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Can Chinese Investments Contribute to Accelerating Economic Growth in Europe?

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Abstract: *This study investigates the impact of Chinese outward foreign direct investment (FDI) on the economic growth of 27 European countries from 2004 to 2021, amid concerns about China's increasing economic influence in Europe. This study employs systematic econometric methods, including the LLC and IPS tests for stationarity, Kao and Pedroni cointegration tests, fully modified ordinary least squares (FMOLS) and dynamic ordinary least squares (DOLS) for long-term effects, and the ARDL test for short- and long-term effects. The findings further supported by Panel Granger causality test, one-way and two-way fixed effect models, and dynamic panel models, suggest a significant positive impact of trade openness and fixed capital on long-term European economic development. The study also reveals that while Chinese FDI and trade openness primarily influence economic growth in the long run, fixed capital has both short and long-term effects. Moreover, a sensitivity analysis of rich and poor European nations confirms these patterns, emphasising the role of trade openness and fixed capital in promoting sustainable economic growth. The study suggests a balanced approach to leveraging FDI, highlighting the importance of policy measures that encourage trade openness and fixed capital investment to enhance economic development in Europe.*

Keywords: Foreign direct investment; Economic growth; International trade; China; Europe
JEL Classification: F20, F21, F43

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1. Introduction

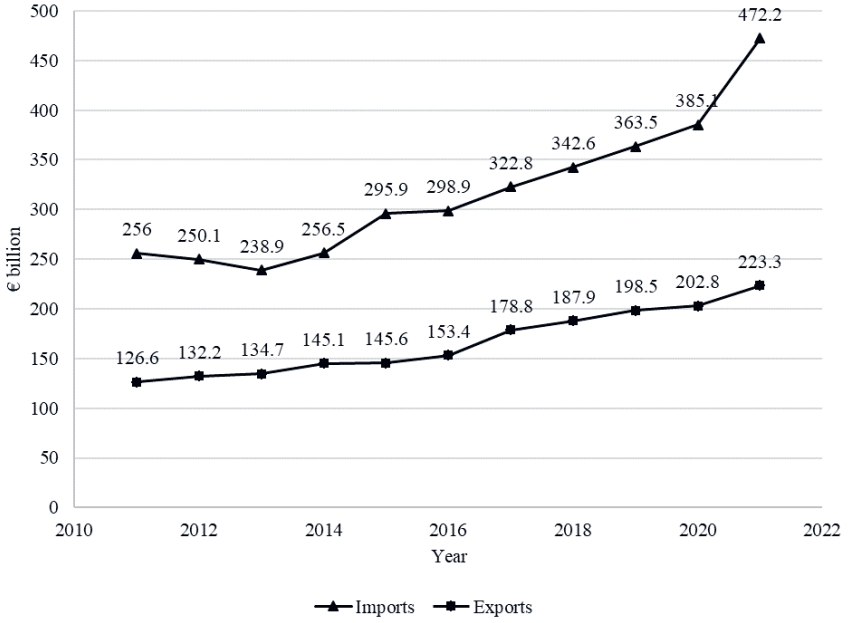
Europeans began trading with China in the 16th century when navigation and shipbuilding advances allowed them to cross the Atlantic Ocean (Paine, 2014). European empires established Pacific Ocean trade routes after discovering a path from South America to China (Chaudhuri, 1985). Since then, Asia-Europe intra-regional trade has driven the global economy (OECD, 2019). After the cold war, Chinese businessmen visited Europe more often (Pedersen, 2018). The commerce between the European Union (EU) and China has seen significant growth since the 1980s, as highlighted by Cottey (2017). Additionally, the EU's 'Towards a New Asia Strategy' in 1994 emphasised the need for continuous economic engagement with China. China remained an important EU business centre after the 1997 Asian financial crisis, which dampened investor excitement. Nevertheless, since the postponement of the annual EU-China summit in November 2008, there has been a noticeable decline in the state of relations between the two entities.

China's Belt and Road Initiative (BRI) in 2013 was a turning point for China-Europe ties. Europe lies at the western end of China's big connectivity ambition and may be crucial to the BRI's success (Amighini, 2017). The BRI represents an initiative aim to increase international trade and connectivity (Kon et al., 2023). The BRI connects Asia, Africa, and Europe via land and sea to boost regional integration, commerce, and economic development (Lee & Shen, 2020). Under this worldwide approach, new and creative projects increase physical and soft infrastructure and cultural links throughout a vast area (EBRD, 2022). Project finance, risk mitigation, and green financing are helping the BRI prioritise high-quality investment (OECD, 2018). Under this programme, China is rising in Europe and two-thirds of EU member states are official partners (Hillman & Sacks, 2021). The 17+1 cooperation platform is another Chinese government effort to develop relations with Central, East, and Southeast Europe (CESEE) outside the BRI. The BRI and 17+1 initiatives promote Chinese investment and trade in CESEE states. After BRI policy implementation, the 17+1 collaboration model encourages local BRI initiatives (Kizeková, 2021; Pendrakowska, 2021).

More recently, China has further strengthened its economic relationship with Europe by increasing international trade with the region. Figure 1 shows China-Europe trade growing rapidly from 2011 to 2021. China

has become Europe's major trade partner in decades (Kratz et al., 2022; Pendrakowska, 2021). From 2011 to 2021, both imports and exports to China rose. In 2021, China was the EU's largest import partner at 22.4%. The EU imported the most from China in 2021 (EUR472.2 billion) and the least in 2013 (EUR238.9 billion). EU exports to China reached their high in 2021 (EUR223.3 billion) and their lowest in 2011 (EUR 126.6 billion). The EU-China trade deficit was EUR248.9 billion in 2021 (Eurostat, 2023).

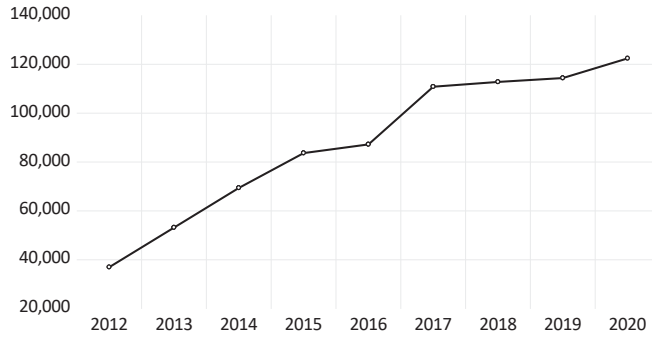
Figure 1: European Union-China Goods Trade, 2011-2021 (Euro billion)



Source: Eurostat (2023).

