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Informal Economy at the European Territory: Evidence from Panel Threshold Fixed Effect Models

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Avrupa Bölgesinde Kayıt-Dışı Ekonomi: Panel Sabit Etki Eşik Modellerinden Kanıtlar	**Informal Economy at the European Territory: Evidence from Panel Threshold Fixed Effect Models**
Öz	**Abstract**
Bu çalışma Avrupa Bölgesinde kayıt dışı ekonominin belirleyicilerini incelemektedir. Finansal gelişme, beşerî sermaye, işsizlik, enflasyon ve ekonomik özgürlüklerin kayıt-dışı ekonomi üzerindeki etkisi çeşitli panel sabit etki modelleriyle tartışılmaktadır. Belirli bir refah düzeyi üzerinde işsizliğin kayıt-dışı ekonomi üzerinde etkisi artarken, belirli bir beşerî sermaye eşik düzeyinin üzerinde işsizliğin kayıt-dışı ekonomi üzerindeki etkisi azalmaktadır. Ayrıca, ekonomik özgürlüğün kayıt-dışı ekonomi üzerindeki etkisinin belirli bir beşerî sermaye eşik düzeyinin üzerinde arttığı tespit edilmiştir. Sonuç olarak, Avrupa'da kayıt-dışı ekonomi ile baş edebilmek için ortak politikalar önerilmiş olup, kayıt dışı ekonomiyi azaltmada finansal gelişme, beşerî sermaye ve ekonomik özgürlüklerin artırılması faydalı olacaktır.	This study investigates the determiners of informal economy at the European Territory. The impact of financial development, human capital, unemployment, inflation, and economic freedom is discussed with various fixed effect models. While the influence of unemployment on informal economy increases above a certain welfare, the influence of unemployment on informal economy decreases above a certain human capital level. Besides, it is detected that the influence of economic freedom on informal economy increases above a certain human capital threshold. Consequently, common policies are recommended to cope with informal economy in Europe, and the increment in financial development, human capital and economic freedom will be beneficial to reduce informal economy.
Anahtar Kelimeler: Kayıt-dışı, Beşerî Sermaye, Ekonomik Özgürlük, Eşik Etkisi, Panel	**Keywords:** Informal, Human Capital, Economic Freedom, Threshold Effect, Panel
JEL Kodları: C33, E26, O17	**JEL Codes:** C33, E26, O17

Araştırma ve Yayın Etiği Beyanı	Bu çalışma bilimsel araştırma ve yayın etiği kurallarına uygun olarak hazırlanmıştır.
Yazarların Makaleye Olan Katkıları	Çalışmanın tamamı tek yazar tarafından oluşturulmuştur.
Çıkar Beyanı	Yazar ya da üçüncü taraflar açısından çalışmadan kaynaklı çıkar çatışması bulunmamaktadır.

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1. Introduction

There is an enlarging literature related with the concept of informal economy. Informal economy is all economic activities away from the track of official authorities. There are lots of different specification of informal economy in literature as like underground, shadow, and illegal. It is seen that these notions are used in place of each other due to their similar descriptions, and estimation methods. However, the notion of informal economy is chosen at this study. Informal economy provides illegal benefits to its members due to the violation of laws, and rules. People join informal economy even though they are aware of its illegality. Informal economy expands with the accession of people wish to increase their benefits, but it is a refuge for some due to low living standards. This brings the question of whether the participation to informal economy is related with morality or living conditions into mind.

Unemployment is one of the resistant problem of the world economy, and substantial amount of people suffers from low living standards. Some of these people inevitably seek for a remedy in the informal economy. Inflation reduces purchasing power of people in society. Even if developed countries mostly does not face with high inflation problem, it can be dominant in developing countries in various time periods. So, unemployment and inflation are considered as important determinants of informal economy.

Financial development reduces informal economy by making official investment more preferable than illegal attempts. High level of human capital also decreases the incentive to join informal economy. High level of institutional quality and well operating market structure lower the size of informal economy. Therefore, financial development, human capital, and economic freedom are evaluated as major important determiners of informal economy, and their impulses are scrutinized at the analyzing part of the study.

The main objective of this study is to clarify and discuss the determinants of informal economy in Europe. For this purpose, informal economy structure of the European Territory is categorized leaning on spatial structure, and countries are compared with each other. Meanwhile, the impact of financial development, human capital, inflation, unemployment, and economic freedom on informal economy is discussed with various fixed effect models at the first part of the empirical analysis. Dependence in cross sections create size-distorted and biased estimations. Cross sectional dependences of models are interrogated with various tests. Then, Driscoll and Kraay (1998) method is applied to verify findings of fixed effect models. At the second step, panel threshold fixed effect method of Hansen (1999) is applied to understand threshold effect of welfare and human capital over these relationships with three different models. Firstly, it is interrogated whether the impact of unemployment on informal economy changes at different welfare levels, or not. Meanwhile, threshold effect of human capital on unemployment, and economic freedom is analyzed, respectively.

The relationship between formal and informal economy is defined at the second part. The size of informal economy and its spatial difference in Europe is discussed at the third part, whereas review of literature is introduced at the fourth part. While dataset is presented at the fifth part, empirical methodology and findings are displayed at the sixth part. The primary importance of this study is about its threshold emphasis, which is considered to arise from the difference in development between Western and Eastern Europe. Main policies and recommendations are stated at the conclusion part to decrease the size of the informal economy in Europe.

2. Nexus between Formal and Informal Economy

Informal economy has several different specifications as like subterranean, irregular, hidden, shadow, clandestine, illegal and black (Feige, 1996: 7). Informal economy provides illegal benefits due to the violation of the laws that establish the rules and institutions of taxes, wage payments, and social security. Medina and Schneider (2018: 4) name shadow economy as informal. Tanzi (1980: 428) defines informal economy as income arise from illegal and unreported activities that are hidden from eye but, present at there. According to Schneider and Enste (2000: 79), the definition of informal economy depends on the measurement method of it. They define it as legal value ad creating activities, even if not taxed, and not registered. People aim to hide from government authorities to avoid taxes and other regulations, and it is different from the formal economic systems (Gershuny, 1979: 7). As a whole, informal economy embodies all unmeasured economic activities, which are excluded from the measurement of GDP (Carter, 1984: 209).

People, who are working in informal economy, get rid of rules, rights, regulations, and punishment due to their illegal actions. This also affects official economy, and exchange of goods and services. Informal economy represents activities that are unmeasured and unreported, and could not be reflected to systems of monitoring (Feige, 1979: 6; 1996: 8). Medina and Schneider (2018) describe informal economy as all economic activity away from the track of official authorities in association with monetary, regulatory and institutional foundations. Monetary factors are associated with hampering tax payments, and social security constituents. Regulatory factors are connected with the burden of bureaucracy, whereas institutional factors are related with weak rule of law.

Borlea et al. (2017: 20) state that informal economy has two main components. First is related with undeclared work that employees and businesses aim to avoid taxes or market regulations. Second is concerned with underreporting income, which aspires to deter tax payment. According to Bayraktutan and Ustaoğlu (2021), main reasons of informality can be grouped under five headings as economic, legal, administrative, political and social. Informal economy is all economic activities and data that are partially or completely excluded from the knowledge of public authorities.

Tedds and Giles (2000: 8) deal with this case from the nexus of formal and informal economy. A downward reduction in economic activity may cause job switch from formal to informal economy. This switch increases the size of informal economy due to economic contraction. An increase in unemployment rate has a positive impact on informal economy based on this view. So, it captures Okun's Law from this perspective. An increase in unemployment rate reduces GDP and causes increment in informal economy (Sahnoun & Abdennadher, 2019: 5).

Informal economy is seen as one of the important challenges as it induces inefficient functioning of labor and goods markets. It harms the competition of firms, and stint people from rights and guarantees by attracting them outside of the official framework. As a vicious circle, it decreases the size of formal economy by distracting people from official framework and conduces less public expenditure by reducing revenue of government (Dellanno, 2007: 253). On the other hand, households can spend less on goods and services at the contractionary economic conditions, which also affects the revenue of informal economy. Thus, informal workers are able to make less spending on formal goods, and they can earn less informal income as like tips. Schneider and Enste (2000: 78) state that two-thirds of the revenue retained

in the informal economy is instantly expended in the formal economy. Hence, stagnation of economic activities has a negative influence on informal economy, which decreases the size of it. Eventually, the net effect depends on the total weight of these two disparate forces (Tedds and Giles, 2000: 8-9).

