The Evolution of Tax Evasion in the Czech Republic: Markov Chain Analysis

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Abstract

This study departs from standard analyses of tax evasion which ask why people evade. We seek instead to measure the average individual's transitions between evading and not evading and use this to predict the evolution of tax evasion for the Czech Republic with the help of surveys taken in 2000 and 2002. We asked each respondent whether he evaded taxes in 1995, 1999, 2000, and 2002. The answers to our questions about evasion allowed us to calculate probabilities the average individual will move between being a non-evader and being an evader. This "trasition" probability allows us to predict a rising tide of tax evasion in the next decade. We estimate the reduced form parameters which determine evasion and suggest how government might influence these parameters to prevent the Czech Republic from bogging down in a permanent mire of tax evasion.
 (JEL Codes : H26, H43, K42, O17)

1. Motivation

Most research into tax evasion has focused either on measuring the size of the sector that

evades taxes, or in explaining why people evade taxes. Put differently, most studies of

evasion are concerned with structural equations that predict the partial equilibrium response

of an individual to a change in preferences or incentives. Few have sought to model how tax

evasion evolves. The man who today does not evade taxes may next year decide to deduct

from taxable income the car he uses to take his children to school. Emboldened by his first

dodge he may in later years graduate to the corps of hardened evaders who do not declare

their incomes and so do not need to fuss with receipts for false deductions. Another hardened

evader may decide it is time to quit his stealthy ways and return to the society of taxpaying

citizens. Each year government revenues will vary as millions of individuals slip in and out of

the shadows of evasion. If we could know how likely an individual is to slip between tax-paying and tax-evading status we could draw a line to the future that traces the size and composition of the community of tax evaders. To know this likelihood we need know nothing about why he evades. We can rely on simple time series of his evasive behavior and use these time-series to predict how he will behave in years to come.

To model and track transitions individual make between evading and paying taxes we use non-panel surveys of Czechs we conducted in 2000 and 2002. We asked respondents whether they evaded never, sometime, or frequently and used this information to classify individuals as evaders or non-evaders. We asked 2000 respondents this question for 1995, 1999, and 2000, and we asked 2002 respondents these questions for 1997, 2000, 2002. By asking the question for different years we were able to form an idea of how people drift between evading and not evading. Our estimate of the drift allows us to surmise how people might move between these two categories over the next five years. Our results suggest that unless the probabilities of moving between categories changes, a growing number of Czechs will become tax evaders.

To discover how governments might slow the slide to tax evasion we estimate a reduced form equation that shows how evasion will vary with changes in parameters such as age, sex and education, as well as with parameters that government may control, such as the probability of being caught evading and the penalty for evading. Such "kitchen-sink" equations are of little value for understanding partial equilibrium behaviour, but they are useful for predicting how some parameters under the government's control will sway individuals away from evading.

The plan of the present paper is first to discuss the dataset on which we base our analysis, and then to use this data to forecast how tax evasion will evolve if government does nothing to change the parameters which influence an individual's choice to evade. Finally, we estimate the parameters of the individual's choice to evade and use these to perform simulations which show how government might stem the rising tide of evasion our data predict.

2. Data on the Czech Republic

Our data come from two, multi-thousand person surveys of Czechs carried out in 2000 and 2002. Summary statistics of all variables used in the survey as well as the survey questions are available in Hanousek and Palda (2002).[1] Our survey is similar to that of Fortin et al. (2000). The technique they used was to conduct interviews (in our case face-to-face interviews) to gather information about how much tax people evade and why they evade. The Fortin et al. survey differed from ours in that it did not ask questions that would allow a researcher to infer the dynamics of tax evasion. Fortin et al. were interested in the link between buying goods and services on which taxes were not declared. We present a detailed analysis of our dataset elsewhere (Hanousek and Palda 2002), but the main features of tax evasion to note are that it is primarily a function of life-cycle (rising until late middle-age, then falling), is primarily a male activity, and is highly associated with part-time work and unemployment.

