

Corruption and Shadow Economy: Evidence from Ukraine and Russia

Grygorii Polonskyi

Kyiv School of Economics

Abstract

The issues of corruption and shadow economy are of great interest for researchers and policy makers. This thesis aims to investigate the relationship between these two phenomena on the data from Ukraine and Russia. The data on 66 Ukrainian and Russian regions is taken and various estimation approaches are employed (2SLS, GMM and 3SLS). In order to mitigate potential endogeneity of shadow economy and corruption, a set of instrumental variables are used for each. Although previous studies suggest complementary relation for these countries, we found no evidence of such a relation.

Keywords: Corruption, Shadow Economy

1.0 INTRODUCTION

The phenomena of corruption and shadow economy are of great interest for researchers. One can find lots of literature on their estimation procedures and causes. For instance, Schneider and Enste (2000) discuss determinants of the shadow economy and perform estimation for the large number of countries. Shadow economy and its causes are also discussed in paper by Friedman et. al (2000). As for corruption, a number of papers were published. For extensive review see, for example, Seldadyo and Haan (2006). Both issues are of extreme interest especially for post-Soviet countries. In the annual rating published by Transparency International one can find Ukraine sharing the 134th position (out of 180) with Nicaragua and Pakistan on the Corruption Perceptions Index (CPI). Other transition countries are also at the bottom of this rating. Organizations, which focus their investigations particularly on corruption issues, state that “corruption in Ukraine is extremely widespread and often accepted by the population as a customary means of getting things done” (Corruption in Ukraine.2007 Baseline National Survey). According to Dreher and Schneider (2006), the relationship between shadow economy and corruption varies from country to country. A cross-country analysis on a large sample provides no evidence of any type of relationship. In his study Schneider (2007) suggests dividing countries into groups on some particular criteria (income level, for instance) and expect different relation for each group. Such an approach led to more convincing results (statistically significant coefficients, larger magnitudes), although different in each group of countries being studied. The intuition behind this idea is the difference in firms’ behavior under either low or high levels of institutional development. In other words, going underground might be an option to avoid paying bribes to officials, or, alternatively, official might be easily sued once trying to get a bribe.

The first situation is more likely to happen in low-income country, the second – in high-income one. Although one can estimate this relationship for transition countries on cross-country level, a lack of observations would still be the case (no more than 26 observations). However, research on the regional level alleviates this problem. Taking data on Ukrainian and Russian regions one obtains a large sample, with the possibility to increase it even more by adding data on other countries. In such a way, more precise and reliable results will be obtained. In this research I will focus on Ukraine and Russia, as two representatives of transition countries, in investigating a relationship between hidden economy and corruption. According to the available data indices which describe both underground economy (the values are obtained using MIMC technique) and corruption (indices from national surveys) vary significantly between regions in both Ukraine and Russia. Since one cannot consider corruption and shadow economy as exogenous determinants of each other, the simultaneity appears. The instrumental variables approach is used to mitigate this problem. Conventional estimation techniques such as 2SLS (IV), GMM and 3SLS are used.

2.0 LITERATURE REVIEW

In this section review of the available articles on the topic is given. It will provide a base for this research. In particular, I will focus on three major groups of articles. Firstly, I go through **works on shadow economy and its estimation**. Secondly, **articles on corruption measurement** are reviewed. After that, with a final section of the literature review, I will cover the **works on relation between corruption and shadow economy**. In the final section I will consider articles on shadow economy and corruption on regional level, on Ukraine in particular. Starting with the issue of the estimation of the shadow economy, one needs to define the term “shadow economy” itself. One of the most widely used definitions tells that shadow economy is “all economic activities which contribute to the officially calculated (or observed) Gross National Product, but are currently unregistered.” This definition could be found in early works, for example, Feige (1989, 1994). Another definition (see, for example, Smith, 1994) views

shadow economy as „market-based production of goods and services, whether legal or illegal that escapes detection in the official estimates of GDP. “ These definitions, however, are not that precise and allow for ambiguous interpretation. Mirus and Smith (1997) offer a more explicit view on legal and illegal underground activities (see Table 1).

