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ECONOMETRIC MODELS FOR EVALUATING INVESTMENT PROJECTS AND ENSURING THE DEBT SUSTAINABILITY OF RAILWAY TRANSPORT ENTERPRISES

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Abstract. This article presents an integrated econometric framework for assessing debt sustainability and investment efficiency at Uzbekistan Railways Joint Stock Company, which is undergoing structural transformation under Resolution No. PQ-329 in the context of comprehensive reforms in the railway sector. The impact of CapEx (capital expenditures), exchange rates, and tariff changes on the financial stability of the enterprise was analyzed using ARDL and dynamic DSCR (debt service coverage ratio) stress-testing models. The results show that unsecured external debt under macroeconomic shocks may reduce the DSCR below the safety threshold. Targeted optimization of operating costs helps mitigate the risk of default. Based on the obtained results, a strategic policy for capital allocation to railway infrastructure was proposed.

Keywords: railway transport economics, debt service coverage ratio, econometric modeling, investment project evaluation, debt sustainability, capital expenditures, ARDL model, structural decomposition.

Аннотация. В статье предложен интегрированный эконометрический подход к оценке долговой устойчивости и инвестиционной эффективности акционерного общества «Узбекистон темир йуллари», проходящего процесс структурной трансформации в соответствии с постановлением № ПП-329 в условиях масштабных реформ железнодорожной отрасли. Влияние CapEx (капитальных затрат), валютного курса и изменений тарифов на финансовую устойчивость предприятия проанализировано с использованием модели ARDL и динамических стресс-тестовых моделей DSCR (коэффициента покрытия обслуживания долга). Результаты показывают, что необеспеченный внешний долг в условиях макроэкономических шоков может привести к снижению коэффициента DSCR ниже безопасного порогового значения. Целевая оптимизация операционных расходов способствует снижению риска дефолта. На основе полученных результатов предложена стратегическая политика распределения капитальных вложений в железнодорожную инфраструктуру.

Ключевые слова: экономика железнодорожного транспорта, коэффициент покрытия обслуживания долга, эконометрическое моделирование, оценка инвестиционных проектов, долговая устойчивость, капитальные затраты, модель ARDL, структурная декомпозиция.

INTRODUCTION

Amid geoeconomic fragmentation and the profound transformation of logistics chains, rail transport stands as a strategic infrastructure sector that ensures the continuity of economic activity across time and space, as well as the country's export-import potential. The stable operation of the sector plays a pivotal role in strengthening national economic security by deepening interregional integration and diversifying foreign trade corridors.

Projects involving comprehensive infrastructure development, the electrification of railway sections, and the renewal of rolling stock require substantial capital investment. Due to technological complexity and high technical standards, the ability of industry enterprises to fully finance this growing volume of investment from their own funds or the state budget is limited.

Therefore, the implementation of development strategies requires the active attraction of external and domestic debt capital, including loans from international financial institutions, sovereign borrowing, corporate bonds, public-private partnership mechanisms, and syndicated lending. However, the diversity of funding sources and their differing financial terms complicate the structure of an enterprise's debt portfolio.

A fundamental feature of railway projects is their long payback period (15–30 years) and relatively low direct profitability. Although this situation may pose a high risk for private investors, the substantial indirect, socio-economic, and environmental benefits of such projects require specific methodological approaches to investment decision-making.

In recent years, the rapid modernization of the railway sector in developing countries has been accompanied by a significant increase in corporate and state-guaranteed debt portfolios. The growth of large-scale liabilities may adversely affect the financial independence indicators of transport enterprises and further increase liquidity risks.

The main systemic problem in debt management arises from the fact that operating income and tariff revenues are generated in the national currency, while a significant share of loans is attracted in foreign currency. In the long term, depreciation of the national currency may create currency and interest-rate mismatches, substantially increasing debt-servicing costs.

To prevent financial instability and maintain solvency, it is necessary to apply debt restructuring and hedging instruments. The risk of failing to meet obligations on time may have a direct adverse impact not only on the reputation of the transport enterprise but also on the sovereign credit rating of the state.

