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AN EMPIRICAL ANALYSIS OF THE FACTORS AFFECTING THE FINANCING OF INVESTMENT PROJECTS

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Abstract. This article presents an empirical analysis of the factors affecting the financing of investment projects in the Republic of Uzbekistan. Three methods are applied jointly: estimation of a trend model based on 2019–2025 data, decomposition of the contribution of individual financing sources to investment growth, and measurement of shifts in the structure of financing sources using the Gatev index. The estimated exponential trend model has high explanatory power ($R^2 = 0.9566$), and the average annual growth rate of investment over the period amounted to 20.5 per cent. The decomposition shows that, of the 10.94 percentage points of growth recorded in 2025, 8.70 percentage points, or 79.5 per cent, are attributable to foreign investment and loans; together with foreign loans extended under state guarantees, external sources account for 93.2 per cent of the growth. Enterprises' own funds, while representing 15.3 per cent of total investment, contributed only 1.1 per cent of the growth. The Gatev index value of 0.4131 confirms a considerably high degree of structural change in financing sources over the 2022–2025 period. Conclusions and policy recommendations are formulated on the basis of the identified regularities.

Keywords: investment project, financing factors, empirical analysis, trend model, growth contribution decomposition, structural shift, Gatev index, foreign investment, bank credit, financing sources.

Annotatsiya. Ushbu maqolada O'zbekiston Respublikasida investitsiya loyihalarini moliyalashtirishga ta'sir etuvchi omillarning empirik tahlili amalga oshirilgan. Tadqiqotda uchta usul birgalikda qo'llanilgan: 2019–2025-yillar ma'lumotlari asosida trend modelini baholash, alohida moliyalashtirish manbalarining investitsiyalar o'sishiga qo'shgan hissasini dekompozitsiya qilish hamda Gatev indeksi yordamida moliyalashtirish manbalari tarkibidagi siljishlarni o'lchash. Baholangan eksponensial trend modeli yuqori tushuntirish qobiliyatiga ega ($R^2 = 0,9566$), mazkur davrda investitsiyalarning o'rtacha yillik o'sish sur'ati 20,5 foizni tashkil etgan. Dekompozitsiya natijalari shuni ko'rsatadiki, 2025-yilda qayd etilgan 10,94 foiz punktlilik o'sishning 8,70 foiz punkti yoki 79,5 foizi xorijiy investitsiyalar va kreditlar hissasiga to'g'ri keladi; davlat kafolati ostida jalb etilgan xorijiy kreditlar bilan birgalikda tashqi manbalar umumiy o'sishning 93,2 foizini ta'minlagan. Korxonalarning o'z mablag'lari jami investitsiyalarning 15,3 foizini tashkil etgan bo'lsa-da, ularning o'sishiga qo'shgan hissasi atigi 1,1 foizni tashkil etgan. Gatev indeksining 0,4131 qiymati 2022–2025-yillar davomida moliyalashtirish manbalari tarkibida sezilarli darajada yuqori strukturaviy o'zgarish yuz berganini tasdiqlaydi. Aniqlangan qonuniyatlar asosida xulosalar hamda iqtisodiy siyosatga oid tavsiyalar ishlab chiqilgan.

Kalit so'zlar: investitsiya loyihasi, moliyalashtirish omillari, empirik tahlil, trend modeli, o'sishga qo'shilgan hissani dekompozitsiya qilish, tarkibiy siljish, Gatev indeksi, xorijiy investitsiyalar, bank krediti, moliyalashtirish manbalari.

Аннотация. В данной статье представлен эмпирический анализ факторов, влияющих на финансирование инвестиционных проектов в Республике Узбекистан. Совместно применены три метода: оценка трендовой модели на основе данных за 2019–2025 годы, декомпозиция вклада отдельных источников финансирования в рост инвестиций и измерение изменений в структуре источников финансирования с помощью индекса Гатева. Оцененная экспоненциальная трендовая модель обладает высокой объясняющей способностью ($R^2 = 0,9566$), а среднегодовой темп роста инвестиций за рассматриваемый период составил 20,5 процента. Результаты декомпозиции показывают, что из 10,94 процентного пункта роста, зафиксированного в 2025 году, 8,70 процентного пункта, или 79,5 процента, приходится на иностранные инвестиции и кредиты; вместе с иностранными кредитами, привлеченными под государственную гарантию, внешние источники обеспечили 93,2 процента общего роста. Собственные средства предприятий, составляя 15,3 процента общего объема инвестиций, обеспечили лишь 1,1 процента прироста. Значение индекса Гатева, равное 0,4131, подтверждает достаточно высокую степень структурных изменений в источниках финансирования за период 2022–2025 годов. На основе выявленных закономерностей сформулированы выводы и рекомендации в области экономической политики.

