998, and 7% lower in 2002. As in the case of Latvia, the logarithmic age would also have attained statistical significance, but the overall estimation results would have changed little.



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 shares of unreported employment and the substantial structural changes taking place in the Baltic countries during the period from 1998 to 2002 (cf. Section 'Introduction').

### Comparison across the Baltic countries

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 countries. 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 likely to receive envelope wages than women 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 unreported employment, 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 administration sector receive unreported wage income less frequently than respondents employed in other sectors. There are also other interesting findings. The estimated marginal effect for the agricultural sector is not statistically significant for Lithuania, although, *a priori*, one would assume people working in the farm sector in Lithuania to have the same incentives and possibilities to receive envelope wages as their counterparts in Estonia and Latvia. The marginal effect to the manufacturing sector dummy is not statistically significant for Estonia, but significant for Latvia and Lithuania.



**Table 6:** Determinants of unreported employment in the Baltic countries, 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 <sup>2</sup>	0.143		0.148		0.128	
Log likelihood	-527.2		-620.2		-411.9	
Observations	1468		1459		1458	

*Note:* Regional dummies are also included in the regressions, but the results are not reported. The omitted sectoral dummy is *public administration*.

\*\*\*, \*\*, \* denote that the marginal effect is statistically significant at the 1%, 5% and 10% level of significance.

In all three Baltic countries unreported employment is more common among individuals working in small firms than among individuals working in larger firms. This likely captures the fact that smaller firms generally have less formalised management, contract and accounting procedures than 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.<sup>12</sup> This would be consistent with the findings based on the 2007 Eurobarometer study

<sup>12</sup> Another possibility is reverse causality, implying that firms that pay envelope wages to many of their employees are thriving and therefore expand their employment.



that envelope wages are to a large extent paid to employees who are formally employed by the firm (Williams, 2009a, c).

The marginal effects of the 2002 dummy are highly significant in both economic and statistical terms for all three countries, but the marginal effect is negative for Estonia and positive for Latvia and Lithuania. The significant dummy suggests that there are important factors affecting the prevalence of unreported employment, which are not included in the models. We return to this point in the section 'Explaining developments in unreported employment'.

Overall, the estimations in Table 6 reveal several interesting results. The marginal effects related to the *socio-demographic characteristics* of the respondents vary 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. It is noticeable that there are substantial overlaps between the results in Table 6 and the findings based on aggregate data for the Baltic countries and Poland reported in Williams (2009e).

The results in Table 6 comprise the main findings of this paper. In the following we discuss the interpretation of the statistical results in more detail and 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 receive envelope wages 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 fully. Still, the possibility of reverse causality might be relatively unimportant. For most individuals the decision on education is taken relatively early in life and likely with little consideration to future possibilities of unreported employment. The choice of education subsequently has an important effect on the employment and career possibilities of the individual.

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 marginal effects 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.

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 receiving envelope wages regularly into one group. In principle, different factors could lie behind each of the two options. For instance, respondents with regular unreported employment may, to a large extent, rely on income from unreported employment, whereas this need not be the case for respondents with only occasional unreported employment.

Table 7 shows the results for each of the three countries when multinomial logit regressions are employed, that is, 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, in all cases the sum of the marginal effects for occasional and regular unreported employment in Table 7 is essentially equal to the corresponding marginal effect in Table 6. In most cases, the marginal effects for occasional and regular unreported employment 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 unreported employment in all three countries, whereas its effect on occasional unreported employment 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 unreported employment of wage income taxation, whereas the effect on regular unreported employment is statistically insignificant. This may suggest that expanding firms ask their (long-time or newly hired) employees to work overtime and be paid partly in the form of envelope wages.

Given that the separate treatment of occasional and regular unreported employment did not change the results much, the question arises whether one could attain more efficient results (smaller estimated standard errors) if the dependent variable was retained as an ordered variable. The dependent



**Table 7:** Determinants of occasional and regular unreported employment in Estonia, Latvia and Lithuania, multinomial logit estimation, marginal effects, 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***	-0.108**	-0.048*
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
Log likelihood		-659.3		-799.1		-501.2
Observations		1468		1459		1458

Note: Regional dummies are also included in the regressions, but the results are not reported. The omitted sectoral dummy is *public administration*.

\*\*\*, \*\*, \* denote that the marginal effect is statistically significant at the 1%, 5% and 10% level of significance.

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 A1 and A2 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, that is, 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 B1 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 *occupational position* and *education*.<sup>13</sup> In other words, the use of ordered variables does not affect our results in any substantial way.

