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Estimating the roles of financial sector development and international trade openness in underground economies: Evidence from the European Union

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Abstract
This paper investigates both the static and dynamic relationships between the development within the financial sector development and international trade openness with regard to the size of the underground economy in 20 EU (European Union) Countries. Panel data analysis will be conducted for the period 2006 to 2014, in order to examine the effect of the financial sector development and trade openness on the size of the underground economy. In addition to the static relationship framework, the Arellano-Bond Generalized Method of Moments econometric method will be applied to examine the dynamic framework between the variables. The main findings of this paper suggest that financial development has a significant impact on the size of the underground economy, and the existence of the negative correlation between the official GDP and the size of the underground economy is proven. In conclusion, the development within the financial sector is a significant contributor to the underground economy.

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Keywords Financial Sector Development; International Trade Openness; Corruption Perception Index; Underground Economy; European Union Countries.

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1. Introduction:

The underground economy is one of the important concerns that held a highly prominent place in the literature. Even though many countries have taken many actions to prevent unofficial activities, the increase in the size of underground activity is an inevitable fact. Recently estimates of the size of the underground economy on average ranged from 28 to 43% of the GDP in developing countries, 38 to 40% of GDP in transaction countries, and 14 to 17% of GDP in developed countries (see Schneider 2007).

However, there is a lack of consensus on the definition of the term *underground economy* (Öğünç and Yılmaz 2000). The underground economy is the sum of all legal and illegal actions that have not been reported to the government. It includes illegal activities as well as economic transactions that are not measured by government statistics. There are many distinct definitions for the underground economy, and an exhaustive definition was given by Smith (1994) as it being the total sum of the market basket of products and services, whether legal or illegal, which have not been added to the yearly registered GDP of a specific country. The underground economy has both positive and negative effects. One of the most significant positive effects of the underground economy stated by Schneider and Enste (2000) is that two- thirds of income generated from it is spent on the official economy. On the other hand, Capasso and Japelli (2013) pointed out that a large portion of the underground economy causes a distortion in investment and a lack of development in addition to ethical and political concerns. It also results in unreliable macroeconomic variables that may cause ineffective policy making. Informal firms set competitive price advantages over official firms. Avoiding social security contributions causes the financial positioning of social security institutions to deteriorate and avoiding tax obligations

causes a decline in the financial positioning of government budgets. The effects of the underground economy have also been discussed by many scholars (Schneider 2009; Dabla-Norris et al. 2008; Maurin et al 2006; Schneider 2006; Öğünç and Yilmaz 2000). The main reasons to go underground can be summarized as being due to the burdens of taxation, regulations, and labor costs.

The financial market's development, the banking sector's development, and the availability of credit and its cost have not received much attention. The financial sector is one of the foundations that are likely to influence the relative cost and benefits of the operating underground economy, which, in turn, impacts on its size. (Berdiev and Saunoris, 2016; Capasso and Japelli, 2013; Blackburn et al., 2012; Bose et al., 2012; Dabla-Norris et al., 2008; Straub, 2005). The financial sector enhances the efficient intermediaries entering the markets, reduces credit costs, and increases the opportunity cost of continuing to operate underground (see Capasso and Japelli, 2013). Within the economy, the financial sector serves critical functions such as providing access to credit and monitoring business transactions for tax obligations, while financial development reduces informal working by increasing the opportunity cost of operating underground activity by providing access to credit (Capasso and Japelli, 2013; Blackburn et al., 2012). Japelli et al. (2005) stated that financial development reduces credit costs and gives the incentive to operate informally while increasing the revenue from high-tech projects. In their study, a technical model was proposed between agents that choose low-return technology that does not entail a plan versus agents that choose high-return technology, which entails external funding. High-return technology agents need to pledge more collateral in the case of external funding to reduce the credit costs.

