

# THE SHADOW ECONOMY OF CZECH REPUBLIC AND TAX EVASION: THE CURRENCY DEMAND APPROACH

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## Abstract

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This study investigates the shadow economy of Czech Republic and the associated losses in tax revenue. The presence of a shadow economy may not necessarily be bad for the economies in which they prevail but they could cause huge losses to government revenue and could also constitute serious violation of labour regulations. The study uses the Currency Demand Approach. It measures the size of the shadow economy in two stages: a) the econometric estimation of an aggregate money demand equation b) the calculation of the value of the shadow economy through the quantity theory of money. The key variables in the study include: the total currency held outside the banking system, the number of automatic teller machines, the deposit interest rate, GDP deflator, the average tax, velocity of money, nominal GDP and nominal money supply. The results from the study show that the shadow economy of Czech Republic on the average is about 20.9 % as at the end of 2013 and the country loses an average tax revenue of about 7.2 % of GDP yearly. The data was obtained from the World Bank country indicators and the International Financial Statistics.

Keywords: shadow economy, currency demand, quantity theory of money, tax evasion

## INTRODUCTION

The biggest issue with the shadow economy or in other words black market or shadow economy is its hidden nature. There is no official statistics on this subject and it has to be estimated using indirect approaches. Official statistics, closer to the core of the problem suffer with a lot of inaccuracies and misreporting. All of them are just estimations and hypotheses.

The shadow economy consists mostly of illegal and therefore hidden activities of companies or other subjects, avoiding payment of taxes, trading contraband or skirting prices. It should not be confused with the grey market, which means a distribution of illegal wares and things over the legal distribution net.

For a good functioning economy it is important to understand its entire range, so as to be able to estimate the size of the shadow economy.

The definition of shadow economy differs among various authors. The study uses a definition provided by Schneider and Enste (2002) which was modified by Faal (2003). According to them, the shadow economy includes all market-based legal production of goods and services that are deliberately concealed from public authorities for any of the following reasons: (1) to avoid payment of income, value added or other taxes (2) to avoid payment of social security contributions, (3) to avoid having to meet certain legal labor market standards, such as minimum wages, maximum working hours, safety standards, etc., and (4) to avoid complying with certain administrative procedures, such as completing statistical questionnaires or other administrative forms.

From literature, the size of the shadow economy of the Czech Republic as estimated by Schneider et al (2010) was about 18.4 % as at the end of 2007, 16 % by Schneider (2013) and 15.4 % in 2013 by Zídková

(2012). The estimated amount of tax revenue lost in Czech Republic is about 20 %.

The study employed the Currency Demand Approach in estimating the level of the shadow economy. Originally suggested by Cagan (1958), and subsequently redefined and applied by Tanzi (1983) to the U.S. economy, this approach is widely adopted in the literature (see Ferwerda et al. 2010; Schneider et al. 2010). The Currency Demand Approach measures the size of the shadow economy in two stages: a) the econometric estimation of an aggregate money demand equation, with specific variables related to cash transactions in the shadow economy, b) the calculation of the value of these shadow transactions through the quantity theory of money. The key assumptions for the first-stage estimation are that transactions in the shadow economy are settled in cash to avoid traceability, and that the main cause of the shadow economy is a high tax burden.

The objective of this paper is to estimate the size of the shadow economy of Czech Republic and to calculate the associated losses in tax revenue as a percentage of GDP (Gross Domestic Product). The rest of the paper is structured as follows: chapter 2 deals with the materials and methods, chapter 3 focuses on the results and discussions while chapter 4 gives the summary of the study referred to as the conclusion.

## MATERIALS AND METHODS

The study employed the Currency Demand Approach and made use of five variables with yearly observations: currency outside the banking system ( $C_t$ ) measured as the total amount of currency in circulation, the total number of automatic teller machines ( $ATM_t$ ), the GDP deflator, the deposit interest rate ( $DPI_t$ ) and average tax ( $AT_t$ ). All variables except the deposit interest rate and the GDP deflator were in logarithmic form. Average tax in this case is derived as the ratio of total taxes to total taxable income. It is an index. It becomes a rate when multiplied by 100.

Stationarity test using the KPSS test (Kwiatkowski, Phillips, Schmidt, and Shin) was carried out for each variable, over the sample period 1991 to 2013. See Kwiatkowski, Phillips, Schmidt, and Shin (1992). Extrapolation method was used to derive the data for 1991 and 1992. Models with and without trend were applied. For the log-level series, the KPSS test rejected the null hypothesis of no unit roots at 95 % confidence level. Thus variables were non-stationary at level but were stationary after first order differences. The data was obtained from the World Bank country database.