## EXPLAINING DEVELOPMENTS IN UNREPORTED EMPLOYMENT

Table 2 showed that unreported employment changes substantially across the two time periods analysed. Therefore, it is of interest to examine the extent to which these changes can be explained by the changes in the economy as reflected in the explanatory variables used in the estimations in the previous section and to which extent other factors are of importance.

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 endowments of explanatory variables and to which extent the changes can be attributed to changes in the coefficients. We make use of the Oaxaca-Blinder decomposition to investigate the relative contribution of these effects to the changes in the share of unreported employment.<sup>14</sup> Oaxaca-Blinder decomposition implies that two models are estimated separately for two groups, in our case for the year 1998 (labelled group A) and the year 2002 (labelled group B). After the separate estimations, the difference between the means of dependent variable is decomposed as follows:

$$y_A - y_B = \{Eb_B(Y_A|X_A) - Eb_B(Y_B|X_B)\} \\ + \{Eb_A(Y_A|X_A) - Eb_B(Y_A|X_A)\},$$

where  $y_A - y_B$  indicates the difference between the mean outcomes;  $Eb_B(Y_A|X_A)$  is the conditional expectation of  $Y_A$  given the vector of parameters  $b_A$ ,  $Eb_B(Y_B|X_B)$  is the conditional expectation of  $Y_B$  given the parameter vector  $b_B$ ;

<sup>13</sup> 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.

<sup>14</sup> The Stata command *nldecompose* for the Oaxaca-Blinder decomposition of nonlinear regression models is used for the decomposition, see Sinning *et al.* (2008).



**Table 8:** Decomposition in the change in unreported employment from 1998 to 2002 (per cent)

	Estonia	Latvia	Lithuania
Share of unreported employment, 1998	19.1	15.5	7.2
Share of unreported employment, 2002	9.8	24.5	12.7
Change in share of unreported employment, 1998–2002	9.3	−9.1	−5.5
Change because of changed endowments (% of change)	5.0	11.5	2.8
Change because of changed coefficients (% of change)	95.0	88.4	97.2

*Note:* Reported shares of envelope wage receivers correspond to the ones presented in Tables 3–5 except for Estonia in 2002, for which the manufacturing sector is excluded from the estimations of Table 3, but included in the decomposition.

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

and  $Eb_A(Y_A|X_A)$  is the conditional expectation of  $Y_A$  at the parameter vector  $b_B$ . The first term on the right-hand side captures the difference in output variable because of changes in the explanatory variables, while the second term captures the difference in output variable because of changes in coefficients. In our case the first term on the right-hand side shows the development in the mean outcome, if the coefficients were at their year 2002 level and only the value of explanatory variables would have changed; and the second term shows the development in the mean outcome, if the explanatory variables were at the year 1998 values and only the coefficients would have changed.<sup>15</sup>

The decomposition results are shown in Table 8. The results indicate that the majority of the change in receipt of envelope wages is explained by changes in the coefficients. The change in the explanatory variables explains only 5% of the decrease in envelope wage receivers in Estonia, 11.5% of the increase in envelope wage receivers in Latvia and 2.8% of the increase in envelope wage receivers in Lithuania. The choice of the reference group changes the results somewhat, if one takes the year 1998 for the reference instead of year 2002, the characteristics would have explained even less of the development of receipt of envelope wages. Among coefficients the largest contribution stems from the constant term. This indicates that in terms of the over time development the role of changes in firm-related and socio-demographic variables has been modest.

All in all, the changes in the receipt of envelope wages from 1998 to 2002 are very large in all three Baltic countries. However, the changes in the explanatory variables explain only 3%–12% of the changes in the prevalence

<sup>15</sup> The decomposition is based on the estimated coefficients; neither the coefficients nor the associated marginal effects are shown in this section.



of unreported employment, while the rest must be attributed to changes in the coefficients including the constant term.<sup>16</sup>

The set of socio-demographic and employer variables in these models plays an important role in shaping pattern of envelope wages recipients at a certain point of time. The models, however, cannot be used for the prediction of the *dynamics* of unreported employment in the turbulent period from 1998 to 2002 examined in this paper. Taking into account changes in the sectoral composition, firm size, employment developments, etc is not sufficient to predict the dynamics of unreported employment with any degree of precision; the upshot is that other factors have played a major role. We discuss some possible drivers of unreported employment in the final section.

