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Estimating the Shadow Economy for Developing Countries: A Re-Appraisal of Institutional Factors

[a]Farah Iqbal, [b] Saima Sarwar
[a] PhD Scholar, Department of Economics, GC University Lahore
Email: farahramzi19@gmail.com
[b] Associate Professor, Government College University, Lahore
Email: saimasarwar@gcu.edu.pk

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ABSTRACT

Objective: Multi-dimensional shadow economic activities have negatively affected public revenues and welfare. Valid statistics regarding the magnitude and trend of the covert economy are crucial for making effective and efficient conclusions towards resource allocations. This paper presents estimates of this phenomenon in developing countries. The study aims to understand what factors lead to a shadow economy and what the outcomes of these indicators are.

Research Gap: This study contributes novel insights into the estimation of the shadow economy in developing nations by employing a Multi-Indicators Multi-Causes (MIMIC) model across developing nations from 1999 to 2022. Unlike prior research that provides fragmented or regional estimates, this study offers a comprehensive, time-series analysis that captures the evolutionary trends of the underground economy over a broad geographic and temporal scope.

Design/Methodology/Approach: This study has applied the MIMIC model. It is a complex system with two distinct parts. The first part, the Structural Model, is like a puzzle, revealing the determinants of latent variable, the Underground Economy. But, as these causes can't fully explain the underground economy, the error term steps in as the missing piece. The second part, the measurement model, can be seen as a bridge. It connects the latent variable and its indicators, much like a bridge connects two separate entities. The following model will be used to evaluate the shadow economy.

The Main Findings: Empirical findings demonstrate that the size of government expenditures, fiscal easiness, rate of unemployment and GDP are critical variables of the unregistered economy in developing countries. The developed index is instrumental in ranking the countries based on the scale of the underground economy.

Theoretical / Practical Implications of the Findings: The outcomes of this study provide valuable theoretical advancements and actionable policy recommendations for addressing the shadow economy in developing countries. By implementing structural reforms, reducing regulatory burdens, and leveraging technological advancements, policymakers can gradually integrate informal economic activities into the formal sector, fostering sustainable economic growth and financial stability.

Originality/Value: The study's originality and value stem from its novel methodological approach, broad empirical coverage, and strong policy relevance. By integrating cutting-edge econometric techniques, innovative data sources, and actionable policy insights, this research serves as a valuable resource for academics, policymakers, and economists working on economic formalization and financial inclusion in developing nations.

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Corresponding Author's email address: saimasarwar@gcu.edu.pk

1. Introduction

Every country around the globe is struggling to control the economic activities associated with the shadow economy through punishment, prosecutions and awareness. These measures are considered costly and not effective (Kelmanson et al., 2019). For efficient resource allocation, every country must gather information about the unregistered economy, its magnitude and its trends (Schneider, 2010). Although, the hidden economy's indirect nature makes estimation more complex. However, many researchers have dealt with the estimation phenomenon by employing indirect approaches to various economies over different periods, but these estimates predict only tentative values, and they might be distracting from their exact value. These tentative values undermine the counter policies by the government, and consequently, society and the economy have to face complex problems. Despite its crucial importance, very little is known about its magnitude in developing countries. Apart from the economic damages of S.E., it is also considered partially a tolerable phenomenon which depends upon cultural and psychological traditions (Miyamoto et al., 2018). This aspect of the underground economy depends upon the public's attitude towards the detection of illegal activities and how they have been punished. Public perception is also affected by the rituals of public spending, the taxation system and the delivery and provision of public services. When the positive response by the government to the public is not ensured, the magnitude of the unregistered economy is on an increasing trend (Ginevicius et al., 2020).

The underground economy is the dominant feature of developing economies. Although it is still on a downward trend (Medina & Schneider, 2017), its average share in the official economy is 30%, and employment creation is 70% (Loayza, 1996). Substantial literature exists on size, estimation processes, and trends of shadow economy activities, but there are still many open questions that need to be resolved. At first, the definition of shadow economy is still controversial. Schneider (2005) explains that income earned from these ill-legal economic activities escape from institutional regulations and deductions. Meiryani et al. (2021) categorized the illegal activities which have been carried out to avoid taxes and social protection obligations, including drug trafficking, prostitution, hiring of illegal immigrants and illegal gambling. Numerous researches have already adopted the comprehensive definition proposed by (Schneider, 2010). They included all marketable products and commodities obscured from government officials regarding tax avoidance, social protection payments, and labor market standards to gain favorable individual consequences. Dell'Anno and Davidescu (2019) emphasize that the imperative policy targeted at limiting the share of the hidden economy and tax avoidance must be clear regarding its potential reasons and the extent of people indulging in informal activities.

The second open question that the literature deals with is about the actors of the shadow economy. ILO,2013 distinguishes between informal workers and firms. Laborers working as informal self-employed or in informal units are counted as informal workers. Informal firms are those who do not have any legal status or account books, do not maintain their employees according to the threshold set by the government, and their workers are not declared and registered. Actors' identification indulged in shadow economic activities makes it possible to search for the critical factors responsible of the underground economy. For instance, a researcher considers under-development as the primary factor behind the expansion of the hidden economy (Nguyen Le & Tran Pham, 2023). Urbanization is also another reason for engaging in the underground economy. Mendicino and Prado (2014) indicated that the abject implementation of policies makes it less attractive to engage with local administration.

The third question deals with the externalities of the informal economy on the legal economy. Nguyen Le and Tran Pham (2023) identified its flexibility for businesses in their initial stages of start-up or when they are going – through their struggling phase. However, Webb et al. (2013) concluded that these informal businesses that do not make any payments regarding taxes or social contributions fuel unfair competition, reduce the profitability of the formal firms and weaken their competencies and capacities. Additionally, many studies have reported sluggish growth of the economy due to the misallocation of resources in physical and human capital (Wooj et al., 2023).