Chinese investments in Europe increased in the 2010s. Figure 2 shows that Chinese foreign direct investment (FDI) in Europe grew rapidly over the decades. China invested USD36.975 billion in Europe in 2012. In 2015, Chinese investments were USD83.678 billion, up from USD53.161 billion in 2013. Moreover, Chinese investments increased from USD87.201 billion in 2016 to USD110.854 billion in 2017. Recently, Chinese outward FDI rose from USD112.796 billion in 2018 to USD114.383 billion in 2019 and USD122.431 billion in 2020.

Figure 2: Chinese FDI in Europe (USD million)



Source: Ministry of Commerce China (2022).

Despite their quantitative increase, Chinese investments are often challenged by scholars for not contributing to economic development in the recipient's countries (Githaiga et al., 2019; Dossani et al., 2020). Some scholars argue that Chinese investments in Europe have negatively impacted its economy (Burgoon & Raess, 2014; Meunier et al., 2014; Hanemann & Huotari, 2018; Ma et al., 2019). According to Burgoon and Raess (2014), some employees did not welcome Chinese investments since China was perceived as a low-wage manufacturer that may not prioritise labour rights and good industrial relations. Meunier et al. (2014) noted that European political elites and politicians feared China's economy entering Europe *via* significant Chinese investments. Hanemann and Huotari (2018) state that European politicians worried about Chinese investments' adverse impacts. Ma et al. (2019) employed empirical research to show that BRI investments will negatively impact China-European trade.

This paper empirically examines whether Chinese FDI has enhanced the economies of 27 European countries from 2004 to 2021. To the best of our knowledge, no systematic econometric method had been employed to study the relationship between Chinese investments and European economic growth. More specifically, there are four main contributions to this empirical analysis. First, the lack of time-series data on Chinese investments became a hindrance to researching this topic. The study collects the latest official data on Chinese investments from a relevant national agency. Second, this paper uses systematic economic methodologies, including the autoregressive distributed lag (ARDL) method to test short- and long-run relationships

between Chinese foreign investments and Europe economic growth. Third, this study examines the dynamic nature of the 'investment-growth' relationship with the dynamic panel method. Finally, the sensitivity analysis examines the impact of Chinese investments on gross domestic product (GDP) growth in Europe across a spectrum of national income levels (i.e., relatively wealthy European countries with per capita incomes greater than USD13,159[1] in 2020 and relatively poor European countries with per capita incomes less than USD13,159 in 2020).

This paper is split into seven sections. Following the introductory section, the Section 2 examines the major Chinese investment project under the BRI in Europe. Section 3 examines the most influential empirical studies on the connection between FDI and economic growth in Europe. Section 4 describes the data and procedures of this paper. Section 5 discusses the empirical findings, and Section 6 presents the sensitivity analysis for rich and poor European countries. Lastly, Section 7 offers conclusions.

2. Key BRI projects in Europe

The BRI aims to enhance trade, logistics, and infrastructure (see Table 1). European institutions have participated in financing BRI projects in various ways since 2015, benefiting from the supply chain networks created by the BRI (Lee & Shen, 2020). Additional railway and port development projects could aid logistics businesses in creating new routes and supply chain hubs. European insurers have shown interest in the commercial potential of the BRI. According to OECD (2018) data, a small percentage of BRI residents have health insurance.

Table 1: Chronological Overview of Key BRI Projects in Europe

Year	Projects	Description	Reference
2010	Mihajlo Pupin Bridge Construction, Serbia	Initiation of construction by China Road and Bridge Company Corporation, completed in 2014	Zakić (2020)
2016	COSCO Shipping's Acquisition of Piraeus Port, Greece	Chinese shipping giant COSCO's purchase of the Greek port of Piraeus	Vangeli (2017)
2016	Hesteel Serbia Acquisition	Chinese state-owned enterprise acquires a Serbian steel plant	Svetlicinii (2018)

Year	Projects	Description	Reference
2017	Green Belt and Road Investor Alliance Formation, London	An international investor organisation to support sustainable BRI projects	Skala-Kuhmann (2019)
2018	Kičevo–Ohrid Highway, North Macedonia	North Macedonia's largest post-independence infrastructure project	Vangeli (2018, 2021)
2018	Bar–Boljare Highway Project, Montenegro	Start of construction on one of Europe's most costly roads	Gray (2018) Grgić, (2019)
2019	Xi'an to Europe Train via Marmaray Tunnel	The first Chinese goods train from Xi'an to Europe begins operations	Zhu et al. (2021)
2019	Peljesac Bridge Construction, Croatia	It avoids Bosnia and Herzegovina's limited coastal strip at Neum and connects the Southeast Croatian exclave to the remaining parts of the country	Dinic (2021)
2020	Kaposvár Solar Power Station Construction, Hungary	Initiation of construction by China National Machinery Import and Export Corporation	Lukács & Völgyi (2021)
2020	Budapest-Belgrade Railway Construction, Hungary	The remodelling will make transporting Chinese products between Greek ports and central Europe easier	Curic a Kalman (2021)
2021	Vado Gateway Terminal Project, Italy	This will enable big cargo ships and increase the terminal's annual capacity to over one million containers	Ghiretti (2021)
2021	E-763 Highway Project Completion, Serbia	Completion of the Cacak-Belgrade-Montenegro highway by China Communications Construction Company	Zakić (2020)

China's acquisition of Pirelli, the multinational tyre manufacturer in Italy, has provided it with access to one of the world's largest tyre manufacturers. China's Silk Road Fund helped acquire several BRI-related assets in Europe (Jung et al., 2020). The EUR450 million Vado Gateway Terminal project at Italy's Port of Vado Ligure is set to accommodate large cargo ships and increase the terminal's annual capacity to over one million containers. This would increase local employment (Ghiretti, 2021). Thus, many have engaged in large infrastructure projects. Siemens, the German tech company is one example. Siemens pioneered Chinese procurement, engineering, and construction partnerships. Siemens contends that its extensive technical portfolio, deep understanding of local market needs, and enduring presence in most BRI countries make it well-suited for the region (Siemens, 2018).

