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SHADOW ECONOMY: DETERMINANTS AND ITS IMPACT ON FOREIGN DIRECT INVESTMENT

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ABSTRACT

The shadow economy poses a significant threat to government revenue and the effectiveness of economic policies. This paper investigates the causes of the shadow economy and its influence on foreign direct investment (FDI). Our study employs the currency demand approach, a component of the indirect method, to identify the determinants of the shadow economy in a dataset covering 105 countries from 2001 to 2017. These countries are categorized into four income groups: high-income, upper-middle-income, lower-middle-income, and low-income. Parameter estimation is conducted using the Generalized Method of Moments (GMM) model, with robustness tests incorporating reference estimates from Partial Least Squares (PLS) and Fixed Effects Model (FEM). Our findings indicate that a higher GDP and lower interest rates are associated with reduced shadow economy activity. Elevated market interest rates increase the cost of funds in the informal sector, discouraging engagement in shadow economic activities due to reduced profitability. Furthermore, higher tax revenues correlate with intensified regulatory enforcement, increasing the risks associated with shadow economy involvement. A larger workforce and lower unemployment rates similarly diminish shadow economy activity. In the context of foreign direct investment (FDI), the shadow economy positively affects FDI flows when formal institutions, including legal frameworks, property rights protection, and regulatory systems, are either weak or overly burdensome. In such scenarios, economic actors may opt for informal channels like the shadow economy, offering a flexible and cost-effective alternative to the formal sector, a crucial consideration for foreign investors.

Keywords: *Shadow Economy, Foreign Direct Investment, GMM*

ABSTRAK

Shadow economy menimbulkan ancaman signifikan terhadap pendapatan pemerintah dan efektivitas kebijakan ekonomi. Paper ini menyelidiki faktor penentu shadow economy dan pengaruhnya terhadap investasi langsung asing (FDI). Paper ini menggunakan pendekatan permintaan uang, yaitu metode tidak langsung, untuk mengidentifikasi determinan shadow economy dalam dataset yang mencakup 105 negara dari tahun 2001 hingga 2017. Negara-negara ini dikategorikan ke dalam empat kelompok pendapatan: pendapatan tinggi, pendapatan menengah atas, pendapatan menengah bawah, dan pendapatan rendah. Estimasi parameter dilakukan menggunakan model Generalized Method of Moments (GMM), dengan robustness test Partial Least Squares (PLS) dan Fixed Effects Model (FEM). Temuan kami menunjukkan bahwa PDB yang lebih tinggi dan tingkat suku bunga yang lebih rendah berhubungan dengan aktivitas shadow economy yang lebih rendah.

Tingkat suku bunga pasar yang tinggi meningkatkan biaya dana di sektor informal, mengurangi keterlibatan dalam aktivitas ekonomi bayangan karena profitabilitas yang berkurang. Selain itu, pendapatan pajak yang lebih tinggi cenderung berhubungan dengan penegakan regulasi yang lebih intensif, meningkatkan risiko yang terkait dengan keterlibatan dalam ekonomi bayangan. Kehadiran angkatan kerja yang lebih besar dan tingkat pengangguran yang lebih rendah juga mengurangi aktivitas ekonomi bayangan. Dalam konteks FDI), shadow economy menunjukkan efek positif pada aliran FDI ketika lembaga formal, termasuk kerangka hukum, perlindungan hak atas properti, dan sistem regulasi lemah atau terlalu membebani. Dalam skenario seperti itu, para pelaku ekonomi akan memilih saluran informal seperti shadow economy karena menawarkan alternatif yang fleksibel dan hemat biaya dibandingkan dengan sektor formal, begitu halnya dengan investor asing.

