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Foreign direct investment and technology transfer: unlocking Serbia's growth potential

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ABSTRACT
This paper examines the effects of foreign direct investments (FDIs) on economic development and the transfer of knowledge and technology (technology spillover) in developing countries, specifically focusing on the Republic of Serbia.
The analysis is based on a comparative review of EU countries and Serbia in terms of statistical data on R&D activities and patent applications. The study synthesises existing research and proposes a methodological framework for future empirical studies.
Findings indicate that technology spillover - horizontal and vertical - has not yet reached the desired levels in Serbia. Despite the presence of FDIs, the anticipated improvements in domestic innovation and technological advancement remain limited.
This study contributes to the literature by contextualising technology spillover in Serbia and identifying gaps in its realisation. It also provides a foundation for future research on the mechanisms by which FDIs influence domestic enterprise performance and national economic development.
The paper offers insights for policymakers and business leaders seeking to maximise the FDI benefits. It suggests the need for strategic policies to enhance technology transfer, support domestic R&D, and foster stronger linkages between foreign investors and local firms to accelerate economic development.

KEY WORDS
foreign direct investments, technology spillover, knowledge, technology, Serbia, EU

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Introduction

Foreign direct investments (FDIs) are often regarded as catalysts for economic and social development, particularly through knowledge diffusion, innovation, and technology transfer (Solow, 1956; Arrow, 1962; Romer, 1986; Stiglitz & Greenwald, 2014). In developing economies, FDIs can enhance the competitiveness of domestic firms by introducing new capital, fostering research and development, and facilitating the acquisition of managerial and technical skills. This process, also known as technology spillover, occurs through mechanisms such as intel-

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lectual property protection, labour mobility, supplier linkages, and the demonstration effect. However, empirical research suggests that FDIs do not uniformly translate into economic growth (Carkovic & Levin, 2005; Herzer et al., 2008), with horizontal spillover effects often limited (Aitken & Harrison, 1999).

The extent to which FDIs contribute to development depends on a country's ability to absorb and utilise external knowledge. Acemoglu (2014) identified four key factors influencing economic growth: geography, culture, institutions, and happiness. While geography and cultural values shape economic behaviour and social trust, institutions - laws, policies, and governance structures - are the most adaptable and play a critical role in economic reforms. Institutions determine the incentives for investment in technology and human capital, influencing a society's capacity for innovation and long-term growth.

In the context of Serbia, understanding the interplay between FDIs, technology spillover, and institutional frameworks is crucial for shaping policies that maximise economic and social benefits. This paper aims to analyse the impact of FDIs on domestic enterprises and the broader economy through knowledge diffusion, applying historical, comparative, and descriptive methods based on secondary data. Given that productivity gains stem from capital accumulation and technological progress (Stiglitz & Greenwald, 2014), this study underscores the need for institutional strategies that enhance knowledge absorption and innovation capacity in Serbia's evolving economic landscape.

This paper is structured as follows: Section 1 provides a literature review of foreign direct investments and technology transfer in Serbia. Section 2 briefly presents the research methods applied in the study. Section 3 reports the research results, emphasising R&D trends and patent activity. Section 4 discusses these findings in relation to Serbia's institutional and economic context. Finally, the conclusion summarises the key insights and provides limitations of the study, practical implications, and directions for future research.

1. Literature review

Developing countries, including Serbia, face structural constraints such as capital shortages, limited technological capacity, and gaps in engineering expertise. FDIs are often viewed as a strategic avenue to address these deficiencies and stimulate economic growth. However, the impact of FDIs remains a subject of extensive research due to their dual effects. While FDIs can enhance production, wages, employment, and technological transfer, they may also contribute to unemployment, increased market competition, and environmental degradation (Sredojević et al., 2016).

