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

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Abstract

We use a dataset of 1062 individuals from the Czech Republic to forecast the evolution of tax evasion in that country. We ask each respondent how intensely (never, sometimes, often) he evaded taxes in 1995, 1999, and 2000, to calculate probabilities the average individual will move between these categories of evasion in any given year. These "trasition" probabilities allow 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)

I. Motivation

The study of tax evasion by economists is a young field. Most efforts at research have focused either on measuring the size of the sector that evades taxes, or in explaining why people evade taxes. 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 from 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 of the community of tax evaders. To find the likelihood of tax evasion we surveyed Czechs in 2000. We asked them to put themselves in one of three categories: In the course of each year I evade taxes never, sometimes, and frequently. We asked them this question for 1995, 1999, and 2000. By asking the question for different years we were able to form an idea of how people drift between different categories of tax evasion. Our estimates of the drift allows us to surmise how people might move between categories over the next five years. Our results suggest that unless the probabilities of moving between categories change, a growing number of Czechs will become hardened tax evaders. To discover how governments might slow the slide to tax evasion we estimate an equation that seeks to explain why an individual would evade taxes. The individual's age, income, sex, and whether he lives in a town or a village all bear on his decision to evade, as does government's efforts to stem evasion. We show that as the population ages, tax evasion will rise. Government could counter tax evasion either by lowering taxes or by increasing the perception that it is delivering public goods of increasing quality for the crowns taxpayers hand from their wallets.

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 that 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 that show how government might stem the rising tide of evasion our data predict.

II. Data on the Czech Republic

Our data come from a survey of 1062 Czechs carried out in 2000. Table 1 shows some summary statistics of the demographic features of respondents. 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, 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 to the present paper were those that asked people how often they evaded taxes during the year. We gave them the option of answering never, sometimes, often. Table 2 shows the frequency with which people answered they evaded taxes in 1995, 1999, and 2000. We calculated 95% confidence intervals for each category of evasion, (the details of which may be had in the technical appendix). Table 2, which is better interpreted by looking at its graphic illustration in Figure 1 just below it, shows a significant upward trend in the number of those who say they evaded sometimes, an upward but insignificant trend in those who say they evaded often, and a significant downward trend in those who say they never evade. “Trend” may be too ambitious a term to describe the movements of individuals between evasion categories. Our data are over too short a period to allow us to distinguish between what might be evolution over time or business cycle effects. The empirical literature on evasion summarized in Andreoni et al. (1998) is unanimous that evasion increase with income and the years between 1997 and 2000 were years of rising income for the Czechs. Our data must remain silent on this point.

How these trends will play out over time can be best understood by breaking down the proportion of individuals in each category of evasion in Table 2, into transition probabilities. Before considering these transition probabilities, we need to briefly review some of the questions on which research into the evolution of tax evasion has focused.

III. How Tax Evasion Evolves

The work of Allingham and Sandmo (1972), Watson (1985), Jung et al. (1994), Yaniv (1994), others holds 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. 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. We ask the individual whether he evades taxes often, occasionally, or never.

To see how tax evasion will evolve in the Czech Republic we focus on the probability of changing between states of evasion. To understand this concept consider Figure 2 which shows the flow of people in and out of tax evasion status. A proportion of the new labour force arriving on the market will not evade and another proportion will jump to evading occasionally and often. Those who are not new to the labour force and do not evade can make similar jumps. Those who evade often may jump to evading occasionally or not at all and those who evade occasionally may jump to evading frequently or not at all. These flows in and out of tax evasion can be summarized by the following 3x3 "stage/transition matrix" Π_{ij}

Tax evasion		2000		
		Often	*Sometimes*	*Never*
1999	*Often*	$P_{o,o}$	$P_{o,s}$	$P_{o,n}$
	Sometimes	$P_{s,o}$	$P_{s,s}$	$P_{s,n}$
	Never	$P_{n,o}$	$P_{n,s}$	$P_{n,n}$

Each cell gives for an individual the probability he will go from one state in 1999 to another state in 2000. For example, $P_{o,n}$ gives the probability an individual who evaded often in 1999 will never evade in 2000.