***Kata Kunci:** Shadow Economy, Investasi Langsung Asing, GMM*

JEL: E26; F21

Introduction

The term "shadow economy" refers to the legal and illegal market-based production of goods and services that is not included in official GDP estimates (Smith, 1994). Often known as the underground economy or informal economy, the shadow economy encompasses various activities, ranging from unreported income to unregistered businesses and illegal transactions. The fundamental principle of the shadow economy is that all its activities are not subject to government regulation or taxation. Therefore, estimating the size of the shadow economy can be relatively challenging. In terms of its economic activities, the shadow economy has the potential to reduce government revenue and undermine the effectiveness of government policies. This issue gives rise to other social problems, such as government funding shortages for providing infrastructure and public services. The shadow economy also has the potential to hinder government efforts to improve education, healthcare, and social welfare for the public due to limited fiscal capacity. Countries with an elevated degree of shadow economy activity may also have a low level of government governance, as the shadow economy can undermine the effectiveness of public policies while operating outside of government oversight and regulation.

Schneider & Enste (2013) explain three methods for measuring and testing the determinants of the shadow economy: direct approaches, indirect approaches, and the model approach. This study utilizes one of the indirect approaches, precisely the monetary method known as the currency demand approach. It assumes that shadow economy activities often use cash as the primary medium of exchange because it leaves fewer traces. Therefore, if the demand for cash exceeds the relative or absolute 'normal' value, it can be inferred that shadow economy activities are on the rise. Several studies have previously employed the currency demand approach to analyze the determinants of the shadow economy, including Torgler & Schneider (2007), who looked into variables such as tax morale, governance, and institutional quality of the shadow economy.

The currency demand approach has been used to examine the relationship between the shadow economy and other economic phenomena, including foreign direct investment (FDI). Thus far, no research has been conducted to explain the causality between the shadow economy and foreign direct investment. Some studies suggest that a high level of

shadow economy can enhance the inflow of foreign direct investment because multinational corporations seek to take advantage of tax avoidance in countries with a larger shadow economy (Ali & Bohara, 2017). By engaging in tax avoidance and choosing countries with lower governance capacity and regulatory intensity, companies can minimize labor costs and create opportunities for engaging in shadow economy activities, such as employing illegal workers or even engaging in corrupt practices, which may subsequently lead to the growth of the shadow economy's size.

Based on this rationale, this research focuses on analyzing the determinants of the shadow economy using a panel data approach covering 116 countries from 2001 to 2020. In addition to analyzing the determinants of the shadow economy, this study will also identify the impact of the shadow economy on foreign direct investment. This research categorizes the countries into four income groups: high-income, upper-middle-income, lower-middle-income, and low-income. Parameter estimation is conducted using the Generalized Method of Moments (GMM) model, with robustness tests incorporating reference estimates from Partial Least Squares (PLS) and Fixed Effects Model (FEM). The goal of this research is to enhance our understanding of the factors that drive the shadow economy and its interaction with foreign direct investment, providing an alternative perspective on this topic that can be applied to formulate appropriate policies for reducing the size of the shadow economy.

While previous studies have used the ratio of currency in circulation to money (C/M2) as a proxy to estimate the shadow economy size, its use in determining the causes of this phenomenon remains limited. Therefore, this research employs the C/M2 ratio to determine and evaluate the factors impacting the shadow economy. Thus, the goal is to provide a greater grasp of the factors driving the shadow economy. By using a large number of countries and analyzing them based on the income-based classification system by the World Bank, this research can offer an in-depth explanation and analysis of the complexities associated with the underground economy. Furthermore, this paper examines the understudied connection that exists among the shadow economy and foreign direct investment, a topic that has been rarely addressed in previous research.

Our findings indicate that a higher GDP and lower interest rates are associated with reduced shadow economy activity. Elevated market interest rates increase the cost of funds in the informal sector, discouraging engagement in shadow economic activities due to reduced profitability. Furthermore, higher tax revenues tend to correlate with intensified regulatory enforcement, increasing the risks associated with shadow economy involvement. The presence of a larger workforce and lower unemployment rates similarly diminish shadow economy activity. In terms of foreign direct investment (FDI), the shadow economy exhibits a positive effect on FDI flows when formal institutions, including legal frameworks, property rights protection, and regulatory systems, are either weak or overly burdensome. In such scenarios, economic actors may opt for informal channels like the shadow economy, offering a flexible and cost-effective alternative to the formal sector, a crucial consideration for foreign investors.

