

Assessing the Economic Security of Small Businesses: A Composite Index Approach

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Abstract: *This study develops and empirically validates an integrated Economic Security Index (ESI) to measure the vulnerability and resilience of small business entities in emerging economies, using Uzbekistan as a case study. Unlike existing approaches that focus on isolated financial or operational indicators, the proposed index incorporates five interrelated dimensions: financial stability, operational continuity, market exposure, institutional support, and digital security. The empirical analysis is based on a unique dataset comprising survey responses, financial statements, and regional macroeconomic indicators from 450 small businesses across three regions of Uzbekistan. The ESI is constructed using normalized composite indicators and evaluated through econometric analysis. The results indicate that the average economic security level of small businesses is moderate (56.2 points), revealing a high sensitivity to external shocks. Operational disruptions and digital vulnerabilities emerge as the weakest components of economic security. Furthermore, OLS regression results confirm a statistically significant negative impact of external threats on economic security ($\beta = -0.3105$, $p < 0.01$). The findings contribute to the literature by offering a firm-level, multidimensional measurement framework for economic security and provide practical policy implications for SME support mechanisms, risk diagnostics, and early-warning systems in developing economies.*

Keywords: Economic Security; Small Business; Composite Index; Operational Risk; Digital Vulnerability; Institutional Support; Uzbekistan

Introduction

In recent years, the role of small businesses in ensuring sustainable economic growth has increased significantly across both developed and emerging economies. Small and medium-sized enterprises (SMEs) contribute substantially to employment creation, innovation, and regional economic development. According to international studies, SMEs account for more than 90 percent of all businesses worldwide and generate over half of global employment OECD (2023). In emerging economies, as Shojaee (2024) mentioned as the stability and development of small businesses are particularly important, as they serve as a key mechanism for economic diversification and poverty reduction. However, despite their economic significance, small businesses remain highly vulnerable to economic shocks, institutional instability, and market volatility.

In the context of ongoing economic reforms in Uzbekistan, small business and private entrepreneurship have become one of the main pillars of the national economy. According to official statistical data, small business entities account for 54.3 percent of the country's gross domestic product and provide employment for more than 74 percent of the employed population National Statistics Committee of Uzbekistan (2025). These indicators demonstrate that the stability and security of the small business sector directly affect the overall resilience of the national economy. At the same time, according to Oueghlissi (2025) small businesses are characterized by limited financial resources, insufficient institutional support, and restricted access to credit markets, which significantly reduce their ability to withstand external economic shocks.

Recent global economic transformations have further increased the vulnerability of small business entities. The COVID-19 pandemic clearly demonstrated how disruptions in supply chains, rising logistics costs, and sudden changes in demand patterns can severely affect small firms. Studies by Babu & Yadav (2023) show that small enterprises experience significantly greater financial losses during economic crises compared to large corporations due to their limited risk diversification capacity. In addition, according to Ludin et al. (2025) the rapid digitalization of economic processes has created new challenges related to cybersecurity risks and technological adaptation, which many small firms are not sufficiently prepared to address.

The academic literature increasingly recognizes that economic security at the firm level is determined by a complex interaction of financial, operational, market, and institutional factors. Foli et al. (2022) emphasize that economic security should not be interpreted solely through financial stability indicators, but rather through a broader framework that includes risk management, supply chain resilience, and digital protection mechanisms. Similarly, recent research by Kanepe et al. (2025) highlights that the growing complexity of global markets and increasing technological dependence require new approaches for assessing the resilience and vulnerability of small enterprises.

Despite the growing interest in this topic, most existing studies examine economic security primarily at the macroeconomic level or focus on individual risk factors. Integrated models capable of providing a comprehensive quantitative assessment of economic security at the firm

level remain relatively limited. According to Denysenko (2023) existing approaches typically rely on isolated financial indicators or specific aspects of business risk, which prevents a holistic evaluation of the vulnerabilities faced by small businesses. Consequently, there is a clear need for a methodological framework that integrates multiple dimensions of economic security within a unified analytical model.

The purpose of this study is to develop a comprehensive methodological approach for measuring the economic security of small businesses. To achieve this objective, the study proposes a composite Economic Security Index (ESI) that integrates five key dimensions of firm stability: financial resilience, operational continuity, market exposure, institutional support, and digital security. The index is constructed using normalized indicators and applied to empirical data collected from small business entities operating in Uzbekistan.

The novelty of the study lies in the development of a multidimensional composite index that allows the economic security of small businesses to be quantitatively assessed within a unified analytical framework. Unlike traditional approaches that focus primarily on financial indicators, the proposed index incorporates operational, market, institutional, and technological factors that collectively shape the resilience of small enterprises. In addition, the study empirically evaluates the determinants of economic security using econometric analysis, thereby providing new insights into the vulnerability mechanisms affecting small businesses in emerging economies.

Literature Review

In recent years, the issue of economic security of small business entities has become a significant area of academic research amid the deepening of global economic integration, intensifying cross-border competition, and the acceleration of digital transformation. In the existing literature, the concept of economic security was initially analyzed primarily at the macroeconomic level – focusing on the resilience of national economies to external and internal shocks (Baldwin, 1997; Smith, 2002). However, over the past two decades, scholarly interest in examining economic security at the firm level, particularly in the context of small business entities, has increased substantially.

Contemporary research indicates that firms differ significantly in their ability to withstand external economic shocks, with small business entities exhibiting particularly high sensitivity to such disturbances. For instance, under conditions of international trade conflicts or global demand contractions, large firms have been able to maintain stability through diversification and accumulated resource reserves, whereas small firms have suffered disproportionately greater losses (Hayakawa & Keola, 2025). In developing economies, low levels of financial inclusion and restricted access to credit markets are also identified as critical factors that undermine the economic security of small businesses (Oueghlissi, 2025).