Furthermore, eastern, and southeast European states depend on China for investment (Pardo, 2018). Standard Chartered, JP Morgan, China-British Business Council, Agriculture Bank of China, and Green Investment Group are the principal contributors to the Green Belt and Road Investor Alliance. This international investment organisation, established in London in 2017, aims to support sustainable and investable projects under the BRI (Skala-Kuhmann, 2019). China and Europe have established BRI task groups comprising legal firms, global consultancy companies, and commercial banks. They provide BRI briefings, newsletters, websites, databases, and personalised assistance to customers.

China has highlighted the significance of investment in fostering the growth of future commerce between China and Europe, particularly within the maritime component of the BRI. In 2016, COSCO Shipping, the world's largest shipping firm, acquired the Greek port of Piraeus, marking a significant investment under BRI (Vangeli, 2017). Moreover, Hesteel Serbia, the oldest and largest industrial site in Serbia, was acquired by a Chinese state-owned enterprise from Hebei province (Svetlicinii, 2018). Following its acquisition, Hesteel Serbia became the country's leading exporter, with shipments of around USD400 million even in a pandemic-ravaged 2020.

The Mihajlo Pupin Bridge Building, the first Chinese-built bridge in Europe, spans the Danube River in Serbia. This bridge in Belgrade was constructed by the China Road and Bridge Company Corporation beginning in 2010, and it was completed in 2014 (Zakić, 2020). This bridge was formally inaugurated during the Third Prime Ministers' Meeting of the 16+1 Cooperation Mechanism in Belgrade. After the Pančevo Bridge was constructed in 1946, it became the second bridge that crossed the Danube in Belgrade.

Additionally, the Serbian E-763 project is the largest in the southernmost part of the region. The Cacak-Belgrade-Montenegro highway was built rapidly (Zakić, 2020). China Communications Construction Company, a state-owned infrastructure company, built this project. The 75 km route, which comprises 51 km of bridges and tunnels, is situated in the country's south-central region. The EUR420.3 million Peljesac Bridge in Dubrovnik-Neretva County is being constructed by the China Road and Bridge Corporation. It avoids Bosnia and Herzegovina's limited coastal strip at Neum and connects the Southeast Croatian exclave to the remaining parts of the country (Dinic, 2021). The bridge restricts admission into Bosnia and

Herzegovina by crossing the sea passage between Komarna on the northern mainland and Peljesac on the peninsula.

The Budapest-Belgrade railway in southern Hungary was constructed by China Railway International and the China Communication Construction Company. As one of Hungary's costliest infrastructure projects, the railway upgrades passenger services with a 370 km dual-track electrified high-speed train network. The remodelling will make transporting Chinese products between Greek ports and central Europe easier (Curic & Kalman, 2021). Hungary's largest solar power station in Kaposvár, southern Hungary, was constructed by the China National Machinery Import and Export Corporation (Lukács & Völgyi, 2021). China and Hungary believe the Kaposvár solar power facility would boost environmental protection and green development cooperation. The project prioritises environmentalism throughout building. Hungary will enjoy cleaner energy when the power plant is connected.

Part of Corridor Xi, the Bar–Boljare Highway aims to connect Montenegro's developed south with its developing north (Gray, 2018). Due to its steep geography, this road is one of Europe's most costly to build (Grgić, 2019). The project avoids the Moraca Canyon, one of Montenegro's dangerous roads, to reduce travel time from Podgorica, the capital, to the hilly north. North Macedonia's largest and costliest post-independence infrastructure project is the Kičevo–Ohrid Highway (Vangeli, 2018). Development is vital to North Macedonia's economy, yet it is highly disputed (Vangeli, 2021). Technological difficulties have delayed the project and cost EUR598 million.

The New Eurasian Land Bridge links the Pacific and Atlantic Oceans. The geographical connection between China and Europe has enhanced economic and commercial connections. The bridge links Lianyungang and Rizhao, China, to Rotterdam and Antwerp, Netherlands, and Belgium, through Belarus, Germany, Kazakhstan, Russia, and Poland (Sarwar, 2018). Spanning over thirty countries, it significantly enhances economic and commercial connections (Zhu et al., 2021). In 2019, operations began for the first Chinese goods train from Xi'an to Europe, passing through the Marmaray Tunnel.

3. Literature review: Foreign investments and economic growth

Empirical research on the impact of FDI on economic growth in Europe presents a diverse and nuanced landscape, characterised by studies with varying findings and methodological approaches. This body of research collectively aims to unravel the complexities surrounding the influence of FDI on different European economies, yet it offers a range of perspectives that are reflective of the multifaceted nature of this topic.

A considerable portion of this research underlines a positive correlation between FDI and economic growth. For example, Mehic et al. (2013) utilises a sophisticated Prais–Winsten regression with panel-corrected standard errors to uncover a substantial positive impact of FDI on seven Southeast European nations. In a similar vein, Comes et al. (2018) employ hierarchical cluster analysis in their examination of seven central and eastern European (CEE) countries, and conclude that FDI exerts a beneficial effect on their economies. Further reinforcing this viewpoint, Doğan et al. (2020) conducted a comprehensive study across 32 European states and find a highly favourable influence of FDI on economic expansion, supported by robust statistical evidence.

In contrast, other studies highlight the negative implications of FDI on economic growth. Notably, Gjini (2013) applies a fixed-effect model with heteroskedasticity-corrected standard errors to his research on 12 CEE states and reveals an adverse effect of FDI on economic progress. Additionally, Curwin and Mahutga (2014) show that FDI slows economic progress in the short and long run in 25 CEE and Eurasian post-socialist countries from 1990 to 2010. Sağlam (2017) leverages panel causality analysis in his study of 14 CEE and former Soviet Union nations and suggests that direct overseas investments might undermine the economy over time. These findings propose a more cautious perspective on the role of FDI, hinting at potential downsides that might outweigh its benefits in certain contexts.

Additionally, a strand of research takes a neutral stance, indicating no significant relationship between FDI and economic growth. For instance, Golitsis et al. (2018) employ the vector autoregressive (VAR) model and Granger-causality approach in their study on Albania and conclude there is a lack of correlation between FDI and economic development. This perspective introduces a critical dimension to the discourse, acknowledging that the impact of FDI might be context-dependent, and not universally beneficial or detrimental.

