MANAGING ENTERPRISE ECONOMIC BEHAVIOR IN A TURBULENT DIGITAL ENVIRONMENT: MODELS AND DEVELOPMENT PROSPECTS

Olena Rayevnyeva
Vitalina Babenko
Kostyantyn Stryzhychenko
Olha Brovko
Volodymyr Chernyshov

PROBLEM

The aim of this article is to develop a comprehensive set of models for assessing the labor and capital resource capacities of enterprises operating across different economic activity sectors, as well as to formulate recommendations for managing their economic behavior under conditions of market instability caused by the full-scale military aggression against Ukraine



THREE HYPOTHESIS

H1. **Hypothesis of the Heterogeneity of Structural Changes across Economic Activity Sectors (EAS). ;**

H2. **Hypothesis of the Transformation of Production Functions and Returns to Scale. A decrease in the stability of the external market environment leads to significant ;**

H3. **Hypothesis on the Adaptation of Enterprise Economic Behavior Management under Conditions of External Market Volatility and Resource Constraints**

THE ALGORITHM OF THE INVESTIGATION

Stage 1. Analysis of Key Trends in Ukraine's Economic Development

- Examination of trends in GDP per capita growth
- Analysis of human capital transformation trends
- Assessment of financial system development trends
- Analysis of international support provided to Ukraine during the full-scale invasion

Stage 2. Analysis of Trends and Resource Responses of Economic Activity Sectors (EAS)

2.1. Development of an integrated clustering framework for economic activity sectors under normal economic conditions and force majeure circumstances (2014-2021; 2022-2024).

2.2. Assessment of the resource sensitivity of economic activity sectors to changes in external conditions.

Stage 3. Modeling the Behavior of Economic Activity Sectors (EAS) Based on the Production Function Framework

3.1. Development of production function models for EAS clusters under stable and force majeure operating conditions (2014-2021; 2022-2024).

3.2. Estimation of resource substitution elasticity indicators.

Stage 4. Development of Recommendations for Managing the Economic Behavior of Enterprises in Selected Economic Activity Sectors

DATA SETS

Data sources: State Statistics Service of Ukraine (Ukrstat), Ministry of Finance of Ukraine, National Bank of Ukraine, and World Bank.

Study coverage: Ukrainian economic activity sectors (EAS), classified according to NACE.

Observation periods:

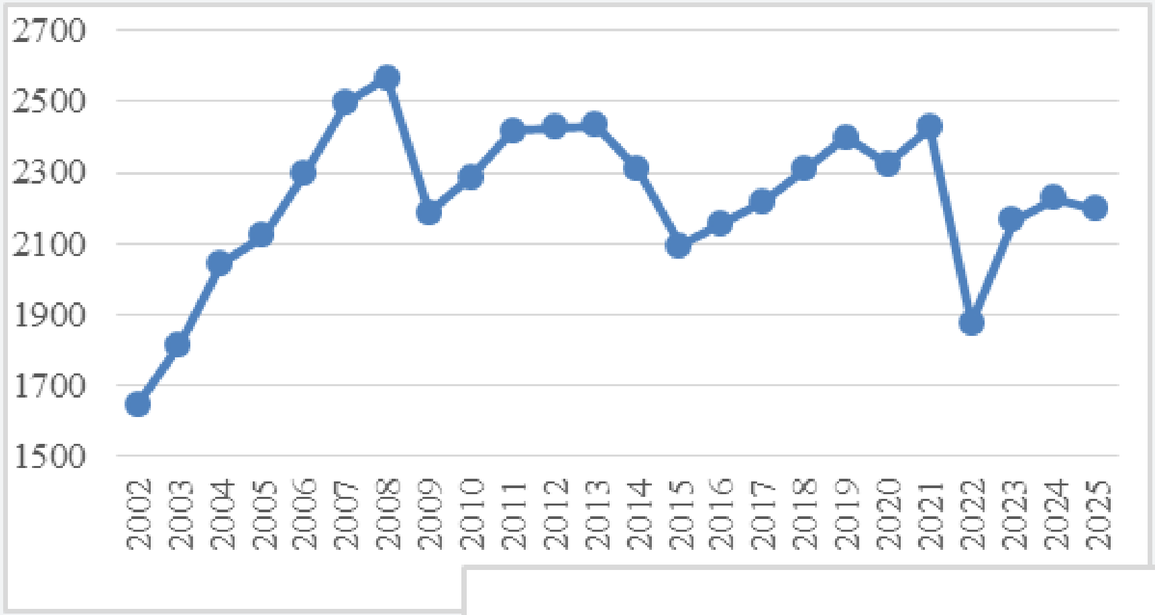
- **2014–2021: Stable economic conditions**
- **2022–2024: Wartime and force majeure conditions**
- **2014–2024: Extended period for the Wholesale and Retail Trade production function**