Let us formalize this approach using standard probability notation and identities:

(1) $P_j\,(t) = P_{.,j} = P_{o,j} + P_{s,j} + P_{n,j}\ ,\quad j=o,\ s,\ n$

and

(2) $P_i\,(t+1) = P_{i,.} = P_{i,o} + P_{i,s} + P_{i,n}\ ,\quad i=o,\ s,\ n.$

For any given matrix Π_{ij} , the conditional probability that an individual will be in state *i* in the period *t+1*, given he was in state *j* in the period *t* is defined as

(3) $P(i/j) \equiv P[i(t+1)/j(t)] = P_{i,j}\,/P_j\,(t) = P_{i,j}\,/P_{.,j},\quad i,j = o,\ s,\ n.$

Using the fact that states o,s,n are disjunct partition of the whole probability space, we get

(4) $Pi\ (t+1) = \Sigma j=o,s,n\ Pj\ (t).P(i/j),\quad i=o,\ s,\ n.$

Equation 4 is an important guide to carrying out simulations of tax evasion over the long term. The notation of equation (4) emphasizes that 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 three 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 1999 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 around the true mean (provided that individual transition probabilities are uncorrelated with each other) will not be far off their true values.

We can set the above framework into action by considering Table 3 which shows the probability than an individual who was in any of three possible states of evasion in 1999 will either remain in that state or move to another state. To read this table, consider the second large cell of the first row. This cell indicates that there were five people in our sample who in 1999 evaded often and then moved to evading occasionally in 2000. These "travelers" from *often* to *occasionally* made up 12.8% of those who evaded often in 1999 and made up 0.5% of the total sample of respondents in our survey.

In Table 4 we reproduce Table 3 as Table 4(a) and add a new table, Table 4(b). Table 4(b) is the transition matrix derived from the confidence intervals implicit in Table 4(a). To create this table we chose as our transition probabilities the values at the end of our confidence bounds. For individuals switching to higher levels of evasion we took as transition probability the lower bound of the confidence interval, and for those switching to lower levels of tax evasion we took the upper bound of the confidence interval. We call this the "optimistic scenario" because it can be used to simulate the least dramatic growth of the underground economy predicted from our data. Tables 5(a) and 5(b) use Tables 4(a) and 4(b) to project the percentage those who will participate in the underground economy over the next five years. Both tables show a sustained growth of the underground sector. Within the underground sector the category of those who evade sometimes grows in both pessimistic and optimistic cases. In the pessimistic case those who evade often grows by roughly a third, and falls by roughly a third in the optimistic case. In calculations not shown here we found that under the optimistic scenario our model would converge to a "bad" steady state after several decades, in which all would find themselves evading taxes. 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 1999 and 2000. Our data also allow us to calculate long-term transition probabilities that show the tendencies to shift between categories of evasion over the period 1995-2000.

Figure 3 shows the evolution of evasion over the next five years using the transition matrix between 1999 and 2000 as well as the using the long-term transition probabilities between 1995 and 2000. Long-term transition probabilities make projections that go in the same direction but are less radical than those using the short-term stage-transition matrix between 1999 and 2000. 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. A long-term matrix includes five years of shifting in and out of particular states and may hide the fact that for four of the last five years an individual was a frequent evader but only shifted to occasional evasion in his last year. The projections in Figure 3 show only the expected tendency for the three classes of evasion. Figure 3 does not show the variance of these tendencies. Errors may cumulate or cancel each other over the long term. Nevertheless, short and long term transition matrices bound what will be actual tendencies, and as Figure 3 indicates, the Czech Republic will suffer from a growing number of occasional and frequent tax evaders.

IV. How to Moderate Tax Evasion

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

Estimating nine transition probabilities calls for a data set far larger than that assembled in our survey. The demands on the data can be eased if we impose restrictions on the stage transition matrix. Here is where equation (4) comes in handy. Not all probabilities in equation (4) may be relevant for predicting participation in the shadow economy several periods ahead. It is unlikely that an individual will jump from evading no taxes to being a frequent evader, or that he will go from frequent evasion to no evasion. Our data confirm the hypothesis that jumps across two states of evasion are unlikely (our data show no instances of such jumps). Our data indicate also that once a person is evading, the chance of moving from evading often to evading sometimes is similar to the chance of moving from evading sometimes to evading often. It seems there is no ratchet effect between these two categories and that over time we should observe a random walk in both types (often, and sometimes) of underground participation. Finally, our data suggest a symmetry in intensity changes for those already participating. That is, $P_{s,o} = P_{o,s}$.