Since one of the basic assumptions of the Currency Demand Approach is that a higher tax burden stimulates a higher tax evasion, which in turn causes an increase in the demand for cash, the expected sign on the average tax was positive. Empirical results of the influence of the tax burden on the shadow economy is provided in the studies of

Schneider (see Schneider 1994; 2000) and Johnson, Kaufmann and Zoido-Lobaton (1998); they all found strong evidence for the general influence of taxation on the shadow economy.

The study confirmed the relationship between the average tax and total currency outside the banking system from the first stage (see equation (1)) where the first differenced log currency held outside the banking system was regressed on the four other explanatory variables as seen in equation (1).

$$\Delta \log C_t = \alpha_0 + \alpha_1 \Delta \log ATM_t + \alpha_2 \Delta DPI_t + \alpha_3 \Delta GDP \text{ deflator}_t + \alpha_4 \Delta \log AT_t + \varepsilon_t \quad (1)$$

where  $\alpha_0$  is a constant,  $\alpha_i$  are coefficients. Parameter restrictions were as follows:  $\alpha_0 > 0$ ,  $\alpha_1 < 0$ ,  $\alpha_2 < 0$ ,  $\alpha_3 < 0$  and  $\alpha_4 > 0$ .  $\varepsilon_t$  is the random error term.

The restrictions implied that an increase in the number of automatic teller machines countrywide will lead to a decrease in the total amount of currency the public hold, an increase in the deposit interest rate will cause individuals to invest money in the banks thus decreasing currency holdings, an increase in the GDP deflator will cause people to hold more cash for transactions and an increase in average tax will cause businesses to keep money away from the banking system so as to avoid taxes.

The estimated results from equation (1) were then converted from log form to nominal values and used to calculate the amount of currency in the shadow economy ( $UC_t$ ).  $UC_t$  was derived as the difference from equation (1) with and without the average tax variable ( $AT_t$ ).

The second stage entailed the estimation of the size of the shadow or informal economy by using the Fisher equation. The Fisher quantity theory of money, states that there is a stable relationship between the quantity of money and the price level. In other words, changes in the money supply can in the long run lead to changes in nominal but not in real variables. See Friedman (1956; 1968). These basic considerations date back to the seminal work by Hume (1955) and Fisher (1911). The basic Fisher equation is specified in (2).

$$M_t \times V_t = P_t \times Y_t \quad (2)$$

where  $M_t$  refers to the nominal money supply measured as M2+,  $V_t$  represents the velocity of money,  $P_t$  represents the average price level (inflation) and  $Y_t$  represents real GDP. The velocity of money was derived from equation (2) as,

$$V_t = \frac{P_t \times Y_t}{M_t} \quad (3)$$

The assumption here was that the velocity of money was the same in the regular and the shadow economy (Tanzi, 1980). This assumption was used as

a proxy due to the unobserved nature of the shadow economy.

The underground economy was then calculated as the product of the velocity of money and the total amount of currency in the shadow economy. See equation (4).

$$\text{Underground GDP} = UC_t \times V_t \quad (4)$$

The size of the shadow economy (% of GDP) was then computed as the ratio of the shadow GDP to official GDP.

The study then proceeded to calculate the level of tax evasion. In other words, the amount of tax revenue lost as a result of the shadow economy. Given average tax (AT), tax revenue lost was derived as the product of the average tax and the underground GDP. See equation (5).

$$\text{Tax revenue lost} = ATR_t \times \text{Underground GDP} \quad (5)$$

## RESULTS AND DISCUSSION

This chapter discusses the results obtained using the methods above and makes comparison with similar studies in this area. The results which include the unit root test of variables, OLS model of currency outside the banking system, the velocity of money in Czech Republic, the size of the shadow economy and the amount of tax revenue lost as a percentage of GDP are clearly explained.

### Unit root test

Tab. I shows the results of the unit root test from the KPSS test. The results show that the null hypothesis of no unit root was rejected at the 95 % confidence level. The variables were non stationary at level and were therefore first order differenced after which they became stationary.