The main questions of interest for the present paper were those which asked people how often they evaded taxes. We gave them the option of answering never, sometimes, often. Tables 1a and 1b derive from our 2000 and 2002 surveys of Czechs and shows the frequency with

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[1] Detailed description of the surveys including questionnaires, summary tables and results explicitly mentioned in the text are available from authors upon a request or at http://home.cerge-ei.cz/hanousek/evasion .

which people answered they evaded taxes for varying years. We calculated 95% confidence intervals for each category of evasion, (the details of which may be had in the technical appendix). We found that the incomes of those who answered sometimes and never were statistically indistinguishable, as were most of their other demographic features. With little to distinguish these two groups of evaders we decided to merge them into one category which we call "evaders." We have decided to do away with the distinction between frequent and sometime evaders because we have found it puts excessive demands on the data for dubious gains in distinguishing why people shift between the subjective categories of frequent and sometime evasion.[2]

Table 1a, summarizes our 2000 survey of 1062 Czechs, to whom we asked whether they evaded taxes in 1995, 1999, or 2000. The graphic illustration in Figure 1 just below it, shows a significant upward tendency in the number of those who say they evaded, and a significant downward tendency in those who say they never evade.. Table 1b summarizes our year 2002 survey and shows a remarkable consistency with the 2000 survey, even though the respondents were drawn at random at two years apart. Particularly heartening is that the responses of those questioned in 2002 about their evasion in 2000 are statistically indistinguishable from what year 2000 respondents said about their 2000 evasion. It seems the retrospective data of the 2002 survey is as good as the contemporary data of the 2000 survey.

3. How Tax Evasion Evolves

Our retrospective data allow us to project future tax evasion using either survey. To see how tax evasion will evolve in the Czech Republic we focus on the probability of changing

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[2] An earlier version of this paper which analyzed all three categories of evasion is available at http://home.cerge-

between states of evasion. A proportion of the new labor force arriving on the market will not evade and others will jump to evading. Those who are not new to the labor force and do not evade can make similar jumps. Those who evade may jump to not evading. These flows in and out of tax evasion can be summarized by the following 2x2 "stage/transition matrix" for each individual

Tax evasion		2000	
		Evade	*Never evade*
1995	*Evade*	P_{ee}	P_{en}
	Never evade	P_{ne}	P_{nn}

Each cell gives for an individual the probability he will go from one state in 1995 to another state in 2000. For example, $P_{e,n}$ gives the probability an individual who evaded in 1995 will never evade in 2000. Each individual will have a different transition probability from other individuals. To precisely estimate how total evasion will evolve in society we would need to calculate a stage-transition matrix for each individual and then see what "percentage" of that individual (singular) moves from cell to cell. We would then add all these percentages in each year to arrive at the total number of evaders in each of the two categories. A simpler, though slightly less precise way of arriving at the same calculation is to simply calculate the aggregate transition probabilities. This is easily done by calculating the percentage of people who moved from cell to cell between 1995 and 2000. The aggregate probabilities are slightly less accurate than if we used a transition matrix for each individual, but given the large numbers we surveyed, the central limit theorem suggests that the variance of our calculations

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around the true mean (provided that individual transition probabilities are uncorrelated with each other) will not be far off their true values.

Our technique for predicting the evolution of tax evasion is new and needs to be considered in the context of past research on evasion. The work of Allingham and Sandmo (1972), Watson (1985), Jung et al. (1994), Yaniv (1994), others hold that tax evasion is seen as a risky decision. Agents weigh the risk of detection against the gains from evasion. These models are mainly concerned with optimal audit and detection policy as in the literature on the economics of crime and do not model tax evasion over extended periods. Engle and Hines (1999) have built on these previous models to simulate and test a model of long-term evasion dynamics in the US using aggregate data. Those outside the US Internal Revenue Service do not know the basis upon which that service decides to audit taxpayers, but surmise that a taxpayer's probability of being audited is an increasing function of his current evasion. Engle and Hines (1999) build this surmise in their model in which a taxpayer's current evasion is a decreasing function of prior evasion, "since if audited and caught for evading this year, the taxpayer may incur penalties for past evasions." Aggregate evasion shows cycles if a sufficiently large number of individual taxpayers cycle together, as happens under the influence of aggregate shocks which tend to influence all in the same direction. In the absence of such shocks Engle and Hines find the interesting result that the cross-section of evasion rates converges to a steady state and aggregate tax evasion approaches a limit even though individual rates cycle. The distinction between aggregate and individual cycles arises because an individual's steady state is conditional on not being audited, while the economy's steady state is conditional on a distribution of individual audits across taxpayers with differing evasion histories. The distinction between aggregate and individual cycles in tax evasion is similar to the distinction between family and societal sex ratios.