A considerable body of literature identified that the legal economy can be extended by overcoming the causal determinants of shadow economic activities. Goel and Nelson (2016) synthesizes the literature to recognize

the robust causal factors of the informal economy. He concluded that regulatory burden is more robust to the monetary intensity in ballooning the informal economy. Tax complexity and increasing costs of business start-ups also incentivize the informal economy. An important insight from data that the factors of the hidden economy are dissimilar to the developed economies. A research ascertained that the share of the unregistered economy in OECD countries is 20% less than the developing countries of sub-Saharan Africa and Latin America (Medina & Schneider, 2019).

Furthermore, a novel night light satellite dataset was utilized for this estimation. Mitra (2017) maintained a positive and significant association of high tax rates and social security contributions to the informal economy. F. Schneider and D. Enste (2000) extended the list of shadow economy drivers by including labor market regulations, low institutional quality, low tax morale, tax burden, and social security contributions. Dell'Anno et al. (2007) established that the rate of unemployment and the tax burdens are the principal factors in Spain and Greece. However, developed countries like Germany and Italy, which have moderate rates of unemployment, did not exhibit any significant association with the unregistered economy. Moreover, the unemployment is more sensitive in the following years of the economic downturn of 2008.

Trade liberalization and finance freedom policies can mediate to the expansion of the illegal economy. In a study it is estimated that 141 European and OECD countries that the financial freedom index influences the share of the informal economy negatively (Freytag et al., 2022). The relationship peculiarly supports the sub-components of this financial freedom index: institutional settings and ownership of property. Another sub-component, "trade freedom," further strengthens this relationship, but the effects are asymmetric. For Egypt (Farzanegan et al., 2020), trade liberalization policy's declining impact on the underground economy.

From the normative standpoint, expansionary fiscal policy negatively affects illegal economic activities, while contractionary fiscal efforts fuel these activities in 24 Asian developing countries. In this study, they prove that malpractices and informal economy are complements to each other (Huynh, 2020).

Although, the existing body of literature on shadow economies is vast, yet this study finds that there are still some gaps which warrant further exploration. While past studies may have sought to understand the size, reasons, and consequences of the shadow economy, most of it is either biased towards developed economies, or very generic in nature and does not emphasize the nuances of developing countries. There is a gap in the specialized literature that considers developing countries, for example, the role of institutional elements such as fiscal and business freedom, or the shadow economy in developing countries where the governance is weak and there is already a high level of inefficiency regulatory distortions. Furthermore, although a number of estimation methods have been applied, including the MIMIC and Currency Demand approaches, there is a strong contention on what the best approach to capture the shadow economy is, as it is latent and multi-faceted in nature. In addition to this, the relationship of some economic factors such as unemployment, and GDP per capita, and institutional factors remain understudied, especially in economies where informal economies dominate labor and output. Using the MIMIC model to analyze the shadow economy of developing countries, its causal determinants, observable outcomes and time trends is the goal of this study. In doing so, it seeks to provide nuanced understanding relating to informality within the context of institutional and economic factors, while also working towards the creation of policies aimed at the reduction of informality and the promotion of sustainable economic growth. This study's dataset covers the years 1999 to 2022, encompassing the COVID-19 pandemic period of 2020-2022. This timeframe is characterised by unprecedented economic disruption impacting both the informal and formal sectors worldwide. Economically strenuous activities such as government-mandated lockdowns, supply chain halts, and movement restrictions resulted in a sharp contraction of economic activity, particularly in labour-centric and informal industries. Although these years are included in the model to maintain the integrity of the complete time series, the model's unique contextual framework is appreciated and the results are interpreted accordingly.

The expansion of informal economic activities puts serious concern on the growth of developing countries. For the inception of concrete growth policies, comprehensive knowledge of the indicators and causes of the informal economy is considered a significant pre-requisite (Dell'Anno & Davidescu, 2019). The underground economy is a two-edged razor. On one side, it is grave damage to government revenue and, consequently, fewer allocations for public services; on the other hand, honest citizens have to bear the unfair burden of

taxes (Androniceanu et al., 2019). Based on this ground, the study intends to seek the answer to the following question.

1.2: Objectives of the study

The proposed study aims to achieve the following goals:

- To quantify concealed economies for developing countries.
- To bring forth a detailed analysis of how the informal economy is impacting the development and welfare of developing countries.
- To quantify the trend of the hidden economy for sample countries based on its evolution over time.
- To develop the policy framework for reducing the share of underground economies for the sample economies.

1.3: Research Questions:

Study intends to provide a multi-dimensional understanding of the underground economy and how it is impacting the level of development and welfare of countries.

1. What are the theoretical dimensions of the concealed economy?
2. Where do the countries stand based on the evolution of the hidden economy over time?
3. Which trend do the developing countries follow for underground economy? Rising or declining?
4. Which policy options do the countries need to adopt for the enhancement of official economy?

Following the introduction, this study explores the extensive literature about the hidden economy. The third section provides details about the data, its sources, and methodology. Section 3 exhibits estimated results and their pictorial presentation, and the final section discusses the conclusion and policy guidelines.

2. Literature Review

Literature on the underground economy reveals controversy over the concept and its multidimensional causes and outcomes. It affects formal economies of developing, transitioning, and advanced countries differently over different periods. The body of literature offers a variety of estimation techniques and their linkages in multiple dimensions, including ecological problems or environmental pollution and the connection between the shadow economy and crime. Nobel laureate Arther Lewis, in 1955, was the first to incorporate the informal sector and consider its infinite elasticity of labor supply. He also diagnosed the under-employment in urban areas, which is now called the informal sector. Young (2020) identified that the cities and urban areas are the center of illegal economic activities. A researcher examines the relationship of economic development and the magnitude of the underground economy on a panel of 114 countries for 2002-2015 (Ștefoni et al., 2024). The authors identified that the efficiency of finance regulators had a strong role to play. Additionally, research claimed a non-linear, short-run relationship of some monetary indicators – access and depth to the underground economy.

