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ANALYSIS OF THE TRANSFORMATION OF THE REGIONAL STRUCTURE OF THE DIGITAL ECONOMY

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Methods. The digital economy is transforming the global economic landscape at an unprecedented pace and has become an important driver of regional economic restructuring and sustainable development. This study investigates the mechanisms and effects of the digital economy on the transformation of regional economic structures using data mining and quantitative analysis methods. The research combines factor analysis with orthogonal least squares regression to assess the relationship between the level of digital economy development and structural changes in regional economies. The analysis considers the technological, industrial, resource, and spatial dimensions of digital transformation and identifies the main channels through which digitalization affects regional economic development.

Results. The empirical results demonstrate a statistically significant positive relationship between the level of digital economy development and the transformation of regional economic structures. The findings obtained through factor analysis and orthogonal least squares regression confirm that digitalization contributes to the modernization and optimization of regional economic structures. The results also indicate that the intensity of this effect depends on the capacity of regions to adopt digital technologies, stimulate innovation, improve resource allocation, and integrate traditional industries with emerging digital sectors.

Novelty. The scientific novelty of the study lies in the comprehensive assessment of the relationship between digital economy development and the transformation of regional economic structures. The study identifies the key mechanisms through which digital technologies contribute to structural upgrading, including technological innovation, more efficient resource allocation, industrial integration, and the strengthening of spatial economic interactions. The findings provide a theoretical basis and practical recommendations for regions to develop differentiated digital economy strategies according to their specific economic, technological, and resource potential.

Practical value. The results of the factor analysis support the theoretical hypothesis that the digital economy promotes the advancement of regional economic structures through technological innovation, resource optimization and allocation, industrial integration and upgrading, and the realization of spatial effects. The findings can be used by regional authorities, policymakers, and economic development institutions to design targeted digital transformation policies, strengthen digital infrastructure, stimulate innovation activity, and reduce regional disparities. The proposed analytical approach can also serve as a methodological basis for monitoring and evaluating the structural effects of digital economy development at the regional level.

Keywords: digital economy, regional economy, structural transformation, Regression Analysis.

Statement of problem. Digital economy, a brand-new economic form recently, originates from networked intelligence, which can be related back to the 1990. It is not clearly defined until the G20 leaders' Hangzhou Summit in September 2016 that the digital economy, with information technology as the core and modern network as the carrier, comes from a series of economic activities intending at efficient application in communication technology and economic structure improvement.

Currently, global economic governance is entering a new era through digital transformation. Resultant business model innovations have fundamentally altered consumers' expectations and behaviors, pressured traditional firms, and disrupted numerous markets.

Digital technologies, based on cloud computing, big data analytics, artificial intelligence (AI) and the widespread dissemination of digital data, are deeply embedded in economic and social systems, changing the way countries produce, trade and innovate.

According to endogenous economic growth theory, knowledge accumulation is the driving force of the economy. Digital technology with an interactive structure is bound to be an important link in TFP representing scientific and technological innovation. It is of great value to explore the impact of digital economy on TFP, promote the deep integration of digital economy and real economy, and accelerate the high-quality development of economy and society.

Today, the digital economy is not just a sector – it is a fundamental enabler of productivity, competitiveness and economic sustainability. Therefore, accurately measuring its size, structure and transformation dynamics has become essential for the development of inclusive and forward-looking policy frameworks.

Much of the existing research focuses on digital sectors in isolation and pays insufficient attention to how digitalization transforms traditional sectors through upstream and downstream linkages – an essential feature of digital transformation that drives system-wide productivity growth.

As an important engine of economic development in the new era, the digital economy is profoundly changing the global economic structure and regional development mode. The rapid progress of digital technology has brought about

fundamental changes in information flow and processing, and data and information have become key factors of production, which is conducive to the continuous optimization and upgrading of the economic structure.

At present, a new generation of digital technologies such as big data, cloud technology and artificial intelligence are fully penetrating all areas of the economy and society, not only giving rise to new industries, new forms and modes, but also having a profound impact on the ways of transformation and upgrading of traditional industries and becoming the main driving force for the transformation of regional economic structure.