We can use Engle and Hines' (1999) insight that tax evasion converges to a steady state to draw conclusions about the evolution of tax evasion in the Czech Republic. Engle and Hines used their model to examine continuous aggregate data on tax evasion. Our data is on individuals and is discrete and spans five years during which we can see how the respondent jumped between the categories of evading and not evading. As far as we know, such a dataset is unique.

We can set the above framework into action by considering Table 2a which shows the probability than an individual who was in any of two possible states of evasion in 1995 will either remain in that state or move to another state. To read this table consider the second large cell of the second row, first column. This cell indicates that of those who never evaded in 1995, 11.2% were evading in 2000, and that this percentage represents 100 observations in our sample of those who never evaded in 1995. Table 2b can be read in a similar manner. Both these tables are used to project tax evasion out to 2007 (by which time we hope this paper will have made it at least into the revision stage). The first and third column project using the year 2000 survey (Table 2a) and columns 2 and 4 project using the year 2002 survey (Table 2b).

Both surveys show a sustained growth of the underground sector but the 2000 survey shows a 63% growth in the number of evaders whereas the 2002 survey indicates only an 11% rate of growth. The difference can be attributed to the Czech government's 2002 crackdown on evasion. Even though this crackdown changes the transition probabilities for 2002 only slightly from what they were predicted to be using the 2000 survey, such a small change leads to large changes in future evasion.

In calculations not shown here we found that whatever survey we used, the percent of evaders and non-evaders each converge to some constant percentage. Such convergence is similar to Engle and Hines (1999) discovery of a steady state in evasion. Our work goes a step further than theirs in that we use transition probabilities estimated from individual data to make our projections.

So far we have presented projections of tax evasion using the probability of moving between states of evasion between 1995 and 2000, and 1997 and 2002. These should rightly be called "long-term" transition probabilities because they map the individual's change between the starting and ending dates covered by our survey questions. Our data also allow us to calculate short-term transition probabilities which show the tendencies to shift between categories of evasion over the period 1999-2000 (for the 2000 survey) and over the period 2000-2002 (for the 2002 survey).

In simulations not shown here (though available in Hanousek and Palda 2002) we found that long-term transition probabilities make projections which go in the same direction but are less radical than those using the short-term stage-transition matrix. That the results using the long-term stage-transition matrix are less pronounced than those using the short-term matrix may be due to chance. Errors may cumulate or cancel each other over the long term. Nevertheless, short and long term transition matrices set the bounds on what will be actual tendencies, and as Table 3 indicates, the Czech Republic will suffer from a growing number of tax evaders.

4. How to Moderate Tax Evasion

What can Czech governments do to fight against the growing tide of tax evasion predicted by our survey? One strategy is to change the parameters which influence tax evasion. To influence these parameters both governments need a feel for what influences evasion. To get such a feel we could estimate a reduced-form regression for each of the four possible transition probabilities. We have focused on reduced forms because prediction is our goal. Those who wish to predict need not concern themselves with the structural parameters that figure in the steps leading to equilibrium. Once we estimate the parameters associated with the variables driving tax evasion we can ask how one, or a combination of these variables would have to change to reverse the upward trend of evasion.

We have a sufficient number of observations to estimate four transition probabilities but such estimation would be redundant. Rows of the transition matrix add to one. All we need estimate in order to analyze the effects of changes in government policy on evasion are the off-diagonal elements of the matrix.