In Serbia, scholars have critically examined these dynamics. Šabić and associates (2012) found that while FDIs contributed to economic growth, their concentration in non-tradable sectors (banking, insurance, telecommunications, real estate, and retail) limited export potential and industrial productivity. Hadžić and Pavlović (2011) emphasised the importance of supporting high-growth "gazelle" companies to strengthen the competitiveness of Serbian SMEs. Lehnert, Benmamoun, and Zhao (2013) highlighted FDIs' role in fostering human capital development and technological advancement, while Narula (2012) underscored the need for sustainable financing strategies that integrate economic, environmental, and social considerations into investment decisions.

For Serbia and other developing nations, the challenge lies in maximising FDIs' developmental potential while mitigating their adverse effects. A growth model that prioritises sustainable investment - ensuring intergenerational equity and long-term economic resilience - should be a core policy objective.

Highly educated labour is increasingly recognised as a key factor in attracting FDIs, positioning education as a critical individual and societal investment. In developing countries like Serbia, however, weak linkages between higher education institutions and the labour market contribute to brain drain, as skilled professionals seek opportunities abroad. The relationship between labour and foreign investors is fundamentally investment: individuals invest in their education and skills, while investors allocate capital in anticipation of future returns.

Beugelsdijk, Smeets, and Zwinkels (2008) distinguished between vertical and horizontal FDIs, each with distinct implications for human capital formation. Vertical FDIs, driven by cost-efficiency, typically target countries with cheap labour, offering low wages that discourage further education (Zeng & Eastin, 2012). In contrast, horizontal FDIs, focused on market expansion, incentivise education by offering higher wages for skilled workers (Wang & Zhao, 2008). Serbia's FDI landscape is dominated by vertical investments, which prioritise low-cost, unskilled labour

with limited opportunities for upskilling. This structural imbalance is reflected in Serbia's low proportion of highly educated workers (6.5 % per the 2011 census) and high unemployment rates among university graduates (24 %) (Pejić, 2012; Labour Force Survey, 2019). The absence of policies fostering knowledge-based job creation through FDIs exacerbates these challenges, highlighting the need for institutional reforms that align foreign investment with human capital development.

Serbia has emerged as a leader in FDIs within the region, with Russia, Kazakhstan, Azerbaijan, Turkmenistan, and Serbia accounting for 81 % of the FDI inflows in Southeast Europe and the Commonwealth of Independent States in 2017 (UNCTAD World Investment Report, 2018). Over the period from 2006 to 2017, Serbia experienced its highest FDI inflows in 2006, 2007, 2008, and 2011, followed by a downturn starting in 2012. This decline can be attributed to the global economic crisis, diminished privatisation revenues, and a lack of greenfield investments (Ignjatijević, 2015). However, FDI growth rebounded in 2017, with a 22 % increase compared to 2016, reaching a total of USD 2.9 billion. Despite this, investment in new projects fell by nearly 50 % in 2017, dropping from USD 505 million in 2016 to USD 281 million in 2017 (UNCTAD World Investment Report, 2018).

The sectoral distribution of FDIs in Serbia is notably concentrated in the automotive industry, agriculture, food and beverages, textiles, construction, electrical engineering, electronics, machinery, and furniture. The EU countries, particularly Italy, Germany, Austria, Slovenia, France, and Greece, along with the United States, remain the dominant FDI sources in Serbia. However, there has been a noticeable shift towards greater diversification, with increasing participation from investors in the Asia-Pacific and Middle East regions (Dugalić, 2017). Structural reforms, including simplified property registration procedures, streamlined building permit processes, new subsidy regulations, competitive labour costs, and access to the EU market under the Stabilisation and Association Agreement, have all contributed to making Serbia an increasingly attractive destination for foreign investment. These shifts reflect broader social and economic transformations that underscore the importance of FDIs in shaping Serbia's development trajectory within the context of regional integration and global economic shifts. Some recent studies highlighted the importance of FDIs in Serbia's economy by analysing their relationship with GDP, the unemployment rate, and the global competitiveness index (GCI), providing insights for shaping future investment and public policies (Vukmirović et al., 2020). While FDIs play a crucial role in Serbia's economic growth, their impact on innovation remains limited, as local firms primarily engage in imitation rather than novel creation, underscoring the need for stronger institutional frameworks and leadership strategies to enhance knowledge generation and long-term competitiveness (Vujanović, 2022).

