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Research Article

Measuring Size and Causes of Shadow Economy in Ethiopia

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Abstract

The paper estimates the size of the Shadow Economy (SE) in Ethiopia from 1995 to 2022 and rigorously tests the statistical relationships between the SE and various causal variables. In order to carry out the comprehensive econometric analysis, a multiple indicator multiple causes (MIMIC) model was effectively applied. The main causes of the Ethiopian SE are carefully analyzed, and several economic policies aimed at reducing it are thoughtfully suggested. An appraisal of the reliability of these estimates is conducted, along with an alternative benchmark strategy for the MIMIC approach that was proposed for enhanced accuracy. The findings reveal that the causal variables, including tax burden, inflation rate, trade openness, and economic freedom, significantly influence the shadow economy. Furthermore, it shows that indicator variables, such as currency in circulation and official economic growth rates, significantly indicate the presence and extent of a shadow economy. Thus, based on the insightful findings of the research, the author recommends that the government increase trade relations with the rest of the world and promote greater economic freedom. It also endorses adjusting inflation and tax burdens to effectively minimize the shadow economy in Ethiopia.

Keywords

Ethiopia, Latent Variable, Mimic Model, Shadow Economy

1. Introduction

Different scholars call the shadow economy by other names, such as the irregular economy [8], subterranean economy [13], black economy [7], and informal economy [32]. All these synonyms refer to the same type of shadow economy activities. The shadow economy includes all economic activities that are hidden from official authorities for monetary, regulatory, and institutional reasons. Monetary reasons include avoiding paying taxes and all social security contributions, regulatory reasons include avoiding governmental bureaucracy or the burden of the regulatory framework, while institutional reasons include corruption law, the quality of political institutions; and weak rule of law [17]. The study uses terminologies like; informal economy, shadow economy, parallel economy, subterranean economy, underground economy, black economy, irregular economy, and hidden economy interchangeably.

As crime and other underground economic activities are a fact of life around the world, most societies attempt to control these activities through various measures like punishment, prosecution, economic growth or education. Gathering statistics about who is engaged in underground activities, the frequencies with which these activities are occurring and the magnitude of them is crucial for making effective and efficient

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decisions regarding the allocations of a country's resources in this area. Unfortunately, it is very difficult to get accurate information about shadow economic activities on the goods and labor market, because all individuals engaged in these activities wish not to be identified. Hence, the estimation of the shadow economy activities can be considered as a scientific passion for knowing the unknown.

Attitudes towards the informal economy, which is sometimes seen as a major problem that has to be solved. In some circles, it is seen as made up of people engaged in activities that may be viewed as clandestine and illegal. However, it is also seen by many as a spontaneous and creative response to the formal economy's incapacity to satisfy basic needs. For many economists, the informal economy has often been viewed as a temporary alternative to unemployment and a coping mechanism against poverty which would disappear as an economy matures and becomes more developed. It is therefore not surprising, that many economists initially associated informal economic activity with developing countries where decent work deficits were most pronounced and social safety nets were relatively underdeveloped. The informal economy has not only persisted but also grown in many developing countries, particularly in Africa.

The mean value of the size of the shadow economy of the 158 countries from 1991 up to 2015 was 31.9. The three largest shadow economies are Zimbabwe with 60.6, Bolivia with 62.3 and Georgia with 64.9. The three smallest shadow economies are Austria with 8.9, the United States with 8.3 and Switzerland with 7.2. The average shadow economy comes close to Equatorial Guinea with 31.8 percentage and Suriname with 32.2 percentage of official GDP. They also relied on that the average size of the shadow economy of Ethiopia during their study period was 34.31 which exceed the world's average size of shadow economy [17].

The world is suffering from the emerging of shadow economic activities which changes type, size, structure and method of illegal economic activities. Knowing the causes and size of shadow economy helps to check countries economic policies and regulation that encourages expansion of shadow economy. The emergence and growth of the shadow economy can also suggest that existing economic policies, such as tax or regulatory policies are overly burdensome or oppressive.

Effective monetary and fiscal policy formulation necessitates accuracy in important macroeconomic indicators such as national output, revenue, consumption, inflation, unemployment, and others. Furthermore, the presence of non-trivial production in the shadow economy has the potential to distort these measures. As a result, efforts should be made to augment official national accounts data with estimates of shadow economic activity.

Many scholars have attempted to estimate the size of the shadow economy in Ethiopia in different periods. But some of them neglected the basic causal variable in estimating the size of the shadow economy. Missed corruption [2], rejected interest rate and corruption [20], excluded corruption [5], and also removed interest rate [18]. Therefore, the research intended to incorporate those variables and uses up-to-date data to estimate the size of the shadow economy and its causes in Ethiopian from 1995 up to 2022 by using MIMIC approach.

The general objective of the study is to estimate the size and causes of the shadow economy in Ethiopia, with the following specific objectives.

1. To estimate the size of the shadow economy in Ethiopia.
2. To examine the causes of shadow economy in Ethiopia.

This research helps in providing relevant information on the size and causes of shadow economy; so that the concerned body such as government, policymakers, and other institutions could take proper actions to overcome the undesirable side effect of informal economy. It also helps as a benchmark for upcoming researchers.

The study focuses on the cause and size of the shadow economy in Ethiopia with in period over 1995 up to 2022. Seven case variables (deposit interest rate, tax burden, inflation rate, unemployment, economic freedom, government consumption, trade openness) and two indicator variables (currency in circulation and official economic growth) were included to estimate one latent variable. It will estimate the size of the shadow economy in Ethiopia by using MIMIC approach.

In the succeeding chapter, related theoretical and empirical literatures are summarized. The third chapter contains data types and sources, the methodology used in the study, and the estimation techniques used. In the fourth chapter, econometric analysis and diagnostic tests were conducted. In the last chapter, conclusions and policy implications were presented.

2. Literature Review

2.1. Definition of Shadow Economy

The definition of the shadow economy differs with the objective and approach of the study and plays an important role in determining its size. For example, the underground economy can be defined as any economic activity that does not appear in the statistics of the national income and GDP [33]. According to this definition, while it happens that illegal activities lie within the hidden economy, there are many legal ones that may contribute. The shadow economy is defined as all currently unregistered economic activities that contribute to the officially calculated (or observed) Gross National Product (GNP) [37]. He considered the underground economy as all market-oriented activities-whether legal or illegal-that escaped detection in the official estimates of GDP. Others defines informal economic activity as "'the production and exchange of legal goods and services that involves the lack of appropriate business permits, violation of zoning codes, failure to report tax lia-

bility, non-compliance with labor regulations governing contracts and work conditions and/or lack of legal guarantees in relations with suppliers and clients [42].

