UNVEILING THE FACTORS BEHIND THE SHADOW ECONOMY: A GLOBAL INVESTIGATION UTILIZING PANEL DATA ANALYSIS

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Abstract

The paper addresses the topic of the shadow economy and the socio-economic factors that influence it. By reviewing relevant studies, we will observe that a variety of factors play a role in shaping this economy. Using a dataset comprising 50 countries from around the world, monitored over 13 years, we conducted an analysis to determine which of the discussed factors most significantly impact the level of the shadow economy. The OLS model shows a positive relationship between income inequality, the unemployment rate and the shadow economy and a negative relationship between the World Governance Index, income inequality and the shadow economy. We will find that this model will have autocorrelation problems that might influence the significance of the coefficients. Our main model (the GMM one) addresses autocorrelation and heteroskedasticity but shows some different outcomes. The findings can serve as a valuable resource for other researchers or even governments, helping to identify what changes are needed to reduce the share of the shadow economy. By the end of this research, we will have identified the key areas that need enhancement and growth to effectively address and reduce the shadow economy.

Keywords: Shadow economy, income inequality, economic development, public governance, GMM.

Introduction

In recent decades, the shadow economy has become a central topic in economic and political analysis, attracting the attention of researchers, politicians, and international institutions alike. It is generally defined as the sum of economic activities that contribute to the Gross Domestic Product (GDP) but are not officially reported due to non-compliance with tax or legal regulations (Smith, 1994). The shadow economy affects countries globally, and its impact on tax revenues, social policies, and economic development is well-documented in numerous studies (Schneider, 2015). Despite its

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importance, the true size of the shadow economy remains difficult to estimate, primarily due to its hidden nature and the diversity of factors that influence it.

Although many studies have focused on the dimensions of the shadow economy, its relationship with various economic factors such as income inequality, unemployment, the level of economic development, and public governance remains partially unexplored. Recent studies, such as those by Achim, Borlea, and Găban (2018) and Rosser, Rosser, and Ahmed (2003), suggest that these factors can significantly influence the shadow economy, yet comprehensive analyses explicitly correlating these indicators with the informal economy are still lacking.

This study aims to address these gaps by empirically investigating the relationships between the shadow economy and various economic and governance factors, such as income inequality, unemployment rate, level of economic development, and public governance indicators. Our study offers a detailed analysis of a sample of 50 countries over a 13-year period (2005-2017), employing a robust methodology: the Generalized Method of Moments (GMM). In this context, our research aims to test the following working hypotheses: 1. The existence of a positive relationship between income inequality and the shadow economy, 2. A negative relationship between economic development and the shadow economy, 3. The impact of public governance on the size of the informal economy and 4. A positive relationship between the unemployment rate and the level of the shadow economy. Thus, this study aims not only to provide a deeper understanding of the factors that drive the shadow economy but also to equip governments and policymakers with the necessary tools to develop effective policies to combat this phenomenon. Ultimately, the objective is to contribute to the improvement of the fiscal and economic environment in the countries analysed and to offer a solid foundation for public policies that discourage informal economic activities.

The paper is structured as follows. Section 1 presents the literature review on the proposed topic, along with the corresponding research hypotheses. Section 2 describes the research methodology. The paper continues in Section 3 with the presentation of research results and the discussions surrounding them. Section 4 is dedicated to research conclusions, identifying the limitations and suggesting future research directions.

1. Review of the scientific literature
What is the shadow economy?

Studies attempting to quantify the shadow economy first face difficulties in clearly defining it. For example, one frequently used definition is that the shadow economy includes all current economic activities that contribute to GDP but are not officially reported. Smith (1994, p.18) defines the shadow economy as "the production of market goods and services, whether legal or illegal, that are not included in official GDP estimates." These activities are ubiquitous in everyday life. For instance, a painter might sell a piece at a reduced price to avoid taxes, or a bartender could sell drinks without registering them, thus avoiding reporting to authorities. Another common case is employers declaring minimum wages for employees in official documents, while these employees receive "under-the-table" payments to evade taxes. Additionally, the shadow economy encompasses a wide range of illegal activities, such as the production and sale of counterfeit goods, drug trafficking, unauthorized transactions, commercial

prostitution, usury, illegal gambling, employing undocumented workers, and tax evasion (Schneider et al., 2015). These examples illustrate how the shadow economy can evade the control of authorities and undermine the formal economy. Other definitions used in specialized studies include:

- "All unregistered economic activities that would contribute to the official calculation of Gross National Product (GNP) is observed" (Schneider, 2012, 2022);
- "Those economic activities and the income derived from them that circumvent regulation, taxation, or government observation" (Thomas, 1999);
- "Activities that illegally produce branded goods, drug trafficking, commercial vices and prostitution, usury, illegal gambling, bartering, employment of illegal immigrants, self-employed activities, hidden incomes, and tax fraud" (Shelak, 1997).
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The Relationship Between the Shadow Economy and Income Inequality

Income inequality generally refers to the unequal distribution of income among members of a society (The Equality Trust, 2016). More precisely, it describes the variations in income earned by different individuals or groups within an economy. A commonly used indicator to measure inequality is the Gini coefficient, which ranges from 0, representing perfect income equality, to 100, indicating maximum inequality. While numerous studies have analysed the shadow economy and income inequality separately, few have focused on the direct relationship between the two. A study by Rosser, Rosser, and Ahmed in 2003 showed that an increase in income inequality in a country could lead to a rise in illegal activities, fuelled by a decline in trust and social solidarity. They also suggested that the expansion of the shadow economy contributes to increasing inequality by reducing tax revenues and weakening the effectiveness of redistributive policies. However, their study did not empirically test this causal relationship, using only graphical representations to analyse the two variables. Later research, such as that conducted by Winkelried (2005), Dell'Anno (2016), and Chong and Gradstein (2007), confirmed a positive relationship between income inequality and the shadow economy, highlighting that under conditions of greater inequality, high-income individuals tend to invest more, while low-income individuals invest less.

Based on the above findings, this paper aims to test the following research hypothesis:

Hypothesis 1: There is a positive relationship between the level of the shadow economy and income inequality.

The Relationship Between the Shadow Economy and the Level of Economic Development

Several studies suggest that a higher level of economic development in a country improves tax collection capacity and increases the demand for public goods and services (Mare, 2014; Torgler, 2007). For example, Torgler's (2007) study emphasizes a close link between household financial satisfaction and the willingness to pay taxes. Torgler shows that when households face financial difficulties, paying taxes can be perceived as a significant burden, which may reduce tax compliance and encourage involvement in

shadow economy activities. In research conducted between 2007 and 2013 within the European Union countries, Achim, Borlea, Găban, and Cuceu (2018) demonstrated that as a country becomes more prosperous, citizens are less likely to engage in informal activities. However, the results vary between the older EU member states (EU 15) and the new member states (EU 13), with the regression coefficient for GDP per capita having a greater impact on the shadow economy in the EU 13 countries. Thus, economic development in the new EU member states has a more pronounced effect on reducing the shadow economy, although the result is not statistically significant.

Based on the above findings, this paper aims to test the following research hypothesis:
Hypothesis 2: There is a negative relationship between the level of the shadow economy and economic development.

The Relationship Between the Shadow Economy and Worldwide Governance Indicators

The study conducted by Achim, Borlea, Găban, and Cuceu (2018) highlights that the Worldwide Governance Indicators have a significant and negative effect on the shadow economy in the analysed sample. In the case of countries that joined the European Union after May 1, 2004 (EU 13), the influence of governance components on the shadow economy is less strong. Specifically, the Voice and Accountability Index, Political Stability and Absence of Violence, Government Effectiveness, Regulatory Quality, and Rule of Law have a significant negative impact on the shadow economy, at significance levels of 5% and 10%. Although Control of Corruption also negatively influences the shadow economy, it is not statistically significant. The results obtained by Achim, Borlea, Găban, and Cuceu (2018) are largely aligned with those reported by Dreher and Schneider (2010), who highlighted differences in this relationship between high-income and low-income countries, due to distinct mechanisms operating in each category.

Recent studies also show that education and government efficiency play a significant role in influencing the shadow economy. Schneider (2017, 2018) emphasizes that tax morality and the quality of public services are crucial factors affecting participation in informal activities. Buehn and Farzanegan (2013), based on an analysis conducted over nine years in 80 countries, demonstrated that public institutions impact the shadow economy, largely influenced by the level of education. In another study, Stefoni and Draghia (2020) found that education is inversely related to the shadow economy, such that increasing educational levels reduces the size of the informal economy. Their study also shows that poor-quality public services negatively impact the shadow economy, suggesting that countries with more developed and efficient public services can reduce informal activities.

