WORKING PAPER

ANALYSIS OF THE IMPACT OF THE CHANGE IN CREDIT RATING AND OUTLOOK ON FDI INFLOW AND ECONOMIC ACTIVITY IN SERBIA

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The views expressed in the papers constituting this series are those of the author and do not necessarily represent the official view of the National Bank of Serbia.

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Analysis of the impact of the change in credit rating and outlook on FDI inflow and economic activity in Serbia

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Abstract: Following S&P's decision in October 2024 to raise Serbia's credit rating to investment grade (BBB–) for the first time in its history, the question arises regarding the manner in which changes in the credit rating level and outlook may impact key macroeconomic indicators. For this purpose, we conducted research analysing the short- and long-run impact of change in the rating awarded by the three leading international agencies (S&P, Fitch and Moody's) on FDI inflow and economic activity in Serbia (approximated by the industrial production index). For the econometric analysis, we used linear and non-linear autoregressive distributed lag models ((N)ARDL) confirming the initial thesis that an improvement in the credit rating can have a significant impact on higher FDI inflow and industrial production growth in Serbia in both short and long run. This supports a more favourable investment and business environment, and a better living standard for citizens, contributing to sustainable economic growth over the long term.

Non-technical summary

Credit rating is one of the most important indicators of a country's financial position, reflecting its capacity to regularly service its financial obligations and attract foreign investors which is reflected in lower financing costs. It is particularly important for emerging and developing economies, where credit rating is considered to be a signal of sorts of the country's economic stability and economic potential. In economic theory, a higher credit rating means lower costs of borrowing, higher FDIs, greater value of domestic companies and faster economic growth. In this research, we have therefore empirically tested the effects of the change in credit rating and outlook on FDI inflow and economic activity in Serbia.

According to the three leading rating agencies – S&P, Fitch and Moody's – Serbia's credit rating has been on a gradual upward path since 2016 thanks to the successful fiscal consolidation, macroeconomic stabilisation and a more favourable business and investment environment. In October 2024, Serbia was awarded investment-grade rating of BBB- by S&P for the first time in its history. The rating upgrade, coupled with a stable macroeconomic and business environment, boosted FDI inflows to Serbia in the past decade to a record-high level of EUR 5.2 bn in 2024 alone. Investment growth into export sectors, primarily the manufacturing industry, lower risk premium and costs of borrowing, and easier access to international financial flows pushed up industrial production in Serbia in the observed period, supporting overall economic growth. The purpose of this research is, therefore, to measure the effects and to determine the quantitative connection among credit rating, FDI inflow and industrial production in Serbia.

In the paper, we conducted the econometric testing of the individual effect of the change in rating on FDI inflow and industrial production, including the interactive effects of the simultaneous rating change, both in the short and long run. The choice of the econometric model is based on the conducted testing of stationarity of the observed time series. As time series of a mixed level of integration, $I(0)$ and $I(1)$, were tested, and in line with comparable papers in this area, we chose the autoregressive distributed lag model (ARDL) to determine causal links among the observed variables. The results of the econometric analysis demonstrate a positive, statistically significant, causal link between credit rating and FDI inflow and between credit rating and industrial production in Serbia. Our results have confirmed that rating upgrades by S&P, Fitch and Moody's lead to greater FDI inflow and industrial production growth, with these effects being more pronounced in the long run than in the short run, while the interaction of these agencies' ratings further amplifies them.

Contents:

1 Introduction

Credit rating is one of the most significant indicators of a country's financial position, reflecting its capacity to regularly service its financial obligations. As an instrument of assessing the creditworthiness of a country, credit rating is an important factor in shaping macroeconomic expectations and movements in international financial markets. It is particularly important for emerging and developing economies, where credit rating is considered to be a signal of sorts of an economy's stability and potential. A higher rating means lower costs of borrowing, higher foreign direct investments (FDI) and value of domestic companies, and faster economic growth.

S&P's decision in October 2024 to raise Serbia's credit rating to investment grade (BBB–) represents a historic success for our country, making it the first non-EU country with the status of an extremely attractive investment destination in Southeast Europe. This international recognition is the result of many years of structural reforms, responsible pursuit of economic policy and the achieved macroeconomic stability. The investment-grade rating also opens numerous possibilities for a more dynamic economic growth, either directly through greater activity in the industrial and service sectors, or indirectly, through higher FDI inflows, lower country risk premium and the resulting more favourable terms of borrowing.

With this in mind, this paper econometrically examined the complex interaction between credit rating, FDI inflow and economic activity, with rating taken as the single explanatory factor for FDI inflow and economic activity. In other words, we have examined how changes in credit rating, its level and outlook may impact the dynamics of FDI inflows and the dynamics of economic activity in the short and long run. The paper further looked into how individual and combined factors of the interaction of credit rating assessment by the three eminent credit rating agencies influence economic activity measured through the industrial production index.

2 Theoretical framework

The credit rating level and outlook point to the current state of public finances and key macroeconomic indicators, and signals potential yields and risks for investors. In that context, credit rating influences the cost of borrowing, a country's perception in international financial markets and external competition in attracting FDI. Investment flows often depend on the financial capacities indicated by the rating. A higher rating diminishes the level of risk perceived by investors and stimulates capital inflows, supporting economic growth. FDIs are an important driver of economic growth, particularly in emerging and developing economies, as they result in new production capacities, technologies, knowledge and jobs.

2.1 Meaning and significance of credit rating

Credit rating is an assessment of credit risk, i.e. of the borrower's capacity and readiness to service its short- and long-term obligations to creditors fully and without delay. In effect,

credit rating reflects a borrower's capacity to regularly service its obligations, primarily in the long-term. Whether the creditor will assume the financing risk or not depends on this.

Table 1 **Credit rating awarded by the three leading international rating agencies**

Brief description	Grade	S&P	Fitch	Moody's
extremely strong capacity to meet financial commitments, minimal credit risk	investment grade	AAA	AAA	Aaa
very strong capacity to meet financial commitments, very low credit risk.	investment grade	AA+ AA AA-	AA+ AA AA-	Aa1 Aa2 Aa3
strong capacity to meet financial commitments, low credit risk.	investment grade	A+ A A-	A+ A A-	A1 A2 A3
adequate capacity to meet financial commitments, moderate credit risk.	investment grade	BBB+ BBB BBB-	BBB+ BBB BBB-	Baa1 Baa2 Baa3
capacity to meet financial commitments, risk of changes in business environment and economic conditions, significant credit risk.	non-investment/ speculative	BB+ BB BB-	BB+ BB BB-	Ba1 Ba2 Ba3
current capacity to meet financial commitments, high risk of changes in business environment and economic conditions, high credit risk	non-investment/ speculative	B+ B B-	B+ B B-	B1 B2 B3
low capacity to meet financial commitments, very high credit risk.	non-investment/ speculative	CCC+ CCC CCC-	CCC+ CCC CCC-	Caa1 Caa2 Caa3
incapacity or very low capacity to meet financial commitments, bankruptcy or high likelihood of bankruptcy	non-investment/ speculative	CC C	CC C	Ca
payment default on financial commitments, bankruptcy	non-investment/ speculative	CD D	DDD DD D	C

Source: NBS.

Credit risk assessment in the form of a qualitative rating is performed by specialised rating agencies, with S&P, Fitch and Moody's as the three leading international rating agencies. The key activity of these agencies is to analyse and assess the creditworthiness of corporations, countries, local government, capital projects, financial institutions and structured financial products (mortgage-backed bonds, fixed and financial assets, collateralised bonds, credit derivatives, etc.). Credit rating grade and outlook awarded to a country represent a signal for investors regarding the reliability and profitability of investing in a specific market. The first credit ratings were awarded in the early 20th century, but they gained particular importance after the Great Depression in 1933–35 when banking sector regulators in the USA, and later also in Europe, enacted regulations prohibiting banks to invest in low credit rating speculative bonds. The intention was to avoid the elevated risk of default which would result in pronounced financial losses and their spillover to the financial sector, and even in bank failure, after which other financial institutions and corporations in the real sector soon accepted this practice. Over the past decades, credit ratings have become an instrument for steering international capital flows and an indicator for making investment decisions.

