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METHODOLOGY FOR ASSESSING THE SHADOW ECONOMY: FOREIGN EXPERIENCE AND MODERN APPROACHES

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ABSTRACT: This article presents a systematic comparative analysis of the principal methodological approaches employed in assessing the shadow economy, encompassing direct survey-based methods, indirect macroeconomic indicator methods, and model-based econometric approaches — most notably the Multiple Indicators Multiple Causes (MIMIC) model and the Dynamic General Equilibrium (DGE) framework. Drawing on empirical evidence from Italy, Brazil, South Korea, and Estonia, the study examines how rigorous measurement methodology underpins effective policy intervention. Special attention is given to the applicability of these approaches to transition economies, with a particular focus on Uzbekistan. The findings indicate that no single method achieves universal accuracy; rather, an integrated approach combining the MIMIC model with the currency demand method yields the most robust estimates in developing and transition country contexts. The study also identifies emerging methodological challenges posed by digitalization and cryptocurrency transactions, which render conventional indicators increasingly insufficient. Practical policy recommendations are advanced for strengthening shadow economy monitoring in Uzbekistan, including the establishment of a dedicated statistical unit, harmonization with OECD and IMF standards, and targeted formalization incentives.

Keywords: shadow economy, assessment methodology, MIMIC model, currency demand approach, informal sector, tax burden, fiscal policy, digital economy, transition economy, macroeconomic analysis, budget policy

JEL Classification: O17, H26, E26, C51, P20

1. INTRODUCTION

The shadow economy — encompassing all economic activities that fall outside the purview of state regulation, taxation, and official statistical measurement — represents one of the most complex and multidimensional phenomena confronting contemporary economic science. The concept extends beyond strictly illicit activities to include legal productive processes conducted in concealment: informal manufacturing, unreported trade, and off-the-books service provision. The capacity to identify, measure, and systematically assess the shadow economy has emerged as a distinct and increasingly consequential field within economics [1].

According to recent estimates by the International Monetary Fund (IMF) and the World Bank, the shadow economy in low- and middle-income countries accounts for an average of 30–40 percent of Gross Domestic Product (GDP), while the corresponding figure for advanced economies stands at 10–20 percent [2]. For Uzbekistan, expert assessments suggest that the informal sector may constitute approximately 20–25 percent of official GDP [3]. A shadow economy of this magnitude suppresses tax revenues, distorts competitive conditions, degrades the quality of public expenditure, and constrains the effectiveness of macroeconomic stabilization policy.

The precise measurement of the shadow economy confronts several inherent methodological difficulties. By their very nature, informal activities resist direct observation; the structural characteristics of informal sectors vary substantially across national contexts; and available statistical databases are frequently incomplete or of questionable reliability. These challenges make the refinement of methodological approaches and the systematic study of international best practices an urgent scientific priority [4].

The primary objective of this study is to conduct a rigorous, systematic analysis of the modern methodological approaches employed internationally in assessing the shadow economy and to provide a scientifically grounded assessment of their applicability to Uzbekistan's economic context. The research carries broad practical significance for policymakers in economics and finance, research institutions, and the academic community in higher education.

In pursuit of this objective, the following research tasks were addressed:

(i) to establish the theoretical and terminological foundations of the shadow economy concept;

(ii) to develop a comprehensive taxonomy of the principal methodological approaches to shadow economy assessment;

(iii) to conduct a comparative analysis of effective methods applied internationally;

(iv) to propose the most appropriate methodological approaches for application in Uzbekistan's economic conditions.

The scientific novelty of this article lies in the fact that, for the first time in the Uzbek-language academic literature, the modern model-based approaches to shadow economy assessment — specifically the MIMIC (Multiple Indicators Multiple Causes) and DGE (Dynamic General Equilibrium) frameworks — are subjected to comparative analysis with explicit reference to their applicability to the Uzbekistan economy [5].

2. RESEARCH METHODOLOGY

The study employs a multimethod research design, drawing on systematic analysis and synthesis, comparative analysis, economic modelling, statistical processing of empirical data, and both inductive and deductive reasoning. The research methodology is grounded in the harmonized application of quantitative and qualitative approaches.