Readers will wonder how new entrants to the labor force figure in our calculations. Our data give us no way of knowing who is a new entrant. If we assume that entry and exit from the labor force bear a stable relation to each other and that entry and exit from the labor force is uniformly distributed over evasion categories, we need not consider explicitly the rates of entry and exit from the labor force in our calculations of how tax evasion will evolve. Some indirect evidence in support of this surmise comes from our survey, which shows that those

who evade often and those who evade occasionally have statistically indistinguishable average incomes.

The off-diagonal elements of the transition matrix we wish to analyse (P_{en}, $P_{n,e}$) are discrete. Discrete data, as McFadden and Domenich (1975) emphasize, call for us to model the individual's choice in a probabilistic framework. The decision to evade taxes and to move between categories of evasion depends on one's propensity to evade. This propensity depends in turn on the characteristics of the individual Z (a vector), the penalties for evasion Pe, his perceived risk of apprehension R, and some unobserved characteristics of the individual U. Deaton and Muellbauer (1984) show that if the unobserved characteristics enter linearly in the utility function, then provided the difference between the unobserved component of the utility of evasion and the utility of paying taxes lies above a certain threshold, the individual will begin to evade, or if already evading, will change evasion categories. Because the U's are unobserved the researcher must infer from their distributions the probability an individual will evade. The individual's choice is not probabilistic, but rather the researcher's ability to know the characteristics of each individual is sketchy, so that he can only talk of his model's ability to attach a probability to an individual's decision to evade. $P_{n,s}(Z,Pe,R,U)$ is a function of the above-mentioned parameters of the individual's choice.

Table 4 shows the logit regression for the off-diagonal element P_{ne} of the stage transition matrix. We need not consider the regression P_{en} due to symmetry. There are many possible candidates for variables that might influence the transition probabilities. We must choose only the most likely candidates for inclusion in our equations because maximum likelihood is a technique whose appetite for data rises exponentially as we add parameters to be estimated.

Demographic variables such as age and sex are standard proxies for the vector of individual characteristics *Z*. We also include a number of regional variables such as town size. Recall that we are in pursuit of a reduced form equation. Only prediction of tax evasion interests us. The structural parameters of evasion are not the topic of this paper.

The equation in Table 4 was estimated with data from our 2000 survey as well as with data from our 2002 survey. The variable *2000 dummy* takes the value of one if an observation is from 2000 and zero if an observation is from the 2002 survey.

The exercise for a government concerned about the entry of previous non-evaders to the world of tax evasion is to estimate the parameters of the equation $P_{n,s} = P_{n,s}(Z,Pe,R,U)$ and then to imagine how a change in the independent variables would affect the stage transition probability $P_{n,s}$.

We discovered four variables of individual significance in our logits.

1) If an individual believes his family's economic situation has degraded from the year before he is 4.6% more likely to move from never evading to sometimes evading. This finding is interesting because it suggests that a government which identifies individuals whose economic situation degraded may perhaps raise, or at least not lose revenue in the long-run if it cuts taxes for the afflicted groups.

2) Women are 4.1% less likely to evade than are men. Data from the ministry of labour of the Czech Republic show a growing trend in the female composition of the labour force. The rising trend in female participation will moderate the rise in tax evasion our simulations predicted.

3) Someone who buys goods or services from the underground sector is 9.9% more likely to shift from not evading to sometimes evading than someone who does not buy from the underground sector. As Fortin et al. showed for Quebec, those who consume underground learn the benefits of working underground and some of those who learn the benefits may shift their labour outside the reach of taxation. If the Czech Republic moves into the European Union, the Union may help the Czech Republic prevent the sale of underground goods. Our estimated parameters suggest such restrictions will discourage a significant number of Czechs from learning to become tax evaders.

4) Higher income leads to higher evasion. This is no surprise given the ample theoretical and empirical research that already supports this hypothesis.

Reduced form estimates present themselves without the reproach of being correlated with error terms and their interpretation is not troubled by those critiques that beset structural parameters, but of what use can reduced form estimates be to policy makers? A reduced form variable is a given. Government cannot change the age or the sex ratio of a population. Beliefs about the chance of being caught evading, beliefs about whether it is moral to evade are the structural variables that a government could influence.