Several studies have investigated the impact of the institutional framework on the shadow economy. Torgler and Schneider (2009) and Aruoba (2010) identified an indirect, negative relationship between governance quality and the shadow economy. In an influential study, Johnson et al. (1997) emphasized that the government's effectiveness in implementing regulations plays a crucial role in determining the size of the shadow economy. In the fiscal sphere, Buehn, Lessman, and Markwardt (2013) showed that fiscal decentralization is an important factor influencing the informal

economy. Contrary to common belief, which suggests that high taxes lead to an increase in the shadow economy, Friedman et al. (2000) concluded that over-regulation and corruption are the main determinants of the informal economy. Singh et al. (2012) also discovered an indirect, negative relationship between the Rule of Law and the shadow economy.

In their work "Shadow Economy, Voice and Accountability, and Corruption," Torgler, Schneider, and Macintyre (2011) emphasize that higher levels of governmental accountability and political participation can reduce the size of the shadow economy. Their research shows that increased public participation and better government responsiveness are usually associated with lower levels of informal economic activity, although factors like corruption may alter this effect. Another study by Schneider and Bühn (2013) explores how institutional quality, including Voice and Accountability (VA), affects the shadow economy. They argue that a well-functioning government, reflected in high Voice and Accountability scores, can create an environment where citizens are more inclined to comply with laws, reducing the need to operate in the informal economy.

Based on the findings above, this paper aims to test the following research hypothesis:
Hypothesis 3: There is a negative relationship between the level of the shadow economy and Worldwide Governance Indicators.

The Relationship Between the Shadow Economy and Unemployment Rate
In the study conducted by Saafi, Farhat, and Mohamed, the authors investigated the dynamic links between unemployment and the shadow economy for 32 developed and developing countries over the period 1980-2009, using parametric and non-parametric techniques. By applying Hansen and Seo's (2002) threshold cointegration approach and Kyrtsou and Labys' (2006) nonlinear causality test, they found that in most cases, the relationship between unemployment and the shadow economy is not neutral. However, in Bolivia, China, Colombia, Pakistan, the Philippines, and Portugal, a neutral relationship was identified. In Finland and Sweden, strong evidence of a bidirectional relationship was found, indicating that high levels of unemployment lead to an increase in the shadow economy, and vice versa. Additionally, a unidirectional causality from unemployment to the shadow economy was identified in the USA, Jamaica, and Venezuela, suggesting that an increase in the unemployment rate stimulates a larger share of the shadow economy in GDP. In contrast, in Chile, the causality relationship is reversed. The study's results highlight the importance of carefully interpreting the relationships between unemployment and the shadow economy, as they can vary depending on the methods used and the particularities of each country.

In his study, Tran (2023) investigated the relationship between unemployment and the shadow economy in seven ASEAN countries and found that unemployment is a major factor contributing to the growth of the shadow economy. The author explains that, under conditions of high unemployment, individuals unable to access the formal labour market are often forced to work in the informal sector, leading to the expansion of the shadow economy. The study thus highlights that unemployment has a direct and significant impact on the size of the shadow economy in these economies.

Based on the above findings, this paper aims to test the following research hypothesis:
Hypothesis 4: There is a positive relationship between the level of the shadow economy and the unemployment rate.

2. Research methodology

For the analysis in this paper, we utilized a sample of 50 countries from around the world. The data for each variable span from 2005 to 2017, using a panel dataset. Thus, we are analysing a dataset comprising 650 observations (50 countries * 13 years). The sample size is determined by the availability of data. We processed the data using R and EViews.

The reason we selected these 50 countries is purely due to data availability. The same reasoning applies to the choice of the period. When we began the project, we selected several variables that might influence the shadow economy and searched for relevant databases. We were only able to find observations from 1995 to 2020. After that, we created a database that included all countries worldwide with all variables arranged in a panel data format. Many countries had missing observations between 1995-2004 and 2018-2020, so we decided to exclude those countries. We preferred not to influence the database with different methods that help us counter the missing observations problem. Once again, we emphasize that these 50 countries we analysed have nothing in common (they are not all from the same continent, do not have the same structure, etc.).