S&P, Moody's and Fitch issue two types of ratings: issuer ratings and sovereign debt ratings. In most cases, these two ratings are the same until the point of default, when the sovereign issuer may select which obligations it will continue to service. Table 1 shows that all three agencies award one of the two rating grades – investment or non-investment (speculative), depending on the assessed credit risk level. Investment grade includes ratings which signal to investors a low to moderate credit risk level, reflecting reinforced capacities of a country to regularly meet its commitments, which is why it is perceived as reliable and

recommendable for investment. Non-investment grade signals a higher degree of risk for investors and reduced reliability of the borrower in meeting its commitments. There are several categories (marked with initial alphabet letters) within the investment grade – starting from "AAA" as the highest to "BBB" as the lowest category, while non-investment grade categories range from "BB" to "C". Special credit rating categories are "SD" (selective default) and "D" (default). Each of the credit rating categories can be followed by a "+" or a "–", specifying the relative position of a country and its securities in a given category. Compared to S&P and Fitch, Moody's applies a somewhat different system, where numbers (1, 2 and 3) are used instead of signs to indicate the relative position of the country and its securities. In addition to determining the credit rating grade and category, S&P, Moody's and Fitch also assess the future rating outlook which may be positive, negative, stable or developing (which means that it can be raised or lowered).

Final rating grades and outlooks are the result of a comprehensive data analysis, monitoring of global economic flows and direct communication with economic policy makers. In line with the specified methodological guidelines, S&P establishes credit rating to states and securities based on an expert assessment and integral analysis of qualitative and quantitative factors in several interconnected areas:

- institutional effectiveness and political risks,
- economic structure and growth prospects,
- external liquidity,
- fiscal position and public debt, and
- monetary policy efficiency and credibility.

All three agencies – Fitch, Moody's and S&P – use a combination of qualitative and quantitative methods to assess credit risk, with an emphasis on the historical data and trends, but also for forecasting future economic and political developments. The assessments of the credit rating grade and outlook of a country and its long-term debt securities are important for all stakeholders – for investors, they are an indicator of the level of risk and return on investment, for the governments they are an indicator of the financing costs and the risk premium, while for financial markets they are a signal of movement in prices and yields on bonds and of the credit risk perception by market players.

Credit rating has become an unavoidable factor in international finances as it determines the conditions under which countries, banks and companies can access capital. As a rule, a high credit rating lowers the cost of borrowing, whereas a low rating may limit access to funding. In addition, the credit rating of a country and its securities impacts the economic stability and the ability to attract FDI, which is particularly important for emerging and developing economies. In the corporate sector, a high rating improves the terms of bond issuance and diminishes the costs of capital, contributing to long-term stability and predictability of doing business. Credit rating indirectly affects the activities of consumers and households through interest rates on loans and prices in the real estate market, which is why credit rating is a tool for managing personal finances.

2.2 Serbia's credit rating dynamics

Serbia got its first credit rating (B+, stable outlook) from S&P on 1 November 2004. A year later it was assigned a credit rating by Fitch (BB-, stable outlook), while Moody's awarded its first credit rating to Serbia (B1, stable outlook) on 14 July 2013. At the time, all rating agencies assessed that Serbia was capable of meeting its financial commitments, but that there was a high risk of change in the business climate and economic conditions and a pronounced credit risk. Starting from 2016, when the first results of fiscal consolidation, macroeconomic stabilisation and a more favourable business and investment environment became apparent, Serbia's rating – both its grade and outlook – gradually started to climb, indicating increasing efficiency of the country in servicing its long-term financial commitments. This is best illustrated by the rating awarded by S&P – in December 2017, S&P raised Serbia's credit rating to BB (with a stable outlook), affirmed it at BB (with a positive outlook) in late 2018, and raised it to investment grade of BBB- in October 2024.

2.2.1   Serbia's credit rating by S&P and Fitch

In the period observed in the empirical part of the paper, from January 2007 until October 2024, Serbia's credit rating as assessed by S&P and Fitch recorded a similar trend, indicating that their credit risk assessments were broadly similar. Ratings were most often upgraded, with a stable or a positive outlook, signalling a gradual improvement of financial and economic conditions in Serbia. Observed by narrower time periods, Serbia's credit rating was unchanged at BB- from 2007 until 2013, while the outlook was several times negative after the global financial crisis broke out and public debt increased. From 2014 to 2016, both agencies affirmed the country's rating at BB- but with a positive outlook after the start of fiscal consolidation and attending reforms in public administration and the labour market. In 2018, S&P raised Serbia's rating to BB with a positive outlook, and Fitch soon followed suit, mostly on account of the initiated downward public debt trajectory and the rebound in economic activity. Thanks to the achieved macroeconomic stability, Fitch raised Serbia's rating to BB+ in late 2019, and S&P followed suit soon after. Despite the global crisis caused by the COVID-19 pandemic, both agencies affirmed their credit ratings from 2020 through 2022, with S&P awarding a positive outlook in early 2022. The crisis in the global market of food and energy in 2021 was aggravated by the outbreak of the Ukraine conflict (February 2022) and further compounded by the escalation of conflict in the Middle East (October 2023). In all these years, Serbia's rating was a notch below investment grade, which was reflected in investors' ample interest in investing in government securities in the international financial market. This was officially verified by S&P's decision in October 2024, verifying the long-awaited investment grade rating for Serbia at BBB- (with a stable outlook), as a result of accelerated economic growth, FX reserves which were double their pre-crisis level, reduced share of public debt in GDP and responsible conduct of monetary and fiscal policies.

2.2.2   Serbia's credit rating by Moody's

In the period since July 2013, i.e. since Moody's first published their rating for Serbia, and until October 2024, the outlook was first upgraded from stable to positive. The grade improved

in 2017 from B1 to Ba3 (with a positive outlook), suggesting to investors that the economic situation in our country had stabilised after the fiscal consolidation. The next rating increase to Ba2 (with a stable outlook) was in early 2021. The rating stayed at this level in the coming years marked by the multidimensional economic and geopolitical crisis. The outlook was upgraded from stable to positive in August 2024, when the same was done by Fitch, which reaffirmed this assessment in January 2025. Moody's has still not awarded investment grade rating to Serbia, but its latest assessments signal an improved fiscal and macroeconomic position and diminishing risks from external and internal shocks.

Table 2 **Serbia's credit rating**

Rating agency	Rating	Date	Press release
Standard & Poor's	BBB– / stable outlook	4 October 2024	**rating upgraded**
Fitch Ratings	BB+/ positive outlook	31 January 2025	**rating affirmed**
Moody's Investors Service	Ba2 / positive outlook	30 August 2024	**rating affirmed**

Source: S&P, Fitch and Moody's press releases.

2.3   FDI inflows to Serbia – concept and dynamics

FDIs represent a form of long-term investment by foreign companies in the domestic economy, which entails the establishment of new companies, the acquisition of a significant stake (more than 10% of equity capital) in existing companies, or investment in strategic infrastructure and other capital projects. A key characteristic of FDIs is the involvement of investors in decision-making and the management of business activities, unlike portfolio investments, which are often short-term in nature and focused on financial market instruments such as government securities and corporate bonds. FDIs stimulate economic growth based on multiple factors, which is particularly pronounced in emerging and developing countries. The inflow of FDIs contributes to the expansion of production capacities, thereby boosting employment and exports. It also facilitates the transfer of technology and knowledge, which positively impacts the competitiveness of the domestic economy. Furthermore, FDIs can contribute to the improvement of infrastructure and the enhancement of the institutional framework through the introduction of international business standards and practices. For example, the inflow of FDIs into the automotive industry, as well as other areas of the manufacturing industry and information technology, has not only spurred economic activity in Serbia but also integrated domestic supply chains into global ones.