Ключевые слова: инвестиционный проект, факторы финансирования, эмпирический анализ, трендовая модель, декомпозиция вклада в рост, структурный сдвиг, индекс Гатева, иностранные инвестиции, банковский кредит, источники финансирования.

INTRODUCTION

The financing of investment projects is influenced by a broad range of factors, including the macroeconomic environment, the level of financial market development, the internal saving capacity of enterprises, inflows of foreign capital, and the investment policy pursued by the state. A qualitative description of each of these factors is insufficient; their relative importance must also be assessed quantitatively, since such an assessment makes it possible to substantiate the priorities of investment policy.

Investment activity in Uzbekistan has expanded rapidly in recent years: investment in fixed capital increased from UZS 195.9 trillion in 2019 to UZS 591.1 trillion in 2025, representing an increase of more than threefold. However, the composition of this growth has been far from uniform: some financing sources have expanded rapidly, while others have remained almost unchanged or have contracted. Uncovering the structural processes underlying the aggregate growth figure therefore constitutes a separate research task.

The purpose of this study is to empirically assess the relative importance of the factors affecting the financing of investment projects, identify the regularities in investment growth dynamics, and quantitatively measure shifts in the structure of financing sources.

LITERATURE REVIEW

The empirical assessment of the determinants of investment activity is one of the traditional areas of economic research. In D. Jorgenson's neoclassical investment model, the user cost of capital is regarded as the principal explanatory factor [1]. The study by S. Fazzari, R. Hubbard, and B. Petersen provided empirical evidence that, under financing constraints, investment is highly sensitive to internal cash flow [2], indicating the need to consider internal saving capacity as a separate determinant.

Two approaches coexist in the literature concerning the impact of foreign investment on the investment process in host countries. According to E. Borensztein, J. De Gregorio, and J.-W. Lee, foreign direct investment has a positive effect on economic growth, but this effect materialises only when a certain threshold level of human capital is reached [3]. L. Alfaro and co-authors show that the magnitude of this effect depends on the level of development of the domestic financial market [4]. In other words, foreign capital cannot substitute for domestic financial intermediation.

The relationship between financial development and investment has been extensively examined by R. Levine, who demonstrates that the level of development of the banking system and capital markets is an important determinant of long-run economic growth [5]. The study by R. Rajan and L. Zingales provided empirical evidence that industries that are more dependent on external finance grow faster in countries with more developed financial markets [6].

From a methodological perspective, the decomposition of contributions to growth is widely used in statistical analysis and makes it possible to attribute changes in an aggregate indicator to its individual components. Structural shifts are measured using the Gatev, Ryabtsev, and Salai indices [7]. Individual aspects of the investment process have also been examined in the domestic literature [8; 9]. However, studies combining decomposition analysis with structural shift indices in the analysis of financing sources remain relatively rare. The present article is intended to fill this gap.

RESEARCH METHODOLOGY

Three empirical methods are applied jointly in this study.

The first method is the estimation of a trend model. Using the 2019–2025 series, linear and exponential models were estimated by ordinary least squares, and the better-fitting specification was selected on the basis of the coefficient of determination (R^2). The exponential model takes the following form:

$$\ln y_t = a + b \cdot t + \varepsilon_t, \quad \text{average annual growth rate} = (e^b - 1) \times 100 \%,$$

where y denotes investment in fixed capital; t is the ordinal number of the time period; and a and b are the parameters of the model.

The second method is the decomposition of contributions to growth. The contribution of each financing source to aggregate growth is obtained as the product of the share of the source and its growth rate: $C_i = w_i \times g_i$, where w_i is the share of source i in total investment, g_i is its growth rate, and C_i is the contribution expressed in percentage points. The sum of the contributions equals the aggregate growth rate.

The third method is the measurement of structural shift. The magnitude of the change in the structure of financing sources was assessed by means of the Gatev index:

$$K = \sqrt{[\sum (w_{1i} - w_{0i})^2 / \sum (w_{1i}^2 + w_{0i}^2)]},$$

where w_{0i} and w_{1i} denote the shares of source i in the base and reporting periods, respectively. Index values in the range 0.151–0.300 are interpreted as a significant shift, values in the range 0.301–0.500 as a

considerably high shift, and values above 0.501 as a large structural shift.

The information base of the study comprises the 2019–2025 data of the Statistics Agency and the Central Bank of the Republic of Uzbekistan, while artificial intelligence tools were used for up to 10% of the preparation of the article text.

ANALYSIS AND RESULTS

The results of the estimation of the trend model are presented in Table 1.

Table 1.

