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Unveiling the nexus between foreign direct investment and economic restructuring: evidence from Vietnam's transformative journey

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Abstract: This study interrogates the complex dialectical relationship between foreign direct investment (FDI) and structural economic transformation in Vietnam's transitional context. While extant literature explores FDI-growth connections globally, the mechanisms through which FDI catalyses sectoral reallocation remain undertheorised in rapidly industrialising economies. Employing system GMM estimation on provincial panel data (201–2020), the epistemic trajectory reveals FDI's significant positive impact on economic restructuring – intensified by human capital development, trade openness, and institutional quality. The hermeneutic analysis uncovers a critical threshold effect, demonstrating FDI's transformative potential amplifies once inflows reach 18.5% of provincial GDP. Furthermore, substantial regional heterogeneity emerges, with North and South regions exhibiting stronger FDI-restructuring nexuses than the Central region, suggesting geographical and historical development pathways significantly moderate outcomes. This transdisciplinary scholarship contributes a sophisticated conceptual framework for understanding FDI's role in structural transformation across diverse institutional contexts.

Keywords: foreign direct investment; FDI; economic restructuring; emerging market; panel data; Vietnam; threshold dynamic panel; regional heterogeneity.

JEL codes: B22, F63, O11.

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1 Introduction

The relationship between foreign direct investment (FDI) and structural economic transformation represents one of the most critical yet incompletely understood dimensions of development economics in the twenty-first century. As global investment flows have reconfigured economic landscapes worldwide, understanding precisely how and under what conditions FDI catalyses sectoral shifts has emerged as an urgent imperative for both scholars and policymakers navigating increasingly complex development pathways (Alfaro et al., 2004; Meyer and Peng, 2016). While extensive literature explores FDI-growth relationships, the specific mechanisms through which external capital transforms economic structures – particularly in institutionally evolving contexts – remain inadequately theorised and empirically examined.

The role of FDI in driving economic growth and restructuring has been a subject of extensive scholarly inquiry (Borensztein et al., 1998; Liang, 2009; Mühlen and Escobar, 2020). These studies consistently underscore the pivotal role of FDI in catalysing growth and facilitating economic restructuring (ER) in recipient nations. Developing countries, in particular, have focused on attracting FDI to industries that propel industrialisation and modernisation efforts. FDI projects often serve as conduits for technology transfer,

enabling recipient countries to access cutting-edge technological advancements (Osano and Koine, 2016).

The infusion of technology across various sectors, particularly through FDI in the industrial sector, often results in accelerated development of local industries, outpacing growth in the agricultural and service sectors. This phenomenon typically leads to an increased contribution of the industrial sector to the overall gross domestic product (GDP). Moreover, industrial growth is intrinsically linked to the expansion of service industries (Castellacci, 2008; Pham and Riedel, 2019). Consequently, localities receiving substantial FDI often witness a significant increase in the industrial sector's proportion within their economic structure, which, in turn, stimulates the growth of service industries, particularly those allied with production and business activities. Beyond its impact on inter-sectoral economic structure, FDI also plays a crucial role in shaping intra-sectoral ER, inevitably altering the labour structure across industries.

Vietnam serves as a compelling case study for exploring the complex interplay between FDI and ER, particularly since the Doi Moi reforms initiated in 1986. These reforms marked Vietnam's transition from a centrally planned economy to a more market-oriented one, thereby establishing FDI as a central pillar of its development agenda, which has led to significant economic growth (Hoang and Ha, 2014; Le et al., 2021). The World Bank notes that this shift has resulted in substantial inflows of FDI, contributing to a remarkable trajectory in Vietnam's economic output and structural transformation (Hoang and Ha, 2014). Vietnam's intricate regional dynamics provide a unique platform for analysing how uniform investment policies can yield disparate outcomes across diverse subnational areas, each possessing distinct characteristics and levels of development (Anwar and Nguyen, 2010; Minh, 2019).

In Vietnam, FDI is widespread, affecting all provinces and major urban areas (Dao et al., 2023; Le et al., 2019). Nonetheless, capital inflows have predominantly concentrated in more prosperous regions, such as the Red River Delta, which has historically been a hub for FDI attraction. Research indicates that the region, despite its economic advantages and substantial investment potential, faces challenges regarding inter-provincial connectivity and backward linkages between foreign firms and local businesses (Huong et al., 2018). For instance, Nguyen et al. (2019) highlight that connectivity issues hinder FDI's potential to stimulate a broader economic transformation by limiting spillover benefits to local firms. Moreover, empirical studies have revealed that, although the inflow of FDI has had positive impacts on income and productivity, the pace of ER in the Red River Delta has been gradual, reflecting a complex interaction of local institutional quality (IQ) and infrastructural challenges (Rosli et al., 2022). The varying patterns of FDI across Vietnam's regions underscore the nation's developmental disparities and the nuanced impacts of external investment. While FDI indeed stimulates economic growth and productivity, it is essential to consider the implications for inequality and the unevenness of economic benefits across different demographics (Le et al., 2019; McLaren and Yoo, 2017). The disparities in FDI absorption capacity among provinces have been attributed to various factors, including market size, infrastructural availability, and IQ, which play critical roles in shaping the effectiveness of FDI (Dao et al., 2023; Minh, 2019). Consequently, understanding Vietnam's transformative journey necessitates a comprehensive analysis of these dynamics to fully grasp how FDI can be leveraged for sustainable economic growth while addressing regional inequalities and fostering inclusive development.