Since traditional financial management methods cannot fully account for external macroeconomic shocks, the introduction of modern analytical and forecasting tools in the sector is becoming increasingly important. Based on this, the study aims to develop a comprehensive methodology for effective investment portfolio management, risk minimization, and ensuring debt sustainability in railway enterprises.

LITERATURE REVIEW

The macroeconomic and sectoral effects of investment in transport infrastructure, particularly railways, have been the focus of considerable attention among international and domestic scholars. According to classical theories developed by A. Aschauer and R. Barro, infrastructure capital is one of the key drivers of economic growth and the productivity of private investment. Empirical studies have confirmed that capital investment in railways may have a multiplier effect on national output by reducing logistics costs, increasing regional connectivity, and promoting market integration.

Researchers from international financial institutions such as the World Bank, the Asian Development Bank (ADB), and the European Bank for Reconstruction and Development (EBRD) emphasize that railway projects often have relatively low direct commercial profitability due to their high capital intensity and long payback periods of 15–30 years. Therefore, the evaluation of such projects should not be limited to traditional financial indicators but should also make extensive use of socio-economic cost-benefit analysis (CBA).

The characteristics of financing large infrastructure projects through long-term debt capital and corporate bonds have been thoroughly examined in the works of E. Brigham, M. Ehrhardt, and S. Myers. According to corporate finance theory, matching long-term liabilities with long-term assets and optimizing the capital structure are fundamental factors in reducing financial risks and ensuring sustainability. However, as experts from the IMF and the World Bank have noted, excessive debt burdens in developing countries and the growth of debt-servicing costs at a faster rate than revenues may weaken the solvency of enterprises and increase the risk of sovereign debt distress.

The management of currency and interest-rate risks in infrastructure projects is one of the most pressing issues. As researchers such as G. Franke and R. Stulz have shown, the fact that railway companies generate revenues in national currency while holding debt obligations denominated in foreign currencies (USD, EUR, CNY) creates a structural currency mismatch. In the event of devaluation, this mismatch may sharply increase debt-servicing costs and create a risk of default.

Although derivatives and hedging techniques have been widely studied as instruments for ensuring debt sustainability, the development of alternative institutional and operational mechanisms, such as foreign-currency-linked export tariffs or natural hedging, is particularly important in developing countries where financial markets remain insufficiently developed. Moreover, European and Asian experience, as reflected in the studies of C. Nash and D. van de Velde, confirms that separating infrastructure management from operational activities and introducing public-private partnership (PPP) models can facilitate more rational risk allocation and reduce the debt burden of railway enterprises.

Although issues related to investment resource management, the expansion of transit capacity, and digitalization in the railway sector have been studied by researchers from the CIS, Central Asia, and Uzbekistan, integrated methodological approaches applicable under conditions of macroeconomic instability remain insufficiently developed. In particular, there is a need for deeper analysis of critical indicators and multifactor models capable of forecasting the relationship between debt-servicing obligations and operating income under currency risk. This research gap determines the relevance of the present study.

RESEARCH METHODOLOGY

The study of mechanisms for effective investment portfolio management, currency risk mitigation, and long-term debt sustainability in railway enterprises requires a logically and methodologically coherent step-by-step approach. This section develops the theoretical and methodological foundations of the study, identifies the data sources, and specifies the parameters of an econometric model used to assess the dependence of the debt burden on operational indicators and macroeconomic shocks.

The methodological basis of the study includes systematic and comparative analysis, financial and investment analysis methods, empirical econometrics, as well as time-series and panel-data analysis. Taking into account the specific characteristics of the railway network, methodological elements of socio-economic cost-benefit analysis and intersectoral balance models are used in project evaluation alongside traditional financial evaluation criteria.

The empirical basis of the study consists of multi-year financial and operational reports of Uzbekistan Railways JSC, including balance sheets and financial statements prepared in accordance with GAAP and IFRS standards, as well as open databases of the State Statistics Agency, the Central Bank, the Ministry of Finance, and international financial institutions such as the World Bank and the Asian Development Bank. To ensure the reliability of the analysis, the dataset covers a period of at least 10–15 years.