In highly developed nations, the term informal economy seems to be mostly associated with illegal activities. In developing nations, the informal economy is associated with both illegal and legal activities. Classified the informal economy of developing countries into three distinct groups [4].

A, Informal: refers to very small-scale units that produce and distribute goods and services. They are unregistered and unrecorded in official statistics.

B, parallel: refers to those activities that form an alternative to legal market activities. It includes illegal production and trade of goods and services that are, originally, legal in nature.

C, Black market: refers to the production and distribution of market/non-market goods and services that are illegal in nature and forbidden by government.

Defined shadow economy, as part of the domestic product which is not measured under the official statistics of the national GDP accounts [34], whereas, defined as market-based production of goods and services [22], other also defined as; legal or illegal, that escapes from the detection of the official estimates of the national GDP [34].

On the other hand, underground economy is one that includes only all legal and market-based production of goods and services that are deliberately concealed from governments for the following reasons [22]:

1. To avoid payment of income, value added or other taxes,
2. To avoid payment of social security contributions,
3. To avoid having to meet certain legal labor market standards, such as minimum wages, maximum working hours, safety standards, etc., and
4. To avoid complying with certain administrative procedures, such as completing statistical questionnaires or other administrative forms.

The United Nations System of National Accounts states that the shadow economy consists of activities that may be both productive in an economic sense and also quite legal (provided certain standards or regulations are met).

‘‘all economic activities that contribute to value added and should be included in national income in terms of national accounting conventions, but are presently not registered by national measurement agencies” [11]. The following table shows the various classifications of shadow economic activities according to their monetary and legal status.

Table 1. *Taxonomy of types of underground economic activities.*

Type of activity	Monetary transactions		Non-monetary transactions	
Illegal activities	Trade in stolen goods; drug dealing and manufacturing; prostitution; gambling; smuggling, contraband, and fraud		Barter: drugs, stolen goods, smuggling etc. Produce or growing drugs for own use. Theft for own use.	
	Tax Evasion	Tax Avoidance	Tax Evasion	Tax Avoidance
Legal activities	Unreported income from self-employment; Wages, salaries and assets from unreported work related to legal services and goods	Employee discounts, fringe benefits	Barter of legal service and goods	All do it yourself work and neighbour help

Source: [15], with additional remarks by [10]

The table above demonstrates how the underground economy has several shapes depending on what is utilized in transactions. Additionally, it described the manner in which they evade taxes from the government. Trade using stolen products and theft for one's own goods are two examples of illegal acts that are included in the underground economy. It is also difficult to evaluate prostitution's impact on the economy and related repercussions because it is not legal or acceptable from a religious perspective. For a variety of causes, the legally permitted activities are moving into the informal economy; these transactions might be financial or non-financial in nature. The underground economy includes unreported income from legal services, products, and do-it-yourself projects.

2.2. Theoretical Background

The International Conference of Labor Statisticians (ICLS) sees the informal economy as that part of production units embedded in the household institutional sector of the System of National Account (SNA), which means that informal sector enterprises are part of the household.

Analyzes what would happen if authorities promote the use of e-purse and limit the use of currency [6]. Accordingly, equilibrium exists with no illegal production if monitoring is sufficiently extensive and money supply is moderate. When enforcement is not too extensive, however, there is monetary equilibrium where legal and illicit production coexists. Accordingly, the results provide a

rationale for limiting the amount of cash in circulation. Nonetheless, using currency as an exogenous discipline on illicit undertakings may have unintended consequences, such as depressing all trading activities and decreasing welfare. Applied inter temporal general equilibrium model to explore the link between tax rates, access to credit and the size of the underground economy [43]. Simulation results for Pakistan demonstrate that entry into the underground economy can have a cyclical nature. Moreover, the share of underground activity will decline over time and sectors gradually move back into legal economy. With low taxes, there is no underground economy, but due to high budget and trade deficit the low tax regime is not sustainable over time. Thus, an economy may have to accept some underground activity as part of an otherwise acceptable tax program.

Suggest that shadow transactions may increase welfare. They argue in the experience goods framework that by allowing agents to self-select into the black market, the government can target tax breaks to transactions involving low-quality goods [35].

Providing an encompassing definition and boundaries for the informal economy activities is one of the biggest challenges faced by literature attempting to estimate its size. There are several approaches and criteria often employed by researchers to provide a comprehensive definition of the informal sector. But, most studies that used an econometric model in estimating the size of the informal economy often defined the informal economy as all market-based goods and services not included in the official estimates of GDP [27].

Literature on the informal sector uses various approaches to explain its development, from simplistic to more philosophical, are as follows:

Dualist approach: - The informal sector as a set of subsidiary activities that provide incomes for the deprived; those who are incapable (for various reason) of accessing employment in the formal sector. Informal sector growth, "is due to the fact that not enough modern job opportunities have been created to absorb surplus labor, due to a slow rate of economic growth and/or a faster rate of population growth.

Structuralist approach: explains the informal sector as a set of subordinated sector units and workers that serve to decrease the input and labor costs for the large formal enterprises, and thereby, increase the competitiveness of formal enterprises. According to this school of thought, the nature of industrial progress (rather than a lack of formal sector growth) accounts for the persistence and development of informal production interaction. Subscribe to the idea that the informal sector ought to be viewed as subordinate economic units and employees that provide to shrink input and labor costs, increase the competitiveness of large capitalist firms [38]. Currently, the development of informal employment is related to several structural changes in the dominant economy, such as new immigrant labor - market entrants to a pool of workers already swollen by technological changes.

Legalist approach: - The most common technique of distinguishing between the informal sector and the formal sector considers the nature of technology used and whether business activity escapes regulation. A striking feature of the informal sector in developing countries is that production of goods and services is legal, but is largely unregulated. As opposed to regulating the informal sector, authorities tend to adopt a non-interventionist attitude, as they are aware that the informal sector provides a means of survival for poor people. In addition, informal economic activities are not fundamentally carried out by way of calculated objective to escaping expenses of taxes, social security contributions, or infringing labor legislation or other regulation.

Continuum approach: - informal activities fall outside the criminal economy but can nonetheless be seen as being part of a progression which shades gradually from activity that is legal, into illegal activities. Informal operators produce legal goods and services and use legal production and distribution channels. By contrast, irregular operators produce legal goods and services but do not use legal production and distribution channels (i.e. they do not register their business, report their output, or pay taxes) criminal operators produce illegal goods and services and use illegal production and distribution channels.