Why should we pay attention to shadow economic activities? In the political and social arena, it is undesirable to promote illegal activities by the official institutions. Medina and Schneider (2017) identified that enlarging underground economy could be taken as a response of businesses who are over-regulated by the government, and they opt for the exile to the official economy rather than the voice option. Olson, 1985 cautioned that if the share of the underground economy is ballooning due to high tax rates and social protection contributions, then necessarily, the future of the official economy is the vicious circle of budget deficits or tax collection. This trend ultimately leads to the progressive deterioration of socio-economic structures, a concern that should be at the forefront of our collective consciousness.

The literature on the underground economy encompasses a variety of approaches, including both macroeconomic indicators and micro-level data. Notably, some studies have utilized surveys of company managers to estimate the scale of the shadow economy, particularly focusing on the underreporting of employees and wages to official authorities. In this context, the MIMIC (Multiple Indicators Multiple Causes) approach underscores the significant role of low labor force participation in the official economy as a major contributor to the underground economy. Barrios et al. (2016) applied this innovative approach to three EU member states, finding that firms' misreporting of labor size and wages is highly responsive to the complexity of taxation and labor market regulations. They also noted that new firms' perceptions of the taxation system could incentivize their participation in the shadow economy, as tax avoidance offers a competitive edge in established markets.

(Heshmati, 2016) conceptualized the underground economy as the result of interactions among three key stakeholders: government, households, and businesses. He posited that government interference in economic activities, combined with households' tax avoidance behavior and high taxes on businesses, directly contributes to the expansion of the informal economy. Furthermore, he identified a negative correlation between political stability, economic development, and the size of the underground economy, with natural resource-rich countries typically exhibiting larger shadow economies.

The relationship between the shadow economy and sustainable development has been found to be inversely proportional. Caurkubule and Rubanovskis (2014), examining a large sample, concluded that sustainability is more closely linked to efficiency, whereas the informal economy disrupts growth. Similarly, Tvaronavičienė (2014) supported the view that sustainable development correlates with efficient economic performance. Financial development within a country enhances market liquidity, which, in turn, stimulates business activities. This dual effect reduces poverty while also strengthening legal frameworks, including contracts and property rights. Blackburn et al. (2012) argued that weak financial development fosters tax avoidance and the growth of the underground economy, while an efficient banking system may help curb illegal activities. Botev et al. (2019) further established a non-linear relationship between financial development and the unregistered economy, noting that for countries with a per capita income of US$33,600, a negative and significant relationship exists between these variables. Thus, while financial development fosters growth, its role in reducing the undocumented economy becomes more pronounced as developing countries reach a certain income threshold.

Exploring its various dimensions, the initial paper addressing the nexus between illegal economy and degradation of environment was published in 1983. The Goel and Saunoris (2020) highlighted the problem of the unregistered sector's contaminated wastage to the countryside’s environment. Goel and Saunoris (2020) concluded, that own and pollution of trans-national boundaries can shrink the size of the underground economy, validated by the theory of substitution. Another emerging dimension of investigation is the connection between the crime and informal activities. Serrano-López (2020) describes that the hidden payments and atrocity are the grease for hidden economy. Gupta (2021) also investigated the impact of globalization on illegal activities and the link between professional and informal wage differences.

Furthermore, the literature offers too many direct and indirect techniques to estimate shadow economies. Among indirect approaches, MIMIC and Currency Demand are the most employed by the researchers. Medina and Schnieder 2018 used MIMIC approach for a sample of 161 countries throughout 1991-2015. This approach allows us to estimate the relative indicators for the share of the informal economy. Conversely, the approach currency demand gives the absolute measure of these hidden economies. Although the estimation techniques are different, data employed by these methods are highly correlated, so a comparison of the shadow economies by country may produce different results. Elgin and Schneider (2016) showed inconsistent results, while Medina and Schneider (2019) exhibited a declining trend in the world sample.

3. Theoretical Framework

Two primary approaches, the CD (Currency Demand) and the MIMIC model, have been employed since the previous century to estimate the unregistered economy. The MIMIC approach treats the unregistered economy as an unobserved variable. It estimates it by linking measurable causes to the effects of this latent variable, thereby predicting relative estimates of the unobserved phenomenon. In contrast, the Currency Demand approach relies on two or three absolute measures to provide a quantitative estimation of the share and expansion of the hidden economy.

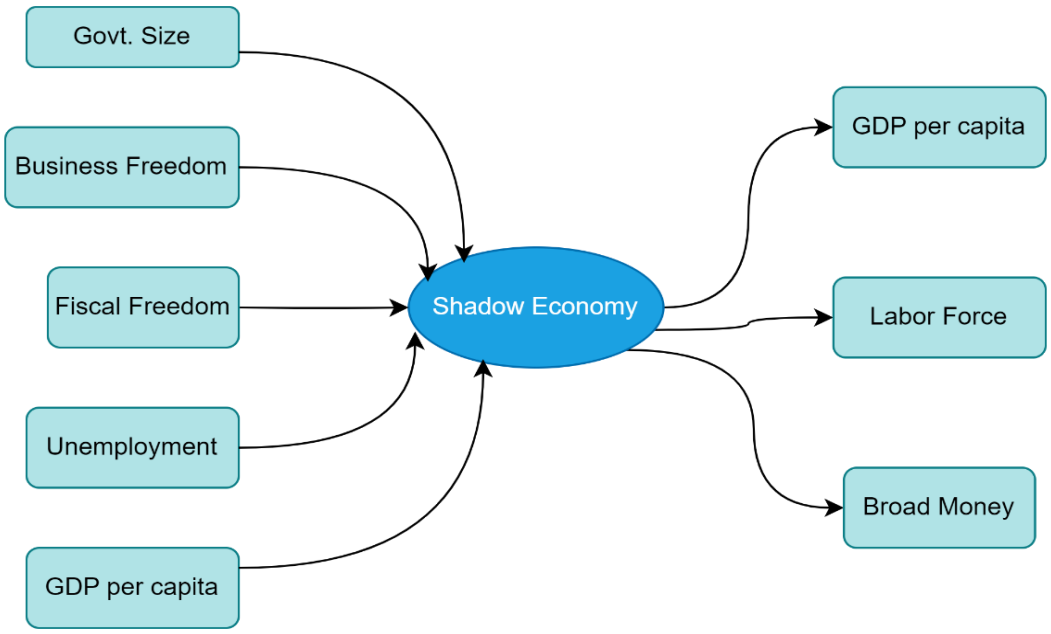
F. Schneider and D. Enste (2000) elaborated on the causes of non-tax compliance in Latin American and OECD countries, highlighting that tax compliance is motivated by a cost-benefit analysis. The cost of non-compliance is the reduced provision of tax-financed public goods and services, while the benefit is the increased income resulting from tax avoidance. Schneider (2005) incorporated these reasons into their model, hypothesizing that high tax rates expand the shadow economy. This hypothesis holds, particularly in the absence of effective governance. High taxes enable the government to increase its size; however, if accountability is poor, this leads to the growth of the hidden economy.