Table 1
Taxonomy of Types of Underground Economic Activities

Type of Activity	Monetary Transactions		Non-Monetary Transactions	
ILLEGAL ACTIVITIES	Trade in stolen goods; drug dealing and manufacturing; prostitution; gambling; smuggling and fraud		Barter: drugs, stolen goods, smuggling etc. Produce or growing drugs for own use. Theft for own use.	
	Tax Evasion	Tax Avoidance	Tax Evasion	Tax Avoidance
LEGAL ACTIVITIES	Unreported income from self-employment; Wages, salaries and assets from unreported work related to legal services and goods	Employee discounts, fringe benefits	Barter of legal services and goods	All do-it-yourself work and neighbor help

Source: Mirus, Rolf and Roger S. Smith (1997).

After defining shadow economy we are interested in its estimation. Methods used for this purpose can be divided into direct (micro), indirect (macro) and econometric ones. Surveys and tax auditing are examples of direct methods. Schneider and Enste (2000) point out the disadvantages of survey method such as a high sensitivity to questionnaire content as well as with respondents' cooperation efficiency. Another disadvantage mentioned is the impossibility to measure precisely the shadow economy in monetary terms. As for tax compliance, we face selection bias since tax-payers selection for the auditing is not random but rather depends on certain signals, increasing probability of tax fraud.

Let's turn then to indirect, or macro, approaches. One of such methods suggests difference between National Expenditures and National Income as a proxy for hidden economy size. The logic behind this approach implies that shadow sector hides incomes but cannot hide expenditures. Despite easiness in implementation the approach has obvious disadvantages. Results are affected by data limitations and inaccuracies. Statistical independence of income and expenditures estimates is questionable – statisticians while working on the statement can influence it to some extent in order to make the difference smaller. While initial difference between accounted expenditures and incomes would better reflect to the size of shadow economy, this figure is never observed. This method was employed by Petersen (1982) and Smith (1985) in their studies of hidden economy size in Germany and Great Britain respectively.

Another discrepancy considered is one between official and actual labor force. The idea of this method is following: assuming a constant participation rate one can consider decrease in it as a signal of an increasing shadow sector. The main drawback here is a possibility of having official job although working in hidden economy at the same time. O'Neill (1983) has used this approach for estimating US shadow economy. Also, not possibility of controlling for business cycles is another disadvantage. A more sophisticated approach, the transaction approach, was suggested by Feige (1979). In the given approach author assumes constant transactions volume to GNP ratio. Then, recalling quantity equation $MV=PY$, one computes official part GNP and compares to given one. By this means unofficial part of GNP is determined. Criticism of this method focuses on too strong assumptions made – no shadow economy in the base year (absolutely unrealistic), constant transaction to GNP rate and others. A third group of approaches is referred to as econometric methods. The widely used currency demand approach was introduced first by Cagan (1958) and then developed Tanzi (1983) in his study of underground economy in the US. Based on the assumption that transactions in the hidden sector take place in cash only (which is not the case, in fact), theory suggests that an increase in currency demand is a signal of growth of the shadow economy, controlling for other factors influencing demand for currency, such as income changes, interest rates, and habits. Factors which determine shadow economy (e.g. direct

and indirect tax burden) are also controlled for. Thus, comparing currency demand under “zero tax burden” and on the current one provides estimates of shadow economy. Despite having been employed in a number of studies (Schneider, 1997; Johnson et al., 1998), the approach has been subject to criticism by, for example, Thomas (1999). One argument is about strong assumption of underground economy operating with cash transactions only. Violation of this assumption leads to underestimation of true level of hidden economy by this method. Moreover, we still deal with questionable assumption of no shadow economy in the base year.