When it comes to FDI inflows into Serbia, the period from January 2007 to October 2024 is characterised by two intervals with divergent trends. Up until 2012, there was a trend of declining FDI inflows, which can be linked to the global financial crisis and the European public debt crisis, which created significant uncertainty in international financial markets and increased the risk premium for countries. This period was marked by heightened risk aversion among investors, who were cautious and invested predominantly in safe assets. However, in addition to international factors, domestic factors such as high inflation, rising public debt

levels, political instability, and similar issues also contributed to the lower FDI inflows up to 2012. An exception in this sub-period was the year 2011, when FDI inflows surged significantly thanks to the completion of privatisation and restructuring processes for certain domestic companies, the provision of fiscal incentives and additional subsidies for investors, as well as increased investments by Fiat in Kragujevac for the production of the new Fiat 500L model. From 2012 onwards, there has been a continuous increase in FDI inflows into Serbia. This positive trend is not only the result of an improved global investment environment but also significant improvements in Serbia's macroeconomic fundamentals. During this period, inflation stabilised, fiscal consolidation was achieved, and structural reforms accelerated, all of which significantly improved the business and investment environment in Serbia. Notably, FDI inflows remained high even in 2020 (Chart 1), despite the global COVID-19 pandemic and the resulting increased global uncertainty, indicating sustained confidence among foreign investors in Serbia's economic potential, even in the face of multiple global economic crises.

Chart 1 **Dynamics of the FDI inflow to Serbia in the past decade**
(in EUR mn)
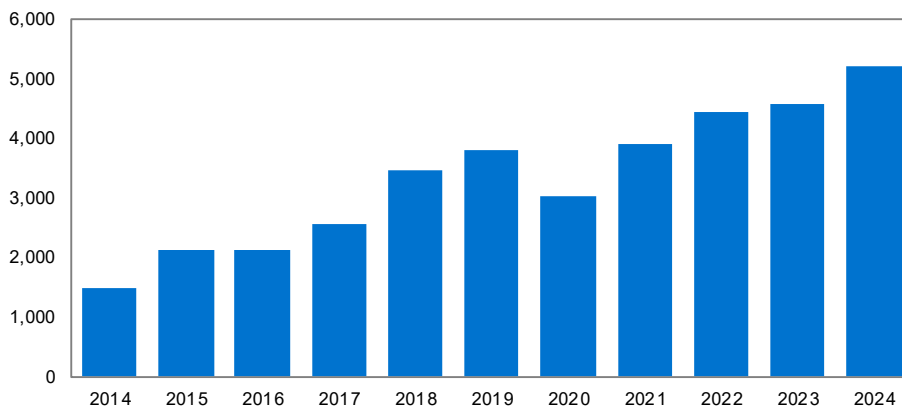
Source: SORS and NBS.

Chart 2 **Sectoral structure of FDI**
(in EUR mn)
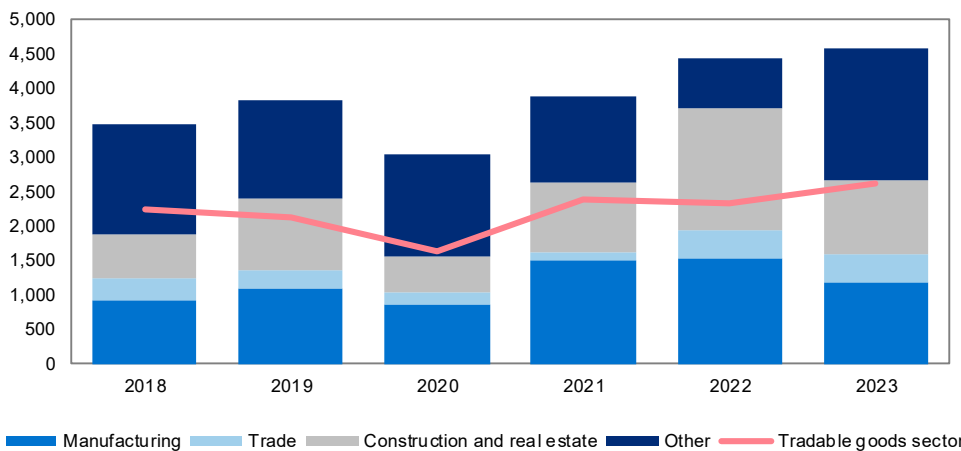
Source: NBS and authors' calculation.

* Industry, agriculture, transport and storage, hospitality.

It should be noted that not all FDI is equally beneficial for the country's long-term economic development. The biggest positive impact on economic growth comes from investments channelled into tradable sectors (agriculture, industry, transport and storage, hospitality, and the IT sector), which stimulate export growth, improve competitiveness, and create new jobs. In contrast, FDI directed towards non-tradable sectors does not contribute to economic diversification or increased productivity. Therefore, it is important to note that FDI in Serbia is predominantly channelled into tradable sectors (Chart 2). In addition to project diversification, FDI inflows into Serbia are characterised by high geographical diversification, with EU countries accounting for the largest share, while investments from China and other Asian countries have grown significantly in recent years. The diversification of foreign investors' countries of origin helps reduce risks arising from economic and political turbulence in a single country or region.

Overall, FDI inflows into Serbia from 2007 to 2023 amounted to approximately EUR 47 bn, and a similar trend continued in 2024, with FDI inflows reaching EUR 5.2 bn, a record level since comparable data have been available. In the coming period, a stable inflow of FDI is expected, which will be supported, among other factors, by Serbia's attainment of an investment-grade credit rating from S&P at the end of 2024.

2.4   Dynamics of the industrial production index for Serbia

When analysing the movement of the industrial production index as an indicator of industrial activity in Serbia, three significant sub-periods can be identified. In the initial years, from 2007 to 2010, a negative trend in industrial activity was observed, primarily as a consequence of the global financial crisis, which spilled over onto the real sector and reduced external demand, thereby impacting the decline in Serbia's industrial production. In the following two years, production stagnated, reflecting a slow recovery from the crisis but without significant new contractions. From 2012 onwards, the industrial production index showed a stable positive growth trend, with growth accelerating after 2014 due to the initiation of an investment cycle and labour market reforms. Exogenous shocks led to occasional deviations from this trend, with a notable decline in industrial activity in 2014 as a direct result of the May flooding, which significantly damaged Serbia's energy sector. Another significant decline occurred in April 2020 under the impact of restrictive measures related to the COVID-19 pandemic, but even so, industrial activity grew over the course of the year. Despite ongoing supply chain disruptions in 2021 and record high energy prices on the global market in 2022, industrial production in Serbia rose in both observed years, with growth continuing into 2023, driven by the recovery of production in the energy sector. Industrial production was also expanding for most of 2024, led by increased activity in mining (7.4%) and manufacturing (4.7%).

A single market for financial services has been under construction in the European Union since 1973 (Kokkola, 2010). Initially, the focus was on the provision of a secure prudential environment for the cross-border activities of banks. Financial markets were still divided along national lines. Integrative processes accelerated after the changeover to the euro in 1999 and the creation of the euro area. The single money market was the first important step in integrating the market of financial services, i.e. the market for the provision of payment and securities services, while ensuring fair competition and appropriate consumer protection.

To achieve this, it was not enough to remove only technical barriers (to upgrade infrastructure), but legal ones as well. Only a modern and efficient legal and regulatory framework is capable of guaranteeing the safety and efficiency of payments and securities transactions. This also entailed the exchange of payments data among payment service providers, and there was a rising awareness of the importance of this exchange. Since the 1980s, the European Commission issued a number of recommendations relating to payment systems, including Commission Recommendation 87/598/EEC on a European Code of Conduct relating to electronic payment, Commission Recommendation 88/590/EEC concerning payment systems, and in particular the relationship between cardholder and card issuer, and Commission Recommendation 97/489/EC concerning transactions by electronic payment instruments and in particular the relationship between issuer and holder. These were non-binding documents.

In late 1990s, as the market became more complex, the internet and internet-based technologies developed and the EU was enlarged, binding legal documents as we know them today were adopted – regulations and directives. The main difference between the two is that regulations are applied directly, in all members states, without intervention by national parliaments, while directives indicate a target to be achieved, and it is up to the national governments to achieve it in the most appropriate manner. Already in 1997, the first Directive 97/5/EC on cross-border payments was adopted, followed by Directive 98/26/EC on settlement finality in payment and securities settlement systems.

