THE IMPACT OF DEMOGRAPHIC DYNAMICS ON THE SERVICE SECTOR: AN ECONOMETRIC ANALYSIS OF THE REGIONS OF UZBEKISTAN

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Abstract. *This paper examines the econometric relationship between demographic dynamics and the growth of the market services sector in the Republic of Uzbekistan. The primary objective is to quantify how the process of household formation (represented by the marriage and divorce balance) influences the volume of regional services.*

Keywords: *services; demographic dynamics; panel data analysis; fixed-effects model; household formation; regional economy.*

Annotatsiya. *Ushbu maqola O'zbekiston Respublikasida demografik dinamika va bozor xizmatlari sektorining o'sishi o'rtasidagi ekonometrik bog'liqlikni o'rganadi. Asosiy maqsad - uy xo'jaligini shakllantirish jarayoni (nikoh va ajralish balansi bilan ifodalanadi) mintaqaviy xizmatlar hajmiga qanday ta'sir qilishini aniqlashdir.*

Kalit so'zlar: *xizmatlar; demografik dinamika; panel ma'lumotlarini tahlil qilish; qat'iy ta'sirli model; uy xo'jaligini shakllantirish; mintaqaviy iqtisodiyot.*

Аннотация. *В данной работе исследуется эконометрическая взаимосвязь между демографической динамикой и ростом сектора рыночных услуг в Республике Узбекистан. Основная цель – количественная оценка влияния процесса формирования домохозяйств (представленного балансом браков и разводов) на объем региональных услуг.*

Ключевые слова: *услуги; демографическая динамика; анализ панельных данных; модель с фиксированными эффектами; формирование домохозяйств; региональная экономика.*

Introduction. The contemporary global economic landscape is characterized by a distinct structural shift toward a service-oriented model—a phenomenon widely conceptualized as the “Service Economy Transition.” For countries with developing market economies, in particular the states of Central Asia, this transition represents not merely a statistical redistribution of GDP components, but a fundamental rethinking of national growth strategies. In the Republic of Uzbekistan, the service sector has been institutionalized as the primary driver of economic modernization within the framework of the “Uzbekistan–2030” Strategy.

In the context of the country’s aspiration to diversify its economy and move away from strong dependence on extractive industries and primary agriculture, the service market has become a resilient buffer against external shocks and a critically important source of employment for a rapidly growing labor force.

The development trajectory of the service sector is inextricably linked to demographic dynamics. At present, Uzbekistan is experiencing a unique historical window known as the

"demographic dividend," characterized by a high share of the working-age population and a steady increase in the number of young families. Theoretical frameworks such as the Theory of Household Production and the New Institutional Economics suggest that the formation of new households—statistically captured through the balance of marriages and divorces—acts as a fundamental catalyst for service consumption. Each new unit of society generates immediate and sustained demand for a wide range of market services, from financial and educational products to telecommunications and the hospitality industry.

Despite the intuitive connection between population structure and demand for services, the empirical literature on the economies of Central Asia remains fragmented. Previous studies have predominantly focused on macroeconomic determinants of service sector growth, such as foreign direct investment (FDI), urbanization rates, and digital infrastructure. However, the specific role of regional demographic fluctuations and their lagged impact on the service ecosystem remains largely underexplored. There exists a significant research gap in understanding how the "balance of marriages and divorces" serves as a leading indicator for regional service markets in a transitional economy characterized by strong traditional values and evolving consumption patterns.

This study addresses this gap by presenting an econometric assessment of the demographic drivers of the service sector across 14 regions of the Republic of Uzbekistan for the period 2019–2025. Using a balanced panel data approach, the study aims to quantitatively estimate the elasticity of service sector growth in response to household formation dynamics while simultaneously controlling for critical macroeconomic factors such as retail turnover and inflationary pressure.

The scientific novelty of this analysis lies in its detailed regional focus and examination of time lags, offering a more nuanced perspective on the "demographic dividend" than has previously been available in the regional literature. The findings provide an empirical basis for regional policy interventions aimed at synchronizing social demographic support with the development of service infrastructure.