Finally, we get to another econometric method – so called (Dynamic) Multiple Indicators Multiple Causes (DY/MIMIC) approach. It was first introduced by Zellner (1970), and then further developed by Joreskog and Goldberger (1975). The general idea behind this method is capturing multiple factors and multiple causes, unlike previously reviewed method which focus on some particular issue in determining shadow economy. The rationale is that shadow economy affects all markets rather than one. Although criticism in some particular studies using this method, MIMIC approach is called “the most comprehensive and builds on a well-structured behavioral model” (Maurin et al. 2003). So far I have reviewed shadow economy and its estimation in the literature. Next I would like to look at the literature on corruption and its measurement. Again, I will start from corruption definition and then continue with its estimation. Corruption, as defined by the Transparency International, is “the misuse of entrusted power for private gain”. Still such a description is something broad and transcendental. Definitions vary from one study to another making thus estimates (indices) incomparable. Usually indices reflecting corruption level are based on surveys of public and/or businesses. The phenomenon of corruption itself does not allow for some advanced methods of estimation other than different types of surveys.

Corruption perception index (CPI) developed by Transparency International is the example. Another source of data on corruption is BEEPS dataset constructed by the World Bank and the EBRD. Though broad choice of indices for cross-country comparison, for this research I need regional estimators rather than state ones. Such works will be covered later on in special subsection. Voznyak (2008) also mentions inapplicability of CPI index for research on lower levels. Although cross-state indices of corruption are not of interest for this particular research one can refer to Knack (2006) for a detailed analysis of these indices. After summarizing existing literature on both corruption and shadow economy, I turn explicitly to the research topic, reviewing findings received so far. Since we might expect two possible outcomes in the relation between two considered phenomena, then it would be logical to overview studies supporting each of them. Let's start with works providing complementary relation between corruption and shadow economy. Johnson et al. (1998) is an example of such a research. The logic behind their model is that corruption can be considered as a special kind of taxation. In case corruption increases it forces entrepreneurs to go underground, thus increasing hidden economy. Another study by Hindriks et al. (1999) presents complementary view on corruption and shadow economy relations. In this article complementary relation is explained as follows: tax payer contracts with tax inspector in such a way that inspector bribed will underreport true income of the agent. In other words, under this scenario both corruption (bribe was paid) and shadow economy (taxes are underreported) increase.

On the contrary, studies by Choi and Thum (2004) present opposite view on the relation. In their article entrepreneur faced the problem of corrupted official has an option of going underground. Therefore, firm is either working in shadow economy and not paying bribes or works legally but forced to corrupt officials. Thus, this work suggests substitutive relationship between hidden economy and corruption. Similar results were obtained by Dreher et al. (2005) – “corruption and shadow markets are substitutes in the sense that the existence of the shadow market is associated with smaller levels of graft”. So far I have reviewed papers on corruption and shadow economy estimation issues. With the next subsection of the literature review I would like to make an insight into the studies on Ukraine with the focus on considered aspects. All the mentioned papers on corruption and shadow economy relation analyze the issue employing data on state level. As Schneider (2007) suggests in his work, the relation indeed could be either complementary or substitutive depending on group of countries studied. However, in my research I focus on small group of countries and for the sake of retrieving enough observations for empirical part I am highly interested in studies on shadow economy and corruption in Ukraine and Russia on the regional level.

As for corruption estimates for Ukraine on regional level one can refer to “Corruption in Ukraine Baseline National Survey for the MCC Threshold Country Program” which provides estimates from different angles: both voluntary bribes and extortion indices are given. Similar studies for other countries (especially, for transition ones) are broadly available. For a study explaining variations of the corruption over Ukrainian administrative units one can refer to Voznyak (2008). Shadow economy estimation on the regional level also has been subject to recent research. Bilonizhko (2006) in her work employs already mentioned MIMIC approach for estimating shadow economy for Ukrainian and Russian administrative units (in total 105). Worth mentioning is that in MIMIC technique corruption factor was not used as input parameter.