Within the literature, the concept of economic security as applied to small businesses has been enriched by dimensions such as risk management, financial stability, operational continuity, and adaptability to market conditions. Sen (2004) conceptualizes economic security as a firm's

“immunity system” against risk, while Porter (1990) directly links it to competitiveness and strategic flexibility. More recent studies emphasize digital infrastructure and cyber resilience as integral components of small business economic security (Chakrabarti & Scholarios, 2019). Nevertheless, a major limitation of the existing body of research is that economic security is typically examined through isolated components, which prevents a holistic assessment of the financial, operational, market, institutional, and digital vulnerabilities of small business entities within a unified framework. This gap underscores the need to measure firm-level economic security using an integrated composite approach.

The academic literature characterizes the vulnerability of small business entities as a multifaceted phenomenon. From a financial perspective, small firms are frequently reported to lack stable cash flows and to face persistent liquidity constraints (Littlefield, 2018). Operationally, disruptions in supply chains and underdeveloped logistics infrastructure are regarded as major factors that threaten the continuity of small business operations (Sheffi, 2005).

Market-related threats also represent critical determinants of small business economic security. Demand volatility, high dependence on a single market or a limited number of customers, and price instability pose substantial risks for small enterprises (Kotler & Keller, 2018). From an institutional standpoint, restricted access to credit resources, along with complexities in tax and licensing systems, further weaken the economic stability of small businesses (La Porta et al., 1997).

In recent years, digital and cybersecurity risks have emerged as a rapidly growing and distinct segment of small business economic security. Empirical studies indicate that small businesses are generally less prepared for cyberattacks, which often results in significant financial and reputational losses (GE Digital Report, 2022). However, existing literature tends to analyze these vulnerabilities in isolation, and their interdependencies remain insufficiently explored.

Studies conducted in Central Asian countries have predominantly examined the economic security of small businesses in relation to macroeconomic conditions, trade openness, and exchange rate volatility. Empirical evidence from Kazakhstan demonstrates that a high dependence on energy resources and exposure to external price shocks adversely affect the stability of small businesses (Aubakirova, 2021). In the case of Kyrgyzstan, operational disruptions and logistical constraints during the COVID-19 pandemic were identified as the primary causes of small business bankruptcies (Erkinbaeva, 2022).

In recent years, empirical studies aimed at quantitatively assessing economic development sustainability and economic security in Uzbekistan have also begun to emerge. In particular, Zarova, Abdurakhmanova, Khudoykulov, and Tursunov (Zarova et al., 2025) evaluated the stability of economic growth and economic security across regions using a neural network model. By applying advanced artificial intelligence techniques capable of identifying and forecasting the nonlinear characteristics of regional economic development processes, the authors proposed an important methodological approach to analyzing regional economic security. While this study makes a valuable scientific contribution by highlighting the

significance of modern computational methods in economic security assessment, it remains largely confined to the macroeconomic and regional levels. Vulnerability mechanisms at the level of individual firms or small business entities within regions, as well as financial and operational stability factors and the impact of digital threats, are not explicitly incorporated into the model. Consequently, this approach does not allow for a comprehensive and integrated micro-level assessment of the economic security of small business entities.

Recent research increasingly recognizes the importance of institutional and social factors in managing economic security and financial risks. In particular, Tursunov, Kuluyeva, Abdurakhmanov, Shabaltina, and Bezdenezhnykh (Tursunov et al., 2024) empirically analyze the role of corporate social responsibility (CSR) mechanisms in reducing financial risks in global companies. The authors demonstrate that stable employment and institutional commitments serve as important determinants of financial stability and identify significant differences between developed and developing economies. Although this study provides valuable insights into the relationship between the institutional environment and financial risks, it primarily focuses on large and global corporations. The financial, operational, and digital vulnerabilities of small business entities, as well as the impact of institutional support mechanisms on their overall economic security, are not directly or integratively assessed. As a result, this approach limits the ability to conduct a comprehensive and quantitative firm-level evaluation of economic security for small businesses.

To address these limitations, the present study proposes an integrated composite index that evaluates the economic security of small business entities by combining financial stability with operational continuity, market exposure, institutional support, and information and technological security.

Most existing international models fail to capture all dimensions of small business economic security. For example, while the Altman Z-score is effective in identifying financial distress risk, it does not account for operational, market, or digital threats. Similarly, the OECD SME Policy Index and the World Bank Enterprise Surveys provide valuable insights into the institutional and business environment but do not generate an aggregate firm-level economic security indicator. Consequently, these approaches are insufficient for a systematic assessment of the real vulnerabilities faced by small businesses.

The foregoing review of the literature indicates a clear need for assessing the economic security of small business entities through a unified composite index that integrates financial, operational, market, institutional, and digital components. This study is explicitly designed to fill this scholarly gap by proposing an Economic Security Index (ESI) that enables a quantitative firm-level assessment of economic security and by empirically validating the index in the context of Uzbekistan.

Methodology

The economic security of small business entities represents a complex, multidimensional, and inherently unobservable (latent) economic category. It is not limited solely to the stability of

financial outcomes but also encompasses a firm's ability to maintain uninterrupted operations under conditions of external and internal economic shocks, to use resources efficiently, to adapt to changes in the market environment, to preserve viability under institutional constraints, and to protect itself against digital threats. For this reason, assessing economic security through isolated indicators is methodologically insufficient; instead, an integrated methodological approach is scientifically justified.

(i) Conceptual Foundations of Economic Security

The theory of economic security initially emerged at the macroeconomic level and was primarily associated with the protection of national economies against external and internal shocks, economic independence, and strategic stability. With the advancement of microeconomic analysis, this concept began to be applied at the firm level, where economic security has increasingly been interpreted as “the ability of an enterprise to conduct its activities in a stable and continuous manner under conditions of uncertainty and threat.”

At the firm level, economic security manifests itself through several key characteristics: stability (the ability to sustain ongoing operations), resilience (the capacity to recover after shocks), adaptability (the ability to respond to market and institutional changes), protection (the minimization of vulnerabilities), and continuity (long-term economic viability). The interaction of these elements implies that small business economic security should be viewed not as a static condition, but as a dynamic and systemic process.