The growing importance of the digital economy and the issue of active growth are constantly discussed in all countries of the world. Economic data is an essential element of the digital economy. It is important to collect, analyze and continually process the information that underpins the success of the digital economy [1].

Under the wave of globalization and informatization, the digital economy is changing the global and regional economic landscape with unprecedented speed and scale. According to the latest reports of the International Telecommunication Union (ITU) and the World Economic Forum (WEF), the volume of the global digital economy will exceed 32 trillion dollars in 2023, accounting for 43% of global GDP.

The rise of the digital economy has not only changed consumption patterns, but also given rise to new industrial employment patterns, such as online education, telemedicine, digital finance, intelligent transportation, etc. The rapid development of these new manufacturers is transforming the regional economic structure to be greener, smarter, and service-oriented.

Therefore, an in-depth study of the driving mechanism of the digital economy in the transformation of the regional economic structure contributes to the formulation of more effective policies to guide the sustainable development of the digital economy and promote the optimization of the regional economic structure.

This study conducts a test by dividing into northern, central, and southern regions to examine the differential impact of the digital economy on the structural transformation of the economy in different regions and provide a theoretical

basis for formulating targeted strategies for the development of the digital economy in each region.

The Digital Economy Development Index System is built on a broad concept and the conditions necessary for its development.

The three dimensions are: digital economy infrastructure, digital economy openness, and digital technology innovation environment and competitiveness. This index system can reflect the development of information and communication technology (ICT) technologies and industries, as well as the factor conditions and innovation environment necessary for the development of the digital economy.

The digital economy-related indicators must be standardized and given reasonable weights, and then the selected indicators are multiplied by the corresponding weights and added up, through which the digital economic development scores of countries along the «Belt and Road» can be calculated.

Among them, digital economy infrastructure mainly reflects the foundations and application of digital technologies; innovation environment and competitiveness reflect the research and development capabilities and environment in the field of digital economy; digital economy openness reflects the international competitiveness of products produced by the digital industry. Each dimension consists of a specific indicator.

Regression Analysis of Digital Economy. For further analysis of the impact of the digital economy on the transformation and renewal of the regional economic structure, the paper takes the regional economic structure (Res) as an explanatory variable, and the share of the value added of the tertiary industry in GDP as a proxy variable.

Based on data mining technology, this paper deeply explores the mechanism and impact of the digital economy on the transformation of regional economic structure. The study uses a factor analysis model to construct an evaluation index system from four dimensions, namely, digital communication infrastructure, digital network infrastructure, digital industry development level and innovation ability, to measure the development level of the digital economy in the region from 2016 to 2025 and analyze the impact of the digital economy on the structural

transformation of the regional economy by combining the orthogonal least squares method. [11].

The relevant literature proposes an open market paradigm with a digital transformation approach, which is the most popular e-business model that can provide strategic directions for participants. A major trend in integrated manufacturing is the creation of digital copies of industrial processes, data platforms, and manufacturing ecosystems to facilitate economic transactions

The strategic management literature has mainly focused on the impact of the digital economy and various responses to it. To some extent, the digital economy has not only significantly reduced business-related frictions, but also created new challenges for market operations. The sharp decline in the costs of information retrieval, transmission, and copying has put traditional firms under pressure and they have been overtaken by innovative, rapidly growing digital players.

Institutional regulation, information security, and industrial restructuring are the focus of researchers. In addition, the quantitative research literature is concerned with the relevance of traditional research approaches and methodologies that attempt to measure the development of the digital economy from different aspects.

Based on the experience of selecting indicators in the existing literature and the study of related scientific practices, the level of development of the digital economy (Dig) is selected as the explanatory variable, and the score of the digital economy development level measured above is used as the proxy variable, based on which the level of financial development (Fin), the level of urbanization (Urb), the level of investment in education (Edu) and the level of state support (Gov) are selected as the control variables, respectively. [6].

A regression model of the digital economy on the regional economic structure is built using the balance of deposits of financial institutions in relation to GDP, the share of the non-agricultural population, the share of education investment funds in government financial expenditures and the share of state financial expenditures in GDP as proxy variables.

Regression analysis is one of the most common methods for studying relationships and

processing experimental results in natural sciences, economics, technology, and other fields.