To effectively harness regional strengths in attracting FDI while fostering inter-provincial linkages and spillover effects, Vietnam has actively pursued the establishment and development of special economic zones (SEZs) (Song et al., 2020). By concentrating FDI within these zones, the Vietnamese government aims to stimulate regional economic growth and enhance productivity by enabling firms to benefit from economies of scale and closer ties with local businesses (Song et al., 2020). Empirical evidence supports the notion that such SEZs can lead to improved output, capital accumulation, and spillover effects that enhance industrial development well beyond their immediate vicinity (Görg and Greenaway, 2015; Song et al., 2020). However, to optimise the impact of FDI on ER, it is essential to conduct targeted studies that analyse the specific effects of capital inflows on various economic sectors within diverse local contexts (Ebghaeı, 2023). This research necessity is not limited to Vietnam; it resonates with challenges faced by policymakers in emerging economies worldwide. These governments often grapple with the complexities of crafting investment frameworks that not only maximise structural benefits from FDI but also mitigate potential market distortions (Jude and Levieuge, 2015). For instance, Jude and Levieuge (2015) underscore the importance of contextualised FDI policies that take into account local IQ, which significantly influences the effectiveness of FDI in stimulating ER and development (Jude and Levieuge, 2015). Scholars also emphasise that effective governance and regulatory frameworks within destination regions are crucial for enhancing the absorptive capacity of FDI (Ha and Zhang, 2022). In the face of globalisation, emerging economies must adapt their strategies to attract FDI that contributes to sustainable growth while effectively integrating foreign investment into the local economy (Pantina and Zogjani, 2015). This involves not only improving infrastructural development but also enhancing the quality of institutions and governance to leverage FDI advantages effectively (Ha and Zhang, 2022; Pantina and Zogjani, 2015). By prioritising these strategies, Vietnam and similar economies can create a more conducive environment for foreign capital, ultimately leading to balanced and inclusive economic development.

This study, therefore, aims to develop an analytically precise model to verify the direct impact of FDI on ER in Vietnam, with particular attention to regional variations and moderating factors. Additionally, it considers other critical variables influencing the restructuring of economic sectors, such as human resource quality, trade openness (TO), and institutional characteristics. By adopting this focused, multidimensional approach, this research seeks to contribute to the existing body of knowledge on the dynamics of FDI and ER, with implications extending far beyond Vietnam's borders to inform theoretical developments and policy approaches in diverse developmental contexts worldwide.

Through this analysis, we aim to shed light on the intricate relationship between FDI and ER, providing valuable insights for policymakers and researchers alike across multiple geographical contexts. The findings offer potential guidance for more effective strategies for FDI attraction and utilisation across developing economies, ultimately contributing to our understanding of economic transformation and development in the emerging markets.

2 Literature review

2.1 FDI and ER

2.1.1 FDI's role in sectoral shifts

Recent studies have highlighted the transformative impact of FDI on the sectoral composition of host economies. Zhu et al. (2017) conducted a comprehensive analysis of FDI's effects on China's economic structure, revealing that FDI has significantly contributed to the expansion of the tertiary sector, particularly in more developed regions. Their findings suggest that FDI can accelerate the transition from manufacturing-based to service-oriented economies. Similarly, Yang and Tsou (2020) examined the sectoral growth effects of FDI across 70 countries, demonstrating that FDI in services tends to promote growth in the service sector while potentially crowding out manufacturing. However, the impact of FDI on sectoral shifts is not uniform across all contexts. A study by Santangelo and Meyer (2017) emphasised the importance of IQ in determining the effectiveness of FDI in driving structural changes. They found that countries with stronger institutions are better positioned to leverage FDI for economic diversification and upgrading. This nuanced understanding of FDI's role in sectoral shifts underscores the need for context-specific analyses, particularly in developing economies like Vietnam.

2.1.2 Technology transfer and productivity spillovers

The potential for FDI to facilitate technology transfer and generate productivity spillovers remains a central theme in recent literature. Chen et al. (2022) investigated the mechanisms through which FDI contributes to technological upgrading in emerging economies. Their study of Chinese manufacturing firms revealed that FDI can enhance indigenous innovation capabilities through both direct technology transfer and indirect learning effects. However, they also noted that the extent of these benefits depends on the absorptive capacity of local firms. In a meta-analysis of FDI spillover effects, Demena and van Bergeijk (2017) synthesised findings from 69 primary studies published between 1986 and 2013. Their results indicated substantial heterogeneity in spillover effects across different contexts, highlighting the need for more nuanced research approaches. Building on this, Newman et al. (2015) explored the conditions under which FDI spillovers are most likely to occur. They found that the type of FDI (e.g., greenfield vs. brownfield), the characteristics of host country firms, and the nature of linkages between foreign and domestic firms all play crucial roles in determining the extent of productivity spillovers.

2.1.3 Labour market dynamics and FDI

The impact of FDI on labour markets has been a subject of growing interest, particularly in the context of developing economies. Javorcik and Poelhekke (2017) examined the effects of foreign ownership on wages and employment in Indonesia, finding that foreign-acquired plants pay higher wages and are less likely to shut down compared to similar domestic plants. This suggests that FDI can contribute to job stability and wage growth in host economies. However, the relationship between FDI and labour market outcomes is complex and multifaceted. A recent study by Galina and Mingzhi (2016)

analysed the impact of FDI on labour demand elasticities across 57 developing countries. They found that while FDI generally increases labour demand, it also makes labour demand more elastic, potentially increasing job insecurity for workers. This highlights the need for policies that can maximise the benefits of FDI while mitigating potential negative impacts on labour markets. Furthermore, Crescenzi and Iammarino (2017) explored the spatial dimension of FDI's impact on labour markets, focusing on regional disparities in Europe. Their findings suggest that FDI can exacerbate regional inequalities in labour market outcomes, underscoring the importance of place-based policies in managing the distributional effects of FDI.

2.2 Determinants of ER

2.2.1 Human capital and skills development

Human capital (HC) has emerged as a critical factor in driving ER and maximising the benefits of FDI. A recent study by Teixeira and Queirós (2016) analysed the relationship between HC, FDI, and economic growth across 22 OECD countries. Their findings underscore the importance of HC in enhancing a country's absorptive capacity, thereby facilitating technology transfer and productivity spillovers from FDI. Building on this, Kheng et al. (2017) investigated the role of HC in mediating FDI spillovers in Malaysia's manufacturing sector. They found that firms with higher levels of HC were better positioned to benefit from FDI-induced knowledge spillovers. The quality of education and skills development programs plays a crucial role in shaping HC. In this vein, Hanushek and Woessmann (2020) conducted a comprehensive review of the impact of education quality on economic growth. Their analysis reveals that cognitive skills, rather than mere years of schooling, are strongly associated with individual earnings, income distribution, and economic growth. This highlights the need for policies that focus not only on expanding access to education but also on improving its quality and relevance to the evolving needs of the economy.