Dynamics of investment in fixed capital and results of the trend model

Year	Actual value, UZS trillion	Model value, UZS trillion	Deviation, UZS trillion	Deviation, %
2019	195.9	174.7	+21.2	+12.1
2020	210.2	210.5	−0.3	−0.1
2021	239.6	253.7	−14.1	−5.6
2022	269.9	305.6	−35.7	−11.7
2023	352.1	368.2	−16.1	−4.4
2024	449.3	443.6	+5.7	+1.3
2025	591.1	534.5	+56.6	+10.6

Source: author's calculations based on data of the Statistics Agency and the Central Bank of the Republic of Uzbekistan. Model: $\ln y = 4.9770 + 0.1863t$; $R^2 = 0.9566$; for the linear specification $R^2 = 0.8872$.

The exponential model fits the data considerably better than the linear one ($R^2 = 0.9566$ against 0.8872). This indicates that investment has been growing not at a constant absolute increment but at a constant relative rate. The estimated parameter $b = 0.1863$ implies an average annual growth rate of investment of 20.5 per cent over the period under review.

The analysis of deviations provides additional information. In 2022, the actual value fell 11.7 per cent short of the model value, which is explained by the unfavourable change in the global environment. In 2025, by contrast, the actual value exceeded the model value by 10.6 per cent; that is, growth outpaced the trend. The fact that the sign of the deviations turned from negative to positive from 2022 onwards confirms that the process accelerated in the second half of the period.

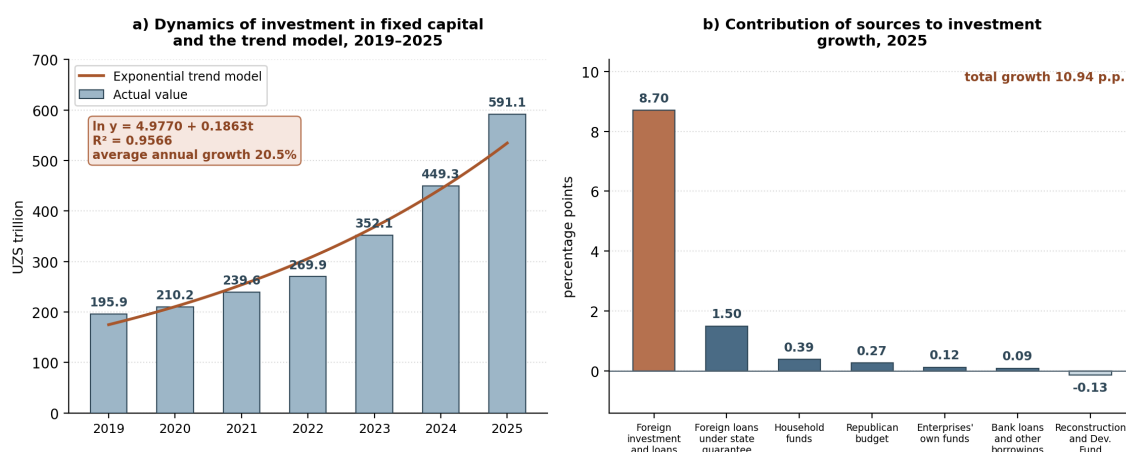


Figure 1. Investment dynamics, the trend model, and the contribution of sources to growth

In order to establish the relative importance of the individual factors, the contribution to growth in 2025 was decomposed (Table 2).

Table 2.
Contribution of financing sources to investment growth, 2025

Financing source	Share (w), %	Growth rate (g), %	Contribution (C), p.p.	Share of contribution, %
Foreign investment and loans	65.9	+13.2	8.70	79.5
Foreign loans under state guarantee	5.5	+27.2	1.50	13.7
Household funds	6.3	+6.2	0.39	3.6
Republican budget funds	4.7	+5.8	0.27	2.5
Enterprises' own funds	15.3	+0.8	0.12	1.1
Bank loans and other borrowings	1.9	+4.6	0.09	0.8
Reconstruction and Development Fund	0.4	-32.0	-0.13	-1.2
Total	100.0	x	10.94	100.0

The results of the decomposition reveal a pronounced divergence in the relative importance of the individual factors. Of the aggregate growth of 10.94 percentage points, 8.70 percentage points, or 79.5 per cent, are attributable to foreign investment and loans. Taken together with foreign loans extended under state guarantee, the combined contribution of external factors reaches 93.2 per cent.

The contribution of domestic sources, by contrast, is very small. Enterprises' own funds account for 15.3 per cent of total investment, yet their contribution to growth amounts to only 0.12 percentage points, or 1.1 per cent — a result explained by the very low growth rate of this source (0.8 per cent). The contribution of bank loans does not exceed 0.09 percentage points. This finding yields an important methodological conclusion: a large share of a given source does not imply a correspondingly large contribution to growth. Enterprises' own funds rank second in terms of volume, yet as a dynamic factor they are barely operative.

The long-run outcome of the interaction of these factors is reflected in the shift in the structure of financing sources (Table 3, Figure 2).