A multivariate econometric regression model is developed to determine the critical thresholds of debt sustainability and assess the impact of currency risk on the solvency of the enterprise. In the model, the enterprise's Debt Service Coverage Ratio (DSCR) or Debt/EBITDA ratio is used as the dependent variable:

$$DSCR_t = \beta_0 + \beta_1 EXCH_t + \beta_2 IR_t + \beta_3 CAPEX_t + \beta_4 TRAFF_t + \epsilon_t$$

Here:

$DSCR_t$ — debt service coverage ratio for period t ;

$EXCH_t$ — the exchange rate of the national currency against the US dollar (the degree of currency devaluation);

IR_t — weighted average interest rate on borrowed funds;

$CAPEX_t$ — the volume of capital investments in railway infrastructure;

$TRAFF_t$ — freight and passenger traffic turnover (operating revenue driver);

ϵ_t — random error (stochastic term).

To prevent spurious regression results in the econometric model based on time-series data, all variables are tested for stationarity. For this purpose, the Augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) tests are applied. If the variables are stationary after first differencing, the Johansen cointegration test is used to determine whether a long-run equilibrium relationship exists among them.

To assess the short- and long-term effects of changes in the debt burden and macroeconomic shocks, either a Vector Error Correction Model (VECM) or an Autoregressive Distributed Lag (ARDL) model is constructed. These econometric models make it possible to quantitatively assess how strongly and for how long the depreciation of the national currency or an increase in interest rates may affect the solvency of a railway enterprise.

The next important stage of the modelling process involves stress testing and scenario analysis. This stage simulates the resilience of the debt portfolio under unexpected and sharp fluctuations in macroeconomic and sectoral parameters, such as a 15–20% depreciation of the exchange rate, a decline in transit cargo revenues, or an increase in interest rates. The probability distribution of default is modelled using the Monte Carlo method.

The investment portfolio optimization section involves constructing investment and debt portfolio models that ensure maximum financial and socio-economic efficiency at a minimum level of risk, based on the principles of Harry Markowitz's "Portfolio Theory." The objective function is to minimize debt-servicing costs while maximizing the aggregate net present value (NPV) of projects.

The accuracy and adequacy of the econometric model results are tested using various diagnostic procedures, including tests for heteroscedasticity, autocorrelation, and the normality of residuals. These tests help ensure the statistical significance and reliability of the indicators obtained from the model.

At the final stage, based on the developed econometric model and simulation results, "Early Warning System" indicators for ensuring debt sustainability in railway enterprises are formed. This methodological framework serves as a risk-management tool for investment decision-making and helps prevent the debt portfolio from reaching a critical level. In addition, artificial intelligence tools were used as an auxiliary instrument

in systematizing the research materials and preparing the article text, accounting for no more than 10% of the overall work.

ANALYSIS AND RESULTS

The developed mathematical-econometric model and stress-testing methodology were validated using data from a hypothetical large-scale investment project in the railway transport sector (an electrification and rolling stock renewal portfolio) designed for a 15-year period.

The total cost of the project is USD 500 million. Of this amount, 70 percent (USD 350 million) is financed by International Financial Institutions (IFIs) for a period of 15 years, including a 3-year grace period, at an annual interest rate of SOFR + 2.5%. The remaining 30 percent (USD 150 million) is financed through the enterprise's own funds and a state subsidy.

As part of the analysis, simulations were conducted under three main scenarios:

Baseline scenario: stable GDP growth (+5.5%), annual devaluation of $\delta = 6.0\%$, and tariffs fully indexed to inflation ($\gamma = 1.0$).

Moderate stress scenario: annual devaluation of $\delta = 12.0\%$, tariffs lagging behind inflation by 50% ($\gamma = 0.5$), and a 10% decrease in cargo volume.

Pessimistic (crisis stress) scenario: sharp devaluation ($\delta = 25.0\%$), frozen tariffs ($\gamma = 0.0$), and a 25% decrease in cargo volume.

Table 1. Initial macroeconomic and operational parameters for the model

Indicator	Baseline scenario	Moderate stress	Pessimistic scenario
Currency devaluation (δ), annual	6.0%	12.0%	25.0%
Tariff indexation coefficient (γ)	1.0	0.5	0.0
Change in cargo turnover (ΔV)	+4.5%	-10.0%	-25.0%
Loan interest rate (SOFR+Spread)	6.5%	8.0%	10.5%
WACC (in Sum)	14.5%	17.0%	21.0%

The modeling results show that, under the baseline scenario, the project is fully self-financing and remains within the safe zone of debt sustainability ($DSCR \geq 1.30$). However, due to the mismatch between foreign-currency-denominated debt and local-currency revenues, the financial indicators deteriorate sharply under conditions of currency depreciation and tariff restrictions.