Micro-Business Enterprises Approach: business constraints that are explained by Micro-business enterprise approach and this is focused on small medium and micro enterprises (SMMEs) and (limited access to finance, high taxes, and lack of market access) may, on one hand, limit physical capital accumulation, while on the other hand, constrain a firm's ability to undertake its daily operations by reducing the capacity to make business decisions. Limited labor absorption in the formal sector is a more complex problem than merely the adoption of a relatively capital-intensive structure of production, induced by underpricing capital and overpricing labor [39].

2.3. Empirical Review

By estimating the size, growth, and causes of the informal economy using an error correction MIMIC (EMIMIC) model, looked at the extent of economic loss attributable to informality in Nigeria [21]. According to the findings, the informal economy accounted for nearly 75% of GDP in 2010, with unemployment, taxation, regulation, and inflation serving as its main drivers.

Used tax burden, government consumption, unemployment rate, inflation, interest rate, and trade openness as causal variables and used economic growth and currency out of bank as indicator variables to estimate size and causes of informal economy in Ethiopia in his Doctoral dissertation. Overall, the average size of informal economy in Ethiopia from 1980 to 2016 was 43.3% [2].

Used the currency demand approach, the autoregressive

distributed lag technique, and the Engel granger two-step approaches to estimate Pakistan's shadow economy for the years 1973 to 2015 [36]. The findings revealed that the average percentage of the shadow economy throughout the studied period ranged from 25.29 to 26.41. The research also showed that while the short-term effects of the shadow economy expansion on the formal sector were negative, the long-term effects were favorable.

Used the EMIMIC model (error correction multiple indicators multiple causes) to assess the informal economy's scale and root causes in Nigeria from 1970 to 2010 [21]. According to the report, between 1970 and 2010, the informal economy's size averaged out to 64.6% of GDP. Further findings revealed that the major drivers of informal economy in Nigeria include tax burden, government regulations, unemployment and rate of inflation.

Estimated size of shadow economy from 1999 up to 2006 for the developing countries by MIMIC approach with six cause variables: (ii) size of government (iii) fiscal freedom; (IV) regulatory intensity for state regulation; (v) the business freedom index; and (VI) the state of economy. As indicator variables, they used growth rate of GDP per capita, the labor force participation rate, and currency out of the bank. They estimated the size of the shadow economy during 2006 was 36.4% of the official economy and the average shadow economy during his study period was 39.1 % of the official economy [23].

Others examined the size of the shadow economy in 28 European Union (EU) countries from 2003 to 2014 using a percentage of official GDP. They disclosed that the average size of the shadow economy in 28 EU countries was 22.6% in 2003 but decreased to 18% in 2014 [15].

The hidden economy in Jordan was smaller than in Medina and Schneider, analysis, according to other recent studies by the duo that evaluated the extent of the shadow economy in 157 countries from 1991 to 2017 [19]. According to their estimates, Jordan's hidden economy had an average size of 17.3% of GDP from 2009 to 2017, a slight decline from 15.9% in 2009 to 14.9 percent in 2017. Their research suggests that the average size of the world was 30.9% of GDP between 1991 and 2017, taking into account the 157 countries they chose.

The study on the subterranean economy was expanded using data from 158 nations and spanning the years 1991 to 2015 [17]. The study's main goal was to estimate the average size of the shadow economy across the 158 countries, and it came out to be 31.9% over the time frame. With 60.6% and 62.3%, respectively, of its GDP made up of the shadow economy, Zimbabwe and Bolivia had the highest percentages. Austria and Switzerland had the lowest rates with 8.9% and 7.2%, respectively.

The trend and size of Egypt's hidden economy were measured by using two different approaches [14]: structural equation modeling and the currency demand approach (CDA). Their study employed indicators that were pertinent to Egypt's formal sector, such as agriculture and self-employment, which were utilized as proxy indicators to gauge the effectiveness of democratic institutions. They discovered a decline in the hidden economy, from roughly 50% in 1976 to 32% in 2013.

The author calculated the growth and size of the hidden economy in all Association of Southeast Asian Nations (ASEAN) nations, excluding Singapore and Brunei [24]. Their study used the MIMIC methodology and spanned the years 1995 to 2014. The results presented evidence that labor freedoms, tax rates, and business freedoms have significantly influenced the shadow economies of these Asian countries.

Shadow economy of Romania from 1999 to 2012 was calculated by using synthetic index data [40]. In order to assess the impact of shadow economy on Romania's economic growth, the synthetic index was transformed into an econometric model and the statistical results showed a co-integration relationship which implied that shadow economy could have a long term consistent relationship with the formal economy.

3. Methodology and Data Source

3.1. Data Description and Sources

Data sources

Quantitative yearly secondary data from the National Bank of Ethiopia (NBE) and the Heritage Foundation covering the years 1995–2022 were used in this study.

Definition of variable

Latent variable

Shadow economy (SE)

The shadow economy can be referred to any economic activity that is unrecorded in national statistics. It is expressed by percentage of official economy.

Causal variables

Interest rate (INT): It is believed that high interest on bank deposit decreases the opportunity cost of holding money in cash. Thus, a rational expectation is that an increase in this rate will make economic agents hold less cash, while a lower rate will act as a disincentive to holding deposits. Ultimately, interest rates should have a negative effect on the currency in circulation outside of banks and hence the informal economy. Therefore, it is expected a negative relationship between the interest rate and the informal economy following the work of [21]. The researcher used deposit interest rate as a proxy for interest rate.

Tax burden (TAB): It is presumable that operating in the informal economy to avoid paying taxes will be more attractive as the tax burden increases [21, 29]. The tax burden is calculated as a proportion of total tax revenue to GDP.

Inflation rate (INF): Refers to the persistent increase in the general price of goods and services. During any period of high inflation, the government's upkeep costs for everything

rises and the purchasing power of consumer's decreases, which consequently imply drastic real business revenue loses [41]. In this regard, the actual real tax proceeds gathered by the government in periods of hyperinflation are less than those collected in a period of normal inflation. Economists believe that a rise in the inflation rate increases the size and breadth of the hidden economy, due to increased demand for cheaper goods and services. Inflation can trigger a decline in the value of money over time, which then pushes people's incomes into a higher tax bracket (the process of "bracket creep"), constituting an additional incentive for taxpayers to work for "cash in hand" in order to avoid paying extra tax [25].