The discourse becomes further nuanced with studies focusing on specific aspects or sectors. Shera and Meyer (2013) employ a quasi-fixed-effect panel with heteroskedasticity-corrected standard error suggested a positive role for FDI in Albania's economic growth. Angelopoulou and Liargovas (2014) use panel data from various country groups to explore the effects of FDI in the EU and European Monetary Union, found mixed impacts across different regions.

Hlavacek and Bal-Domanska (2016) identify significant connections between FDI, economic growth, and investment in eight CEE countries, reinforced the positive narrative. Similarly, Miteski and Stefanova (2017) distinguish the varying impacts of FDI in different sectors across central, eastern, and southeastern European countries, suggested sector-specific effects of FDI. Gherghina et al. (2019) further contribute to this field with their use of the panel vector error-correction model, uncovered both short- and long-term effects of FDI on economic development.

This methodological diversity is a key factor contributing to the varied conclusions drawn from these studies. The application of different statistical methods, such as panel data regression, hierarchical cluster analysis, fixed-effect models, and VAR models with Granger-causality tests, reflects a broad spectrum of analytical tools. These methodologies differ in their handling of variables, accounting for heteroskedasticity, and interpretation of causal relationships. This methodological pluralism has led to disparate insights into the impact of FDI on economic growth, underscoring the complexity of this relationship.

Table 2: Summary of Key Findings on Investments and European Economic Growth

Authors (year)	Variables	Data	Methods	Findings (relationship)
Gjini (2013)	*DV*: Real GDP per capita *IVs*: FDI (% of GDP), remittances per capita, gross capital formation per capita, terms of trade	1996–2010	Fixed-effects model with heteroscedasticity corrected standard errors	Negative
Mehic et al. (2013)	*DV*: Real GDP per capita *IVs*: FDI, GDP per capita, domestic investment, government balance, openness, inflation	1998–2007	Prais–Winsten regression with panel-corrected standard errors, OLS	Positive

Authors (year)	Variables	Data	Methods	Findings (relationship)
Shera & Meyer (2013)	*DV*: Real GDP per capita *IVs*: FDI, remittances, investment in physical and human capital, international trade, final consumption expenditures, inflation, fixed capital formation	1992–2012	Quasi-fixed effects method, random effects method	Positive
Angelopoulou & Liargovas (2014)	*DV*: GDP growth *IVs*: FDI, initial GDP, trade openness, investment share, government spending, inflation, R&D expenditure, tariff rate	1989–2008	Multiple regression analysis with panel data	Positive
Curwin & Mahutga (2014)	*DV*: GDP per capita *IVs*: FDI	1990–2010	IV regression, two-stage least squares	Negative
Hlavacek & Bal-Domanska (2016)	*DV*: GDP per capita *IVs*: FDI, gross fixed capital formation, human resources in science and technology	2000–2012	Endogenous growth model, least squares with dummy variable model, OLS	Positive
Miteski & Stefanova (2017)	*DV*: per capita real GDP growth rate *IVs*: FDI, physical capital, human capital, domestic investment, education, inflation, government consumption, trade openness, transition index	1998–2013	Fixed-effect model, GMM estimator	Positive
Sağlam (2017)	*DV*: GDP per capita *IVs*: FDI, international trade	1995–2014	VAR, OLS	Negative
Comes et al. (2018)	*DV*: GDP *IVs*: FDI, remittances	2010–2016	Hierarchical cluster analysis, least squares method, fixed effect method, OLS	Positive
Golitsis et al. (2018)	*DV*: GDO and remittances *IVs*: FDI, gross capital formation, Inflation	1996–2014	Granger-causality, VAR	No

Authors (year)	Variables	Data	Methods	Findings (relationship)
Gherghina et al. (2019)	DV: GDP per capita IVs: FDI, poverty, inequality of income distribution, education, innovation, transport infrastructure, information technology, institutional quality, government expenditure, urbanisation, domestic credit to the private sector, international trade	2003–2016	FMOLS, DOLS, and six tri-variate panel vector error-correction models	Positive
Doğan et al. (2020)	DV: GDP per capita IVs: FDI, economic complexity index, share of renewable energy, share of non-renewable energy, per capita trade openness, institutional quality	1995–2014	Panel quantile regression	Positive

4. Data and procedures

This study examines the influence of Chinese FDI on economic development in 27 European nations from 2004 to 2021. The Statistical Bulletin of China's Outward FDI is the source for Chinese FDI data in its several editions (Ministry of Commerce, China, 2022). The World Development Indicators database provides time series data on economic growth and other macroeconomic variables for European countries (World Bank, 2022). Table 3(a) contains a detailed description of all variables and their data sources. Table 3(b) shows the list of 27 European countries by GDP per capita.

Table 3(a): Description of Variables

Variables	Description	Sources
GDPL	Natural log of GDP (in US$)	World Development Indicator
CFDIB	China's FDI/billion (in US$)	Statistical Bulletin of China's Outward Foreign Direct Investment.
TOP	(Export + Import) / GDP (in US$)	World Development Indicator
GFCL	Natural log of Gross fixed capital (in US$)	World Development Indicator

Table 3(b): List of 27 European Countries

Relatively poor countries (per capita GDP < US$13,159)	**Relative wealthy countries (per capita GDP > US$13,159)**
Albania, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Hungary, Moldova, Montenegro, North Macedonia, Poland, Romania, Russian Federation, Serbia, Ukraine	Austria, Cyprus, Czechia, Estonia, Greece, Italy, Latvia, Lithuania, Luxembourg, Malta, Portugal, Slovak Republic, Slovenia

This study implemented five different steps of empirical analysis. Two types of panel unit root tests, the Levin-Lin-Chu (LLC) test (Levin et al., 2002) and the Im-Pesaran-Shin (IPS) test (Im et al., 2003), are utilised to analyse the unit root process of variables in the first stage of empirical test. These two prominent unit root tests are based on different assumptions. The LLC test assumes homogeneity of the autoregressive coefficient, whereas the IPS test relies on its heterogeneity.

In the second stage, the cointegrating relationship between variables is examined using two different panel cointegration tests, the Kao and Pedroni cointegration tests (Kao, 1999; Pedroni, 1999). The Kao test and Pedroni test are based on a similar two-stage approach or residual-based approach. In the first stage of estimation, the Pedroni test uses heterogeneous coefficients that would vary across cross-sections. By contrast, the Kao test employs homogenous coefficients that would be constant across cross-sections.