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previously employed the currency demand approach to analyze the determinants of the shadow economy, including Torgler & Schneider (2007), who looked into variables such as tax morale, governance, and institutional quality in relation to the shadow economy.

The currency demand approach has been used as a foundation for examining the relationship between the shadow economy and other economic phenomena, including foreign direct investment (FDI). Thus far, there hasn't been any research that can explain the causality between the shadow economy and foreign direct investment. Some studies suggest that a high level of shadow economy can enhance the inflow of foreign direct investment because multinational corporations seek to take advantage of tax avoidance in countries with a larger shadow economy (Ali & Bohara, 2017). By engaging in tax avoidance and choosing countries with lower governance capacity and regulatory intensity, companies can minimize labor costs and create opportunities for engaging in shadow economy activities, such as employing illegal workers or even engaging in corrupt practices, which may subsequently lead to the growth of the shadow economy's size.

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Literature Review

While there is no definitive theory for measuring the shadow economy, one strategy to reduce the shadow economy magnitude is by focusing on variables that impact it. Several investigations have already been conducted to determine the factors influencing the shadow economy. Schneider & Buehn (2012) explain that several factors influence the shadow economy, including tax and social security contribution costs, because individuals and organizations may have strong incentives to engage in informal economic activities to avoid high tax rates and social security obligations. Individuals and companies might be more inclined to operate within the shadow economy when tax rates are high. If the tax burden becomes too high, operating costs may exceed profits, encouraging individuals and businesses to engage in informal economic activities in order to avoid paying taxes. This is especially the case when the tax system is complex, pushing companies to operate outside the established system.

Another consideration in the underground economy is the institutions quality. Individuals and organizations are more inclined to engage in informal economic activities in countries with weak or ineffective institutions to avoid official regulations, taxes, and other costs. Strong and effective institutions can help minimize the extent of the shadow economy. Effective tax administration, strong property rights, and effective law enforcement, for example, can all help reduce the motivation of individuals and companies to engage in shadow economy activities. This supports Schneider's (2015) research, where the findings indicate that countries with lower tax rates have a lesser shadow economy. Similarly, Buehn & Schneider (2012, 2012a) discovered that reducing regulatory burdens can help minimize the magnitude of the shadow economy.

Torgler & Schneider (2007) conducted another study that looked at the connection between the shadow economy, tax morale, governance, and institutional quality. The research indicated that strengthening governance and quality of institutional, as well as tax morale, reduces the likelihood of shadow economy activities. The population of a country also affects the size of its underground economy, as countries with larger populations have a larger underground economy due to more opportunities for informal labor and greater challenges in monitoring and enforcing tax compliance.

Zhanabekov (2021) identified the drivers of the shadow economy and the strongest factors contributing to its size. The Bayesian Model Averaging (BMA) methodology was used in this study, allowing for the consideration of multiple models and model uncertainty. The unit of analysis in this research was the country, examining data from 162 countries. Factors tested in the shadow economy included institutional quality, macroeconomic stability, regulatory intensity, trade openness, and tax burden. According to the study, tax and social contributions, as well as institutional quality, accounted for approximately 60 percent of the influence on the shadow economy. However, the significance of tax-related factors was very weak, while the significance of other factors such as economic openness and regulatory burden was very strong. The study also found a negative relationship between the shadow economy and economic performance, with Sub-Saharan Africa and post-Soviet countries having a larger shadow economy and lower income levels.

Economic theory suggests that the impact of the shadow economy on foreign direct investment (FDI) can be measured by two major factors: tax burden and institutional quality. In several discussions, the tax burden is linked to lower profitability. Hence, this can encourage multinational corporations to relocate to countries with a substantial shadow economy and greater tax avoidance/evasion opportunities. (Chiarini et al., 2013; Haberly & Wójcik, 2015;

Esteller-Moré et al., 2020). The majority of studies have confirmed that the overall tax burden and social security contributions are one of the primary causes of the shadow economy's existence; however, national tax burdens and the global tax avoidance effect are rarely mentioned (Nikopour et al., 2009).