2.2.2 TO and international integration

TO and international integration have been recognised as significant drivers of ER. A study by Fei (2022) examined the impact of trade liberalisation on structural transformation in China. Their findings suggest that TO accelerates the reallocation of resources from low-productivity sectors to high-productivity sectors, thereby facilitating ER. Similarly, Antràs et al. (2017) developed a model to analyse the relationship between trade and structural change, demonstrating that trade integration can accelerate the process of structural transformation, particularly in developing economies. However, the benefits of TO are not uniformly distributed. Autor et al. (2016) investigated the impact of rising Chinese import competition on local labour markets in the USA. Their research reveals that increased trade exposure can lead to significant job losses and wage declines in affected industries, highlighting the potential downsides of rapid trade liberalisation. These findings underscore the need for complementary policies to manage the distributional consequences of trade-induced ER.

2.2.3 IQ and governance

The role of IQ and governance in shaping ER has gained increased attention in recent years. A comprehensive study by Acemoglu and Robinson (2019) emphasises the critical importance of inclusive institutions in fostering sustainable economic growth and development. They argue that countries with inclusive economic and political institutions are better equipped to adapt to changing economic conditions and facilitate structural transformation. In the context of FDI and ER, IQ plays a crucial role in determining the effectiveness of foreign investments. Slesman et al. (2015) examined the interplay between FDI, institutions, and economic growth in developing countries. Their findings suggest that the growth-enhancing effects of FDI are contingent on the quality of economic and political institutions in the host country. Countries with stronger institutions are better able to attract high-quality FDI and leverage it for ER. Governance quality also affects the distribution of benefits from ER. A study by Iammarino et al. (2019) explored the relationship between governance quality and regional economic resilience in Europe. They found that regions with better governance structures were more resilient to economic shocks and better positioned to benefit from structural changes in the economy. This underscores the importance of effective governance in managing the process of ER and ensuring its benefits are broadly shared.

2.3 FDI and ER in Vietnam

2.3.1 Historical context of FDI in Vietnam

Vietnam's engagement with FDI surged significantly after the implementation of the Doi Moi (Renovation) Policy in 1986, facilitating the country's transition from a centrally planned economy to a market-oriented one. This transition has been remarkably influential in shaping Vietnam's economic landscape, with FDI inflows increasing steadily since the 1990s and playing an essential role in the country's rapid economic growth (Ta et al., 2020; Van, 2019). As noted by Anwar and Nguyen (2010), these inflows have advanced Vietnam's export-oriented growth strategy, which has enabled the nation to integrate into global value chains, thereby broadening its economic horizons and fostering industrial growth (Anwar and Nguyen, 2010; Ngo, 2019).

A study by Dao and Ngo (2022) offers an in-depth analysis of the sectoral distribution of FDI over time in Vietnam. The findings indicate that while initial FDI was predominantly directed towards labour-intensive manufacturing, there has been a discernible shift towards technology-intensive sectors and services in recent years. This shift signifies Vietnam's evolving comparative advantage as it strives to climb the value chain and enhance its industrial capabilities (Asada, 2020; Nguyen, 2024). However, the transition has not been uniform; regions and sectors exhibit significant variability in how they benefit from FDI, underscoring the critical need for targeted policies aimed at optimising FDI's effects across different economic contexts (Dao and Ngo, 2022; Tuan, 2021). The uneven regional development reflects broader implications regarding economic disparities within the country, suggesting that aligning FDI inflows more effectively with regional developmental goals is essential for equitable growth (Ngo et al., 2020).

In light of these dynamics, policymakers are urged to implement strategic frameworks that not only attract FDI but also maximise its potential for fostering inter-capital linkages and enhancing the growth of domestic enterprises (Bozsik et al., 2023;

Despotović et al., 2024). Addressing the quality of structural transformation and regional disparities requires a nuanced understanding of the implications of FDI on various economic sectors, particularly considering that effective governance and the local institutional environment significantly influence FDI impacts (Dao et al., 2023; Xuan, 2020). Hence, exploring and addressing these aspects will enable Vietnam to leverage its FDI more effectively, promoting inclusive economic progress throughout the country (Raihan, 2024).

2.3.2 Regional disparities in FDI attraction

Vietnam has made significant strides in attracting FDI; however, notable regional disparities persist. A comprehensive analysis by Nguyen and Pham (2011) reveals a pronounced concentration of FDI in major urban centres and coastal areas, particularly around Hanoi and Ho Chi Minh City. Their findings indicate that this uneven distribution of FDI has exacerbated regional economic disparities, which can have detrimental effects on inclusive growth and development (Nguyen and Pham, 2011). Following this, Eşiyok and Uğur (2017) explored the underlying factors contributing to these regional disparities in FDI attraction. They discovered that variations in infrastructure quality, HC, and the efficiency of local governance are influential determinants in FDI location decisions across Vietnam (Eşiyok and Uğur, 2017; Huong et al., 2018). Additionally, their research highlights the agglomeration effects, where the presence of existing FDI projects tends to attract further investments, creating a reinforcing cycle that widens the gap between regions (Anh et al., 2021).

These regional disparities have profound implications for Vietnam's broader ER efforts. Vu et al. (2008) emphasise, the concentration of FDI in select regions can lead to uneven patterns of industrial upgrading and structural transformation throughout the country. This distribution of investment not only affects economic growth but also has significant social implications, particularly in terms of employment opportunities and income distribution among the population (Goldberg, 2004; Ngo, 2019). Addressing these imbalances necessitates the implementation of targeted policies that promote a more equitable distribution of FDI and its associated benefits, which may involve enhancing local infrastructures, improving educational outcomes, and fostering transparent and efficient governance structures to attract FDI more evenly across all regions (Dinh et al., 2019; Nguyen et al., 2012). Only through such measures can Vietnam harness the full potential of FDI for sustainable and inclusive economic growth, ensuring that all regions can contribute to and benefit from national prosperity (Nguyen, 2019).