Despite the regulatory dynamism of the European Union,[1] at the start of the century it was still difficult to say who was allowed to provide payment services. An entity wishing to provide these services faced widely differing national regulations, with one member state requiring customer authorisation and the other not. In some member states, payment services could only be provided by credit institutions (e.g. banks), while in others a special e-money licence or another type of licence was required. In the conditions of dynamic economic growth – which also entails rising demand for cashless payments and increasing diversity of financial services – such heterogeneity required regulation.

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[1] In March 2000, the importance of responding to the shift to a 'digital, knowledge-based economy, prompted by new goods and services' was recognised. This involved the creation of a more favourable environment for the expansion of e-commerce and for the wider use of the internet and information technologies. In order to help achieve those objectives, a comprehensive 'eEurope Action Plan' was drafted in 2002, and upgraded in 2005 (Athanassiou & Mas-Guix, 2008).

3 Data and methodology

For the purposes of the empirical analysis presented below, monthly data published by the National Bank of Serbia (NBS), the Statistical Office of the Republic of Serbia (SORS), and Bloomberg were used. These data relate to quantified credit ratings, gross FDI inflows, the industrial production index, and the country risk premium measured by EMBI.

Data on credit ratings assigned by the three global agencies – S&P, Fitch, and Moody's – are collected and published by the NBS. For the purposes of econometric analysis, these qualitative credit ratings were quantified using appropriate methods, following the approach of several authors: Meyer & Mothibi (2021), Akin (2021), and Bayar & Kilic (2014). A common feature of these studies is that qualitative ratings were transformed into quantitative scores, with appropriate weights depending on the rating level and outlook. The only specific difference is that Akin (2021) and Meyer & Mothibi (2021) assigned identical weights to different rating levels and outlook changes, while Bayar & Kilic (2014) assigned higher weights to rating levels compared to outlooks. Specifically, changes in the credit rating level are quantified on a numerical scale through a unit quantitative change in a positive (+1) or negative (–1) direction. When the outlook is revised downward from positive to stable or from stable to negative, the quantitative rating score is reduced by one-third of a notch, while a change from positive to negative reduces the score by two-thirds of a notch. Similarly, an improvement in the outlook increases the rating score by one or two-thirds of a notch, respectively. In our paper, changes in the rating level correspond to one notch (in a positive or negative direction), while changes in the outlook correspond to half a notch (in a positive or negative direction). This creates the prerequisites for adequate statistical and econometric analysis of the observed variables. The ratings from S&P and Fitch were collected for the period from January 2007 to October 2024, while Moody's ratings are available for a significantly shorter period, from July 2013 to October 2024.

Data on FDI inflows into Serbia are also published by the NBS. In this research, FDI was used as the dependent variable in three models, where the impact of changes in credit ratings and outlooks on FDI was examined. For all models, the logarithmic form of the original time series was used, which is a common practice in econometric analyses, as it allows for a comparable analysis of relative changes.

Data on the industrial production index were taken from the SORS database. These data reflect the physical volume of production in the industrial sector and are fully aligned with Eurostat standards and regulations. This ensures a high level of comparability with data from other countries and adherence to best statistical practices. In line with the SORS methodology, chain indices of industrial production were used in the empirical analysis, with data up to October 2024 (base period 2023), and the time series was seasonally adjusted. For econometric modelling, a logarithmic transformation of these data was used to observe relative changes between the industrial production index and credit ratings.

The country risk premium was measured by the EMBI indicator, and data were taken from the Bloomberg platform. This variable was used as a control variable in econometric modelling, given its relationship with FDI and economic activity. Specifically, a lower risk

premium reflects lower market risk and vice versa. This suggests a negative relationship between EMBI and FDI, as well as between EMBI and industrial production.

Chart 3 **Time series of variables that are the subject of empirical analysis**
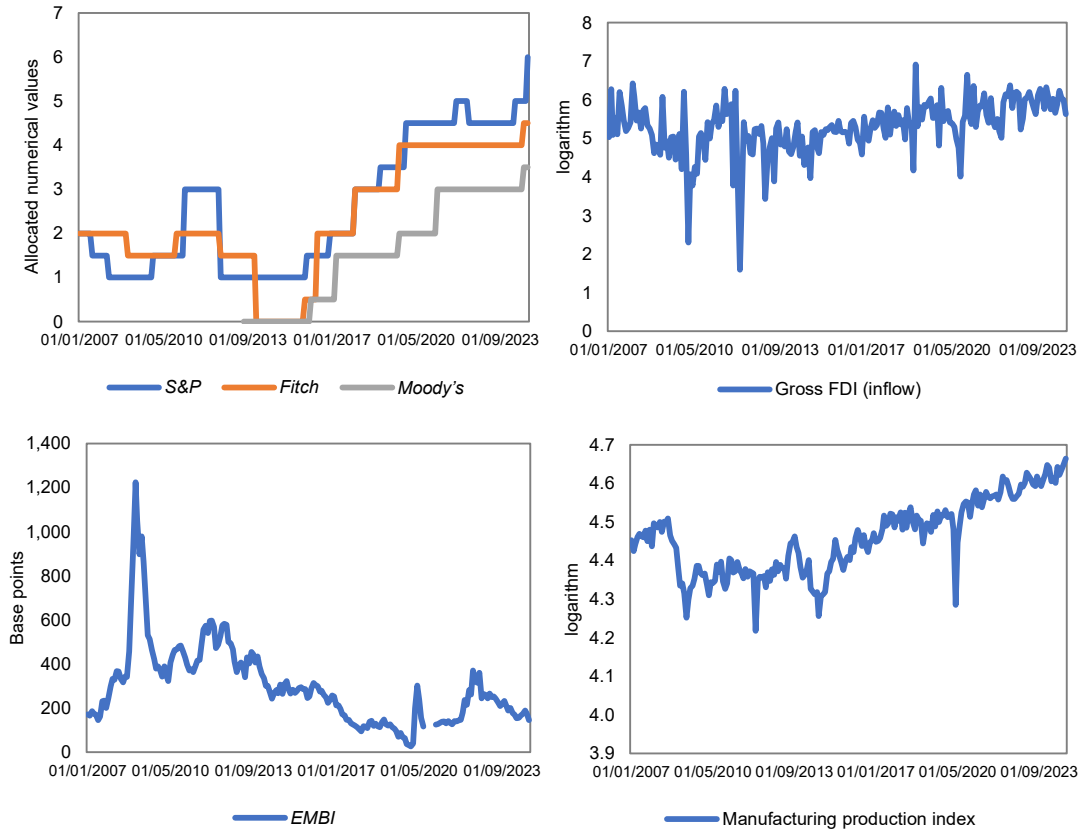
Source: SORS, NBS and the authors' calculation.

4 Review of empirical literature

Below is a brief overview of studies that have empirically investigated the relationship between credit ratings, FDI inflows, and economic activity. Regression models in linear or non-linear forms, as well as other statistical and econometric techniques, were used in these studies to determine the nature and type of relationships between these variables in the short and long term.