A number of investigations have been conducted to better understand the effects of shadow economy activities on foreign direct investment. Ali & Bohara (2017) conducted a panel study using a gravity model on data from 1999 to 2007 for OECD countries. The primary goal of the study is to investigate whether there is an association between variations in the size of shadow economy activities in each country for investors and FDI inflows into OECD countries. This study was carried out within the framework of a gravity model, which offers reliable estimates whenever bilateral international trade occurs.

Ali & Bohara (2017) added a new perspective to the analysis of FDI inflows and tax rates within the gravity model framework by incorporating differences in the shadow economy using the Baier and Bergstrand method (2009). The results showed that when the shadow economy level of the host country increased by one unit compared to the investing country, FDI inflows to OECD countries increased by 0.0571%, holding other variables constant. It can be concluded that a larger shadow economy increases FDI inflows because multinational corporations use tax avoidance in host countries with a larger shadow economy. The effect of differences in the shadow economy on incoming FDI is both negative and positive, or consistent. An unresolved research gap is the precise calculation and mechanism of tax evasion.

Cuong et al. (2021) used the static linear two-step-GMM estimator method to calculate the effect of the shadow economy on FDI in 158 countries from 2003 to 2018. Their research did not employ the tax evasion or institutional quality approach but rather focused more on the types of FDI. In their study, FDI was assumed to be the total FDI inflows or its two main subtypes: Greenfield investment and merger and acquisition (M&A). This is because Greenfield and M&A are two different investment strategies with distinct features and, therefore, are not perfect substitutes for each other. M&A includes the transfer of equity ownership, whereas greenfield requires the establishment of new production facilities. The variables used included income, exchange rate, inflation, infrastructure, domestic capital investment, human resources, population growth, urbanization, and trade openness. In this study, the authors investigated the effect of the shadow economy on FDI. The findings revealed that, while the shadow economy had no discernible impact on total FDI inflows, it was positively related to greenfield investment and inversely linked to M&A.

Abdullayevich (2015) used a random effects panel data model to study the connection between the shadow economy and FDI in 40 countries over nine years from 2000 to 2008. The 40 countries were grouped into four groups to study geographic regions influences: Europe, South and North America, Africa and the Middle East, and Asia and Oceania. European countries showed a statistically significant and negative relationship between the shadow economy and FDI. However, the results for South and North American countries indicated a statistically significant and positive relationship among them. Meanwhile, the findings for the other groups indicated that there was no link between the shadow economy and FDI.

Our study aims to analyze the determinants of the shadow economy, with the C/M2 to GDP ratio as a proxy for the shadow economy as the dependent variable. The independent variables used are the real interest rate, tax revenue, and the unemployment rate. Furthermore, this research investigates how foreign direct investment (FDI) is influenced by the shadow economy. In addition to the shadow economy, the independent variables involved are GDP

growth, the ratio of gross capital formation to GDP, and the labor participation rate. Gross capital formation reflects the investment climate and economic conditions of a country, where higher gross capital formation indicates a more favorable investment environment, including factors such as stable institutions, infrastructure development, and government policies.

Methodology

Model Specification

This paper employs the currency demand approach. The dependent variable used is the ratio of currency in circulation (C) to broad money (M2) as a proxy for the shadow economy. The equation can be expressed as follows:

$$\ln CM2_{it} = \beta_0 + \beta_1 \ln GDP_{it} + \beta_2 R_{it} + \beta_3 TAX_{it} + \beta_4 \ln POP_{it}$$
$$+ \beta_5 UNEMPLOYMENT_{it} + u_{it} \tag{1}$$

In equation (1), the dependent variable is *CM2* the ratio of currency in circulation (C) to broad money (M2). Meanwhile, the independent variables are as follows: the *GDP* of 116 countries; the real interest rate of 116 countries; *TAX* the ratio tax revenue to *GDP*; *POP* the number of country population in those 116 countries; *UNEMPLOYMNT* the unemployment level in 116 countries.

The Generalized Method of Moment (GMM) is applied to equation (1). The estimation involves five sub-sample categories. The first estimation is involving the whole 116 countries. The estimation subsequently will follow by low-income country group, middle income country group, upper middle income country group, and high-income country group.