Government consumption (GOVEX): The more the government spends on final consumption goods and services means there is more publicly provided goods and services, which is directly related to government revenues. The lower government revenue results in a lower level of publicly provided goods and services in quantity as well as in quality. This leads to a rise in the formal sector's tax rate. However, it also makes it easier for companies to manipulate the market's normal operation by concealing goods in order to spur a shortage and raise prices. It is expressed by percentage share of total government expenditure to gross domestic product.

Trade Openness (TOP): The market size and global openness of a nation are shown by trade as a percentage of GDP. Moving economic activity from the formal to the informal sector is probably going to get harder as economies grow. Furthermore, it would be more difficult to conceal commerce from the authorities as global trade grows.

Unemployment rate (UNEMP): Unemployment refers to the share of the labor force that is without work but available for and seeking employment. It is believed that high unemployment in the official economy will induce growth in informal employment, which increases the size of the informal economy. The argument is that as people are unable to find jobs in the formal economy, they turn to the informal economy for sustenance [21].

Economic freedom index (ECONF): is the independency experienced by individuals within a given society to pursue their interests. It is the liberty to engage and make choices about economic activities and endeavors; which ranges from 0 to 100, where 0 is least economic freedom and 100 maximum economic freedoms (negative sign expected).

Indicator Variables

As mentioned earlier, the informal economy cannot be measured directly; as a result, researchers rely on variables indicating the presence of high informality in an economy [29-31].

Currency in Circulation (CIC): The majority of transactions in the informal economy are thought to be made with cash or money from a current account that is withdrawn immediately, either to conceal the transactions from authorities or because they may be small and only call for a small amount of cash. The researcher used the real money in circulation (M1) in accordance with [1, 12], and anticipates a favorable association between the informal sector and money in circulation.

Official Economy (GDPpc): People's decisions to work in the shadow economy or not are significantly influenced by the state of the official economy [23]. People have many options to make a solid income and "extra money" in the formal economy when it is thriving. This is not the case in an economy that is experiencing a recession; more people attempt to make up for their income losses from the official sector by increasing their involvement in the shadow economy. A growing informal sector is connected with more economic activity migrating away from the formal economy, resulting in a decline in official economic growth. Researcher will make GDP per capita (GDPpc) variables to capture official economy.

3.2. Model Description and Specification

Methods of Estimating Informal Economy

Due to a lack of data, it is challenging for economists to estimate the size of the shadow economy. Despite the lack of available data, there are a variety of methods that may be used to estimate the size of shadow economies in general. The measurement techniques are broadly split into direct and indirect methods, each of which has benefits and drawbacks: because they use proxy variables in their estimations. The majority of techniques used to measure the shadow economy are indirect methods [44]. The following subsections will go into further detail on each of these estimation methods.

Direct Method

This method is also known as a microeconomics technique, since it entails taking a sample or census of the informal sector enterprise in order to gather data at the microeconomic level. One particular advantage of the direct method is that it can obtain detailed information with regard to the structure, nature, distribution, and demographic characteristics of the size of the informal economy when compared to other approaches [3, 11]. Surveys and tax audits approach are the most known direct methods.

I, survey approach - is mostly employed by most direct approach studies in estimating the size of the informal economy, especially World Bank projects [29]. It could be a survey of firms or a survey of households. Surveys of firms can capture both firm-level information and worker-level information (both employers and employees) and surveys of households can also capture information both about workers (whether they are employees or are working in a household enterprise) and firms (as reported by workers, or as pertaining to the household enterprise) [3]. The disadvantage of this approach includes respondent hostility, difficulty to assess the amount of undeclared work, hidden information; the result might be affected by the design of the questionnaire, lack of global consensus on the methodology, and sample

frame, among others. In general, the biggest problem to surveys is inconsistent or lack of international comparability of the methods in the survey.

II, tax auditing - is another direct approach which involves selective check as compared to the amount declared for tax purpose. The challenges with this approach are that it is selective based on available data, and the data only reflects those that the tax authority discovered or that comply with tax irregularly [14].

Indirect Approach

This approach is also known as Proxy approach/indicators / macroeconomic approach, where researchers often rely on certain macroeconomic variables that indicate the growth of the informal economy [11, 28].

I, Currency demand approach: is an approach that is based on currency demand indicators, such that an increase in currency demand is an indication the informal economy is growing. Assuming that informal transactions take the form of cash payments, in order not to leave an observable trace for the authorities, an increase in the size of the informal economy will consequently increase the demand for currency. To isolate this "excess" demand for currency suggests using a time series approach in which currency demand is a function of conventional factors, such as the evolution of income, payment practices and interest rates, and factors causing people to work in the informal economy, like the direct and indirect tax burden, government regulation and the complexity of the tax system [46]. One issue with this approach is the emphasis on cash transactions.

II, Transaction approach: This is based on the Fisher model of Money*Velocity = Prices*Transactions, and assuming that there is a constant relationship between the money flows related to transactions and the total (official and unofficial) value added, i.e. Prices*Transactions = k (official GDP + informal economy), it is reasonable to derive the following equation Money*Velocity = k (official GDP + informal economy). The stock of money and official GDP estimates are known, and money velocity can be estimated. Thus, if the size of the informal economy as a ratio to the official economy is known for a benchmark year, then the informal economy can be calculated for the rest of the sample [5].

III, Discrepancy approach: where the difference between the estimate of GNP using both the income method and expenditure method is used to measure the informal economy. Most literature suggests the use of the first discrepancy to capture the informal sector rather than the published discrepancy [5].

IV, Physical input or electricity method: endorse the idea that electricity consumption is the single best physical indicator of overall (official and unofficial) economic activity [30]. Using findings that indicate the electricity overall GDP elasticity is close to one, these authors suggest using the difference between growth of electricity consumption and growth of official GDP as a proxy for the growth of the informal economy.

V, Discrepancy between national expenditure and income statistics:

If those working in the informal economy were able to hide their incomes for tax purposes but not their expenditure, then the difference between national income and national expenditure estimates could be used to approximate the size of the informal economy. This approach assumes that all the components of the expenditure side are measured without error and constructed so that they are statistically independent of income factors [18].