III: Unit root test

Variable	P value at level	P value after first order difference
Log ATM <sub>t</sub>	< 0.01	0.043
Log C <sub>t</sub>	< 0.01	0.059
GDP deflator <sub>t</sub>	< 0.01	0.140
DPI <sub>t</sub>	< 0.01	0.125
Log AT <sub>t</sub>	< 0.01	0.116

The study then proceeded to estimate an OLS model which regresses the first differenced log of total currency outside the banking system on the first differenced independent variables as in equation (1). The results (see Tab. II) show that all the estimated coefficients were statistically significant using the P-values criteria. The overall model was also statistically significant using the F-test. The coefficients could therefore be given

interpretations. Currency outside the banking system decreases by 9.5 % for every percentage point increase in the number automatic teller machines. It also decreases by 2.2 % for every percentage point increase in the deposit interest rate. It however increases by 6.5 % for every percentage point increase in the level of average tax. The expected sign of the GDP deflator was not met as it turns out from the results that a percentage point increase in the GDP deflator leads to a decrease in the total amount of cash held outside the banking system.

II: OLS model with Log C<sub>t</sub> as dependent variable

Variable	Coefficient <sup>1</sup>
Constant	69.71(14.98)***
Log ATM <sub>t</sub>	- 9.52(3.60)**
GDP deflator <sub>t</sub>	- 0.67(0.26)**
Log AT <sub>t</sub>	6.51(2.90)**
DPI <sub>t</sub>	- 2.23(0.55)***
R <sup>2</sup> = 0.86; F (4, 14) = 21; P-value (F) < 0.01	

Standard errors are in parenthesis, the asterisk (\*, \*\*, \*\*\*) indicate significance at 10 %, 5 % and 1 % respectively. Δ indicates first order difference.

To ensure that the model met the quality criteria for the usage of the results, diagnostic checks were carried out to ascertain if the classical requirements on model specification, distribution of residuals, heteroscedasticity, autocorrelation etc were met. The results showed that the model met the requirements. See Tab. III.

I: Diagnostic test of OLS model

Variable	P-value form	Decision
Specification test (linearity)	0.34	Correctly specified
Specification test (RESET)	0.72	Correctly specified
Heteroscedasticity test	0.22	Homoscedastic
Normality test	0.25	Normally distributed Residuals
Chow test	0.25	No structural break

### The velocity of money in Czech Republic

Velocity of money can be defined as how often the money supply turns over or the number of times a single Czech Koruna is used to purchase goods and services that comprise the GDP in a given period of time. It can also be thought of as the average frequency with which a unit of money is spent or how many times a given Czech koruna bill is spent by all of the consumers that spend it as it works its way through the Czech economy in a given period of time.

Figure 1 shows the results of the velocity of currency use in the shadow economy as derived from equation (3). The concept of velocity is discussed in numerous textbooks of macroeconomics (see, for example, Barro (1997), and Mankiw (2000). Friedman and Schwartz (1963) present the historical behavior of velocity in the United States. The velocity of currency in Czech Republic as observed in Figure 1 is declining. It shows a declining pattern from 1993 with intermittent peaks.

Several reasons account for the slowing down of the velocity of money. First, it slows down in times of deflation when a contraction in the amount of money in circulation declines, resulting in lower prices. This is however not the case in Czech Republic. Secondly, the velocity of money slows during recession as consumers decide to hold onto their cash rather than spend it on new products. Thirdly, it can slow down because of the accumulation of debt in the economy, mostly in the case of government debt. The third case is easily applicable in explaining the current trend in the velocity of money in Czech Republic. This is because data from the International Financial Statistics shows that government debt to GDP ratio in 1993 was 16.5 % and it reached 46.0 % in 2013. Rising debt to GDP ratio causes a decline in the velocity of money.

The result from this study was compared with the results of Młodkowski (2007) who also obtained a declining velocity of money for Czech Republic in his study. See Figure 1 for the pattern of the velocity

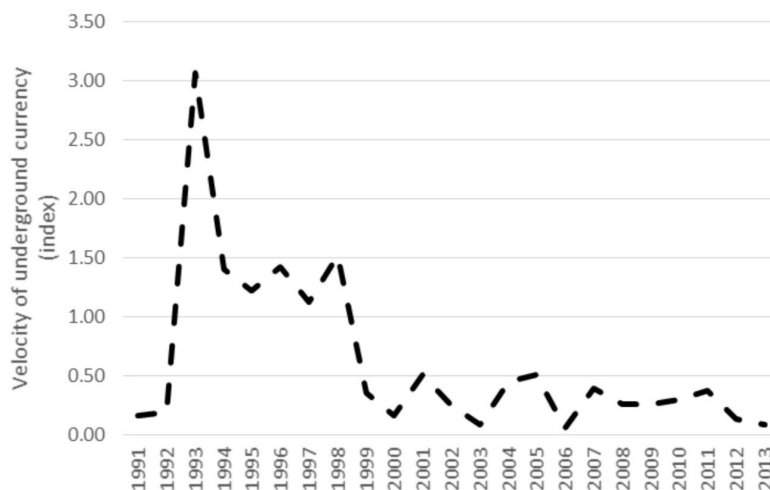
of money in Czech Republic for the past twenty years.