3.0 DATA DESCRIPTION

3.1 Corruption

As a source for corruption, the data from “Corruption in Ukraine Baseline National Survey for the MCC Threshold Country Program” and Report on “Regional Corruption Indices” held jointly by TI-Russia and INDEM Foundation will be used. Since the methodologies behind these studies are different, indices are normalized to the same scale sequentially for each group. Particularly, corruption perception index is given in (0, 1) interval with 1 corresponding to most corrupted region and 0 – to the least corrupted. Values for Ukrainian regions are given in different scale. After demeaning and dividing demeaned values by the maximum value the normalization is completed and all the corruption indices are in (0, 1) scale. A big variation across regions is observed with mean 0.41 and standard deviation 0.27. Due to data limitations on Russian regions, the data is used for the year 2002.

3.2 Shadow Economy

The MIMIC approach results, taken from Bilonizhko (2006), are used as a source of regional shadow economy levels. The data obtained in such a way was successfully used in similar research by Dreher and Schneider, 2006. According to this data shadow economy in Ukrainian and Russian regions vary from 48% to 63.88% of GRP with mean of 55%. The variation here is relatively big.

3.3 Instrumental Variables

Ethnic and linguistic fractionalization indices are measured by the ethno-linguistic fractionalization index described in the previous section. The data on ethnic and linguistic fractionalization as well as on self-employment is taken from the last national censuses in Ukraine and Russia. Although conducted not the same year (2002 and 2001 respectively), the data used is not subject to significant changes in the short-run. The data for construction industry is approximated (because of data availability) by the number of square meters delivered in each region in the next year (2003). Average salary data is given in UAH (Russian data is transformed into UAH using exchange rate by National Bank of Ukraine for 2002 - 10 RUR=1.70 UAH).

3.4 Control Variables

A set of control variables includes log GRP, crime rate, capital investments to GDP ratio and Ukrainian dummy. Ukrainian dummy indicates whether given region is in Ukraine and has value 1 if so and 0 otherwise. Data description and sources can be found in Appendix A1.

4.0 METHODOLOGY

Theory considered in the latter section shows that there is no single approach to relation between shadow economy and corruption. In order to make a conclusion concerning relation between corruption and shadow economy empirical estimation will be used. Given number of works on this particular topic one cannot come up with the convincing theoretical model. This indeed was the main argument behind the critique (see, for example, Thomas 1999) of such an empirical works. Nonetheless the model will be based on certain assumptions and economic intuition which is common for the works on this issue. Corruption and Shadow Economy are considered as determinants of each other. Magnitude of the gross regional product is assumed to impact both corruption and shadow economy. Also, we control for crime rate and capital investment to GRP ratio. The following system of equations is estimated:

$$\begin{cases} Corruption_i = \alpha_0 + \alpha_1 ShadowEconomy_i + \alpha_2 \ln GRPpc_i + \alpha_3 CrimeRate_i + \alpha_4 CapInv / GRP_i + \varepsilon_i \\ ShadowEconomy_i = \beta_0 + \beta_1 Corruption_i + \beta_2 \ln GRPpc_i + \beta_3 CrimeRate_i + \beta_4 CapInv / GRP + \varepsilon_i \end{cases}$$

So, a simultaneous equations model has to be estimated. For doing this, conventional methods such as 2SLS (IV), GMM and 3SLS are used. The major difficulty to overcome is endogeneity problem. In order to deal with it instrumental variables are used. It is worth saying that, by contrast to previous works on the similar issue, here IV will be employed on the relatively big sample. This makes results obtained more reliable. Thus, *two sets of instruments are used* – one set for corruption and the other set for the shadow economy. Since the regional dimension is being considered, variables which vary across regions may be used. This limits analysis to some extent; however, literature suggests number of possible instruments suitable on regional level. For the first group literature (see Virta 2007, Friedman et al. 2000, La Porta et al. 1999) suggests ethnic, linguistic and religious fractionalization and geographical latitude. La Porta et. al (1999) have shown empirically on a large sample of cross-country these variables to be

correlated with the level of corruption. As a measure for either type of fractionalization the ethno-linguistic fractionalization index is used. It is computed as follows:

$$1 - \sum_{k=1}^K p_k^2,$$

where p_k is the share of k^{th} group and K is a number of those groups. The value is interpreted as the probability that 2 arbitrary selected agents are from different groups. These indices vary significantly across regions being studied, which makes them suitable for this particular work.

