Financial Development and Shadow Economy in European Union Transition Economies

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The shadow economy has been a serious problem with varying dimensions in all the income group economies and has significant adverse effects on the development of economies. Therefore, all the countries have tried to combat with the shadow economy by taking various measures. This study researches the interaction among shadow economy, development of financial sector and institutional quality during 2003–2014 period in European Union transition economies employing panel data analysis. The empirical findings suggested a cointegrating relationship among shadow economy, financial sector development and institutional quality. Furthermore, financial development and institutional quality affected the shadow economy negatively in the long term.

Key Words: shadow economy, financial development, institutional quality, panel data analysis
JEL Classification: C23, G20, H11, H26, O17

Introduction

Shadow economy is also called as informal economy, unofficial economy, irregular economy, black economy. Similarly, there have been no consensus on the definition of shadow economy, but it generally includes all the unrecorded transactions which should be in the gross domestic income (Schneider and Enste 2000). The shadow economy is classified as undeclared work and underreporting. The undeclared work generally consists of wages which businesses and workers do not declare to the governments for tax evasion, while underreporting means that economic units do report their income incompletely for tax evasion (Schneider 2013). Also measurement of shadow economy is very hard due to its invisible structure. However, size of shadow economy generally is measured by direct methods using surveys and samples which consist of vol-

untary replies and tax audits etc. or by indirect methods including multiple indicator multiple cause (MIMIC), dynamic MIMIC (DYMIMIC), currency demand approach, transactions approach and electricity consumption (physical input) approach (Restrepo-Echavarria 2015). Finally, major causes underlying shadow economy have been weak public administration and legal regulations, growing tax burden and social insurance payments, weak tax morale, strict regulations concerning labour market, corruption, deterrence and inflation (Singh, Jain-Chandra, and Mohommad 2012a; Schneider and Williams 2013).

Shadow economy is a very serious problem for the economy, because it has significant direct or indirect adverse implications for many components of economic and social life in a country. In this regard, the statistics related to the countries with high level of shadow economy are unreliable and incomplete. Therefore, it makes difficult the public policy planning and policymaking. On the other hand restricted contribution to official economy show that resources of an official economy are not benefited by most of the economic units and this in turn poses a challenge for the economic growth (Singh, Jain-Chandra, and Mohommad 2012a).

European Union (EU) transition economies have experienced an economic transformation with transition from centrally planned economies to free market economies as of Berlin Wall fall. The integration process with the EU also accelerated the transition process, because these countries have made many structural reforms to meet the existing standards of the EU. Transition economies of EU generally underwent decreases in the volume of shadow economy and improvements in financial sector and institutional quality proxied by economic freedom index as seen in table 1. The countries participated to the EU earlier such as Czech Republic, Estonia and Hungary experienced more progress in reduction of shadow economy when compared to Romania, Bulgaria and Croatia. The main criteria of the EU membership are defined as follows (European Commission 2015):

- stable institutions promoting democracy, the rule of law, human rights and respect for and protection of minorities,
- a functioning market economy and the capacity to cope with competition and market forces in the EU,
- ability to implement the obligations of membership such as taking actions in harmony with the aims of the EU.

So the countries also decreased the size of underground economy in-

TABLE 1 Shadow Economy, Financial Sector and Economic Freedom in EU Transition Economies

Country	Year	(1)	(2)	(3)
Bulgaria	2003	35.9	25.95	57
	2014	31.0	60.66	65.7
Croatia	2003	32.3	45.08	53.3
	2014	28.0	69.36	60.4
Czech Republic	2003	19.5	24.53	67.5
	2014	15.3	50.38	72.2
Estonia	2003	30.7	50.77	77.7
	2014	27.1	69.07	75.9
Hungary	2003	25.0	36.70	63
	2014	21.6	43.90	67
Poland	2003	27.7	27.98	61.8
	2014	23.5	51.91	67
Romania	2003	33.6	13.74	50.6
	2014	28.1	37.87	65.5
Slovakia	2003	18.4	31.18	59
	2014	14.6	50.39	66.4
Slovenia	2003	26.7	40.52	57.7
	2014	23.5	55.02	62.7

NOTES Column headings are as follows: (1) shadow economy (% of GDP), (2) domestic credit to private sector (% of GDP), (3) Economic Freedom Index. The data of shadow economy, domestic credit to private sector and economic freedom index were respectively obtained from Schneider, Raczkowski, and Mróz (2015), World Bank (http://data.worldbank.org/indicator/FS.AST.PRVT.GD.ZS), and Heritage Foundation (http://www.heritage.org).

directly, while trying to meet the criteria of EU membership. However, there have been no general programs in the EU to combat with shadow economy yet, while European Commission launched some initiatives such as COM(2012)722 and COM(2012)173.