### ESTIMATES OF INCOME FROM UNREPORTED EMPLOYMENT

The third section concluded that the prevalence of unreported employment was largely related to the firm characteristics, while personal factors had less explanatory power. This leaves the question what makes individuals work in informal employment. There are two main possibilities (Arias and Khamis, 2008; Maloney, 2004). The ‘voluntary’ argument posits that individuals choose the informal unreported employment, because the income from such employment is higher than the net-of-tax income from employment which is fully reported. The ‘exclusion’ or segmentation argument posits that employees work in the informal sector, even if the income in the informal sector is lower than in the net-of-tax income in formal sector as they cannot find employment in the formal sector. Exclusion from formal employment might stem from trade unions, minimum wages, efficiency wages and/or subjective characteristics of the individual.

It may be possible to distinguish between the two underlying reasons for informal employment by comparing the remuneration to the individual – adjusted for different characteristics – in the two sectors. Such an estimate might be based on the answers to question no. 49 in the WLB: ‘What was your net salary in the last month?’ The answer should contain the net-of-tax income from *all* jobs held, including income from unreported employment.

We compare the income of respondents who occasionally or regularly receive envelope wages with that of respondents who never received envelope wages, taking into account observable heterogeneity across the

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<sup>16</sup>The estimations in Table 6 for the two years merged found that the dummies for year 2002 were of substantial magnitude, broadly following the changes in the unconditional rates of unreported employment and highly significant in statistical terms. This suggests that changes in the constant term are a very important driver of the change because of changed coefficients.



**Table 9:** Net wage income gain from unreported employment, percentage of mean income of individuals without unreported employment, 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

Note: Predicted income based on characteristics of individuals.

Source: WLB (1998, 2002), own calculations

groups. We employ a methodology derived from 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.<sup>17</sup>

Based on a sub-sample of only individuals *without unreported* employment, we estimate standard Mincer wage equations for each of the two years, 1998 and 2002. The predicted net wage income from this equation, given various personal (and employer) characteristics, can then be taken as a measure of the after-tax wage earnings potential if the individual has reported only reported employment. For those *with unreported* employment, we compare the actual net wage income with the hypothetical predicted net wage income if they had not been engaged in unreported employment. The result is a measure of the gain (or loss) of an individual with unreported employment instead of only reported employment – conditional on various individual and employer characteristics.

We estimate a Mincer wage equation for individuals without unreported employment. The variable *log net wage income* is explained by the personal characteristics of the respondent, that is, *male, age, titular ethnicity, education* and *second job*. The wage regressions for 1998 and 2002 are reported in Meriküll and Staehr (2008, Tables C.1–C.2). The estimated wage regressions are used to predict the *log net wage income* of individuals with occasional and regularly unreported employment, respectively. The 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.

<sup>17</sup> Arias and Khamis (2008) employ a more sophisticated technique explicitly taking into account the endogenous selection between different employment categories. This approach, however, induces additional layers of complexity.



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  $-6\%$  to  $12\%$  of the mean income of individuals without unreported employment. The modest or non-existing gains to the employees of receiving envelope wages may be surprising in light of the relatively high tax rates in the Baltic countries, but could reflect that the 'surplus' from not paying taxes does not to a large extent benefit the employees receiving envelope wages.

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 (Williams, 2009c). In many instances employment is only offered if the employee accepts to receive all or part of the salary as envelope wages. In a survey undertaken in Estonia in 2004, a total of  $45\%$  of the respondents receiving envelope wages were not pleased with the situation;  $55\%$  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 as individuals with the highest wage income potential have moved from unreported to reported employment along the process of transition.

Third, among the categories of unreported employment, the income gain from unreported employment is largest for individuals who receive envelope wages occasionally, and this holds for all three countries and in both time periods. According to Table 7, respondents who occasionally receive envelope wages have even higher wage potential than respondents who do not receive envelope wages.

Table 9 is based on a Mincer equation in which only the socio-demographic characteristics of the respondent have been used. As a robustness check we also estimated the regression using the socio-demographic characteristics of the individual *and* the main employer as explanatory variables. In this case the Mincer equation contains all the explanatory variables from the models in the previous section as explanatory variables. The results are reported in Meriküll and Staehr (2008), but the main conclusions from Table 9 remain: (a) The gain for individuals engaged in unreported employment is modest or negative. (b) The gain is somewhat bigger for individuals with occasional unreported employment than for those with regular unreported employment. (c) The gain is smaller in 2002 than in 1998.