3. Informal Economy at the European Territory

Dellanno and Solomon (2008: 2538) divide the categorization of informal economy into two as labor and size oriented. According to labor-oriented categorization, informal economy is all income earning activities, except contract and legal employment. It has been proposed by Schneider and Enste (2000: 107) that informal economy labor force enlarges and attract more people due to high unemployment in European countries of OECD. Labor force of informal economy arises from the evasion of tax and social security. According to size-oriented categorization, it is the nexus between government regulation and business operation, which enlarge out of the government recognition. However, the existence of informal economy means that people in formal economy have to pay more taxes due to people who do not (Ciutiene, 2015: 463). People, who obey rules, pay more taxes than they should pay due to extensity of informal economy.

Borlea et al. (2017) declare that informal economy absorbs one-fifth GDP of the European Union countries. At the same time, European Transition Economies have the highest rating of corruption and informal economy. Enlargement of informal economy also brings problem for the implementation of government policies. People, who are working in the informal economy, can have intention to deceive and utilize from the social welfare system by asserting to be unemployed. Even if these people do not pay taxes, they utilize from public services, which reduces the quality of these services as a consequence (Dellanno and Solomon, 2008: 2537).

Table 1: Informal Economy Structure of European Countries

Country Groups	Average Values
5 Western Europe	0.160
4 Scandinavian	0.187
13 Central Europe	0.216
4 Southern Europe	0.252
7 South-Eastern Europe	0.334
3 Eastern Europe	0.460

Source: Author's Categorization based on The World Bank (2021).

The categorization of countries in European Continent is displayed in Table 1 for the period of 1996-2018. European countries are clustered in 6 groups in terms of their geographic locations. Informal economy is expressed as a ratio to GDP, and attained from The World Bank (2021). In addition to this, country groups are demonstrated in Table 2.

Meantime Western Europe have the lowest informal economy rates, Eastern Europe have the highest rates on average in whole period. The average informal economy of countries have the lowest rate with 0.239 at 2018, whereas the average highest rate is 0.265 at 1996. Meanwhile, average rates of whole countries exhibit a diminishing trend from 1996 to 2018, which is discussed by Elgin et al. (2021). However, diminishing trend is not valid for the average periods of 2008-2012, which suggests the impact of economic crisis on informal economy. Switzerland has the lowest rate with 0.086 value, whilst Ukraine has the highest rate with 0.488 value on average. It is seen that Western Europe has relatively low level of informality in

comparison with Eastern Europe. One of the reason of high informality in Eastern Europe can be related with previous habits and implementation difficulties of new rules after transition. In addition, this brings the inquiry of whether there is an income level impact on this result. It should be concentrated how to increase spillover effect from West to East to cope with high level of informality in Eastern Europe.

Table 2: European Territory Countries at Each Group

5 Western Europe	4 Scandinavian	4 Southern Europe
Belgium	Denmark	Italy
France	Finland	Malta
Ireland	Norway	Portugal
Netherlands	Sweden	Spain
United Kingdom		
13 Central Europe		
Austria	Hungary	Slovak Republic
Croatia	Latvia	Slovenia
Czech Republic	Lithuania	Switzerland
Estonia	Luxembourg	
Germany	Poland	
7 South-Eastern Europe		**3 Eastern Europe**
Albania	Moldova	Armenia
Bulgaria	Romania	Russia
Cyprus	Turkey	Ukraine
Greece		

4. Review of Literature

Inflation, insufficient wages, and accelerating surplus of urban labor force lead high level of informality in income generating processes of workers (Hart, 1973: 61). Gerxhani (2004: 278) divides main reasons of informality into two motives as economic and non-economic. Unemployment, inelastic labor market, a declining price of capital, recession, depreciation of capital, and penetrating cost of production are the main incentives rising the size of informal economy. People mostly resort unofficial path in order to evade taxation, avoid losing government benefits, regulations and licensing requirements. Escalating of leisure time is one of the important non-economic motives creating incentive to participate informal economy. Moreover, quality of public institutions, size of government, and tax burden are other important factors affecting the size of informal economy (Sahnoun and Abdennadher, 2019: 7).

Institutional level is an important determiner of informal economy. This is supported by Sweidan (2017) that the effect of economic freedom on informal economy is negative and statistically significant. People seek for alternative illegal ways at the case of less economic freedom circumstances. Therefore, Economic Freedom Index of Heritage Foundation is taken to consider institution and freedom level at this study. Economic Freedom Index is comprised from the weighted mean sub-indices of judicial effectiveness, fiscal health, government integrity, government spending, tax burden, property rights, monetary freedom, trade freedom, business freedom, financial freedom, investment freedom, and labor freedom.

Todaro (1969: 138-140) interrogates the qualifying period of migrants before obtaining a formal job in urban areas. The level of unemployment is one of the important arbiters of the

probability of employment in the modern sector. This reflects the view of Banerjee (1983: 400) that employment in informal economy serves as a harbor before the process of formal employment. So, the absorption level of labor market is one of the key factors determining the level of informal economy. People, who are not finding jobs in the official economy, are mostly employed in the informal economy (Gupta, 1993: 137-138). Unemployment is taken into consideration as one of the identifiers of informal economy, and the threshold effect of welfare level on unemployment is discussed to reveal the net effect at the European Territory. Thus, per capita real GDP is determined as one of the threshold variables at the analyzing part.

Capasso and Jappelli (2013: 167) states that firms investing in high technology are in need of external funding. These firms decrease their credit costs by showing more collateral for their investment. On the other hand, more collateral increases the expense of credit due to the requirement of reporting revenue, and assets to financial intermediaries, and government for tax accruals. Thereby, firms face with a dilemma of investing in high or low technology, where low technology investment does not require disclosure of revenue, and external funding. It also means a dilemma of formal and informal economy. An alternative view is held by Bittencourt et al. (2014: 207) that firms, who undeclared their income to financial institutions, face greater cost in the case of seeking a loan. Because, banks reimburse more monitoring cost, which is reflected to the cost of credit for the demands of lesser-known firms. Financial development enables more profitable investment by reducing cost of obtaining loan, and the informal attempts (Capasso and Jappelli, 2013: 167).

Financial development reduces barriers of access to credit and rise incentive to work in formal economy as a substitute of informal economy by increasing opportunity cost of production in the informal economy (Henri, 2018: 2). However, low level of financial development means shortage of loanable funds, highly financial constraints, and spillover of informal economy (Bose et al., 2012: 621). So, financial development is evaluated as one of the crucial indicators of informal economy and included into analysis.

Arouri et al. (2014) discuss the effect of skill, education, and human capital on informal economy. Low-income citizens, who fail to find appropriate job in formal economy due to lack of skills and education, find low-paid job in the informal economy. According to Porta and Shleifer (2014), half of the economic activity belongs to informal firms in developing countries. Informal firms mainly consist of less educated entrepreneurs and workers, and hardly transform into formality in the long run. However, informality decreases slowly as the development increases further. It has been argued by Gerxhani and Werfhorst (2013) that high level educated people have less incentive to participate informal economy. Buehn and Farzanegan (2013) declare that education can decrease informal economy, if political institutions are open and transparent. It is stated by Ciutiene et al. (2015) that human capital, and unemployment are the most crucial factors affecting the size of informal economy. Thereby, Human Capital Index is included into analysis as a decisive of informal economy leaning on average years of schooling.

Wu and Schneider (2019) examine the nonlinearity between economic development and informal economy. It is expressed that relationship is U-shaped. Informal economy decreases with the increment in per capita GDP at the low level of development. But two starts to move together, after per capita GDP pass a certain level of threshold. At the same time, it is stated that the increment in speed of development rises level of human capital, which also increases living standards of people. Wu and Schneider (2019) investigate this relationship with panel

data analysis in 158 countries for the period of 1996-2015. They also add inflation, financial depth, openness and political stability as control variables into model. While inflation has positive and statistically significant impact on informal economy, financial depth influences it negatively.