The next stage is to estimate the influence of the shadow economy on foreign direct investment in 105 countries during the period 2001-2017. Using foreign direct investment as the dependent variable and the shadow economy *SE*, GDP growth *GDPG*, and ratio of gross capital formation to GDP (*IR*), labor participation (*LABOR*) as independent variables, the estimation is carried out using GMM.

$$FDI_{it} = \beta_0 + \beta_1 SE_{it} + \beta_2 GDPG_{it} + \beta_3 IR_{it} + \beta_4 LABOR_{it} + \varepsilon_{it} \tag{2}$$

The Generalized Method of Moments (GMM) is a common econometric technique for estimating model parameters, especially when there are endogeneity and other statistical challenges (Hansen, 1982). GMM estimation begins with the specification of a set of moment conditions that reflect the theoretical relationship between variables. In this research, the two-step system GMM estimator, as proposed by Arellano & Bond (1991), is utilized. The first step involves solving the moment conditions to obtain initial parameter estimates. In the second step, the parameters are re-estimated to improve efficiency, and an efficient weight matrix is constructed using the initial estimates.

The Sargan test, also known as the Sargan-Hansen test or the overidentification test, is a statistical test used in the framework of the Generalized Method of Moments (GMM) estimation. The Sargan test is used to determine the validity of instrumental variables and evaluate overidentifying restrictions in the model (Sargan, 1958). If the probability values (Prob>chi2) appearing above the significance levels of 1%, 5%, and 10% are observed, then the null hypothesis (*H*0) is accepted, or the model can be considered valid, and vice versa.

The Arellano-Bond test, also known as the Arellano-Bond autocorrelation test, is a statistical test for dynamic panel data models used in Generalized Method of Moments (GMM) estimation. The purpose of the Arellano-Bond test is to examine the presence of autocorrelation in the residuals of different estimation models. If autocorrelation is detected,

it indicates that the model specification is incorrect and can lead to biased parameter estimates and incorrect inferences. If the z probability value (Pr>z) is below the significance level of 1%, 5%, or 10%, then the null hypothesis (H0) is rejected, and the model is considered invalid. Conversely, if the z probability value is greater than the significance level of 1%, 5%, or 10%, it indicates that the null hypothesis (H0) is accepted, and there is no autocorrelation, making the model valid.

The data in this study was obtained from 116 countries. In the determinant test of the shadow economy, these 116 countries were classified into four categories based on their national income, namely high-income countries, upper-middle-income countries, lower-middle-income countries, and low-income countries. In the test of the influence of the shadow economy on foreign direct investment, data was collected from 105 countries, excluding Barbados, Belarus, Djibouti, Samoa, Sao Tome and Principe, Serbia, St. Lucia, St. Vincent and the Grenadines, Sudan, Tonga, and Vanuatu.

Table 1: Sample of countries

High income countries				
The US	Chile	Japan	Norway	Sweden
Australia	Hungarian	Canada	Qatar	Switzerland
Barbados	Iceland	Korea	Rep. Ceko	Trinidad & Tobago
The UK	Israel	Croatia	Romania	United Arab Emirates
Brunei	Italy	Kuwait	Singapore	Uruguay
Upper Middle-Income Countries				
South Africa	Brazil	Guinea equator	Mexico	St. Vincent & Grenadines
Albania	Bulgaria	Guyana	Moldova	Suriname
Armenia	China	Jamaica	Namibia	Thailand
Azerbaijan	Rusia	Columbia	Paraguay	Tonga
Belarus	Gabon	Costa Rica	Rep. Dominica	Turkey
Belize	Gambia	Maldives	Rep. Fiji	Venezuela
Bosnia	Georgia	Malaysia	Serbia	
Botswana	Guatemala	Mauritius	St. Lucia	
Lower Middle-Income Countries				
Angola	Djibouti	Comoro	Nicaragua	Senegal
Bangladesh	Philippines	Kyrgyz	Pakistan	Sri Lanka
Benin	Honduras	Lesotho	Papua New Guinea	Tajikistan
Bhutan	Indonesia	Morocco	Solomon island	Tanzania
Bolivia	Cambodia	Mongolia	Rep. Congo	Tunisia
Cabo Verde	Cameron	Myanmar	Samoa	Ukraine
Cote d'Ivoire	Kenya	Nigeria	Sao Tome & Principe	Vanuatu
Low Income Countries				
Central Africa	Ghana	Mali	Sierra Leone	Togo
Burkina Faso	Guinea-Bissau	Mozambique	Sudan	Zambia
Burundi	Congo	Niger	Syria	
Chad	Madagascar	Rwanda	Uganda	