The opportunity cost of operating the underground economy is increasing due to the higher credit costs in the informal system. Financial development lessens the cost of credit and boosts the opportunity cost of operating underground, as shown in some of the literature studies. Straub (2005) built a model in which firms choose between the official and unofficial economies. Firms that choose the formal economy have to be registered, which exposes them to high entry costs. In addition, they have to declare their certifiable income and assets, which gives them access to credit markets, as well as the advantages of key public goods and the enforcement of property rights and contracts. It also lowers the default and financial costs. Antunes and Cavalcanti (2007) investigated the formal sector versus the informal sector; engagement in the formal sector exposes a company's higher entry costs, regulations and tax obligations, with the trade-offs of better outside financing against the higher financial costs of the informal sector. Ellul et al. (2012) pointed out that transparent firms can access cheaper financing but also have heavier tax obligations. They studied this trade-off in a model via the deadweight loss of taxation and the endogenous rationing of exterior finance. La Porta and Shleifer (2008) stated unofficial firms avoid tax payments and adhering to regulations, but lose access to public goods and other authorized advantages, such as exterior finance. The main conclusion is that there is a negative correlation between private credit availability and an individual's subjective assessment of their access to credit. Bose et al. (2012) state that development in the banking sector is associated with a smaller underground economy by evaluating the effect of both the depth and the efficiency of the banking system on the underground economy. Berdiev and Saunoris (2016) found evidence that financial development shrinks the shadow economy and shocks to the shadow economy prevent financial development.

The interaction between trade openness and the size of the underground economy is another interesting link despite the fact that it did not receive too much attention either. The correlation between trade openness and the size of the underground economy is ambiguous. Trade reforms expose corporations to increasing foreign competition, and in response, some corporations reduce their labor force costs by cutting employee benefits, for example by using part-time instead of full-time labor to reduce social security payments, and therefore trade liberalization boosts the informal economy (Fugazza and Fiess, 2010; Goldberg and Pavcnik 2003). Furthermore, many studies state that trade openness increases the scale of informal employment, as does the underground economy (see Ghosh and Paul, 2008). On the other hand, Elgin and Oyvat (2013) stated that trade openness may have either a positive correlation or a negative correlation with the underground economy; a positive correlation is expected when openness facilitates the external subordination of the informal sector to the formal sector, while a negative correlation is likely to occur if openness in international trade eases the government's ability to examine informal production.

This study will be based on the links that receive very little attention in both theory and in empirics. The paper will emphasize the direct effect of financial development, trade openness, official gross domestic product, corruption perception index, as well as the indirect effect of interest rates on the size of the underground economy. This indirect effect of the interest rate with respect to any fall associated with an increase in money supply causes the rise of an underground economy. Cornell (1983) states that standard Keynesian theory predicts that actual monetary expansion leads to lower interest rates through the liquidity effect. There is the inverse relationship between interest rates and money supply. The indirect effect of interest rates with

respect to any fall associated with an increase in money supply causes the rise of underground economy. In light of the fact that most of the underground activity transactions are made in cash, an increase in the money in circulation may increase the size of the underground activity. Many scholars (see Schneider and Enste, 2000; Dell'Anno, 2003; Dell'Anno and Schneider, 2003; among others) suggest a negative correlation between the official GDP and the underground economy. Johnson et al. (1997, 1998) state the positive correlation between corruption and the underground economy, yet on the other hand, Dreher and Schneider (2006) could not robust relationship between the variables, and only found that corruption and the underground economy complement each other only in low-income countries. This study throws some light on the case of interaction between financial development, trade openness, official gross domestic product, corruption perception index, interest rates, and the size of the underground economy. All the expected correlations are negative except the corruption perception index i.e. the expected correlation between the financial sector development and the size of the underground economy is negative; the expected correlation between trade openness and the size of the underground economy is negative; the expected correlations between interest rates and the size of the underground economy is negative; the expected correlation between the official GDP and the size of the underground economy is negative; and finally the expected correlation between the corruption perception index and the size of the underground economy is positive. This research is the first of its kind to link financial sector development, trade openness, and the size of the underground economy. It is also the first in terms of using interest rate variables to examine their indirect effect on the size of the underground economy separately.

This paper will provide an empirical study of the relationship between financial sector development, trade openness, the official gross domestic product, the corruption index, and the interest rate in the size of the underground economy. The impact of financial development on the size of the underground economy through the channels of trade openness, the official gross domestic product, the corruption perception index, and interest rates will be investigated for the time period 2006 to 2014, using panel data. In addition to the static framework of the relationship between the variable, since the relationship between the financial sector development and the underground economy volume occurs over time, so a dynamic framework need to be used to examine the relationship between them (see Berdiev and Saunoris, 2016; Bardiev et al., 2015; Birinci, 2013). To the best of the author's knowledge, this study will be the first to investigate both roles: financial sector development and trade openness within the size of the underground economy, and this research is the first to investigate both the static and the dynamic relationships between the variables. This study proceeds as follows: Section 2 describes the data; section 3 describes the methodology; section 4 presents the empirical results and discussions; and section 5 concludes and discusses policy implications.

