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THE DISTRIBUTIONAL IMPLICATIONS OF INCOME TAX EVASION IN HUNGARY

Dóra Benedek
Central European University and Ministry of Finance, Hungary

Orsolya Lelkes
European Centre, Vienna and CASE, LSE, London[*]

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Abstract

The paper estimates the distributional implications of income tax evasion in Hungary based on a random sample of administrative tax records of 230 thousand individuals. Gross incomes in the administrative tax records are compared with those in a nationally representative household budget survey, assuming that tax-evaders are more likely to report their true incomes in an anonymous interview. Our estimates show that the average rate of underreporting is 11%, which conceals large differences between self-employed (who hide the majority of their incomes) and employees. The estimates are likely to be lower bound, due to measurement error in the income survey. These rates are then used in EUROMOD, a tax-benefit microsimulation model to calculate the fiscal and distributional implications of underreporting, while taking account of all major direct taxes and cash benefits and also their interactions. Tax evasion reduces fiscal revenues from personal income taxes by about 19%. While the occurrence of poverty is not affected, income inequality becomes significantly higher (the Gini coefficient increases by 7%), suggesting that high earners tend to evade proportionately more. Finally, we find that tax evasion largely reduces the progressivity of the tax system.

JEL Codes: H26, H22, H21
Keywords: tax policy, tax evasion, income distribution, self-employed

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E-mail: lelkes@euro.centre.org

1 Introduction

Tax evasion obviously interferes with the evaluation of tax policy changes. In addition, where the practice of assessing eligibility to benefits relies on a scrutiny of tax returns, tax evasion will also cause target inefficiency in the form of benefit "leakage" to ineligible recipients. For these reasons, ignoring tax evasion can seriously misjudge the distributive and fiscal effect of changes in social benefits and the tax system. In this light, the objective will be to explore a procedure to correct income data for tax evasion.

The level of income taxes is high in Hungary, but a large proportion of the population does not pay these in full. The bottom 80% of taxpayers pays altogether only 20% of the personal income tax (Krekó and P. Kiss 2007, p. 26). This poses fiscal problems, and affects the financing of public services, but it also results social problems, as an ad hoc distribution of the tax burden is likely to be, or likely to be perceived as, inequitable. In order to design a fair income redistributive system, policy makers need to know not only the incomes of the individuals, but also how they actually comply with the tax regulations. Currently, very little is known on the latter. This paper uses administrative tax records, thus provides novel results on the extent and distribution of income tax evasion.

Tax compliance may be low for two reasons in the country. The first is an attitudinal reason: low trust in the political system, little public awareness on the cost of public services and the budget policy as such (e.g. Csontos, Kornai and Tóth 1998), and the low perceived quality of public services (Hanousek and Palda 2004; Lelkes 2004). The second may be a rational economic argument: the tax policy, with its complexity, offers easy arbitrage opportunities for those who seek to lower their tax burden. One obvious arbitrage opportunity is the choice between employment forms.

The tax system clearly "favours" contractual employment relations compared to standard employee status. According to the calculations of the Ministry of Finance (Bakos et al. 2008), the net income in percentage of total employer costs varies between 39-47% in case of enterprises under Simplified Business Tax (SBT), while it is 65-85% in case of employee status for annual income levels between 2 and 10 million forints (8 thousand and 40 thousand EUR). In case of entrepreneurs under alternative tax treatments[1], the tax burden thus varies between these endpoints. A recent paper by the Hungarian National Bank (Krekó and P. Kiss 2007) highlights two main ways of evading taxes by self-employed: (i) declaring labour incomes as capital incomes, (ii) reducing profits by declaring high operating costs. According to tax data, self-employed have operated with a cost share of 98%, thus only 2% of total revenues were actually reported as tax base.

The aim of the paper is to provide preliminary estimates of the size and distribution of income tax evasion in Hungary. The paper takes advantage of access to a random sample of income tax returns reporting on incomes earned in 2005, containing information on 227.688 individuals, about 5,4% of total taxpayers, provided to one of the authors by the tax authority.

The paper is organized as follows. Section 2 briefly reviews the literature on tax evasion. Section 3 explains the main features of tax policy, with special focus on entrepreneurs. Section 4 presents the data and section 5 the main results. Last, section 6 concludes.

[1] The three alternative forms of taxation are discussed later.

2 Literature

Why do people evade taxes? The question in economics, however, is why do people pay taxes? While classical theory (Allingham and Sandmo 1972) was preoccupied with the former question, recently the latter one has received increasing attention (see e.g. the overview of Andreoni, Erard and Feinstein 1998). There is a great discrepancy between the standard theoretical model and actual compliance, the former predicting greater non-compliance than observable in the real world. Given that audit probability is rather low in general, Expected Utility Theory (using audit probability, penalty rate and expected return on evading the tax in the model) predicts the expected return on tax evasion between 91 and 98%, implying that *all* taxpayers should hide some income (Dhami and al-Nowaihi 2007). Psychological factors or moral preferences, including loss aversion, stigma, guilt, shame or sense of duty, might explain why it is not the case.

A growing strand of authors criticize the traditional neoclassical model of tax compliance, where the tax-payer is treated as an isolated and amoral individual and present evidence that tax evasion is an interdependent decision, and is greatly influenced by social norms and social interactions (Fortin, Lacroix and Villeval 2007; Frey and Torgler 2007). If taxpayers believe tax evasion to be common, tax evasion decreases.

The institutional framework of tax compliance also merits more attention, including the structure, the functioning of the tax authority, its setting within the government, and its dynamic, repetitive interaction with the taxpayers (Andreoni et al 1998). The quality of political institutions (accountability, political stability, government effectiveness, regulatory quality, rule of law, control of corruption) was shown to have positive observable effect on tax morale (Frey and Torgler 2007). Entrepreneurs were found to go underground not to avoid taxes but to reduce the burden of bureaucracy and corruption (Friedman et al 2000).