2.3.3 Policy environment and FDI strategies

Vietnam's policy framework for FDI has undergone significant evolution, shaped by the nation's changing economic priorities and the dynamics of global markets. According to Athukorala and Tran (2012), the development of FDI policies since the implementation of the Doi Moi reforms in 1986 has primarily aimed to attract investment through various incentives, initially focusing heavily on tax relief and the establishment of special economic zones. Recent strategic shifts now emphasise attracting high-quality, environmentally sustainable investments rather than merely increasing the volume of incoming capital. This shift corresponds with a broader recognition of the importance of

industry quality in achieving sustainable economic growth and integration into global supply chains.

A significant component of Vietnam's contemporary FDI strategy is the enhancement of linkages between foreign-invested enterprises and local firms. Ngoc (2016) scrutinises these policies' effectiveness, highlighting that while there has been some success in fostering connections, substantial obstacles remain. The author advocates for more focused interventions, such as supplier development initiatives and technology transfer programs, which can help maximise the spillover benefits of FDI and generate value for the domestic economy. This perspective aligns with findings from Eşiyok and Uğur (2017), who argue that financial and knowledge spillovers from FDI are often most pronounced in regions with established links between foreign and domestic enterprises.

Furthermore, Vietnam's participation in international trade agreements, such as the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) and the EU-Vietnam Free Trade Agreement (EVFTA), has increasingly influenced its FDI landscape. Despite these advancements, several challenges persist within Vietnam's FDI policy framework. Issues such as regulatory inconsistencies, bureaucratic inefficiencies, and limited intellectual property protection continue to impede the country's ability to secure high-quality investments. Nguyen and Zhang (2012) emphasise that addressing these challenges is vital for Vietnam to fully leverage FDI as a driver of its ER and development. It is essential for policymakers to enhance the regulatory environment and improve institutional frameworks to cultivate a more attractive landscape for high-quality FDI, which could profoundly impact Vietnam's long-term economic trajectory.

2.4 Panel data analysis in FDI studies

2.4.1 Methodological approaches in previous research

Recent years have seen a growing sophistication in the application of panel data techniques to FDI studies. Iamsiraroj and Ulubaşoğlu (2015) conducted a comprehensive meta-analysis of 108 empirical studies on FDI and economic growth, finding that panel data methods were the most commonly used approach. They noted that fixed effects models were particularly popular due to their ability to control for time-invariant country-specific factors. Building on this, more recent studies have employed dynamic panel data models to capture the potentially endogenous relationship between FDI and economic outcomes. For instance, Mihaela (2016) used a system generalised method of moments (GMM) approach to examine the bidirectional relationship between FDI and economic growth in the European Union. This method allows for the inclusion of lagged dependent variables and addresses potential endogeneity issues. Another notable trend is the increasing use of spatial panel data models. Blonigen and Piger (2014) employed Bayesian model averaging techniques with spatial autoregressive models to investigate the determinants of FDI. Their approach allowed for the consideration of spatial dependencies in FDI patterns, providing a more nuanced understanding of FDI location decisions. More recently, Kahouli and Maktouf (2015) utilised a gravity model framework with panel data to analyse bilateral FDI flows. Their study employed both static and dynamic panel data techniques, including fixed effects, random effects, and system GMM estimators. This multi-model approach allowed for robust comparisons and sensitivity analyses.

2.4.2 Challenges and limitations of existing studies

Despite the advancements in panel data methodologies, several challenges and limitations persist in existing FDI studies. One significant issue is the potential for omitted variable bias. As pointed out by Iamsiraroj (2016) in a comprehensive review of FDI-growth literature, many studies fail to adequately control for all relevant factors that might influence both FDI and economic outcomes. This can lead to biased estimates of the impact of FDI.

The current study addresses this limitation through the inclusion of a comprehensive set of control variables that capture both economic and institutional dimensions, including GDP per capita, population density, infrastructure quality, sectoral composition, and region-specific characteristics. Additionally, we employ a dynamic panel model that accounts for the persistence in ER, thereby reducing the risk of omitted variable bias. Another challenge is the appropriate treatment of endogeneity. While methods like system GMM have been widely adopted to address this issue, Roodman (2009) cautions against their mechanical application. He highlights the sensitivity of results to the choice of instruments and the potential for instrument proliferation to weaken the validity of the estimates.

Our study directly confronts this challenge by carefully implementing the system GMM approach with specific attention to instrument validity. We limit the number of instruments, conduct thorough diagnostic testing, and employ Windmeijer-corrected standard errors to address potential biases in estimation. Furthermore, our robustness checks using alternative estimation techniques provide additional confidence in our findings. The issue of cross-sectional dependence in panel data has also gained attention. As noted by Baltagi et al. (2016), failure to account for cross-sectional dependence can lead to biased and inconsistent estimates. They propose the use of common correlated effects (CCEs) estimators to address this issue in the context of FDI studies. We explicitly test for and address cross-sectional dependence in our analysis through the application of the CCEs estimator as a robustness check, comparing the results with our baseline System GMM estimation to ensure consistency.

Data quality and availability remain persistent challenges, particularly for studies focusing on developing countries. Herzer (2012) points out that many FDI studies rely on aggregate FDI data, which can mask important sectoral variations. He argues for more disaggregated analyses that can capture the heterogeneous effects of FDI across different sectors of the economy.

While our study primarily uses aggregate FDI measures due to data constraints, we partially address this limitation by examining different regional contexts and considering threshold effects that may capture some of the heterogeneity in FDI impacts. Future research could extend our analysis with more disaggregated data as it becomes available. Furthermore, the majority of panel data studies on FDI assume homogeneous effects across countries or regions. However, as highlighted by Nair-Reichert and Weinhold (2001), the impact of FDI is likely to be highly heterogeneous across different contexts. They advocate for the use of mixed fixed and random coefficient approaches to allow for parameter heterogeneity. Our study directly addresses this limitation through a systematic analysis of regional heterogeneity, examining how the FDI-ER relationship varies across Vietnam's diverse regions. Additionally, our threshold analysis provides insights into how the impact of FDI may vary depending on the level of FDI inflows.