The complete list of variables and their respective sources is provided in Table no. 1 below:

Table no. 1. Variable description

Variable Name	Symbol	Measurement Scale	Source
Shadow economy as a percentage of GDP	SE	0-100%	Schneider, F. (2022)
Unemployment rate	Unemployment	0-100%	World Bank (2023)
Income inequality (measured by the Gini Index)	GINI	Scale of 0-100 (0 = full equality)	World Bank (2023)
Human Development Index	HDI	Scale of 0-1	World Bank (2023)
GDP per capita	GDP	Positive numerical values	World Bank (2023)
Political Stability and Absence of Violence	PS	Scale from -2.5 to 2.5	World Bank (2023)
Regulatory Quality	RQ	Scale from -2.5 to 2.5	World Bank (2023)
Voice and Accountability	VA	Scale from -2.5 to 2.5	World Bank (2023)

Source: Own analysis

A brief description of each variable is provided below:

- SE (Shadow Economy as a Percentage of GDP): This indicator measures the size of the shadow economy relative to a country's gross domestic product. A higher percentage indicates a greater share of economic activities that are not reported to tax authorities, characteristic of economies with weak regulation or low tax compliance.

- Unemployment Rate (Unemployment): Represents the percentage of the labour force that is unemployed but available and seeking work. This indicator is essential for assessing a country's economic state. A high unemployment rate may indicate an economy in stagnation with limited labour market opportunities, while a low rate may reflect a robust economy with increased demand for labour. The calculation formula is: (Total number of unemployed / Total number of active labour force).

- Gini Index (GINI): Measures income inequality within a society. The higher the Gini index, the greater the disparity between the incomes of the richest and poorest individuals.

- Human Development Index (HDI): This index combines three fundamental dimensions of human development: life expectancy at birth, education level, and income per capita. It is a composite indicator that provides an overall picture of the general well-being of a country's population. A higher HDI score indicates a higher level of human development.

- Gross Domestic Product per Capita (GDP per capita): Represents the total value of goods and services produced in a country divided by the total population. It is a widely used indicator to compare levels of economic development between different countries or regions.

Next, we will describe some of the Worldwide Governance Indicators used in our study:

- Political Stability and Absence of Violence (PS): This index measures a state's ability to maintain political stability and prevent social unrest and violence. A high score on this indicator reflects a stable political atmosphere, where the risks of internal conflicts or political violence are low.

- Regulatory Quality (RQ): This indicator evaluates the effectiveness and quality of economic and business regulations in a country. A high score indicates a well-structured regulatory environment that supports economic development and encourages business compliance with existing regulations.

- Voice and Accountability Index (VA): This index reflects the extent to which a country's citizens can participate in the decision-making process through expressing their opinions and engaging in political life. It also refers to the level of government transparency and accountability. A high score on this indicator indicates a high degree of political freedom and citizens' ability to influence governance.

Descriptive Statistics

The descriptive statistics indicate significant variation among the countries in the sample regarding most economic and social indicators. There are notable differences between more developed countries, which have better regulations and political stability, and countries facing issues like inequality, unemployment, and an extensive

shadow economy. These factors suggest that effective policies to combat the shadow economy must be tailored to the specific context of each country.

Table no. 2. Descriptive Statistics

Variable Name	Symbol	Mean	Median	Standard Deviation	Min	Max
Shadow Economy as a percentage of GDP	SE	23.4	21.5	12.69	5.10	65.20
Unemployment Rate	Unemployment	7.72	7.08	4.12	0.25	27.47
Income Inequality (Gini Index)	GINI	35.6	33.98	7.86	23.70	59.50
Human Development Index	HDI	0.82	0.83	0.09	0.59	0.95
GDP per capita	GDP	24856.3	14226.44	24490.80	1034.71	118823.65
Political Stability and Absence of Violence	PS	0.33	0.52	0.77	-2.06	1.6
Regulatory Quality	RQ	0.72	0.77	0.78	-1.62	2.05
Voice and Accountability	VA	0.63	0.92	0.82	-1.77	1.74