These results should be interpreted with caution as the results rely on self-reported net of tax wage income in the WLB surveys. It is debatable



whether such information is provided with any degree of precision for individuals in all three employment groups, that is, individuals with no, occasional and regular unreported employment. Still, the informality of the WLB survey implies that there are no direct reasons for misreporting their earnings.

The analysis provides a partial answer to the question posited, namely why individuals undertake unreported employment. Overall the differences in after-tax earnings between individuals with and without unreported employment are relatively small. Individuals undertaking unreported employment only occasionally seem in most calculations to have earned more after tax than they would if they had only reported employment.<sup>18</sup> The upshot is that these individuals may have chosen unreported employment ‘voluntarily’ to earn additional income. Individuals with regular unreported employment seem to earn very little extra or possibly less than they hypothetically would have done *if* they had only reported employment. Also, they earn in all calculations less than individuals undertaking unreported employment only occasionally. These findings may suggest that the group of individuals having unreported employment regularly may have problems finding employment if they do not accept being paid envelope wages; these individuals may represent a disadvantaged part of a segmented labour market.

## FINAL COMMENTS

This paper represents the first cross-country comparative study of unreported employment in the Baltic countries based on the two years 1998 and 2002. The prevalence and determinants of unreported employment was compared across the three Baltic countries and the two years. The analysis was made possible by the use of the hitherto unheeded WLB data set, which applied a standardised survey methodology across the three Baltic countries. The relevance of the comparative analysis is strengthened by the fact that the countries exhibit many similarities, such as comparable income levels and flat income tax systems, and largely have been subject to the same external environment.

The prevalence of both occasional and regular unreported employment varies substantially across the three countries and across the two sampling years. Estonia saw a marked drop in the prevalence of unreported employment from 1998 to 2002, while the opposite occurred in Latvia and Lithuania. In 2002 the shares of unreported employment amounted to 10% in Estonia,

<sup>18</sup> This effect is most pronounced in the calculations for 1998, but it is also present in some calculations for 2002.



12% in Lithuania and 24% in Latvia. Taking into account the sampling error, these results correspond reasonably well with the findings in the 2007 Eurobarometer survey as also reported in Williams (2009e).

As is the case with all other studies of envelope wages and unreported employment, the results in this paper must be interpreted in light of the quality of the data source (Tanzi, 1999). Unreported employment is, *sui generis*, difficult to measure, but the relatively large sample sizes and the correspondence of the 2002 numbers to the results in the 2007 Eurobarometer survey suggest that the data problems in the WLB survey are not larger than in most other surveys on unreported employment.

The microeconomic estimations, seeking to 'explain' the prevalence of unreported employment, showed that firm-related characteristics, such as sector, firm size and employment growth, are important factors in all three countries. The importance of personal factors, on the other hand, is limited and varies substantially across countries and time. This corresponds well with the institutional setup where the employer withholds and pays in social security contributions and income taxes. 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 compute 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 socio-demographic characteristics. The results showed that only a very small fraction of the changes could be explained by these factors. The rest must therefore be attributed to other factors, which are outside the econometric analysis.

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 may suggest that the labour markets exhibit segmentation, where individuals take up informal employment not because there is any substantial monetary gain, but because they cannot find employment in the formal sector.

The main results of this paper analysing the mid-transition phase are broadly in line with those found in other survey-based studies of envelope wages and unreported employment in the Baltics and the rest of the transition economies (Williams, 2009c, d, e). The prevalence of unreported employment is particular high in certain occupations, in small firms and in expanding firms, while the impact of socio-demographic factors, such as gender, age and education, is generally less important and varies across countries and time. The gain for individuals undertaking unreported employment is modest or non-existent (in particular among individuals who engage regularly in



such activities), which suggests that those undertaking such employment have few alternatives to accepting their wages being paid partly or fully as envelope wages.

Only a small part of the changes in unreported employment between 1998 and 2002 can be accounted for by changes in firm-specific factors and socio-demographic characteristics. Moreover, there are also large differences across the three countries, which cannot be explained by the variables in the WLB data. One can only speculate as to which missing factors that might explain the differences in unreported employment across the countries and the different developments in the three countries from 1998 to 2002. Possible candidates include different tax systems, different tax and auditing administration and different social norms and tax morals.

The tax systems are relatively similar in the three countries and the revenue intakes from social security contributions and income taxes as percent of GDP are also broadly similar. One difference is that Lithuania and Latvia reformed their pension systems already in the mid-1990s making the pension payment dependent on accumulated social security contributions, while this change only took place in Estonia in 1999, that is, between the two years of our sample (Meriküll and Staehr, 2008).