Robustness Test

Robustness tests are conducted to assess the validity of estimation results by re-estimating using several methods: Partial Least Squares (PLS), Fixed Effects Model (FEM), and Generalized Method of Moments (GMM). Partial Least Squares is a statistical technique used to model the relationship between independent and dependent variables. This method is employed in situations with a large number of predictor variables and a small number of observations, making it suitable for panel data analysis. On the other hand, Fixed Effects Model (FEM) and Random Effects Model (REM) in panel data analysis are used to account for potential unobserved heterogeneity. These methods are performed to validate the stability and consistency of results across different modeling frameworks using various estimation techniques.

Result and Discussion

Tables 2 provides the statistical description of the determinants of the shadow economy equation, which includes the number of observations for each variable, the mean, standard deviation, minimum value, and maximum value for each variable.

Table 2: Descriptive Statistics for Shadow Economy Equation

Variable	Obs.	Mean	Std. Dev.	Min	Max
lncm2	2,320	0.4449026	8.965619	0.0002309	321.0726
r	2,320	5.697158	8.894112	-58.32718	93.91508
tax	2,320	16.5812	6.577377	0.0420564	48.1
pop	2,320	3.95e+07	1.32e+08	103210	1.41e+09
gdp	2,320	4.35e+11	1.84e+12	1.56e+08	1.99e+13
unemployment	2,320	7.468034	5.757249	0.1	31.11

Table 3 contains a statistical description of the test for the influence of the underground economy on foreign direct investment, including the number of observations, mean, standard deviation, minimum value, and maximum value for each variable. Table 3 includes 105 countries from 2001 to 2017.

Table 3: Descriptive statistics for FDI Equation

Variable	Obs.	Mean	Std. Dev.	Min	Max
fdi	1,785	4.188767	5.985698	-37.17265	64.3841
se	1,785	31.54067	11.99898	5.1	70.5
gdpg	1,785	4.258456	4.76102	-36.39198	63.37988
ir	1,785	22.54411	10.21766	0	79.40108
labor	1,785	67.94309	9.864504	42.39	90.34

Table 4 shows that variables such as GDP, real interest rate, population, and unemployment rate have a significant influence on the variable cm2, which represents the ratio of currency in circulation to broad money and serves as a proxy for the underground economy in 116 countries. In high-income countries, variables such as GDP, real interest rate, population, and unemployment rate all have a significant impact on the variable cm2, which serves as a proxy for the underground economy. In upper-middle-income countries, the results of the determinants of the shadow economy test using the GMM method in Table 4 show that variables such as GDP, real interest rate, and unemployment rate have a significant impact on the variable cm2, which represents the underground economy.

Table 4: GMM Estimation Result: Shadow Economy as Dependent Variable

	lngdp	r	tax	lnpop	unemployment	AR(1)	AR(2)	Sargan Test	Prob> chi2
Total 116 countries	-0.1021*** (0.000)	-0.0010*** (0.000)	-0.0059*** (0.000)	-0.2410*** (0.001)	-0.0026* (0.069)	0.2352	0.4201	0.1134	0.0000
High Income Countries	0.3571*** (0.001)	-0.0006*** (0.002)	-0.0110*** (0.000)	-0.2749*** (0.003)	0.0135*** (0.000)	0.3185	0.3291	0.9727	0.0000
Upper Middle Income Countries	-0.1898*** (0.000)	-0.0006** (0.043)	-0.0023*** (0.000)	0.0764 (0.530)	-0.0064*** (0.000)	0.0026	0.7238	0.7537	0.0000
Lower Middle Income Countries	-0.2350*** (0.000)	-0.0029*** (0.000)	-0.0058*** (0.000)	0.1140 (0.444)	0.0073*** (0.000)	0.2932	0.2063	0.6699	0.0000
Low Income Countries	-0.4907** (0.018)	-0.0000 (0.982)	0.0011 (0.315)	0.4588** (0.045)	0.0110 (0.190)	0.0645	0.432	0.7934	0.0000