In regression analysis, it is most often used to estimate the conditional mathematical expectation of the dependent variable, given the values taken by the independent variables. In all cases, the mathematical expectation function of the dependent variable from the independent variables is estimated, which is called the regression function. Regression analysis is widely used for numerical forecasting, classification, and industry forecasting [2]. In recent years, many regression analysis methods have been developed and used worldwide.

Assumption Econometrics is a branch of economics that utilizes statistical methods to analyze economic data and heavily relies on linear regression as a fundamental tool. Linear regression is used to model the relationship between a dependent variable and one or more independent variables. In this article, we will discuss linear regression in the context of econometrics, in which this method is crucial for understanding and predicting economic phenomena of Linear Regression:

Several assumptions underlie linear regression analysis, including:

1. **Linearity:** The relationship between the dependent and independent variables is linear.
2. **Independence:** The observations are independent of each other.
3. **Homoscedasticity:** The variance of the error term is constant across all levels of the independent variables.
4. **Normality:** The error term is normally distributed.
5. **No Multicollinearity:** The independent variables are not highly correlated with each other.

The estimation process involves selecting an appropriate model specification, such as linear regression, logistic regression, or time series models, among others.

The coefficients (β_0 and β_1) are estimated using the method of least squares. This method minimizes the sum of the squared differences between observed values and values predicted by the model, known as residuals.

$$\beta_1 = \frac{\sum_1^n (x_i - \bar{x})(y_i - \bar{y})}{\sum_1^n x_i - \bar{x}} \quad (1)$$

$$\beta_0 = \gamma - \beta_1 X \quad (2)$$

These models are parametric in the sense that the regression function is defined by a finite number of unknown parameters that are estimated from the data.

Linear regression is a simple but powerful tool that can make the analyst's job much easier when studying consumer behavior; factors affecting productivity and return on investment; will improve the understanding of business processes in general [3].

We consider the orthogonal least squares (OLS) method, which is a sparse kernel modeling method that adopts local parameter regularization (LR) and the learning error of omission as the optimization target of one, and the soft measurement model constructed by this method has strong generalization ability and sparsity.

It is known that $\chi = [\chi_1, \chi_2, \dots, \chi_M] \in R^{N \times M}$ is the input variable of the system, $\gamma \in R^{N \times I}$ is the output variable of the system and e is the noise signal.

The regression model between x and y is used for nonlinear identification by the OLS method:

$$\theta = \tilde{\theta} + e = \sum_{i=1}^N \beta_i K_p(\chi_1, \dots, \chi_i) + e = \phi \beta + e \quad (3)$$

where the kernel function $K_p(\chi_1, \dots, \chi_i)$, is a Gaussian kernel function, i.e:

$$K_p(\chi, \chi_i) = \exp \frac{|\chi - \chi_i|^2}{2\sigma^2} \quad (4)$$

Solving parameter β of Eq. (5) leads to the solution of the optimization objective described in Eq. (7).

$$\Psi = e^{\text{te}} \quad (5)$$

Equation (7) essentially minimizes the mean square error (MSE) of the training data, which results in $\beta = (\varphi^t \varphi)^{-1} \varphi^t \gamma$. Since $\varphi \in N \times N$, when N is large, the model's operation will be more complicated and prone to dimensional catastrophe problem.

For this kind of problem, the OLS method decomposes φ by orthogonalizing it to obtain $\varphi = WA$.

$$W = [w_1, w_2, \dots, w_n], w_i^t w_i = 0 (i \neq j). \quad (6)$$

The matrices W and A 's can be computed by the improved Gram-Schmidt orthogonalization method, and the final results are as follows:

$$A = \begin{bmatrix} 1 & a_{12} & a_{13} & \dots & a_{1N} \\ 0 & 1 & a_{23} & \dots & a_{2N} \\ 0 & 0 & \ddots & \vdots & - \\ \vdots & \vdots & - & 1 & a_{N-1N} \\ 1 & 0 & \dots & 0 & 1 \end{bmatrix} \quad (7)$$

Then the final regression model can be expressed as:

$$\gamma = w_{N_s} g_{N_s} + \varepsilon \quad (8)$$

where g_{N_s} is the N s term in g . g is the parameter to be optimally solved by the OLS model and $g = A\beta$ and $g = [g_1, g_2, \dots, g_n]^T$.