Excessive regulations and restrictions, such as trade barriers, complex immigration laws, and labour market regulations, limit opportunities within the legal economy. Stringent enforcement of these regulations increases the tax and social protection burdens on labour forces and firms, thereby encouraging a shift from

the official to the underground economy. Additionally, low growth rates fail to provide sufficient job opportunities, resulting in high unemployment rates and low GDP per capita, which drive individuals to engage in informal sector activities. Consequently, the underground economy expands, but this has positive effects on individual income, inflation, and labour force participation rates.

This theoretical framework provides a comprehensive understanding of the factors contributing to the shadow economy, emphasizing the interplay between tax rates, regulatory burden, governance quality, and economic growth.

Figure 1: Theoretical Model



4. Methodology

Numerous authors have attempted to quantify the magnitude and identified the trends of the underground economy with various direct and indirect approaches, including micro and macro data. One of the methods is the total demand of currency approach, in which only currency is the responsible for capturing all the outcomes of the unregistered economy. However, impacts of the illegal economy can be observed simultaneously in labor, goods, and money markets. Empirically, there is no secondary data available to estimate the shadow economy directly. Constructing such data would give insights into the static, spatial and temporal size of shadow economies (Shah et al., 2023). Therefore, this study will use an indirect macro approach to empirically analyze the share and identify the trends of the shadow economy in developing countries. The Multiple Indicator Multiple Causes (MIMIC) framework constitutes a specific subtype of structural equation modeling aimed at inferring an unobservable construct—here, the magnitude of the shadow economy—via a constellation of measurable antecedent and consequential variables. This investigation underscores the shadow economy's latent magnitude as the primary construct of interest. The MIMIC configuration unfolds in a bifurcated analytic sequence, commencing with the incorporation of observable causal dimensions into the latent construct and subsequently permitting the latent variable to predict observable indicators. This dual-process mechanism facilitates the concurrent evaluation of the determinants generating the shadow economy and the observable manifestations it subsequently produces.

The MIMIC model is backed up on the statistical theory of latent variables. This model envisaged the indicators and outcomes of the phenomenon to be measured, i.e., it would explicitly consider various causes contributing to the existence of the informal economy and quantify the effects of the hidden economy over time. Although there is no consensus on the definition of hidden economy in the literature, in this study, we will follow the definition employed by Schneider (2010). It mostly covers all the aspects of the underground economy, which is attributed to the sample of developing economies. Therefore, all marketable legal production of commodities and products which are unregistered from public institutions to tax evasion, compulsory payments for social protection, labor market rules and certain administrative permissions are

considered shadow economies. Furthermore, we will use different terminologies of the shadow economy alternatively in our study.

Additionally, for this research, Table 1 distributes the variables into two categories. The first category consists of causal variables, including government size (general government final consumption expenditures), Fiscal freedom and business freedom (fiscal burden and ease of doing business in an economy) and two causal economic variables, per capita GDP (based on ppp constant 2015 US$ and unemployment rate as a per cent of the total labour force. All these variables have been used by various researchers on the underground economy (Feld & Schneider, 2010). Since the underground economy is not a variable that can be measured directly. To capture and reflect on its activities, we have to use some outcome variables. In developing countries, additional use of cash or currency demonstrates shadow economic activities. Therefore, to take into account this variable, we have used the Broad money as variable. Other outcome variables are participation rate of labour force (proportion of the population who participates in economic activities) and GDP per capita growth rate (PPP constant 2015 US$). MIMIC is a distinct model of simultaneous equations that will be utilized to estimate and analyze the hidden economies of developing countries between 1999 and 2022. The data sources are World Development Indicators (WDI), Heritage Foundation and ILO. The indicators include the magnitude of the government (it is considered as total spending as % of GDP), Financial Freedom (as three tax burden variables), Business Freedom (conducive business environment), and Unemployment Rate and per capita GDP for the state of the economy.

Table 1: Variables and Data sources

Variable Name	Category	Source
Govt. Size (size)	**Indicator**	**WDI**
Business Freedom (BF)	**Indicator**	**Heritage Foundation**
Fiscal Freedom (FF)	**Indicator**	**Heritage Foundation**
Unemployment (UNE)	**Indicator**	**WDI**
GDP per capita (GDPPC)	**Indicator**	**WDI**
GDP per capita(GDPPC)	**Outcome**	**WDI**
Labor Force (LFR)	**Outcome**	**ILO**
Broad Money (BM)	**Outcome**	**WDI**

4.1. Model of the Study

This study has been employing the MIMIC model. It is a complex system with two distinct parts. The first part, the Structural Model, is like a puzzle, revealing the determinants of latent variable, the Underground Economy. But, as these causes can't fully explain the underground economy, the error term steps in as the missing piece. Second part, the measurement model, can be seen as a bridge. It connects the latent variable and its indicators, much like a bridge connects two separate entities. The following model will be used to estimate the shadow economy.

$$SE_{it} = b1 + b2\text{size}_{it} + b3\ \text{ff}_{it} + b4\text{bf}_{it} + b5\text{unr}_{it} + b6\text{gdppc}_{it} + \varepsilon_{it} \quad (1)$$

The measurement model is specified by:

$$y = \gamma\eta + \varepsilon \quad (2)$$

Here y represents the vector of outcome variables (Per capita GDP, participation rate of labour force and broad money) γ the set of regression coefficients and ε_{it} as a vector of disturbance term.