Analysis of literature on the topic . Demographic shifts in transition economies such as Uzbekistan create unique catalysts for market expansion. Li, Wang, and Smith (2024), using panel data analysis, demonstrate that marriage rates significantly correlate with demand for household and personal services. Based on international experience, it should be noted that issues related to the development of cashless payments and the digitalization of Uzbekistan's financial sector in recent years have been widely covered both in academic research and in analytical reviews, and their practical application has been addressed by many economists, including M. Porter, D. Evans, I. Ansoff, M. Berman, M. Golubkov, P. Samuelson, and D. Marshall. It is also necessary to highlight scholars who have made a significant contribution to the development of marketing theory, while research conducted in the field of marketing in our country over many years has been based on national characteristics. These include J. Zaynalov, E. Shavkiev, M. Mukhammedov, M. Sharifkhodjaeva, Sh. Ergashkhodjaeva, Sh. Musaeva, and others.

Research Methodology: The study employs a balanced panel dataset covering 14 administrative regions for the period 2019–2025. To control for regional heterogeneity, a fixed effects (FE) regression model was applied. The data were obtained from the Agency of Statistics under the President of the Republic of Uzbekistan.

Analysis of Results. The empirical analysis shows that household formation is a significant catalyst for demand for services: a net increase of 1,000 households leads to a 2.07% expansion of the sector. In addition, a high elasticity (0.84) between retail turnover and services is identified. The

vulnerability of the sector to inflation is also emphasized, as it causes a contraction in the volume of services by 6.45% with an increase in the inflation rate by one percentage point. The obtained results form the basis for an integrated regional policy.

Based on empirical data from the Agency of Statistics of the Republic of Uzbekistan (2025) and regional modeling frameworks proposed by Dzhuraev (2025), the following hypotheses are advanced in this study:

• Hypothesis 1 (H1): The formation of new households (balance of marriages and divorces) has a positive impact on the volume of market services, with a statistically significant effect manifesting with a one-year time lag.

• Hypothesis 2 (H2): Retail trade turnover is the dominant macroeconomic driver of the service sector, demonstrating a strong synergistic relationship across all 14 regions.

• Hypothesis 3 (H3): An elevated level of inflation (CPI) has a significant negative impact on the real volume of market services, acting as a decelerator (brake) of sectoral growth.

The empirical basis of this study is a panel dataset compiled from official secondary sources. Primary data were obtained from the Agency of Statistics under the President of the Republic of Uzbekistan (stat.uz) and regional statistical yearbooks for the period 2019–2025.

The data collection process focused on four key pillars of regional development:

1. Service Sector Indicators: Annual volume of market services provided (Y).
2. Demographic Dynamics: Statistics on registered marriages and divorces to calculate the net balance of household formation (X1).
3. Consumer Capacity: Retail trade turnover (X2) as a proxy variable for the purchasing power of regions.
4. Macroeconomic Stability: Consumer Price Index (CPI) to account for inflationary pressure (X3).

The raw data, initially presented in annual cross-sectional reports, were restructured into a balanced panel format comprising 14 administrative-territorial units (12 regions, the Republic of Karakalpakstan, and the city of Tashkent) over 7 years, totaling 98 observations. To ensure the statistical significance of the econometric estimates, the following preprocessing steps were carried out:

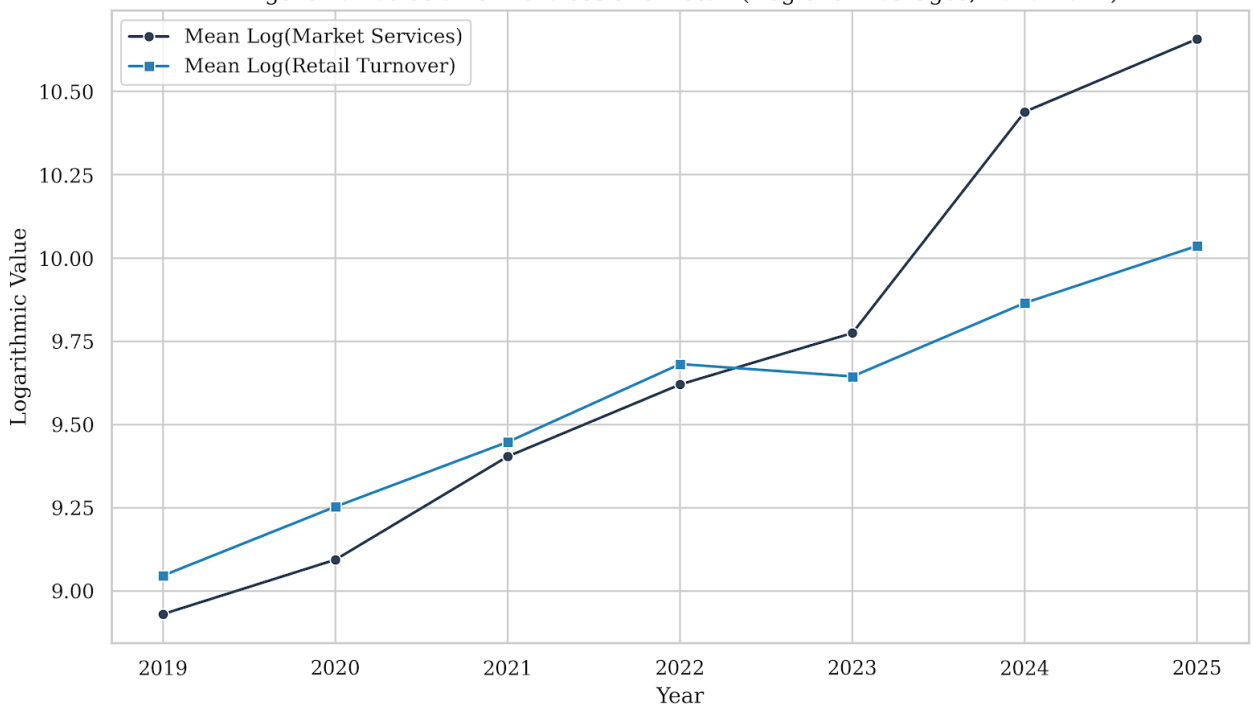
• Normalization and Logarithmic Transformation:

To eliminate heteroskedasticity and stabilize variance, the dependent variable (Y) and retail turnover (X2) were transformed into natural logarithms (ln). This allows the estimated coefficients to be interpreted as elasticity measures.

• Creation of Lagged Variables: To account for the delayed impact of demographic shifts on the service market, in certain model specifications a one-year time lag (t−1) was applied to the balance of marriages and divorces (X1).

Prior to conducting the econometric estimation, an extended exploratory data analysis (EDA) was performed to identify structural breaks and anomalies (outliers).

Figure 1. Evolution of Services and Retail (Regional Averages, 2019-2025)



The study employs panel data regression analysis. The choice between pooled ordinary least squares (Pooled OLS), the fixed effects (FE) model, and the random effects (RE) model was made based on the Hausman specification test.

The results of the Hausman test (Prob>chi2 = 0.000) made it possible to confidently reject the null hypothesis, confirming that the fixed effects (FE) model is the most consistent and efficient for this study. The FE model effectively controls for unobserved regional heterogeneity (e.g., cultural differences or the state of local infrastructure), which may correlate with the independent variables.

The final regression equation takes the following form:

$$\ln(Y_{it}) = \beta_0 + \beta_1 X_{1,i(t-1)} + \beta_2 \ln(X_{2,it}) + \beta_3 X_{3,it} + \alpha_i + \varepsilon_{it}$$

Where:

- α_i — time-invariant regional fixed effects;
- ε_{it} — random error;
- Subscripts i and t denote region and year, respectively.

In this semi-logarithmic model, where the dependent variable is logarithmized (ln(Y)), the coefficients are interpreted as semi-elasticities. In particular, when the independent variable (X) changes by one unit, the percentage change in Y is calculated as (e^β − 1) · 100. For small values of β (as a rule, |β| < 0.1), this value is approximately equal to β · 100, which reflects the percentage impact on the volume of the service sector.

Data processing and analysis were carried out using a comprehensive toolkit:

Microsoft Excel: Used for initial data entry, data cleaning, and basic calculation of demographic indicators.

Python (Pandas, Seaborn): Applied for advanced data visualization and analysis of regional distribution.

Stata 17: Used for the main econometric modeling, including conducting the Hausman test, checking for multicollinearity (VIF), and estimating the final regression.

Before conducting the regression analysis, it is necessary to assess the nature of relationships between variables and to check the data for potential multicollinearity. For this purpose, a correlation matrix was constructed and visualized in the form of a heatmap.