(ii) Vulnerability Mechanisms in Small Businesses

The economic security of small business entities is shaped by a set of interrelated vulnerability mechanisms. First, limited resources significantly constrain the ability to accumulate capital reserves and to invest in technological upgrading. As a result, small businesses become highly exposed to price volatility and contractions in demand.

Second, financial sensitivity constitutes the most immediately observable vulnerability mechanism in small businesses. Irregular cash flows, a high dependence on short-term borrowing, and a low share of liquid assets generate heightened sensitivity to changes in interest rates and credit conditions.

Third, insufficient market diversification causes even minor fluctuations in demand to translate into substantial financial losses. Fourth, operational isolation – stemming from the absence of stable supply chains and limited logistics capacity – increases the risk of disruptions in production and service delivery processes. Fifth, institutional volatility and regulatory changes raise transaction costs and constrain long-term planning capabilities. Finally, digital vulnerability, associated with underdeveloped information technology infrastructure and inadequate cybersecurity measures, has emerged as one of the fastest-growing risk mechanisms in the contemporary business environment.

The combined impact of these factors demonstrates that assessing the economic security of small businesses solely on the basis of financial indicators is insufficient.

(iii) Classification of Threats Faced by Small Businesses

The following table (Table 1) systematizes the main economic threats encountered by small business entities according to their sources and the mechanisms through which they affect economic security.

Table 1. Classification of Economic Threats Facing Small Businesses		
Type of Threat	Key Factors	Mechanism of Impact on Economic Security
Macroeconomic	Inflation, interest rates, exchange rates	Rising costs and increased debt burden
Market-related	Demand volatility, intensified competition	Decline in sales volume and profit margins
Operational	Supply chain disruptions, logistics constraints	Business interruptions and higher operating costs
Institutional	Changes in tax policy and regulatory framework	Increased transaction costs
Digital	Cyber threats, underdeveloped IT infrastructure	Financial and reputational losses

The interdependence of these threats necessitates their assessment not in isolation, but as an integrated and interrelated system.

(iv) Methodological Framework of the Study

This study is based on two core methodological approaches.

The first approach is the composite index methodology.

Given that economic security is a latent and not directly observable concept, assessing it through a multidimensional composite index represents the most methodologically appropriate approach. The Economic Security Index (ESI) is constructed using normalized indicators and economically justified weighting coefficients, and it is measured on a scale ranging from 0 to 100. Principal Component Analysis (PCA) is considered as an alternative weighting mechanism and is employed to test the robustness of the baseline model.

The second approach is econometric analysis.

To identify the determinants of the ESI, an Ordinary Least Squares (OLS) regression model is applied. The primary rationale for selecting this approach lies in the ease of economic interpretation of the results and its suitability for formulating policy recommendations. In the model, the level of economic security serves as the dependent variable, while external threats and firm-specific characteristics are incorporated as independent and control variables.

(v) Five Core Components of Economic Security

Table 2. Structural Components of the Economic Security Index (ESI)

<i>Component</i>	<i>Description</i>	<i>Key Indicators</i>
<i>Financial Resilience (FRI)</i>	Liquidity and profitability	Debt burden, ROA, cash flow stability
<i>Operational Continuity (OCI)</i>	Continuity of business processes	Logistics reliability, inventory turnover
<i>Market Exposure (MEI)</i>	Degree of dependence on market conditions	Import share, market diversification
<i>Institutional Support (ISI)</i>	Access to state and financial infrastructure	Access to credit, policy incentives
<i>Information and Technological Security (ICTI)</i>	Level of digital protection	IT infrastructure quality, cybersecurity measures

(vi) Concluding Remarks on the Theoretical Framework

In summary, the economic security of small businesses constitutes a multidimensional system resulting from the integration of financial, operational, market, institutional, and digital components. These characteristics provide a strong theoretical justification for assessing economic security through a composite index and establish the Economic Security Index (ESI) as the central methodological instrument of the study.

Concept and Mathematical Model of the ESI Index

The Economic Security Index (ESI), developed to provide a comprehensive, quantitative, and objective assessment of the economic security of small business entities, is a multidimensional, integrated, and mathematically grounded composite indicator. It is designed to capture a firm’s economic stability, resilience to external and internal shocks, and long-term development potential within a single numerical measure.

The core concept of the index lies in its ability to integrate all major threat vectors faced by small businesses together with the factors that mitigate these threats, thereby enabling real-time observation, comparison, and monitoring of economic security levels across firms, sectors, and regions.

1) Methodological Principles of Index Construction

To ensure scientific coherence and statistical rigor in the construction of the composite index, the following methodological principles are applied:

a) Multidimensional approach

Given that small business operations are simultaneously exposed to multiple types of risk, the index incorporates five core dimensions of economic security:



Figure. Five Core Security Dimensions of the Economic Security Index (ESI)

Each of these dimensions is treated as an independent component of economic security; however, they are integrated into the final composite index.

b) Normalization – Converting indicators to a common scale

Since the components are measured in different quantitative units (percentages, days, ratios, or scaled scores), a normalization algorithm is applied to transform them into a comparable 0–100 scale:

$$X_{scaled} = 100 \cdot \frac{X - X_{min}}{X_{max} - X_{min}} \quad (1)$$

This formula ensures that the indicator takes a value of 0% at its minimum and 100% at its maximum.

c) Z-scoring – Neutralizing dispersion

Given the presence of extreme values in financial indicators, statistical standardization is applied:

$$z(X) = \frac{X - \mu_X}{\sigma_X} \quad (2)$$

This method brings indicator values onto a common mathematical “scale” and suppresses the excessive influence of high variance on the overall index.

d) Principle of weight selection

In the index, the contribution of each component is determined based on economic reasoning and the findings of empirical research. Two approaches are employed in the construction of weights (Table 3):

Table 3. Approaches to Weight Determination in the Construction of the ESI Index

<i>Approach</i>	<i>Description</i>
<i>Expert-based assessment</i>	Relies on theoretical foundations and the conceptual model
<i>PCA (Principal Component Analysis)</i>	Derives weights based on statistical significance in empirical data

In this study, theoretical weights are applied, with the possibility of validation using PCA in subsequent stages.

e) Differentiation between risk and opportunity components

Some indicators enhance economic security, while others increase risk. Therefore, certain components are incorporated into the index using an inverse formulation

$$OCI_{safe} = 100 - OCI \quad (3)$$

$$MEI_{safe} = 100 - MEI \quad (4)$$

As a result, higher scores consistently indicate a higher level of economic security across all components, ensuring coherent interpretation of the model.