Measurement of tax evasion

How much tax do individuals evade? There are three main methods of measuring tax compliance, which may be called direct approach, indirect approach and the modelling approach (Schneider and Enste 2000; Frey and Schneider 2001). The indirect approaches are mostly based on macroeconomic data. Possible indicators include the discrepancy between national expenditure and income statistics, the discrepancy between official and actual labour force, the currency demand approach and the electricity consumption method. Direct methods, on the other hand, are based on micro datasets. They could include specific surveys or tax auditing data. The modelling approach, developed by Frey, focuses on the causes and effects of the undergrounds economy, and builds on a behavioural model. This requires a large amount of data, which are often not available. In our paper, we are using a direct method.

Direct methods seem to be better suited for Eastern European countries. Hanousek and Palda (2006) express a rather critical view about macro approaches measuring tax evasion in transition economies (e.g. money demand and electricity demand equations), and plea for the use of direct methods. They argue that the pace of change of the parameters of the money demand and electricity demand equations is too variable for these methods, demonstrating with data for the Czech Republic for the period between 1990 and 2000.

Direct approach has been used by Fiorio and D'Amuri (2005) for Italy, with a similar basic assumption as in this paper. Their analysis was based on comparing incomes reported in administrative tax records and income survey, assuming that people might consider declaring a closer-to-true income to an anonymous interviewer. They focused on the active population only, and measured only income tax evasion, not that of social security contributions or VAT.

Existing evidence on the shadow economy in Hungary

The share of the underground (or shadow) economy is rather high in Hungary in European comparison, ranging between 18 and 25% in 1998-2000. This places the country into a group of high evaders together with other former Communist countries, but also Mediterranean countries such as Greece and Italy. The estimates about the actual size of the grey and black economy, however, are subject to measurement difficulties, therefore we provide a brief overview of the alternative measures and results.

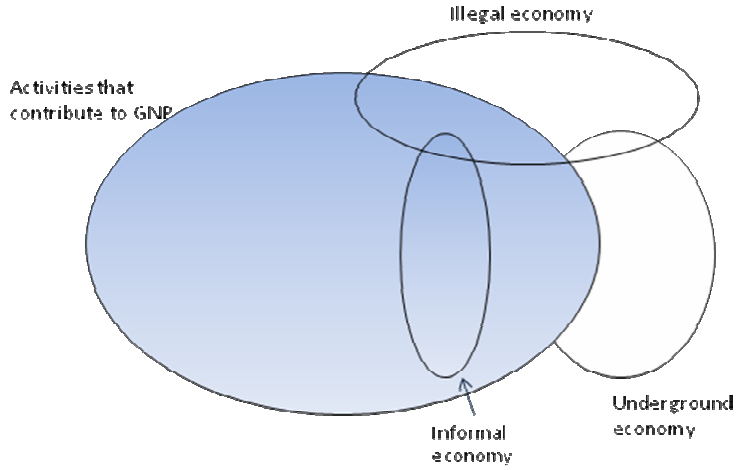
Table 1 Size of informal labour and shadow economy in European countries

Country	*Size of informal labour as % of GDP, various years, 1995-2001*	*Shadow economy in % of GDP, 2002/2003*
Austria	1,5	11
Finland	4,2	18
France	4-6,5	15
Germany	6	17
Greece	Over 20	28
Italy	16-17	26
Spain	n.a.	22
Sweden	3	19
UK	2	12
		Shadow economy in % of GNP, 1999/2000
Bulgaria	22-30	37
Czech Republic	9-10	19
Hungary	18	25
Latvia	18	40
Lithuania	15-19	30
Poland	14	28
Romania	21	34
Slovakia	13-15	19
Slovenia	17	27

Source: European Commission (2004) (share of informal labour) and Schneider and Klinglmair (2004) (shadow economy)
Estimates referring to informal labour use various methods, and in most cases are compiled by national statistical offices

Little is known on the size of the underground economy. Official estimates of GNP and GDP include estimates for the size of the informal sector and partly also that of the illegal economy, but not for the underground sector, including tax evasion (see Figure 1 on the relationship of these concepts).

Figure 1 Concepts related to the black and shadow economy



Source: based on European Commission[2] (2004)

Economic underground (our focus in this paper) consists of activities that are productive in an economic sense and quite legal, but which are deliberately concealed from public authorities in order to avoid the payment of taxes or social security contributions. It includes underreporting of production, (understating of revenues or overstating costs), and also intentionally not registering (whole enterprises or parts of a registered enterprise) (see Figure 1). The *informal sector* typically comprises small-scale production units, most often households. It includes activities such as agriculture, construction, renovation of dwellings, private lessons, and other personal services. Note, however, that some of this activity is not subject to tax. The illegal economy includes activities forbidden by the law, related to e.g. production of drugs, smuggling or prostitution.

There was no major change in the size of the, the shadow economy during the past 10 years staying in the range of 12-16% of the GDP, according to the Hungarian Central Statistical Office (HSCO). The latest estimates suggest a rate of 15% in 2007 (KSH, 2005; Fehérítő Bizottság, 2008). Alternative estimates for an earlier period (although with alternative methods) show higher figures, and imply a possibly declining trend. Johnson and Lackó estimated the shadow economy as large as 28.4% and 30.5% of the GDP in 1994-95, based on the electricity consumption method (Lackó 1998; Schneider and Enste 2000, p. 101). Both authors find an increase *in tax evasion* compared to 1989-90, although in Johnson's case it is only 1% point. This is far from being surprising, given the boom in the number of small enterprises, and tax units during the early phase of economic transition. These figures are far above the extent of tax evasion in most EU countries, but seem to be on the same level as some Central and Eastern European ones.

The calculations of Christie, Holzner and Lacko provide one of the few recent comparative evidence on the extent of tax evasion. Their approach is particularly relevant to us, as they use individual level data and include both Personal Income Taxes (PIT) and Social Security Contributions (SSC) (2005). First, they computed the total income tax base using National Accounts figures. The countries' income distribution was then estimated from micro datasets, mainly Household Budget Surveys. They found a higher compliance for PIT than for SSC in Hungary: while SSC compliance was 64%, PIT compliance reached 70% in 2002 (see Table 2). Their fundamental assumption was that *tax evasion is uniform* across all income groups (as

[2] The concepts and their definitions are based on the1993 SNA (System of National Accounts) and the OECD Handbook for the Measurement of the Non-Observed Economy.

they had no access to individual tax records). Our paper relieves this latter assumption and explores differences across various population groups.