4.2: Estimation of results

Various methods are available for developing an index, including the arithmetic mean for equally weighted items, factor analysis for co-variance-based weights, structural model (SEM) and the model of multiple causes and multiple indicators for regression-based weights (Weijters & Baumgartner, 2019). This model is a peculiar type of structural models that is used to assess the features of underlying phenomena attributed to various indicators and investigates the predictors which affect these explored factors (Hodge & Treiman, 1968; Low & Meghir, 2017; Weijters & Baumgartner, 2019). MIMIC is the model that allows the estimate of a latent variable accurately while incorporating other factors that might affect these hidden variables. It produces accurate estimates and is widely offered by statistical software (Jöreskog & and Goldberger, 1975; Kessels & Moerbeek, 2023).

Many empirical studies have been used to estimate the latent variables in a variety of settings. For instance, to estimate shadow or underground economy (Arshed et al., 2022), for macroeconomic stress (Arshed et al., 2022), and firm performance (McVicar, 2016).

Our research study, which will use the MIMIC model on unbalanced panel data for developing countries, represents a novel approach in the field. The model will provide a score for 5 latent variables that represent the shadow economy. These created indices will then be plotted on the world map to assess patterns and trends between countries. Figure 1 exhibits the structure of the latent variable with its predictors and outcomes.

4.3: MIMIC Results

Table 2: Descriptive Statistics

Stats	SIZE	FF	BF	UNR	GDPPC	DLGDPPC	DLLFR	LBM
Mean	2.745	67.903	63.887	8.123	14963.5	0.180	-0.000	3.817
p50	2.776	79.6	63.75	6.455	5348.4	0.020	-0.000	3.848
SD	0.436	30.424	15.755	5.958	21975.3	0.056	0.0149	0.729
Skewness	0.100	-0.917	-0.155	1.368	2.820	-1.708	-1.057	-0.172
Kurtosis	5.236	2.511	3.049	4.963	14.107	34.956	13.832	50726452

The table containing descriptive statistics presents a summary of the important features of the variables which were captured in the study, including their central tendencies and how they spread from one point to another and from one region to another. The mean values show the average amounts of each of the variables for the cohort of developing countries, and the standard mean deviations portray the number of deviations from the mean. For example, the government size variable has a balanced amount of variability which indicates differences in the spending of the public sectors among the countries. On the other hand, fiscal freedom and business freedom, with their standard deviations, exhibit relatively weaker divergence which means that the institutional and regulatory diversity among the sampled countries was limited. The available information on developing economies reveals that the ratio of unemployment to GDP per capita exhibits greater volatility in comparison to other metrics. Such, volatile metrics advance the diverse economic and labor market structures of informal economies, and in the context of the developing world. Understanding the variation is crucial, as it further emphasizes the overarching economic, sociopolitical, and institutional contexts in which informal economic activities take place.

The estimation of the model reveals that all the included causal variables have theoretically expected signs except unemployment. An overview of the policy causal variables and economic causal variables both look similar and important to decreasing the magnitude of the hidden economy across the countries. Many previous studies, including (Nguyen Le & Tran Pham, 2023; F. Schneider & D. Enste, 2000)explained the ambiguous relationship between public expenditures and the hidden economy. These studies indicated that extensive government presence might drive citizens into hidden economies through high taxes. At the same time, Goel and Nelson (2016) found that a bigger size of government might allocate more resources to counter-shadow activities. In our study, government size (consumption of govt. as a % of GDP) is taking a positive sign. Analysis exhibits that an increase in government size will scale up the shadow economy. A large government financed with high taxes encourages the growth of hidden economy. In this regard, our study supports the idea of Schneider (2010).

The regulatory burden is recognized to proliferate the shadow economy (McVicar, 2016). In this study, fiscal freedom and index of business freedom have been used as indicators of regulations and institutions. These variables measure regulatory and institutional facets, but they have smaller coefficients which denote a weaker, yet still significant, impact on the shadow economy. Such findings indicate that regulatory frameworks are indeed important, though their influence is likely to be tempered by other factors like governance or corruption. Fiscal freedom confirms the negative relationship with the underground economy, and it is significant, too, taking a value of 0.0284. The business freedom index, which reflects the regulatory efficiency and ease of doing business, exhibits a negative but statistically significant relationship with the shadow economy. This suggests that even modest improvements in the business regulatory environment can reduce firms' incentives to operate informally. A streamlined legal framework, reduced bureaucratic hurdles, and lower entry costs likely enhance the attractiveness of formalization, thereby contributing to the contraction of the shadow economy.

However, it is pertinent to note that the relationship between economic freedom and the underground economy can be complex and may vary depending on other factors, such as corrupt practices and the democracy level in a country (Malański & Póvoa, 2021).