2. Research methods

This study employs a comparative and descriptive methodology, relying on secondary data analysis of statistical reports, international databases, and academic research. These methods were chosen to highlight Serbia's position relative to EU countries in terms of FDI inflows, R&D investment, and patent activity, and to identify patterns of technology transfer and spillover. The analysis focuses on long-term trends (2006–2023), drawing from Statistical Yearbooks, Eurostat, UNCTAD, and related research studies.

3. Research results

Between 2018 and 2023, Serbia's foreign direct investment experienced notable fluctuations. In 2018, FDI inflows reached USD 4.12 billion. This upward trend continued, with investments totalling USD 4.27 billion in 2019 and USD 4.60 billion in 2021. In 2022, FDIs slightly increased to USD 4.61 billion, followed by a 6.06 % rise in 2023, amounting to USD 4.89 billion (Serbia Foreign Direct Investment 2007–2025).

Technological progress has been a key factor in improving living standards in the 20th and 21st centuries, with the application of scientific and technical knowledge driving economic and societal development. Knowledge is fundamental to progress, acting as both a societal goal and a meritocratic principle (Pejić & Radivojević, 2018). GDP disparities between countries are largely due to differences in technological development, innovation, and investment in research and development. FDIs are crucial for development, as they foster technology spillover. However, Miroslav Antevski suggested that such spillovers are unlikely when there is a significant technological gap between countries (Antevski, 2011).

When a spillover occurs, questions arise regarding the ownership and conditions for utilising new knowledge. Greenhalgh and Rogers identified several

perspectives on innovation: (1) knowledge as a public good (Solow, 1957); (2) innovation as a private good with positive externalities; (3) innovation as uncertain and costly, potentially leading to under-investment; (4) market competition that results in redundant discoveries (Greenhalgh & Rogers, 2010). While fundamental knowledge can be a public good, innovations that threaten profits require intellectual property protection. For countries with limited capital, such as Serbia, incremental innovations - small improvements to existing processes - are more common than radical innovations, which involve entirely new products or production methods (Greenhalgh & Rogers, 2010).

For technology spillover to be successful, information about new processes or products must be transferred to potential buyers, and decisions on innovation adoption must be made to achieve market saturation. Under the influence of FDIs, local companies may be compelled to adopt more efficient technologies or face competitive pressures that threaten their survival. Foreign companies often transfer knowledge to local suppliers, raising technical standards and productivity, which can lead to vertical backward spillovers where suppliers improve productivity, as well as vertical forward spillovers where domestic firms benefit from higher quality inputs, better technical instructions, and more timely deliveries (Zildović et al., 2016). However, the success of these spillovers depends on the technological distance between countries and the absorptive capacity of the follower country (Greenhalgh & Rogers, 2010; Gerschenkron, 1962; Gugler & Vanoli, 2015).

Serbia, as a developing country, faces numerous social and systemic challenges in achieving sustainable economic growth. To attract FDIs, the government offers subsidies conditioned on the employment of a set number of workers for a minimum period, based on the investment value (Decree on establishing criteria for the allocation of incentives to attract direct investments, 2019). These subsidies cover 50 %, 60 %, and 70 % of project costs for large, medium, and small companies, respectively. Importantly, subsidies are granted based on the development level of the municipality, regardless of whether the investor is foreign or domestic. However, the government does not address the specifics of employee roles or wages, nor the extent of cooperation with the local economy. While the government expects technology spillovers, foreign investors primarily seek profit. Thus, the government must facilitate the transfer of technology and knowledge to ensure domestic businesses can benefit from foreign investments.