Table 2. Income tax evasion in European countries

Country	SSC Compliance, %	PIT Compliance, %	SSC Theoretical Effective Rate, %	PIT Theoretical Effective Rate, %	Year
Austria	91	75	14,1	19,0	2003
Belgium	69	70	10,9	25,4	2002
Czech Republic	67	77	12,8	12,1	2003
Estonia		56		21,6	2003
France	72	60	3,8	16,5	1999
Germany	84	75	17,8	17,7	2002
Hungary	**64**	**70**	**8,5**	**21,1**	**2002**
Italy	83	62	6,0	22,7	2002
Latvia	53	45	6,8	18,9	2002
Netherlands		73		13,3	1998
Poland		66		18,6	1998
Portugal	66	68	7,7	12,1	2002
Slovakia	69	56	10,2	11,2	2002
UK	65	78	5,4	16,9	2002*

Note: *UK fiscal year: 6 April 2002 - 5 April 2003
Source: Christie, Holzer and Lacko 2005

Semjén et al (2008), based on attitudinal survey questions, find that about 15% of all respondents received a share of their income cash-in-hand and 14% received part of their wage incomes as enterprise income. Altogether 26% of the respondents evaded some of their income taxes in 2006 and 2007. Using specially designed enterprise surveys from 1996, 1998 and 2001 on attitudes, Semjén and Tóth (2004) conclude that the informal sector has considerably declined during this period. The authors do not aim to estimate the size of the informal sector as such, rather present a series of attitudinal questions. They find that the tax and contractual discipline of firms has greatly improved: the enterprises report a declining occurrence of unregistered sales in their sectors, both among their competitors and their contractual partners; and significantly less of the firms claim to have tax arrears.

Sik (2000) explores the informal labour markets, or in other words, „casual“ labour marketplaces based on specific local government surveys in years 1995, 1997 and 1999, with a sample size of 1000 each. 62% of local governments reported the occurrence of black labour markets. The likelihood of the presence of such labour marketplaces increases with population size. Most of them are located in the South-Eastern region.

Elek et al (forthcoming) estimate the share of unregistered employment to 16-17% of the labour force, based on the comparison of administrative (pension insurance registry data) and survey data for 2001-2004. They find that in 2003 about 50-60% of those reporting minimum wage underreported their incomes and on average received about one-third of their actual income as “envelope wages”.

Tonin (2007) analyses the relationship of minimum wage and tax evasion, focusing on the first year of the massive minimum wage rise that took place in Hungary in 2001 and 2002. He uses a rotating panel data, assessing the impact of the minimum wage rise on food consumption, and thus on “real available income”. Using the minimum wage rise in Hungary, as a natural experiment, Tonin (2007) shows that the increase of minimum wage has actually lowered consumption for those affected, and in a macro level, it boosted fiscal revenues. Minimum wage thus induces higher compliance by some low-productivity workers. He also

presents cross-country evidence on the occurrence of a spike in the wage distribution at the minimum wage level and finds a positive correlation between the size of the spike and the size of the informal economy.

3 Features of tax policy, with special focus on entrepreneurs

The income tax system is subject to frequent (mostly annual) changes, including both the tax rates and the tax brackets. Some of this might be explained with the indexation to inflation, but in most cases they reflect changing policy priorities, at times focusing on raising revenues, other times on lowering the tax burden (and thus hoping that increased economic activity would result in ultimately higher tax revenue). This contributes to the unpredictability of the tax system, and according to some, to the prevalence of mistrust and thus tax evasion.

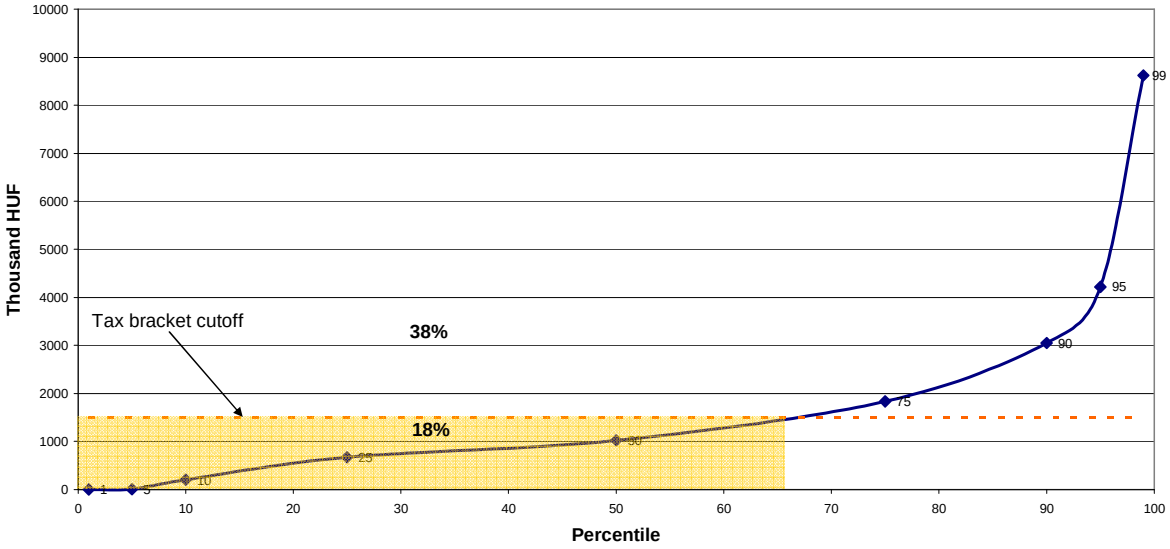
Table 3. Personal income tax brackets (in HUF) and rates

2003		*2004*		*2005*		*2006*	
Tax bracket	*Rate*	*Tax bracket*	*Rate*	*Tax bracket*	*Rate*	*Tax bracket*	*Rate*
0-650.000	20%	0-800.000	18%	0-1.500.000	18%	0-1.550.000	18%
650.001- 1.350.000	30%	800.001- 1.500.000	26%				
1.350.001-	40%	1.500.001-	38%	1.500.001-	38%	1.550.001-	36%

In addition to PIT, employers had to pay a total of 32% as social security contributions on their labour incomes in 2004. Employee social security contribution amounted to 13,5%. These rates had been relatively stable and remained the same between 2004 and 2006.