Table 3 **Overview of papers on the impact of credit rating on FDI inflow and economic activity**

Author(s)	Sample	Analysis method	Key finds of the analysis
Md Badrul Alam, **Muhammad Tahir** & **Norulazidah Omar Ali** (2024)	Member states of the South Asian Association for Regional Cooperation (SAARC) timeframe: 2011–2019	unit root tests Granger causality test panel models	Credit risk in the banking sector has a statistically significant negative relationship with FDI inflows. Market size and inflation rate are also significant factors that drive FDI inflows. Market size loses relevance for attracting FDI when India is excluded from the sample due to its dominant economic weight. The degree of trade openness does not have a significant impact on FDI inflows, with most

Author(s)	Sample	Analysis method	Key finds of the analysis
			specifications showing an insignificant or negative coefficient.
Ahmed Said Karam Elbokl (2023)	Egypt timeframe: 1990–2022	unit root tests ARDL regression model	The study found that a negative credit rating significantly reduces FDI inflows into the Egyptian economy in the short term, while a positive rating has no significant impact. Variables such as the credit-to-GDP ratio and the trade-to-GDP ratio show significant impacts, indicating the need for policies that would attract FDI.
Daniel Francois Meyer (2023)	Poland and South Africa timeframe: 1994–2021	descriptive statistics correlation analysis unit root tests Granger causality test ARDL and ECM regression models	The research found significant differences between the two countries: Poland outperformed South Africa in terms of attracting FDI and improving its rating, which in 2021 achieved only 43% of Poland's performance. In the long-run relationship model for South Africa, the coefficients on the credit rating index were much larger than in the model for Poland. In Poland, the level of public debt had the largest impact on FDI inflows, while in South Africa, the level of GDP growth had the largest impact.
Chunling Li, **Khansa Pervaiz**, **Muhammad Asif Khan**, **Muhammad Atif Khan** & **Judit Oláh** (2022)	China timeframe: 1980–2018	descriptive statistics unit root tests N(ARDL) regression model	The financial market reaction (FMD) to the disclosure of sovereign credit ratings (SCR) is asymmetric, meaning that the effects are not the same in all situations. There is a threshold at a certain level, above which the relationship between SCR and FMD becomes nonlinear. Up to that threshold, the effects are negative, but beyond the threshold, the effects become positive.
Sathanantham Shiyalini & **Kanesh Suresh** (2022)	Sri Lanka timeframe: 1980–2020	unit root tests ARDL regression model	A country's external debt crowds out domestic investment in the short and long term, while domestic debt increases FDI in the short term but reduces it in the long term. External debt has the opposite effect on FDI in the short term but has no long-term effect. Higher interest rates discourage domestic investment in the short term but do not affect long-term FDI. Exchange rate depreciation reduces investment in the short term but encourages it in the long term.
Shanana Desiree Motseta & **Oliver Takawira** (2021)	South Africa timeframe: 1994–2017	descriptive statistics unit root tests N(ARDL) and ECM regression models	The study found that there is a positive and statistically significant relationship between sovereign credit ratings and capital inflows into South Africa. An improvement in credit ratings can attract more foreign investment.
Daniel Francois Meyer & **Lerato Mothibi** (2021)	South Africa timeframe: Q1 1994 – Q2 2020	descriptive statistics correlation analysis unit root tests Granger causality test ARDL regression model	The results show that there is a bidirectional causality between economic growth and the credit rating index, as well as between FDI and the credit rating index. To positively influence the decisions of rating agencies, it is necessary to significantly stimulate investment and economic growth in South Africa.
Nilofer, Nilofer & **Qayyum, Abdul** (2018)	Pakistan timeframe: 1970–2015	descriptive statistics unit root tests ARDL and ECM regression models	The results show that public and private investment positively affect growth, while public spending and FDI slow down GDP growth. Improving security and creating investor-friendly policies are recommended to strengthen the impact of investment.

Author(s)	Sample	Analysis method	Key finds of the analysis
Peilin Cai, **Quan Gan** & **Suk-Joong Kim** (2018)	31 OECD member states investing FDI and 72 non-OECD states to which the FDI arrive timeframe: 1985–2012	correlation analysis unit root tests Granger causality test panel models	Credit ratings of creditors and debtors are important drivers of bilateral FDI flows. FDI generally flows from creditor countries (OECD members) with lower ratings to debtor countries (non-OECD) with higher ratings. OECD creditors experience higher FDI inflows when they have high credit ratings, while non-OECD creditors experience higher FDI inflows when they have low credit ratings. Countries experience higher FDI inflows when the average credit rating of their geographic region is higher than that of other regions.
Yılmaz Bayar & **Cüneyt Kılıç** (2014)	Turkey timeframe: January 1995 – July 2013	unit root tests Granger causality test VECM and VAR impulse response function models	There is a positive relationship between FDI inflows and sovereign credit ratings, with S&P ratings being the most significant for FDI inflows. Bidirectional causality was found between S&P and Fitch ratings and FDI inflows, as well as unidirectional causality between Moody's ratings and FDI inflows. There is no causality between crisis events (modelled using artificial variables) and FDI inflows.

5 Empirical analysis of the impact of credit rating on fdi inflow and economic activity in serbia

Through empirical analysis, which builds on the theoretical framework, we aim to provide a more detailed explanation of how improving the level and outlook of Serbia's credit rating can contribute to increasing FDI inflows and economic activity.

5.1 Unit root and causality tests

For the purpose of specifying an adequate econometric model, unit root tests – ADF and KPSS – were first conducted, the results of which are shown in Table 4. For variables related to credit ratings by S&P and Fitch, which were previously quantified, as well as for the industrial production index, both tests agree in their conclusion that the above time series each have one unit root, while for the remaining variables the tests conducted give different conclusions. The reason for this in the case of the lnSDI and EMBI variables may be breaks in the time series, hence a modified ADF test was applied that includes dummy variables for modelling one-time breaks. These are variables that take the value one in the month when the break occurred, and the value zero in the remaining months. The modified ADF test showed that the time series for lnSDI and EMBI do not have a unit root, i.e. that these time series are level stationary, while the ADF test for the Moody's variable showed the presence of one unit root.

Table 4 **Unit root tests on time series of observed variables**

Variables	Unit root tests	ADF (k) test	Unit root present	KPSS test	Unit root present	Component determinant
lnSDI	level	-7.27 (1)	**NO**	1.02	YES	Constant
	I difference	-	-	0.11	**NO**	
EMBI	**level**	**-4.12 (1)**	**NO**	0.99	YES	Constant
	I difference	-	-	0.06	**NO**	
S&P	level	0.003 (0)	YES	1.39	YES	Constant
	I difference	-13.94 (0)	**NO**	0.25	**NO**	

Variables	Unit root tests	ADF (k) test	Unit root present	KPSS test	Unit root present	Component determinant
FITCH	level	-0.43 (0)	YES	1.13	YES	Constant
	I difference	-14.55 (0)	**NO**	0.23	**NO**	
Moody's	**level**	-2.96 (0)	YES	0.10	**NO**	Constant and trend
	I difference	-11.85 (0)	**NO**	-	-	
lnIND	level	-0.13 (12)	YES	1.52	YES	Constant
	I difference	-4.77(11)	**NO**	0.18	**NO**	

Source: Calculation and illustration by the authors using the EViews statistical package.
Note: The deterministic components were selected using the Stock-Watson procedure, and the critical values at the 5% significance level are: -2.88 (for τ_μ) and -3.44 (for τ_t) for the ADF test, or 0.46 (for τ_μ) and 0.15 (for τ_t) for the KPSS test. The k in the ADF test refers to the number of correction factors that need to be added in order to eliminate autocorrelation. In order to eliminate the effect of a single break, a modified ADF test was applied with dummy variables: 2010M2 and 2012M2 for lnSDI, 2008mM2 for EMBI, and 2012M2 and 2020M4 for lnIND.

The choice of econometric model is based on the conducted stationarity test of the observed time series. **Given that the time series tested were of mixed integration level I(0) and I(1), we believe that the autoregressive distributed lag (ARDL) model**, developed by Pesaran et al. (2001), **is an adequate econometric model** for assessing causal relationships among the observed variables. It is a model that uses the least squares method to estimate the econometric specification in the case of data series with different levels of integration, provided that no series has more than one unit root. The ARDL model allows for the differentiation of short-term and long-term impacts of credit ratings on FDI inflows to Serbia and its economic activity.

In order to identify causality between the observed variables, a Granger causality test was conducted. The results presented in Table 5 show that credit ratings by all three agencies, S&P, Fitch and Moody's, cause FDI and industrial production in a Granger sense, while FDI and industrial production do not cause credit ratings in a Granger sense. Thus, the Granger test showed that FDI and industrial production are endogenous variables when looking at their relationship with credit ratings. This means that **it is justified to look at FDI and industrial production as a function of credit ratings**.