2.5 Research model development

A comprehensive review of recent literature reveals several key factors that influence the relationship between FDI and ER. Drawing on the work of Iamsiraroj (2016) and Do and Park (2022), we identify the following critical variables: FDI inflows, HC, TO, IQ, and sectoral composition of the economy. Additionally, as highlighted by Nguyen and Nguyen (2007), regional characteristics play a significant role in mediating the impact of FDI on ER. The importance of HC in maximising the benefits of FDI is underscored by studies such as Kheng et al. (2017), who emphasise its role in enhancing absorptive capacity. TO, as discussed by Fei (2022), is crucial in facilitating the reallocation of resources across sectors. IQ, emphasised by Slesman et al. (2015), plays a pivotal role in attracting high-quality FDI and leveraging it for ER.

Based on the synthesis of key factors, we propose a conceptual framework that posits ER as a function of FDI inflows, moderated by HC, TO, and IQ. The framework also incorporates regional characteristics and sectoral composition as control variables. This approach aligns with recent studies such as Dao and Binh (2013), who emphasise the need for a multidimensional understanding of FDI impacts. The proposed panel data model can be expressed as:

$$\begin{aligned} ER_{it} = {} & \beta_0 + \beta_1 ER_{i,t-1} + \beta_2 FDI_{it} + \beta_3 HC_{it} + \beta_4 TO_{it} + \beta_5 IQ_{it} \\ & + \beta_6 (FDI_{it} \times HC_{it}) + \beta_7 (FDI_{it} \times TO_{it}) + \beta_8 (FDI_{it} \times IQ_{it}) \\ & + \beta_9 SC_{it} + \beta_{10} RC_i + \alpha_i + \varepsilon_{it} \end{aligned}$$

where

- ER_{it} = ER index for region i at time t
- FDI_{it} = FDI inflows
- HC_{it} = HC index
- TO_{it} = TO measure
- IQ_{it} = IQ index
- SC_{it} = sectoral composition index
- RC_i = time-invariant regional characteristics
- α_i = region-specific fixed effects
- ε_{it} = error term.

This model allows for the examination of both direct effects of FDI on ER and interaction effects with key moderating variables. Based on the proposed conceptual framework and drawing from the existing literature of Nguyen et al. (2012), Kheng et al. (2017), Fei (2022), Slesman et al. (2015) and Nguyen and Nguyen (2007), we formulate the following hypotheses:

H1 FDI inflows have a positive impact on ER.

H2 The positive impact of FDI on ER is stronger in regions with higher levels of HC.

H3 TO enhances the positive effect of FDI on ER.

H4 Higher IQ strengthens the positive relationship between FDI and ER.

H5 The impact of FDI on ER varies significantly across regions with different characteristics.

These hypotheses provide a framework for empirical testing that can contribute to a more nuanced understanding of the relationship between FDI and ER in Vietnam. The proposed model and hypotheses address some of the limitations identified in previous studies, such as the need for more disaggregated analysis and consideration of moderating factors.

3 Research methodology

This study employs a quantitative approach to examine the relationship between FDI and ER in Vietnam, with a focus on regional disparities and the moderating effects of HC, TO, and IQ. The research design is based on a panel data analysis, which allows for the examination of both cross-sectional and time-series dimensions of the data.

3.1 Data collection and sample

The study utilises secondary data collected from multiple sources to construct a comprehensive panel dataset. FDI inflow data are obtained from the Vietnam Foreign Investment Agency (FIA), while economic indicators are sourced from the General Statistics Office of Vietnam (GSO). HC measures are derived from the Vietnam Household Living Standards Survey (VHLSS), and IQ indices are obtained from the Provincial Competitiveness Index (PCI) compiled by the Vietnam Chamber of Commerce and Industry (VCCI). The panel dataset covers all 63 provinces and cities of Vietnam over the period from 2012 to 2022, resulting in a balanced panel of 693 observations. This timeframe is chosen to capture the period of significant ER and FDI growth in Vietnam, as noted by Dao and Binh (2013).

3.2 Variables

Measuring the independent variable, ER, in Vietnam's provincial economies requires a multidimensional composite index that effectively captures the dynamic shifts in sectoral compositions. This index should integrate sectoral value-added shares and employment shares across key sectors such as agriculture, industry, and services. The rationale for utilising a composite index lies in its ability to provide a nuanced understanding of structural transformation within the provinces, which is crucial for policymakers aiming to promote balanced economic growth. The multidimensional approach to measuring ER is supported by literature that emphasises the complexity of economic development. For instance, Beraha et al. (2023) note that the restructuring of supply chains through clustering can significantly enhance regional competitiveness and performance. This suggests that simply measuring sectoral outputs or employment in isolation may overlook the interaction effects between sectors and their collective contributions to economic growth. By including both value-added and employment shares, the composite index reflects the contributions of each sector to the overall economy and aids in understanding

the interdependencies that characterise provincial economies. However, the selection of metrics for the composite index should be approached with caution. Existing studies highlight the need for careful consideration of how different sectors interact and contribute to ER. For instance, the traditional reliance on sector-specific value-added measures might mask the real impact of employment shifts, particularly if labour-intensive sectors like agriculture are in decline while high-value sectors are emerging. A balanced assessment, therefore, requires a holistic view that recognises both productivity improvements and potential job losses in certain sectors. Moreover, the evolution of the economic landscape in Vietnam necessitates ongoing evaluation of how the composite index aligns with actual development dynamics. Asonuma et al. (2018) emphasised that restructuring efforts should be informed by empirical data and feedback mechanisms that adapt to changing economic conditions. This perspective is relevant for refining the composite index, ensuring that it remains responsive to the dynamic nature of sectoral restructuring across provinces.

Specifically, the ER index is constructed as follows:

$$ER = \alpha(\Delta SVA_{it}) + \beta(\Delta SEMP_{it})$$

where

- ΔSVA_{it} represents the change in sectoral value-added shares for province *i* at time *t*
- $\Delta SEMP_{it}$ captures the change in sectoral employment shares for province *i* at time *t*
- α and β are weighting parameters (set at 0.6 and 0.4 respectively based on previous literature and sensitivity analysis).

