Corvinus University of Budapest
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Thesis Booklet

The Effect of China's Outward Foreign Direct Investment on the Economic Growth of the Visegrád Group

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Abstract

The relationship between foreign direct investment and economic growth has been widely debated in the economic literature, but the results have been inconsistent and vary between the short and long run. As such, this study examines and provides additional quantitative evidence on the effect of China's outward foreign direct investment (OFDI) on the economic growth of the Visegrád Group (V4), namely, the Czech Republic, Hungary, Poland, and Slovakia, both in short and long run, using annual data from 2004 to 2020. Various econometric models are employed to ensure the robustness of the findings, including panel-based Feasible Generalized Least Squares (FGLS), Pooled Ordinary Least Squares (POLS), Fixed Effects (FE), and Random Effects (RE); Markov-Switching Dynamic Regression (MSDR); Principal Component Analysis (PCA) and Cross-Sectional Autoregressive Distributed Lag model (CS-ARDL). The novelty of this research is the acknowledgement of productive capacities as a moderating factor between China's OFDI and economic growth of the V4 countries. The results show that FDI stimulates economic growth in both short and long run. Productive capacities index, as a moderating factor, is significant in explaining the relationship between China's foreign direct investment and economic growth of the V4. Other macroeconomic factors also play an important role in explaining economic growth in V4. Long-run economic growth is driven by total factor productivity and trade openness, although trade openness is not significant in the short-run. MSDR model divides the V4's economic growth into high growth state (state 1) and low growth state (state 2). This study has found that FDI can enhance economic growth of each V4 country in both state 1 and state 2, except in Czech Republic FDI is insignificant in state 1. MSDR model also estimates the transition probability of each country from one state to another and provides the expected duration of remaining in each state. The results reveal that the transition probability of remaining in state 2 is high and persistent in Czech Republic, Poland, and Slovakia, while it's low in Hungary. In line with the transition probability, the expected duration of remaining in state 2 is longer than in state 1 in Czech Republic, Poland, and Slovakia, while it's the other way around for Hungary. PCA model groups three components and the "the dimension of China's OFDI" [pc1] is the main variable of interest and it consists of China's OFDI, total factor productivity, fixed capital formation, trade openness, population growth, and producer price inflation. Quantile regression shows that pc1 has a positive

and highly significant effect when real GDP growth is at its .50 and .75 percentile, and moderately significant at its .25 percentile.

The findings of this study have significant implications for policymakers, investors and academic researchers. The results emphasise the importance of decision-making for government, investors, and investees to understand relationship between foreign direct investment and economic growth thoroughly. Therefore, policy recommendations are developed for V4 countries.

1. Research background

Foreign Direct Investment (FDI) has emerged as a vital catalyst for economic growth and development. With the ascendance of China as a global economic powerhouse and a significant source of outbound FDI, the effects of Chinese investment on recipient countries have become a subject of substantial interest and investigation. Visegrád Group (V4) has become an important role after joining the European Union (EU) in 2004. In this context, examining the empirical relationship between China's OFDI and the economic growth of the Visegrád Group holds significant importance.

China opened its economy to the world through the reform and open-up policy proposed by Deng Xiaoping in 1970s and got engaged in overseas investment through the 'going global' policy in 2000. China aimed to engage in the foreign market and has become an FDI-exporting country in the world (Cai, 1999). The Chinese government encouraged domestic companies to look for investment opportunities outside of China and improve their competitiveness (Szunomár, 2016). China's rapid economic expansion and its strategic initiatives, such as the Belt and Road Initiative (BRI)[1], have propelled it to the forefront of the global investment landscape (OECD, 2018). China's OFDI in the V4 countries has primarily focused on strategic sectors such as energy, infrastructure, manufacturing, telecommunication, and technology. This rise has prompted scholars, policymakers, and economists to explore the multifaceted impacts of China's OFDI on recipient economies, particularly in regions where economic dynamics are in transition. The V4 countries are participating economies in the BRI and form part of the New Eurasian Land Bridge known as the New Silk Road (NSR). The NSR is a concept and initiative that focuses on enhancing transportation and connectivity between Europe and Asia. It is a modern iteration of historical trade routes that facilitated the exchange of goods, culture, and ideas between these two continents. Further among more than 60 BRI countries, 16 Central and Eastern European (CEE) countries and China set up the "16+1" framework[2], aiming at the promotion of business and investment relations.