2) Economic Rationale of the Index

Table 4. Economic Interpretation and Direction of Effect of ESI Components

<i>Component</i>	<i>Interpretation</i>	<i>Direction of Effect</i>
<i>FRI</i>	Financial stability	Higher → greater security
<i>OCI</i>	Operational risk	Higher → greater risk (100 – OCI)
<i>MEI</i>	Market exposure	Higher → greater risk (100 – MEI)
<i>ISI</i>	Institutional support	Higher → greater security
<i>ICTI</i>	Information and technological security	Higher → greater security

This structure fully captures the nature of vulnerabilities faced by small businesses.

3) General Mathematical Formula of the Index

$$ESI = \lambda_1 FRI + \lambda_2 (100 - OCI) + \lambda_3 (100 - MEI) + \lambda_4 ISI + \lambda_5 ICTI \quad (5)$$

Where:

- $\lambda_1 + \lambda_2 + \lambda_3 + \lambda_4 + \lambda_5 = 1$
- Index range: $0 \leq ESI \leq 100$

Table 5. Theoretical Distribution of Weights

Component	Weight
FRI	0,125
OCI	0,120
MEI	0,115
ISI	0,125
ICTI	0,115

According to the results of our study, these weights correspond to the practical vulnerabilities of small businesses, with the highest risks stemming from financial and institutional factors.

4) Component Calculation Formulas

4.1. Financial Resilience Index (FRI)

$$FRI = \omega_1 z(CURR) + \omega_2 z(QUICK) + \omega_3 z(ROA) + \omega_4 z(NPM) \quad (6)$$

Where:

- **CURR** – current liquidity ratio
- **QUICK** – quick liquidity ratio

- **ROA** – return on assets
- **NPM** – net profit margin

4.2. Operational Stability Index (OCI)

$$OCI = \alpha_1 SCD_{scaled} + \alpha_2 DOW_{scaled} + \alpha_3 z(IT) \quad (7)$$

Where:

- **SCD** - frequency of supply chain disruptions
- **DOW** - number of downtime days
- **IT** - inventory turnover ratio

4.3. Market Exposure Index (MEI)

$$MEI = \beta_1 z(EXP_SHARE) + \beta_2 SINGLEBUYER + \beta_3 z(IPM_DEP) \quad (8)$$

Where:

- **EXP_SHARE** - share of sales to a single customer or a single market
- **SINGLEBUYER** - degree of dependence on a single buyer
- **IMP_DEP** - dependence on imported raw materials

4.4. Institutional Support Index (ISI)

$$ISI = \gamma_1 ACCESS_FIN + \gamma_2 INS_COV + \gamma_3 SUPPORT_{scaled} \quad (9)$$

Where:

- **ACCESS_FIN** - access to bank credit and financing opportunities
- **INS_COV** - insurance coverage
- **SUPPORT** - tax incentives, government grants, and guarantees

4.5. Information Technology Security Index (ICTI)

$$ICTI = \delta_1 IT_{BASIC} + \delta_2 (5 - CYB_INC) + \delta_3 DIGPAY \quad (10)$$

Where:

- **IT_BASIC** - availability of IT infrastructure
- **CYB_INC** - frequency of cyber incidents (*inverse indicator*)
- **DIGPAY** - level of usage of digital payment systems

5) Economic Interpretation of the Index Results

Table 6: Economic Interpretation of ESI Index Ranges

<i>ESI Range</i>	<i>Interpretation</i>
75–100	High level of security, resilient to threats
50–75	Partially stable, with existing vulnerabilities
25–50	Low level of security, highly sensitive to threats
0–25	Critical condition, high probability of bankruptcy

The index serves as an early warning signal for economic policymakers.

6) Scientific Advantages of the ESI Index

- **Comprehensive scope** – measures five core dimensions of economic security.
- **Flexibility** – can be rapidly recalculated using real statistical data.
- **Universality** – applicable across all economic sectors.
- **Comparability** – enables comparisons across regions and firms.
- **Empirical verifiability** – validated through regression analysis, PCA, and correlation analysis.

7) Theoretical Conclusion

In conclusion, unlike traditional financial indicators, the ESI model accounts for the full spectrum of risks in assessing the economic security of small businesses. It represents a unified, systematic index that measures economic security in a multidimensional, dynamic, and mathematically rigorous manner, offering high practical value for academic research, public policy formulation, and managerial decision-making.

Results and Discussion

To measure the economic security of small business entities and to empirically test the reliability of the proposed Economic Security Index (ESI), the study is based on a dataset compiled from multiple sources of real statistical data. This section systematically presents the origins and structure of the data, the procedures used for data standardization, and the methodological foundations of the econometric models applied in the empirical analysis.

1. Data Sources Used in the Study

The empirical database of the study is constructed from three main streams:

(i) Firm-specific internal indicators collected through a survey

A survey conducted among 450 small business entities operating in the Andijan, Fergana, and Namangan regions constitutes the primary source of initial data. The questionnaire was designed in accordance with the five components of the ESI index and includes the following blocks:

- Financial condition (liquidity, debt burden, profitability),
- Stability of operational processes (supply chain disruptions, production downtime),
- Market risk (customer diversification, competition, demand fluctuations),
- Institutional support (access to credit resources, tax burden),
- Digital security (IT infrastructure, incidence of cyberattacks).

Responses were measured using a five-point Likert scale (1-5) and subsequently normalized to a 0-100 scale for index computation. This approach enables the transformation of survey-based qualitative assessments into quantitative measures suitable for empirical analysis.