Maddah and Sobhani (2014) emphasize the importance of informal economy from the nexus of unemployment and inflation in 98 developing countries for the period of 1999-2007. Empirical findings suggest that inflation and unemployment rates have statistically significant and positive influence on informal economy. While inflation drives people towards informality by reducing their purchasing power, unemployment downsizes their living standards under subsistence level. Saafi et al. (2015) examine Tunisian economy with Toda and Yamamoto (1995) method for the period of 1980-2009. Empirical findings reflect that there is unidirectional causality running from unemployment to informal economy. Meanwhile, they add misery index as a control variable, which influences informal economy positively, but it is statistically insignificant.

Davidescu (2015) investigates the relationship between unemployment and informal economy in Romania for the period of 2000-2010. ARDL model findings suggest that unemployment negatively influences informal economy in the short run, whereas it has positive effect in the long run. Dobre and Alexandru (2009) find a positive nexus between informal economy and unemployment in Spain for the period of 1970-2007. Sahnoun and Abdennadher (2019) asses the same relationship in 38 developing and 40 developed countries with GMM model for the period of 2000-2015. Empirical results imply that there is unidirectional and negative nexus running from unemployment to informal economy in developing countries, whereas there is bidirectional and negative link in developed countries. It is also demonstrated that high level of corruption contributes the growth of informal economy and unemployment in countries who have low level of institutional quality. It is stated that the effect of unemployment on informal economy is low, if institutional quality is high. A similar view is claimed by Dreher et al. (2009) that increment in institutional quality lowers corruption and informal economy. Institutional quality is one of the most crucial components that determine the size of informal economy, and better institutions lower the size of informal economy (Singh et al., 2012).

Buehn and Farzanegan (2013) investigate the influence of education on informal economy in 80 countries for the period of 1999-2007. High level of institutional quality with together educational attainment reduces informal economy. Gerxhani and Werfhorst (2013) search the nexus between informal sector participation and formal sector in Albania based on survey data. It is stated that highly educated people have less incentive to participate informal economy. Berdiev and et al. (2018) study the relationship between sub-indices of economic freedom and informal economy in 100 countries for the period of 2000-2015. Meanwhile, they include education variable into analysis, but its impact is found statistically insignificant due to quality variation of education across countries.

Bose et al. (2012) examine the relationship between banking development and informal economy in 137 countries during the period of 1995-2007. Empirical findings indicate that financial depth and the increment in efficiency of banking system reduces the size of informal economy. A similar view is held by Berdiev and Saunoris (2016) that financial development derogates informal economy. Din et al. (2019) focus on the subject in Malaysia for the period

of 1970-2013. They discuss the impact of financial development, income, government consumption, tax burden, and misery index on informal economy.

Bayar and Öztürk (2016) investigate the interaction among financial development, informal economy, and institutional quality in European Transition Economies for the period of 2003-2014. Empirical findings reveal that an increase in financial development and institutional quality bring down informal economy in the long run. Yereli et al. (2007) interrogate the effect of informal economy on debt sustainability. According to findings, informal economy is not the only factor increasing debt stock, but it is one of the factors. Kelmanson et al. (2019) state that informal economy is alleviated in European Union countries, but still high in Eastern Europe. Borlea et al. (2017) evaluate the relationship between corruption and informal economy in European Union over the period of 2005-2014. While corruption positively affects informal economy, both corruption and informal economy negatively affect economic growth. Schneider (2005: 602) emphasizes that an increase in informal economy can lower tax income, which ultimately shrink the quality and quantity of public goods and enhance the burden of taxes in the official economy.

5. Dataset

Given the following framework above, the impact of financial development, human capital, unemployment, inflation, and economic freedom on informal economy become the main focus area of this study for the period spanning from 1996-2018. While countries are considered that have territory in European Continent, balanced panel data is strictly designed for the whole period. However, Andorra, Azerbaijan, Belarus, Bosnia and Herzegovina, Iceland, Kazakhstan, Kosovo, Liechtenstein, Moldova, Monaco, Montenegro, North Macedonia, San Marino, Serbia, and Vatican City are excluded due to lack of missing data, unfortunately. Dataset and definition of variables are expressed in Table 3. Data of informal economy was taken from The World Bank (2021), which is estimated leaning on MIMIC (Multiple Indicator Multiple Causes) method as a ratio to GDP (see Bose et al. (2012), Elgin et al. (2021), Porta and Shleifer (2014), Saafi et al. (2015)).

Table 3: Definition of Variables

Variables	Series	Sources
I	MIMIC estimates of informal output per GDP	The World Bank (2021)
FD	Financial Development Index	IMF (2021)
HC	Human Capital Index	PWT (2021)
UNEMP	Unemployment, as a ratio of total labour force	WDI (2021)
INF	Inflation, consumer prices (annual change)	WDI (2021)
EF	Economic Freedom Index	The Heritage (2021)
LGDP	Log of GDP per capita, PPP (constant 2017 in $)	WDI (2021)

FD is determined as a composite indicator in order to take into account the complex structure of financial system based on Sahay et al. (2015), Capasso and Jappeli (2013), Din et al. (2019). HC relies on schooling years and yield of education. It is attained from the Penn World Table, and Feenstra et al. (2015: 3172) demonstrate the estimation method of HC (see Henri (2018), Kelmanson et al. (2019), Buehn and Farzanegan (2013)). While per capita real GDP (see Bittencourt et al. (2013), Wu and Schneider (2019)), unemployment (see Davidescu (2015), Dobre and Alexandru (2009), Medina and Schneider (2018)), and inflation rates (see

Henri (2018), Singh et al. (2012), Sahnoun and Abdennadher (2019)) are obtained from the World Development Indicators (WDI, 2021), Economic Freedom Index (see Arouri (2014), Sweidan (2017), Berdiev and Saunoris (2016), Berdiev et al. (2016)) is attained from The Heritage Foundation (2021). All variables, which are expressed in percentage, are transformed to ratio, and logarithmic transformation is realized for per capita real GDP.

Table 4: Descriptive Statistics

	Mean	Maximum	Minimum	Standard Deviation
I	0.252	0.543	0.081	0.102
FD	0.514	1.000	0.091	0.229
HC	3.121	3.821	1.881	0.350
UNEMP	0.088	0.275	0.018	0.043
INF	0.064	10.583	-0.045	0.383
EF	0.658	0.826	0.404	0.083
LGDP	10.267	11.701	8.081	0.640

Descriptive statistics of variables are summarized in Table 4, and correlation matrix is displayed in Table 5. High correlation between LGDP and FD is taken into consideration at the part of analysis.

Table 5: Correlation Matrix

	I	FD	HC	UNEMP	INF	EF	LGDP
I	1.000						
FD	-0.741	1.000					
HC	-0.339	0.171	1.000				
UNEMP	0.351	-0.352	-0.261	1.000			
INF	0.133	-0.098	-0.109	0.039	1.000		
EF	-0.705	0.544	0.377	-0.338	-0.188	1.000	
LGDP	-0.841	0.835	0.313	-0.437	-0.164	0.676	1.000

6. Empirical Methodology and Findings

Unrestricted model is displayed in Equation 1, which includes all variables. This model is diversified with two restricted models to clarify influence of thresholds at the second step. ϑ_t is the full set of time effect, and $\varepsilon_{i,t}$ is the random disturbance.

$$I_{i,t} = \beta_0 + \beta_1 FD_{i,t} + \beta_2 HC_{i,t} + \beta_3 UNEMP_{i,t} + \beta_4 INF_{i,t} + \beta_5 EF_{i,t} + + \vartheta_t + \varepsilon_{i,t} \quad (1)$$

One of the issue in panel data estimation is about the cross sectional dependence. Cross sectional dependence would not avoid consistent parameter estimation, but it induces inconsistent standard error estimates of these coefficients. Driscoll and Kraay (1998: 549-550) express that errors of Ordinary Least Square (OLS) estimation are biased, if cross sectional dependence is neglected.

$$CD = \sqrt{\frac{2T}{N(N-1)}} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \rho_{ij} \quad (2)$$

Pesaran (2021: 22) introduce CD test for cross sectional dependence in Equation 2, which is more appropriate for large N and small T dimensions. Cross sectional dependence is identified with the null hypothesis of $(H_0: Cov(\varepsilon_{it}, \varepsilon_{jt}) = 0)$ for $i = j$, against $(H_A: Cov(\varepsilon_{it}, \varepsilon_{jt}) \neq 0)$

alternative hypothesis for at least one pairwise of $i \neq j$ (Menyah et al., 2014: 390). Friedman (1937) and Frees (1995) tests are also applied to robust findings for the detection of cross-sectional dependence.