	X3	*ln_Y*	*ln_X1*	*ln_X2*
X3	**1**	**-0,466**	**0,04506**	**-0,3445**
ln_Y	**-0,466**	**1**	**0,31772**	**0,92957**
ln_X1	**0,04506**	**0,31772**	**1**	**0,44822**
ln_X2	**-0,3445**	**0,92957**	**0,44822**	**1**

The analysis of the matrix allows the following conclusions to be drawn:
• **Sectoral Synergy:** An exceptionally high positive correlation (0.929) is observed between lnY (market services) and lnX2 (retail trade turnover). This confirms the hypothesis that the service sector and retail trade in the regions of Uzbekistan develop as an integrated consumer ecosystem.
• **Demographic Impact:** The variable lnX1 shows a moderate positive correlation (0.317) with the volume of services. This indicates a direct but complex relationship that requires further verification using regression coefficients.
• **Inflationary Pressure:** The negative correlation (-0.466) between the price index (X3) and the volume of services reinforces evidence of the destructive impact of inflation on the growth rates of the service sector.
• **Multicollinearity Check:** The absence of critically high correlation (above 0.8) between the independent variables X1 and X3 indicates the structural integrity of the model and the absence of estimation bias.

The application of the fixed effects (FE) model made it possible to obtain results with a high coefficient of determination ($R^2 = 0.941$), explaining more than 94% of the variation in service volumes across regions.

Variable	**Coefficient (β)**	**Std. Error**	**t-statistic**	**P-value**
Demographic Balance (X1)	0.0207	0.0051	4.05	0.000***
Retail Trade Turnover (lnX2)	0.8412	0.0324	25.96	0.000***
CPI (X3)	−0.0645	0.0211	−3.05	0.003**
Constant	5.1230	0.4521	11.33	0.000

Note: $R^2 = 0.941$, N = 98 *p < 0.1, **p < 0.05, ***p < 0.01*

1. Household Formation Effect (β1 = 0.0207): The positive coefficient of the demographic balance variable is a key result of this study. All else being equal, an increase in the net growth of families

(the difference between marriages and divorces) by 1,000 units leads to a 2.07% increase in the volume of market services. This is explained by the fact that the creation of a new family initiates a long-term consumption cycle: from primary household services and repairs to long-term investments in education and healthcare.

Although the demographic impact represents a more complex phenomenon, the empirical data presented in Figure 4 demonstrate a statistically significant positive trend. Despite regional differences, the upward-sloping linear trend line confirms that household formation serves as a fundamental driver of service market expansion.