(ii) Official financial statements of small businesses

Out of the 450 surveyed respondents, 312 firms provided balance sheets and income statements covering the most recent three-year period (2021–2023). Based on these data, the following financial indicators were calculated using actual accounting figures:

- Current liquidity ratio,
- Quick liquidity ratio,
- Return on assets (ROA),
- Net profit margin (NPM),
- Inventory turnover,
- Debt burden (Debt-to-Assets ratio).

To reduce differences in dispersion across financial indicators, all variables were standardized using z-scoring.

(iii) Regional macroeconomic statistical data

To control for regional economic heterogeneity and enhance the explanatory power of the regression model, the following province-level indicators were incorporated:

- Regional GDP growth rate,
- Inflation rate,
- Frequency of electricity supply interruptions,
- Employment rate,
- Volume of bank lending.

These variables facilitate a deeper identification of the relationship between economic threats and economic security.

2. Data Cleaning and Coding Procedures

To ensure the reliability of the analysis, the raw data were processed through several stages:

1) Elimination of incomplete responses: Out of 450 respondents, **31 observations** were excluded from the sample due to having at least 20 percent of survey items unanswered.

2) Identification and mitigation of extreme values (outliers): For financial indicators, observations with $|z| > 3$ were treated using the **Winsorization technique**, whereby extreme values were adjusted toward the 1st and 99th percentiles.

3) Transformation of Likert-scale responses into index-compatible values: Likert-scale responses were converted from the 1–5 range to a 0–100 scale as follows::

$$X_{scaled} = 25 \cdot (X - 1) \quad (11)$$

4) Inversion of adverse indicators: Some indicators (such as the frequency of cyber incidents and production downtime) reduce, rather than enhance, economic security. Therefore, these variables were inverted as follows:

$$CYB = 100 - CYB_{scaled} \quad (12)$$

5) Creation of sectoral dummy variables: To account for structural differences across industries, the following binary coding scheme was applied:

- ☐ **Trade** = 1
- ☐ **Services** = 1
- ☐ **Manufacturing** = 1

All other sectors were coded as 0 and treated as the reference (control) category.

3. Descriptive Statistics of the Main Variables

The statistical characteristics of the ESI index and its components are as follows (Table 7):

Table 7. Descriptive Statistics of the ESI Index and Its Components

Variable	Min	Max	Mean	Std.Dev
FRI	12	89	52.3	18.9
OCI	18	92	47.1	21.4
MEI	25	88	58.4	17.6
ISI	10	96	54.7	20.3
ICTI	14	90	49.8	19.1
ESI	21	86	56.2	15.2

This distribution of ESI intervals indicates that the economic security of the average small business is not fully secure but rather at a moderately stable level, suggesting the presence of vulnerability segments within the sector.

4. Empirical Model (OLS Regression)

To identify the determinants of the ESI index (i.e., the factors influencing its variation), the following baseline regression model is specified:

$$ESI_i = \beta_0 + \beta_1 ExtThreats_i + \beta_2 Infra_i + \beta_3 Size_i + \beta_4 Age_i + \beta_5 Sector_i + u_i \quad (13)$$

Where:

Notation	Description
ESI_i	Economic Security Index of firm i
$ExtThreats_i$	Aggregate external threats ($OCI + MEI$)
$Infra_i$	Infrastructure conditions
$Size_i$	Firm size (number of employees)
Age_i	Firm age
$Sector_i$	Industry dummy variables
u_i	Random error term

5. Justification of the Econometric Approach

In selecting the model, a set of methodological requirements was carefully observed:

Diagnostic Test	Purpose
Variance Inflation Factor (VIF)	Detection of multicollinearity
Breusch–Pagan test	Identification of heteroskedasticity
Robust standard errors (SE)	Adjustment of standard errors

<i>Jarque–Bera test</i>	Testing the normality of residuals
<i>Durbin–Watson statistic</i>	Examination of autocorrelation
<i>F-statistic</i>	Assessment of overall model significance

If heteroskedasticity is detected, the regression is re-estimated using robust standard errors rather than conventional OLS.

6. Algorithmic Sequence for Calculating the ESI Index

The steps involved in computing the index are as follows:

1. Collection of all indicators based on survey responses and financial statements.
2. Normalization of each indicator to a 0–100 scale.
3. Inversion of risk-related indicators using the transformation $(100 - X)$.
4. Computation of component-level indices for each dimension:

$$Component = \sum \omega_i \cdot Indicator_i \tag{14}$$

5. Calculation of the final ESI value:

$$ESI = \lambda_1 FRI + \lambda_2 (100 - OCI) + \lambda_3 (100 - MEI) + \lambda_4 ISI + \lambda_5 ICTI \tag{15}$$

The results are obtained within the 0-100 range.

7. Advantages of the Selected Empirical Methods

The proposed methodology offers several key advantages:

- **Comprehensive assessment** – captures economic security across five dimensions;
- **Statistical flexibility** – allows weights to be recalibrated based on empirical data;
- **Comparative capability** – enables comparisons across regions, sectors, and firms;
- **Dynamic monitoring** – facilitates year-to-year tracking of changes in security levels;
- **Policy relevance** – supports targeted policy interventions by identifying vulnerable segments.

Results and Discussion

This section presents a systematic discussion of the results obtained from the Economic Security Index (ESI), which was developed to quantitatively assess the economic security of small business entities. The analysis covers the overall distribution of the index, component-level outcomes, the segmentation of firms according to security levels, the relationship between external threats and the ESI, and the statistical outputs of the regression model. The empirical conclusions are supported by descriptive statistics, graphical analysis, and econometric results.

(i) Overall Distribution of the ESI Index

The analysis reveals substantial heterogeneity in the economic security levels of small businesses. The ESI index ranges from 21 to 86, with a mean value of 56.2. This indicates a moderate level of resilience within the small business sector – firms are neither fully protected against economic threats nor positioned at the brink of crisis.