The empirical foundation comprises data and publications from the IMF, the World Bank, the Asian Development Bank, Eurostat, the State Statistics Committee of the Republic of Uzbekistan, and leading international and domestic peer-reviewed journals. The analytical period spans 2000–2023, enabling the long-term observation of structural trends [6].

The methods examined in this study are organized into three principal categories:

(1) Direct methods: identification of informal activity through household and enterprise surveys, purpose-specific audit examinations, and structured interviews with economic agents;

(2) Indirect (indicator-based) methods: estimation of the informal sector through macroeconomic indicators including electricity consumption, currency demand, and employment statistics;

(3) Model-based approaches: estimation of the shadow economy as an unobserved (latent) variable using the MIMIC, DGE, and related econometric models [7].

Statistical analyses were conducted using STATA 16, EViews 12, and Python. The theoretical and methodological foundations of the study draw on the seminal contributions of F. Schneider, D. Enste, E. Feige, V. Tanzi, Ch. Elgin, and other leading scholars in the field.

3. LITERATURE REVIEW

The systematic academic study of the shadow economy traces its origins to the 1970s. Feige (1979) was among the first scholars to introduce the concept of the "unobserved economy" into scientific discourse, proposing the use of monetary aggregates to assess the shadow sector's impact on macroeconomic indicators [8]. Contemporaneously, Gutmann (1977) applied the currency demand approach to the United States economy, achieving the first quantitative measurement of the scale of informal economic activity [9].

The landmark study by Schneider and Enste (2000) produced a paradigm shift in the methodology of shadow economy assessment. Their comprehensive comparative analysis across 76 countries systematically juxtaposed results obtained through different methods and presented a universal taxonomy of methodological approaches [10]. This work remains among the most extensively cited references in the field. Subsequently, Schneider (2010, 2022) applied the MIMIC model across 162 countries, finding that the global average shadow economy stood at 17.1 percent of GDP in 2022 [2]. Buehn and Schneider (2012) further refined MIMIC methodology through structural equation modelling (SEM), establishing new criteria for variable selection [11].

Research addressing the shadow economy in Central Asia and the post-Soviet space includes the contribution of Kuznetsov (2012), who analyses the causes of informal sector growth in CIS countries from an institutional economics perspective, identifying weak state institutions and excessive bureaucracy as principal drivers [12]. Tanzi (2002) empirically demonstrated the positive relationship between rising tax burdens and the expansion of the shadow economy, elucidating the transmission mechanisms through which tax policy influences informal sector activity [13].

Within the domestic academic literature, Mustafoyev (2018) examined the institutional determinants of informal sector formation in Uzbekistan, identifying elevated tax burdens, bureaucratic obstacles in the licensing process, and restricted access to formal banking as primary causes [14]. Kholmurodov (2020) proposed novel methodological approaches for shadow economy assessment under conditions of digital transformation, arguing for the use of mobile payment and e-commerce data as observational tools [15].

The two-sector Dynamic General Equilibrium (DGE) model proposed by Elgin and Oztunali (2012) represents one of the most significant recent advances in the theoretical economics of informality. This model subsumes a broader range of macroeconomic variables — consumption, investment, and labour market indicators — than the conventional MIMIC framework and enables the dynamic modelling of informal sector development [16]. The model is currently being adapted for application in digital economy and cryptocurrency contexts.

The electricity consumption method developed by Kaufmann and Kaliberda (1996) retains practical value for developing countries to the present day. The method's core logic holds that electricity consumption should grow proportionally with economic activity; if a portion of that activity is concealed, energy consumption will rise at a faster rate than officially recorded GDP. Analysis of this differential provides a basis for estimating the informal sector [17].

4. ANALYSIS AND RESULTS

The comparative analysis conducted in this study identifies the distinguishing features of different methodological approaches to shadow economy assessment, their relative strengths and weaknesses, and the specific conditions under which each is most appropriately applied.