Budget revenue from personal income taxes made up 6,6% of the GDP in 2005 (European Commission 2007). The Hungarian budget however relies heavily on indirect taxes, and received about 53% higher amount from VAT than from PIT in 2005[3], a typical phenomenon of economies with high tax evasion as the collection of the former is somewhat easier for the administration. Burden from both taxes falls on households (although note that some of the VAT is paid by corporations).

Figure 2 Tax rates and total income tax base by percentile, 2005



Source: own calculations based on administrative tax records

[3] Ministry of Finance, Hungary, Balance sheet of the central government annual budget. Retrieved on 14 January 2009 from www.pm.gov.hu

With respect to the distribution of tax burden in the country: about one third of taxpayers paid the higher marginal tax rate of 38% on some of their total incomes in 2005.

The taxation of entrepreneurs is very complex in Hungary, partly because they can choose between 3 options (with some limitations related to their income levels), partly because these schemes themselves are complicated.

1) Taxation based on fix cost share ("átalányadózás")
2) Taxation based on entrepreneurial income („vállalkozói jövedelem alapján történő adózás")
3) Simplified Business Tax, SBT („EVA")

13% of the entrepreneurs paid tax under the SBT scheme in 2005. 69% of total entrepreneurs[4] paid taxes under 2, which also implies and item-by-item cost deduction[5]. Within this group, 85% of entrepreneurs report incomes around or below the minimum wage, according to the calculations of the Ministry of Finance. Only less than half of the entrepreneurs return financial gains (APEH 2007). These latter figures highlight the probability of tax evasion, given that these figures tend to occur over a number of years, and 2004-2006 were not years of recession.

4 Data and methodology

Our estimation of income underreporting is based on two datasets: a random sample of unaudited administrative tax records and the Household Budget Survey (HBS) of the Hungarian Central Statistical Office, both containing data on the 2005 incomes.

We compare incomes reported to the tax authorities with those declared in the surveys. The ratios of underreporting are calculated by region and source of income. We then feed these so-called adjustment factors into the tax-benefit microsimulation model (EUROMOD) in order to calculate how tax evasion affects the distribution of incomes

The sample of administrative tax records (also referred to as APEH, reflecting the name of the tax authority) includes 227.688 individuals, about 5,4% of total taxpayers in the country[6]. The data refer to annual incomes from 2005. The sample size falls to 217,530 in the sample used for analysis. We top-coded the dataset by excluding those taxpayers who have incomes (any type of income) above the highest value in the survey data.[7] We also excluded taxpayers with zero taxable income[8]. The dataset includes both records from self-declaration and from declaration made by employers. The tax records include some socio-demographic

[4] Based on the statistics of the Tax Authority, about 12% of entrepreneurs did not report any tax payment in 2005, therefore do not belong into any of the above three categories. Total number of entrepreneurs includes these as well.

[5] Source: APEH (2006) and Taxation statistics from www.apeh.hu (date of access: 15 January, 2009.)

[6] There were only 4,37 million taxpayers in 2005, 44% of the total population, out of which 4,2 million had tax base taxed under the progressive tax system (APEH 2006). This later is our reference population.

[7] We excluded taxpayers with total income tax base above 26,88 million HUF, wage income above 19,67 million HUF, self-employment income above 24 million HUF and other taxable income above 7,21 million HUF. Altogether these make up about 0,2% of the sample.

[8] We use a broad definition of taxable income including income subject to the progressive tax scheme + separately taxed self-employment income (tax base of SBT is not included). Note that other separately taxed income, such as capital income is not included.

characteristics of individuals, including age, sex, ZIP code, and for a smaller sub-sample the number of dependants, and occupation.

The HBS dataset includes 24.549 individuals in 9058 households. Income data is collected from household members aged 16 and over, while demographic information is available on all members. The income reference period is the calendar year of 2005. Note than an alternative income survey, the EU SILC, has been chosen as the dataset for the Hungarian version of the EUROMOD, the European tax-benefit microsimulation model. As this paper uses EUROMOD as a means for estimating the incidence of income tax evasion, choosing the EU SILC for estimating underreporting would have been a logical choice. Our preliminary calculations, however, showed that income data is not detailed enough and also some measurement errors bias the calculations, which hindered the comparison with the tax audit data. Thus, we concluded that using the HBS data would provide more appropriate estimates, which could then be used in the EU-SILC based microsimulation model.

The results of the analysis crucially depend on the comparability of the two datasets: both in terms of the target population and in terms of income. Initially we thus assessed the comparability as such.

The main differences of the datasets are the following: (1) HBS is based on voluntary participation, while the filing of tax records is a legal obligation for those with taxable incomes; (2) under-sampling of high-income households may be present in the HBS due to non-response, thus underestimating top incomes and the extent of inequality; (3) incomes in the HBS are self-reported, thus recall errors might occur (respondents not remembering correctly); (4) while the sampling unit is the household in the HBS, it is the individual in the tax records, and household composition cannot be reconstructed in the latter due to the lack of relevant information.

Similarities of the datasets: (1) both include personal incomes with reference to the calendar year of 2005, and incomes are measured on an annual basis (rather than e.g. on a monthly basis); (2) information on gross income is available in both; (3) both datasets include basic demographic information on respondents, including sex, age, region, employment status (employee or self-employed). These features ensure that the two datasets are actually comparable. Having concluded this way, we then went on creating comparable reference populations and the income concepts.

We created a comparable reference population in the two datasets, by (1) assuring the representativeness of the tax records sample, and by (2) reconciling the taxpayer population identified in the two datasets.

We thus reweighted the tax records sample on the basis of aggregate data on the entire population of taxpayers. The weights were calculated on the basis of region and employment status.