The next stage employs the FMOLS, DOLS, and ARDL methods to evaluate the long-run co-movement between dependent and independent variables. Phillips and Hansen (1990) introduced the fully modified ordinary least squares (FMOLS) method, which uses a semi-parametric approach to eliminate serial correlation issue. Stock and Watson (1993) suggested the dynamic ordinary least squares (DOLS) method, which incorporates the lags and leads of the first difference of independent variables in the estimation model. Pesaran et al. (2001) popularised the ARDL method that allows a dependent variable to have a relationship with the current value of independent variables as well as the lagged value of dependent and independent variables.

In the fourth stage, the panel Granger causality test is used to determine the causal connection between the independent and dependent variables. A common method for determining causality that assumes that all coefficients are equal across cross-sections is the panel Granger causality test. It

presupposes the homogeneity of coefficients across the cross-section, like the LLC test (Baltagi, 2008).

In the final step of the empirical test, four distinct panel regression models are used: the one-way fixed effects, two-way fixed-effect, first-difference dynamic, and orthogonal-deviation dynamic panel methods.

5. Empirical findings

Table 4 presents the empirical results from the LLC and IPS tests for 27 European nations. The LLC test and the IPS test offer more consistent findings for the unit root analysis at the first difference. Both panel unit root tests reject the null hypothesis of a unit root, both with an intercept and with an intercept and trend, at the first difference for all four variables.

Table 4: Panel Unit Root Tests

Variables	Deterministic	Level		1st difference	
		LLC	IPS	LLC	IPS
GDPL	Intercept	-3.899***	0.558	-7.697***	-6.767***
	Intercept and trend	-3.628***	-2.465***	-7.352***	-3.274***
CFDIB	Intercept	-2.557**	-0.996	-4.321***	-4.714***
	Intercept and trend	-0.918	-0.482	-1.296*	-2.143*
TOP	Intercept	-1.903**	2.105	-12.731***	-10.497***
	Intercept and trend	-6.994***	-2.384***	-11.540***	-7.769***
GFCL	Intercept	-4.432***	-1.897**	-10.883***	-8.535***
	Intercept and trend	-4.468***	-2.099**	-10.101***	-5.853***

Notes: 1%, 5%, and 10% levels of significance represented as ***, **, and *, respectively.

Given that the first differences of the four variables are stationary, the analysis proceeds to the cointegration tests. Table 5 presents the empirical results of the Kao and Pedroni panel cointegration test. The Kao cointegration test suggests that there is no evidence in support of long run cointegration relationships among the variables in European countries. However, the Pedroni cointegration test suggests a different result. The Pedroni cointegration test rejects the null hypothesis of no cointegration between the variables with an intercept for the Group-PP statistic and Group-ADF statistic. Moreover, the Pedroni cointegration test rejects the

null hypothesis of no cointegration between the variables with an intercept and trend for the Panel-PP statistic and Group-PP statistic. Thus, despite discrepancies between the tests, the empirical results suggest long-run cointegration relationships among the variables.

Table 5: Kao and Pedroni Cointegration Test

Test Method			
Kao Cointegration Test	**Null Hypothesis**	**Statistic**	**P-value**
	no cointegration	**-0.807**	**0.209**
Pedroni Cointegration test	Test statistics	Intercept	Intercept and trend
	Panel-v	-2.334	0.592
	Panel-rho	2.852	3.101
	Panel-PP	2.586	-1.565*
	Panel-ADF	3.487	1.821
	Group-rho	4.275	4.368
	Group-PP	-2.428***	-4.440***
	Group-ADF	-0.196**	1.225

Notes: 1%, 5%, and 10% levels of significance represented as ***, **, and *, respectively.

Then follows the FMOLS and DOLS tests to determine the direction of the cointegration relationships between the variables. Table 6 showcases the empirical findings of the FMOLS and DOLS tests. As seen in the table, FMOLS and DOLS tests share the same result, the tests imply that trade openness and fixed capital have positive and significant influences on the economic growth of European countries. These findings are corroborated by Lakić et al. (2021) and Zeqiraj et al. (2020). For instance, the FMOLS test indicates that a 1% increase in trade openness could stimulate long-run economic growth in these countries by 0.238%, whereas the DOLS tests suggests a 0.369% increase. Similarly, a 1% increase in fixed capital is shown to enhance long-run economic growth by 0.399% according to the FMOLS test, while the DOLS test indicates a 0.163% increase.

Table 6: Cointegrating Regression (FMOLS and DOLS) Test

Variables	Cointegrating regressions	
	FMOLS	**DOLS**
CFDIB	0.002	0.010
	[0.387]	[0.518]
TOP	0.238***	0.369***
	[6.593]	[6.161]
GFCL	0.399***	0.163**
	[12.970]	[2.375]

Notes: 1% and 5% levels of significance represented as*** and**, respectively. *t*-statistics in [].

Table 7 reports the empirical findings for the panel ARDL test. The panel ARDL test indicates that when there is a deviation from the long-run equilibrium, the economic growth in the European countries adjusts by 15.8% in the opposite direction. Moreover, the panel ARDL results indicate a negative and significant long-run impact of Chinese FDI on economic growth in European countries. This further support the findings of Gjini (2013), Curwin and Mahutga (2014), and Sağlam (2017). Specifically, the panel ARDL test suggests that a 1% increase in Chinese FDI reduces the long-run economic growth by 11.9%. Conversely, trade openness and fixed capital positively and significantly influence long-run economic growth in European countries, reaffirm the FMOLS and DOLS results. This result shows that a 1% increase in trade openness increases long-run economic growth by 55%. Moreover, a 1% increase in fixed capital increases the long-run economic growth by 36.4%. Aside from that, the panel ARDL result indicates that fixed capital has a positive and significant impact on economic growth in the short run. Specifically, the result suggests that a 1% increase in fixed capital increases economic growth by 15.5%. In short, the panel ARDL test suggests that Chinese FDI and trade openness impact economic growth only in the long-run, while fixed capital affects economic growth both in the short-run and long-run.