5. Challenges and Conclusions

The present paper has presented a model of tax evasion dynamics. We assumed that individuals jump to and from higher and lower levels of tax evasion. We collected survey data which allowed us to estimate the stage-transition probabilities which represent the probabilities of such jumps. Using our estimated probabilities we found that even under the most optimistic scenarios, tax evasion will grow in the Czech Republic. Our data allowed us in a limited fashion to see what variables influence an individual to begin evading taxes occasionally. We found that a rising participation of females in the Czech workforce will

temper future evasion, and that the state may also reduce tax evasion by cutting taxes to those who have recently found their wealth decline. If the state were somehow able to discourage consumption of underground goods, it would in the long-term also discourage production. Those who consume learn how to become evaders. If they do not consume their knowledge of underground networks does not grow and so they are less tempted to become evaders than if they consumed underground.

How seriously should policymakers take these results? The first critique a policy maker would unleash on our model is that we have not really provided at all a model of tax evasion. We have simply assumed transition probabilities without concerning ourselves with the question of what influences these probabilities. Put differently, we assume the stage transition probabilities are fixed. Feedback from the economic environment could change these probabilities. Our simulations do not allow for such feedback. Our dataset gives a way of seeing whether our assumption of fixed probabilities is a far step from the path of reality. We asked questions which allowed us to calculate both short (1 year) and long-term (5-year) transition probabilities. There was a small statistically significant difference between the two. We simulated the future using both probabilities. Table 3 showed that no matter what probabilities we chose, tax evasion would increase. The difference between the simulations seemed small. The relative stability of stage-transition probabilities over the last five years does not guarantee a future stability of such parameters, nor would a government anxious to curb evasion wish to believe in such stability. We estimated a logit regression of the probability of moving between non-evader status and the status of occasional evader. We found that a rising female work-force may significantly change average transition probabilities over the coming years. Government may also be able to influence these probabilities by easing the tax burdens of those whose economic situations have deteriorated.

Our estimation of the parameters underlying the transition probabilities is a partial answer to the critique that we have assumed transition probabilities fixed. We admit the need for further explicit modeling of evasion dynamics, but given the sketchiness of existing models, we believe the present work gives policy-makers a short-to-medium term tool for predicting the path of aggregate evasion and for understanding how to influence that path.

Our use of survey data to pronounce on tax evasion may also provoke criticism. Survey data are subject to selection bias. Only those who evade the least will answer surveys on evasion and their answers will understate how much they evade. We take this as a favorable critique. Our results underestimate trends in tax evasion and so we err in favour of Type I error.

Appendix:

Calculating the precision of our estimates: The sample relative frequencies p_o, p_s, and p_n allow us to construct confidence intervals for underlying probabilities P_o, P_s, and P_n and for a whole transition matrix Π_{ij} . Since we analyze a random sample from the Czech population, population size, N, will refer to several millions, and therefore, we can use the well-known normal approximation (see for example Cochran, 1963) to show that

$$(5) \qquad \frac{p - P}{\sqrt{\dfrac{p(1-p)}{n-1}\dfrac{N-n}{N}}} \approx \frac{p - P}{\sqrt{\dfrac{p(1-p)}{n-1}}} \sim N(0,1),$$

where p and P can refer to p_o, p_s, p_n and P_o, P_s, and P_n , respectively. Hence, a $(1-\alpha)\%$ confidence interval is simply determined by (we use $1/2n$ correction for non-continuous random variables)

$$(6) \qquad p - \frac{1}{2n} - u_{1-\alpha/2}\sqrt{\frac{p(1-p)}{n-1}} < P < p + \frac{1}{2n} + u_{1-\alpha/2}\sqrt{\frac{p(1-p)}{n-1}},$$

where u denotes quantile of the standard normal distribution.

Using this formula, we can see that (retrospectively measured) intensity of participation in underground economy has changed between 1995 and 2000 (we reject hypothesis, that 1995-2000 rates are same.

The above are confidence intervals for any particular instant of the Markov process. What about the confidence interval surrounding a projection T years into the future?

References

Allingham, Michael.G. and Sandmo, Agnar. "Income Tax Evasion: A Theoretical Perspective." *Journal of Public Economics,* 1972, 1, pp. 323-338.