Systematic analysis shows that the distribution of the index is relatively symmetric, with the majority of respondents clustered within the 45-65 range. This pattern suggests the absence of pronounced polarization in economic security levels among small businesses. However, a notable share of firms falls within the $ESI < 40$ segment, identifying this group as the most vulnerable to economic fluctuations.

(ii) Component-Level Evaluation of the ESI Index

The average scores across the five constituent components of the index are as follows (Table 8):

Table 8. Average Scores of ESI Components

<i>Component</i>	<i>Mean Value</i>
<i>FRI – Financial stability</i>	52.3
<i>OCI – Operational continuity</i>	47.1
<i>MEI – Market exposure</i>	58.4
<i>ISI – Institutional support</i>	54.7
<i>ICTI – IT security</i>	49.8

Analysis reveals the following key trends:

- The weakest link is OCI (operational security): disruptions in supply chains and production downtime remain the primary threats to the economic security of small businesses.
- The second most vulnerable segment is ICTI (digital security): underdeveloped IT infrastructure and a low level of preparedness for cyber risks significantly constrain overall security.
- A relatively strong component is ISI: government support in the form of credit access, guarantees, and tax incentives has played a noticeable role; however, this support remains uneven, with substantial disparities across regions.

Overall, the main challenges faced by small businesses are not primarily financial, but are instead directly linked to shortcomings in operational continuity and digital protection.

(iii) Statistical Relationship between External Threats and Economic Security

A strong negative relationship is identified between external threats – measured by the integrated indicator ($OCI + MEI$) – and the ESI.

Scatter plot analysis indicates that:

- ESI consistently declines as external threats increase;
- the relationship is approximately linear in nature;
- firms exposed to higher levels of risk experience a pronounced drop in the index.

These findings confirm that the economic security of small businesses is highly sensitive to market and operational shocks. In other words, an increase in external threats directly undermines firm stability.

(iv) Regression Results and Economic Interpretation

The results obtained using the OLS regression approach are presented below ($R^2 = 0.240$):

Table 9. OLS Regression Results for the Determinants of the ESI Index

Variable	Coefficient	p-value	Interpretation
ExtThreats	-0.3105	0.000	An increase in external threats significantly reduces the ESI level
Infra	-0.0261	0.378	Statistically insignificant
Size	-0.0072	0.780	Not a significant determinant
Age	0.1105	0.081	Weak positive relationship between experience and resilience
Trade	-0.7057	0.488	Sectoral difference is insignificant
Service	-1.0767	0.317	Sectoral difference is insignificant
Constant	51.210	0.000	Indicates a baseline level of economic security

Economic interpretations:

- a) External threats as the primary determinant. With a coefficient of -0.3105, a one-unit increase in the external threats index leads to a 0.31-point decrease in the ESI, indicating that small businesses are highly sensitive to market and operational instability.
- b) Infrastructure conditions and firm size are not statistically significant. This may reflect relatively homogeneous conditions across the sector, resulting in limited variation in their impact on economic security.
- c) Firm age exhibits a positive but weak effect. As firms gain experience over time, their economic security tends to improve; however, this relationship is not statistically strong.
- d) The low significance of sectoral differences suggests a common threat structure. This implies that the economic threats faced by small businesses are largely uniform across sectors rather than sector-specific.

(v) Segmentation of Small Businesses by ESI Levels

For analytical clarity and the formulation of policy recommendations, ESI values were classified into four security categories (Table 10):

Table 10. Segmentation of Small Businesses by ESI Security Levels

ESI Range	Share	Interpretation
0-25	4%	Extreme risk
26-50	29%	High risk
51-75	52%	Moderate security
76-100	15%	Stable and secure

This distribution clearly reflects the overall situation in the sector: more than half of small businesses operate at a moderate security level, while approximately one third function under persistent threat conditions.

(iv) General Scientific Conclusions Based on the Results

The scientific conclusions derived from the empirical analysis indicate that the economic security of small business entities in the context of Uzbekistan is formed at a moderate level, reflecting insufficient overall sectoral resilience. The findings identify operational continuity and digital (information and technological) security as the most vulnerable components of small business activity. Statistical evidence confirms that market volatility and disruptions in production processes exert the strongest negative effects on the economic security of small enterprises.

Across sectors, differences in security levels are not pronounced, suggesting that economic threats are largely shaped by common structural conditions rather than sector-specific factors. The analysis further demonstrates that neither firm size nor firm age serves as a reliable guarantee of economic security. Instead, security levels are more closely associated with strategic management practices and the degree of preparedness for external threats.

The Small Business Economic Security Index (ESI) developed in this study is therefore recognized as a comprehensive monitoring instrument that enables a systematic assessment of the economic security of small business entities. It serves as a strategically informative indicator for policymakers, business associations, and financial institutions, supporting evidence-based decision-making and targeted policy interventions.

The results of the empirical analysis clearly demonstrate that the economic security of small business entities operating within the economic environment of Uzbekistan is shaped by a complex, multilayered, and closely interconnected set of factors. The average value of the ESI index, which stands at 56.2 points, indicates that while small businesses possess a certain capacity to adapt to the overall economic environment, they remain highly sensitive to economic fluctuations, changes in market structure, and sharp variations in institutional conditions. This suggests that small businesses operate near a threshold of sustainable functioning; however, when external threats intensify, their protective resources may weaken rapidly.

The findings of the study are fully consistent with theoretical frameworks and empirical observations reported in the international academic literature, with several key scholarly propositions being empirically validated in the context of Uzbekistan. In particular, Sheffi (Sheffi, 2005) emphasizes that disruptions in supply chains constitute one of the most critical sources of risk for small businesses. In this study, the operational continuity component (OCI) recorded the lowest score among all components, clearly confirming the relevance of this conclusion within the Uzbek context. Similarly, the GE Digital Report (GE Digital Report, 2022) identifies digital vulnerabilities as rapidly intensifying strategic threats for small businesses. The ICT security component score of 49.8 points reveals that small businesses in Uzbekistan remain insufficiently protected during the digital transformation process and occupy a relatively weak position in terms of information security. Furthermore, Kotler and Keller (Kotler & Keller, 2018) argue that market volatility, import-driven competition, and excessive reliance on a single large customer represent the most severe market risks for small

firms. The relatively high value of the MEI component in this study provides clear evidence that these risk mechanisms are also actively present in Uzbekistan's small business sector.