For each component, we calculate:

$$\Delta SVA_{it} = \sqrt{\left[(VAagr_t - VAagr_{t-1})^2 + (VAind_t - VAind_{t-1})^2 + (VAser_t - VAser_{t-1})^2\right]}$$

where *VAagr*, *VAind*, and *VAser* represent the value-added shares of agriculture, industry, and services respectively.

Similarly, for employment shares:

$$\Delta SEMP_{it} = \sqrt{\left[\begin{array}{c}(EMPagr_t - EMPagr_{t-1})^2 + (EMPind_t - EMPind_{t-1})^2 \\ +(EMPser_t - EMPser_{t-1})^2\end{array}\right]}$$

This formulation captures the Euclidean distance in sectoral composition between consecutive time periods, thereby quantifying the magnitude of structural change. A higher index value indicates more substantial ER. To ensure comparability across provinces of different sizes, the index is normalised to range from 0 to 1.

Data for constructing this index were sourced from the General Statistics Office of Vietnam, which maintains consistent sectoral classifications across the study period. The robustness of this measure was validated through correlation analysis with alternative indicators of structural change and through sensitivity analysis using different weighting schemes.

Control variables include GDP per capita, population density, and infrastructure quality, all of which have been identified as potential determinants of ER in previous studies Do and Park (2022).

3.3 Analysis methods

To address the dynamic nature of ER and potential endogeneity concerns, we employ the system GMM estimator developed by Arellano and Bover (1995) and Blundell and Bond (1998). This estimator is particularly appropriate for our analytical context given the panel structure with a large number of cross-sectional units (N = 63 provinces) and relatively short time series (T = 11 years).

The baseline model specification is as follows:

$$\begin{aligned} ER_{it} = {} & \beta_0 + \beta_1 ER_{i,t-1} + \beta_2 FDI_{it} + \beta_3 HC_{it} + \beta_4 TO_{it} + \beta_5 IQ_{it} \\ & + \beta_6 (FDI_{it} \times HC_{it}) + \beta_7 (FDI_{it} \times TO_{it}) + \beta_8 (FDI_{it} \times IQ_{it}) \\ & + \beta_9 SC_{it} + \beta_{10} RC_i + \alpha_i + \varepsilon_{it} \end{aligned}$$

where $ER_{i,t-1}$ is the lagged dependent variable, allowing for persistence in ER patterns; α_i represents province-specific fixed effects capturing time-invariant unobserved heterogeneity; and $\varepsilon_{i,t}$ is the idiosyncratic error term.

The system GMM estimator combines moment conditions for equations in first differences with additional moment conditions for equations in levels. This approach addresses the weak instrument problem associated with the difference GMM estimator, particularly when the dependent variable is highly persistent. We treat FDI and its interactions as potentially endogenous, while considering HC, TO, and IQ as predetermined variables based on theoretical considerations and previous empirical evidence.

To ensure valid estimation, we implement the two-step procedure with Windmeijer (2005) finite-sample corrected standard errors. We carefully manage the instrument count to avoid overfitting of endogenous variables and weakening of the Hansen test, following the guidelines of Roodman (2009). Instrument validity is assessed through the Sargan-Hansen test of overidentifying restrictions and the Arellano-Bond test for autocorrelation in the differenced residuals.

4 Research findings

4.1 Diagnostic tests and robustness checks

Before presenting the main estimation results, we conducted several diagnostic tests and robustness checks to ensure the validity and reliability of our dynamic panel data model. These tests are crucial for verifying the appropriateness of the System GMM estimator and the overall model specification. Table 1 presents the results of the key diagnostic tests.

Table 1 Diagnostic test results

Test	*Statistic*	*p-value*
Sargan-Hansen test of overidentifying restrictions	52.37	0.213
Arellano-Bond test for AR(1) in first differences	–3.56	0.000
Arellano-Bond test for AR(2) in first differences	–0.84	0.401
Difference-in-Hansen test of exogeneity of instrument subsets	11.23	0.339

The Sargan-Hansen test of overidentifying restrictions yields a p-value of 0.213, which is greater than the conventional significance levels. This result fails to reject the null hypothesis that the overidentifying restrictions are valid, suggesting that our instruments are exogenous and the model is well-specified. The Arellano-Bond test for autocorrelation in the first-differenced errors shows significant negative first-order autocorrelation (AR(1)) with a p-value of 0.000, which is expected in a dynamic panel model. More importantly, the test for second-order autocorrelation (AR(2)) yields a p-value of 0.401, indicating no significant second-order autocorrelation. This result is crucial as it supports the validity of our instruments and the consistency of the GMM estimator. The difference-in-Hansen test of exogeneity of instrument subsets produces a p-value of 0.339, failing to reject the null hypothesis that the additional moment conditions used in the system GMM are valid. This result supports the use of the system GMM over the difference GMM estimator.

Table 2 Comparison of system GMM and CCE estimator results

Variable	*System GMM*	*CCE estimator*
$ER_{i,t-1}$	0.342*** (0.057)	0.315*** (0.063)
FDI	0.156** (0.063)	0.148** (0.069)
HC	0.087* (0.045)	0.092* (0.048)
TO	0.103** (0.041)	0.097** (0.044)
IQ	0.075* (0.039)	0.071* (0.042)
*FDI * HC*	0.062* (0.033)	0.058* (0.035)
*FDI * TO*	0.048* (0.028)	0.045* (0.030)
*FDI * IQ*	0.055* (0.031)	0.051* (0.033)

Note: Standard errors in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

To address potential cross-sectional dependence, we applied the CCEs estimator proposed by Pesaran (2006). Table 2 presents a comparison of the main coefficients obtained from our baseline System GMM model and the CCE estimator.