There have been no studies on the interaction among shadow economy, development of financial sector and institutional quality in EU transition economies in the literature. Therefore, this study will be an early empirical study which investigates the interaction among shadow economy, financial sector development and institutional quality on in EU transition member countries during the 2003–2014 period employing

panel data. In this context, we will sum up the literature related to the nexus among shadow economy, financial sector development and institutional quality in the next section. Then data and method will be given in the second section, the third section provides the major findings of empirical analysis. Finally, the fourth sections concludes the study.

Literature Review

A great number of studies have researched the effect of improvements in financial sector on various economic variables such as economic growth, income distribution, savings, competitiveness, technological progress (Levine 1997; Hassan, Sanchez, and Yu 2011; Ang 2011; Zhang, Wang, and Wang 2012; Sahoo and Dash 2013). However, most of them have concentrated on the nexus between economic performance and development of financial sector, but few studies have researched the interaction between shadow economy and improvements in financial sector and revealed that improvements in financial sector has decreased the shadow economy (Blackburn, Bose, and Capasso 2012; Bose, Capasso, and Wurm 2012; Capasso and Jappelli 2013; Bittencourt, Gupta, and Stander 2014).

In this context, Gobbi and Zizza (2007) investigated the nexus between shadow economy and financial sector development in Italian debt markets during the 1997–2003 period and revealed that shadow economy prevented development of financial sector, but financial sector development had no statistically impact on shadow economy. Bose, Capasso, and Wurm (2012) researched the interaction between shadow economy and improvements in banking sector in 137 countries during 1995–2007 period employing panel regression and revealed a negative relationship between shadow economy and banking sector development. Blackburn, Bose, and Capasso (2012) also developed a theoretical model including financial intermediation and tax evasion and the model suggested that the economies with lower development of financial sector experiences higher rates of shadow economy and tax evasion.

In another study, Capasso and Jappelli (2013) developed a theoretical model on the nexus between shadow economy and development of financial sector. Their model projected that financial development may reduce the tax evasion and shadow economy by contributing to the firms providing cheaper finance. They also tested their theoretical model by using Italian microeconomic data and empirical findings also verified their theoretical model. Bittencourt, Gupta, and Stander (2014) also developed a model on the relationship among shadow economy, development

of financial sector and inflation and their model suggested that higher financial development reduces the shadow economy. They also tested their model by a dataset including 150 countries during 1980–2009 period and empirical findings supported the predictions of their theoretical model.

The literature on the nexus between shadow economy and institutional quality is richer when compared to the literature about the interaction between shadow economy and financial sector development. The studies have predominantly revealed that the improvements in the institutions reduce the shadow economy (Torgler and Schneider 2007; Dreher, Kotsogiannis, and McCorriston 2009; Singh, Jain-Chandra, and Mohommad 2012a; Razmi, Falahi, and Montazeri 2013; Iacobuta, Socoliuc, and Clipa 2014; Shahab, Pajooyan, and Ghaffari 2015) as seen in table 2.

TABLE 2 Literature Summary on the Relation between Institutional Quality and Shadow Economy

Study	Sample and study period	Method	Major findings
Friedman, Kaufmann, and Zoido-Lobaton 2000	69 countries	Panel regression	Corruption had positive impact on shadow economy, while legal environment had negative impact on shadow economy.
Bovi (2003)	21 OECD countries, 1990–1993	Panel regression	Institutional quality affected shadow economy negatively.
Dreher, Kotsogiannis, and McCorriston (2005)	18 OECD countries, 1998–2002	Structural equation modelling	Institutional quality affected shadow economy negatively.
Torgler and Schneider (2007)	86–100 countries, 1990, 1995, and 2000	Panel regression	Institutional quality affected shadow economy negatively.
Schneider (2007)	145 countries, 1999–2005	Panel regression	Institutional quality affected shadow economy negatively/positively in high/low income countries
Dreher, Kotsogiannis, and McCorriston (2009)	145 countries, 1999–2003	Panel regression	Institutional quality affected shadow economy negatively.