VI, Multiple Indicators, Multiple Causes (MIMIC) approach:

This method explicitly considers several causes, as well as the multiple effects, of the shadow economy. The methodology makes use of associations between the observable causes and the effects of an unobserved variable, in this case the shadow economy, to estimate the variable itself [16]. There are limitations in many of the macroeconomic methods for measuring the informal economy highlighted so far. The first is that most of these methods are limited to using just one indicator like; currency demand approach, electricity consumption approach, discrepancy approach or transaction approach. Secondly, the models often do not take into account the determinants or causes of informal economic activity. The multiple-Indicator Multiple-Causes (MIMIC) model has been developed to address these limitations by factoring in the multiple determinants and indicators of informal economic activity [9]. MIMIC is "based on the statistical theory of unobserved variables, which considers multiple causes and multiple indicators of the phenomenon to be measured" [11]. The unobserved variable in this case is the informal economy, and the model assumes that the informal economy is influenced by a number of different factors. This model has several key advantages. The first is that it has an intuitive quality in that it utilizes multiple data sources to capture as many components of informal economic activity, and important asset when trying to measure an "elusive" phenomenon such as the informal economy. The second advantage is that the model can determine both the size and development of informal economic activity over time.

MIMIC Model

The MIMIC model is a special case of the structural equations model (SEM). It consists of two equations: the structural equation and the measurement equation. The structural equation defines the relationship between the latent variable and its causes. The relationship can be represented in below [26, 29]:

$$\eta_t = \gamma_t x_t + \zeta_t \quad (1)$$

Where, η_t is the unobservable (latent) variable, which represents the index of the shadow economy at time t, γ_t is

(q×1) vector of parameters describing the relationships between the shadow economy (η_t) and its es $x_t(x_{1t}, x_{2t}, x_{3t}, \ldots\ldots\ldots x_{qt})$, while ζ_t represents the error term of the structural equation model. The model assumes that the variables have a constant deviation from their means, such that the disturbance term does not correlate with the causal variables. As such, $E(\eta_t) = E(x_t) = E(\zeta_t) = 0$ and $E(x_t\zeta_t) = E(\zeta_t x_t) = 0$.

The measurement equation defines the relationship between the shadow economy (latent variable) and its indicators. It is given by:

$$y_t = \lambda\eta_t + \epsilon_t \quad (2)$$

Where, $y_t(y_{1t}, y_{2t} \ldots\ldots\ldots y_{pt})$ is a (p x 1) vector of indicators of the shadow economy (η), λ is (p×1) vector of parameters describing the relationships between the latent variable and its indicators, and ϵ_t a (p×1) vector is the measurement error term and assumed normally distributed. Like in the structural equation model, in the measurement equation, the indicators are directly measurable and expressed as deviations from their means, that is $E(y_t) = E(\epsilon_t) = 0$, Moreover, it is assumed that the error terms in the measurement model do not correlate either to the causes x_t or to the latent variable, η_t hence, $E(x_t\epsilon_t) = E(\epsilon_t x_t) = 0$ and $E(\eta_t\epsilon_t) = E(\epsilon_t\eta_t) = 0$.

Final assumption is ϵ_t do not correlate to ζ_t, i.e. $E(\epsilon_t\zeta_t) = E(\zeta_t\epsilon_t) = 0$.

Substituting equations (1) into equation (2), the author get the reduced form of the MIMIC model, which can be viewed as the following multivariate regression model:

$$y_t = \lambda(\gamma' x + \zeta_t) + \epsilon_t = \prod x + v_t \quad (3)$$

Where, $\prod = \lambda\gamma'$, is a reduced form coefficient matrix and $v_t = \lambda\zeta_t + \epsilon_t$ is a reduced form vector of a linear transformation of disturbances that has a reduced form covariance matrix is as follows:

$$\text{cov}(v_t) = E[(\lambda\zeta_t + \epsilon_t)(\lambda\zeta_t + \epsilon_t)'] = \lambda\psi\lambda' + \Theta\varepsilon \quad (4)$$

$\psi = \text{var}$ (ζ_t and $\Theta\varepsilon = E$ ($\epsilon_t\epsilon_t'$) is measurement error's covariance matrix.

It can be explained the structural relations of the model in the following path diagram where the arrows, which represent the causal relationship, go from the causes of the shadow economy $x_t(x_{1t}, x_{2t}, x_{3t}, \ldots\ldots\ldots\ldots\ldots x_{qt})$ to the latent variable η_t (shadow economy), and then from the shadow economy to its indicators $y_t(y_{1t}, y_{2t}\ldots\ldots\ldots\ldots\ldots y_{pt})$.

4. Estimation and Discussion

Estimation of the Size of Shadow Economy

This strategy is predicated on the notion that the shadow economy is a latent variable that simultaneously has several indications and is caused by a number of different variables. Consequently, it is possible to estimate an overtime index for the shadow economy in a specific country by utilizing a specific kind of structural equations model (SEM). The shadow economy index is then converted to a time series of shadow economy in that country as a percentage of official GDP using a benchmarking technique and an external value of the shadow economy for that country at some point in the time series.

Once the relationships are identified and the parameters estimated, the MIMIC model results which have significant influence are used to calculate the MIMIC index. However, this analysis provides only relative estimates, not absolute, of the size of the shadow economy. Therefore, an additional procedure, benchmarking or calibration procedure is required in order to calculate absolute values of the size of the shadow economy [23]. The procedure was supported by [31].

Table 2. *MIMIC Parameter estimation results.*

Variables	Coefficient	Remarks
Causal variable		
Interest rate	-0.0442 (0.317)	insignificant
Tax burden	1.1490 (0.00)***	significant
Consumer Price Index	0.6327 (0.008)***	significant
Government consumption	0.0828 (0.672)	insignificant
Trade openness	-0.8338 (0.006)***	significant
Unemployment rate	0.0415 (0.443)	insignificant
Economic freedom	-0.1179 (0.020)**	significant
Indicator variable		
Currency in Circulation	0.9929 (0.000)***	significant
Official Economy	-0.9587 (0.000)***	significant
Test Statistics		
RMSEA (P-value)	(0.000)	
Chi-square (P-value)	(0.000)	

Source: Author's compilation

Significance is indicated as follows: *** for 1% and ** for 5% respectively.

The P-values of root mean squared error of approximation (RMSEA) and Chi-square are less than 0.05 indicates that the model fits better.

The Causal Variables

The coefficient of the deposit interest rate of -0.0442 with p-value of 0.317 implies that; Ethiopian deposit interest rate does not drive its shadow economy.

The tax burden is statistically significant at the 1% level of significance, with a coefficient of 1.1490 and a p-value of 0.000. This indicates that an increase in taxation will likely make it more difficult for certain informal sector businesses to transition to the formal economy. Studies verify statistically significant evidence for the impact of tax burden on the shadow economy, and provide empirical results demonstrating this relationship [14, 29, 34]. The shadow economy grows by 1.15 percentage points for every one percentage point rise in tax burden.