The results from the CCE estimator are largely consistent with those from the system GMM, with only minor differences in the magnitude of the coefficients. This consistency suggests that our main findings are robust to potential cross-sectional dependence. Additionally, we conducted sensitivity analyses using alternative measures of key variables. For instance, we used FDI stock instead of flows and explored different proxies for HC and IQ. These alternative specifications yielded results that were qualitatively similar to our main findings, further supporting the robustness of our model. The diagnostic tests and robustness checks provide strong support for the validity of our model specification and the reliability of our estimation approach. The results indicate that the system GMM estimator is appropriate for our dynamic panel data model, and that our findings are robust to various potential econometric issues.

4.2 Estimation results

4.2.1 System GMM estimation results

Table 3 presents the estimation results using the System GMM estimator for our dynamic panel data model, with Windmeijer-corrected standard errors reported in parentheses.

Table 3 System GMM estimation results

Variable	*Coefficient*	*Std. error*
$ER_{i,t-1}$	0.342***	(0.057)
FDI	0.156**	(0.063)
HC	0.087*	(0.045)
TO	0.103**	(0.041)
IQ	0.075*	(0.039)
*FDI * HC*	0.062*	(0.033)
*FDI * TO*	0.048*	(0.028)
*FDI * IQ*	0.055*	(0.031)
SC	0.094**	(0.037)
RC	0.068*	(0.035)
GDP per capita	0.043*	(0.025)
Population density	0.032	(0.022)
Infrastructure quality	0.052*	(0.027)
Constant	0.183***	(0.052)

Notes: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

The results reveal several important findings. First, the coefficient on the lagged dependent variable ($ER_{i,t-1}$) is positive (0.342) and highly significant ($p < 0.01$), confirming the dynamic, path-dependent nature of ER processes. This indicates that approximately 34% of the previous period's economic structure persists into the current period, suggesting both momentum and inertia in structural change.

The direct effect of FDI on ER is positive (0.156) and statistically significant at the 5% level. This coefficient indicates that a one percentage point increase in FDI (as a share of provincial GDP) is associated with a 0.156 unit increase in the ER index, holding other factors constant. This finding provides robust support for Hypothesis 1, confirming FDI's role as a catalyst for economic structural change.

The control variables display varied significance patterns. HC demonstrates a positive effect (0.087) that is marginally significant ($p < 0.1$), suggesting that higher levels of HC facilitate ER, though with less statistical confidence than other factors. TO shows a stronger positive association (0.103) with ER at the 5% significance level, highlighting the importance of international economic integration for structural transformation. IQ demonstrates a positive but marginally significant effect (0.075, $p < 0.1$), indicating that better governance may facilitate ER, though this relationship appears more tenuous than for other variables.

The interaction terms reveal important moderating effects. The FDI-HC interaction (FDIHC) is positive (0.062) and marginally significant ($p < 0.1$), providing tentative support for Hypothesis 2 that HC enhances FDI's impact on ER. Similarly, the interactions between FDI and TO (FDITO, coefficient = 0.048) and between FDI and IQ (*FDI * IQ*, coefficient = 0.055) are both positive and marginally significant ($p < 0.1$), lending qualified support to Hypotheses 3 and 4.

Among the additional control variables, GDP per capita and infrastructure quality show marginally significant positive associations with ER ($p < 0.1$), while population density does not demonstrate a statistically significant relationship at conventional levels.

4.2.2 Threshold dynamic panel data model

To explore potential nonlinearities in the relationship between FDI and ER, we employed a threshold dynamic panel data model following the approach of Kremer et al. (2013). Table 4 presents these results, with FDI as the threshold variable.

Table 4 Threshold dynamic panel data model results

Variable	*Low FDI regime*	*High FDI regime*
$ER_{i,t-1}$	0.328*** (0.061)	0.355*** (0.059)
FDI	0.112* (0.067)	0.203*** (0.071)
HC	0.079* (0.047)	0.095** (0.046)
TO	0.097** (0.043)	0.112** (0.044)
IQ	0.068* (0.041)	0.083** (0.040)
*FDI * HC*	0.053* (0.035)	0.071** (0.034)
*FDI * TO*	0.041 (0.030)	0.056* (0.029)
*FDI * IQ*	0.047 (0.033)	0.064* (0.032)
Threshold estimate: 0.185		
95% confidence interval: [0.162, 0.207]		

Notes: Standard errors in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

This threshold analysis reveals a significant discontinuity in the FDI-ER relationship at approximately 18.5% of provincial GDP (95% confidence interval: [0.162, 0.207]). This finding represents a novel contribution to the literature on FDI and structural change, suggesting that a critical mass of foreign investment is necessary to trigger substantial economic transformation.

In the high-FDI regime (provinces with FDI above 18.5% of GDP), the coefficient on FDI is substantially larger (0.203) and more statistically significant ($p < 0.01$) compared to the low-FDI regime (coefficient = 0.112, $p < 0.1$). This suggests that beyond this threshold, FDI produces more potent transformation effects, possibly due to agglomeration economies, demonstration effects, or critical mass for supplier networks. The difference in coefficients represents approximately an 81% increase in the marginal impact of FDI on ER once the threshold is crossed.

Notably, the interaction effects also become stronger and more statistically significant in the high-FDI regime. The FDI-HC interaction increases from 0.053 ($p < 0.1$) to 0.071 ($p < 0.05$), while the FDI-TO and FDI-IQ interactions become statistically significant ($p < 0.1$) only in the high-FDI regime. This suggests that complementarities between FDI and these factors become more consequential once FDI reaches a critical level.

4.2.3 Regional heterogeneity analysis

To explore potential heterogeneity in the effects of FDI across different regions, we conducted subsample analyses for three main regions of Vietnam: North, Central, and South. Table 5 presents the results of this regional analysis.

The results reveal some regional variations in the impact of FDI on ER. The effect of FDI appears to be strongest in the South, followed by the North, and then the Central region. The interaction effects also show some regional differences, with the South region exhibiting stronger complementarities between FDI and HC, TO, and IQ. These findings

highlight the importance of considering regional characteristics and disparities when formulating policies to maximise the benefits of FDI for ER in Vietnam.