2. Data:

Even though the underground economy research is a widely investigated study in the literature, its interaction with financial sector development and trade openness has not received much attention. Annual data covering 2006 to 2014 are utilized in this article. The variables of the study are the size of the underground economy (UE), the composite financial index as a proxy for financial development (FD), TRD as international trade openness that has been proxied by

the sum of exports plus the imports of goods and services as a percentage of the GDP, the long-term interest rate (INT), gross domestic product per capita as the official GDP, and finally the CPI as the corruption perception index.

Measuring the underground economy is a crucial task since it is an attempt to evaluate what is already hidden. Individuals and institutions that engage in underground economic activities, endeavor to hide their participation from disclosure (see Schneider and Enste 2000; Öğünç and Yılmaz 2000). However, some of the researchers have done estimates of the underground economy (see Schneider 2007; Elgin and Öztunali, 2012; Schneider, 2013). The data of underground economy are attained from Imamoglu (2016) who use the MIMIC (multiple causes and multiple indicators) model approach with five cause and two indicator variables. Indirect taxation, direct taxation, social security contributions, unemployment, and self-employment are used as cause variables, while real GDP per capita and the labor force participation rate have been used as indicator variables in order to measure the underground economy (% of GDP). The model estimates are calibrated with of Schneider's estimates (2007).

Various determinants used to measure the financial sector development in the literature have involved various proxies for financial development. Ang (2009) used the commercial bank offices per thousand people ratio, the liquid liabilities and broad money supply to nominal GDP ratio, the commercial bank assets to the sum of central bank assets ratio, and commercial bank assets and the bank claims in the private sector to nominal GDP ratio as the proxies for financial development. Love (2003); Love and Zicchino (2006) have constructed a financial development index with market capitalization over GDP, total value traded over GDP, total value traded over

market capitalization, ratio of liquid liabilities to GDP, and credit going to the private sector over GDP. Ang and Kibbin (2007) have developed a financial development index by using development proxies as liquid liabilities to nominal GDP, commercial bank assets to commercial bank assets plus central bank assets, and domestic credit to private sectors divided by nominal GDP.

In this paper, five different proxies will be used to construct a composite financial development index that parallels the variable selection in the studies by Beck et al. (2000), Levine et al. (2000) and Katircioğlu and Taşpinar (2017). This study's financial development proxies are the ratio of commercial bank assets to central bank assets plus commercial bank assets, domestic credits by banking sector as a percentage of the GDP, domestic credits provided to private sector as a percentage of the GDP, broad money supply as a percentage of the GDP, and finally liquid liabilities as a percentage of the GDP. The financial development index is generated using the principal component factor analysis in the SPSS statistical software. All the financial development proxies are obtained from World Development Indicators, except the ratio of commercial bank assets to central bank assets plus commercial bank assets that are obtained from Bankscope.

Finally, TRD and GDP per capita have been obtained from the World Data Bank (WDI 2016); INT has been obtained as the long-term interest rate from the OECD statistical database, and the corruption perception index has been obtained from Transparency International (TI 2014). Variables of the study have been summarized in Table 1. Annual data for financial sector development, trade openness, and gross domestic product variables are used in logarithmic

forms. Although this paper attempts to investigate the empirical between the variables of interest for all European Union countries, due to the data availability Bulgaria, Croatia, Cyprus, Estonia, Latvia, Lithuania, Malta, and Romania have been excluded from the study. Prior to empirical analyses it would be good step to present descriptive statistics of all series under consideration as can be found in Table 2.