We can summarize the above paragraph in the three following working hypotheses which allow us to restrict the number of transition probability equations we need to estimate :

- Symetricity in intensity change for those who are already participating, i.e. $H_0 : P_{s,o} = P_{o,s}$
- Bad equilibria (Shadow economy trap) : $H_0 : P_{s,n} = 0, P_{n,s} > 0$.
- No long jumps : $P_{o,n} = P_{n,o} = 0$.

These restrictions can be further illustrated in the following modified stage-transition matrix :

Tax evasion		T+1		
		Often	*Sometimes*	*Never*
T	*Often*	$P_{o,o}$	$P_{s,o}$	*0*
	Sometimes	$P_{s,o}$	$P_{s,s}$	*0*
	Never	*0*	$P_{n,s}$	$P_{n,n}$

Using the fact that the sum of probabilities equals 1, the above table indicates that we have only 4 unknown transition probabilities to estimate.

We have attached to Figure 2 the relevant transition probabilities from the above modified stage-transition matrix. Readers will wonder how new entrants to the labour 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 labour force bear a stable relation to each other and that entry and exit from the labour force is uniformly distributed over evasion categories, we need not consider explicitly the rates of entry and exit from the labour 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.

Figure 2 suggests that policy makers concerned about stunting the evolution tax evasion should guide their attention to lowering the probability of going from never being an evader to sometimes evading $P_{n,s}$. This probability is the one way door through which an honest citizen passes on his way to novice and then mature tax evader status. Before the policy maker can influence the transition probability $P_{n,s}$ he needs an estimate of the parameters attached to the independent variables which influence the dependent variable $P_{n,s}$. If there is a change in the variables with which the parameters interact we can expect the probability of transition from not-evading to evading sometimes to change. A government worried about tax evasion will want to study these parameters so that it may know what to expect in the future and so that it may also change that future.

The dependent variable $P_{n,s}$ is 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 a logit regression of $P_{n,s}$ on independent variables. 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. The explanatory variables we have chosen are fully spelled out in Table 6. 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 6.8% 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 3.4% 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 7.7% more likely to shift from not evading to sometimes evading than someone who does not buy from the underground sector. As Fortin et al. (2000) 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) Believing the penalty for evasion is high will discourage evasion. For each extra one percent the individual believes he will have to pay as a fine on undeclared income, he becomes 0.1% less likely to move from never evading to sometimes evading. As we explained in a related paper (Hanousek, Palda 2002) individuals in the Czech Republic made grossly exaggerated estimates of the probability of being caught evading. Government should not be put off by taxpayer ignorance. Taxpayers need not estimate the level of the probability of being caught correctly to feel the fear of capture. All a government need do if it wishes to reduce evasion is to stoke this fear of apprehension.

V. 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 that allowed us to estimate the stage-transition probabilities that 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 tip 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 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 assumed 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. Figure 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 favourable 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) $$\frac{p-P}{\sqrt{\frac{p(1-p)}{n-1}\frac{N-n}{N}}} \approx \frac{p-P}{\sqrt{\frac{p(1-p)}{n-1}}} \sim N(0,1),$$

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- α)% confidence interval is simply determined by (we use *1/2n* correction for non-continuous random variables)

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

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?