Research and development (R&D) activities are key indicators of a country's technological spillover capacity and its ability to absorb and apply new knowledge (Yip & McKern, 2014). A country seeking accelerated economic development must have a robust scientific and research workforce, which plays a crucial role in driving societal progress. The number of researchers in the EU-28 has steadily grown, reaching 1.88 million in 2016, i.e., 32.2 % more than in 2006. A similar trend is seen in rapidly developing non-EU countries. By 2014, China (1.52 million researchers) had surpassed the USA (1.27 million), while Turkey doubled its researcher count from 2005 to 2014. Researcher distribution correlates with country size and development level. In 2016, 49.3 % of EU researchers worked in business, 38.6 % in higher education, and 11.2 % in government. More developed EU countries have a higher share of researchers working in business, while in less developed states, they are more concentrated in academia. Leading nations include Germany (360,300), France (365,200), and the UK (259,300), followed by Spain, Italy, Sweden, the Netherlands, Poland, Austria, Switzerland, and the Czech Republic.

Serbia faces significant challenges in research and development (R&D) activities. In 2017, according to the Statistical Office of the Republic of Serbia, the distribution of R&D organisations was as follows: 38.2 % in the non-financial (business) sector, 19.3 % in the governmental sector, 39.6 % in higher education institutions, and 2.9 % in the non-profit sector (Statistical Yearbook 2018: 367). The number of researchers in R&D decreased by more than 2.4 % in 2017 compared to 2016. Despite this decline in personnel, the number of research papers increased, with 46 % classified as fundamental, 37 % as applied, and 17 % as development research. This suggests that in Serbia, research has primarily grown as an academic pursuit rather than a societal or economic necessity.

An analysis of the funding structure of research and development (R&D) in Serbia over the period 2008–2023 reveals significant changes in the relative contributions of different funding sources (Table 1). Government funds represented the dominant source of R&D financing in the early years of the observed period, peaking at 63.4 % in 2011. However, this share has gradually declined over time, reaching 37.4 % in 2021 and stabilising at around 40 % in 2023.

In contrast, the share of own funds has exhibited a general upward trend. After fluctuating between 20.86 % and 26.83 % from 2008 to 2011, own contributions increased markedly in 2012 to 33.7 %, and peaked at 45.7 % in 2021. Although a decline followed in 2023 to 28.2 %, this still represents a significant increase compared to the beginning of the period.

Enterprise funding remained relatively stable in the range of 7–9 % through 2014, with a notable increase to 12.8 % in 2015. However, this source experienced a steady decline, thereafter dropping below 1 % in 2021–2023, indicating a weakening role of the business sector in R&D investment.

The contribution of foreign funds has shown a substantial and consistent increase, particularly after 2014. From 9.03 % in 2008, foreign sources accounted for more than 19 % annually between 2017 and 2019, reaching 21.6 % in 2018 and 30.3 % by 2023 - the highest share in the observed period. This trend highlights the growing importance of international collaboration and external financing mechanisms in Serbia's R&D landscape.

Funding from non-profit institutions has remained marginal throughout the period, never exceeding 0.76 %, and registering 0.0 % in several years.

Overall, the data indicate a shift from predominantly public-sector financing toward increased reliance on own and foreign funds, alongside a declining contribution from enterprises. This transformation suggests a changing landscape of R&D funding in Serbia, shaped by both domestic policy shifts and international engagement.

In 2021, Business Enterprise Expenditure on R&D (BERD) in Serbia amounted to 0.4 % of GDP, significantly below the EU average of 1.49 % for the same year, indicating a comparatively low level of the business sector's investment in research and development relative to the national economic output (ERA Country Report 2023: Serbia). In Serbia, the largest number of researchers in R&D activities are employed in the state and higher education sectors. According to the Statistical Office of the Republic of Serbia, a total of 22,782 researchers (full-time and part-time) were employed in R&D in 2017. Of these, 14,156 were in higher education, 5,262 in the state sector, 3,340 in the non-financial sector, and 24 in the non-profit sector (Statistical Yearbook, 2018).