Coefficient of inflation rate has the expected sign of 0.6327 with a p-value of (0.008) and it is statistically significant effect on Ethiopian shadow economy. High inflation forces small businesses to be out of market that they couldn't compete in the formal economy. It encouraged them to participate in the informal economy. Most economists argue that high inflation rates increase the size of the shadow economy for two reasons. First, higher official inflation increases the demand for cheaper goods and services in the shadow economy. Second, the effect of "tax bracket-creep", where inflation pushes income into a higher tax bracket, constitutes an additional incentive for taxpayers to work in the shadow economy in order to evade paying the additional tax [25].

The value of the coefficients of government consumption is 0.0828 with a p-value of (0.672). In Ethiopia, this variable is statistically insignificant and has expected sign. Government consumption doesn't bring any influence in the Ethiopian shadow economy. Hence, it doesn't incorporate in shadow economy estimation.

The shadow economy is significantly negatively impacted by trade openness, with a coefficient of -0.8338 and a p-value of (0.006). The less likely it is to conceal economic activity, the more open trade. The finding is in line with study result of [18].

Unemployment, as expected, has a positive coefficient of 0.0415, with a p-value of 0.443. This implies that the variable is insignificant at a 10% level. So it couldn't be casual variable to estimate the shadow economy in Ethiopia. It does not influence the shadow economies in Ethiopia; which is in line with findings of [23].

However, the coefficient of the economic freedom index of -0.1179 with a p-value of 0.02 is negative, significant effect on shadow economy, as expected priory.

Indicator variables

With a p-value of 0.000, the currency in circulation in Ethiopia is, as anticipated, a significant indicator of the country's shadow economy. This suggests that Ethiopia's shadow economy will shrink as more technology is incorporated into the banking system to decrease cash transactions.

Last but not least, GDP per capita, which is highly statistically significant and has the expected negative sign, is consistent with findings of [29]. The assumption is that the production of the formal sector will decrease as more laborers enter the unorganized informal market.

The MIMIC model index of the shadow economies is calculated using the structural equation (equation 1), i.e. by multiplying the coefficients of the significant causal variables with the respective time series. Only those causal variables significant at a 5% level will be used in estimating the size of the informal sector [11, 14]. Based on the above table, in this study from seven causal variables, only four variables are significant and incorporated in the equation (1).

$$\tilde{\eta}_t = 1.149008 * x_{2t} + 0.6327394 * x_{3t} - 0.8338721 * x_{5t} - 0.1179061 * x_{7t} \quad (5)$$

The study uses base year 2000 as benchmark calibrator and the share of the shadow economy in Ethiopia in that period was 40.3% which is taken from [23], who presents estimates of the shadow economies in 145 countries around the world using the MIMIC and the currency demand approach. Therefore, the size of informal economy of Ethiopia is estimated as follows by adopting the bellow estimation method from [1, 21].

$$\hat{\eta}_t = \frac{\tilde{\eta}_t}{\tilde{\eta}_{2000}} * \eta_{2000} \quad (6)$$

Where $\hat{\eta}_t$ is the value of the shadow economy as percentage of GDP at time t, $\tilde{\eta}_t$ is the value of the MIMIC index at time t according to equation (4), $\tilde{\eta}_{2000}$ is the value of MIMIC index in the base year 2000, η_{2000} is the (base value) of the shadow economy in year 2000.

Applying this benchmarking procedure, the final estimates of the shadow economies are calculated for each year as follows: For instance, to calculate the informal economy for 2005, it starts by calculating the MIMIC index for the informal economy for 2005 and 2000 by replacing the values in equation 4 in both years.

$$\tilde{\eta}_{2000} = 1.149008 * \ln TAB_{2000} + 0.6327394 * \ln CPI_{2000} - 0.8338721 * \ln TOP_{2000} - 0.1179061 * \ln ECONF_{2000} = 4.73$$

$$\tilde{\eta}_{2005} = 1.149008 * \ln TAB_{2005} + 0.6327394 * \ln CPI_{2005} - 0.8338721 * \ln TOP_{2005} - 0.1179061 * \ln ECONF_{2005} = 4.71$$

Then estimated value of shadow economy at year 2005 is calculated based on equation (2) as follows: $\hat{\eta}_{2005} = \frac{\tilde{\eta}_{2005}}{\tilde{\eta}_{2000}} * \eta_{2000} = \frac{4.71}{7.73} * 40.3 = 40.10$.

The process is repeated to get the size of the shadow economy for Ethiopia from 1995 to 2022, and the detailed result is shown in Table 3.

Table 3. Estimates of the size of the Ethiopian informal economy.

Year	Estimated size of shadow economy as % of GDP
1995	42.43
1996	42.22
1997	41.27
1998	39.80
1999	40.70
2000	40.30
2001	41.79
2002	41.21
2003	42.02
2004	40.44
2005	40.10
2006	40.40
2007	41.04
2008	43.92
2009	44.20
2010	46.16
2011	49.23
2012	51.03
2013	52.84
2014	53.57
2015	53.78
2016	55.22
2017	55.99
2018	57.68
2019	59.02
2020	60.89
2021	62.42
2022	62.42

Source: Author compilation by STATA 13 software

5. Conclusion and Recommendation

5.1. Conclusion

The main objective of this study, as earlier stated, is to examine the size and causes of the shadow economy in Ethiopia. A multiple-Indicator Multiple-Causes (MIMIC) model was applied to estimate the unobserved/latent variable (shadow economy) and its causes.

All causal and indicator variables demonstrate the theoretically expected association to the shadow economy, and the various estimated specifications show adequate goodness-of-fit statistics (their selection was driven by past theoretical as well as empirical discoveries). The author acknowledges the empirical models' validity, and the fresh insights gained from my examination of the size and causes of Ethiopia's shadow economy lead to the following conclusions.

The size of the shadow economy in Ethiopia ranges between 39.8 and 62.42 percent of GDP (1995-2022), with an average of 47.93%. Also, tax burden, inflation rate, trade openness, economic freedom plays the most significant role in an economic agent's decision to remain in the shadow economy or not. The researcher discovered that the shadow economy has been rising steadily in Ethiopia; it exceeds 50 percent of GDP for the last eleven years since 2012.

Tax burden has a statistically significant influence on the shadow economy, and its estimated coefficients have the theoretically expected signs. The coefficient of 1.14 with p-value of 0.000 indicates tax burden plays a major role in shadow economy increment in Ethiopia. An increase in the tax burden could impose on the participant of the formal economy to shift in to the informal economy, and also it opens the door for new entrants to choose the informal economy. This finding supports the studies that pointed out a rise in tax burden as one of the most important causes of the increase in the shadow economy [27].