Source: Own analysis

In this paper, we employ the Panel GMM (Generalized Method of Moments) methodology as the initial model exhibited problems with autocorrelation and heteroscedasticity. We introduced two lagged periods of the independent variable to ensure that these issues were addressed. The Generalized Method of Moments (GMM) is an econometric estimation method introduced by Lars Peter Hansen in 1982. GMM is a flexible and robust method that is used when other methods, such as OLS (Ordinary Least Squares), are not applicable due to problems like endogeneity, autocorrelation, or heteroscedasticity in the errors. GMM can be applied to both time series and panel data and is particularly valuable for dynamic economic models. There are two main variants of GMM used in dynamic panel models:

1. Difference GMM (Arellano-Bond): This method transforms the data through differencing to eliminate individual effects and uses lags of the endogenous variables as instruments. It was developed by Arellano and Bond (1991) and is suitable for dynamic models with many cross-sectional observations and few periods.
2. System GMM (Arellano-Bover/Blundell-Bond): This model extends Difference GMM by including level equations to improve the efficiency of

estimates, especially when variables are highly persistent. It was proposed by Arellano and Bover (1995) and Blundell and Bond (1998).

Unlike other methods, the GMM model does not require strong assumptions about the distribution of errors. When applying the Generalized Method of Moments (GMM) estimation, researchers must conduct two post-estimation tests to verify whether an appropriate econometric model has been used. These tests are: (i) the Sargan test and (ii) the Arellano-Bond test for first-order and second-order autocorrelation. A crucial assumption for the validity of GMM estimates is that the instruments are exogenous. The Sargan test is used to determine whether the econometric model is valid and whether the instruments are correctly specified. Specifically, if the null hypothesis is rejected, the researcher must reconsider the model or the instruments used in the estimation process. The post-estimation test (Sargan test) will be automatically performed in R Studio when estimating the GMM model. To examine the validity of the strong exogeneity assumption, the Arellano-Bond test for autocorrelation (or lack of autocorrelation) is used, under the null hypothesis that the error terms from two different periods are not correlated. In other words, this means that the variables with observations from previous periods are not correlated with the error term. In R Studio, this test will also be automatically performed by the software when estimating the GMM model. The final model is presented as per the equation below:

SE = a*SE (t-1) + b*SE(t-2) + c*Gini + d*Unemployment + e*GDP + f*HDI + g*RQ + h*PS + i*VA

(1)

Next, the model will be tested for validity using various specific tests. Tests such as the Sargan test, which checks the validity of the model, and two autocorrelation tests for both lagged periods, will be employed. The next step is to check for multicollinearity between the variables. If the above tests are validated, our chosen model will be considered valid.

3. Results and discussion

First, before we begin the analysis, we need to check if the variables are stationary. We will use the ADF (Augmented Dickey-Fuller) / Panel Unit Root test with H0: "The series has a unit root (is not stationary)." We applied this test to all variables in our model and obtained a p-value lower than the significance threshold (5% in our case). Therefore, we can proceed with the analysis, as our variables are stationary. The next step when working with a panel data set is to choose between fixed or random effects. We will use the Hausman test with H0: "The random effects model is appropriate." We obtained a p-value of 0.79, meaning we will use random effects. Additionally, we performed another test to check whether it is necessary to use effects. This is the Breusch-Pagan Lagrange Multiplier (LM) Test with H0: "There is no need to use effects." We obtained a minimal p-value, thus rejecting this hypothesis. This model will account for differences between countries (cross-section), such as variations in government or economic structure, as well as differences between periods due to crises or spontaneous events that may influence the values of the variables included in our model. The resulting model is as follows:

SE = Intercept(***) + 0.11(***)Gini + 0.05(**)Unemployment − 6.73*10^-5(***)GDP − 52(***)HDI − 2.26(***)RQ − 1.15(***)PS − 0.73VA

(2)

*** - significant at a 1% level (0.01)
** - significant at a 5% level (0.05)
* - significant at a 10% level (0.1)

In this model, we observe that all research hypotheses have been validated. There is a positive and significant relationship between income inequality, unemployment rate, and the size of the shadow economy, and a negative and significant relationship between the level of economic development, Public Governance Indicators, and the shadow economy. Next, we need to verify the model. We performed the Breusch-Pagan test to check for heteroscedasticity, with H0: there is homoscedasticity. We obtained a minimal p-value, indicating that the model exhibits heteroscedasticity. Using the Wooldridge test, we can test for autocorrelation. H0: There is no autocorrelation. Since we obtained a low p-value, autocorrelation is also present. The presence of these two issues unfortunately compromises the validity of the model, requiring its re-estimation to obtain correct and robust results. It will be necessary to use a dynamic model, and in this context, the Panel GMM model will be implemented, as outlined earlier.