4.1 Direct Methods: Efficacy and Limitations

Surveys and audit examinations conducted under direct methods offer the advantage of providing disaggregated, sector- or region-specific data on informal activity. However, the response bias inherent in self-reporting represents the principal limitation of this approach. Research in G7 countries indicates that survey-based methods may capture only 40–60 percent of actual shadow economic activity [18].

In the Scandinavian countries (Sweden, Norway, Finland), direct methods yield comparatively high levels of reliability, attributable to elevated public trust in tax authorities. In these countries, the share of the shadow economy identified through surveys ranges from 12–18 percent of GDP, while MIMIC-based estimates stand at 14–19 percent [19]. The convergence of these two independent estimates provides mutual validation and strengthens confidence in both methodologies.

4.2 Indirect Methods: Methodological Characteristics

The Currency Demand Approach, originally developed by Cagan (1958) and subsequently refined by Tanzi (1980), proceeds from the premise that an increasing tax burden induces a rise in cash transactions, since informal economic activity is predominantly conducted in currency. By estimating the money multiplier for formal transactions and comparing it to total money supply, the method enables the derivation of informal sector transaction volumes [20].

Electricity-based estimates for Uzbekistan's neighbouring states, drawing on Schneider's (2022) calculations, indicate that Kazakhstan's shadow economy accounted for 28.4 percent of GDP in 2022, and Kyrgyzstan's for 37.2 percent [2, 21]. For Uzbekistan, the electricity-based estimate stands at approximately 22.3 percent of GDP — a figure that, while lower than some regional comparators, remains substantially above thresholds consistent with sustainable development objectives.

4.3 The MIMIC Model: Structure and Application

The MIMIC (Multiple Indicators Multiple Causes) model is a structural equations model that treats the shadow economy as an unobserved latent variable. The model specifies two sets of relationships: causal variables (causes) — typically including the tax burden, the level of state regulation, the unemployment rate, and the index of economic freedom — and indicator variables (indicators) — typically comprising GDP growth, the employment rate, and the ratio of currency in circulation to broad money supply (M1/M2) [22].

In cross-national empirical applications covering 160 countries, the MIMIC model has demonstrated goodness-of-fit coefficients (R^2) in the range of 0.78–0.85, indicating strong model performance [23]. For transition economies such as Uzbekistan, appropriate variable selection and calibration are essential. The inclusion of institutional variables — degree of property rights protection, corruption indices, and measures of bureaucratic burden — has been shown to materially improve the model's predictive accuracy.

For application of the MIMIC model to Uzbekistan, the following causal variables are recommended: (1) tax burden (total tax revenues as a percentage of GDP); (2) labour market regulation (composite index of hiring and dismissal difficulty); (3) economic freedom index (based on Heritage Foundation data); (4) financial inclusion (degree of bank account penetration); and (5) institutional quality (based on World Bank Governance Indicators). As indicators, GDP growth rate, employment rate, and the M2 money supply aggregate are appropriate [24].

4.4 International Experience: Case Studies

The Italian case is particularly instructive. In the 1990s, the shadow economy in the southern regions of Italy constituted 30–35 percent of GDP. Following the implementation of an integrated methodology combining the MIMIC model with targeted tax auditing, this figure declined to approximately 22–25 percent by 2022 — a reduction of roughly 10 percentage points [25]. This experience demonstrates that a well-founded methodological framework has a direct and measurable impact on the effectiveness of public policy.

The Brazilian government, during the period 2003–2010, introduced a monitoring system integrating geospatial data with artificial intelligence algorithms within the framework of the Bolsa Familia programme, achieving a reduction in informal employment from 18 percent to 11 percent [26]. This case illustrates the considerable potential of combining modern technological tools with conventional methodological approaches.

South Korea pursued a systematic strategy to reduce the shadow economy through the expansion of electronic payment infrastructure from the early 2000s. Between 2001 and 2020, the informal sector's share of GDP declined from 27 percent to 19 percent — a reduction of 8 percentage points [27]. This outcome provides empirical support for the proposition that the development of digital financial infrastructure can serve as a decisive instrument in combating informality.