Table 2. Dynamics of the Project's Financial and Debt Sustainability Indicators ($t = 1-15$ years)

Indicator (Average / Min)	Baseline scenario	Moderate stress	Pessimistic scenario	Critical limit
NPV (USD million)	+112.4	+18.2	-64.5	>0
IRR (%)	16.2%	11.5%	6.8%	>WACC
Basic DSCR (average)	1.65	1.22	0.84	≥ 1.30
Minimum DSCR ($DSCR_{min}$)	1.38	1.04	0.61	≥ 1.20
LLCR (per credit period)	1.78	1.31	0.92	≥ 1.40

In the pessimistic scenario, the minimum DSCR falls to **0.61**. This means that the company would be able to cover only **61% of its scheduled debt-service obligations** from its cash flow available for debt service (CFADS). The remaining **39% shortfall (cash shortfall)** would have to be covered through budget subsidies, additional borrowing, or other financing sources.

The Monte Carlo simulation conducted under stochastic exchange-rate depreciation and cargo-volume fluctuations produced the following results:

- Probability of **DSCR < 1.30: 42.6%**, indicating a high risk of covenant breach.
- Probability of **DSCR < 1.00** (P_{cd} — *Probability of Default*): **18.4%**. This indicates that, under the current financing structure, the project faces an **18.4% risk of technical default**.

The econometric analysis and simulation results show that investment and borrowing decisions based solely on traditional **NPV/IRR indicators** in railway transport enterprises may lead to strategic errors. The

proposed dynamic **DSCR–LLCR and hedging model** enhances the enterprise's debt sustainability and reduces the estimated default risk from **18.4% to 3.2%**.

CONCLUSION AND SUGGESTIONS

This study is devoted to the analysis of comprehensive econometric methods for evaluating investment projects in railway transport enterprises and ensuring debt sustainability in the context of geoeconomic changes and the transformation of logistics chains. The implementation of large-scale and long-term projects, such as the modernization of railway infrastructure and the renewal of rolling stock, requires substantial capital investment. The limited ability to finance such projects solely from the enterprise's own funds or the state budget necessitates the active attraction of external and domestic debt capital.

An analysis of international and domestic literature shows that the long payback period and relatively low direct commercial profitability inherent in railway projects require a comprehensive assessment of socio-economic costs and benefits alongside traditional evaluation criteria. In developing countries, including in national practice, the rapid increase in debt financing and the growth of debt-servicing costs at a faster rate than operating income pose a serious threat to the solvency and financial stability of enterprises.

The econometric methodology used in the study is based on time-series and panel-data analysis, including the ARDL model and dynamic DSCR stress-test simulations. The short- and long-term consequences of macroeconomic shocks are analyzed using specific quantitative indicators by assessing the effects of exchange-rate fluctuations, interest rates, capital expenditures, and tariff revenues on the company's debt-servicing capacity.

The results of the empirical analysis show that making investment and debt decisions in railway enterprises solely on the basis of traditional NPV and IRR indicators may lead to strategic errors. The attraction of foreign-currency-denominated debt while revenues are generated in the national currency creates a structural currency mismatch, which, under pessimistic conditions of sharp devaluation and frozen tariffs, may reduce the enterprise's debt-servicing capacity to a critical level.

Monte Carlo simulations and stress tests have shown that, under crisis scenarios, the company's net operating cash flows may be insufficient to cover part of its debt-service obligations, resulting in a significant increase in the probability of default. However, the results demonstrate that the application of the recommended hedging mechanisms, tariff indexation, and targeted optimization of operating costs can reduce the estimated technical default risk from 18.4% to 3.2% and strengthen financial stability.

In the future, in order to maintain the debt burden at an acceptable level and improve the efficiency of investment in railway transport enterprises, it is necessary to widely implement **Early Warning System** indicators within the risk-management framework. This, in turn, will enable continuous monitoring of currency and interest-rate risks, prevent the debt portfolio from exceeding critical thresholds, and support timely and well-grounded financial decision-making.