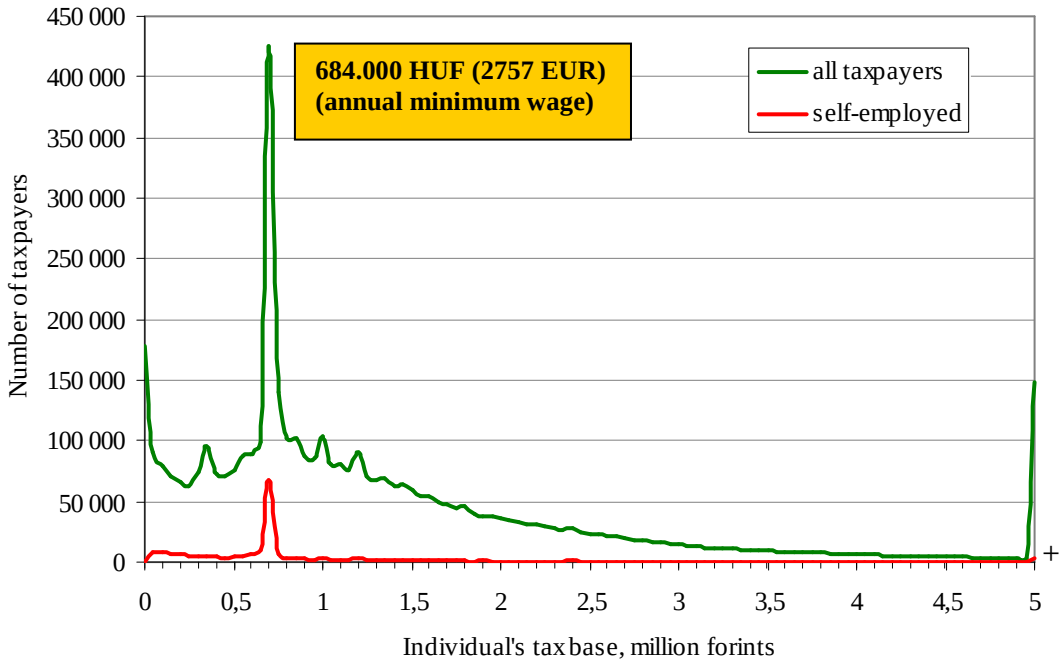
The reweighted tax sample had to be reconciled with the HBS by restricting the latter sample to taxpayers. We thus reduced the HBS sample to those who had positive taxable income and declared to have fulfilled a tax report[9]. This reduces the sample size to 9313. This is a good approximation of Hungarian taxpayers, because most social incomes, including pensions, universal family benefits and other cash transfers, were tax exempt and not reported to the tax

[9] The variable indicating the amount of "tax liabilities" was not a missing value.

authorities in 2005. It also implies that pensioners are only included in case they have employment incomes (besides pensions). Even in this case the pension remained tax exempt.

We find a significant spike around the minimum wage in the tax dataset (Figure 3). This seems to signal tax evasion. According to Elek et al (forthcoming), as mentioned before, around 50-60% of those reporting the minimum wage underreported their income by about 1/3 on average in 2003.

Figure 3 The minimum wage spike. Frequency distribution of taxpayers in the tax data



Source: own calculations based on administrative tax records, data referring to 2005

The definition of income compared in the two datasets is gross personal taxable income. It is gross, thus before the payment of taxes. It is personal, rather than household level, which adequately matches the individual based taxation system in Hungary. It is taxable, thus it refers to positive incomes subject to tax (as explained before). As pensions and benefits are exempt from tax, we did not include them in our definition of the taxable income. Note that capital incomes are not included in the definition of incomes used here[10].

We created two main income variables in the datasets, including (1) wage income, and (2) self-employment income. (1) *Wage income*[11] refers to employees, and all their employment related incomes that are part of the tax base. (2) *Self-employment income* is the sum of wage income from self-employment and other incomes from self-employment, e.g. dividend income.

[10] Evasion of capital incomes might pose an interesting research question, but these incomes are not included in the income survey, probably due to the fact that their accurate measurement is not easy.

[11] In Hungary insurance based maternity benefits (TGYAS and GYED) are to be taxed and these sources of income are declared as wages. Therefore in the HBS we also included these benefits in wage income, whereas in the tax records they are already included. This is likely to result lower-bound estimates for income underreporting.

We then calculated the ratio of underreporting by comparing incomes in the tax data and the survey by region and by type of income.

Table 4 Adjustment factors indicating income underreporting by region and type of income

	Employment income	Self-employment income
Central Hungary	0,960	0,211
Central Transdanubia	1,000	0,337
WestTransdanubia	0,976	0,270
South Transdanubia	1,000	0,255
Transdanubia	1,000	0,288
North Hungary	1,000	0,345
North Great Plain	1,000	0,387
South Great Plain	0,955	0,304
Great Plain and North	0,990	0,342

Note: The estimated adjustment factors for employment income in Central and South Transdanubia, North Hungary and North Great Plain (1,035, 1,045, 1,019 and 1,003 respectively) were recoded to 1, thus excluding the possibility of over-reporting to the tax authorities.
Since information is available only for three main regions (NUTS1 level) and two main types of income in the microsimulation database (EU-SILC), the number of adjustment factors was limited to six.

These estimates are then used in the tax-benefit model in order to assess the likely distributional implication of tax evasion. Income underreporting as such modifies total household incomes, but the impact is largely dependent on the tax system and also on the system of cash benefits. The use of tax-benefit model allows us to account for (i) the complexity of the tax system, including the fact that only some income components are subject to tax, while others are not, (ii) a potential interaction between specific cash and tax policies (benefit entitlements may also change as a result of tax evasion).

In sum, we aim to estimate the distribution of "net income", calculating net incomes in the following way.

$$Y_{net} = Y_{reported} * (1- t) + Y_{hidden} + Y_{social}$$

Where Y_{net} is total personal disposable income for individual i, $Y_{reported}$ refers to reported income, t is the total tax rate, Y_{hidden} is the income not-reported to the tax authority, and Y_{social} is the amount of social transfers received by individual i. Note that in the Hungarian case $Y_{reported}$ consists of only labour income (and not social benefits), and Y_{social} is non-taxable, with the exception of insurance-based maternity benefits, which are included in labour incomes.