Table 5 **Granger causality tests on time series of observed variables**

Zero hypothesis	Probability	Result
S&P does not cause lnSDI	**0.0001**	**Unidirectional causality from S&P to lnSDI**
lnSDI does not cause S&P	0.6406	
Fitch does not cause lnSDI	**0.0003**	**Unidirectional causality from Fitch to lnSDI**
lnSDI does not cause Fitch	0.4248	
Moody's does not cause lnSDI	**0.0000**	**Unidirectional causality from Moody's to lnSDI**
lnSDI does not cause Moody's	0.8727	
S&P does not cause lnIND	**0.0000**	**Unidirectional causality from S&P to lnIND**
lnIND does not cause S&P	0.0533	
Fitch does not cause lnIND	**0.0000**	**Unidirectional causality from Fitch to lnIND**
lnIND does not cause Fitch	0.2330	
Moody's does not cause lnIND	**0.0000**	**Unidirectional causality from Moody's to lnIND**
lnIND does not cause Moody's	0.2618	

Source: The authors' calculation using the EViews statistical package.

Below are the results of the estimated econometric specifications on the example of Serbia, which deals with the effects of individual credit ratings on: 1) FDI inflows and 2) industrial production, as well as the results of the analysis of the interactive effects of simultaneous credit ratings of all three agencies.

5.2 Analysis of the impact of credit rating on FDI inflows to Serbia

Starting from the presented theoretical framework, the results of comparable empirical studies and previously conducted statistical tests, we then applied the selected ARDL model to econometrically examine the individual impact of changes in the level and outlook of credit ratings on the inflow of FDI into Serbia, which in recent years has had a significant share in the structure of total investments in our country. We have also included lagged values of the dependent variable for one or two observations ($lnSDI_{t-1}$, $lnSDI_{t-2}$) to capture the dynamic trajectory of FDI. In economic theory, an improvement in credit rating and outlook is expected to lead to higher FDI inflows, and vice versa. In this context, we estimated three ARDL (2, 0, 0) specifications:

$$lnSDI_t = \beta_0 + \beta_1 lnSDI_{t-1} + \beta_2 lnSDI_{t-2} + \beta_3 S\&P_t + \beta_4 EMBI_t + V_t + \varepsilon_t \tag{1}$$

$$lnSDI_t = \beta_0 + \beta_1 lnSDI_{t-1} + \beta_2 lnSDI_{t-2} + \beta_3 Fitch_t + \beta_4 EMBI_t + V_t + \varepsilon_t \tag{2}$$

$$lnSDI_t = \beta_0 + \beta_1 lnSDI_{t-1} + \beta_2 lnSDI_{t-2} + \beta_3 Moody's_t + \beta_4 EMBI_t + V_t + \varepsilon_t \tag{3}$$

where V is the set of dummy variables in each of the above models, in order to control for the effects of shocks characteristic of specific time intervals. To determine the optimal number of lags in ARDL specifications, appropriate VAR models were first tentatively constructed, and then information criteria were consulted. Based on this, regression equations were formulated that met the stability conditions and stochastic error assumptions. In particular, we examined whether the effects of changes in the level and outlook of the rating are asymmetric, for which we used the Wald test and the nonlinear form of the ARDL model, in the sense of whether the degree of reaction is the same when ratings and/or outlooks improve as when they deteriorate. Generally speaking, the analysis results indicate that **absolute changes in the level** (by one notch) **and outlook** (by half a notch) **of the credit rating have a statistically significant impact on the dynamics of FDI inflows to Serbia**, such that an improvement in the rating leads to a higher FDI inflow, and a deterioration in the rating causes a weaker FDI inflow.

Based on the results of the initially estimated ARDL model, **an improvement in the credit rating and outlook** (in absolute terms) **by S&P and Fitch leads to an increase in FDI inflows to Serbia by 10.6% and 10.2%, respectively**, with other conditions unchanged. Interestingly, Moody's more favourable ratings produce even greater effects on the growth of FDI inflows (25.1%), given that the time series is significantly shorter and covers the period after 2013, when FDI inflows accelerated. Also, Moody's has not once adjusted its rating for Serbia downwards, so in this case, we were unable to examine the effect of asymmetry. It should be noted that the estimated coefficient for the first difference of the dependent variable does not have a meaningful economic interpretation, making it unsuitable for drawing conclusions (Kripfganz & Schneider, 2023).

Table 6 **Effects of the change in the credit rating and outlook on FDI inflow in the short term**

	Model 1	Model 2	Model 3
Dependent variable: FDI inflow – differenced logarithmic values (ΔlnSDI)			
ΔlnSDI$_{t-1}$	-0.2944***	-0.3053***	-
S&P$_t$ (numerical value)	**0.1056***	-	-
Fitch$_t$ (numerical value)	-	**0.1022***	-
Moody's$_t$ (numerical value)	-	-	**0.2507***
EMBI$_t$ (base points)	-0.0000	-0.0108	-
EMBI$_{t-1}$ (base points)	-	-	-0.0116
V2010m2 (dummy variable)	-3.0950***	-3.1169***	-
V2011m11 (dummy variable)	-1.8343***	-1.7371***	-
V2013m2 (dummy variable)	-1.6640***	-1.7313***	-
V2018m11 (dummy variable)	-	-	-1.2673***
V2018m12 (dummy variable)	1.6548***	1.6773***	1.6349***
V2020m9 (dummy variable)	-	-	-1.4713***
C	2.5911***	2.5608***	2.8960***
Adjustment speed coeff. CointEq(-1)	-0.53	-0.52	-0.88
R^2	0.61	0.61	0.62
Adjusted R^2	0.60	0.59	0.60
Analysed period	M1 2007 – M10 2024	M1 2007 – M10 2024	M7 2013 – M10 2024
***statistical significance level of 1% **statistical significance level of 5% *statistical significance level of 10%			

Source: The authors' calculation using the EViews statistical package.
Note: The short-run effects are obtained in the form of an error correction model. Model 1 takes into account only the assessments according to S&P, Model 2 those according to Fitch, and Model 3 those according to Moody's.

The positive effects of a higher credit rating are present in both the short and long run. **In the long term, an improvement in credit rating and outlook** in absolute terms **also increases FDI inflows to Serbia, identically by 19.8% for S&P and Fitch ratings, and by as much as 28.5% for Moody's ratings** (Table 7). It is noted that the positive effects of a rating change in the long term are more pronounced than in the short term, because investment plans and the associated macroeconomic outcomes are realised over a period longer than a year. Investors make decisions based on long-term business strategies, which is why it takes time to see the effects of investments made, primarily capital investments.

Table 7 **Effects of changes in credit ratings and outlook on FDI dynamics in the long term**

	Model 1	Model 2	Model 3
Dependent variable: FDI inflow – logarithmic values (lnSDI)			
S&P$_t$ (numerical value)	**0.1982***	-	-
Fitch$_t$ (numerical value)	-	**0.1983***	-
Moody's$_t$ (numerical value)	-	-	**0.2846***
EMBI$_t$	-0.0006	-0.0210	-0.1311
C	4.8628***	4.9704***	5.0306***
F-Bounds test statistics	13.84* ** ***	13.12* ** ***	32.12* ** ***
Analysed period:	M1 2007 – M10 2024	M1 2007 – M10 2024	M7 2013 – M10 2024
***statistical significance level of 1% **statistical significance level of 5% *statistical significance level of 10%			

Source: The authors' calculation using the EViews statistical package.
Note: Model 1 takes into account only the assessments according to S&P, Model 2 those according to Fitch, and Model 3 those according to Moody's. The results of the F-Bounds test in all three models show that there is cointegration, i.e. a long-term relationship between the variables, given that the assessed F-statistics is above the upper critical value I(1) at all levels of significance.

Using the nonlinear form of the ARDL model and the results of the Wald test, we examined the presence of asymmetric effects in the long run, i.e. whether FDI inflows are differentially affected by positive and negative changes in credit ratings in the long run. **We found that FDI inflows in the long run are exclusively affected by positive changes in the rating (level or outlook) by S&P**, with an estimated effect of increasing FDI inflows by 27.9%. For Fitch, the effects are symmetrical in the long term, while for Moody's it was not possible to conduct an identical procedure because there were no negative rating changes in the observed period.