Table 3.
Shift in the structure of financing sources, 2022 and 2025

Source	2022 (w□), %	2025 (w□), %	Difference, p.p.	Ratio, times
Foreign investment and loans	36.0	65.9	+29.9	1.83
Enterprises' own funds	31.3	15.3	-16.0	0.49
Households, bank loans and other sources	18.4	8.2	-10.2	0.45
Republican budget funds	7.7	4.7	-3.0	0.61
Foreign loans under state guarantee	5.7	5.5	-0.2	0.96
Reconstruction and Development Fund	0.9	0.4	-0.5	0.44

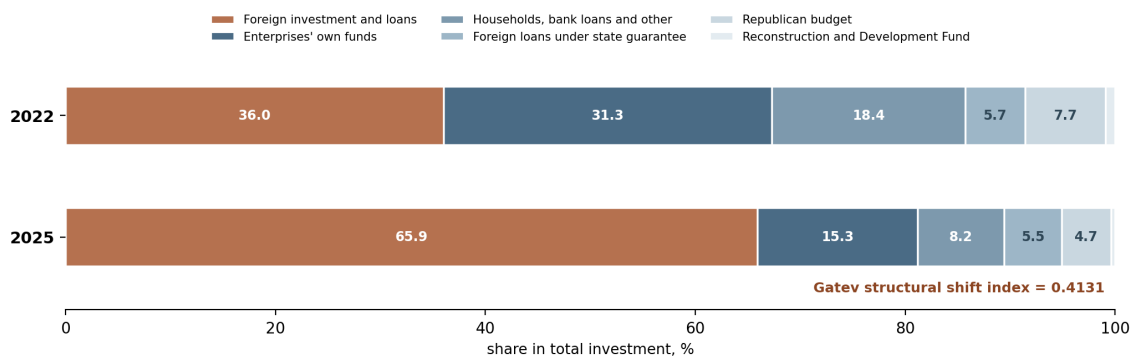


Figure 2. Shift in the structure of financing sources, 2022 and 2025

The Gatev index value of 0.4131 indicates that a considerably high shift occurred in the structure of financing sources over the period under review. The direction of the shift is unambiguous: the share of foreign investment and loans rose from 36.0 to 65.9 per cent, that is, by a factor of 1.83, while the shares of all other sources declined. The sharpest decline was recorded for enterprises' own funds — from 31.3 to 15.3 per cent,

or by almost half.

Interpreting the results of the three methods jointly yields the following conclusion: the rapid expansion of the investment process (an average of 20.5 per cent per year) has been driven almost entirely by a single factor — the inflow of external capital — while domestic financing sources have not merely lost relative weight but have also remained sluggish in absolute terms. Such a structure delivers high growth rates in the short run, yet it increases sensitivity to the external environment over the longer horizon: according to the decomposition results, a 10 per cent contraction in foreign capital inflows would reduce the aggregate growth rate by approximately 6.6 percentage points.

CONCLUSION AND SUGGESTIONS

The estimated exponential trend model ($\ln y = 4.9770 + 0.1863t$; $R^2 = 0.9566$) confirms a stable average annual growth rate of investment in fixed capital of 20.5 per cent over 2019–2025. The model outperforms the linear alternative by a considerable margin ($R^2 = 0.8872$), indicating that growth proceeds at a constant relative rate.

The decomposition of contributions to growth reveals a pronounced divergence in the relative importance of the factors: of the 10.94 percentage points of growth in 2025, 79.5 per cent is attributable to foreign investment and loans, and 93.2 per cent to external sources taken as a whole.

Enterprises' own funds account for 15.3 per cent of total investment, yet contributed only 1.1 per cent of the growth. This gap between the share of a source and its dynamic role points to the weak internal saving capacity of the corporate sector.

The Gatev index value of 0.4131 confirms a considerably high and unidirectional shift in the structure of sources over 2022–2025: the share of external sources increased by a factor of 1.83, while that of enterprises' own funds fell by almost half.

On the basis of the regularities identified, the following recommendations are put forward: first, to monitor, alongside the aggregate growth rate, the contribution of domestic sources to growth as a criterion of the effectiveness of investment policy; second, to strengthen tax and depreciation policy measures aimed at raising the internal saving capacity of enterprises; third, to increase the weight of domestic financial intermediation in the investment process by developing the bank lending and corporate bond channels; and fourth, to assess regularly the degree of dependence on external capital inflows and to incorporate scenario analysis into the procedure for drawing up investment programmes.

The principal limitation of the study is the short length of the time series ($n = 7$); the availability of a longer series would allow a multivariate regression model to be estimated and would improve the precision of the results.

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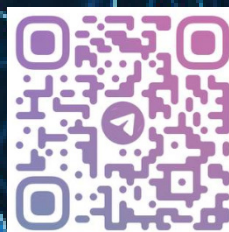
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