Finally, the study shows that the effective use of **Public-Private Partnership (PPP)** mechanisms is strategically important for reducing the direct debt burden and sharing risks in the allocation of capital to railway infrastructure. It is also advisable to develop the corporate bond market and expand natural hedging opportunities by linking transit revenues to foreign currencies.

REFERENCES

1. **Republic of Uzbekistan.** Law of the Republic of Uzbekistan “*On Railway Transport*”, No. O‘RQ–1006, November 27, 2024 // National Database of Legislation of the Republic of Uzbekistan. — Tashkent, 2024. — Current edition [Electronic resource]. — Accessed: August 24, 2026. Qonun 2025-yil 1-yanvardan kuchga kirgan.
2. **President of the Republic of Uzbekistan.** Decree No. PF–60 of January 28, 2022, “*On the Development Strategy of New Uzbekistan for 2022–2026*” // National Database of Legislation of the Republic of Uzbekistan. — Tashkent, 2022 [Electronic resource]. — Accessed: August 24, 2026.
3. **President of the Republic of Uzbekistan.** Resolution No. PQ–329 of October 10, 2023, “*On Measures for the Fundamental Reform of the Railway Transport Sector of the Republic of Uzbekistan*” // National Database of Legislation of the Republic of Uzbekistan. — Tashkent, 2023 [Electronic resource]. — Accessed: August 24, 2026.
4. **Republic of Uzbekistan.** Law of the Republic of Uzbekistan No. O‘RQ–537 of May 10, 2019, “*On Public-Private Partnership*” // National Database of Legislation of the Republic of Uzbekistan. — Tashkent, 2019. — Current edition [Electronic resource]. — Accessed: August 24, 2026.

5. **Aschauer D. A.** Is Public Expenditure Productive? // *Journal of Monetary Economics*. — 1989. — Vol. 23, No. 2. — P. 177–200. — DOI: 10.1016/0304-3932(89)90047-0.
6. **Barro R. J.** Government Spending in a Simple Model of Endogenous Growth // *Journal of Political Economy*. — 1990. — Vol. 98, No. 5, Part 2. — P. S103–S125. — DOI: 10.1086/261726.
7. **Brigham E. F., Ehrhardt M. C.** *Financial Management: Theory & Practice*. — 16th ed. — Cengage Learning, 2020. — 1216 p. — ISBN 978-1-337-90260-1.
8. **Myers S. C.** The Capital Structure Puzzle // *The Journal of Finance*. — 1984. — Vol. 39, No. 3. — P. 574–592. — DOI: 10.1111/j.1540-6261.1984.tb03646.x.
9. **Franke G.** Uncertain Perception of Economic Exchange Risk and Financial Hedging // *Managerial Finance*. — 1992. — Vol. 18, No. 3. — P. 53–70. — DOI: 10.1108/eb018453.
10. **Stulz R. M.** Rethinking Risk Management // *Journal of Applied Corporate Finance*. — 1996. — Vol. 9, No. 3. — P. 8–25. — DOI: 10.1111/j.1745-6622.1996.tb00295.x.
11. **Nash C. A.** Rail Infrastructure Charges in Europe // *Journal of Transport Economics and Policy*. — 2005. — Vol. 39, No. 3. — P. 259–278.
12. **van de Velde D. M.** *Changing Trains: Railway Reform and the Role of Competition: The Experience of Six Countries*. — Aldershot: Ashgate, 1999. — 364 p.
13. **Central Asia Regional Economic Cooperation (CAREC) Program.** *Railway Sector Assessment for Uzbekistan*. — CAREC Program, March 2021 [Electronic resource]. — Accessed: August 24, 2026.
14. **International Monetary Fund (IMF).** *Review of the Debt Sustainability Framework for Market Access Countries*. — Washington, D.C.: International Monetary Fund, 2021. — Policy Paper No. 2021/003. — 124 p. — DOI: 10.5089/9781513568324.007.
15. **World Bank, Transport and ICT Global Practice.** *Railway Reform: A Toolkit for Improving Rail Sector Performance*. — Washington, D.C.: World Bank, 2017.

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