Boadway, Robin; Marchand, Maurice and Pestieau, Pierre. "Toward a Theory of the Direct-Indirect Tax Mix." *Journal of Public Economics,* 1994, 55, pp. 71-88.

Cochran, William G. *Sampling techniques*. 2nd edition, New York: Willey, 1963.

Cox, Dennis. "Raising Revenue in the Underground Economy," *National Tax Journal,* 1984, 37, pp. 283-288.

Cremer, Helmuth and Gahvari, Firouz. "Tax Evasion and the Optimum General Income Tax." *Journal of Public Economics,* 1996, 60, pp. 235-249.

Engel, Eduardo M. R. A. and Hines, James R., Jr. "Understanding Tax Evasion Dynamics." Working Paper: 6903, National Bureau of Economic Research, January 1999.

Feige, Edgar L. and McGee, Robert T. "Sweden's Laffer Curve: Taxation and the Unobserved Economy." *Scandinavian Journal of Economics,* 1983, 85, pp. 499-519.

Fortin, Bernard; Lacroix, Guy and Montmarquette, Claude. "Are Underground Workers More Likely to be Underground Consumers?" *Economic Journal,* October 2000, 110 (466), pp. 838-60.

Hanousek, Jan and Palda, Filip. "Why People Evade Taxes in the Czech and Slovak Republics: A Tale of Twins." Discussion Paper, CERGE-EI, 2002.

Jung, Young H.; Snow, Arthur, and Trandel, Gregory. "Tax Evasion and the Size of the Underground Economy." *Journal of Public Economics,* 1994, 54, pp. 391-402.

Reinganum, Jennifer E. and Wilde, Louis L. "Equilibrium Enforcement and Compliance in the Presence of Tax Practitioners." *Journal of Law, Economics, and Organization,* 1991, 7, pp. 163-168.

Watson, Harry. "Tax Evasion and Labor Markets." *Journal of Public Economics,* 1985, 27, pp. 231-246.

Yaniv, Gideon. "Tax Evasion and the Income Tax Rate: A Theoretical Perspective." *Public Finance,* 1994, 49, pp. 107-112.

Table 1. Values and 95%-confidence intervals for relative frequencies of tax evasion.

A. Results based on 2000 survey: Years 1995, 1999, 2000

Year	Evade	Never evade
1995	15.8%	84.2%
	(13.5%, 18.1%)	(81.9%, 86.5%)
1999	20.3%	79.7%
	(17.8%, 22.9%)	(77.1%, 82.2%)
2000	25.1%	74.9%
	(22.4%, 27.9%)	(72.1%, 77.6%)

B. Results based on 2002 survey: Years 1997, 2000, 2002

Year	Evade	Never evade
1997	23.1	76.9%
	(20.4%, 25.8%)	(74.2%, 79.6%)
2000	25.9%	74.1%
	(23.1%, 28.7%)	(71.3%, 76.9%)
2002	23.9%	76.1%
	(21.2%, 26.6%)	(73.4%, 78.9%)

Figure 1: Graphs for 95% confidence intervals using combined surveys
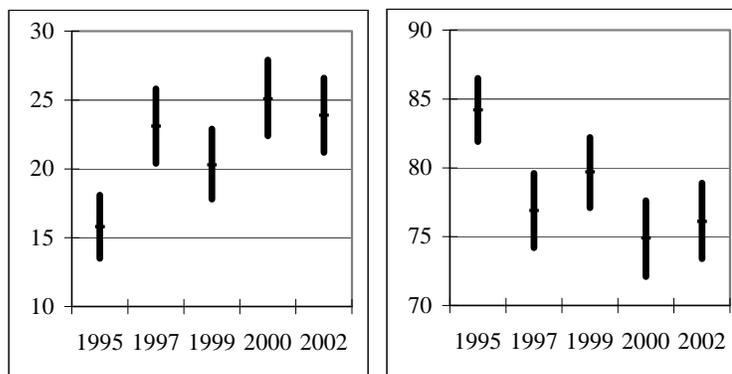
Source: Authors' computation