Gupta (2021) highlighted the two-way connection between the hidden economy and rate of unemployment. On the flip side, from the lens of GDP growth, unemployment is negatively correlated with it, and a diminution in employment might push the size of the hidden economy upward. While, Tanzi (2001) highlighted the heterogeneity of the work force, which participates in the formal and illegal economy simultaneously. Regulations in labour markets and unemployment might contribute positively to the underground economy. However, the economic rationale is indecisive about the signs of unemployment variable, our study finds a negative but weak relationship with the black economy. At first glance, it appears paradoxical, as rising unemployment is traditionally linked with a rise in the informal sector. This may be explained by the context of the analysis which included the years of the COVID-19 pandemic. During this time, the formal and informal economies contracted as a result of health restrictions, business closures, and reduced consumer spending. Informal workers who depend on close contact and daily earnings were particularly hard hit. Therefore, a significant number of unemployed workers during this time frame virtually had no opportunities to engage in informal economic activity. Rather, a large number may have simply dropped out of the labour force altogether, resulting in a discouraged worker syndrome. Therefore, the negative relationship between unemployment and the shadow economy in this case seems to reflect pandemic-distorted labour market wrinkles as opposed to a systematic economic relationship.

However, in emerging countries, income generated from the informal sector guarantees the subsistence of families. Therefore, our results are in same vein with (Schneider, 2010).

Another important determinant of the unregistered economy is per capita GDP. In our study, the negative sign is supported by the economic theory, and it is statistically significant also. As GDP increases by 1% causes a .05% reduction in the Shadow Economy. This finding shows that as a country attains development, the marketable production in the unregister sector decline either due to hard regulations linked with business activities. This result is consistent with (Goel & Nelson, 2016; Meiryani et al., 2021). The analysis also reveals that economic variables like the unemployment rate and per capita GDP significantly influence the informal economy, with improvements in these areas reducing its size. Conversely, policy variables such as business freedom and fiscal freedom do not significantly impact the underground economies in emerging countries. This ineffectiveness is due to weak administrative systems and rent-seeking behaviors that raise business start-up costs, thereby expanding the shadow economy.

Table 3: MIMIC ESTIMATES Structural equation model

	Coefficient (z-statistics)
Structural	
SE	
size	**0.0025115(0.67)****
LFF	**-0.0284766(-12.69)*****
LBF	**-0.0524371(6.69)*****
LUNE	**-0.0283538(-16.28)*****
LGDPPC	**-0.0057736(-3.9)*****
Measurement DLGDPPC	
SE	**1**
_cons	**0.0231703(0.9)*****
LLFR	
SE	**2.711158**
_cons	**4.041622(57.69)*****
LBM	
SE	**1.062482**
_cons	**4.08607(106.43)*****

Note: absolute z-statistics in parentheses. ***, **, * denote significance at 1, 5, and 10% significance levels. The measurement model verifies the interrelations among three macroeconomic variables: GDP per capita, the labor force participation rate, and the broad money stock. The structural pathway indicates that the labor

force participation and broad money variables exert a statistically significant negative influence on the log-difference of GDP per capita. Results reveal that the labor force participation rate and the estimated magnitude of the shadow economy are inversely related, suggesting that increased fiscal discretion—operationalized as a lower effective tax burden, heightened transparency, and a more efficient tax administration—diminishes the incentives for engagement in unofficial economic activity. This finding corroborates the proposition that well-designed and expansionary fiscal policies can curtail the shadow economy in developing contexts (Ahmad & Hussain, 2023).

Table 2 indicates a statistical comparison between the baseline and saturated models. It suggests that the baseline model fits significantly worse than the saturated model.

Table 4: Goodness of Fit Statistics

Fit Statistic	Value	Description
Likelihood ratio		
Chi^2_ms(.)	**.**	**Model vs saturated**
P > chi^2	**.**	
Chi^2_bs (18)	**538.367**	**Baseline vs saturated**
P > chi^2	**0.000*** **	

The goodness-of-fit statistics assess how well the MIMIC model captures the relationships between the latent variable, the shadow economy, and its indicators and causes, and are presented in Table 3. The likelihood ratio test on the baseline model versus the saturated model yields a Chi^2_bs statistic of 538.367 and p-value 0.000. This indicates the baseline model is significantly different from the saturated model. This outcome indicates that the baseline model is not fitting the data well as compared to the saturated model, which is expected as the saturated model is able to flexibly and perfectly fit the data. The significant p-value in this case also indicates that the MIMIC model was able to robustly explain the variance of the shadow economy in terms of the specified causal and measurement variables.

The chi-square test statistic is indicative of the disparity between the observed and expected covariance structures, and a significant result ($p < 0.05$) indicates that the assumptions of the model do not fully hold true in relation to the data set. This is typical in studies with large sample sizes, as even a small discrepancy from the model leads to a significant chi-square value. Regardless, a model's structure may still provide useful insights to interpret the relationships between the shadow economy and its determinants. These findings highlight the challenges posed when attempting to construct a model of latent variables such as the shadow economy, especially for developing nations which face data scarcity coupled with structural diversity which may impact the model's suitability. In any case, the MIMIC model helps to understand the shadow economy by providing a powerful structure to analyze its causes and consequences.

Table 5: Equation-Level Goodness of Fit Statistics

Dependent variables	Fitted	Variance Predicted	Var-Residual	R-Squared	Mc	Mc^2
			Observed			
DLGDPPC	**.0024014**	**.0008998**	**.0015015**	**.374723**	**.6121462**	**.374723**
LLFR	**.035741**	**.0066142**	**.0291268**	**.1850601**	**.4301862**	**.1850601**
LBM	**.4034093**	**.0010158**	**.4023935**	**.0025181**	**.0501803**	**.0025181**
			Latent			
SE	**.0008998**	**.0008999**	**-1.00e-09**	**1.00001**	**1.000001**	**1.000001**
Overall				**1.000001**		

The goodness-of-fit, or model diagnostics, statistics listed in Table 4 reveal information about the model in the context of its accuracy in explaining variance in the dependent variables, alongside the underlying construct, the shadow economy (SE). In the case of the dependent variables, the R-squared metrics provide the amount of variance attributed to the predictors. The model captures 37.47% of the variance in GDP per capita growth (dlgdppc), 18.51% of the variance in the labor force participation rate (llfr), and a mere 0.25% of the variance in broad money (lbm). These findings indicate that the model is, to some extent, useful in

explaining GDP per capita growth and labor force participation, but does not explain the variance in broad money. The low R-squared value for broad money suggests that this variable is heavily influenced by other factors not included in the model, underlining the necessity of further analysis of the determinants of this variable. In the case of the latent variable, SE, the model captures a perfect R-squared value of 1. This is as expected, since it is constructed as a variable fully determined by its causal variables.