5 Results

In this section we present our estimates based on EUROMOD, the European tax-benefit microsimulation model (see Immervoll et al 1999, Lietz and Mantovani 2007). This model includes all major direct tax and cash benefit policies in 2005, thus allows us to consider the complexity and interaction of these. In addition to the policy rules, the model includes a nationally representative household dataset, which enables the user to assess the impact of specific policy measures (or their changes) on the total population[12]. In our case, we do not model policy change as such, but rather a change in one of the basic assumption of

[12] On the principles of microsimulation, see Benedek and Lelkes (2007).

microsimulation models, that of full compliance. Using our adjustment factors for income underreporting we are able to assess the impact of tax evasion on the budget, but also on individuals' incomes and their distribution.

Table 5 Under-reporting by level of income

	"True" income	"Reported" income	Difference*
1 (poorest)	9.151	8.370	-8,5%
2	27.268	25.444	-6,7%
3	51.018	45.079	-11,6%
4	61.258	56.021	-8,5%
5	72.392	67.537	-6,7%
6	88.172	81.747	-7,3%
7	108.273	100.241	-7,4%
8	131.844	119.771	-9,2%
9	171.236	156.329	-8,7%
10 (richest)	360.343	303.597	-15,7%
top 1%	1.023.299	757.892	-25,9%
top 0.1%[13]	3.337.049	2.038.363	-38,9%
total	107.444	95.764	-10,9%

Notes: Mean income by income group is monthly gross personal income in national currency (forint). "True" income is as observed in the EU-SILC 2006. "Reported" income is adjusted for under-reporting using EUROMOD and the adjustment factors presented in Table 4, recalculated for the 3 NUTS1 regions. Income quantiles were generated based on "true" income, excluding those earning zero or negative incomes.
* The difference between the means is statistically significant for all income groups at a 1% level (expect for the top 0.1% where it holds at 5% level).

First we present evidence on underreporting by income groups. As shown by Table 5, the average rate of underreporting for the total population is about 11%. Income underreporting is the highest among the richest decile (about 16%) and the third decile (around 12%), around the value of the minimum income[14]. This is attributable to the prevalent minimum wage spike, shown in Figure 3. The top income groups might conceal even more, although these estimates need to be interpreted with caution due to the small number of observations, in particular in the top 0.1%. Note that as income surveys typically underestimate top incomes (partly due to non-response among the very rich), tax evasion among them is likely to be even higher than shown here. Our estimates are lower bound due to our methodology as well, as capital incomes are not considered, while these are likely to make up a relatively higher share of the total incomes of the affluent households. Thus, the rich benefit the most from income tax evasion, not only in monetary value but also proportionately as well.

[13] The estimate is based on a small number of observations, 8 cases, which warrants for caution with the interpretation.
[14] The value of minimum wage was 57000 in 2005. The definition of income used here includes cash benefits as well as wages. This explains why the mean income in the third decile group is below the value of the minimum wage.

Table 6 Under-reporting by main source of income, region, age and gender

	Population share	"True" income	"Reported" income	Difference*
Employment status				
Wage earners	78,2%	115.153	111.954	-2,8%
Self-employed	9,2%	148.301	51.296	-65,4%
Pensioners	7,1%	36.976	33.143	-10,4%
Region				
Central Hungary	26,0%	142.874	122.635	-14,2%
Transdanubia	32,2%	102.096	93.609	-8,3%
Great Plain and North	41,8%	89.549	80.728	-9,9%
Gender				
Female	47,9%	94.355	87.927	-6,8%
Male	52,1%	119.481	102.971	-13,8%
Age				
16-29 yrs	23,3%	82.676	78.554	-5,0%
30-44 yrs	35,8%	118.778	105.492	-11,2%
45-59 yrs	33,6%	121.420	106.501	-12,3%
60+ yrs	7,3%	66.630	53.571	-19,6%

Notes: Mean income by income group is monthly gross personal income in national currency (forint). "True" income is as observed in the EU-SILC 2006. "Reported" income is adjusted for under-reporting using EUROMOD and the adjustment factors presented in Table 4, recalculated for the 3 NUTS1 regions.
* The difference between the means is statistically significant for all groups at a 1% level.

Tax evasion is pervasive among the self-employed[15]: about two thirds of their incomes are not reported as a tax base to the tax authority. Based on their true income self-employed earn either around the minimum wage or are at the top of the distribution, whereas based on the reported income around 2/3 of entrepreneurs belong to the bottom three deciles. Self-employed report their total income in two parts, wage income and capital income. Their wage income, that is subject to the progressive tax base and social security contributions, is underreported by around 80% while the capital income part is underreported by around 45%. The latter is the basis of corporate income tax and the respective marginal effective tax rate is lot lower in general.

In contrast, employees seem to comply with tax rules at large, with an overall rate of 2.8% tax evasion. Employees have little leeway for underreporting incomes due to the reporting duties of employers towards the tax authority, except for employees who have some (a minor share of) self-employment incomes, which are also included here. There is 10.4% underreporting among those whose main income source is pensions, due to those within this group who work as self-employed (as well as receive pensions). Our calculations (not shown here) highlight that one third of this pensioner group is of working age (below 60), referring to the high number of invalidity pensioners in the country many of whom do actually continue working, often on the informal market.

Underreporting is the highest in the highest income region, Central Hungary (including Budapest). This may be explained with the higher share of those economic sectors particularly prone to tax evasion. Much of the construction industry and the service sector can be found around the capital, in the highest income region. Transdanubia, as well as Budapest, are favoured for tourism.

[15] We define self-employed as those whose main income source is income from self-employment.

Tax evasion is higher among men and increases by age. This is partly a composition effect: (i) men tend to be over twice as frequently entrepreneurs than women, (ii) there are more self-employed among those aged 60 or over than in younger age groups. Our calculations also show that men underreport both wage income and self-employment income more than women do and the elderly underreport more. Similarly, men and the elderly were found to be more likely to evade payroll and income taxes (Kriz, Meriküll et al. 2007). Based on a specific survey on Hungary, Tóth (2008) also finds that men tend to underreport wages more than women, while he concludes that envelope wages are more widespread among young and middle-aged people than old.

Note that we consider only the tax-payer population here, thus pensioners without labour income do not (cannot) evade tax as pensions were tax exempt in 2005. Thus age and gender differences can be explained by the higher tax evasion of self-employed in this model.