Table 2. Stage (Long-term) Transition Matrix of Tax evasion in the Czech Republic

A. 1995 versus 2000

1995/2000		Tax evasion in 2000		
		Evade	**Never evade**	**Total**
Tax evasion in 1995	**Evade**	**168** 100,0% 15,8%	**0** 0,0% 0,0%	**168** 100,0% 15,8%
	Never evade	**100** 11,2% 9,4%	**795** 88,8% 74,8%	**895** 100,0% 84,2%
	Total	**268** 25,2%	**795** 74,8%	**1063**

To read this table consider the second large cell of the second row, first column. This cell indicates that of those who never evaded in 1995, 11.2% were evading in 2000, and that this percentage represents 100 observations in our sample of those who never evaded in 1995.

B. 1997 versus 2002

1997/2002		Tax evasion in 2002		
		Evade	**Never evade**	**Total**
Tax evasion in 1997	**Evade**	**194** 81,5% 18,8%	**44** 18,5% 4,3%	**238** 100,0% 23,1%
	Never evade	**73** 9,2% 7,1%	**720** 90,8% 69,8%	**793** 100,0% 76,9%
	Total	**267** 25,9%	**764** 74,1%	**1031**

Source: Authors computation. Data on individuals is weighted to achieve representativity.

Table 3. Estimated probabilities (and simulations) for different level of tax evasion

year	Evaders		Non-evaders	
	2000	**2002**	**2000**	**2002**
2000	25.2%	#N/A	74.9%	#N/A
2001	26.9%	#N/A	73.2%	#N/A
2000	28.6%	25.9%	71.5%	74.1%
2003	30.2%	26.3%	69.8%	73.7%
2004	31.9%	26.7%	68.1%	73.3%
2005	33.6%	27.1%	66.4%	72.9%
2006	35.1%	27.5%	64.9%	72.5%
2007	36.5%	27.9%	63.5%	72.1%
2008	38.0%	28.2%	62.0%	71.8%
2009	39.5%	28.5%	60.5%	71.5%
2010	41.0%	28.8%	59.0%	71.2%

Source: Authors computation. We used transition matrix for five years. Probabilities between these periods are linearly interpolated.

Table 4. Logit regression results for $P_{n,e}$ (transition from never to a tax evasion stage). Czech Republic, Combined surveys (standard errors are in parentheses).

Variable	Coefficient	Derivative dP/dX going from never to a tax evading category
Constant	-3,82*** (0.63)	-0,266
Year 2000 dummy	0,62*** (0.19)	0,043
Family economic situation is worse compared to previous year	0,66*** (0.22)	0,046
Income < 10,000 CZK	0,48 (.38)	0,033
Income 10,001 – 15,000 CZK	0,93** (0.38)	0,065
Income 15.001 – 20.000 CZK	0,88** (0.43)	0,062
Income 20.001 – 25.000 CZK	1,04* (0.59)	0,073
Income 25.001 – 30.000 CZK	1,68** (0.73)	0,117
Village dummy	0,49* (0.26)	0,034
Small town dummy	0,48** (0.21)	0,034
Female dummy	-0,59*** (0.18)	-0,041
Age	-0,05*** (0.01)	-0,003
Primary education	0,89** (0.45)	0,062
Apprenticeship (2 years)	0,83* (0.47)	0,058
Apprenticeship (3-4 years), without GCE	0,61 (0.39)	0,042
Secondary vocational with GCE	0,54 (0.42)	0,038
Grammar school with GCE	0,23 (0.54)	0,016
Prague	1,00*** (0.35)	0,070
Middle Bohemia	0,17 (0.36)	0,012
Southern Bohemia	0,24 (0.39)	0,017
Western Bohemia	0,98*** (0.33)	0,069
Northern Bohemia	0,76** (0.33)	0,053
Eastern Bohemia	0,54 (0.34)	0,038
Southern Moravia	0,59** (0.29)	0,041
Buying goods/services from underground sector	1,42*** (0.22)	0,099

*significant on 10% level, ** significant on 5% level, *** significant on 1% level*