The administrative and governance structure shows more differences across the countries. The World Bank assesses that Estonia within the sample period had substantially higher scores than Latvia and Lithuania within a range of indicators such as governance effectiveness, regulatory quality, the rule of law and control of corruption (World Bank, 2009). A similar conclusion follows from the work by Fabrizio and Mody (2008). The quantitative importance of this factor cannot be assessed.

Alm and Torgler (2006) show that the tax morale of individuals differs substantially across otherwise comparable Western countries. According to the World Values Survey for 1999, the attitudes towards cheating on taxes were quite different across people in the three Baltic countries. However, Latvia was the country with the lowest acceptance rate and it is therefore unlikely that different societal norms can explain the different prevalence of unreported employment.<sup>19</sup>

In sum, while it possible to tie together the prevalence of unreported employment and various socio-demographic and firm-related factors, it is

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<sup>19</sup> On a scale between never justified (1) and always justified (10), the mean score was 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 of tax evasion in the whole of EU25 (World Values Survey, 1999).



very difficult to explain cross-country differences and changes across time. This may be an area where future could provide interesting insights.

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### REFERENCES

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- Abbott, P and Wallace, C. 2009: Patterns of participation in the formal and informal economies in the commonwealth of independent states. *International Journal of Sociology* 39(2): 12–38.
- Alm, J and Torgler, B. 2006: Culture differences and tax morale in the United States and in Europe. *Journal of Economic Psychology* 27(2): 224–246.
- Antila, J and Ylostalo, P. 1999: *Working life barometer in the Baltic States 1999*. Labour Policy Studies, No. 214, Ministry of Labour, Helsinki, Finland.
- Antila, J and Ylostalo, P. 2003: *Working life barometer in the Baltic States 2002*. Labour Policy Studies, No. 247, Ministry of Labour, Helsinki, Finland.
- Arias, O and Khamis, M. 2008: *Comparative advantage, segmentation and informal earnings: A marginal treatment effects approach*. IZA Discussion Paper, no. 3916.
- Commission. 2007a: *Undeclared work in the European Union*. Special Eurobarometer, No. 284, European Commission.
- Commission. 2007b: *Taxation trends in the European Union. Data for the EU member states and Norway*. Eurostat Statistical books, European Commission. Office for the Official Publications of the European Communities: Luxembourg.
- Cowell, F. 1990: *Cheating the government: The economics of evasion*. MIT Press: Cambridge, MA.
- Cramer, JS. 1999: Predictive performance of the binary logit model in unbalanced samples. *The Statistician* 48(1): 85–94.
- Danopoulos, CP and Znidaric, B. 2007: Informal economy, tax evasion and poverty in a democratic setting: Greece. *Mediterranean Quarterly* 18(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](http://www.ki.ee/publikatsioonid/valmis/Varimajandus_Eestis_2004(elanike_hinnangute_alusel).pdf).
- Fabrizio, S and Mody, A. 2008: *Breaking the impediments to budgetary reforms: Evidence from Europe*. IMF Working Paper, WP/08/82, International Monetary Fund.
- Kim, B-Y. 2005: Poverty and informal economy participation. Evidence from Romania. *Economics of Transition* 13(1): 163–185.
- Kriz, K, Meriküll, J, Paulus, A and Staehr, K. 2008: Why do individuals evade payroll and income taxation in Estonia? In: Pickhardt, M and Shinnick, E (eds). *Shadow Economy, Corruption and Governance*. Edward Elgar Publishing: Cheltenham, pp. 240–264.
- Maloney, W. 2004: Informality revisited. *World Development* 32(7): 1159–1178.
- Masso, J, Eamets, R and Philips, K. 2006: Job flows and worker flows in the Baltic States: Labour reallocation and structural changes. In: Paas, T. and Eamets, R. (eds). *Labor Market Flexibility, Flexicurity and Employment*. Nova Science Publishers: New York.