The final model is as follows:

SE = 1.087*SE (t-1) − 0.107*SE(t-2) -0.009*Gini + 0.001*Unemployment + 2.3*10^-6*GDP -0.418*HDI − 0.11*RQ − 0.282*PS + 0.206*VA (3)

Table no. 3. Model Results

SE(t-1)	SE(t-2)	Gini	Unemployment	GDP	HDI	RQ	PS	VA
1.087	-0.107	-0.009	0.001	2.3*10^-6	-0.418	-0.11	-0.282	0.206
(0.000)	(0.012)	(0.18)	(0.816)	(0.001)	(0.69)	(0.09)	(0.04)	(0.02)

Source: Own analysis

The coefficient of 1.087 indicates a strong persistence of the shadow economy from one period to the next. The shadow economy in period t-1 strongly affects its size in the current period. This means that if the shadow economy was high in the previous period, it is likely to remain high in the current period as well. The p-value of 0.000 shows that this result is extremely statistically significant. The negative coefficient of -0.107 suggests a corrective effect of the shadow economy from two periods ago. The shadow economy in t-2 has a reducing effect on the shadow economy in the current period. This may indicate a cycle or a self-regulating trend, where an increase two periods ago is followed by a decrease. The p-value (0.012) indicates that this effect is statistically significant. The statistically significant coefficient of -0.11 suggests that better regulatory quality is associated with a reduction in the shadow economy. The negative coefficient of -0.282 indicates that greater political stability is associated with a reduction in the shadow economy. A stable political environment reduces the need to resort to the shadow economy. The p-value of 0.04 shows that this effect is statistically

significant. The positive coefficient of 0.206 suggests that an increase in political freedom and governmental accountability is associated with an increase in the shadow economy. This may seem counterintuitive, but it could reflect the fact that in more politically open environments, individuals have more opportunities to exploit legislative loopholes. GDP and political freedom show a positive effect on the shadow economy, but these results require careful interpretation. This effect may indicate that larger economies and those with a high degree of political freedom provide a more favourable environment for tax evasion and informal economic activities. Thus, economic growth and political freedom, while beneficial in other aspects, may create circumstances that facilitate the expansion of the shadow economy in the absence of effective regulatory and control mechanisms. A relevant example might be the situation in developed economies, where high GDP and a consolidated democracy, characterized by high political freedom, provide individuals and firms with greater autonomy in making economic decisions. For instance, in economies such as the United States or Germany, despite economic prosperity and a stable political framework, the complexity of tax legislation and elaborate regulations may create loopholes that allow for tax avoidance and other informal economic activities. This demonstrates that despite economic growth and an open political environment, without adequate controls, the shadow economy can continue to thrive, taking advantage of the opportunities found in large and less regulated economies. Unfortunately, the coefficients for unemployment and income inequality are not significant, meaning that in our model, we do not have clear statistical evidence that they influence the shadow economy.

Following the tests used, Sargan (with a maximum p-value) and an autocorrelation test (p-value > 0.05), the results indicate that there is no autocorrelation and there is homoscedasticity among the errors. We now need to check whether multicollinearity exists between the variables.

Table no. 4. VIF for variables in the model

Gini	Unemployment	GDP	HDI	RQ	PS	VA
2.18	1.2	3.5	5.68	4.94	3.39	5.56

Source: Own analysis

As we can see in Table 4, the variance inflation factors (VIF) are below 10, indicating that there is no multicollinearity. After performing all these checks and adjustments, it can be concluded that the model is appropriately specified and provides robust and reliable estimates.