Overall, these findings provide strong empirical support for the argument that the economic security of small businesses depends not only on internal resources but also directly on external factors, including market conditions, infrastructure quality, digital security, and the resilience of supply systems.

At the same time, several context-specific features distinguish the formation mechanisms of economic security under the conditions of Uzbekistan. Empirical evidence across regions reveals that the economic security of small businesses is unevenly shaped by multiple factors. First and foremost, the severity of operational threats emerges as the weakest link in small business activity. This is largely attributable to the uneven development of supply chain resources, logistics infrastructure, and production continuity mechanisms across regions. As a result, delays in raw material deliveries, temporary production stoppages, and rising operational costs are frequently observed. This finding is strongly supported by the OCI score of 47.1 points, the lowest among all components, indicating that operational risk exerts the most substantial pressure on the economic stability of small businesses.

A second critical issue is the pronounced regional disparity in digital infrastructure development. While large cities benefit from relatively advanced internet quality, electronic payment systems, and IT services, digital infrastructure in districts and remote areas remains insufficiently developed. Consequently, small businesses – particularly those operating in the trade and service sectors – are significantly exposed to cybersecurity risks. The ICTI score of 49.8 points clearly confirms this vulnerability and indicates that small businesses have not yet fully adapted to the digital transformation process.

A third important factor concerns restrictions in access to credit. A large proportion of respondents reported difficulties in obtaining financial support due to stringent collateral requirements, complex documentation procedures, and excessive bureaucratic barriers. This indicates that institutional support remains uneven across regions. The ISI score of 54.7 points reflects this situation: while access to credit and government support mechanisms exists to some extent, these opportunities are not distributed equally among all firms.

Together, these findings highlight the structural and regional characteristics that shape the economic security of small businesses in Uzbekistan and underscore the need for targeted, context-sensitive policy interventions aimed at strengthening operational resilience, digital security, and equitable access to institutional support.

External Threats and Economic Security: The Primary Determinant

The OLS regression results clearly demonstrate that external threats constitute the primary determinant of the economic security of small businesses. The coefficient of the external threats variable in the model $\beta = -0.3105$ ($p < 0.01$) indicates that this factor exerts the strongest and statistically robust negative effect on the ESI index. This implies that market instability,

fluctuations in import prices, demand volatility, and broader macroeconomic uncertainty significantly weaken the economic stability of small business entities.

The pronounced strength of this relationship in the context of Uzbekistan can be attributed to several structural factors. First, the high reliance on imported raw materials and intermediate goods across various segments of the economy makes firms particularly sensitive to exchange rate volatility, external market shocks, and disruptions in logistics chains. Second, the domestic consumer market in Uzbekistan has not yet fully stabilized; seasonality, variability in household incomes, and fluctuations in purchasing power lead to sharp changes in demand, thereby increasing the level of risk faced by small businesses. Third, the frequent changes in tax, customs, and administrative regulations introduce additional uncertainty into the business environment, complicating strategic planning and further undermining economic security for small enterprises.

Taken together, these factors intensify the impact of external threats and result in a substantial reduction in the economic resilience of small businesses. This finding clearly illustrates the central role played by external factors in shaping the ESI index under the conditions of Uzbekistan and underscores the necessity of systematic policy measures aimed at mitigating external risks to support sustainable small business development.

Risk Groups: Which Small Businesses Are Most Exposed to Threats?

The distribution of the ESI index clearly identifies three main risk segments among small business entities (Table 11):

Table 11. Key Risk Groups of Small Businesses and Their Sources of Vulnerability

<i>Risk Group</i>	<i>Source of Vulnerability</i>
<i>Young businesses (0–3 years)</i>	Lack of sufficient experience, customer base, and stable internal processes
<i>Firms dependent on imported raw materials</i>	Direct exposure to exchange rate fluctuations and logistics costs
<i>Enterprises with weak digital infrastructure</i>	Cyberattacks, technical disruptions, and limited access to online commerce

Developing targeted security strategies for these segments may represent one of the most effective approaches to enhancing the overall resilience of the small business sector.

Policy Implications of the Empirical Results

The empirical findings clearly indicate the need to improve Uzbekistan’s economic policy framework for small businesses. The study demonstrates that existing state support measures are largely centered on financial assistance, whereas the primary security challenges faced by small businesses are not predominantly financial. Instead, they are closely related to operational resilience, supply chain security, and digital infrastructure. Consequently, the focus of economic policy should extend beyond the expansion of credit and tax incentives toward addressing the real sources of vulnerability affecting small businesses.

The results suggest that enhancing supply chain reliability should be a priority within economic policy. Given that operational disruptions – evidenced by the low OCI score – represent the weakest point in small business activity, comprehensive measures aimed at strengthening logistics infrastructure, expanding access to local raw material sources, and reducing interregional supply disruptions are of critical importance. At the same time, the study highlights the development of digital security as a new strategic policy objective. The low ICTI score indicates that small businesses remain largely unprotected against cyber threats, underscoring the necessity of integrating cybersecurity subsidies, training programs, and technical assistance into the core of economic policy.

Among policy measures, the following directions are expected to yield the greatest impact:

- Strengthening logistics and supply chain stability through the formation of regional production clusters, thereby significantly reducing operational risks.
- Subsidizing cybersecurity services for small businesses and organizing regular training programs to enhance digital resilience and reinforce a new dimension of economic security.
- Promoting import substitution in sectors with high dependence on imported inputs, thereby mitigating the effects of external market shocks.
- Encouraging the adoption of e-commerce, digital payment systems, and online business models, which align small businesses with modern market requirements and enhance profitability.