Table 6: Panel Diagnostic Test Findings of Fixed Effect Models

Tests	Restricted 1	Restricted 2	Unrestricted
LM_h	591.781[c]	675.913[c]	698.851[c]
LM^*	655.923[c]	639.914[c]	636.773[c]
Durbin Watson	0.259	0.244	0.251
Country/Time Effect	Yes/Yes	Yes/Yes	Yes/Yes
Hausman Test	63.923[c]	40.637[c]	65.571
Cross Sectional Dependence			
Pesaran CD	34.030[c]	28.468[c]	26.340[c]
Friedman	122.903[c]	66.789[c]	70.902[c]
Frees	6.387[c]	7.327[c]	7.011[c]

Note: [c] indicates significance at 0.01 level.

Panel diagnostic test findings of fixed effect models are displayed in Table 6. While the null hypothesis of LM_h test is the fixed variances of all units, the null hypothesis of LM^* is the non-existence of first order autocorrelation. Durbin Watson test verifies first order autocorrelation, if $DW < 2$. Existence of country and time effects are evaluated in all models and Hausman Test is done to clarify the estimator of panel. Pesaran CD test is applied to clarify cross sectional dependency. The null hypothesis of CD test is cross sectional independency $(E(u_{it}, u_{is}) = 0)$, which is more appropriate for small T and large N dimensions (Kar et al., 2011: 691). Besides, Friedman (1937) and Frees (1995) tests are also performed to diversify findings.

The existence of autocorrelation and heteroscedasticity is accepted in all models in Table 6. So, White correction is used for autocorrelation and heteroscedasticity at the standard error estimations of fixed effect. While country and time effects exist, Hausman Test verifies fixed effect as the estimator. Pesaran (2021), Friedman (1937), and Frees (1995) tests imply the existence of cross-sectional dependence in all models.

Table 7: Findings of Fixed Effect Estimations

Variables	Restricted 1	Restricted 2	Unrestricted
Financial Development	-0.041[c]	-0.025[a]	-0.024[a]
Human Capital	-0.015	-0.010	-0.012
Unemployment		0.155[c]	0.139[c]
Inflation	-0.0002	-0.0001	-0.0005
Economic Freedom	-0.083[c]		-0.049[b]
Constant	0.377[c]	0.290[c]	0.325[c]
R^2	0.629	0.363	0.515
Observation	828	828	828
Number of Groups	36	36	36

Note: [a], [b], [c] indicate significance at 0.1, 0.05 and 0.01 levels, respectively.

Findings of fixed effect estimations are demonstrated in Table 7. Standard errors are calculated by using White correction for heteroscedasticity and autocorrelation, which includes robust standard errors in fixed effect estimations. Both unemployment and economic freedom are dealt as threshold variables in Hansen (1999) method at the second part of the analysis. So, restricted models exclude unemployment and economic freedom, respectively. Findings imply that financial development and economic freedom have negative and statistically significant impact on informal economy, whereas unemployment has positive and statistically significant effect on informal economy. On the other hand, the influence of human capital and inflation is statistically insignificant on informal economy.

Driscoll and Kraay (1998) state that cross sectional dependence conduces to inconsistent standard error estimates of coefficients. A nonparametric correction is propounded for cross sectional dependence, which is simulant to time series correction of nonparametric serial dependence.

$$\hat{\theta}_T = \underset{\{\theta\}}{\operatorname{argmin}} \left[\frac{1}{T}\sum_{t=1}^{T} \tilde{h}_t(\theta)\right]' \hat{\tilde{S}}_T^{-1} \left[\frac{1}{T}\sum_{t=1}^{T} \tilde{h}_t(\theta)\right] \quad (3)$$

Driscoll and Kraay (1998) rely on estimator of GMM covariance matrix by hoarding orthogonality condition of R for each value of N. While θ is the parameter vector, $\tilde{S}_T$ is $NRxNR$ matrix of consistent estimator in Equation 3, which is necessary for the variance estimation of GMM. Thus, estimation of non-parametric covariance matrix inclines robust standard errors for the cross sectional dependence. Even if Driscoll and Kraay (1998) estimator is not only regarding the fixed effect model, fixed effect is determined for model estimations at this study.

Table 8: Findings of Driscoll and Kraay (1998) Method

	Fixed Effect		
Variables	**Restricted 1**	**Restricted 2**	**Unrestricted**
Financial Development	-0.038[c]	-0.032[c]	-0.024[b]
Human Capital	-0.025[c]	-0.039[c]	-0.031[c]
Unemployment		0.161[c]	0.145[c]
Inflation	-0.0004	-0.0003	-0.0004
Economic Freedom	-0.088[c]		-0.058[c]
Constant	0.408[c]	0.374[c]	0.389[c]
R^2-within	0.472	0.571	0.598
Observation	828	828	828
Number of Groups	36	36	36

Note: [b], [c] indicate significance at 0.05 and 0.01 levels, respectively.

Standard errors of Driscoll and Kraay (1998) method is robust for autocorrelation, heteroscedasticity, and cross-sectional dependence, and estimations are demonstrated in Table 8. Financial development has negative and statistically significant impact on informal economy in accordance with fixed effect results. One-unit increment in financial development decreases informal economy approximately by 0.024 in Unrestricted Model. This is consistent with the findings of Capasso and Japelli (2013), and Berdiev and Saunoris (2016). Financial development decreases the cost of loanable funds by reducing barriers to credit access, which in turn means more profitable investment for the economy. Thus, financial development

increases the mobility from informal economy to formal economy by making formal economy more attractive for the financial needs of people.

Highly educated people have less incentive to attend informal economy, and it is expected that increment in education should have contractionary pressure on informal economy. It is seen that human capital has negative and statistically significant effect on informal economy. This is in contrary with fixed effect findings, but Driscoll and Kraay (1998) estimator is seen more reliable due to consider cross sectional dependence. One-unit increment in human capital reduces informal economy approximately by 0.03 in Unrestricted Model. This is in consistency with the findings of Gerxhani and Werfhorst (2013), and Buehn and Farzanegan (2013).

The impact of unemployment on informal economy depends on two disparate forces. Growth of unemployment rate can increase informal economy due to job switch from formal to informal economy. On the other hand, the increment in unemployment can also decrease informal economy due to reduction in informal income arising from economic stagnation. So, the net effect depends on the total weights of these two factors. The uptick in unemployment influences informal economy positively and significantly, which is matching with fixed effect findings. One-unit increment in unemployment rise informal economy by 0.145 in Unrestricted Model. Moreover, threshold effect of welfare level on unemployment is further discussed in threshold models to clarify whether income level differentiates the impact of unemployment on informal economy, or not. Meanwhile, threshold effect of human capital on unemployment is also discussed to elucidate whether level of human capital creates an effect on the relationship between unemployment and informal economy, or not.

Inflation reduces purchasing power of people. So, it is expected to enlarge the size of the informal economy. But there is no enough evidence for the statistically significant influence of inflation on informal economy in both fixed effect and Driscoll and Kraay (1998) estimations. This can be related with low level of inflation at the European Territory over the period of 2001-2018, which was fluctuated between the bands of %1-7. Besides, inflation is less than %3 in 36 European Countries after 2012 on average.