The estimated coefficients of the speed of adjustment (CointEq(-1)) in the models show the pace at which deviations from the long-run equilibrium are corrected in subsequent periods, so this coefficient is key to understanding the dynamics of the long-term and short-term relationships between the analysed variables. Values closer to minus one indicate a faster return to equilibrium of the dependent variable, while less negative values imply a slower adjustment. In all models, the estimated coefficient is both negative and statistically significant. Also, convergence and cointegration relationship between variables are confirmed because the calculated F statistic in the Bounds Test in all models is above the upper critical value at all levels of significance. Moreover, all models meet the basic statistical assumptions of the absence of autocorrelation, homoscedasticity and normal distribution of residuals, as well as correct specification and stability, which was confirmed by the RESET and CUSUM tests.

The models purposefully include the risk premium, measured by the EMBI indicator, as a function of the control variable. **Although EMBI did not prove to be significant in explaining FDI movements, it should be noted that its place in explaining FDI inflows is not negligible, given that a higher risk premium increases market risk and investment costs and therefore discourages FDI inflows**, as evidenced by the expected negative signs of the estimated coefficients with EMBI. Global and regional factors, such as geopolitical risks, market interest rates and economic developments in neighbouring countries, can influence changes in EMBI, which indirectly affects the perception of investment risk and return. In the case of Serbia, the absence of a statistically significant impact of EMBI can be partly explained by the stabilisation of regional markets and increased resilience to external shocks in the last decade. Therefore, a more detailed analysis of global and regional trends, as well as their correlation with investment plans, may be important for future research. Also, several artificial variables circulate in the models in order to isolate the impact of specific events in certain periods – for February 2010, November 2011 and February 2013, which were marked by the public debt crisis in Europe when the risk premium increased and FDI fell, then for November and December 2018, when FDI inflows significantly increased with the concession of the Nikola Tesla Airport, and for September 2020, when the new wave of the coronavirus global pandemic began.

5.3 Analysis of the impact of credit rating on Serbia's economic activity

The second part of the empirical analysis relates to the effects of credit rating changes on Serbia's economic activity, which is approximated by the industrial production index. Based on the assumptions of economic theory, it is expected that an improvement in the level and

outlook of the rating will have a positive effect on the volume of industrial production and, accordingly, on overall economic activity. As in the previous section, econometric estimates were obtained using a linear ARDL model (1, 0, 0):

$$lnIND_t = \beta_0 + \beta_1 lnIND_{t-1} + \beta_2 EMBI_t + \beta_3 S\&P_t + V_t + \varepsilon_t \tag{4}$$

$$lnIND_t = \beta_0 + \beta_1 lnIND_{t-1} + \beta_2 EMBI_t + \beta_3 Fitch_t + V_t + \varepsilon_t \tag{5}$$

$$lnIND_t = \beta_0 + \beta_1 lnIND_{t-1} + \beta_2 EMBI_t + \beta_3 Moody's_t + V_t + \varepsilon_t \tag{6}$$

where V is the set of dummy variables in each of the above models.

The results of the econometric analysis conducted for all three specifications show statistically significant effects of changes in credit rating and outlook on the dynamics of industrial production in the short and long run. The coefficients with the numerical scores of credit rating and outlook have the expected sign and are statistically significant. In the case of S&P and Fitch ratings, **an improvement in credit rating and outlook** in absolute terms **leads to growth in industrial production of 0.7% and 1.0%**, respectively, all other conditions being unchanged. The short-term impact of changes in Moody's credit ratings and outlook is even more pronounced (2.8%), influenced by the factors explained in the previous chapter of the empirical analysis.

In addition to the numerical rating scores, the EMBI indicator is also included as an explanatory variable in the models. **In the models with S&P and Fitch ratings, EMBI proved to be significant in explaining the dynamics of industrial production in the sense that an EMBI of 1.0 pp in the short term leads to a decrease in industrial production of 0.4% and 0.5%**, respectively. This shows that an increase in the country risk premium signals to investors an increased likelihood of financial distress, which may have a negative impact on industrial production. In the model with Moody's EMBI ratings, it is not statistically significant, but it is retained in the model given its positive sign. Also, EMBI in all three models serves as a control variable, the introduction of which captures the effects on industrial production (along with the random error ε_t) that are not explained by the numerical ratings. Analysing this relationship is justified given that the growth of EMBI means a higher risk premium and, accordingly, higher financing costs, which reduces investments and consequently production. In addition, increased investment risk may reduce investor and consumer confidence, further undermining industrial activity.

Table 8 **Effects of changes in credit ratings and outlook on industrial production dynamics in the short term**

	Model 1	Model 2	Model 3
Dependent variable: **Industrial production index** – differenced logarithmic values (ΔlnSDI)			
EMBI$_t$	-0.0040***	-0.0048***	-0.0000
S&P$_t$ (numerical value)	0.0071***	-	-
Fitch$_t$ (numerical value)	-	0.0100***	-
Moody's$_t$ (numerical value)	-	-	0.0280***
V2012m2 (dummy variable)	-0.1582***	-0.1531***	-
V2014m9 (dummy variable)	-	-	-0.0947***
V2020m4 (dummy variable)	-0.2078***	-0.2101***	-0.2174***
V2020m5 (dummy variable)	0.1130***	0.1033***	-

	Model 1	Model 2	Model 3
Dependent variable: Industrial production index – differenced logarithmic values (ΔlnSDI)			
C	0.7621***	0.9175***	1.8096***
Adjustment speed coeff. CointEq(-1)	-0.1719***	-0.2073***	-0.4114***
R^2	0.45	0.46	0.54
Adjusted R^2	0.43	0.45	0.52
Analysed period	M1 2007 – M10 2024	M1 2007 – M10 2024	M7 2013 – M10 2024
***statistical significance level of 1% **statistical significance level of 5% *statistical significance level of 10%			

Source: The authors' calculation using the EViews statistical package.
Note: The short-run effects are obtained in the form of an error correction model. Model 1 takes into account only the assessments according to S&P, Model 2 those according to Fitch, and Model 3 those according to Moody's.

Positive changes in credit ratings and outlooks have a greater impact on the increase in industrial production levels in the long term than in the short term. In the long term, in the case of S&P and Fitch, an improvement in ratings and outlook in absolute terms affects the growth of industrial production by 4.1% and 4.8%, respectively, and in the case of Moody's by 6.8% (Table 9). In both the short and long term, Moody's ratings have been shown to have a greater impact on industrial production trends than S&P and Fitch ratings, which is partly a consequence of methodological differences in credit risk assessment, and partly a significantly improved business and investment environment in Serbia after 2013, characterised by accelerated FDI inflows, in which Moody's assigned a rating to Serbia. It should be noted that the models with S&P and Fitch ratings showed that a 1.0% increase in EMBI affects a decrease in industrial production in the long run, by 2.3% in both models.

Table 9 **Effects of changes in credit rating and outlook on the dynamics of industrial production in the long run**

	Model 1	Model 2	Model 3
Dependent variable: Industrial production index – logarithmic values (lnSDI)			
EMBI	-0.0230***	-0.0229***	0.0000
S&P (numerical value)	0.0414***		
Fitch (numerical value)		0.0484***	
Moody's (numerical value)			0.0681***
C	4.4338***	4.4251***	4.3982***
F-Bounds test statistics	8.33* ** ***	9.62* ** ***	17.48* ** ***
Analysed period	M1 2007 – M10 2024	M1 2007 – M10 2024	M7 2013 – M10 2024
***statistical significance level of 1% **statistical significance level of 5% *statistical significance level of 10%			

Source: The authors' calculation using the EViews statistical package.
Note: Model 1 takes into account only the assessments according to S&P, Model 2 those according to Fitch, and Model 3 those according to Moody's. The results of the F-Bounds test in all three models show that there is cointegration, i.e. a long-term relationship between the variables, given that the assessed F-statistics is above the upper critical value I(1) at all levels of significance.