The Mc and Mc^2 alternative measures of the goodness of fit along with R-squared results are consistent with each other which strengthens the model's explanatory power regarding dlgdppc and llfr and lbm does not receive the same explanatory strength. Broad money has the highest residual variance reinforcing its weak fit within the model. In aggregate the high-level model fit statistics indicate the MIMIC model is able to explain some variables effectively but its inability to explain broad money indicates some lack of model specification or absence of other causative variables. These results demonstrate the difficulty of constructing a model for the shadow economy and its complex interactions with observable economic indicators.

Figure 2: Map of the shadow economies expressed as a percentage of GDP per country. (Darker coloration corresponds to greater magnitude of informal economic activity. Data derived from the MIMIC model and the author's computational work.)

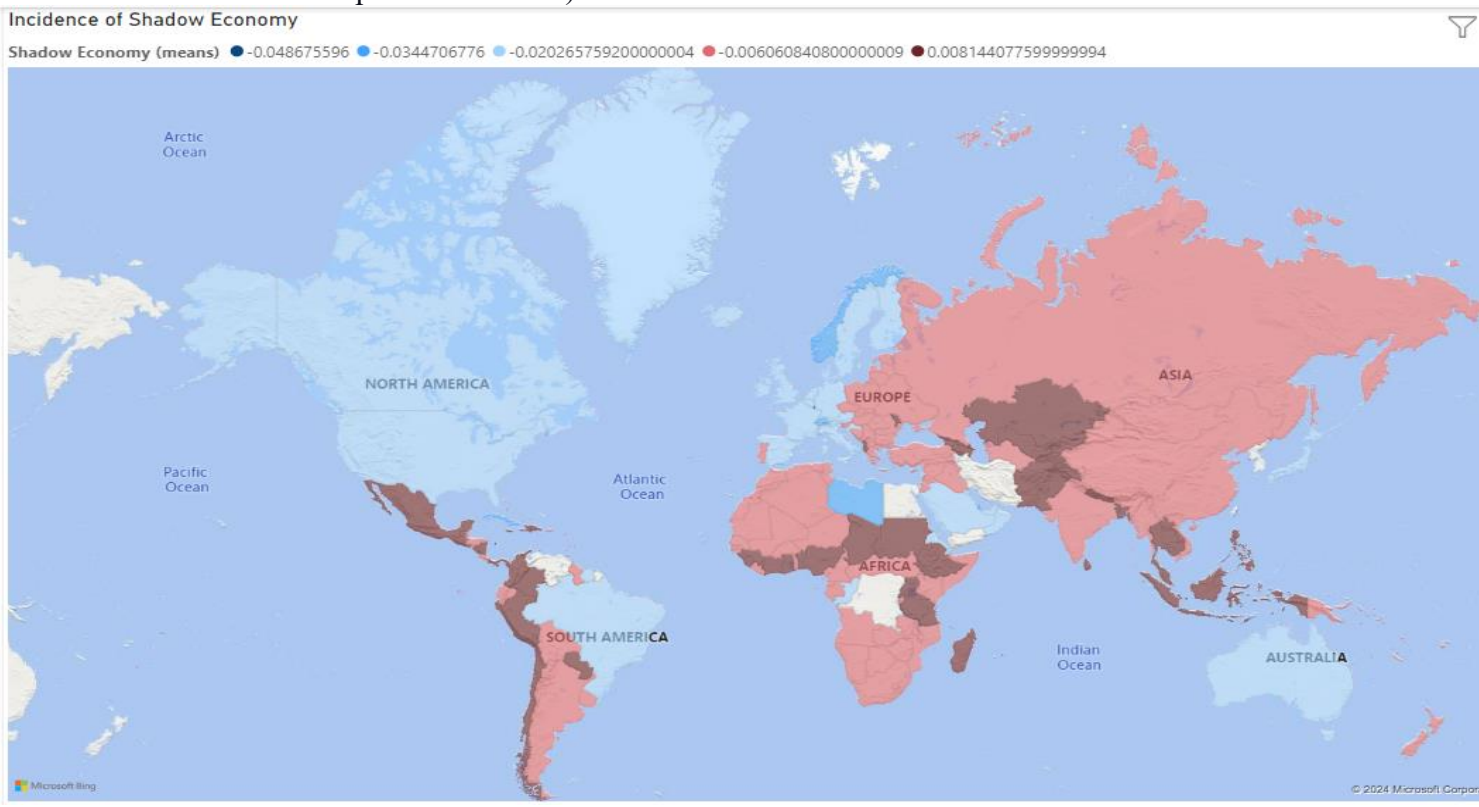


Figure 2 provides a graphical representation of the geographic distribution of shadow economy incidence among developing nations. Shadow economy size estimates stem from the Multiple Indicators Multiple Causes (MIMIC) methodology, which enables the indirect recovery of unobservable quantities through a structured assembly of measurable determinants. For the present analysis, the model incorporates per capita GDP, labor force participation rates, and broad money relative to GDP as root causes, thereby capturing, in turn, dimensions of national wealth, labor market organization, and the breadth of the financial system. Observable phenomena that signal the shadow economy's footprint consist of size of government, the business freedom index, the fiscal freedom index, unemployment rates, and per capita GDP.