The data used in this paper comes from a regional statistical yearbook, municipal statistical yearbooks, etc. from 2015 to 2024, and for a small number of statistically missing data, linear interpolation is used to fill in the blanks, and the relevant variables are standardized to be dimensionless. [7]. Using SPSS 25.0 software, panel data regression analysis was carried out with OLS method, control variables were gradually increased, and random effects were found to be more suitable for this study through Hausman test. The results of the basic regression test are shown in Table 1, with *, **, and *** indicating significant at 10%, 5%, and 1% confidence intervals, respectively.

The number of control variables and the goodness of fit of the model change in the same direction, and with the addition of control variables, the goodness of fit of the model is improving, and the R^2 improves from 0.188 to 0.686, which indicates that the choice of control variables is reasonable and scientific. [8].

Table 1

Basic regression test results

Variables	Model 1	Model 1	Model 1	Model 1	Model 1
Dig	0.431	0.332	0.348	0.369	0.446
	0.001	0.000	0.004	0.001	0.002
	***	***	***	***	***
Fin		0.243	0.263	0.348	0.286
		0.002	0.003	0.005	0.005
		***	***	***	***
Urb			0.122	0.319	0.205
			0.005	0.004	0.004
			***	***	***
Edu				-0.373	-0.273
				0.001	0.003
				***	***
Gov					0,406
					0,002

R^2	0.188	0.473	0.499	0.588	0.686
N	135	135	135	135	135

The regression results of the core explanatory variables are significantly positive ($p < 0.01$), with regression coefficients of 0.431, 0.332, 0.348, 0.369 and 0.446, indicating that the digital

economy has a positive effect on the transformation and upgrading of the regional economic structure, and the higher the level of the development of the digital economy, the more obvious is

the transformation and upgrading of the regional economic structure [4].

Application of Linear Regression in Econometrics.

- Linear regression is often used in econometrics to quantify the impact of changes in independent variables on the dependent variable. For example, consider a scenario where a company wants to assess the impact of changes in advertising expenditure on its sales revenue. By collecting data on advertising spending and corresponding sales revenue over a period, linear regression can be used to estimate the relationship between these variables.

- The regression analysis might reveal that for every additional dollar spent on advertising, sales revenue increases by a certain amount. This information can be invaluable for businesses in determining their marketing strategies and budget allocations.

Forecasting.

- Another crucial application of linear regression in econometrics is forecasting future trends based on historical data. For instance, economists often use linear regression to predict GDP growth rates based on various economic indicators such as consumer spending, government expenditure, and investment levels.

- By analyzing historical data and identifying the key variables that influence GDP growth, linear regression models can be developed to forecast future GDP growth rates. These forecasts play a crucial role in informing government policy decisions, business planning, and investment strategies.

Policy Analysis.

- Linear regression is also widely used in econometrics for policy analysis. Governments and policymakers often use regression analysis to assess the impact of policy changes on economic variables. For example, consider a government that is considering raising the minimum wage. By using linear regression to analyze historical data on minimum wage levels and employment levels, policymakers can estimate the potential impact of a minimum wage increase on employment.

- This analysis can help policymakers make informed decisions about whether or not to implement the proposed policy change. Additionally, linear regression can be used to evaluate the effectiveness of existing policies by examining their impact on relevant economic variables.

Linear regression is a fundamental statistical method used to understand relationships between variables. It is commonly used to predict outcomes based on one or more factors. In econometrics, linear regression helps economists analyze economic data, test theories, and make forecasts. While linear regression is easy to understand and apply, it has some challenges.

Problems like heteroscedasticity, multicollinearity, and endogeneity can make results less reliable. Overall, linear regression is a useful tool for analyzing data and making predictions in econometrics, but it requires careful attention to assumptions and model validation to ensure accuracy.

Conclusions. All over the world, the competitiveness of the state is determined by the efficiency and speed of reaction to the emerging modern digital technologies. The impact of the digitalization process on the competitive environment and the labor market is stronger. [5].