Table 1. Variables of the Study

Variable	Definition
Dependent Variable	
UE	underground economy as a percentage of GDP
Financial Variables	
A	the ratio of commercial bank assets to central bank assets plus commercial bank assets
DC	domestic credits by banking sector as a percentage of the GDP
DCP	domestic credits provided to private sector as a percentage of the GDP
M2	broad money supply as a percentage of the GDP
M3	liquid liabilities as a percentage of the GDP
Independent Variables	
TRD	the sum of exports plus the imports of goods and services as a percentage of the GDP
INT	the long-term interest rate
GDP	the gross domestic product per capita
CPI	the corruption perception index

Table 2. Descriptive Statistics

Variable	Mean	Std. Dev.	Min	Max
u	12.73211	3.959069	6.298446	22.04038
f	3.662852	1.008049	2.179826	8.478314
t	4.615094	0.490258	3.819614	5.924651
i	4.201117	2.385283	1.163333	22.4975
g	10.43672	0.528399	9.268347	11.60825
cpi	6.832222	1.705124	3.4	9.6

3. Empirical Methodology:

In order to find the relationship between the size of the underground economy and the development in the finance sector, the following static relationship established using panel data:

$$UE_{it} = \beta_0 + \beta_1 FD_{it} + \beta_2 TRD_{it} + \sum_{k=2}^{n} \beta_k X_{it} + \alpha_i + u_{it} \quad (1)$$

Where UE_{it} is the size of the underground economy of country i, in year t; FD_{it} is the development in the finance sector of country i, in year; TRD_{it} is the international trade openness; other explanatory variables that are the official GDP, the corruption perception index, and interest rates are denoted by X_{it}; country fixed-effects are represented by α_i; and finally u_{it} represents the error term.

There are many variables that have been used to estimate the size of the underground economy, for instance, the tax burden – that is direct tax, indirect tax, and social security contributions – strict regulations, the inflation rate, interest rates, self-employment, and the unemployment rate are some of the cause variables. On the other GDP growth rate, real GDP per capita, the labor force participation ratio, and the currency in circulation outside of the banks are some of the indicator variables that have been used to estimate the size of the underground economy. However, there is a lack of consensus when it comes to choosing the right instrument for the size of the underground economy. Therefore, using lagged values of independent variables as instruments is a reasonable way to handle the situation in order to estimate the equation above. Additionally, to address any endogeneity issues of regression, and to capture persistence and potentially mean-reverting dynamics in the size of the underground economy, dynamic panel

data estimations using Arrelano and Bond's (1991) GMM estimator where one period's lagged values of regressors are used as instruments. In this case the following equation is estimated;

$$UE_{it} = \beta_0 + \beta_1 UE_{it-1} + \beta_2 FD_{it} + \beta_3 TRD_{it} + \sum_{k=2}^{n} \beta_k X_{it} + \alpha_i + u_{it} \quad (2)$$

Baltagi et al. (2009) state that incorporating the lagged dependent implies the existence of a correlation between regressors and the error term since the lagged dependent variable depends on u_{it-1} which is a function of the country fixed-effect, α_i. This occurs because the correlation equation (2) suffers from the Nickell (1981) bias, which disappears if, and only if, T tends to infinity. Once again, this preferred estimator is GMM (generalized method of moments) as suggested by Arellano and Bond (1991). GMM differences the model in order to eliminate country fixed-effects. Differencing also gets rid of any endogeneity that may be due to the correlation of these country fixed-effects and regressors. Differencing also helps to provide stationary regressors.

The orthogonality is between the lagged dependent variable of the size of the underground economy and the differenced errors utilized by moment condition. This assumes that the original disturbances in equation (2) are serially uncorrelated and that the differenced error is the first order moving average with a unit root. To reach this conclusion, two diagnostics are computed using the GMM estimator of Arellano and Bond's GMM procedure to test for first order and second order serial correlation in the disturbances. One of two diagnostics should reject the null of the absence of the first order serial correlation but not reject the absence of the second order serial correlation.

Since the number of moment conditions increases with T which is a special feature of dynamic panel data GMM estimation, a Sargan test has to be performed to test the over-identification restrictions. Too many moment conditions cause bias while increasing efficiency. Therefore, a subset of these moment conditions could be used to take advantage of the trade-off between the reduction in bias and the loss in efficiency (see Baltagi 2005).

Sargan's J test for over-identifying restrictions in a statistical model and the AR(2) test for autocorrelation will be provided to support for the exogeneity of the instrument and the absence of autocorrelation, respectively.