Based on the model used in our analysis, several relevant conclusions can be drawn regarding ways to reduce the shadow economy. First, improving the quality of regulations and political stability by strengthening governments and public institutions, encouraging civic participation, and intensifying anti-corruption measures is essential. Authorities should focus on simplifying and clarifying economic regulations to reduce compliance costs and limit incentives for participation in the shadow economy. Policies that promote transparency and regulatory predictability could help reduce informal economic activities. Enhancing political stability and preventing social instability and

violence should be priorities in reducing the shadow economy. Specifically, governments should pursue policies that promote security and trust in state institutions, which can contribute to reducing informal activities. A free and accountable political environment is not always sufficient to reduce the shadow economy. In fact, in some cases, greater political freedom may provide more opportunities to engage in informal economic activities, especially if the legal framework is too complex or permissive. Therefore, governments must improve the quality of regulations and ensure a balance between political freedoms and the firm enforcement of economic laws.

The introduction of a new variable —Tax Revenues (expressed as a percentage of GDP)—was considered for the model. However, it was ultimately excluded because an increase in tax revenues could influence the shadow economy in an ambivalent way, with the potential to both increase and decrease it. Additionally, the coefficient for this variable was not statistically significant. For example, an increase in tax revenues could stimulate the shadow economy by raising the tax burden on citizens and businesses, leading them to evade taxes and engage in informal activities to reduce costs. On the other hand, higher tax revenues could, in some cases, reduce the shadow economy if they are used to improve public services and institutional capacity, thereby increasing trust in the tax system and encouraging voluntary compliance.

Following the analysis, Hypothesis 1 was not confirmed, literature suggests there is a positive relationship between the level of the shadow economy and income inequality and we obtained the opposite but not statistically significant. Hypothesis 2 was also not confirmed, studies said there is a negative relationship between the level of the shadow economy and economic development and we obtained the opposite. Hypothesis 3 was partially confirmed because we find a negative relationship between Regulatory Quality and the Shadow Economy and a positive relationship between Voice and Accountability and the Shadow Economy. Hypothesis 4 was confirmed, studies said there is a positive relationship between the level of the shadow economy and the unemployment rate and we obtained the same.

Conclusions

The main goal of this paper is to identify the key determinants of the shadow economy. To begin, we provided descriptive statistics regarding the shadow economy and the variables analysed.

This study aims to offer a solid foundation for governments to monitor and manage the factors driving the shadow economy. While we have thoroughly analysed only a few factors that we deemed essential, a wider range of economic and social variables contribute to the expansion of the informal economy. These factors not only influence the shadow economy but are also interdependent with other economic phenomena, such as income inequality, education levels, and governmental stability.

It is crucial for governments to actively collaborate with the private sector, non-governmental organizations, and other stakeholders to formulate and implement policies that effectively combat the shadow economy. Such policies should include initiatives like promoting financial and entrepreneurial education, facilitating access to formal financial services, and developing a transparent, stable, and predictable business environment. Improving regulatory quality, increasing governance efficiency, and

ensuring political stability are also crucial measures that can reduce the tendency of individuals and businesses to engage in informal economic activities.

This research also has certain limitations, such as the fact that due to a lack of data, we only found values for 50 countries worldwide during the period 2005-2017. The method used in our model, the Generalized Method of Moments (GMM), although highly effective for estimating dynamic econometric models, has some important limitations. One of the most significant is the sensitivity to the choice of instruments, which can affect both the consistency and accuracy of the estimates. Over-instrumentation, or the use of too many instruments, can lead to overfitting, distorting the results and weakening the validity tests, such as the Sargan or Hansen tests. Additionally, the validity of GMM depends on the exogeneity of the instruments, and if they are correlated with the error term, the estimates become inconsistent. The method is also sensitive to the presence of heteroscedasticity and autocorrelation, and the correct implementation of GMM requires a high level of expertise, as its complexity can make the interpretation of results difficult. Furthermore, GMM requires a large dataset to provide precise estimates, and for smaller datasets, the power and validity of the tests can be compromised. Thus, while GMM is a robust method, its use demands careful attention to proper model specification and validation.

We are fully aware of the complexity and breadth of the subject addressed in this paper, as well as its potentially subjective nature, particularly when analysed from the perspective of behavioural factors. In this context, we acknowledge the limitations of this research and recognize that they may influence the interpretation of the results. We appreciate in advance any constructive feedback, comments, or criticisms from readers, which could contribute to improving the arguments presented and the overall quality of the paper.

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