Table 7: Panel Autoregressive Distributed Lag (ARDL) Test

	Long-run		**Short-run**
		ECTt-1	**-0.158*** **
			[-3.672]
CFDIB	-0.119***	D(CFDIB)	0.000
	[-2.887]		[0.024]
TOP	0.550***	D(TOP)	0.160
	[9.791]		[1.347]
GFCL	0.364***	D(GFCL)	0.155***
	[7.606]		[4.091]

Notes: 1% level of significance represented as***. *t*-statistics in [].

Table 8 displays the panel Granger causality test results. The empirical findings from the panel Granger causality test reveal a mutually reinforcing causal relationship between fixed capital and economic growth. Besides that, the findings also indicate that there is a significant causal relationship from *GDPL* to *TOP* and from *GFCL* to *TOP*. Interestingly, the results imply that economic growth in the European countries contribute to creating a stronger trade openness through enhancing capital formation in the region, and *vice versa* (see Figure 3).

Figure 3: Causal Relationships

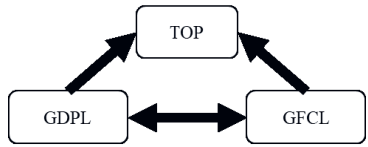


Table 8: Panel Granger Causality Test

Direction of Causality	**Granger statistics**	
	F-Stat.	**Prob.**
CFDIB→GDPL	0.069	0.9327
GDPL→CFDIB	0.922	0.399
TOP→GDPL	0.603	0.547
GDPL→TOP	11.321***	0.000
GFCL→GDPL	6.352***	0.001
GDPL→GFCL	16.387***	0.000

Direction of Causality	Granger statistics	
	F-Stat.	Prob.
TOP→CFDIB	1.793	0.168
CFDIB→TOP	1.986	0.139
GFCL→CFDIB	0.769	0.464
CFDIB→GFCL	0.016	0.984
GFCL→TOP	3.664**	0.026
TOP→GFCL	0.052	0.948

Notes: 1% and 5% levels of significance represented as*** and **, respectively.

Table 9 displays the empirical results of the one-way fixed effect regression model and the two-way fixed effect regression model. These models demonstrate that trade openness and fixed capital positively and significantly affect European economic growth, however, Chinese FDI has no significant impact on the economic growth of European countries.

Table 9: One-Way and Two-Way Fixed Effect Model (dependent variable: $GDPL_t$)

Variables	One-way fixed effect model	Two-way fixed-effect model
$CFDIB_t$	0.002	-0.001
	[0.528]	[0.417]
TOP_t	0.259***	0.049**
	[11.441]	[2.114]
$GFCL_t$	0.359***	0.376***
	[18.150]	[22.192]
$Intercep_t$	16.468***	16.348***
	[35.821]	[41.501]
R^2	0.998	0.999
Adjusted R^2	0.998	0.999

Notes: 1% and 5% levels of significance represented as*** and **, respectively. *t*-statistics in [].

In addition, Table 10 presents the empirical results of the first difference and orthogonal-deviation dynamic panel model. Both dynamic panel regression models substantiate that trade openness and fixed capital substantially benefit Europe's economic development. These dynamic models also confirm that the lagged values of *GDPL* also contribute to economic growth in the region. Overall, the empirical from this study highlights

the pivotal role of trade openness and fixed capital in driving economic development in Europe.

Table 10: Dynamic Panel Model (dependent variable: $GDPL_t$)

Variables	First-difference dynamic panel model	Orthogonal-deviation dynamic panel model
$GDPL_{t-1}$	0.426***	0.481***
	[140.596]	[86.539]
$CFDIB_t$	0.000	-0.001
	[1.169]	[-0.423]
TOP_t	0.271***	0.261***
	[321.39]	[83.898]
GFCLt	0.161***	0.142***
	[96.683]	[54.241]
Hansen J	21.361	21.572
Significance	0.559	0.485

Notes: 1% level of significance represented as***. *t*-statistics in [].

6. Sensitivity analysis

This paper conducted a sensitivity analysis of the rich and poor European nations. Table 11 displays the results of the LLC and IPS tests for relatively rich and poor European nations, respectively. The results indicate that the level series of the variables are non-stationary, suggesting that these variables contain a unit root at the level. Despite some minor discrepancies in the empirical findings, the tests indicate that all four variables in rich and poor European nations are stationary after the first difference. This indicates that the empirical results for the relatively wealthy and poor European nations largely corroborated those for the 27 European nations overall.

Table 11: Panel Unit Root Tests (rich and poor countries)

Variables	Deterministic	Level				1st difference			
		Rich		Poor		Rich		Poor	
		LLC	IPS	LLC	IPS	LLC	IPS	LLC	IPS
GDPL	Intercept	-1.478*	1.030	-3.731***	-0.217	-5.865***	-4.927***	-5.020***	-4.650***
	Intercept and trend	-2.309**	-1.833**	-2.804***	-1.657**	-5.126***	-2.269**	-5.335***	-2.360

Variables	Deterministic	Level				1st difference			
		Rich		Poor		Rich		Poor	
		LLC	IPS	LLC	IPS	LLC	IPS	LLC	IPS
CFDIB	Intercept	-2.026**	-0.837	-1.639*	-0.556	-1.270	-1.656**	-4.609***	-5.181***
	Intercept and trend	0.498	-0.727	-1.634*	-0.211	-0.841	-0.370	-0.651	-3.036***
TOP	Intercept	-0.598	2.771	-1.982**	0.255	-7.507***	-6.682***	-10.003***	-8.136***
	Intercept and trend	-3.735***	-0.885	-5.904***	-2.455**	-6.435***	-4.771**	-9.261***	-6.187***
GFCL	Intercept	-1.844**	-0.491	-4.129***	-2.155**	-6.498***	-5.900***	-8.506***	-6.168***
	Intercept and trend	-0.765	-0.141	-4.850**	-2.762***	-6.069***	-4.220***	-7.952***	-4.064***

Notes: 1%, 5%, and 10% level of significance represented as ***, **, and *, respectively.

The cointegration tests for the separated categories of European countries is shown in Table 12. The Kao cointegration test suggests no long-run cointegration relationship between the variables for rich and poor European countries. However, the results of the Pedroni cointegration test do not concur with the result of the Kao cointegration test. Therefore, the empirical results of the panel cointegration tests again suggest that there are long run cointegration relationships among the variables in rich and poor European countries despite the discrepancy in the results.