People refrain to participate informal economy at the circumstances of high level of economic freedom. So, people have less willing to attend illegal activities where freedoms are widespread. This is mainly related with high level of market openness, rule of law, regulatory efficiency, and government size, which are major sub-indices of Economic Freedom Index (Gezer, 2020: 162). This is supported by Esposito and Zaleski (1999: 180) that economic freedom promotes resource allocation and specialization by declining transaction cost of protection of property rights. People lose their motivation to get in productive activities at the low level of economic freedom, which increase informal economy. Therefore, it is expected negative and statistically significant influence from economic freedom to informal economy. One-unit increment in economic freedom reduces informal economy by 0.058 in Unrestricted Model, which is in line with Sweidan (2017). In addition to this, the threshold effect of human capital on economic freedom is further examined to clarify whether different level of human capital affects the relationship between economic freedom and informal economy.

6.1. Findings of Panel Threshold Fixed Effect

Hansen (1999: 345-349) introduces threshold regression to determine whether observations can be clustered into classes for each value of the sample in balanced panel model. The significance of the threshold is assessed with bootstrap method. So, threshold variable divides regression into regime groups to evaluate whether a scalar value lies over threshold, or not.

$$y_{it} = \mu_i + \beta_1' x_{it} I(q_{it} \leq \gamma) + \beta_2' x_{it} I(q_{it} > \gamma) + e_{it} \quad (4)$$

Threshold model is expressed in Equation 4 for two regimes, which can be stated for more regimes as well. q_{it} is the scalar threshold variable, x_{it} is the k vector of explanatory variables, γ is the scalar threshold value, y_{it} is the dependent variable, $I(.)$ is the indicator function, and β_1 and β_2 are the regression slopes of two regimes. Meanwhile, model can also be demonstrated as like Equation 5:

$$y_{it} = \begin{cases} \mu_i + \beta_1' x_{it} + e_{it}, q_{it} \leq \gamma \\ \mu_i + \beta_2' x_{it} + e_{it}, q_{it} > \gamma \end{cases} \quad (5)$$

Ordinary Least Square method is used to estimate β coefficient with $((X^*(\gamma)'X^*(\gamma))^{-1}(X^*(\gamma)'Y^*))$ expression, where X^* and Y^* are deviated from within groups (Wang, 2015: 122). However, threshold effect must be tested before regression estimations to verify its existence. $(H_0: \beta_1 = \beta_2)$ is the null hypothesis of threshold effect (non-existence), which is tested with F statistic, and significances of p-values are attained with a bootstrap procedure (Hansen, 1999: 350-351).

F statistic is consecutively applied up to triple regime cases, and the acceptance of null hypothesis reflect the number of regimes in model. Moreover, the confidence interval of each threshold is stated with Lagrange Multiplier (LR) function, and threshold parameter can be demonstrated with graphics as well.

Panel threshold method was implemented by adding regime dependent and threshold variables. Unemployment is determined as regime dependent variable, and welfare level (log of per capita real GDP) is specified as threshold variable.

Model 1:

$$I_i = \beta_0 + \beta_1 FD_i + \beta_2 HC_i + \beta_3 INF_i + \beta_4 EF_i + \begin{cases} \beta_5^1 UNEMP_i + \varepsilon_i, LGDP \leq \hat{\lambda}_1 \\ \beta_5^2 UNEMP_i + \varepsilon_i, \hat{\lambda}_1 \leq LGDP < \hat{\lambda}_2 \\ \beta_5^3 UNEMP_i + \varepsilon_i, \hat{\lambda}_2 < LGDP \end{cases} \quad (6)$$

Threshold adjusted version of model is signified in Equation 6, where $\hat{\lambda}_1$ is the first threshold variable, $\hat{\lambda}_2$ is the second threshold variable, β_5^1 is the slope coefficient of unemployment at regime 1, β_5^2 is the slope coefficient of unemployment at regime 2, and β_5^3 is the slope coefficient of unemployment at regime 3.

Table 9: Number of Thresholds in Model 1

Tests for Single Threshold	
F_1	124.750
$P-value$	0.033
(critical values at %10, %5, %1)	(45.684, 56.669, 86.615)
Tests for Double Threshold	
F_2	61.380
$P-value$	0.030
(critical values at %10, %5, %1)	(43.019, 50.556, 62.814)
Tests for Triple Threshold	
F_3	15.920
$P-value$	0.717
(critical values at %10, %5, %1)	(43.022, 55.082, 78.995)

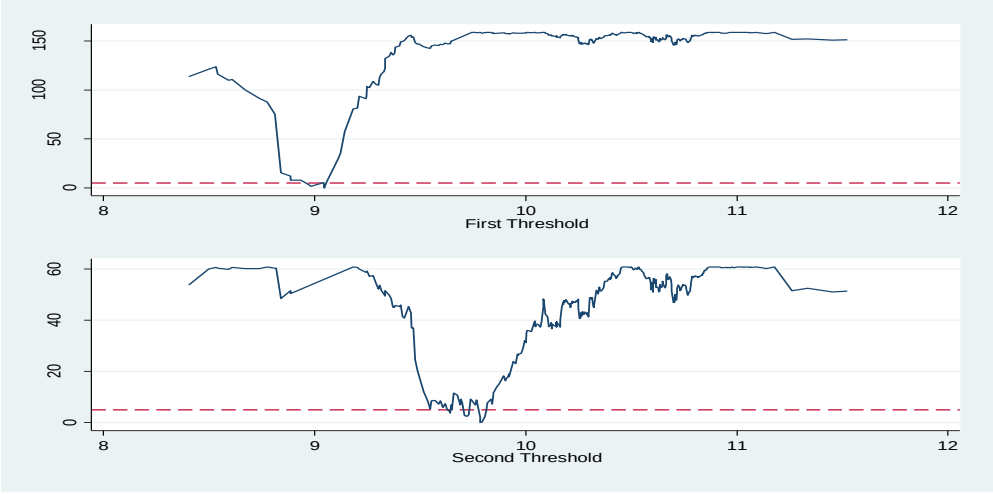
Firstly, the existence of threshold effect is tested with F statistic for single, double, and triple regimes, respectively. The null hypothesis of no threshold effect is accepted at triple threshold. So, the number of threshold is determined as two with triple regime consequences.

Table 10: Threshold Estimator at %95 Confidence Level in Model 1

Estimates	Threshold	Confidence Interval
$\hat{\lambda}_1$	9.045	[8.964; 9.056]
$\hat{\lambda}_2$	9.785	[9.775; 9.791]

Confidence intervals of threshold variables are demonstrated in Table 10. It is seen that threshold estimates lie in confidence interval at %95 levels.

Figure 1: Graphical Illustration of Thresholds in Model 1



Graphical illustrations of threshold values are demonstrated at Figure 1. First threshold corresponds to $8476 per capita real income level, whereas second threshold matches with per capita real income level of $17765.

Table 11: Findings of Fixed Effect Threshold Panel Estimations for Model 1

Variables		Estimates	
Financial Development		-0.016[c]	
Human Capital		-0.027[c]	
Inflation		-0.0008	
Economic Freedom		-0.045[c]	
Unemployment	$LGDP \leq \hat{\lambda}_1$	$\hat{\lambda}_1 < LGDP \leq \hat{\lambda}_2$	$LGDP > \hat{\lambda}_2$
	0.324[c]	0.159[c]	0.087[c]
Constant		0.351[c]	

Note: [c] indicates significance at 0.01 level.

Findings of panel threshold are demonstrated in Table 11. Financial development, human capital, and economic freedom have negative and statistically significant impact on informal economy, which is in accordance with Driscoll and Kraay (1998) findings. Inflation does not have statistically significant effect on informal economy, which is compatible with previous findings of fixed effects. The impact of unemployment is divided into three regimes based on welfare level. Firstly, the net effect of unemployment is positive and statistically significant on informal economy in all three regimes. But it is detected that the impact of unemployment is high on informal economy, if welfare level is low. *This can be expressed as subsistence effect of unemployment on informal economy.* If per capita real GDP level is low, the lofty effect of unemployment arises on informal economy due to subsistence drive. One-unit rise of unemployment induces 0.324 increments in informal economy, if per capita real GDP is less than $8476. One-unit upswing of unemployment inclines 0.159 increments in informal economy, if per capita real GDP lies between $8476 and $17765. In addition, one-unit uptick of unemployment rises informal economy by 0.087, if per capita real income is more than $17765.