Table 7 Fiscal and distributional implications of tax evasion

	Full compliance	Tax evasion	Difference
Personal income tax receipts (billion HUF, annual)	1.119	902	-19,4%
Poverty line (HUF, monthly)	45.279	46.822	3,4%
Poverty rate (FGT a=0)	14,8	14,6	not sign.
Poverty gap (FGT a=1)	3,4	3,3	not sign
Gini	0,274	0,292	6,8%
S80/S20	4,020	4,320	7,5%
Atkinson e=0.5	0,064	0,076	17,9%
Atkinson e=2	0,235	0,253	7,6%
Theil	0,139	0,173	24,5%
Kakwani	0,259	0,231	-10,8%
Reynolds-Smolensky	0,073	0,053	-26,9%
Suits	0,294	0,254	-13,5%

Notes: full compliance provides estimates of income tax variables assuming incomes are reported to tax authorities as observed in the EU-SILC. Tax evasion provides estimates of the same variables assuming incomes are under-reported to tax authorities by the adjustment factors shown in Table 1. FGT refer to the Foster Greer Thorbecke family of poverty indices.
Income concept: equivalised household income, monthly.
Difference in the poverty rates and the poverty gaps under the two scenarios are not statistically significant.
The actual amount of personal income tax receipts in the state budget was 1.207 billion forints in 2005 (APEH 2006). It includes tax on other types of incomes (e.g. agricultural incomes, intellectual activities) which are not measured accurately in the EU-SILC survey.

The fiscal implications of tax evasion are substantial; the "tax gap", the difference between the taxes households actually owe and what they report, equals about 220 billion forints. Revenues fall short by about 19%. This figure is somewhat higher than the Ministry of Finance estimate, quoted by the Worlbank report (Worldbank, 2008) which estimates the tax gap to be above 10%. The microsimulation model somewhat underestimates the total budget revenue from income taxes, which was 1.207 billion forints in 2005 (APEH 2006), due to data limits. For specific incomes types, the number of observations is very small, for some others, there are measurement errors (e.g. property incomes, agricultural incomes, intellectual activities). On the other hand, certain tax rules (especially tax credits) are simplified in the model, as there is no adequate information in the income survey (e.g. on donations to charities). These modelling features, however, are not likely to affect the estimated implications of tax evasion as such, as they are expected to affect the results under both scenarios equally.

Income inequality is significantly higher under tax evasion. The Gini coefficient and the quintile ratio increase by 7-8%. This has two major implications. First, high earners tend to evade proportionately more, and second, progressivity of the tax system is lower under tax evasion than intended. This is confirmed by the indicators measuring progressivity.

Tax evasion reduces the progressivity of the income tax system to a rather large extent. All indices of progressivity suggest that the income tax evasion reduces progressivity. The Kakwani and Suits indices indicate a decline of 11-14%, while the Reynolds-Smolensky an even greater, 27% fall. In these calculations we consider the impact of both personal income taxes and social security contributions, thus all taxes on labour at the employee level. Note that we measure progressivity of (equivalised) household incomes, rather than personal incomes. Equivalised household income is a better proxy for individual resources, as individuals live in households and share incomes. The use of (equivalised) household income for measuring tax progressivity is clearly a virtue of tax benefit microsimulation models as normally information on tax payments (e.g. in tax records) cannot be linked to household structures or other sources of household incomes.

By international comparison, tax evasion is rather high, but not outstanding. In Greece, the tax gap with respect to personal income taxes was found to be 25% (Matsaganis and Flevotomou 2008). The tax gap (of all federal taxes, not simply income taxes as in our case) in the US was estimated to be 17.3 % in the early 1990's, and found to be relatively unchanged in the past 20 years (Andreoni et al 1998). Non-compliance was calculated using data from intensive audits conducted on a stratified random sample of tax returns. One third of taxpayers were found to underreport their incomes.

6 Conclusions

The paper estimated the incidence of income tax evasion in Hungary on the basis of a random sample of administrative tax records of 230 thousand individuals, not accessible for research so far. Gross incomes in the administrative tax records are compared with those in a nationally representative income survey, HBS, assuming that tax-evaders are more likely to report their true incomes in an anonymous interview.

A striking feature of income distribution is a pronounced minimum wage spike, which is more pronounced in the tax records than in the income survey, in particular among entrepreneurs.

Our estimates show that the average rate of underreporting is 11%, which conceals large differences between the self-employed (who hide the majority of their incomes) and the employees. Men are more likely to conceal their incomes than women, but it is due to the composition effect: the majority of self-employed is men. These estimates are likely to be lower bound, due to measurement error in the income survey.

The estimated rates of underreporting are then used in EUROMOD, the European tax-benefit microsimulation model to calculate the fiscal and distributional implications of underreporting, comparing the scenarios of full compliance to that of tax evasion, while taking account of all major direct taxes and cash benefits and their interactions. Tax evasion reduces fiscal revenues from personal income taxes by about 19%. While poverty does not change under tax evasion, income inequality becomes significantly higher (the Gini coefficient and the quintile ratio increase by 7-8%), suggesting that high earners tend to evade proportionately more. This implies that the progressivity of the tax system is lower under tax

evasion. The effects are rather large, as shown by various indices of progressivity, suggesting a decline of 11-26%.

In the policy debate, tax evasion is often attributed exclusively to the high level of taxes in Hungary, or to a culture of free-riding by citizens. Although the level of taxes undoubtedly influence labour costs, thus the profit and competitiveness of businesses, and declared income (Bakos-Benczur-Benedek 2008). On the other hand, as shown by the literature, higher marginal tax rates are not necessarily associated with larger unofficial economy in a cross-country comparison (Friedman et al 2000). To the contrary: higher taxes were found to be associated with more tax revenue, a stronger legal environment and less unofficial activity (p. 481). Various alternative explanations may also hold. There may be a dominant culture of non-compliance, whereby individuals are not likely to pay if they believe that their compatriots do not pay either. In order to (perhaps slowly) turn this behavioural game into a cooperative one, the perception of government activities and services pays a key role. Institutional weaknesses, including corruption[16], the low perceived quality of government services, the limited public information on the rather complex system of public finances, including the complexity of the tax system itself, the unpredictability of fiscal policy need to be addressed. All in all, tackling the problem of tax evasion needs a coordinated and conscious effort by the government. Relying on ever stronger penalties is unlikely the produce landslide outcomes.