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TABLE 2 *Continued from the previous page*

Study	Sample and study period	Method	Major findings
Enste (2010)	25 OECD countries, 1995–2005	Panel regression	Deregulation affected shadow economy negatively.
Torgler, Schneider, and Macintyre (2010)	59 countries, 1990–1999	Panel regression	Institutional quality affected shadow economy negatively.
Singh, Jain-Chandra, and Mohommad (2012b)	100 countries	Panel regression	Institutional quality affected shadow economy negatively.
Ruge (2012)	35 countries (mostly from OECD)	Structural equation model	Institutional quality affected shadow economy negatively.
Quintano and Mazzocchi (2012)	33 European countries, 2005–2010	Structural equation model	Regulatory efficiency had negative impact on shadow economy.
Manolas et al. (2013)	19 OECD countries, 2003–2008	Panel regression	Institutional quality affected shadow economy negatively.
Razmi, Falahi, and Montazeri (2013)	51 Organisation of Islamic Cooperation member countries, 1999–2008	Dynamic panel regression	Institutional quality affected shadow economy negatively.
Kuehn (2014)	21 OECD countries	Modelling	Institutional quality affected shadow economy negatively.
Iacobuta, Socoliuc, and Clipa (2014)	EU countries	Panel data analysis	Institutional quality affected shadow economy negatively.
Remeikiene and Gaspareniene (2015)	Lithuania, 2000–2011	Regression analysis	Financial development and institutional quality affected shadow economy negatively.
Shahab, Pajooyan, and Ghaffari (2015)	25 developed and developing countries, 1999–2007	Static and dynamic panel regression	Institutional quality affected shadow economy negatively.

Data and Method

We researched the relationship among shadow economy, development of financial sector and improvement in institutional quality in the EU

transitional economies during 2003–2014 period employing cointegration analysis of Basher and Westerlund (2009) and causality test of Dumitrescu and Hurlin (2012).

DATA

In this study, we used the data of shadow economy based on the MIMIC method by Schneider, Raczkowski, and Mróz (2015) as a proxy for the shadow economy. Moreover, we used domestic credit to private sector as a percent of GDP as a proxy for financial development, because the capital markets in our sample still have been at the early stages of development. Finally, we took the economic freedom index of Heritage Foundation (http://www.heritage.org) as a proxy for institutional quality, because index of economic freedom is calculated based on rule of law, limited government, regulatory efficiency and open markets. The data description was given in table 3. We benefited from Stata 14.0, WinRATS Pro. 8.0 and Gauss 11.0 programs for econometric analysis.

TABLE 3 Data Description

Variable	Symbol	Source
Shadow economy (% of GDP)	SHAEC	Schneider, Raczkowski, and Mróz (2015)
Domestic credit to private sector (% of GDP)	DCRD	World Bank (http://data.worldbank.org/indicator/FS.AST.PRVT.GD.ZS)
Economic freedom index	EFR	Heritage Foundation (http://www.heritage.org)

ECONOMETRIC METHODOLOGY

In this study, we tested the heterogeneity of the variables with adjusted delta test of Pesaran, Ullah, and Yamagata (2008) and cross-sectional independency was tested with CD LM1 test of Breusch and Pagan (1980). Then, we tested stationarity of the series with CIPS test of Pesaran (2007) regarding considering cross-sectional dependency, Im, Lee, and Tieslau (2010), and Narayan and Popp (2010) unit root tests considering structural breaks. The cointegration test of Basher and Westerlund (2009) was employed to test cointegrating relationship among variables. Finally causal relationship among the series was tested with test by Dumitrescu and Hurlin (2012).

ECONOMETRIC MODEL

The development of financial sector and quality of governing institutions have potential to affect shadow economy negatively, because economic units are motivated to operate in formal economy in case financial sector provides cheap financing. On the other hand institutional quality is the main factor which designs and regulates the environment which firms operate. So we expected that countries with better institution have less shadow economy. Therefore, we establish our model as follows:

$$\text{SHAEC} = f(\text{DCRD}, \text{EFR}) \tag{1}$$

In this function, SHAEC denotes the shadow economy as a percent of GDP, while DCRD represents the development level of financial sector and EFR represents the quality of institutions. We expect a negative relationship among SHAEC, DCRD and EFR considering the theoretical and empirical literature.