Table 5 Regional heterogeneity analysis results

Variable	*North*	*Central*	*South*
$ER_{i,t-1}$	0.335*** (0.062)	0.351*** (0.064)	0.339*** (0.060)
FDI	0.168** (0.068)	0.143** (0.071)	0.179*** (0.067)
HC	0.092* (0.048)	0.083* (0.050)	0.097** (0.047)
TO	0.109** (0.044)	0.095* (0.046)	0.118** (0.043)
IQ	0.078* (0.042)	0.071* (0.043)	0.085** (0.041)
*FDI * HC*	0.065* (0.035)	0.057 (0.037)	0.073** (0.034)
*FDI * TO*	0.051* (0.030)	0.043 (0.031)	0.058* (0.029)
*FDI * IQ*	0.058* (0.033)	0.049 (0.034)	0.066** (0.032)

Notes: Standard errors in parentheses. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

5 Discussion of results and conclusions

This study provides comprehensive insights into the dynamic relationship between FDI and ER in Vietnam, with a particular focus on regional disparities and the moderating effects of HC, TO, and IQ. The findings offer several important contributions to the existing literature and policy discussions.

Firstly, our results confirm a significant positive relationship between FDI and ER in Vietnam, consistent with previous studies such as Anwar and Nguyen (2010) and Nguyen et al. (2012). The dynamic nature of this relationship, as evidenced by the significance of the lagged dependent variable, underscores the importance of considering the time dimension in analysing ER processes. This finding aligns with the theoretical framework proposed by Borensztein et al. (1998), suggesting that FDI contributes to economic transformation through various channels, including technology transfer and productivity spillovers. The positive and significant effects of HC, TO, and IQ on ER corroborate the findings of several studies in the context of developing economies (e.g., Alfaro et al., 2004; Blomstrom and Kokko, 2003). More importantly, our results reveal that these factors enhance the impact of FDI on ER, as indicated by the positive interaction terms. This finding supports the argument that the benefits of FDI are contingent upon the host country's absorptive capacity and institutional environment (Acemoglu et al., 2005; Cohen and Levinthal, 1990).

The threshold effect identified in our analysis provides important insights with substantial implications for both theory and policy. The finding that FDI's impact on ER becomes considerably stronger once inflows reach 18.5% of provincial GDP suggests the presence of important nonlinearities in how foreign investment transforms economic structures. This threshold effect may reflect several underlying mechanisms. First, the existence of a threshold may indicate the presence of agglomeration economies, where the benefits of FDI materialise more fully once a critical mass of foreign enterprises is established in a region. As documented by Head et al. (1995) and Kinoshita and Campos (2003), FDI tends to cluster geographically due to information spillovers, shared labour pools, and supplier networks. Our findings suggest that these agglomeration effects may

have direct implications for the pace and extent of ER. Second, the threshold might reflect the need for accompanying investments in supporting infrastructure and institutions, which typically occur once FDI reaches a substantial level. As noted by Santangelo and Meyer (2017), the effectiveness of FDI in driving structural changes depends significantly on IQ. The stronger IQ interaction in the high-FDI regime supports this interpretation. Third, the threshold could represent a tipping point in terms of technology transfer and demonstration effects. Castellacci (2008) argues that industrial growth has spillover effects on service sector development, but these effects may only become substantial once industrial FDI reaches a critical level that enables technology diffusion across sectors. From a policy perspective, this threshold finding suggests that provinces seeking to leverage FDI for economic transformation should aim not only to attract foreign investment but to concentrate it sufficiently to cross this critical threshold. This may involve targeted investment promotion strategies focused on specific sectors or regions rather than dispersing FDI promotion efforts broadly. Policymakers might consider prioritising regions that are close to reaching this threshold, as incremental increases in FDI in these areas may yield disproportionate benefits for ER. However, it is important to note that this threshold represents an average effect across Vietnamese provinces and may vary in other contexts. The specific value should be interpreted with caution when considering applications in different institutional and developmental settings. Nevertheless, the principle that FDI's transformative impact may be subject to threshold effects has potential relevance for developing economies globally as they craft investment promotion policies aimed at structural transformation.

Our regional heterogeneity analysis reveals important variations in the FDI-ER relationship across different regions of Vietnam. The stronger effects observed in the South and North regions compared to the Central region align with the findings of Nguyen and Anwar (2011), who noted regional disparities in FDI spillovers in Vietnam. These regional differences may be attributed to variations in infrastructure development, HC endowments, and agglomeration economies, as suggested by Mai (2002) and Thang et al. (2016). The stronger complementarities between FDI and HC, TO, and IQ in the South region are particularly noteworthy. This finding suggests that the more developed regions of Vietnam are better positioned to leverage FDI for ER, possibly due to their higher absorptive capacity and more advanced institutional frameworks. This result echoes the arguments of Meyer and Sinani (2009), who emphasised the role of development level in moderating FDI spillovers.

However, it is important to note that our findings diverge from some previous studies in certain aspects. For instance, while we find a consistently positive effect of FDI on ER, Vu et al. (2008) reported mixed effects of FDI on economic growth across sectors in Vietnam. This discrepancy may be due to our focus on overall ER rather than sector-specific growth, highlighting the importance of considering the broader structural changes induced by FDI.

In conclusion, this study contributes to the existing literature by providing a nuanced understanding of the dynamic relationship between FDI and ER in Vietnam. By employing advanced econometric techniques and considering regional heterogeneity, we offer insights that can inform more targeted and effective policies for leveraging FDI in Vietnam's ongoing economic transformation. The findings underscore the importance of complementary policies that enhance HC, promote TO, and improve IQ to maximise the benefits of FDI for ER. Furthermore, the identified threshold effect suggests that policies aimed at attracting FDI should consider not only the quantity but also the concentration

of FDI inflows. The observed regional disparities in the FDI-ER relationship call for tailored approaches to regional development policies. While efforts should be made to enhance the absorptive capacity of less developed regions, policymakers should also recognise and leverage the strengths of more advanced regions in attracting and benefiting from FDI.

Future research could build on these findings by exploring sector-specific effects of FDI on ER, examining the long-term sustainability of FDI-induced structural changes, and investigating the potential for inter-regional spillovers of FDI benefits. Such studies would further enhance our understanding of the complex dynamics of FDI and ER in developing economies like Vietnam.

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Declarations

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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