Similar to the specifications from the first part of the empirical analysis, in the second part of the analysis the estimated coefficient with the error from the long-term relationship from the previous period (Cointeq(-1)) is statistically significant and with a negative sign. The estimated ARDL models are characterised by the absence of autocorrelation, homoscedasticity and normality in the distribution of residuals, as well as the satisfied conditions of adequate specification and stability. In addition, the extent to which industrial production dynamics respond to positive and negative changes in the long run was re-examined. **It was found that**

the effects of changes in credit ratings and outlook on industrial production in the long run are symmetric for S&P (between 3% and 4%) and Fitch (between 4% and 5%). It was not possible to conduct an identical testing procedure for Moody's ratings for the reasons already mentioned.

5.4 Analysis of the interactive impact of credit rating on economic activity in Serbia

Based on the results obtained in the previous chapters with empirical analysis, the interactive impact of simultaneous changes in the credit ratings of all three agencies S&P, Fitch and Moody's on the economic activity of Serbia is examined below, with the observation period shortened in order to equalise the lengths of the time series. In this regard, we evaluated three additional ARDL (1, 0, 0) specifications:

$$lnIND_t = \beta_0 + \beta_1 lnIND_{t-1} + \beta_2 lnSP_t + \beta_3 S\&P*Fitch*Moody's_t + V_t + \varepsilon_t \tag{7}$$

$$lnIND_t = \beta_0 + \beta_1 lnIND_{t-1} + \beta_2 Fitch_t + \beta_3 S\&P*Fitch*Moody's_t + V_t + \varepsilon_t \tag{8}$$

$$lnIND_t = \beta_0 + \beta_1 lnIND_{t-1} + \beta_2 Moody's_t + \beta_3 S\&P*Fitch*Moody's_t + V_t + \varepsilon_t \tag{9}$$

where V is the set of dummy variables in each of the above models, which refer to September 2014, when a larger decline in industrial production was recorded, due to the slowdown in economic growth of Serbia's main foreign trade partners and the negative effects of the May floods that continued to play out during Q3 2014. Also, dummy variables were introduced for April and May 2020, when the negative effects of the first wave of the global coronavirus pandemic occurred.

Table 10 **Individual and interactive effects of credit rating changes and outlook on industrial production dynamics in the short term**

	Model 1	Model 2	Model 3
Dependent variable: **Industrial production index** – differenced logarithmic values (**ΔlnSDI**)			
S&P$_t$	0.0084**	-	-
Fitch$_t$	-	0.0073**	-
Moody's$_t$	-	-	0.0226***
S&P*Fitch*Moody's	0.0003	0.0005***	0.0000
V2014m9 (artificial variable)	-0.2177***	-0.2185***	-0.2127***
V2020m4 (artificial variable)	0.0921***	0.0843***	0.0821***
V2020m5 (artificial variable)	-0.0841***	-0.0839***	-0.0871***
C	1.0551***	1.2166***	1.3979***
Adjustment speed coeff. CointEq(-1)	-0.24***	-0.28***	-0.32***
R^2	0.55	0.55	0.57
Adjusted R^2	0.52	0.53	0.55
Analysed period	M7 2013 – M10 2024	M7 2013 – M10 2024	M7 2013 – M10 2024

***statistical significance level of 1%
**statistical significance level of 5%
*statistical significance level of 10%

Source: The authors' calculation using the EViews statistical package.
Note: The short-run effects are obtained in the form of an error correction model. All models include interactive effects through the product of S&P*Fitch*Moody's rating scores.

In all three models, a positive impact of individual ratings by rating agencies on the growth of industrial production in the short term was obtained - by 0.8% in the case of S&P ratings, by 0.7% in the case of Fitch ratings, and by 2.3% in the case of Moody's ratings. The specificity of the model with individual Fitch ratings is reflected in the fact that the **interactive effects of ratings from all three agencies – S&P, Fitch and Moody's** – have also proven to be significant in explaining the current dynamics of industrial production, **in such a way that simultaneous changes in the level and outlook of the credit rating increase industrial production by 0.05%.**

In the long run, Model 2 has shown that simultaneous changes in the level and outlook of the credit rating by all three agencies together increase industrial production by 0.2% (Table 11). Although these effects are not large, they nevertheless suggest that industrial production responds to changes in credit ratings, whether individual or collective. Although the interactive effects of all rating assessments were also found to be positive in Model 1 and negative in Model 3, neither were statistically significant, so they were not interpreted in economic terms.

Table 11 **Individual and interactive effects of the change in credit rating and outlook on the dynamics of industrial production in the long term**

	Model 1	Model 2	Model 3
Dependent variable: **Industrial production index** – logarithmic values **(lnSDI)**			
S&P$_{t-2}$	**0.0349****	-	-
Fitch	-	**0.0263*****	-
Moody's	-	-	**0.0710*****
S&P*Fitch*Moody's	0.0011	**0.0017*****	-0.0001
C	4.3748***	4.3971***	4.3970***
F-Bounds test statistics	6.08* ** ***	6.50* ** ***	8.02* ** ***
Analysed period	M7 2013 – M10 2024	M7 2013 – M10 2024	M7 2013 – M10 2024
***statistical significance level of 1% **statistical significance level of 5% *statistical significance level of 10%			

Source: The authors' calculation using the EViews statistical package.
Note: All models include interactive effects through the product of S&P*Fitch*Moody's rating scores. The results of the F-Bounds test in all three models show that there is cointegration, i.e. a long-term relationship between the variables, given that the estimated F-statistic is above the upper critical value I(1) at all levels of significance.

All models confirmed the cointegration relationship and the stability of the results, indicating a strong relationship between credit rating and economic indicators of Serbia. In order to more fully understand the effects of credit rating changes on FDI inflows and industrial production, it is necessary to consider the broader context. **Global factors**, such as geopolitical risks and the volatility of international financial markets, can significantly influence the intensity of these effects, and in some situations the direction of the impact. For example, rising market interest rates and yields on securities and shares increase the borrowing costs and opportunity costs of companies, which can partially offset or limit the benefits of a better rating. On the other hand, stable regional and global capital markets provide easier access to funds for capital investments. **Regional factors**, such as foreign trade and economic integration within the European Union and Western Balkan markets, may further modify the effects of rating changes at the level of individual economies. **Domestic factors**, such as the structure of the economy and industry, the degree of diversification, and the realisation of FDI, also shape the effects of credit ratings on key macroeconomic indicators. Countries with

competitive export-oriented companies can further benefit from an improved rating due to more favourable financing conditions and greater investor confidence, especially among conservative investors. The increase in the share of FDI in total investments also encourages the growth of domestic investments in industry and other economic sectors.

6 Conclusion

Empirical analysis has shown that in both the short and long term there is a positive causal relationship between credit ratings by the three most well-known international rating agencies (S&P, Fitch and Moody's), on the one hand, and FDI inflows and industrial production, on the other. Moreover, the positive effects are more pronounced in the long run than in the short run and are strengthened by the interaction of the ratings from all three agencies. This can be explained by the fact that a higher rating level and/or more favourable prospects for a rating change contribute to a reduced perception of credit risk and, accordingly, a decline in the country risk premium and lower borrowing costs on the international financial market, which encourages FDI inflows and growth in industrial production. The results of the econometric analysis conducted in three related chapters provide detailed insight into the potential ways in which an improvement in a country's credit rating can influence higher FDI inflows and growth in industrial activity, which may be of particular benefit to economic policymakers. In this sense, policies and measures aimed at preserving macroeconomic stability and reducing the risk premium can have a significant effect on attracting future investments and intensifying production. The empirical results obtained need to be viewed in the context of a complex economic system where global, regional and domestic factors synergistically affect FDI and economic activity.

From a fiscal policy perspective, due to more favourable financing conditions, fiscal space is opening up for increased government investments, primarily in infrastructure, social programs and other development projects. From a monetary policy perspective, it is expected that the improved credit rating will contribute to maintaining the stability of the domestic currency, precisely through increased FDI inflows, which have a positive impact on gross foreign exchange reserves. Additionally, an investment-grade credit rating places Serbia in the group of the most attractive investment destinations and becomes an important factor in increasing the country's competitiveness at the regional level, encouraging investments not only from foreign investors, but from domestic companies as well. Higher foreign investment, together with investments by the domestic economy and the state, are drivers of long-term growth in economic activity, employment, productivity, and citizens' living standards.

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