### The size of the shadow economy and level of tax evasion

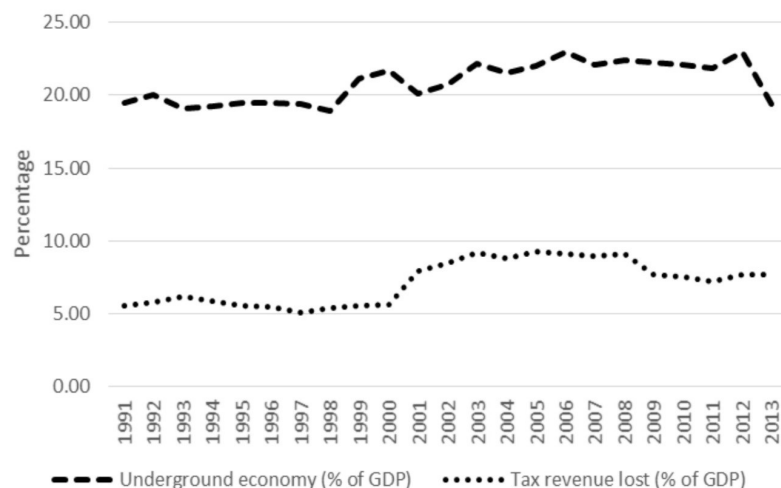
Figure 2 shows the estimated level of the shadow economy as a percentage of GDP and the estimated level of tax revenue lost as a result of the shadow economy. Lemieux et al. (1994) attempted to find out the structural determinants of the decision to participate in the shadow economy. The estimated results from this study were compared with results by Schneider (2005; 2007) and Schneider and Klinglmaier (2004). The trend is similar but the magnitude differs. The estimated size of tax evasion as a percentage of GDP is about 7.2 % on the average and about 15 % in the works by Schneider.

The estimated results of the shadow economy were compared with those derived by prominent authors in this area. Pioneering work in this area has been done by L. Frey (1972; 1980) Cappelletto (1986), Lubell (1991), Pozo (1996) and Tanzi (1999). This is especially true in Europe (e.g. in Germany and Austria), where the total tax and social security burden put a strain on the wage effectively earned.

From the Economy Watch Journal (2015), the tax burden of Czech Republic as a percentage of GDP is about 35.5 %, the corporate tax rate is about 19 % and the income tax rate is about 15 % in 2015.



1: The velocity of money in Czech Republic



2: The size of the shadow economy of Czech Republic and percentage of losses in tax revenue.

## CONCLUSION

The estimation of the shadow economy by the use of the Currency Demand Approach as in this study oversimplifies the real economy. As pointed out by Schneider and Enste (2002; 2000) there are many substantial drawbacks to this approach. These include the assumption that there is absence of any transactions in the underground economy in a given base year, that the velocity of money in both the official and the irregular economy are the same and the excessive tax burden as the only determinant of the shadow economy.

Several other variables determine the level of shadow economy which include: the level of GDP per capita, the level of unemployment, the level of business regulation, the level of corruption, the size of government and the quality level of public services. This study however sought to emphasize the impact of taxes hence the high level of emphasis on the role of average taxes. The results obtained do not vary greatly from those obtained from major studies by Schneider. The estimates however obtained are slightly higher about 20.9 % on the average for the shadow economy with Schneider estimating a value of about 15.5 % for the year 2013.

About 7.2 % of state revenue is lost as a result of the presence of the shadow economy. This estimate is not too high when compared to other EU states in studies in this field. It is however economically significant given the size of the nominal value.

There is a generally declining average tax but the impact on underground activities as seen in the results is negligible. The shadow economy has hovered around a particular level for quite a long period of time. In subsequent works, the study will focus on diagnosing the impact of the individual taxes such as personal income tax, indirect taxes on goods and services, social security contributions and other tax burdens on the decisions of individuals and businesses to participate or otherwise in shadow economic activities.

The study discovered that Czech Republic's economy is experiencing a decline with regards to velocity of money and this is largely due to the growing government debt to GDP ratio. It is an indication that debt incurred in the economy does not in a whole translate to productive economic activities.

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