EU member states have made significant progress in expanding access to ICTs and digital networks. In addition, developed countries have achieved a high level of universal access through mobile communications. At the same time, developing countries have made significant progress in this area by expanding mobile services.

The analysis shows that more attention is paid to existing national digitalization strategies aimed at a broader transformation of the national economy and society. Most of the existing e-services for agriculture in EU countries are usually limited to e-government systems or ICT strategies [10].

The contributions of this paper include the following aspects. First, researchers have mainly studied the digital economy from a specific perspective, but the digital economy is a complex covering various high-tech industries, and it is very incomplete to measure the development of the digital economy only from the changes in the network or Information and Communication Technology (ICT) industries.

This multidisciplinary discussion is needed to study the digital economy from three aspects: infrastructure, industry scale, and spillover value, to comprehensively reflect the development of digital economy. Second, the subjective weighting method usually introduces uncertainty in the construction of the indicator system. We use the principal component analysis, which is an

objective weighting method to scientifically reflect the contribution of different dimensions of evaluation elements and construct the digital economy index.

Third, TFP calculation using the Solow residual method is susceptible to the influence of capital stock estimates. Therefore, we use the dual approach that does not require measuring the capital stock, as well as setting up a production function with a constant elasticity of substitution to accurately account for TFP. In addition, linear regressions are mostly employed in panel data analysis, but we argue that there is a nonlinear relationship between digital economy index and provincial TFP. Therefore, this paper constructs a nonlinear panel model with square terms and interactive terms, which is more in line with the current situation.

The digital economy has become a key driving force for the transformation of regional economic structure. Through factor analysis and orthogonal least squares regression, it is confirmed that the digital economy has a significant positive impact on regional economic structure, with a regression coefficient as high as 0.446, indicating that for every unit increase in the level of development of the digital economy, the proportion of the tertiary industry in the GDP will increase by 0.446 percentage points.

This result fully verifies the theoretical hypothesis that digital economy promotes the advanced economic structure through the mechanisms of technological innovation, resource optimization and allocation, industrial integration and upgrading, and spatial effect release.

The analysis of regional heterogeneity reveals that the digital economy plays the most significant role in the central region, with an impact coefficient of 0.701, much higher than that of 0.532 in the southern region and 0.487 in the northern region, and this difference mainly stems from the central region's better digital infrastructure, higher innovation capacity and talent concentration effect, which enables digital technology to be more fully applied to the transformation and upgrading of traditional industries.

The level of financial development and urbanization also have a positive contribution to the transformation of economic structure, with regression coefficients of 0.286 and 0.205 respectively, reflecting the positive contribution of

financial support and urbanization to the optimization of industrial structure.

It is worth noting that the level of education investment shows a negative correlation with the transformation of economic structure, with a coefficient of -0.273, suggesting that the training of talents in each region should be more closely aligned with the market demand, to avoid the disconnection between the training of talents and industrial demand. [9].

In the future, regions should formulate differentiated digital economy development strategies according to their own characteristics, focus on strengthening digital infrastructure construction, promoting the in-depth integration of digital technology and traditional industries, accelerating the cultivation of digital talents in line with market demand, and promoting the transformation and upgrading of regional economic structure to a higher level.

References

1. Carta, M., Ronsivalle, D., & Lino, B. (2020). Inner archipelagos in Sicily. From culture-based development to creativity-oriented evolution. *Sustainability*, 12(18), 7452. <https://doi.org/10.3390/su12187452>
2. Harrison, E.L., & Huntington, I.S. (2000). *Culture matters: How values shape human progress*. Basic Books.
3. Hofstede, G. (2000). *Culture's consequences: International differences in work-related values*. Sage.
4. Jaskyte, K., & Dressler, W.W. (2004). Studying culture as an integral aggregate variable: Organizational culture and innovation in a group of nonprofit organizations. *Field Methods*, 16(3), 265-284.
5. Kafka, K.I. (2020). Economic theory and economic reality: A continuously dialectic relationship. In I.C. Kafka, K.I., Kostis, I.C., & Lietrakis, I.E. (2020). *Why coevolution of culture and institutions matters for economic development and growth?* In Yonk, R.M. (Edition). *Economic-Financial Development and Cultural Transformation*
6. Veretkhina, S.V., & Novikova, V.A. (2019). Transformation of education in the digital economy. *Contemporary problems of social work*, 5(2), 30-37. <https://doi.org/10.17922/2412-5466-2019-2-30-37>
7. Lin, B., Tang, J., Dai, C., & Lu, B. (2024). Spatial effect of digital economy on the coordinated development of Port cities. *Research in Transportation Economics*, 103, 101385.
8. Liu, Y., Chen, W., Zhang, X., & Liao, W. (2025). Digital economy, consumption structure and rural economic transformation: a case study of China. *Frontiers in Sustainable Food Systems*, 9, 1565067.
9. Novikova, N.V., & Stroganova, E.V. (2020). Regional aspects of studying the digital economy in the system of economic growth drivers. *Journal of new economy*, 21(2), 76-93.