4. Results:

As suggested by Antonie et al. (2010), in order to validate the pooled OLS estimation, the poolability test detects with null hypothesis that all α_i are zero. The results suggest rejecting the null hypothesis so that the OLS estimator is biased and not consistent. The presence of individual-specific effect is accepted.

Second, in order to decide between random-effects regression and OLS regression the Breusch-Pagan Lagrange multiplier test rejects the null hypothesis that variances across entities are zero therefore the random-effects estimation will be appropriate.

Third, the Hausman test employed with the null hypothesis of the preferred model is random-effects versus the alternative hypothesis of the preferred model is fixed-effects estimation. The Hausman test checks whether the unique errors are correlated with the regressors, while null hypothesis are the unique errors which are not correlated. Since the probability of the Chi-Square

of the test statistics rejects the null hypothesis, so the fixed-effects estimation must be preferred in order to analyze the functional relationship of the model.

Baltagi (2005) states that cross-sectional dependence is an issue with macro panels with a long time horizon. Even though a micro panel will be used in estimations; cross-sectional dependency, serial correlation, and heteroskedasticity tests will be carried out to gain a better understanding of the nature of the dataset.

In order to detect heteroskedasticity, a modified Wald test for groupwise heteroskedasticity in fixed-effects models that has been implemented in STATA by Christopher Baum, was performed. It uses the null hypothesis that is homoskedastic and in other words constant variance. The probability of the test statistics rejects the null hypothesis with a probability that is less than 0.01. This proves the presence of heteroskedasticity.

In order to test cross-sectional dependency, as in contemporaneous correlation, a Pesaran CD (cross-sectional dependency) test will be employed. The importance of the cross-sectional dependency is that it might provoke bias test results. The Pesaran CD test has rejected the null hypothesis of residuals which is not correlated with a probability that is less than 0.01. There is evidence of cross-sectional dependency as expected because of the cross-country observations which are influenced by common considerations such as similar political or economic issues.

Finally, the Lagrange-Multiplier test for serial correlation will be carried out with the null hypothesis that has no serial correlation. Serial correlation causes the standard errors of the coefficients to be smaller than they actually are and it also causes a higher R-square. Serial correlation in the idiosyncratic errors of linear panel data has been implemented by David Drukker in the STATA statistical programme. The Lagrange-Multiplier test for serial correlation

will be carried out and has rejected the null hypothesis with a probability that is less than 0.01. There is evidence of first order auto-correlation. All diagnostic tests are presented in table 4.

In conclusion, there is heteroskedasticity, cross-sectional dependency, and serial correlation problems in the model. Ignoring any of the cross-sectional dependency or the serial correlation, or the presence of heteroskedasticity in the estimation of the panel models may induce a biased statistical result. In order to control the heteroskedasticity the model will be estimated with a robust fixed-effects estimation. Also, the model will be estimated by using a fixed-effects estimation with Driscoll and Kraay standard errors to control cross-sectional dependency as suggested by Hoechle (2007). Fixed-effects within regression with Driscoll and Kraay standard errors assume the error structure to be heteroskedastic, serially correlated, and up to some lag possibly correlated between groups.

As it stated previously, a dynamic framework needed to be used to examine the relationship between development in the financial sector and the volume of the underground economy due to the relationship between the variables which occurs over time. Therefore, dynamic panel data estimation using the GMM estimator of the Arellano-Bond was carried out.

Table 3. Estimation results

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	RE	FE	FE robust	FE dris~kraay	GMM-AB
Dep.var.UE						
FD	0.686***	0.393**	0.283*	0.283	0.283***	3.089**
	(0.006)	(0.032)	(0.092)	(0.142)	(0.000)	(0.013)
TRD	-2.340***	0.477	0.931	0.931	0.931	-2.166
	(0.000)	(0.568)	(0.278)	(0.265)	(0.443)	(0.332)
INT	0.419***	0.047	-0.024	-0.024	-0.024	0.098**
	(0.000)	(0.255)	(0.526)	(0.601)	(0.599)	(0.025)
GDP	-0.938	-9.650***	-17.511***	-17.511***	-17.511***	-9.568**
	(0.184)	(0.000)	(0.000)	(0.000)	(0.000)	(0.017)
CPI	-0.620***	0.139	0.351*	0.351	0.351**	-0.065
	(0.005)	(0.489)	(0.062)	(0.206)	(0.017)	(0.800)
UE(-1)						0.363**
						(0.026)
R square	0.412	0.183	0.166	0.166		-
Observstions	180	180	180	180	180	140
Wald test (p-value)	-	(0.000)	-	-		-
F test (p-level)	(0.000)	-	(0.000)	(0.000)	(0.000)	(0.000)
Sargan *J* test (p-level)	-	-	-	-		0.271
AR (2) test (p-level)	-	-	-	-		0.519