[16] As stated by Friedman et al "corrupt governments become small governments and only relatively uncorrupt governments can sustain high tax rates" (p. 459).

Annex A. Descriptive and summary statistics

Table A1. Descriptive statistics of the HBS sample

Variable	Total sample		Sample used for analysis	
	mean	Std. dev.	mean	Std. dev.
Variables from original data (HUF)				
Imputed entrepreneurial income	9 256	120 075	23 909	192 360
Income from main employment	575 280	1 009 254	1 395 993	1 229 938
Income from secondary employment	2 437	48 217	6 292	77 676
Income from self-employment (wage like)	46 962	394 777	123 276	633 143
Income from enterprise (wage like)	25 027	264 693	65 761	426 251
Dividend from entrepreneurship	2 409	60 025	5 980	91 984
Income from one-off contract	1 047	26 269	2 752	42 592
Income from intellectual activies	645	29 968	1 593	48 367
Income from occasional employment	21 528	118 916	17 898	111 945
Tip	702	19 089	1 281	27 218
Maternity benefit (GYED)	7 077	68 855	18 384	109 922
Maternity benefit (TGYÁS)	1 000	22 998	2 635	37 283
Income tax*	318 619	459 030	321 981	462 428
Computed variables used for calculations (thousand HUF)				
Wage income	590	1 013	1 434	1 213
Entrepreneurial income - part of tax base	71 989	527 529	189 036	842 979
Entrepreneurial income - separately taxed	9 256	120 075	23 909	192 360
Other income part of tax base	26	147	29	176
Tax base	688	1 129	1 652	1 320
Total entrepreneurial income	81	568	213	907
Total taxable income (tax base + separately taxed)	697	1 144	1 676	1 337
Other variables				
Entrepreneur	0,04	0,19	0,10	0,30
Age	37,18	20,83	41,21	11,04
Agegroup	1,97	1,31	2,26	0,78
Sex (1=female)	0,53	0,50	0,50	0,50
Region	3,80	2,23	3,52	2,23
Observations	24 549		9 313	

* Total sample mean calculated for 9517 observations, missing for the rest

Table A2. Descriptive statistics of the APEH sample

Variable	Total sample		Sample used for analysis		Sample used for analysis, with weights	
	mean	**Std. dev.**	**mean**	**Std. dev.**	**mean**	**Std. dev.**
Variables from original data (th HUF)						
Wage income	1 394	2 081	1 416	1 579	1 447	1 634
Severance pay	4	71	4	65	4	67
Severance pay from earlier years	2	54	2	51	2	49
Other wage income	22	195	22	134	22	132
Other income from other non-independent operation	44	427	40	247	42	252
Income from intellectual activies	5	132	4	82	5	90
Income from other sources	8	705	5	84	5	89
Wage-like entrepreneurial income	25	153	26	157	26	152
Income fro individual acitivites	17	162	17	132	19	142
Entrepreneurial income subject to flat rate	2	32	2	33	2	33
Other entrepreneurial income	6	188	6	154	6	156
Computed variables used for calculations (th HUF)						
Total wage income	1 416	2 089	1 438	1 577	1 469	1 632
Entrepreneurial income - part of tax base	25	153	26	157	26	152
Entrepreneurial income - separately taxed	8	190	8	158	8	159
Other income part of tax base	80	875	73	322	77	334
Tax base	1 521	2 365	1 537	1 601	1 571	1 658
Entrepreneurial income	33	271	34	251	34	249
Total taxable income (tax base + separately taxed)	1 530	2 372	1 546	1 608	1 579	1 665
Other vars.						
Entrepreneur	0,06	0,24	0,06	0,24	0,06	0,24
Age	41,13	12,23	40,82	11,85	40,97	11,95
Agegroup	2,26	0,86	2,24	0,84	2,25	0,85
Sex	0,52	0,50	0,52	0,50	0,52	0,50
Region*	3,53	2,20	3,51	2,19	3,21	2,22
Observations	227 688		217 530		189 459	

* Region data only available for 198452 from the total and 189459 from the working sample

Table A3. Main characteristics of the taxpayers in administrative and survey datasets

Number of observations

APEH				*HBS*			
regions	*employed*	*entrepr*	*total*	*regions*	*employed*	*entrepr*	*total*
Central Hungary	55097	3465	58562	Central Hungary	2481	378	2859
Central Transdanubia	18632	1279	19911	Central Transdanubia	963	86	1049
WestTransdanubia	18017	1266	19283	WestTransdanubia	992	123	1115
South Transdanubia	21320	1314	22634	South Transdanubia	630	55	685
North Hungary	18977	1148	20125	North Hungary	1070	79	1149
North Great Plain	24161	1650	25811	North Great Plain	1094	102	1196
South Great Plain	21556	1577	23133	South Great Plain	1142	118	1260
Total	177760	11699	189459	Total	8372	941	9313

Share (%)

APEH	*employed*	*entrepr*	*total*	*HBS*	*employed*	*entrepr*	*total*
Central Hungary	29%	2%	31%	Central Hungary	27%	4%	31%
Central Transdanubia	10%	1%	11%	Central Transdanubia	10%	1%	11%
WestTransdanubia	10%	1%	10%	WestTransdanubia	11%	1%	12%
South Transdanubia	11%	1%	12%	South Transdanubia	7%	1%	7%
North Hungary	10%	1%	11%	North Hungary	11%	1%	12%
North Great Plain	13%	1%	14%	North Great Plain	12%	1%	13%
South Great Plain	11%	1%	12%	South Great Plain	12%	1%	14%
Total	94%	6%	100%	Total	90%	10%	100%

Number of observations

APEH	*employed*	*entrepr*	*total*	*HBS*	*employed*	*entrepr*	*total*
male	95606	8203	103809	male	4013	628	4641
female	108201	5520	113721	female	4359	313	4672
Total	203807	13723	217530	Total	8372	941	9313

Share (%)

APEH	*employed*	*entrepr*	*total*	*HBS*	*employed*	*entrepr*	*total*
male	44%	4%	48%	male	43%	7%	50%
female	50%	3%	52%	female	47%	3%	50%
Total	94%	6%	100%	Total	90%	10%	100%

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