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Table 1. Structure of informal sector in Czech Republic: Frequencies

	Total sample	*Purchase of informal goods/ services (Total N)*	*Active engagement in informal activities*			
			Total N	*Informal Salary [CZK]*		
				<10000	*<10000, 25000)*	*>=25000*
Total	**1062**	**524**	**267**	**93**	**73**	**54**
Sex						
Male	530	270	178	55	52	41
Female	532	254	89	38	22	13
Age						
18 to 24 years	183	91	60	29	14	10
25 to 39 years	338	185	93	25	28	22
40 to 59 years	440	216	106	37	29	21
Older than 60	101	33	8	2	3	1
Status						
Married	635	317	147	43	45	32
Single w. partner	61	31	20	8	4	5
Divorced/widow(er)	152	79	36	13	11	5
Single w/out partner	214	98	66	30	13	11

Table 1. (continued)

	Total sample	Purchase of informal goods/ services (Total N)	Active engagement in informal activities			
			Total N	Informal Salary [CZK]		
				<10000	<10000, 25000)	>=25000
Level of education						
Primary	256	131	70	25	19	13
Without GCE	396	212	136	42	42	30
With GCE	313	144	49	17	10	10
Higher	97	38	14	9	3	1
Labor market position						
Full time job	633	313	148	52	42	32
Part time job	35	19	12	4	4	3
Entrepreneur (no empl.)	68	45	31	11	4	7
Entrepreneur (w. empl.)	23	12	11	3	2	3
Pensioner working	19	8	6	0	2	0
Pensioner not working	120	40	10	4	4	1
Unemployed	59	35	28	7	12	7
Student	65	27	16	9	3	2
Wife working in HH	28	17	5	3	1	1

Table 2. Values and 95%-confidence intervals for relative frequencies of different level of tax evasion. Czech Republic 1995, 1999 and 2000.

Year	Often	Sometimes	Never
1995	3,2% (2,0%, 4,4%)	12,6% (10,5%, 14,7%)	84,2% (81,9%, 86,5%)
1999	3,7% (2,4%, 4,9%)	16,7% (14,3%, 19,0%)	79,7% (77,1%, 82,2%)
2000	3,9% (2,6%, 5,1%)	21,3% (18,7%, 23,9%)	74,9% (72,1%, 77,6%)

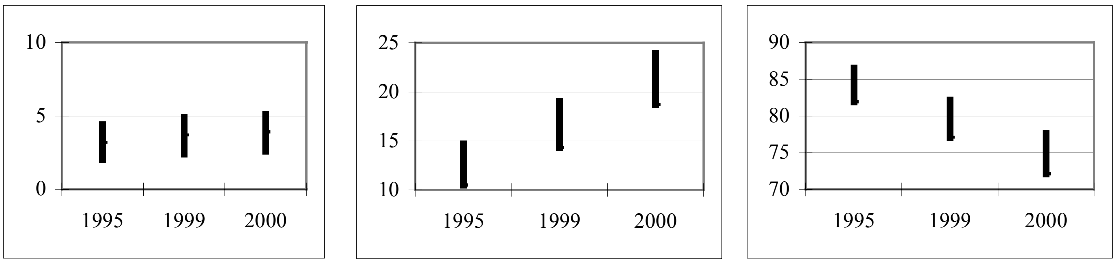


Figure 1: Graphs for 95% confidence intervals

Source: Authors' computation

Table 3. Tax evasion in 1999 versus 2000 in the Czech Republic

1999/2000		Tax evasion in 2000			
		Often	**Sometimes**	**Never**	**Total**
Tax evasion in 1999	**Often**	**34** 87.2% 3.2%	**5** 12.8% 0.5%	**0** 0.0% 0.0%	**39** 100.0% 3.7%
	Sometimes	**7** 4.0% 0.7%	**170** 96.0% 16.0%	**0** 0.0% 0.0%	**177** 100.0% 16.7%
	Never	**0** 0.0% 0.0%	**51** 6.0% 4.8%	**795** 94.0% 74.9%	**846** 100.0% 79.7%
	Total	**41** 100.0% 3.9%	**226** 100.0% 21.3%	**795** 100.0% 74.9%	**1062**

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

Table 4. Transition matrices used in different scenarios of modelling tax evasion dynamics.