As an *instrument for shadow economy* a fraction of region population which is *self-employed and average salary* are used. Self-employment is a good instrument since it, being a source of shadow economy, is unlikely to correlate with corruption. Corruption, in turn, has little effect on self-employment decision, which is determined rather exogenously. Higher average salary is associated with lower level of shadow economy. While average salaries of officials might be correlated with corruption, the average salary consists of salaries in all areas, and officials salaries are minor part of it. Because of using regional data we cannot employ usual and more natural instruments for shadow economy such as tax burden and government efficiency. These variables do not vary on the state level within the country.

Additionally, *control variables* are needed. Firstly, both shadow economy and corruption are affected by welfare. Therefore, *logarithm of gross regional product* is a control variable. Also, *dummy* which has value 1 if region is in Ukraine and 0 otherwise is included to control for differences between two groups of regions being studied. Finally, following Mauro (1995), *capital investments to GRP ratio* is included – more investments are associated with less corruption. At the same time, taking into account peculiarities of Ukrainian and Russian it is reasonable to assume that capital investments are associated with shadow economy.

5.0 RESULTS

In this section econometric analysis is given using data and methodology from chapters 3 and 4 respectively. Table 2 provides the results of 2SLS and GMM regressions for corruption equation as well as the OLS estimates. Because of endogeneity OLS estimates are not valid and differ from those by 2SLS and GMM. Results imply weak positive effect of shadow economy on corruption though highly insignificant. Construction industry variable and GRP per capita are significant at 11%. Construction industry has positive effect which was predicted. Increase in per capita gross regional product, however, has negative effect on corruption. It is explained by negative relation between corruption and welfare. Corruption is on average less for Ukrainian regions (compared to those 40 Russian regions observed). While more linguistically diverse region is likely to have more corruption (as predicted by Mauro 1995), ethnical diversity decreases corruption, which also supports the theory. The post estimation implies rejection of under identification of the equation at 5%. Homoskedasticity hypothesis is not rejected and residuals are normally distributed. Weak identification test is passed also. Finally, Sargan test (Hansen test, in case of GMM) of over identifying restrictions suggests not rejection of hypothesis that instruments are valid. Specification Ramsey/Pesaran-Taylor RESET test is also passed successfully.

Table 2
Effect of shadow economy on corruption

VARIABLES	(1) OLS	(2) 2SLS	(3) GMM
Corruption	0.658 (0.481)	-1.881 (0.489)	0.425 (0.870)
Self-employment	-8.554** (0.0109)	-9.125*** (0.00555)	-7.440 (0.120)
Average salary	-0.00374* (0.0744)	-0.00536** (0.0407)	-0.00438* (0.0752)
UA dummy	-2.800*** (0.00251)	-3.051*** (0.000891)	-2.715*** (0.00231)

Crime Rate	0.000176 (0.808)	3.79e-05 (0.959)	0.000173 (0.814)
ln(GRPpc)	4.997*** (3.43e-05)	5.611*** (9.79e-06)	5.476*** (1.44e-07)
Capital Investments/GRPpc	0.00282 (0.997)	0.687 (0.530)	0.0612 (0.954)
Constant	15.69* (0.0816)	12.38 (0.189)	11.77 (0.145)
Observations	66	66	66
R-squared	0.775	0.745	0.773

p-values in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The equation for shadow economy estimated also with 2SLS and GMM, and the results could be found in Table 3. The coefficient on corruption estimated by 2SLS is negative, though again very insignificant. GMM estimation yields positive coefficient on corruption, but highly insignificant one. In turn, effect of self-employment is significant (2SLS) and has negative effect on shadow economy. Each 100 UAH (or its equivalent in RUB) increase in average salary decrease shadow economy by 0.5% of GRP per capita. Ukrainian regions compared to 40 Russian ones are on average have 3% less shadow economy. Magnitude of the gross regional product per capita still matters – regions with higher production unsurprisingly tend to have more shadow economy. Capital investments though having positive coefficient are insignificant. The overall crime rate is very small and not significant in both equations of the system. Model testing implies rejection of underidentification at 6%. Weak instruments test has been passed as well. Test of overidentifying restrictions allows not rejecting of joint validity of the instruments employed. Also, not rejection of homoskedasticity on corresponding test occurs. Residuals are normally distributed and specification RESET test is passed.