Inflation is one of the causes of the shadow economy in Ethiopia. It has coefficient of 0.6327 and p-value of 0.008. This has positive significant contribution to the shadow economy rise. When the level of inflation rises, there is also a rise in shadow economic activities, ceteris paribus. The Ethiopian economy had faced high levels of inflation in previous years due to different reasons. This has affected the economy in various ways, such as wiping out small businesses and fostering black markets. Even though inflation is expected when the economy of a country grows, controlling it is one important method to sustain small businesses in the market.

The coefficient of trade openness is negative and statistically significant at 5% significance level and implies that more openness significantly reduces the size of the shadow economy, all else equal. This finding bodes well with the conclusions in [45]; where these authors showed that more freedom to trade significantly reduces informal sector activity. Reforming the economy to increase its openness improves the ability of entrepreneurs to trade internationally by providing an incentive for these entrepreneurs to formalize their operations. A more restrictive trade regime provides the incentive for entrepreneurs to operate underground, causing a proliferation of illegal activities such as smuggling, black market and underground activities.

Economic freedom has a negative significant contribution in shadow economy. Individuals that are free to cooperate in a market setting with institutions that support strong private property rights, feel less of a need to migrate to the shadow economy. Indeed, one of the main benefits of

the shadow economy is the freedom and autonomy that it allows its participants, thus more economic freedom in the formal sector lessens the attractiveness of the underground sector.

5.2. Recommendation

As discussed earlier, the major driving forces behind the size and growth of the shadow economy are tax burden, inflation, trade openness and economic freedom. Increase in currency out of bank and decrease in official economic growth reveals that there is a shadow economy in the country. Thus, based on research finding, some implications are forwarded for policymakers.

Government is recommended to decrease the size of shadow economy through different methods like formalization of informal sectors, endorsing marginal tax rates (are more relevant to people's shadow-economy work decisions) or by maintaining price stability.

It is also suggested to improve and expand digital monetary transactions (like telebirr) which reduces currency out of bank, reduces transaction cost, secures payment, and saves time.

Governments should put emphasis on making good trade integration with the rest of the world. It may be in terms of preferential tariffs, free-trade associations, customs unions, common markets, economic unions, and full economic integration.

More emphasis is required to explore the size and causes of Ethiopia's shadow economy, as well as multidirectional investigation. Other researchers interested in this area may find this study useful as a starting point.

Abbreviations

ASEAN	Association of Southeast Asian Nations
CDA	Currency Demand Approach
CIC	Currency in Circulation
CPI	Corruption Perceptions Index
DEPINT	Deposit Interest Rate
EU	European Union
GDP	Gross Domestic Product
GDPCAP	Gross Domestic Product Per Capita
GNP	Gross National Product
ICLS	International Conference of Labor Statisticians
INF	Inflation
MIMIC	Multiple Indicators Multiple Causes
NBE	National Bank of Ethiopia
OECD	Organization for Economic Co-operation and Development
OLS	Ordinary Least Square
SE	Shadow Economy
SEM	Structural Equations Model
SNA	System of National Account
TAXB	Tax Burden
UNEMP	Unemployment Rate

Author Contributions

Wondimu Mekonnen is the sole author. The author read and approved the final manuscript.

Conflicts of Interest

No conflict of interest.

Appendix

	OIM					
Standardized	Coef.	Std.Err.	Z	P>|Z|	[95% Conf. Interval]	
Structural						
SE <-						
lnint	-.0443	.0443	-1.00	0.317	-.1311	.0425
lntab	1.1490	.2732	4.21	0.000	.6135	1.6845
lncpiinf	.6827	.2375	2.66	0.008	.1673	1.0982
lngovex	.0829	.1967	0.42	0.672	-.3007	.4665
lntop	-.8340	.3024	-2.76	0.006	-1.4265	-.2412
lnunemp	.0415	.0541	0.77	0.443	-.0645	.1476
lnecofrep	-.1180	.0506	-2.33	0.020	-.2171	-.0187
Measurement						
lncic <-						
SE	0.9929	.0032	310.44	0.000	.9867	.99922
Cons	5.4022	2.7951	1.93	0.053	-.0761	10.8805
lngdppercap <-						
SE	-.9588	.0175	54.76	0.000	.9245	.9931
Cons	33.9369	7.2083	4.71	0.000	19.8089	48.0648
Var(e.lncic)	.0141	.0063			.0006	.0341
var(e.lngdppercap)	.0807	.0335			.0357	.1824
Var(e.SE)	0	.0043			.	.

\ LR test of model VS. Saturated: chi2 (7) = 95425.56, Prob > chi2 = 0.0000

Source: Authors compilation

Figure A1. *MIMIC Estimation Result.*

```
. estat gof, stats(all)
```

Fit statistic	Value	Description
Likelihood ratio		
chi2_ms(7)	95411.595	model vs. saturated
p > chi2	0.000	
chi2_bs(15)	285.558	baseline vs. saturated
p > chi2	0.000	
Population error		
RMSEA	22.063	Root mean squared error of approximation
90% CI, lower bound	0.000	
upper bound	.	
pclose	0.000	Probability RMSEA <= 0.05

Source: Authors compilation

Figure A2. *Test Statistics Result.*

References

[1] Buehn, A. and Schneider, F., 2008. MIMIC models, cointegration and error correction: An application to the French shadow economy.

[2] DEJENE, G. (2018). Size and causes of informal economy in Ethiopia (Doctoral dissertation, St. Mary's University).

[3] Benjamin, N., Beegle, K., Recanatini, F. and Santini, M. (2014). Informal economy and the World Bank. World Bank Policy Research Working Paper, (6888).

[4] Bagachwa, M. S. and Naho, A. (1995). Estimating the second economy in Tanzania. World development, 23(8), pp. 1387-1399.

[5] Buehn, A., & Schneider, F. (2012). Size and Development of Tax Evasion in 38 OECD Countries: What do we (not) know?

[6] Camera, G. (2001). Dirty money. Journal of Monetary Economics, 47(2), pp. 377-415.

[7] Dilnot, A. and Morris, C. N. (1981). What do we know about the black economy? Fiscal Studies, 2(1), pp. 58-73.

[8] Ferman, P. R. and Ferman, L. A. (1973). The structural underpinnings of the irregular economy. Asia Pacific Journal of Human Resources, 8(1), pp. 1-17.

[9] Frey, B. S. and Pommerehne, W. W. (1984). The hidden economy: state and prospects for Measurement 1. Review of income and Wealth, 30(1), pp. 1-23.