Despite the increase in foreign direct investments (FDIs) in Serbia, it appears that FDIs have not significantly influenced the employment of more researchers in the non-financial sector. However, there was a noticeable increase in funds from foreign clients for R&D activities between 2011 and 2017. This suggests that while FDIs have not directly boosted employment in the non-financial sector's R&D workforce, it

Tab. 1. Sources of funds for R&D in Serbia (% share)

Year	Own funds (%)	Gov. funds (%)	Enterprise funds (%)	Non-profit inst. (%)	Foreign funds (%)
2008	22.33	60.15	7.77	0.72	9.03
2009	20.86	62.87	8.33	0.76	7.18
2010	26.83	59.4	8.62	0.04	3.58
2011	21.8	63.4	9.1	0.1	5.5
2012	33.7	51.3	5.8	0.1	9.2
2013	25.1	59.5	7.5	0.0	7.8
2014	25.9	53.5	8.2	0.0	12.5
2015	24.0	50.6	12.8	0.0	12.6
2016	32.3	45.6	9.2	0.0	13.0
2017	23.5	46.6	10.0	0.0	19.9
2018	25.3	43.1	10.0	0.0	21.6
2019	25.0	45.9	9.1	0.1	19.7
2020	44.4	43.4	2.1	0.2	9.6
2021	45.7	37.4	0.5	0.1	15.9
2022	41.7	39.3	1.3	0.0	17.5
2023	28.2	40.2	0.9	0.2	30.3

Source: author's elaboration on the basis of (*Statistical Yearbooks*, 2008–2024).

has had some positive effect on funding for research and development. In 2022, Serbia reported approximately 2,350 researchers per million people (Serbia - Researchers in R&D). Serbia's R&D growth is partly driven by rising FDIs and increasing collaboration between Serbian and foreign companies, particularly in IT. Serbian IT experts are increasingly contributing to global product development. In 2018, Serbia's software exports (USD 1.198 billion) doubled its imports, surpassing transport and tourism (NBS, 2019). However, research and economic projects remain scarce, with universities focusing on basic research that attracts little FDIs. In 2017, FDIs in R&D saw only a modest net increase of USD 5.5 million.

Science and technology professionals play a key role in societal advancement. In the EU-28, 78 million people (32.1 % of the workforce) were employed in these fields in 2016. Leading countries include Luxembourg (50.9 %), Sweden (42.8 %), and Switzerland (41.6 %), while Romania (20.0 %) and Greece (20.2 %) lag behind. In Serbia, 96,800 people (3.4 % of total employment) worked in professional, scientific, and technical sectors in 2017.

As of 2022, Serbia's professional, scientific, and technical activities sector employed approximately 78,600 individuals, accounting for 3.5 % of the nation's total employment, which is not considered a significant increase compared to 2017 (Annual Bulletin 2023 - the Chamber of Commerce and Industry of Serbia).

The structure of R&D funding and the participation of personnel within the business sector in Serbia from 2008 to 2023 reveal evolving trends that reflect broader shifts in national and international engagement with industrial research and innovation (Table 2).

Throughout the observed period, own funds consistently represented the primary source of R&D financing in the business sector, peaking at 83.98 % in 2010. However, their share fluctuated in subsequent years, declining to 22.0 % by 2017, before rising again to 63.5 % in 2021 and then dropping sharply to 30.3 % in 2023. This volatility suggests varying levels of internal capacity and willingness among enterprises to invest directly in R&D activities. The contribution of government funds to business-sector R&D remained modest across the entire period, ranging from a high of 26.69 % in 2009 to a low of 2.6 % in 2011. In recent years, government funding remained below 5.5 %, highlighting the limited role of direct public investment in stimulating private-sector R&D. Enterprise funds, defined here as R&D investment sourced from other enterprises, showed modest contributions with a notable increase in 2014–2017, peaking at 27.4 % in 2015. However, in 2021–2023, their share had dropped to below 2 %, indicating reduced inter-enterprise collaboration or outsourcing in R&D investment. Foreign funding emerged as a particularly dynamic component of business R&D financing. Initially modest, foreign sources accounted for 19.1 % in 2011 and increased significantly thereafter. By 2023, foreign funds constituted 64.2 % of business R&D financing, marking a substantial shift toward international dependence and possibly reflecting increased participation in cross-border research programmes, foreign ownership, or donor-funded initiatives. The number of R&D personnel in the business sector generally increased over time, rising from 1,344 in 2008 to 5,435 in 2023. While fluctuations occurred, particularly a drop to just 517 personnel in 2011, the overall growth suggests a strengthening of human capital within the sector. When expressed as a share of total national R&D personnel, the business sector's contribution grew from 6.96 % in 2008 to 20.07 % in 2023, more than tripling over the 15-year period. This rise signals a growing institutionalisation of R&D within enterprises and reflects the gradual alignment of Serbia's innovation system with international trends, emphasising the role of the private sector.