Note: (i) UE denotes the size of the underground economy; FD denotes the development in financial sector; TRD denotes the international trade openness; INT denotes the long term interest rate; GDP denotes gross domestic product; CPI denotes corruption perception index. (ii) *** and ** and * indicate rejection of null hypothesis at 1% and 5% and 10% significance level. (iii) AB-test is Arellano-Bond test.

Table 4. Hausman Test and Diagnostics of the Model:

Other Tests/Diagnostics	Test Statistics	Probabilities
Hausman Test	102.63	(0.000)
Breusch and Pagan LM Test	505.43	(0.000)
Pesaran CD Test	20.635	(0.000)
Heteroskedasticity Test	133.83	(0.000)
Lagram- Multiplier Test for Serial Correlation	38.883	(0.000)

In table 3, six regressions are reported. In the first five regressions, the static panel data estimations are carried out that are pooled OLS, random-effects regression, fixed-effects regression, robust fixed-effects estimation which control heteroskedasticity, and fixed-effects estimation with Driscoll and Kraay standard errors to control cross-sectional dependency, respectively. Finally, sixth regression includes dynamic panel data estimation using the Arellano-Bond GMM estimator. The statistically significant and positive relationship of the interest rate found in the pooled-OLS and the dynamic panel data estimation indicates the raise in the interest rate will contribute to the volume of the underground economy. The corruption perception index produces significant coefficients in some regressions. In some it indicates positive correlation while in others it indicates a negative relationship between corruption and the volume of the underground economy. On the other hand, international trade openness is statistically significant only in pooled-OLS estimations and reduces the volume of the underground economy according to expectations.

In all the cases, one of the main findings surprisingly suggests the significant positive impact of financial development in the size of the underground economy, which means that financial sector development contributes to the volume of the underground economy. Another important point in the findings is the evidence of negative correlation between the official GDP and the size of the underground economy, parallel to the findings of Schneider and Enste (2000); Dell'Anno (2003); Dell'Anno and Schneider (2003) and among many others.

5. Conclusion:

This study attempts to investigate the effect of the financial sector development and international trade openness on the size of the underground economy in the European Union countries. The research question is 'does financial sector development and also international trade openness successfully attempt to reduce the size of the underground economy?' The results of the present study are of interest to both scholars and policymakers because European Union countries are developed countries with a decreasing underground economy, even though the financial sector is consistently developing and trade openness is reaching huge aggregate numbers due to rapid industrialization. The justification for this research is that financial sector development and trade openness are expected to have a statistical relationship with underground economic activity in such a dynamic economy. Furthermore, to the best of the author's knowledge, this study is one of the first of its kind in the relevant literature, which examines the role of the financial sector development and trade openness in underground economic activity using a panel dataset.

Panel data analyses prove that the size of the underground economy in the European Union countries has a statistical relationship with its determinants which are financial sector development and interest rates. These determinants apply a statistically significant impact on the

size of the underground economy. The financial sector development affects the size of the underground economy through the channels of trade openness, interest rates, official GDP, and the corruption perception index.

The main results of this study surprisingly suggest that financial sector development has a positive and statistically significant impact on the size of the underground economy; that is financial development is a significant contributor to underground economic activity. Additionally, interest rates and corruption also have a positive and statistically significant impact on the size of the underground economy in the European Union countries. The results of this paper indicate that the authorities pay more attention, and they need to do this while operating in financial markets in order to minimize underground activity. The findings show that control of financial operations and precautions to minimize underground activity is needed, since this study has detected a significant relationship between financial development and underground economic activity in European Union countries. For comparative purposes further research should be undertaken in the other countries where there is a considerable volume of underground economic activity.

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