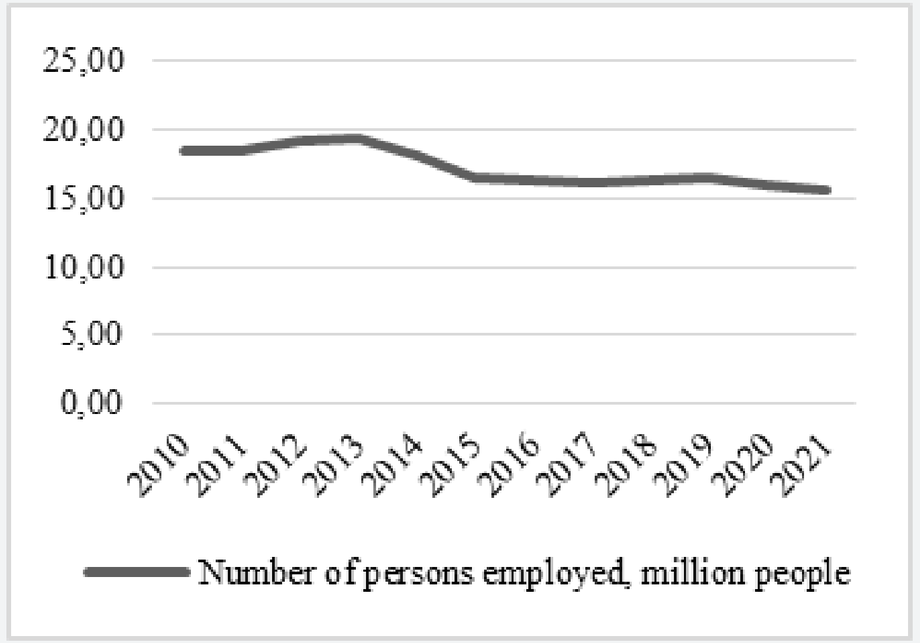
1. **Five indicators for cluster analysis: Number of persons employed, Value of output of business entities, Gross investment of enterprises**
2. **Number of active business entities, Profit (loss)**

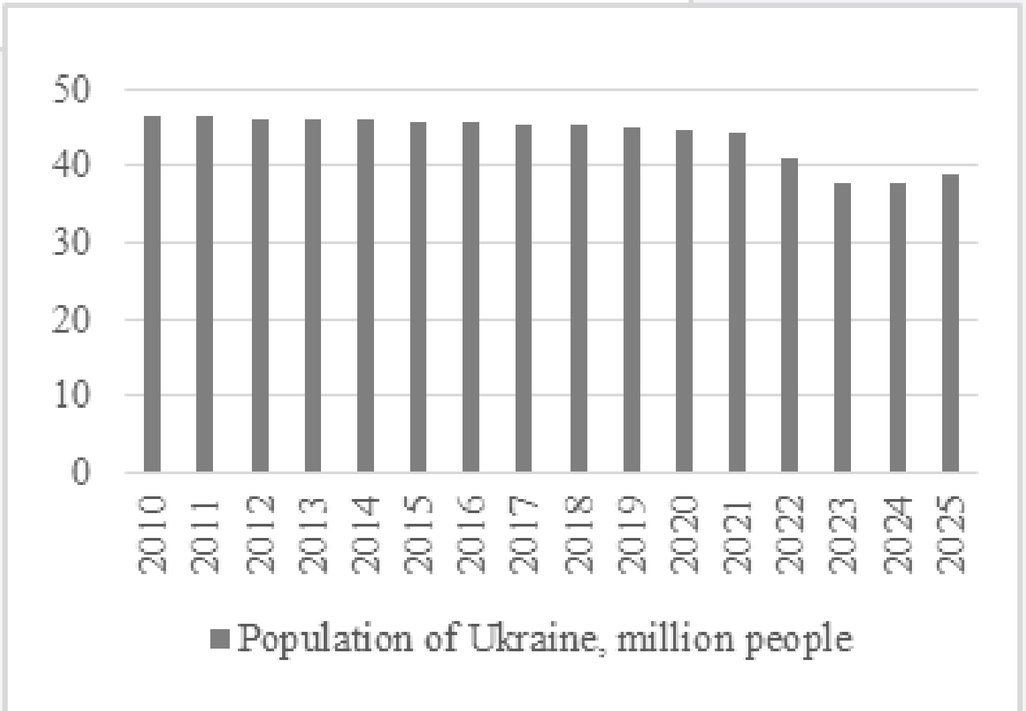
Production function variables: Output (Y), capital investment (I), employment (L), and a time trend representing technological progress (t).regression with individual fixed effects.