Collectively, these trends illustrate a transition in Serbia's business R&D landscape: from one primarily self-financed and modest in scale to a more externally funded and personnel-intensive sector. Nevertheless, the still relatively low share of enterprise funds and modest government involvement point to structural challenges in building a robust, self-sustaining innovation ecosystem led by domestic industry.

Strong R&D is key to patent competition, as new products and innovations boost a company's edge. Developed countries tend to register more patents due to their robust R&D, but many firms keep innovations as trade secrets to avoid exposing them to competitors. Patent competition arises when two firms develop the same solution, and the profits go to the first to patent and market it. Innovation success depends on R&D investment, geography, and technology spillover, which enhances firms' ability to innovate (Cincera, 1997; Jaffe, 1986).

Technology spillover occurs in two forms: competitive, where firms in the same field compete to patent first, and diffusion, where one company's research benefits another. Measuring spillover

Tab. 2. R&D funding and personnel in the business sector in Serbia (2008–2023)

Year	Own funds (%)	Gov. funds (%)	Enterprise funds (%)	Foreign funds (%)	R&D personnel (business sector)	Total R&D personnel	Business sector share (%)
2008	72.63	12.34	6.05	7.57	1344	19321	6.96
2009	57.84	26.69	10.36	4.4	2052	20087	10.22
2010	83.98	9.66	4.23	2.07	1193	19341	6.17
2011	67.5	2.6	10.6	19.1	517	19742	2.62
2012	74.5	2.7	1.5	21.3	776	19646	3.95
2013	63.8	11.6	4.8	19.7	1121	21044	5.33
2014	37.1	11.6	19.8	31.4	3182	21880	14.54
2015	31.6	9.0	27.4	31.9	3334	23629	14.11
2016	41.7	7.3	22.4	28.6	3849	23542	16.35
2017	22.0	7.0	25.2	45.8	3340	22782	14.66
2021	63.5	5.3	0.6	30.7	3735	23977	15.58
2022	61.0	4.1	1.7	33.2	4056	24838	16.33
2023	30.3	4.5	0.9	64.2	5435	27078	20.07

Source: author's elaboration on the basis of (*Statistical Yearbooks,* 2008–2024).

involves tracking innovation transfer via patent activity and citations (Verspagen, 1997; Leoncini & Montresor, 2003). Studies show foreign patents are frequently cited, suggesting they drive domestic innovation (Malebra et al., 2007).

According to data from the European Patent Office, Germany led the EU-28 in patent applications in 2018, with 26,734, followed by France (10,317), the Netherlands (7,140), and Great Britain (5,736) (European Patent Application 2009–2018 per Country of Residence of the Applicant, 2019). In terms of R&D investment, Germany allocated 2.9 % of its GDP (approximately USD 109.56 billion), France had 2.3 % (USD 60.59 billion), the Netherlands had 2 % (USD 16.4 billion), and Great Britain followed with 1.7 % (USD 43.81 billion). Serbia, by comparison, invested only 0.9 % of its GDP in R&D activities (Global Innovation Index, 2018). This disparity in R&D spending is closely linked to a country's success in patent creation and innovation.

A significant portion of R&D spending in developed countries is directed towards the business sector, which is crucial for successful innovation. For instance, in 2018, the top 20 patent applicants globally included major corporations such as Siemens, Huawei, Samsung, LG, and others, reflecting the high level of investment and innovation within these businesses (Top 100 Applicants, 2018, 2019).