Model 2:

$$I_i = \beta_0 + \beta_1 FD_i + +\beta_2 INF_i + \beta_3 EF_i + \begin{cases} \beta_4^1 UNEMP_i + \varepsilon_i, HC \leq \hat{\lambda}_1 \\ \beta_4^2 UNEMP_i + \varepsilon_i, HC > \hat{\lambda}_1 \end{cases} \quad (7)$$

Threshold adjusted second version of model is displayed in Equation 7, where $\hat{\lambda}_1$ is the threshold variable, β_4^1 is the slope coefficient of unemployment at regime 1, β_4^2 is the slope coefficient of unemployment at regime 2.

Table 12: Number of Thresholds in Model 2

Tests for Single Threshold	
F_1	76.300
$P-value$	0.040
(critical values at %10, %5, %1)	(59.634, 71.475, 90.051)
Tests for Double Threshold	
F_2	15.350
$P-value$	0.850
(critical values at %10, %5, %1)	(60.568, 73.700, 83.736)
Tests for Triple Threshold	
F_3	11.540
$P-value$	0.967
(critical values at %10, %5, %1)	(43.621, 52.413, 58.873)

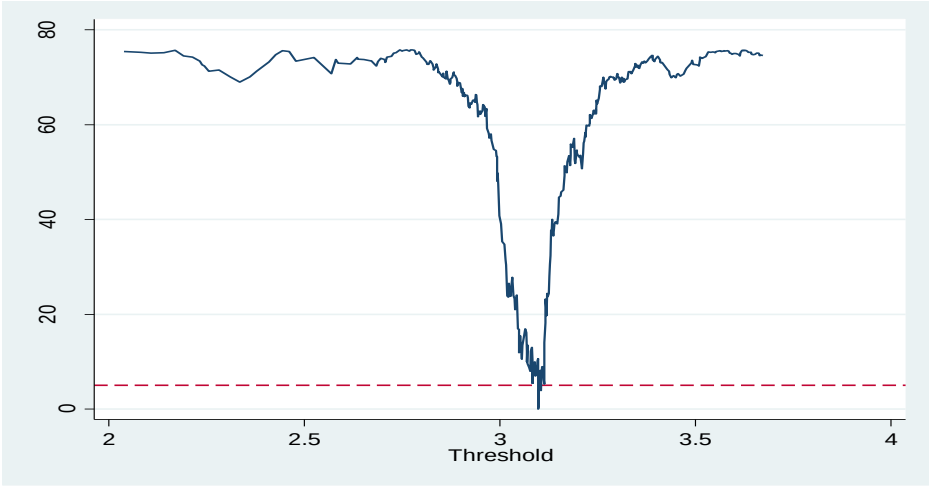
Human capital is determined as threshold variable, and unemployment is introduced as regime dependent variable for Model 2. The null hypothesis of no threshold effect is accepted at double threshold. So, there is strong evidence to claim the number of thresholds as one with double regime results.

Table 13: Threshold Estimation at %95 in Model 2

Estimates	Threshold	Confidence Interval
$\hat{\lambda}_1$	3.0986	[3.0983; 3.0987]

Confidence interval of threshold variable is indicated in Table 13. It is seen that threshold estimate lies in confidence interval at %95 level.

Figure 2: Graphical Illustration of Threshold in Model 2



Graphical illustration of threshold value is presented at Figure 2. Threshold value corresponds to 3.0986 human capital levels.

Table 14: Findings of Fixed Effect Threshold Panel Estimations for Model 2

Variables	Estimates	
Financial Development	-0.045[c]	
Inflation	-0.00003	
Economic Freedom	-0.086[c]	
Unemployment	HC $\leq \hat{\lambda}_1$	HC $> \hat{\lambda}_1$
	0.109[c]	0.026[b]
Constant	0.326[c]	

Note: [b, c] indicates significance at 0.05, and 0.01 levels, respectively.

Panel threshold fixed effect estimation of Model 2 is presented in Table 14. Financial development, and economic freedom have negative and statistically significant effect on informal economy, which is compatible with Driscoll and Kraay (1998) findings. Inflation does not have statistically significant influence on informal economy. The impact of unemployment is divided into double regime based on human capital level. It is detected that the influence of unemployment is low, if human capital level is high. *This can be interpreted as education effect*

of unemployment on informal economy. If level of education is high in society, the effect of unemployment on informal economy is low. One-unit upswing of unemployment increases informal economy by 0.109, if human capital is less than 3.0986. On the other hand, one-unit rise of unemployment inclines 0.026 increments in informal economy, if human capital level is more than 3.0986.

Model 3:

$$I_i = \beta_0 + \beta_1 FD_i + +\beta_2 UNEMP_i + \beta_3 INF_i + \begin{cases} \beta_4^1 EF_i + \varepsilon_i, HC \leq \hat{\lambda}_1 \\ \beta_4^2 EF_i + \varepsilon_i, HC > \hat{\lambda}_1 \end{cases} \quad (8)$$

Threshold adjusted third version of model is identified in Equation 8, where $\hat{\lambda}_1$ is the threshold variable, β_4^1 is the slope coefficient of economic freedom at regime 1, β_4^2 is the slope coefficient of economic freedom at regime 2.

Table 15: Number of Threshold in Model 3

Tests for Single Threshold	
F_1	114.490
$P-value$	0.020
(critical values at %10, %5, %1)	(81.198, 96.074, 133.742)
Tests for Double Threshold	
F_2	25.260
$P-value$	0.803
(critical values at %10, %5, %1)	(84.133, 94.166, 111.266)
Tests for Triple Threshold	
F_3	26.290
$P-value$	0.787
(critical values at %10, %5, %1)	(61.713, 71.384, 91.822)

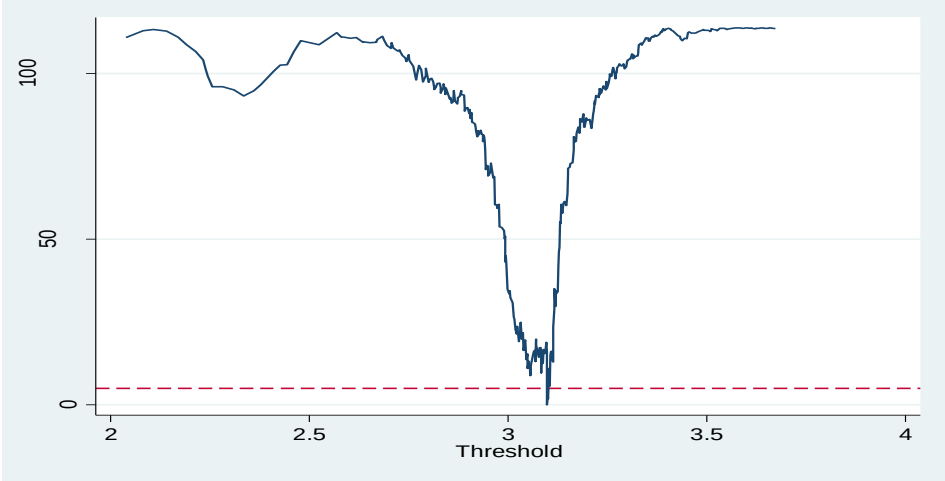
Human capital is specified as threshold variable, and economic freedom is determined as regime dependent variable for the third version of model. The null hypothesis of no threshold effect is accepted at double threshold. So, there is strong evidence to claim the number of threshold as one with double regime findings.

Table 16: Threshold Estimation at %95 in Model 3

Estimates	**Threshold**	**Confidence Interval**
$\hat{\lambda}_1$	3.0986	[3.0984; 3.0987]

Confidence interval of threshold variable is displayed in Table 16. It is seen that threshold estimate ranks in confidence interval at %95 level.

Figure 3: Graphical Illustration of Threshold in Model 3



Graphical illustration of threshold value is presented at Figure 3. Threshold value corresponds to 3.0986 human capital level.

Table 17: Findings of Fixed Effect Threshold Panel Estimations for Model 3

Variables	Estimates	
Financial Development	-0.041[c]	
Unemployment	0.138[c]	
Inflation	0.00009	
Economic Freedom	HC $\leq \hat{\lambda}_1$	HC $> \hat{\lambda}_1$
	-0.067[c]	-0.082[c]
Constant	0.310[c]	

Note: [c] indicates significance at 0.01 level.