10. Ober, J. (2020). Innovation adoption: Empirical analysis on the example of selected factors of organizational culture in the IT industry in Poland. Sustainability, 12(20), 8630.

<https://doi.org/10.3390/su12208630>

11. Xinyue Qi and Dong Ch. (2025). In-depth analysis of digital economy on regional economic structure

transformation based on data mining, International Journal for Housing Science and Its Application, Volume 46, Issue 3, Pp. 6457-6466. <https://doi.org/10.70517/ijhsa463555>

АНАЛІЗ ТРАНСФОРМАЦІЇ РЕГІОНАЛЬНОЇ СТРУКТУРИ ЦИФРОВОЇ ЕКОНОМІКИ

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Методологія дослідження. Цифрова економіка трансформує світовий економічний ландшафт безпрецедентними темпами та стала важливим рушієм регіональної економічної реструктуризації та сталого розвитку. Це дослідження досліджує механізми та вплив цифрової економіки на трансформацію регіональних економічних структур за допомогою методів аналізу даних та кількісного аналізу. Дослідження поєднує факторний аналіз з ортогональною регресією найменших квадратів для оцінки зв'язку між рівнем розвитку цифрової економіки та структурними змінами в регіональних економіках. Аналіз розглядає технологічні, промислові, ресурсні та просторові виміри цифрової трансформації та визначає основні канали, через які цифровізація впливає на регіональний економічний розвиток.

Результати. Емпіричні результати демонструють статистично значущий позитивний зв'язок між рівнем розвитку цифрової економіки та трансформацією регіональних економічних структур. Результати, отримані за допомогою факторного аналізу та ортогональної регресії найменших квадратів, підтверджують, що цифровізація сприяє модернізації та оптимізації регіональних економічних структур. Результати також вказують на те, що інтенсивність цього впливу залежить від здатності регіонів впроваджувати цифрові технології, стимулювати інновації, покращувати розподіл ресурсів та інтегрувати традиційні галузі промисловості з новими цифровими секторами.

Новизна. Наукова новизна дослідження полягає у комплексній оцінці зв'язку між розвитком цифрової економіки та трансформацією регіональних економічних структур. У дослідженні визначено ключові механізми, за допомогою яких цифрові технології сприяють структурній модернізації, включаючи технологічні інновації, ефективніший розподіл ресурсів, промислову інтеграцію та посилення просторової економічної взаємодії. Результати дослідження надають теоретичну основу та практичні рекомендації для регіонів щодо розробки диференційованих стратегій цифрової економіки відповідно до їхнього конкретного економічного, технологічного та ресурсного потенціалу.

Практична значущість. Результати факторного аналізу підтверджують теоретичну гіпотезу про те, що цифрова економіка сприяє розвитку регіональних економічних структур завдяки технологічним інноваціям, оптимізації та розподілу ресурсів, промисловій інтеграції та модернізації, а також реалізації просторових ефектів. Результати дослідження можуть бути використані регіональними органами влади, політиками та установами економічного розвитку для розробки цільової політики цифрової трансформації, зміцнення цифрової інфраструктури, стимулювання інноваційної активності та зменшення регіональної нерівності. Запропонований аналітичний підхід також може служити методологічною основою для моніторингу та оцінки структурних ефектів розвитку цифрової економіки на регіональному рівні.

Ключові слова: цифрова економіка, регіональна економіка, структурна трансформація, регресійний аналіз

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