DYNAMICS

DYNAMICS OF GDP PER CAPITA (CONSTANT 2015 US$







TRENDS IN UKRAINE'S TOTAL POPULATION AND EMPLOYED POPULATION

ECONOMIC CHARACTERISTICS OF THE IDENTIFIED SECTORAL CLUSTERS

Cluster name	Economic Essence and Characteristics of a Cluster	List of EAS’s for stable development conditions (2014–2021)	List of EAS’s for conditions of force majeure (2022–2024)
Cluster 1 - Market Leaders	It encompasses sectors characterized by a high rate of capital turnover and a significant concentration of active business entities and the employed population. It forms the primary consumer framework and ensures a high transactional capacity within the domestic market.	Wholesale and retail trade, repair of motor vehicles and motorcycles; Manufacturing	Wholesale and retail trade, repair of motor vehicles and motorcycles
Cluster 2 – Capital-intensive industrial-agricultural core	Sectors characterized by high capital intensity and a high concentration of fixed assets. They are marked by large-scale production output, significant capital investment flows, a stable structure of hired labor, and a decisive influence on the state’s export potential.	Agriculture, forestry and fishing; Mining and quarrying;	Agriculture, forestry and fishing; Mining and quarrying; *Manufacturing (transition from cluster 1); Electricity, gas, steam and air conditioning supply; Transportation and storage (transition from cluster 3);*
Cluster 3 – Diversified Infrastructure and Service Complex	It fosters a supportive socio-economic environment and a mobile service infrastructure. It is characterized by a moderate scale of individual output, yet possesses high resource adaptability and digital mobility, and places a specific functional demand on the state system.	Electricity, gas, steam and air conditioning supply; Transportation and storage; Financial and insurance activities; Water supply; sewerage, waste management and remediation activities; Construction; Accommodation and food service activities; Information and communication; Real estate activities; Professional, scientific and technical activities; Administrative and support service activities; Education; Human health and social work activities; Arts, entertainment and recreation; Other service activities	Water supply; sewerage, waste management and remediation activities; Construction; Accommodation and food service activities; Information and communication; Financial and insurance activities; Real estate activities; Professional, scientific and technical activities; Administrative and support service activities; Education; Human health and social work activities; Arts, entertainment and recreation; Other service activities

COBB-DOUGLAS FUNCTION

Parameters and adequacy	Normal conditions			Shock conditions		K1 (G)
	K1	K2	K3	K2	K3	
α — Investment	0,1969	0,243	0,0966	−0,1426	0,0793	−0,206
β — Employed Persons	1,0717	−0,0610	0,6737	−0,1974	0,9008	1,4025
λ — Scientific and Technological Progress	0,1342	0,1059	0,1575	0,1169	0,1921	0,1938
Adjusted R^2	0,972	0,924	0,985	0,959	0,962	0,9018
Numbers	16	16	112	15	36	11