Panel threshold fixed effect estimation of Model 3 is indicated in Table 17. Financial development has negative and statistically significant effect on informal economy, whereas unemployment has positive and statistically significant impact on informal economy. At the same time, inflation does not have statistically significant effect on informal economy, which is coherent with previous findings of Model 1 and Model 2. The impact of economic freedom is divided into double regime leaning on human capital level. There are enough evidence to claim that the impact of economic freedom differentiates depending on human capital level. *This can be defined as intellectual effect of freedom on informal economy.* If level of education is below a certain threshold, the effect of economic freedom on informal economy is less than high education case. One-unit increment of economic freedom reduces informal economy by 0.067, if human capital is less than 3.0986. On the other hand, one-unit enhancement of economic freedom reduces informal economy by 0.082, if human capital is more than 3.0986.

7. Conclusion

People, who are unemployed or tackling with economic bottleneck face with a dilemma of transition from formal to informal economy. Informal economy comprises of all economic activities away from the track and supervision of official economy. Some attend it to avoid tax payment, market rules, or more payment to workers, and some others to benefit from social security, and etc. in business life. Unemployment is one of the important arbiters of informal economy, but the increment in unemployment creates two different impacts on it. It can increase the size of informal economy due to flow of unemployed people to informality. It can also decrease the size of it due to the reduction in informal income welding from economic stagnation. Net effect depends on the weight of these two reverse forces.

This study investigates the main determinants of informal economy at the European Territory for the period of 1996-2018. Financial development, human capital, unemployment, inflation, and economic freedom are specified as the main determinants of informal economy based on theoretical and empirical discussions, and their impacts on informal economy are scrutinized with fixed effect, Driscoll and Kraay (1998) methods. While financial development, human capital, and economic freedom have negative and statistically significant impact on informal economy, economic freedom has the highest negative impact from the aspect of magnitude. Thereby, improvements in market openness, rule of law, regulatory efficiency, and government size will be effective policy tools to combat with informal economy at the European Territory. Meanwhile, unemployment has positive and statistically significant influence on informal economy, whereas the impact of inflation is statistically insignificant.

The positive impact of unemployment reflects also the weight of the net effect of unemployment on informal economy. Moreover, it is presented that Eastern European countries relatively have higher informal economy rates than Western Europe. It is decided to interrogate whether there exists a welfare threshold for the impact of unemployment on informal economy. So, Hansen (1999) method is performed at the second part of the analysis. It is confirmed that the impact of unemployment on informal economy differentiates depending on the level of per capita real GDP. The additive effect of unemployment is high at the low level of per capita real GDP, whereas its influence goes down after certain threshold levels. *It is interpreted as subsistence effect of unemployment on informal economy.* Therefore, increasing employment and welfare level are major macroeconomic policy recommendations to cope with informal economy.

Nowadays, economies are struggling to invest in new technologies of Industry 4.0, and quality of labor force is getting more and more paramount day by day. Thus, level of human capital is one of the crucial factors to catch and carry burden of development. This brings the question of whether there is a human capital threshold to affect the unemployment impact on informal economy into mind. Hence, the existence of threshold effect of human capital on unemployment is interrogated with Hansen (1999) method. It is identified that the effect of unemployment on informal economy differentiates depending on human capital level. Enhancing effect of unemployment is low on informal economy above a certain threshold level of human capital, whereas high effect is observed below a certain human capital threshold level. *It is stated as education effect of unemployment on informal economy*. Thereby, projects to increase average years of schooling, education quality, and human capital can be seen important policy tools to reduce the impact of unemployment on the informal economy.

Economic freedom comprises of freely functioning markets, wideness of property rights, judicial effectiveness, fiscal health and integrity, freedom of trade, monetary, and business. These are all closely related with the level of institutional quality, and democracy. Economic freedom recovers functioning structure of systems in rule-based administrations. Meanwhile, it is also observed that attractiveness of informal economy decreases in highly educated society. Therefore, it is examined whether human capital creates a threshold in the effect of economic freedom on informal economy. It is detected that the influence of economic freedom on informality differentiates depending on human capital level. The influence of economic freedom is high on informal economy above a certain human capital threshold level. *This is described as intellectual effect of economic freedom on informal economy.*

One of the fundamental contributions of this study is about its threshold emphasis at the European Territory. This can be originated from higher existence of informal economy in Eastern Europe. Therefore, it is important to determine common policies at the European Territory in order to combat with informal economy, which is also crucial to increase integrity at the region. Besides, common policies will be beneficial to create spillover effect for the reduction of informal economy. Policy recommendations can be ordered as rising institutional quality, dissemination of training programs to increase human capital, intensification of rule-based systems to increase willingness and motivation to work in official sectors, provision of financial funds and resources for the business and educational needs of poors and entrepreneur.

References

Arouri, M. E. H.; Youssef, A. B.; Elgin, C. (2014), "Informal Economy in Africa: Building Human Capital to Set the Gazelles Free", Bogazici University Department of Economics, Working Papers 2014/04.

Banerjee, B. (1983), "The Role of the Informal Sector in the Migration Process: A Test of Probabilistic Migration Models and Labor Market Segmentation for India", Oxford Economic Papers, Vol. 35, No. 2: 399-422.

Bayar, Y.; Öztürk, Ö. F. (2016), "Financial Development and Shadow Economy in European Union Transition Economies", Managing Global Transitions, Vol. 14, No. 2: 157-173.

Bayraktutan, Y.; Ustaoğlu, B. (2021), "Dijitalleşme, Denetim ve Kayıtdışı Ekonomi", Vergi Raporu, No. 260: 165-187.

Berdiev, A. N.; Saunoris, J. W. (2016), "Financial Development and the Shadow Economy: A Panel VAR Analysis", Economic Modelling, Vol. 57: 197-202.

Berdiev, A. N.; Saunoris, J. W.; Schneider, F. (2018), "Give me Liberty, or I will Produce Underground: Effects of Economic Freedom on the Shadow Economy", Southern Economic Journal, Vol. 85, No. 2: 537-562.

Bittencourt, M.; Gupta, R.; Stander, L. (2014), "Tax Evasion, Financial Development and Inflation: Theory and Empirical Evidence", Journal of Banking & Finance, Vol. 41: 194-208.

Borlea, S. N.; Achim, M. V.; Miron, M. G. (2017), "Corruption, Shadow Economy and Economic Growth: An Empirical Survey Across the European Union Countries", Studia Universitatis Economic Series, Vol. 27, No.2: 19-32.

Bose, N.; Capasso, S.; Wurm, M. A. (2012), "The Impact of Banking Development on the Size of Shadow Economies", Journal of Economic Studies, Vol. 39, No. 6: 620-638.

Buehn, A.; Farzanegan, M. R. (2013), "Impact of Education on the Shadow Economy: Institutions Matter", Economics Bulletin, Vol. 33, No. 3: 2052-2063.

Capasso, S.; Jappelli, T. (2013), "Financial Development and the Underground Economy", Journal of Development Economics, Vol. 101: 167-178.

Carter, M. (1984), "Issues in the Hidden Economy-A Survey", The Economic Record, Vol. 60, No. 3: 209-221.

Ciutiene, R.; Meiliene, E.; Savaneviciene, A.; Vaitkevicius, S. (2015), "Interdependence Between Human Capital and the Power of a Shadow Economy: Lithuanian Case Study", Technological and Economic Development of Economy, Vol. 21, No. 3: 460-482.

Davidescu, A. A. (2015), "The Relationship Between Shadow Economy and Unemployment Rate: An ARDL Causality Analysis for the Case of Romania", Romanian Statistical Review, Vol. 4: 46-62.

Dellanno, R. (2007), "The Shadow Economy in Portugal: An Analysis with the MIMIC Approach", Journal of Applied Economics, Vol. 10, No. 2: 253-277.

Dellanno, R.; Solomon, O. H. (2008), "Shadow Economy and Unemployment Rate in USA: Is There a Structural Relationship? An Empirical Analysis", Applied Economics, Vol. 40, No. 19: 2537-2555.