Table 3
Effect of corruption on shadow economy

VARIABLES	(1) OLS	(2) 2SLS	(3) GMM
Shadow Economy	0.0229 (0.162)	0.0430 (0.219)	0.0475 (0.216)
Ethnic fr.	-0.592** (0.0416)	-0.637** (0.0213)	-0.641*** (0.00734)
Linguistic fr.	1.029*** (0.00582)	1.029*** (0.00235)	1.006*** (2.80e-05)
ln(Construction2003)	0.108 (0.106)	0.101 (0.109)	0.0914 (0.103)
UA dummy	-0.289* (0.0606)	-0.246 (0.118)	-0.228 (0.153)
Crime Rate	-6.64e-05 (0.525)	-6.10e-05 (0.534)	-5.08e-05 (0.631)
ln(GRPpc)	-0.177 (0.129)	-0.255 (0.118)	-0.282** (0.0461)
Capital Investments/GRPpc	0.0739 (0.645)	0.0846 (0.576)	0.102 (0.393)
Constant	0.251 (0.752)	-0.167 (0.867)	-0.155 (0.901)
Observations	66	66	66
R-squared	0.314	0.295	0.285

p-values in parentheses

*** p<0.01, ** p<0.05, * p<0.1

All the regression output can be found in Appendix B. On the next step, the system is estimated with the 3SLS and the results could be found in Table 4. The results obtained are similar to those by 2SLS and GMM in signs and magnitudes, except of the effect of corruption on shadow economy, where 2SLS and GMM provide different results.

Table 4
Estimation results for 3SLS method.

VARIABLES	(1) Shadow Economy	(2) Corruption
Shadow Economy		0.0430 (0.219)
Ethnic fr.		-0.654** (0.0180)
Linguistic fr.		1.034*** (0.00223)
ln(Construction2003)		0.0986 (0.117)
UA dummy	-3.057*** (0.000867)	-0.245 (0.119)
ln(GRPpc)	5.584*** (1.06e-05)	-0.253 (0.121)
Capital Investments/GRPpc	0.677 (0.536)	0.0899 (0.552)
Crime Rate	3.60e-05 (0.961)	-6.14e-05 (0.532)
Corruption	-1.856 (0.494)	
Self-employment	-9.175*** (0.00528)	
Average salary	-0.00530** (0.0427)	
Constant	12.59 (0.182)	-0.169 (0.865)
Observations	66	66
R-squared	0.746	0.295

p-values in parentheses

*** p<0.01, ** p<0.05, * p<0.1

6.0 CONCLUSIONS

In this research the issue of relation between corruption and shadow economy was made. The question for this study was chosen because both phenomena are extremely widespread in both countries studied, as well as in other post-soviet countries. While Dreher and Schneider (2007) predict complementary relationship for Ukraine and Russia (definitely, low-income countries), regional-level analysis finds no significant evidence of such a relationship. This means that the hypothesis of complementary relationship between corruption and shadow economy for low-income countries and substitutive relationship - for high-income countries is not supported by the data.

The data from agencies, which estimate corruption, were used together with estimates of shadow economy obtained by Bilonizhko (2007) applying MIMC technique. Instrumental variables approach was used in order to overcome endogeneity of shadow economy and corruption. Both sets of instruments successfully passed tests for underidentification, validity and overidentifying restrictions.

The results of the research imply that accepting hypothesis about complementary relation between corruption and shadow economy for low-income countries may be misleading and require further investigation. For further analysis

on the country (or groups of countries) more data is needed. This would allow using panel data for analyzing the issue and expanding the sample.

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