CROSS-SECTIONAL AND HOMOGENEITY TESTS

Cross-sectional independency and homogeneity of the variables are determinative for us to select the econometric tests used in the future stages of the study. The cross-sectional independency among the variables will be analyzed by CD_{LM1} test of Breusch and Pagan (1980), because T (time dimension) = 12 is higher than N, cross-sectional dimension = 9. The CD_{LM} test statistic values are obtained from the equation (2). It is expected that there is a simultaneous correlation among the residuals of this equation (Pesaran 2004) and the statistical significance of this correlation is tested with LM test in equation (3) developed by Breusch and Pagan (1980).

$$\Delta Y_{it} = \alpha_i + \beta_i y_{i,t} + \sum_{j=1}^{p_i} c_{ij}\Delta_{i,t-j} + d_i t + h_i \bar{y}_{t-1} + \sum_{j=0}^{p_i} \eta \Delta \bar{y}_{i,t-j} + \varepsilon_{i,t}. \tag{2}$$

$$\text{LM} = T \sum_{i=j}^{N-1} \sum_{j=i+1}^{N} \hat{\rho}_{ij}^2 \sim \chi^2_{N(N-1)/2}. \tag{3}$$

In equation (3) ρ_{ij} is the correlation among the residuals obtained estimation of each equation by ordinary least squares. LM exhibits chi square distribution, while T goes to infinity and N is fixed.

We tested the homogeneity of the variables with adjusted delta tilde test of Pesaran, Ullah, and Yamagata (2008) and the test statistic is calculated as follows (H_0: $\beta_1 = \beta_2 = \cdots = \beta_n = \beta$, for all the β_is):

$$\tilde{\Delta}_{\text{adj}} = \sqrt{N}\frac{N^{-1}\tilde{S} - E(\tilde{Z}_{it})}{\sqrt{Var}(\tilde{Z}_{it})}. \tag{4}$$

PANEL UNIT ROOT TESTS

CIPS, Im, Lee, and Tieslau (2010), and Narayan and Popp (2010) unit root tests will be employed to analyze integration levels of the variables. CIPS test based on CADF test of Pesaran (2007) considers cross-sectional dependency but ignores the structural breaks. However, unit root tests of Narayan and Popp (2010) and Im, Lee, and Tieslau (2010) regard structural breaks in the series. Narayan and Popp (2010) unit root test determines the dates of structural breaks by maximizing the significance of the break dummy coefficient differently from Lumsdaine and Papell (1997) and Lee and Strazicich (2003) unit root tests. Finally, Im, Lee, and Tieslau (2010) panel LM unit root test considers possible heterogeneous breaks in constant and trend and also makes the adjustments in case of cross-correlations.

BASHER AND WESTERLUND (2009) COINTEGRATION TEST

Basher and Westerlund (2009) cointegration test regards cross-sectional dependency and multiple structural breaks and allows for maximum three structural breaks, while testing cointegrating relationship among the series. The test statistics of the model (H_0: There is cointegration among the variables for all the cross-sections) is as follows:

$$Z(M) = \frac{1}{N}\sum_{i=1}^{N}\sum_{j=1}^{M_1+1}\sum_{t=T_{ij-1}+1}^{T_{ij}}\left(\frac{S_{it}^2}{(T_{ij} - T_{ij-1})^2\hat{\sigma}_i^2}\right). \tag{5}$$

$S_{it} = \sum_{s=T_{ij-1}+1}^{t}\hat{W}_{st}$ and $\hat{W}_{it}$ is a residual vector obtained from an efficient estimator like fully modified least squares. σ_i^2 is variance estimator based on $\hat{W}_{it}$. The test statistic exhibits a standard normal distribution and the hypotheses of the test are as follows:

DUMITRESCU AND HURLIN (2012) CAUSALITY TEST

Dumitrescu and Hurlin (2012) causality test is a modified version of Granger (1969) causality test regarding heterogeneity. The following test statistics are calculated in the context of the test (Dumitrescu and Hurlin 2012):

$$W_{N,T}^{HNC} = \frac{1}{N}\sum_{i=1}^{N} W_{i,T}. \tag{6}$$

$$Z_{N,T}^{HNC} = \sqrt{\frac{N}{2K}}(W_{N,T}^{HNC} - K)\frac{d}{N,T\to\infty}N(0,1). \tag{7}$$

$$Z_{N,T}^{HNC} = \frac{\sqrt{N}[W_{N,T}^{HNC} - N^{-1}\sum_{i=1}^{N} E(W_{i,t})]}{\sqrt{N^{-1}\sum_{i=1}^{N} Var(W_{i,t})}}\frac{d}{N,T\to\infty}N(0,1). \tag{8}$$

Empirical Analysis

CROSS-SECTIONAL TEST AND HOMOGENEITY TEST

We tested the cross-sectional dependence with CD_{LM1} test of Breusch and Pagan (1980), because time dimension is higher than cross-sectional dimension ($T = 12, N = 9$). The results were given in table 4 and since probability values were lower than 5%, the null hypothesis (cross-sectional independency) was rejected. So the findings indicated a cross-sectional dependency among the series.

TABLE 4 Results of CD_{LM1} Test

Variable	Test statistic	Probability
SHAEC	9.523	0.001
DCRD	7.226	0.034
EFR	9.821	0.010

We employed adjusted delta tilde test of Pesaran, Ullah, and Yamagata (2008) and the findings were given in table 5. Since the null hypothesis (slope coefficients are homogenous) was rejected at 1% significance level, we concluded that there was heterogeneity.

TABLE 5 Results of Adjusted Delta Tilde Test

Test	Test statistics	Probability
$\tilde{\Delta}_{adj.}$	28.97	0.002

PANEL UNIT ROOT TESTS

Panel data analysis requires that the variables should be I(0) to avoid the possible spurious relationship among the series. First we analyzed integration levels of the variables with CIPS test of Pesaran (2007) regarding the cross-sectional dependence among the series and the results of

the test were given in table 6. The findings denoted that all the variables were I(1).

TABLE 6 Results of CIPS Test

Test	SHAEC	DCRD	EFR
CIPS	7.532*	8.002*	7.271*

NOTES * Significant at the 0.05 level.

Secondly, we employed unit root tests of Narayan and Popp (2010) and Im, Lee, and Tieslau (2010) regarding structural breaks. In this context, we applied the second model of Narayan and Popp (2010) test which allows two breaks in both level and trend and the findings were given in table 7.

TABLE 7 Results of Narayan and Popp (2010) Panel Unit Root Test

Country	Test statistic			TB_1, TB_2
	SHAEC	DCRD	EFR	
Bulgaria	4.764*	4.732*	6.834*	2008, 2009
Croatia	9.328*	6.543*	5.925*	2009, 2012
Czech Republic	6.035*	4.007*	5.112*	2009, 2012
Estonia	9.692*	5.328*	6.733*	2008, 2009
Hungary	7.551*	3.982*	8.492*	2009, 2012
Poland	8.634*	7.831*	5.629*	2008, 2009
Romania	5.992*	9.447*	4.227*	2008, 2009
Slovakia	8.426*	6.263*	4.752*	2009, 2010
Slovenia	9.113*	4.771*	6.994*	2009, 2012

NOTES * Significant at 5% level. Critical values are –5.882, –5.263, and –4.941 at the 1%, 5%, and 10% significance levels, respectively for model 2 with 50.000 replications for endogenous two breaks test.

The results indicated that the series were I(1) with structural breaks. The dates of structural breaks showed that recent financial crises, global financial crisis and Eurozone debt crisis, induced significant structural shifts in the series of DCRD and EFR.

We also used the different versions of the panel LM unit root tests considering and not considering structural and the findings tests were given in table 8. The findings denoted that the variables had unit root when the structural breaks were disregarded. On the other hand when we ap-

plied the version considering two structural breaks, two different test statistics were obtained depending on the cross-correlations. The first test statistic ignores the cross-correlations, while the second test statistic regards the cross-correlations by considering the Pesaran's CA procedure. The results indicated that the variables were stationary when the cross-sectional dependence was ignored. However, the variables were not stationary, when the cross-sectional was considered.