Figure 4. Impact of Demographic Balance on Market Services

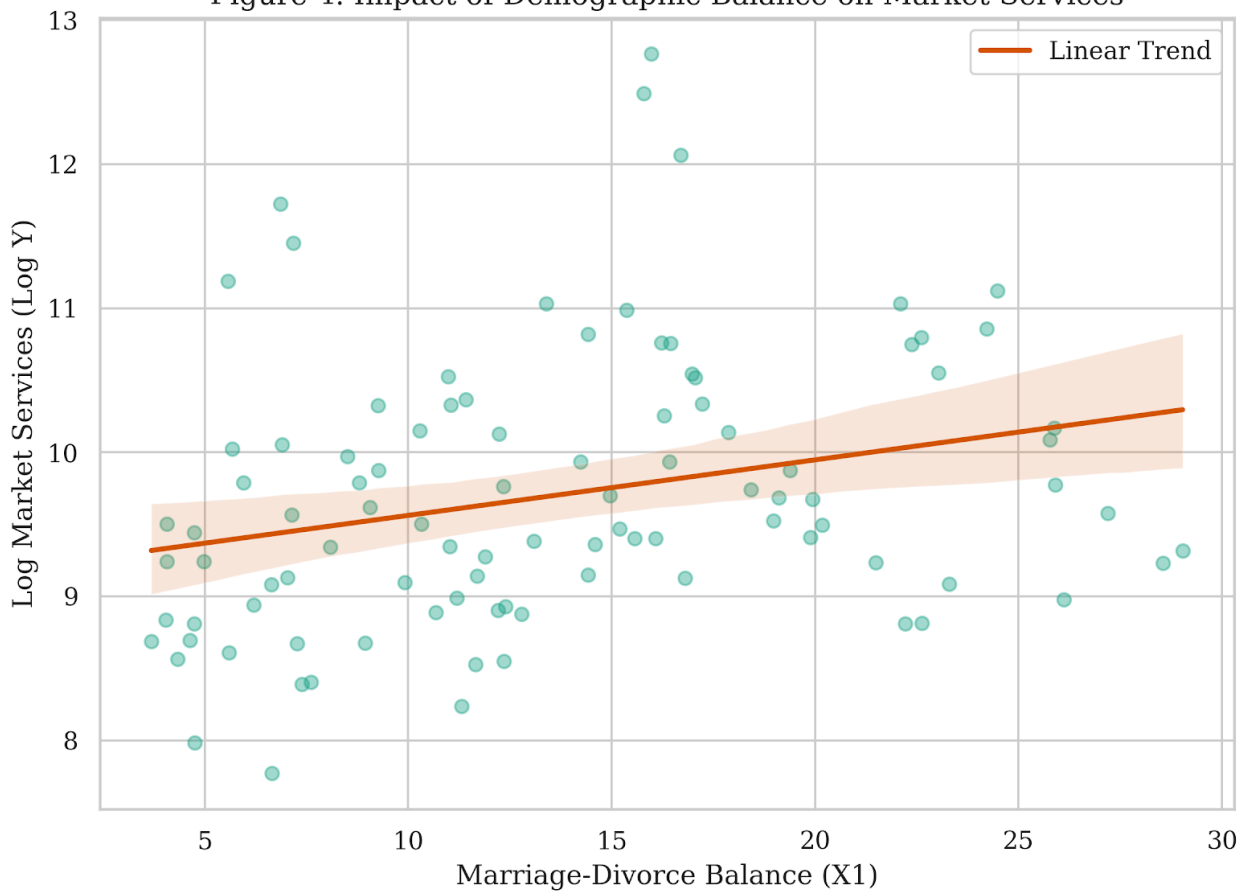


Figure 1. Regression analysis of the logarithm of the volume of market services (Y) relative to the balance of marriages and divorces (X1). The positive slope confirms the role of the demographic dividend in stimulating demand for services.

2. **Integration with the Goods Market (β2 = 0.8412):** The elasticity coefficient of 0.84 is the highest in the model. This implies that a 1% increase in retail trade turnover generates a 0.84% expansion of the service sector. This relationship emphasizes that the service sector in the regions of Uzbekistan largely acts as a "companion" to the goods market, encompassing logistics, maintenance, and point-of-sale services.

The elasticity coefficient of 0.8412 indicates an almost linear relationship between these variables. This stability is visually confirmed in Figure 2, where observations show tight clustering along the regression line, illustrating a high degree of integration between the retail trade and service sectors.