Table 12: Kao and Pedroni Cointegration Test

Test Method		Rich		Poor	
Kao Cointegration Test	Null Hypothesis	Statistic	P-value	Statistic	P-value
	no cointegration	-0.080	0.467	0.237	0.406
Pedroni Cointegration test	Test statistics	Intercept	Intercept and trend	Intercept	Intercept and trend
	Panel-v	-0.646	1.084	-2.198	-0.092
	Panel-rho	1.122	2.086	2.537	2.282
	Panel-PP	-1.058	-1.212	3.170	-1.047
	Panel-ADF	-1.058	0.457	3.839	1.787
	Group-rho	2.625	3.114	3.390	3.066
	Group-PP	-3.868***	-4.084***	0.224	-2.246**
	Group-ADF	-2.292**	0.344	-0.538	1.813

Notes: 1% and 5% levels of significance represented as *** and **, respectively.

The results for FMOLS and DOLS cointegrating regression analysis of both the rich and poor Europe countries are shown in Table 13. The FMOLS and DOLS tests share the same information for rich European countries. The results suggest that trade openness and fixed capital positively and significantly impact the long-run economic growth of rich European countries. In the FMOLS test, it shows that a 1% increase in trade openness stimulates economic growth in rich European countries by 0.192% and a 1% increase in fixed capital stimulates economic growth in rich European countries by 0.483%. Moreover, the DOLS test indicated that a 1% increase in trade openness stimulates economic growth in rich European countries by 0.294% and a 1% increase in fixed capital stimulates economic growth in rich European countries by 0.303%.

Table 13: Cointegrating Regression (FMOLS and DOLS) Tests

Variables	FMOLS		DOLS	
	RICH	**POOR**	**RICH**	**POOR**
CFDIB	0.000	0.027	0.007	0.024
	[0.131]	[1.295]	[0.792]	[0.675]
TOP	0.192***	0.329***	0.294***	0.485***
	[4.466]	[6.435]	[9.185]	[4.825]
GFCL	0.483***	0.288***	0.303***	0.078
	[12.684]	[6.815]	[4.824]	[0.905]

Notes: 1% level of significance represented as***. *t*-statistics in [].

For poor European countries, the FMOLS and DOLS tests yield contradictory results. Both cointegration regression tests indicated that trade openness has a positive and significant impact on economic growth in poor European countries in the long run. Nevertheless, only the FMOLS test suggests that fixed capital has a positive and significant effect on long-run economic development in these poor European countries. In the FMOLS test, it shows a 1% increase in trade openness boosts economic growth in poor European countries by 0.329%, whereas the DOLS test indicates a 0.485% increase. Moreover, the FMOLS test shows a 1% increase in fixed capital stimulates economic growth in poor European countries by 0.288%.

Table 14 reports the empirical finding of the panel ARDL test for the relatively rich European countries. The panel ARDL test reveals that trade

openness and fixed capital positively and significantly impact economic growth in rich European countries in the long-run and short-run. Specifically, the test suggests that a 1% increase in trade openness results in a 17.4% increase in economic growth in the long-run and a 42.1% in the short-run. Similarly, a 1% increase in fixed capital increases leads to a 105.4% increase in economic growth in the long-run and a 26% increase in the short-run.

Table 14: Panel Autoregressive Distributed Lag (ARDL) Test (rich and poor countries)

	Long-run			**Short-run**	
	Rich	**Poor**		**Rich**	**Poor**
				0.001	-0.202***
			ECT_{t-1}	[0.486]	[-3.132]
CFDIB	-0.051	-0.087	D(CFDIB)	0.034	-0.040
	[-1.349]	[0.302]		[0.486]	[-1.094]
TOP	0.174***	0.521***	D(TOP)	0.421***	-0.141*
	[5.818]	[9.036]		[3.668]	[-0.071]
GFCL	1.054***	0.272***	D(GFCL)	0.260***	0.132**
	[561.134]	[9.036]		[4.836]	[2.430]

Notes: 1%, 5%, and 10% levels of significance represented as***, **, and * respectively. *t*-statistics in [].

In terms of poor European countries, the panel ARDL test reveals that the short-run adjustment to the long-run equilibrium is at the speed of 20.2%. For poor European countries, the panel ARDL test demonstrates that trade openness significantly impacts economic growth positively in the long-run but negatively in the short-run. However, fixed capital has a positive and significant impact on economic growth in poor European countries in the long-run and short-run. Specifically, a 1% increase in trade openness stimulates economic growth by 52.1% in the long-run but discourages economic growth by 14.1% in the short-run; a 1% increase in fixed capital could increase economic growth by 27.2% in the long-run and 13.2% in the short-run.

Table 15 presents the results of the panel Granger causality test for both rich and poor European countries, detailing the directional relationship between economic growth, Chinese FDI, trade openness, and fixed capital. The causality relationships for rich European countries are shown in Figure 4. The results indicate that in rich European countries: (1) economic growth

has a direct impact on trade openness; (2) economic growth contributes to creating a stronger trade openness through enhancing fixed capital formation in the region; (3) Chinese FDI could contribute to expanding international trade.

Table 15: Panel Granger Causality Test (rich and poor countries)

Direction of causality	Rich countries		Poor countries	
	F-Stat.	Prob.	F-Stat.	Prob.
CFDIB→GDPL	0.189	0.827	0.653	0.521
GDPL→CFDIB	0.092	0.911	0.446	0.641
TOP→GDPL	1.203	0.302	2.145	0.119
GDPL→TOP	9.183***	0.000	4.435**	0.012
GFCL→GDPL	1.839	0.161	5.841***	0.003
GDPL→GFCL	4.659**	0.010	15.517***	0.000
TOP→CFDIB	1.919	0.152	0.380	0.684
CFDIB→TOP	2.533*	0.085	0.485	0.616
GFCL→CFDIB	0.189	0.827	0.518	0.596
CFDIB→GFCL	0.032	0.968	0.248	0.780
GFCL→TOP	4.353**	0.014	0.752	0.472
TOP→GFCL	0.393	0.675	1.908	0.150

Notes: 1%, 5%, and 10% levels of significance represented as ***, **, and * respectively.