Estonia's experience is equally noteworthy. The introduction of a comprehensive e-governance system in the mid-2000s, including the full digitalization of tax administration, contributed to a decline in the shadow economy from approximately 30 percent to 17 percent of GDP, accompanied by a substantial increase in tax revenues [28].

Table 1. Comparative Assessment of Shadow Economy Estimation Methods

Method | Accuracy | Key Advantage | Key Limitation | Optimal Application

Direct Survey | Moderate | Sector-specific detail | Response bias | Local/sector studies

Currency Demand | Mod.–High | Relatively accessible | Data availability | Developing financial markets

Electricity Use | Moderate | Objective indicator | Energy intensity variation | Industry-intensive sectors

MIMIC Model | High | Broad cross-country coverage | Calibration complexity | Cross-national analysis

DGE Model | Very High | Dynamic system analysis | High technical skill required | Academic research

Source: Compiled by the author based on Schneider & Enste (2000, 2022) and Elgin & Oztunali (2012).

5. CONCLUSION AND RECOMMENDATIONS

The research conducted in this study yields the following principal scientific conclusions:

First, the absence of a universally applicable method for assessing the shadow economy is confirmed by the empirical and methodological evidence. Each approach offers distinct advantages under particular conditions: the MIMIC model is most suitable for broad cross-country comparison; the currency demand approach performs well in developing financial market contexts; and the electricity consumption method provides reasonable accuracy for industry-intensive sectors. It is therefore recommended that Uzbekistan adopt an integrated methodology combining the MIMIC model with the currency demand approach [29].

Second, the international evidence demonstrates unequivocally that reducing the shadow economy necessarily begins with its accurate measurement. The experiences of Italy, Brazil,

South Korea, and Estonia confirm that a robust methodological foundation directly enhances the effectiveness of public policy. Without reliable estimates of the shadow economy's magnitude, the design of targeted countermeasures is fundamentally compromised.

Third, the growing influence of the digital economy and cryptocurrency transactions is intensifying the limitations of conventional assessment methodologies. Transactions conducted through online platforms, gig economy arrangements, and cryptocurrency networks are largely invisible to traditional macroeconomic indicators. The development of new technology-driven approaches — big data analytics, artificial intelligence algorithms, and real-time monitoring systems — is therefore essential [16, 30].

On the basis of these findings, the following practical and scientific policy recommendations are advanced:

1. A dedicated unit for shadow economy monitoring should be established within the State Statistics Committee of the Republic of Uzbekistan, and an annual assessment system based on the MIMIC methodology should be introduced;

2. The system of incentives for formalizing informal activity should be strengthened through streamlined tax registration procedures and targeted tax relief for newly formalized businesses;

3. Targeted state policy aimed at reducing cash circulation through the expansion of electronic payment infrastructure and digital financial services should be continued and intensified;

4. Capacity-building programmes for domestic economists and statisticians in the application of MIMIC and DGE models should be developed, and technical cooperation with the IMF, World Bank, and OECD should be expanded;

5. A national methodological guideline for shadow economy assessment should be developed and institutionalized in alignment with OECD, IMF, and World Bank international standards;

6. A comparative regional research project on shadow economy measurement in collaboration with Central Asian partner countries should be initiated, with a view to constructing a shared regional database.

Promising directions for future research include: the application of artificial intelligence and big data technologies for real-time monitoring of shadow economic activity; the development, calibration, and prospective application of a nationally adapted MIMIC model for Uzbekistan; and the empirical examination, using panel data methods, of the relationship between digital transformation and informal sector dynamics in transition economies.

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Conceptualization, data curation, formal analysis, methodology, writing — original draft, writing — review & editing: Author Name. The author has read and agreed to the published version of the manuscript.

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CONFLICTS OF INTEREST

The author declares no conflict of interest.

DATA AVAILABILITY STATEMENT

Data supporting the reported results are available from public international databases cited in the references section. Datasets generated or analysed during the study are available from the corresponding author upon reasonable request.

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