Serbia, however, invests minimally in R&D within the business sector, which highlights the country's reliance on technology spillover for potential economic growth. Patent activity in Serbia is limited, with data from the European Patent Office indicating only nine patents from Serbia that were registered in the EU in 2018. This has been a consistent trend, with the exception of a dramatic dip in 2016, where only one patent was registered. These patents, classified in fields of chemistry, mechanical engineering, and civil engineering, are few compared to those of more developed nations.

National patent registrations in Serbia are also low and show minimal yearly variation (Statistika - Patenti, 2019). When compared to FDI trends, there is no significant correlation between increased FDIs and a rise in national patent applications. However, Serbia has seen a higher number of extended European patents, suggesting that foreign companies are more inclined to protect their intellectual property in Serbia than to engage in technology spillover. Unfortunately, due to the lack of detailed data on the sectoral distribution, exploitation, and citation of patents, it is difficult to ascertain the true impact of spillover from foreign patents in Serbia. Between 2019 and 2023, Serbia experienced fluctuations in the number of patent applications filed by residents. In 2019, there were 23 patent grants, marking a 23.3 % decrease from the previous year. The total number of patents in force during that period was approximately 9,000, positioning Serbia 56th globally (Intellectual property statistics - Serbia).

4. Discussion of the results

The potential for foreign investment spillovers in Serbia is influenced by key factors such as the absorptive capacity of national firms and the institutional framework of the host country (Farole & Winkler, 2015). While empirical studies have generally identified technology spillovers as a primary benefit of FDIs, the actual effects vary across countries. Ideally, spillovers enable the recipient country to match the growth rates of the investing country, but formal models suggest that GDP per capita convergence is unlikely, meaning the recipient's growth, though aligned, will not reach the same level (Greenhalgh & Rogers, 2010).

In Serbia, Stojanović (2018) found a strong positive relationship between FDI and GDP growth, with a correlation coefficient of 0.732. Despite this, Serbia faces several obstacles that hinder the full exploitation of FDIs' potential, including insufficient investment in R&D, a lack of R&D teams within foreign companies, limited labour mobility, and low patent activity. Additionally, the absorptive capacity of Serbian firms remains limited, preventing them from fully leveraging external knowledge and technology. The productivity gap between domestic and foreign firms is exacerbated by macroeconomic instability, financing challenges, non-performing loans, and weak corporate governance (Zildović et al., 2016).

To overcome these challenges, investing in education and R&D within the business sector, while fostering stronger collaboration between academic institutions and economically significant projects, is vital for Serbia's long-term development. Akin and Vlad (2011) supported this approach by using the Zhang-Markusen (ZM) theory to demonstrate the relationship between education and FDIs. The ZM theory suggests an inverted U-shaped relationship between FDIs and human capital, where countries with low income and human capital are less successful in attracting FDIs. Multinational companies (MNCs) prioritise skilled workers over low wages, recognising the importance of expertise and skills in modern business operations (Šabić et al., 2012). Akin and Vlad's findings affirm that FDIs are significantly higher in countries with higher levels of education, particularly in middle-income nations.

Serbia's long-term economic growth and competitiveness require institutional reforms that enhance the collaboration between education, domestic firms, and foreign investors to stimulate R&D and innovation. While FDIs improve technological efficiency, their impact varies across industries, necessitating targeted policies and strategic leadership to foster knowledge creation and ensure sustainable integration into the EU (Nikolić, 2021).

Conclusions

Serbia's experience with foreign direct investments (FDIs) reveals a complex dynamic between economic growth, technology transfer, and structural limitations. While often seen as a catalyst for development, FDIs' impact is neither automatic nor evenly distributed. Serbia has yet to fully capitalise on its potential for sustainable technological progress (Voica et al., 2015).

Limited technology spillover stems not just from policy gaps but also from structural constraints like weak institutions, labour market imbalances, and low R&D investment. The dominance of vertical FDIs reinforces Serbia's reliance on foreign capital without fostering local innovation, mirroring global economic inequalities. Also, it is crucial to highlight the critical role of managerial styles in overcoming structural barriers, fostering innovation, and driving sustainable development, whether in leveraging FDIs for economic transformation in Serbia or enhancing organisational performance (Nešić Tomašević et al., 2025).