Figure 4: Causality Relationships for 13 Rich European Countries

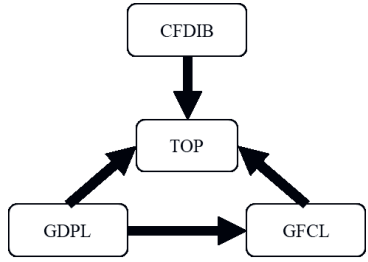
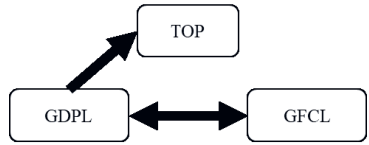


Figure 5 illustrates the causality relationships for 14 poor European countries. The results indicate that in poor European countries: (1) economic growth directly enhances fixed capital formation; (2) fixed capital formation may contribute to creating a stronger trade openness through better economic growth in this region.

Figure 5: Causality Relationships for 14 Poor European Countries



The empirical results for the one-way and two-way fixed effect model for rich and poor European nations are shown in Table 16. The results indicate that trade openness and fixed capital positively influence economic growth in both rich and poor European countries. Conversely, Chinese FDI does not significantly affect economic growth in these regions.

Table 16: One-Way and Two-Way Fixed Effect Model (rich and poor countries)

Variables	Rich countries		Poor countries	
	One-way fixed effect model	**Two-way fixed-effect model**	**One-way fixed effect model**	**Two-way fixed-effect model**
$CFDIB_t$	0.001	-0.000	0.007	0.000
	[0.497]	[-0.076]	[0.408]	[0.021]
TOP_t	0.234***	0.055	0.314***	0.105***
	[9.713]	[1.645]	[7.729]	[3.090]
$GFCL_t$	0.406***	0.445***	0.293***	0.280***
	[18.718]	[20.389]	[8.515]	[10.169]
Intercept	15.425***	14.770***	17.964***	18.489***
	[30.449]	[29.029]	[22.559]	[28.919]
R^2	0.999	0.999	0.997	0.999
Adjusted R^2	0.998	0.999	0.997	0.998

Notes: 1% level of significance represented as***. *t*-statistics in [].

Table 17 presents the outcomes of the first-difference dynamics panel model and the orthogonal-deviation dynamics panel model for rich and poor European nations. For rich European countries, only fixed capital significantly positively impacts economic growth. Conversely, trade openness and fixed capital significantly boost economic growth in poor European countries. However, Chinese FDI significantly hurts economic growth in poor European nations. Additionally, the dynamic models also confirm that the lagged values of *GDPL* would contribute to economic growth only in poor European countries.

Table 17: Dynamic Panel Model (rich and poor countries)

Variables	Rich countries		Poor countries	
	First-difference dynamic panel model	**Orthogonal-deviation dynamic panel model**	**First-difference dynamic panel model**	**Orthogonal-deviation dynamic panel model**
$GDPL_{t-1}$	0.172	0.473	0.516***	0.555***
	(0.117)	(1.210)	(55.465)	(17.393)
$CFDIB_t$	0.003	-0.005	-0.015	-0.013**
	(0.037)	(-0.039)	(-0.606)	(-2.475)
TOP_t	0.244	0.140	0.274***	0.278***
	(1.549)	(1.371)	(22.080)	(4.860)
$GFCL_t$	0.262***	0.224	0.120***	0.091***
	(3.324)	(1.295)	(45.744)	(9.028)
Hansen J	5.438	8.698	8.133	10.564
Significance	0.908	0.465	0.701	0.392

Note: 1% and 5% levels of significance represented as*** and ** respectively. *t*-statistics in [].

7. Conclusion

This study aimed to evaluate the impact of Chinese investment on the economic growth of 27 European countries over the period 2004 to 2021. The empirical research has yielded crucial insights, highlighting the nuanced impacts of trade openness, fixed capital, and Chinese FDI. The FMOLS and DOLS analyses demonstrate that trade openness and fixed capital significantly enhance long-term economic development in Europe. Panel ARDL analyses reveal that Chinese FDI and trade openness impact economic development predominantly in the long run, whereas fixed capital impacts it both long and short term. Moreover, causality analysis has revealed significant relationships among fixed capital, economic growth, and trade openness.

The sensitivity analysis was conducted separately for rich and poor European countries. The results obtained were consistent, with both groups showing similar patterns in terms of stationarity, cointegration, and the impact of trade openness and fixed capital on economic growth. The research indicates that the presence of trade openness and fixed capital are significant factors in promoting sustained economic growth in European nations.

In conclusion, this study highlights the critical role of Chinese investments in accelerating economic growth across Europe, highlighting the dynamic interplay between Chinese investments, trade openness and fixed capital formations. This dynamic interplay suggests that economic growth in Europe not only benefits from, but also contributes to, enhanced trade openness and fixed capital formation, fostering a virtuous cycle of growth and integration.

To foster long-term economic development, policymakers should prioritise increasing trade openness. This involves reducing trade barriers, such as tariffs and non-tariff barriers, fostering the creation of free trade agreements, and enhancing international trade collaboration. By opening up markets, European nations can attract foreign investment, promote competition, and accelerate economic growth.

Despite the panel ARDL test indicating potential negative impacts of Chinese FDI on long-term economic growth, prioritising FDI remains critical. European countries should aim to simplify the regulatory framework and provide incentives for foreign investors to harness the benefit of FDI, including technology transfer, employment creation, and knowledge spillovers, contributing to overall economic development.

The promotion of fixed capital investment is essential, as evidenced by its positive impact on both short- and long-term economic development in the panel ARDL analysis. Implementing tax incentives, fostering public-private partnerships, and encouraging corporate finance can facilitate investments in infrastructure, technology, and productive assets, such as transport, energy, and digital infrastructure, thereby economic development and competitiveness.

Achieving a healthy economic balance involves stabilising macroeconomic conditions. Policymakers should focus on fiscal and monetary policies that ensure stability, including prudent financial management, maintaining low inflation, and fostering market, labour, and regulatory efficiency and adaptability to achieve long-term equilibrium.

Further research should explore the comparative impact of Chinese investment on European economic growth against other significant factors, such as the effects of border shutdowns. This analysis could provide local governments with actionable policy insights and inform the investment strategies of international corporations, offering them additional benefits. Moreover, investigating other variables contributing to the growth of

European economies will enrich our understanding of regional economic dynamics.

Endnote

[1] USD13,159 is used as the 2020 threshold to differentiate rich from poor countries, based on the median average GDP per capita across 27 countries from 2004 to 2021.

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