A: Using estimated probabilities (sample frequencies)

A

Tax evasion		**T+1**		
		Often	*Sometimes*	*Never*
T	*Often*	3,20%	0,47%	0,00%
	Sometimes	0,66%	16,01%	0,00%
	Never	0,00%	4,80%	74,86%

B: Using "optimistic" scenario (giving the lowest probabilities of tax evasion)

B

Tax evasion		**T+1**		
		Often	*Sometimes*	*Never*
T	*Often*	2,03%	0,46%	0,09%
	Sometimes	0,07%	19,64%	0,09%
	Never	0,09%	3,40%	74,13%

Table 5. Estimated probabilities (and simulations) for different level of tax evasion

A

Year	**Tax evasion**		
	Often	*Sometimes*	*Never*
2000	3,86%	21,28%	74,86%
2001	4,21%	25,45%	70,35%
2002	4,67%	29,22%	66,11%
2003	5,23%	32,65%	62,12%

B

Year	**Tax evasion**		
	Often	*Sometimes*	*Never*
2000	2,58%	19,80%	77,62%
2001	2,19%	23,50%	74,32%
2002	1,89%	26,95%	71,17%
2003	1,66%	30,18%	68,16%

Table 6. Logit regression results for $P_{n,s}$ (transition from never to sometimes tax evasion stage). Czech Republic, 1999/2000 (standard errors are in parentheses).

Variable	Coefficient	Derivative dP/dX going from never to occasional evader
Constant	5,24*** (0.96)	-0,243
Gap between current and desirable income > 5000 Kc	0,20 (0.45)	-0,009
Family economic situation is worse compared to previous year	-1,48*** (0.49)	0,068
Village dummy	0,68 (0.57)	-0,031
Small town dummy	0,71 (0.45)	-0,033
Female dummy	0,74* (0.38)	-0,034
Respondent is satisfied with his/her job	-0,52 (0.49)	0,024
Age 18 to 25	-0,96 (0.72)	0,044
Age 26 to 35	-0,26 (0.73)	0,012
Age 36 to 45	-0,15 (0.74)	0,007

Age 46 to 55	-0,02 (0.69)	0,001
Buying goods/services from underground sector	-1,67*** (0.44)	0,077
Probability of being caught (per cent)	0,01* (0.01)	-0,001