[10] Schneider, F. and Enste, D. H. (2000). Shadow economies: Size, causes, and consequences. Journal of economic literature, 38(1), pp. 77-114.

[11] Schneider, F. (2002), July. Size and measurement of the informal economy in 110 countries. In Workshop of Australian National Tax Centre, ANU, Canberra (Vol. 17).

[12] Giles, D. E., Tedds, L. M. and Werkneh, G. (2002). The Canadian underground and measured economies: Granger causality results. Applied Economics, 34(18), pp. 2347-2352.

[13] Gutmann, P. M. (1977). The subterranean economy. Financial analysts journal, 33(6), pp. 26-27.

[14] Hassan, M. and Schneider, F. (2016). Modelling the Egyptian shadow economy: A currency demand and a MIMIC model approach.

[15] Lippert, O. and Walker, M. eds. (1997). The underground economy: global evidence of its size and impact. The Fraser Institute.

[16] Loayza, N. V. (1996), December. The economics of the informal sector: a simple model and some empirical evidence from Latin America. In Carnegie-Rochester conference series on public policy (Vol. 45, pp. 129-162). North-Holland.

[17] Medina, L. and Schneider, M. F. (2018). Shadow economies around the world: what did we learn over the last 20 years?. International Monetary Fund. Type equation here.

[18] Medina, L. and Schneider, F. (2017). Shadow economies around the world: New results for 158 countries over 1991-2015.

[19] Medina, L. and Schneider, F. (2019). Shedding light on the shadow economy: A global database and the interaction with the official one.

[20] Montenegro, C. E., Schneider, F. and Buehn, A. (2010). Shadow economies all over the world: New estimates for 162 countries from 1999 to 2007. The World Bank.

[21] Ogbuabor, J. E. and Malaolu, V. (2013). Size and causes of the informal sector of the Nigerian economy: Evidence from error correction mimic model.

[22] Schneider, F. (2008). The shadow economy in Germany: a blessing or a curse for the official economy? Economic Analysis and Policy, 38(1), pp. 89-111.

[23] Schneider, F., Buehn, A. and Montenegro, C. E. (2011). Shadow economies all over the world: New estimates for 162 countries from 1999 to 2007. In Handbook on the shadow economy. Edward Elgar Publishing.

[24] Vo, D. H. and Ly, T. H. (2014). Measuring the shadow economy in the ASEAN nations: The MIMIC approach. International Journal of Economics and Finance, 6(10), pp. 139-148.148.

[25] Cassar, A. (2001). An index of the underground economy in Malta. Bank of Valletta Review, 23(2), 44–62 https://doi.org/10.14505/tpref.v5.2(8).04

[26] Schneider, F., Buehn, A. & Montenegro, C. 2010. Shadow Economies All Over the World: New Estimates for 162 Countries from 1999 to 2007. World Bank. Policy Research Working Paper, No 5356.

[27] Nguyem, T. H. (2019). How large is Vietnam's informal economy? Economic Affairs, 39(1), 81–100. Oduh, M. (2008). Measurement and explanation of informal sector of the Nigerian economy. AIAE Research Paper 3, 1-64.

[28] Buehn, A., & Schneider, F. (2012). Shadow Economies around the World: Novel insights, accepted knowledge, and new estimates. International Tax and Public Finance, 19, 139–171.

[29] Schneider, F. and Buehn, A., 2017. Estimating a shadow economy: Results, methods, problems, and open questions. *Open Economics*, *1*(1), pp. 1-29.

[30] Kaufmann, D. and Kaliberda, A., 1996. An" unofficial" analysis of economies in transition an empirical framework and lessons for policy.

[31] Dell'Anno, R. and Solomon, O. H., 2008. Shadow economy and unemployment rate in USA: is there a structural relationship? An empirical analysis. *Applied economics*, *40*(19), pp. 2537-2555.

[32] McCrohan, K. F. and Smith, J. D., 1987. Consumer participation in the informal economy. *Journal of the Academy of Marketing Science*, *15*, pp. 62-68.

[33] GREENIDGE, K., HOLDER, C. and MAYERS, S., 2009. ESTIMATING THE SIZE OF THE INFORMAL ECONOMY IN BARBADOS. *Journal of Business, Finance & Economics in Emerging Economies*, *4*(1).

[34] Pesut, M., 1992. Statistics of the hidden economy and informal activities inside the production boundary of the national accounts. An overview of national practices. *Statistical Journal of the United Nations Economic Commission for Europe*, *9*(1), pp. 1-26.

[35] Kanniainen, V., Pääkkönen, J. and Schneider, F., 2004. Determinants of shadow economy: theory and evidence.

[36] Mughal, K. and Schneider, F., 2018. Shadow economy in Pakistan: Its size and interaction with official economy.

[37] Schneider, F. and Klinglmair, R., 2004. Shadow economies around the world: what do we know?. *Available at SSRN 518526*.

[38] Portes, A. and Böröcz, J., 1988. The informal sector under capitalism and state socialism: a preliminary comparison. *Social Justice*, *15*(3/4 (33-34), pp. 17-28.

[39] Ntlhola, M. A., 2010. Estimating the relationship between informal sector employment and formal sector employment in selected African countries (Doctoral dissertation).

[40] Zaman, G. and Goschin, Z., 2015. Shadow economy and economic growth in Romania. Cons and pros. *Procedia Economics and Finance*, *22*, pp. 80-87.

[41] Muchiri, B. K., 2014. An analysis of the effect of the growth of the informal sector on tax revenue performance in Kenya. *Unpublished MA project], University of Nairobi*.

[42] Cross, J. C. and Peña, S., 2006. Risk and regulation in informal and illegal markets. *Out of the shadows: Political action and the informal economy in Latin America*, pp. 49-80.

[43] Dabla-Norris, M. E. and Feltenstein, M. A., 2003. *An analysis of the underground economy and its macroeconomic consequences*. International Monetary Fund.

[44] Abu Alfoul, M. N., Khatatbeh, I. N. and Jamaani, F., 2022. What Determines the Shadow Economy? An Extreme Bounds Analysis. *Sustainability*, *14*(10), p. 5761.

[45] Berdiev, A. N., Saunoris, J. W. and Schneider, F., 2018. Give me liberty, or I will produce underground: Effects of economic freedom on the shadow economy. *Southern Economic Journal*, *85*(2), pp. 537-562.

[46] Tanzi, V., 1980. The underground economy in the United States: Estimates and implications. *PSL Quarterly Review*, *33*(135).

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