The accompanying map translates the model's average predicted levels into a continuous color gradient; wherein darker tones signal heightened informal sector activity and paler tones denote attenuated presence. The resultant spatial profile underscores pronounced regional variation. Countries in Sub-Saharan Africa, South Asia, and selected states of Latin America and Eastern Europe consistently plot in the upper tail of the distribution, whereas nations in North America, Oceania, and some Middle Eastern territories display comparatively restrained estimates. Schneider (2011) carrying out a thorough estimation of shadow economies for a worldwide sample spanning 1999 to 2007, the previous researchers found that Asia, Africa, and North America harbored, on average, higher rates of informality relative to other regions. The empirical

patterns uncovered in the present investigation corroborate those earlier outcomes, thereby lending additional evidential weight to the continuing prominence of informal economic engagement in these same continental zones.

This visual representation both clarifies the results and reveals geographic clustering and isolated outliers. These spatial variations point to the differential impact of institutional integrity, regulatory frameworks, and the underlying economic architecture on the scale of shadow economies in distinct regions. The detailed table of estimated concealed economies of developing countries is attached in appendix.

5: Conclusion & Policy Recommendations:

The shadow economy is successful in attracting the attention of researchers because of its role in the legal economy. Empirical studies have established its existence in developed countries along with developing countries (Friedrich Schneider & Dominik Enste, 2000). A key insight from the analysis is the persistently low and declining productivity within the underground economy. Informality significantly limits investment in research and development, thereby hindering diversification and value addition in production processes. As a result, the competitiveness of firms operating in the shadow economy diminishes, leading to a loss of market share for the country in the international arena due to the high proportion of informal economic activities relative to the official economy. In developing countries, the underground economy often serves as a refuge for substandard businesses and an unskilled labor force, functioning as a safety net for firms and small enterprises that struggle to compete in the formal sector.

Notwithstanding the bleak outcomes on the official economy, it created some positive impacts, including increasing competition and employment opportunities. In estimating the magnitude and trend of the shadow economies and analyzing their consequences for developing countries, many obstacles have to be overcome. However, this research showed some progress. We estimated the underground economies for a big sample of developing countries over the period 1999 to 2022 using the MIMIC procedure. Some new insights regarding the shadow economies are leading to following main conclusions:

- In most countries, the trend of the shadow economies is on a declining rate.
- The shadow economy is a complicated and pervasive phenomenon, existing in all the countries we studied. People engage in shadow economic activities as a response to regulatory burdens. Our research suggests that fostering fiscal freedom could be a promising strategy for promoting inclusive growth. Countries differ in their level of informality due to regional disparities.

In conclusion, our research underscores the significant challenge governments face in discouraging informal economic activities. We advocate for the implementation of incentive-oriented and efficient policy measures to make formal economic activities more attractive. Based on findings, the following policy recommendations can be made:

- Increased fiscal freedom through more simplified and digitised tax systems, as well as wider compliance drives, reduces the burden on firms and individuals, which reduces the tendency for informal economic activity.
- Enhancing the business environment by unclenching registration, compliance costs, and procedural bottlenecks improves the formalisation and transparency of the business environment.
- The observed weak negative relationship between unemployment and the shadow economy, particularly during the COVID-19 window, demonstrates the extent of suppressed both formal and informal sector activity. This underlines the need for more proactive policies to reactivate unemployed and underemployed individuals, including vocational training and digitised public sector employment initiatives, and public job creation programmes.
- Clearly defined and sustained economic policies fortified by inclusivity directly strengthen the economy while reducing informality. Improving and broadening infrastructure and financial access, coupled with strengthening institutional capacity aimed directly at fiscally formalising low-productivity informal sectors, plays a crucial role.
- Ultimately, the voluntary formalisation of informal enterprises may be achieved through digitally supported microcredit access and legal aid, which integrates informal enterprises on an incentive basis and does not criminalise informal sectors.
- Based on the conclusion of this research, a lack of trust and harsh top-down regulations that demonise formal economic activities call for additional policy action, which focuses on the removal of the

informal economy's structural constraints, formal institutional capacity, and enhances formal economic participation, thus improving the economy's inclusivity and transparency.

Successful implementation of such measures could potentially stabilize or even reduce the magnitude of the underground economy. The data reveals that production in the informal sector often complements the official economy, particularly in cases where certain goods are not produced within the registered economy. Consequently, the overall growth in GDP tends to surpass the figures reflected in pure national income statistics. To expand the size of the official economy, robust governance is essential. Policymakers must carefully select strategies that incentivize and motivate firms to transition into the documented economy, thereby realizing the welfare benefits of reducing the shadow economy. The regulations governing the initiation of economic activities play a crucial role in directing businesses either towards the informal (black) or formal (white) economy. Additionally, the analysis underscores the importance of financial inclusion as a pathway for facilitating this transition.

Limitations of the study

The results of this study are subject to numerous methodological and data-related limitations.

First and foremost, the employment of the MIMIC model is useful in estimating latent variables such as the shadow economy. However, this model makes the assumption of linearity for the relationships between causes and indicators, which in the context of heterogeneous developing economies, is likely to miss non-linear interdependencies and feedback loops that are commonplace. Further, the model makes use of an unbalanced panel dataset covering the period from 1999 to 2022, which is often characterized by missing data, especially for some institutional variables, on fiscal and business freedoms. To circumvent this, country-specific averages were applied, which although increases temporal coverage, diminishes the ability to capture changes and trends over time within countries. Also, the assumption that data is missing at random (MAR) is suspect in cases where missing data is associated with the level of informality, which would systematically bias results.

A second limitation of this study is the inclusion of the COVID-19 pandemic years (2020–2022), during which the dynamics of informality and labor markets deviated significantly from typical patterns due to widespread economic disruptions and mobility restrictions. The observed negative relationship of unemployment and the shadow economy during these years might be caused by the peculiarly uniquely subdued economic conditions, and so the relationship should be interpreted very cautiously. Subsequent research might try to apply this model excluding or adjusting for the pandemic years and controlling for policy-induced shocks related to COVID.

As these limitations suggest, the results must be interpreted with care, and future work should consider different approaches, more detailed data collection, and possible non-linear relationships to understand the shadow economy more thoroughly.

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Data Availability Statement

The data will be provided upon the request anytime.