- Meriküll, J and Staehr, K. 2008: *Unreported employment and tax evasion in mid-transition: Comparing developments and causes in the Baltic States*. Working Paper of Eesti Pank, no. 6/2008.
- OECD. 2000: *Baltic States. A regional economic assessment*. OECD Economic Surveys, Organisation for Economic Co-operation and Development: Paris.
- OECD. 2008: *OECD employment outlook*. Organisation for Economic Co-operation and Development Ch. 2 (Declaring Work or Staying Underground: Informal Employment in Seven OECD Countries), <http://browse.oecd.bookshop.org/oecd/pdfs/browseit>.
- Pissarides, C and Weber, G. 1989: An expenditure-based estimate of Britain's black economy. *Journal of Public Economics* 39(1): 17–32.
- Rodgers, P, Williams, C and Round, J. 2008: Workplace crime and the informal economy in Ukraine: Employee and employer perspectives. *International Journal of Social Economics* 35(9): 666–678.
- Round, J, Williams, C and Rodgers, P. 2008a: Corruption in the post-Soviet workplace: The experiences of recent graduates in contemporary Ukraine. *Work, Employment & Society* 22(1): 149–166.
- Round, J, Williams, C and Rodgers, P. 2008b: Everyday tactics and spaces of power: The role of informal economies in post-Soviet Ukraine. *Social and Cultural Geography* 9(2): 171–185.
- 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 and Enste, D. 2000: Shadow economies: Size, causes and consequences. *Journal of Economic Literature* 38(1): 77–114.
- Sedlenieks, K. 2003: Cash in an envelope: Corruption and tax avoidance as an economic strategy in contemporary Riga. In: Arnstberg, K-O and Boren, T (eds). *Everyday Economy in Russia, Poland and Latvia*. Almqvist & Wiksell: Stockholm, pp. 37–52.
- Sinning, M, Hahn, M and Bauer, T. 2008: The blinder-oaxaca decomposition for nonlinear regression models. *Stata Journal* 8(4): 480–492.
- Smith, A and Stenning, A. 2006: Beyond household economies: Articulations and spaces of economic practice in postsocialism. *Progress in Human Geography* 30(1): 1–14.
- Tanzi, V. 1999: Uses and abuses of estimates of the underground economy. *Economic Journal* 109: F338–FF347.
- Williams, C. 2008a: Envelope wages in central and Eastern Europe and the EU. *Post-Communist Economies* 20(3): 363–376.
- Williams, C. 2008b: Illegitimate wage practices in Eastern Europe: The case of 'envelope wages'. *Journal for East European Management Studies* 13(3): 65–83.
- Williams, C. 2009a: Evaluating the extent and nature of 'envelope wages' in the European Union: A geographical analysis. *European Spatial Research and Policy* 16(1): 116–129.
- Williams, C. 2009b: Formal and informal employment in Europe: Beyond dualistic representations. *European Urban and Regional Studies* 16(2): 147–159.
- Williams, C. 2009c: The commonality of envelope wages in Eastern European economies. *Eastern European Economics* 47(2): 37–52.
- Williams, C. 2009d: The hidden economy in East-Central Europe: Lessons from a ten-nation survey. *Problems of Post-Communism* 56(4): 15–28.
- Williams, C. 2009e: The prevalence of envelope wages in the Baltic Sea region. *Baltic Journal of Management* 4(3): 288–300.
- WLB. 1998: *Working Life Barometer dataset for 1998*. WLB: Helsinki.
- WLB. 2002: *Working Life Barometer dataset for 2002*. WLB: Helsinki.
- World Bank. 2009: Governance matters 2009. Worldwide governance indicators, 1996–2008, <http://info.worldbank.org/governance/wgi/index.asp>.
- 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

### Ordered logit

See Tables A1 and A2.

**Table A1:** 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	
Log likelihood	-674.9		814.3		511.3	
Observations	1468		1459		1458	

*Note:* Regional dummies are also included in the regressions, but the results are not reported. The omitted sectoral dummy is *public administration*.

\*\*\*, \*\*, \* denote that the marginal effect is statistically significant at the 1%, 5% and 10% level of significance.



**Table A2:** 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	
Log likelihood	-674.9		814.3		511.3	
Observations	1468		1459		1458	

*Note:* Regional dummies are also included in the regressions, but the results are not reported. The omitted sectoral dummy is *public administration*.

\*\*\*, \*\*, \* denote that the marginal effect is statistically significant at the 1%, 5% and 10% level of significance.



## APPENDIX B

### Unordered explanatory variables

See Table B1.

**Table B1:** 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
Service 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 <sup>2</sup>	0.150		0.153		0.130	
Log likelihood	-523.2		-616.9		-411.3	
Observations	1468		1459		1458	

Note: Regional dummies are also included in the regressions, but the results are not reported. The omitted sectoral dummies are *less than primary education, manual worker and public administration*. \*\*\*, \*\*, \* denote that the marginal effect is statistically significant at the 1%, 5% and 10% level of significance.