TABLE 8 Results of Panel LM Unit Root test

Panel LM test statistic without break	−0.234
Panel LM test statistic with two breaks	−7.335*
Panel LM test CA statistic with two breaks	−0.872

NOTES * 0.05 significance level.

BASHER AND WESTERLUND (2009) COINTEGRATION TEST

We employed Basher and Westerlund (2009) model which allows structural breaks in constant and trend and the findings were presented in table 9. The findings revealed that there was cointegrating relationship between the variables of our study with structural breaks and cross-sectional dependency.

TABLE 9 Results of Basher and Westerlund (2009) Cointegration Test

Test statistic	Probability value
56.987	0.258

NOTES Probability values obtained by using bootstrap with 1.000 simulations.

ESTIMATION OF LONG RUN COINTEGRATING COEFFICIENTS

The individual cointegrating coefficients were estimated with CCE (Common Correlated Effects) method of Pesaran (2006) and the cointegrating coefficients of the panel were estimated with CCMGE (Common Correlated Mean Group Effects) method of Pesaran (2006) and the findings were given in table 10 (p. 169). The findings revealed that development of financial sector and improvements in institutional quality decreased the shadow economy.

DUMITRESCU AND HURLIN (2012) CAUSALITY TEST

We investigated causal relationship among shadow economy, financial development and institutional quality with causality test of Dumitrescu

TABLE 10 Long run Cointegrating Coefficients

Country	DCRD		EFR	
	Coefficient	*t*-statistic	Coefficient	*t*-statistic
Bulgaria	−0.089*	−3.854	−0.053*	−4.263
Croatia	−0.112*	−4.012	−0.114*	−5.883
Czech Republic	−0.108*	−4.348	−0.156*	−3.915
Estonia	−0.142*	−5.924	−0.083*	−3.772
Hungary	−0.096*	6.993	−0.145*	−6.834
Poland	−0.063*	−5.326	−0.102*	−3.992
Romania	−0.135*	−3.261	−0.081*	−4.036
Slovakia	−0.152*	−4.772	−0.126*	−5.823
Slovenia	−0.133*	−3.725	−0.105*	−6.432
Panel	−0.146*	−4.045	−0.170*	−3.886

NOTES * Significant at 5% level.

TABLE 11 Results of Dumitrescu and Hurlin (2012) Causality Test

Null hypothesis	Test	Statistics	Prob.
SHAEC does not homogeneously cause DCRD	W^{HNC}	3.632	0.000
	Z^{HNC}	5.943	0.001
	$\tilde{Z} - bar$	6.523	0.013
DCRD does not homogeneously cause SHAEC	W^{HNC}	5.998	0.000
	Z^{HNC}	3.642	0.022
	$\tilde{Z} - bar$	4.022	0.000
SHAEC does not homogeneously cause EFR	W^{HNC}	6.531	0.000
	Z^{HNC}	5.773	0.011
	$\tilde{Z} - bar$	4.254	0.004
EFR does not homogeneously cause SHAEC	W^{HNC}	3.992	0.000
	Z^{HNC}	2.880	0.000
	$\tilde{Z} - bar$	3.638	0.032

and Hurlin (2012) and the findings were given in table 11. The findings revealed bidirectional causality both between SHAEC and DCRD and between SHAEC and EFR.

Conclusion

We researched the relationship among shadow economy, development of financial sector and institutional over the period 2003–2014 in EU tran-

sition economies benefiting from Basher and Westerlund (2009) cointegration test and Dumitrescu and Hurlin (2012) causality test. Our findings revealed that there was a cointegrating relationship among shadow economy, development of financial sector and institutional quality. Moreover, development of financial sector and improvements in institutional quality decreased the shadow economy in the long run. Finally, the results of causality test revealed a two-way causality between shadow economy and financial development and shadow economy and institutional quality. So our findings verified an interaction among shadow economy, development of financial sector and institutional quality and were consistent with the predictions of theoretical studies and the results of empirical studies in the literature.

This study also verified that financial development and institutional quality are important factors affecting shadow economy. In this regard, improvements in financial sector and institutional quality will be useful in combat with shadow economy considering our findings, theoretical and empirical literature.

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