Note: *indicates significance at 10%, **indicates significance at 5%, and *** indicates significance at 1%. p-value in parentheses

For lower-middle-income countries, the results of the determinants of the shadow economy test using the GMM method in Table 4 indicate that variables such as GDP, real interest rate, and the unemployment rate have a significant influence on the variable cm2, which represents the ratio of currency in circulation to broad money as a proxy for the shadow economy. Finally, the classification of low-income countries shows that the results of the determinants of the shadow economy test using the GMM method in Table 4 indicate that variables such as GDP and population have a significant influence on the variable cm2, which represents the ratio of currency in circulation to broad money as a proxy for the shadow economy.

The estimation findings of the influence of the shadow economy on foreign direct investment using the GMM method in Table 5 show that variables such as the shadow economy, GDP growth, and gross capital formation all have a significant impact on the variable foreign direct investment. The results we obtained show that greater gross domestic product is associated with lower shadow economy activity. Moreover, a negative effect of interest rates on shadow economy indicates that elevated market interest rates increase the cost of funds in the informal sector, discouraging engagement in shadow economic activities due to reduced profitability. Furthermore, higher tax revenues tend to correlate with intensified regulatory enforcement, increasing the risks associated with shadow economy involvement. The presence of a larger workforce and lower unemployment rates similarly diminish shadow economy activity.

Table 5: GMM Estimation Result: FDI as Dependent Variable

Independent Variables	Coefficient and p-value
L1.fdi	0.3962477*** (0.000)
se	0.1297453*** (0.000)
gdpg	0.1197833*** (0.000)
ir	0.1423497*** (0.000)
labor	0.0361431 (0.276)

Independent Variables	Coefficient and p-value
_cons	-8.164369***
	(0.002)
AR(1)	0.0131
AR(2)	0.5043
Sargan Test	0.1003
Prob>chi2	0.0000

Note: *indicates significance at 10%, **indicates significance at 5%, and *** indicates significance at 1%. P-value in parentheses.

The estimation results of the impact of the shadow economy on foreign direct investment using the GMM method in Table 5 show that the variables shadow economy, GDP growth, and gross capital formation have a significant influence on foreign direct investment. The variable shadow economy (SE) has a positive and significant coefficient. This implies that as the size or prevalence of the shadow economy grows, the level of foreign direct investment (FDI) also increases. The presence of a strong shadow economy can create investment opportunities and attract foreign investors seeking alternative channels for capital allocation.

Furthermore, the analysis indicates that GDP growth (GDPG) and FDI have a positive and significant relationship. This is consistent with theoretical expectations because higher economic growth rates typically imply investment opportunities and attractive market potential. Foreign investors are more likely to channel capital into countries experiencing strong economic growth as it signifies a favorable business environment and the potential for investment returns.

Similarly, the variable gross capital formation (GC) has a positive and highly significant coefficient. This implies that a higher portion of investment relative to GDP has a positive impact on FDI. These findings underscore the importance of pro-investment policies and institutions in attracting foreign investors. Countries that prioritize investment promotion and create a favorable business environment are likely to attract more FDI inflows.

Robustness testing aims to validate the estimation results. This test is conducted by re-estimating the comparative analysis and comparing the coefficients obtained from the PLS, FEM, and GMM methods. It can be said that the GMM method is strong or robust in analyzing the determinants of the shadow economy when its coefficient values are in between the coefficients obtained from the PLS and FEM methods.