Weak ties between universities, domestic firms, and multinational corporations fuel brain drain, depriving Serbia of skilled talent and deepening social disparities. To move beyond passive reliance on foreign capital, Serbia must enhance its capacity for technology absorption through institutional reforms, stronger R&D investment, and policies favouring knowledge-based industries. Also, to move beyond low-cost production, Serbia must foster education-industry linkages, support SMEs in high-tech sectors, and leverage regional trade agreements like the Open Balkan initiative to enhance knowledge spillovers. Ultimately, Serbia's ability to harness FDIs for lasting progress depends on aligning investment with domestic capacity-building. A more integrated approach - linking economic policy with social development - is key to ensuring that technological growth benefits society as a whole.

While FDIs bring advanced technology, their influence varies across sectors. Knowledge spillovers are strongest where local firms can integrate foreign innovations. In Serbia, industries like ICT and automotive manufacturing have benefited from technol-

ogy transfer, whereas traditional sectors lag due to weaker linkages with foreign firms. Strengthening these connections through policy support is essential for maximising FDIs' transformative potential. However, the geopolitical dimension of FDI inflows should not be overlooked. The increasing role of Chinese investments in infrastructure projects presents an alternative model of technology transfer that diverges from Western European norms. This dynamic poses both opportunities and risks, requiring further exploration into whether Serbia's technological development trajectory is aligned with long-term economic diversification goals.

Despite the advantages FDIs offer, they remain concentrated in labour-intensive industries, leading to a dual labour market where foreign firms provide high-tech employment opportunities while domestic enterprises struggle with low productivity. Serbia's low wages make it an attractive destination for investors, yet they may also hinder long-term development if wage stagnation discourages innovation. Experiences from economies such as South Korea and the Czech Republic highlight the importance of aligning FDIs with human capital development to ensure sustainable growth.

While Serbia has made progress in improving its investment climate, challenges persist in areas such as contract enforcement, intellectual property protection, and bureaucratic inefficiencies. Additionally, the country's geopolitical position plays a significant role in shaping FDI patterns, with competing interests from EU, Chinese, and Russian investors influencing its economic strategy. Successfully balancing these external influences while aligning with EU integration goals is essential for securing stable, long-term investment.

By addressing these issues, this study aims to refine the understanding of the FDIs' role in Serbia, ensuring a more nuanced assessment of its developmental impact. FDIs have fuelled Serbia's growth; however, the country's long-term success depends on strengthening domestic innovation, addressing sectoral imbalances, and refining investment policies. A strategic shift toward an innovation-based economic model will be essential for sustaining development beyond foreign capital inflows.

This study is limited by its reliance on secondary data sources, including statistical yearbooks, international databases, and published research. While these provide valuable insights into long-term trends, they do not allow for detailed analysis of sector-specific or firm-level spillover effects. In addition, the limited availability of patent data restricts the assessment of innovation diffusion in Serbia. Establishing a clear causal link between foreign direct investment and domestic technological advancement is, therefore, difficult without micro-level, longitudinal evidence. The findings highlight the need for stronger institutional frameworks that support knowledge absorption and innovation in Serbia. Policymakers should prioritise building closer ties between universities, domestic enterprises, and foreign investors to enhance technology transfer. Practical steps that could significantly improve the developmental impact of FDIs include supporting SMEs in high-tech sectors, aligning education and labour market policies to reduce brain drain, and encouraging multinational companies to engage in collaborative R&D activities.

Further research should focus on firm-level analyses of how foreign and domestic enterprises interact in Serbia, particularly in sectors where technology spillovers are most likely to occur. Comparative studies with other emerging economies could help to benchmark Serbia's performance and identify best practices. In addition, the growing role of Chinese and other non-EU investors warrants closer investigation to understand how different FDI models influence Serbia's long-term technological and economic trajectory.

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