R^2 = 0.081

*LR test of zero slopes = 36.32****

N = 582

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

Figure 2. Dynamics of flows between evading and not evading tax categories

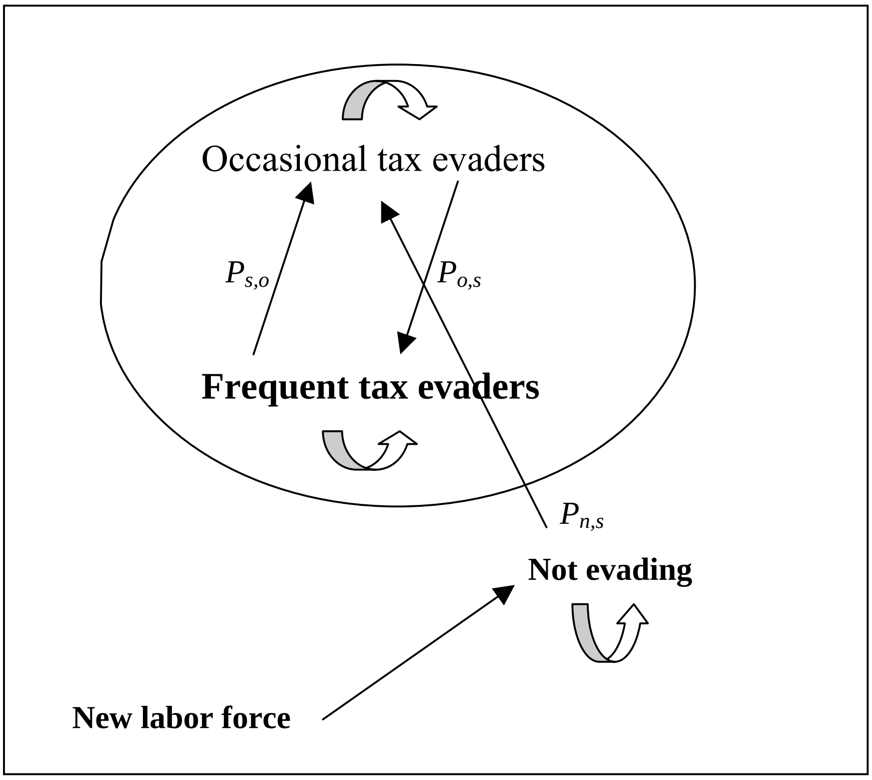
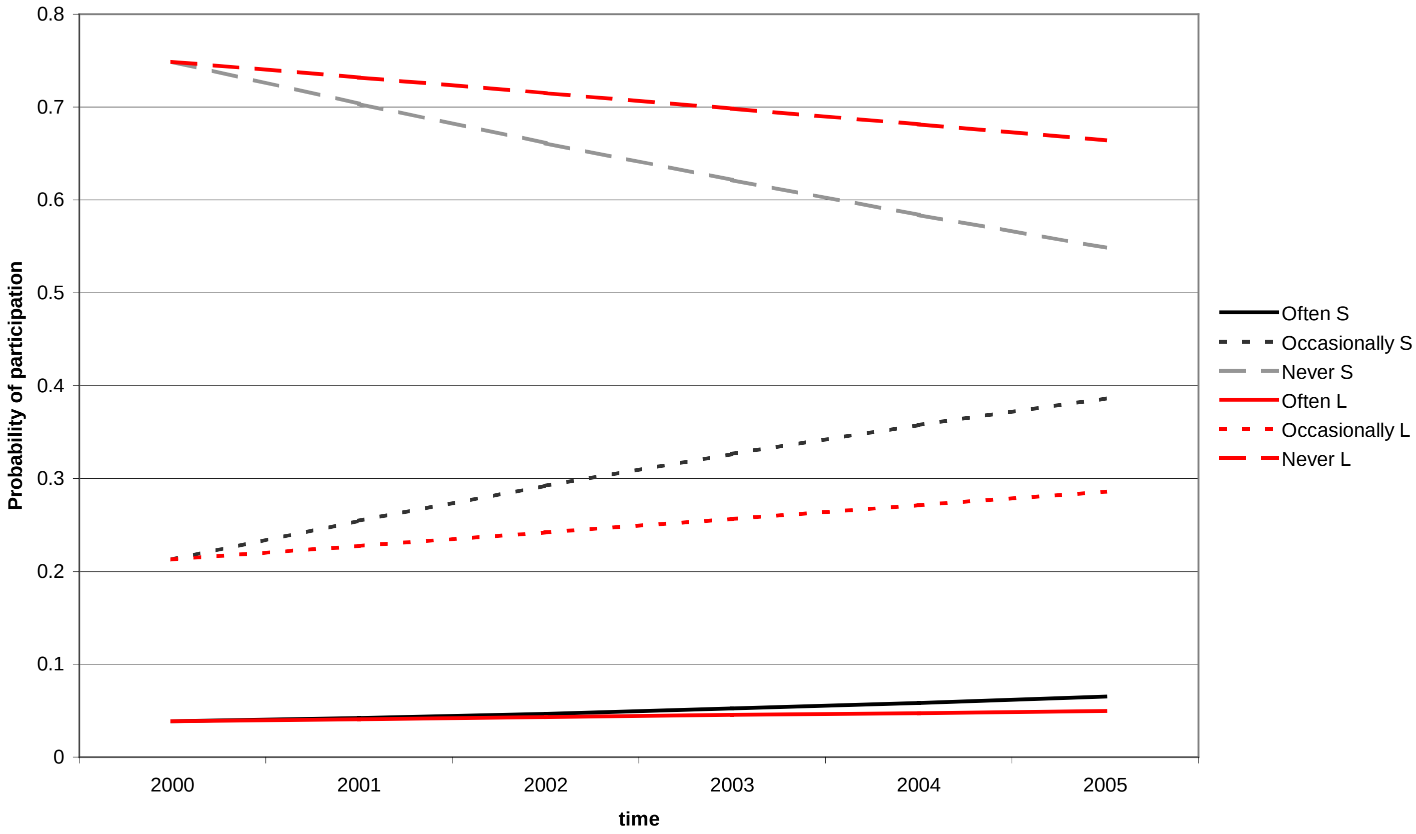


Figure 3. Dynamics of tax evasion. Simulation using sample frequencies (short and long-run transition probabilities)



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