Table 6: Robustness Test for shadow economy model: Using PLS and FEM Estimation

Variable	PLS	FEM	GMM
lngdp	-0.3555	-0.3471918	-0.1021292
	(0.000)	(0.000)	(0.013)
r	-0.0034	-0.0017856	-0.0010713
	(0.041)	(0.099)	(0.000)
tax	-0.0046	-0.0067431	-0.0059656
	(0.042)	(0.008)	(0.000)
lnpop	0.3484	0.0503732	-0.2410861
	(0.000)	(0.472)	(0.001)
unemployment	-0.0007	-0.0214871	-0.0026026
	(0.784)	(0.000)	(0.069)

Variable	PLS	FEM	GMM
R-squared	0.3387	0.1506	
AR(1)			0.2352
AR(2)			0.4201
Sargan Test			0.1134
Prob>chi2	0.0000	0.0000	0.0000

Note: *indicates significance at 10%, **indicates significance at 5%, and *** indicates significance at 1%. P-value in parentheses.

Table 7: Robustness Test for FDI model: Using PLS and FEM Estimation

Variable	PLS	FEM	GMM
se	0.0101	0.0452	0.1297
	(0.375)	(0.226)	(0.000)
gdpg	0.2466	0.2396	0.1197
	(0.000)	(0.000)	(0.000)
ir	0.1304	0.1889	0.1423
	(0.000)	(0.000)	(0.000)
labor	0.0285	0.0196	0.0361
	(0.038)	(0.716)	(0.276)
R-squared	0.1041	0.0991	
AR(1)			0.0131
AR(2)			0.5043
Sargan Test			0.1003
Prob>chi2	0.0000	0.0000	0.0000

Note: *indicates significance at 10%, **indicates significance at 5%, and *** indicates significance at 1%. P-value in parentheses.

Conclusion

This study aims to analyze the factors influencing the shadow economy in 116 countries during the period 2001-2020 and examine the impact of the shadow economy on foreign direct investment (FDI) in 105 countries during the period 2001-2017. Our findings suggest that a higher GDP and lower interest rates are associated with reduced shadow economy activity. Elevated market interest rates increase the cost of funds in the informal sector, discouraging participation in shadow economic activities due to reduced profitability. Furthermore, higher tax revenues tend to be linked to intensified regulatory enforcement, increasing the risks associated with shadow economy involvement. A larger workforce and lower unemployment rates similarly reduce shadow economy activity.

In the context of foreign direct investment (FDI), the shadow economy has a positive effect on FDI flows when formal institutions, including legal frameworks, property rights protection, and regulatory systems, are either weak or overly burdensome. In such scenarios, economic actors may choose informal channels like the shadow economy, offering a flexible and cost-effective alternative to the formal sector, which is a crucial consideration for foreign investors.

Based on these results, we recommend several implications for government policy as well as for future studies in this area. First, the government can strengthen the formal economy by prioritizing economic growth and expanding the formal economy, especially in

high-income and upper-middle-income countries. This can be achieved through initiatives such as promoting entrepreneurship, improving infrastructure, and supporting small and medium-sized enterprises. Second, tax reform, considering the negative impact of tax revenue on the shadow economy, policymakers should consider comprehensive tax reforms aimed at simplifying the tax system, reducing the tax burden, and improving tax compliance. By creating a more favorable tax environment, individuals will be more inclined to engage in formal economic activities. Third, policymakers in countries where unemployment significantly affects the shadow economy should prioritize the implementation of effective employment and social welfare programs. These programs should aim to reduce unemployment by offering skill development opportunities, job creation programs, and social safety nets. Individuals will have more opportunities in the formal economy if the root causes of unemployment are addressed, reducing their reliance on the shadow economy. Fourth, given the positive impact of the shadow economy on foreign direct investment, policymakers should carefully review existing FDI regulations and consider making necessary changes. While attracting foreign investment is important, efforts should be made to ensure transparency, accountability, and fair competition in the business environment. Striking a balance between attracting investment and preventing illegal activities can contribute to creating a sustainable and transparent investment landscape. Fifth, our study has limitations in terms of the time period used, the number of variables, and data constraints. There are several other variables that can be included and investigated to enhance the understanding of the topic and achieve a more comprehensive research goal. Additionally, the researchers faced data access limitations, affecting the scope and depth of the analysis. With these limitations, it is recommended for future research to build on the existing findings by incorporating a broader time frame and involving other variables to gain a deeper understanding of this topic.

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