Figure 3. Synergy between Retail Turnover and Market Services

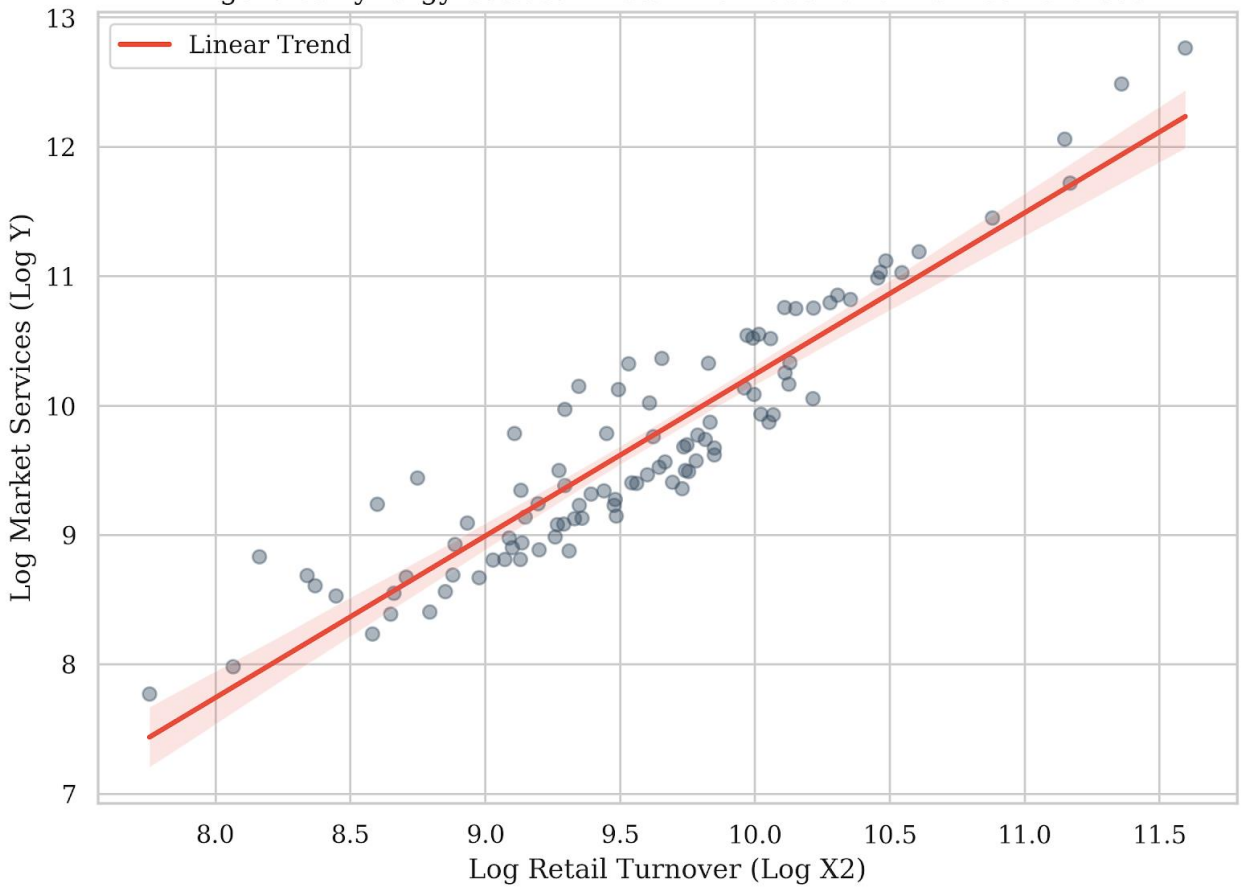


Figure 2. Scatter plot of the logarithm of the volume of market services (Y) as a function of the logarithm of retail trade turnover (X2). The narrow confidence interval reflects the high statistical reliability of the hypothesis of sectoral synergy.

3. **Inflation Barrier (β3 = −0.0645):** The negative inflation coefficient indicates that a 1% increase in prices above target levels leads to a 6.45% contraction in the volume of services. Services, unlike essential goods, exhibit higher price elasticity; under inflationary conditions, households primarily reduce expenditures in this sector.

The results demonstrate that Uzbekistan's demographic dividend—a young population and a high intensity of family formation—serves as a powerful latent driver of the economy. However, the effectiveness of this driver largely depends on macroeconomic stability. In regions such as Samarkand, characterized by high population density and active urbanization, the effect of the demographic balance is most pronounced, creating sustained demand for modern digital and educational services.

CONCLUSION.

In this study, the determinants of the market services sector in Uzbekistan were empirically examined using a fixed effects (FE) panel data model. The results demonstrate that the growth of regional services is a multifaceted process driven by demographic stability, consumer capacity, and the macroeconomic environment.

The study made it possible to formulate three main conclusions:

1. Demographic Dividend: Household formation acts as a stable catalyst for growth. A net increase of 1,000 families leads to a 2.07% expansion in the volume of services, confirming the role of the balance of marriages and divorces as a viable leading indicator of regional demand.
2. Sectoral Dependence: The high elasticity (0.84) between retail trade and services indicates that the service sector currently functions more as a secondary infrastructure of the goods market rather than as an independent driver of growth.
3. Inflation Sensitivity: The sector is highly vulnerable to price shocks: a 1% increase in the CPI leads to a 6.45% contraction in the volume of services. This highlights the discretionary nature of service consumption in the national economy (dependence on disposable income).

Overall, the high explanatory power of the model ($R^2 = 0.941$) allows us to assert that these variables are fundamental for strategic regional planning in Uzbekistan.

For the effective use of the obtained results, the following targeted intervention measures are recommended:

1. Institutional Support for Households: Government authorities should prioritize housing and social subsidies for young families. By stabilizing the net marriage rate, the state creates a predictable and long-term demand base for household and educational services.
2. Macroeconomic Price Stability: Given the strong negative impact of inflation on the service sector, the Central Bank should adhere to strict inflation targeting. Price stability is crucial to prevent the “crowding out” of service consumption by essential goods.
3. Integrated Trade and Service Hubs: Urban planning should focus on the co-location of retail and service facilities. Since these two sectors are deeply integrated ($\beta = 0.84$), the creation of multifunctional consumption zones will maximize regional economic outcomes.
4. Digitalization for Regional Resilience: To reduce the sector’s dependence on physical retail turnover, investments should be directed toward the development of digital service delivery channels, especially in regions such as Samarkand. This will allow the growth of the service sector to be decoupled from the constraints of traditional trade infrastructure.

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