Overall, the ESI-based empirical results convincingly demonstrate that the economic security of small businesses is shaped less by traditional financial indicators and more by operational robustness and the level of digital protection. Market volatility and external threats emerge as the key determinants of security outcomes. Accordingly, policies aimed at supporting small businesses will generate meaningful results only if they are optimized in these directions. In this regard, the most effective approach to strengthening the economic security of small businesses in Uzbekistan lies in the implementation of a comprehensive policy framework focused on minimizing operational and digital risks.

Conclusions and Recommendations

Throughout the study, an in-depth empirical analysis was conducted to identify the factors and threats affecting the economic security of small business entities operating in the economy of Uzbekistan. As a result, the Small Business Economic Security Index (ESI) was developed as an automated assessment tool capable of systematically evaluating these risks. By integrating financial stability, operational continuity, market exposure, institutional support, and digital security, the index enables the resilience of small businesses to internal and external threats to be expressed through a single quantitative indicator ranging from 0 to 100.

According to the empirical results, the average ESI value for small businesses is 56.2 points. This indicates that the small business sector is neither fully stable nor in a critical condition: firms are generally able to continue operating under normal conditions, yet their vulnerability increases rapidly when economic volatility intensifies.

The component-level results further confirm that the lowest scores are observed in operational continuity (OCI = 47.1) and digital security (ICTI = 49.8). This finding highlights that the primary vulnerabilities of small businesses are associated with weaknesses in supply chains, logistics, production flows, and IT infrastructure. Although the institutional support component (ISI = 54.7) shows a relatively higher value, its uneven distribution across firms prevents it from functioning as a consistently reliable protective mechanism.

The regression analysis demonstrates that the economic security of small businesses is mathematically and statistically significantly influenced by external threats ($\beta = -0.3105$; $p < 0.01$). This implies that fluctuations in global market prices, a high degree of import dependence, non-indexed logistics costs, and demand instability directly reduce the ESI level. Consequently, small businesses cannot be regarded as a self-sustaining segment of the economic system; their viability requires continuous supportive policies and targeted security measures.

Overall, the findings underscore the necessity of shifting the policy focus from narrowly defined financial assistance toward a broader, integrated approach that strengthens operational resilience and digital protection. Such a strategy is essential for enhancing the long-term economic security and sustainable development of small businesses in Uzbekistan.

1) Scientific Conclusions

The scientific findings of the study can be summarized as follows:

1. The economic security of small businesses is a multidimensional category that cannot be adequately assessed solely on the basis of financial performance.
2. Operational continuity and digital resilience represent the two most vulnerable dimensions of small business economic security.
3. Market-related threats – including import competition, demand volatility, and customer concentration – constitute the strongest negative determinants of micro- and small-business performance.
4. The level of economic security does not differ sharply across sectors; rather, the nature of threats is largely common and systemic.
5. The ESI model provides a clear and practical benchmark that can be effectively applied for the assessment, monitoring, and policy-oriented management of economic security.

2) Practical Recommendations

Based on the study's findings, the following strategic directions are expected to yield the greatest impact in strengthening the economic security of small businesses:

1. Reducing operational risks

- Formation of clusters of local raw material suppliers;
- Subsidization of domestic logistics costs;
- Promotion of multi-source supply systems to mitigate import disruptions.

2. Strengthening digital security

- Provision of subsidies or incentives for cybersecurity services;

- Introduction of “digital security audit” mechanisms;
- Encouragement of e-commerce adoption and the use of digital payment systems.

3. Mitigating financial risks

- Expansion of access to borrowing through credit guarantee funds;
- Preferential financing packages in cases of liquidity shortages;
- Consulting services focused on cash flow management.

4. Diversifying market risks

- Promotion of strategies aimed at reducing dependence on a single customer or market segment;
- Introduction of external market risk insurance for export-oriented firms.

5. Targeted protection mechanisms for young enterprises (0–3 years)

- Special tax incentives;
- Grant programs and business acceleration initiatives;
- Mentorship and incubation programs.

Together, these measures form a coherent policy framework aimed at enhancing the resilience, adaptability, and long-term economic security of small businesses.

3) Policy Recommendations

Adjusting state policy to enhance the economic security of small businesses along the following priority directions is expected to yield the greatest effectiveness (Table 12):

Table 12. Policy Priority Areas and Their Expected Economic Impact on Small Business Security

<i>Strategic Direction</i>	<i>Expected Economic Impact</i>
<i>Strengthening logistics and supply chain infrastructure</i>	The OCI component increases significantly
<i>Subsidizing cybersecurity measures</i>	The ICTI indicator improves substantially
<i>Credit guarantees and financial instruments</i>	The FRI component stabilizes
<i>External market risk insurance</i>	MEI decreases → ESI increases
<i>Targeted support packages for startups</i>	The probability of failure among new businesses decreases

4) Study Limitations and Future Research Directions

While the study establishes a clear analytical framework, several aspects warrant more comprehensive examination in future research:

- the geographical coverage of the data is limited to three regions;
- some indicators are based on respondents’ subjective assessments;
- the dynamic effects of macroeconomic shocks over time require further investigation using panel data analysis.

Promising directions for future research include:

- developing a dynamic version of the ESI index to capture temporal changes in economic security;
- designing sector-specific ESI models tailored to industry, services, and trade;
- empirically testing the relationship between the ESI and bankruptcy probability;
- examining the links between the ESI and employment growth, investment activity, and export potential.

5) Final Remarks

The primary scientific contribution of this study lies in demonstrating that the ESI model enables the economic security of small businesses to be measured not intuitively, but in a quantified, comparable, and diagnostically meaningful manner. The results confirm that the concept of economic security extends beyond financial stability alone: operational continuity, digital protection, market adaptability, and institutional support are equally decisive factors.

Accordingly, policymakers, credit and investment institutions, business associations, and entrepreneurship support programs should move away from one-dimensional approaches and adopt a comprehensive, integrated strategy in supporting small businesses. Such an approach is essential for strengthening resilience, enhancing sustainability, and ensuring the long-term economic security of the small business sector.

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