Din, B. H.; Habibullah, M. S.; Hamid, B. A. (2019), "Re-estimation and Modelling Shadow Economy in Malaysia: Does Financial Development Mitigate Shadow Economy?", International Journal of Business and Society, Vol. 20, No. 3: 1062-1075.

Dobre, I.; Alexandru, A. A. (2009), "The Impact of Unemployment on the Dimension of Shadow Economy in Spain: A Structural Equation Approach", European Research Studies, Vol. 12, No.4: 179-197.

Dreher, A.; Kotosogiannis, C.; McCorriston, S. (2009), "How do Institutions Affects Corruption and the Shadow Economy?", International Tax and Public Finance, Vol. 16: 773-796.

Driscoll, J. C.; Kraay, A. C. (1998), "Consistent Covariance Matrix Estimation with Spatially Dependent Panel Data", Review of Economics and Statistics, Vol. 80, No. 4: 549-560.

Elgin, C.; Kose, M. A.; Ohnsorge, F.; Yu, S. (2021), "Understanding Informality", MPRA Paper No. 109490.

Esposito, A.; Zaleski, P. A. (1999), "Economic Freedom and the Quality of Life: An Empirical Analysis", Constitutional Political Economy, Vol. 10: 185-197.

Feenstra, R. C.; Inklaar, R.; Timmer, M. P. (2015), "The Next Generation of the Penn World Table", American Economic Review, Vol. 105, No. 10: 3150-3182.

Feige, E. L. (1979), "How Big is the Irregular Economy?", Challenge, Vol. 22, No. 5: 5-13.

Feige, E. L. (1996), "Overseas Holdings of U.S. Currency and the Underground Economy", Exploring the Underground Economy: Studies of Illegal and Unreported Activity, (Ed. S. Pozo), W. E. Upjohn Institute for Employment Research: Michigan: 5-62.

Frees, E. W. (1995), "Assessing Cross-sectional Correlation in Panel Data", Journal of Econometrics, Vol. 69: 393-414.

Friedman, M. (1937), "The Use of Ranks to Avoid the Assumption of Normality Implicit in the Analysis of Variance", Journal of the American Statistical Association, Vol. 32, No. 200: 675-701.

Gershuny, J. I. (1979), "The Informal Economy: Its Role in Post-industrial Society", Futures, Vol. 11, No. 1: 3-15.

Gerxhani, K. (2004), "The Informal Sector in Developed and Less Developed Countries: A Literature Survey", Public Choice, Vol. 120: 267-300.

Gerxhani, K.; Werfhorst, H. G. (2013), "The Effect of Education on Informal Sector Participation in a Post-Communist Country", European Sociological Review, Vol. 29, No. 3: 464-476.

Gezer, M. A. (2020), "The Impact of Economic Freedom on Human Development in European Transition Economies", Economic Computation and Cybernetics Studies and Research, Vol. 54, No. 3: 161-178.

Gupta, M. R. (1993), "Rural-urban Migration, Informal Sector and Development Policies", Journal of Development Economics, Vol. 41: 137-151.

Hansen, B. E. (1999), "Threshold Effects in Non-Dynamic Panels: Estimation, Testing, and Inference", Journal of Econometrics, Vol. 93: 345-368.

Hart, K. (1973), "Informal Income Opportunities and Urban Employment in Ghana", The Journal of Modern African Studies, Vol. 11, No. 1: 61-89.

Henri, N. (2018), "Does Financial Development Reduce the Size of the Informal Economy in Sub-Saharan African Countries?", MPRA Paper No. 89851.

Hsiao, C. (2014), Analysis of Panel Data, 3. Edition, Cambridge University Press: New York.

IMF (2021), Financial Development Index Database, International Monetary Fund, https://data.imf.org, (Access: 24.12.2021).

Kar, M.; Nazlıoğlu, Ş.; Ağır, H. (2011), "Financial Development and Economic Growth Nexus in the MENA Countries: Bootstrap Panel Granger Causality Analysis", Economic Modelling, Vol. 28: 685-693.

Kelmanson, B.; Kirabaeva, K.; Medina, L.; Mircheva, B.; Weiss, J. (2019), "Explaining the Shadow Economy in Europe: Size, Causes and Policy Options", IMF Working Papers: Washington DC.

Maddah, M.; Sobhani, B. (2014), "The Effective Factors on Informality in Developing Countries: Panel Data Model", International Journal of Regional Development, Vol. 1, No. 1: 12-25.

Medina, L.; Schneider, F. (2018), "Shadow Economies Around the World: What did we Learn over the Last 20 Years?", IMF Working Papers: Washington DC.

Menyah, K.; Nazlioglu, S.; Wolde-Rufael, Y. (2014), "Financial Development, Trade Openness and Economic Growth in African Countries: New Insights from a Panel Causality Approach", Economic Modelling, Vol. 37: 386-394.

Pesaran, M. H. (2021), "General Diagnostic Tests for Cross Section Dependence in Panels", Empirical Economics, Vol. 60: 13-50.

Porta, R. L.; Shleifer, A. (2014), "Informality and Development", Journal of Economic Perspectives, Vol. 28. No. 3: 109-126.

PWT (2021), Penn World Table, 10. Version, Groningen Growth and Development Centre, https://www.rug.nl, (Access: 23.12.2021).

Saafi, S.; Mohamed, M. H.; Farhat, A. (2015), "Is There a Causal Relationship Between Unemployment and Informal Economy in Tunisia: Evidence from Linear and Non-linear Granger Causality", Economic Bulletin, Vol. 35, No. 2: 1191-1204.

Sahay, R.; Cihak, M.; Ndiaye, P.; Barajas, A.; Bi, R.; Ayala, D.; ...; Yousefi, S. R. (2015), "Rethinking Financial Deepening: Stability and Growth in Emerging Markets", IMF Staff Discussion Note: Washington DC.

Sahnoun, M.; Abdennadher, C. (2019), "The Nexus Between Unemployment Rate and Shadow Economy: A Comparative Analysis of Developed and Developing Countries Using a Simultaneous Equation Model", Kiel Institute for the World Economy: Kiel.

Schneider, F. (2005), "Shadow Economies Around the World: What do we Really Know?", European Journal of Political Economy, Vol. 21: 598-642.

Schneider, F.; Enste, D. H. (2000), "Shadow Economies: Size, Causes, and Consequences", Journal of Economic Literature, Vol. 38, No. 1: 77-114.

Singh, A.; Jain-Chandra, S.; Mohommad, A. (2012), "Inclusive Growth, Institutions, and the Underground Economy", IMF Working Papers: Washington DC.

Sweidan, O. (2017), "Economic Freedom and the Informal Economy", Global Economy Journal, Vol. 17, No. 4.

Tanzi, V. (1980), "The Underground Economy in the United States: Estimates and Implications", PSL Quarterly Review, Vol. 33 No. 135: 427-453.

Tedds, L. M.; Giles, D. E. (2000), "Modelling the Underground Economies in Canada and New Zealand: A Comparative Analysis", University of Victoria, Econometrics Working Papers 0003.

The Heritage (2021), 2021 Index of Economic Freedom, The Heritage Foundation, https://www.heritage.org, (Access: 23.12.2021).

The World Bank (2021), Informal Economy Database, The World Bank, https://www.worldbank.org, (Access: 23.12.2021).

Toda, H. Y.; Yamamoto, T. (1995), "Statistical Inferences in Vector Auto-regressions with Possibly Integrated Processes", Journal of Econometrics, Vol. 66: 225-250.

Todaro, M. P. (1969), "A Model of Labor Migration and Unemployment in Less Developed Countries", The American Economic Review, Vol. 59, No. 1: 138-148.

Wang, Q. (2015), "Fixed-effect Panel Threshold Model Using Stata", The Stata Journal, Vol. 15, No. 1: 121-134.

WDI (2021), World Development Indicators Databank, The World Bank, https://databank.worldbank.org, (Access: 23.12.2021).

Wu, D. F.; Schneider, F. (2019), "Nonlinearity Between the Shadow Economy and Level of Development", IMF Working Paper: Washington DC.

Yereli, A. B.; Seçilmiş, İ. E.; Başaran, A. (2007), "Shadow Economy and Public Debt Sustainability in Turkey", Economic Annals, Vol. 52, No. 173: 85-104.