RESULTS OF THE STUDY OF ELASTICITY

Cluster 1. Market Leaders

Normal condition

The production function is characterized by positive coefficients for both production factors. Specifically, a 1% increase in capital investment, holding the other included factors constant, corresponds to a 0.1969% increase in the value of output, while a 1% increase in employment corresponds to a 1.07% increase in output

Shock condition

A distinctive feature of the estimated model is the combination of negative capital investment elasticity (−0.206) and positive employment elasticity (1.4025). According to the estimated parameters, a 1% increase in employment, holding the other factors constant, corresponds to an approximately 1.4025% increase in the value of output in the trade sector

RESULTS OF THE STUDY OF ELASTICITY

Cluster 2. Capital-Intensive Industrial and Agricultural Core

Normal condition

The estimated production function demonstrates positive capital investment elasticity of 0.243. A 1% increase in investment corresponds to an approximately 0.24% increase in the value of output, holding the other factors constant. This relationship is consistent with the important role of investment in equipment modernization, the mechanization of technological processes, and infrastructure development in agricultural and mining activities

Shock condition

A distinctive feature of the estimated model is the negative elasticity of output with respect to both production factors. These relationships may be associated with uneven capacity utilization, disruptions in technological linkages, resource shortages, and time lags between capital investment and the realization of production outcomes.

Under shock-related constraints, increases in the quantities of resources employed do not necessarily result in proportional output growth because of disruptions in the interactions among different components of the production system

RESULTS OF THE STUDY OF ELASTICITY

Cluster 3. Diversified Infrastructure and Service Complex

Normal condition

A distinctive feature of the estimated production function is that employment elasticity exceeds capital investment elasticity. A 1% increase in employment, holding the other included factors constant, corresponds to an approximately 0.67% increase in the value of output, whereas an equivalent increase in capital investment corresponds to an increase of approximately 0.10%.

Shock condition

the third cluster retains most of its original economic activity sectors, although energy and transportation activities move to the second cluster. A comparison of the estimated models indicates an increase in employment elasticity from 0.6737 to 0.9008 and a decrease in capital investment elasticity from 0.0966 to 0.0793. However, changes in cluster composition between the two regimes also influence the nature of the production relationships being compared

. RESULTS OF PRODUCTION FUNCTION ESTIMATION FOR ECONOMIC ACTIVITY SECTOR CLUSTERS

Cluster	Decision	Making	Results
K1	Working Capital Management	Optimization of inventory, procurement, and settlement terms	Acceleration of funds turnover
	Increasing labor activity	Staff training, improvement of work time organization	Growth in labor productivity
K2	Ensuring Resource Resilience	Backup power supply, alternative suppliers	Enhanced business continue
	Eliminating production constraints	Analysis of downtime, modernization of critical technological operations	Reduction of production losses
K3	Flexible employment management	Redistribution of functions, workload planning	Reduction of unproductive labor costs
	Reduction of unproductive labor costs	Margin control and contract selection	Increased operational profitability

CONCLUSIONS

The research findings substantiate the appropriateness of applying differentiated approaches to managing the economic behavior of enterprises, depending on the specific production and economic relationships within the respective clusters of economic activity sectors (EAS). For trade enterprises, the main priorities include improving investment efficiency and accelerating capital turnover; for agriculture and manufacturing, technological modernization, eliminating production constraints, and optimizing the utilization of labor resources; and for construction and service activities, flexible management of personnel, capacity utilization, and order profitability. Such differentiation enables enterprises to establish management priorities that reflect the specific characteristics of resource utilization rather than applying universal solutions across all economic activitie

CONCLUSIONS

The practical application of the modeling results involves shifting the focus from increasing the volume of resources employed toward managing the economic efficiency of their utilization. Under conditions of wartime instability, priority should be given to measures that release working capital, reduce unproductive costs, increase profit margins, and decrease dependence on scarce resources. The implementation of capital-intensive decisions should be based on assessments of net present value, projected cash flows, and resilience under adverse scenarios, whereas organizational measures can be implemented as a priority by mobilizing enterprises' internal reserves. The proposed approach provides a practical foundation for the adaptive management of economic behavior, while the effectiveness of specific measures should be verified through subsequent monitoring

THANK'S FOR WATCHING