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[1] Belt and Road Initiative connects Asia, Africa, and Europe through two different ways: land and maritime, which is along the six corridors, aiming at improving regional integration, increasing trade and investment, and strengthening economic growth.

[2] "16+1" framework: it is an initiative proposed by Chinese Ministry of Affairs to expand economic and business cooperation between China and 16 Central and Eastern European countries, namely, Albania, Bosnia and Herzegovina, Bulgaria, Croatia, the Czech Republic, Hungary, Montenegro, North Macedonia, Poland, Romania,

The "16+1" format was founded in Budapest in 2012. V4 as part of the CEE countries has actively held the summit in Warsaw, Poland in 2012 and in Budapest, Hungary in 2017 with the theme of "Deepen economic, innovation, financial cooperation and promote mutually beneficial and win-win development". The CEE countries, including V4, provide incentives for inward FDI via tax concession, tariff-abolition, free economic zones, and double taxation avoidance (Ebbers and Zhang, 2010). Located in the centre of Europe, V4 is a window opportunity for China to access to Western European market easily. The relatively low-cost but skilled labour force is also attracting Chinese investors. Besides, V4 is having high trade openness, good infrastructure, and political stability. Therefore, V4 has been a significant target market for China in the CEE and the EU.

The V4 countries, once part of the Eastern Bloc, have undergone remarkable transformations since the collapse of the Soviet Union (Heydemann and Vodicka, 2017). They have successfully transitioned to market-oriented economies and joined the European Union (EU), embracing liberalization, privatization, and economic reforms. As they continue their paths of growth, the increasing presence of China's OFDI raises questions about how this investment interacts with their economic trajectories. The EU eastern enlargement extends an opportunity for China to expand its market to the newly joined EU countries. The EU debt crisis deepened economic divergence and led to the EU centrifugal (Saraceno, 2015). The national self-interest drives Central and Eastern European countries, including V4, to look for investments outside of the EU. China's investments helped companies that were suffering from the 2008 financial crisis (Szunomár, 2014; Meunier, 2014).

Previous research on the impact of FDI on economic growth has established theoretical frameworks that suggest positive relationships (Djankov & Hoekman, 2000; Campos & Kinoshita, 2002; Meunier, 2014). Foreign capital infusion can lead to technology transfer, knowledge spill overs, improved productivity, job creation, and enhanced trade relationships. However, the specific impacts of China's OFDI within the unique context of the V4 countries remain understudied, requiring an empirical investigation (Dubravčíková et al., 2019).

Serbia, Slovakia, Slovenia, Estonia, Latvia, and Lithuania. In 2019, it became "17+1" when Greece joined, and it became "14+1" from 2022 due to the withdrawal of Estonia, Latvia, and Lithuania.

Figure 1 depicts that China's OFDI as a percentage of total FDI in the V4 countries has been on the rise from 2004 to 2020. China's OFDI stock in V4 has reached USD 5.5 billion in 2020, with USD 3350 million the most in Hungary (OECD, 2023). This development encourages research into the importance and effectiveness of China's investments. Considering regional developments in the V4 countries, this research estimates whether China's OFDI contributes to V4's economic growth during the sample period of 2004 to 2020. This dissertation conducts research from 2004 as the starting timeline because a visible number of investments flew to the V4 from this year when the V4 joined the EU.

Figure 1. China's OFDI in the V4 countries, 2004-2020
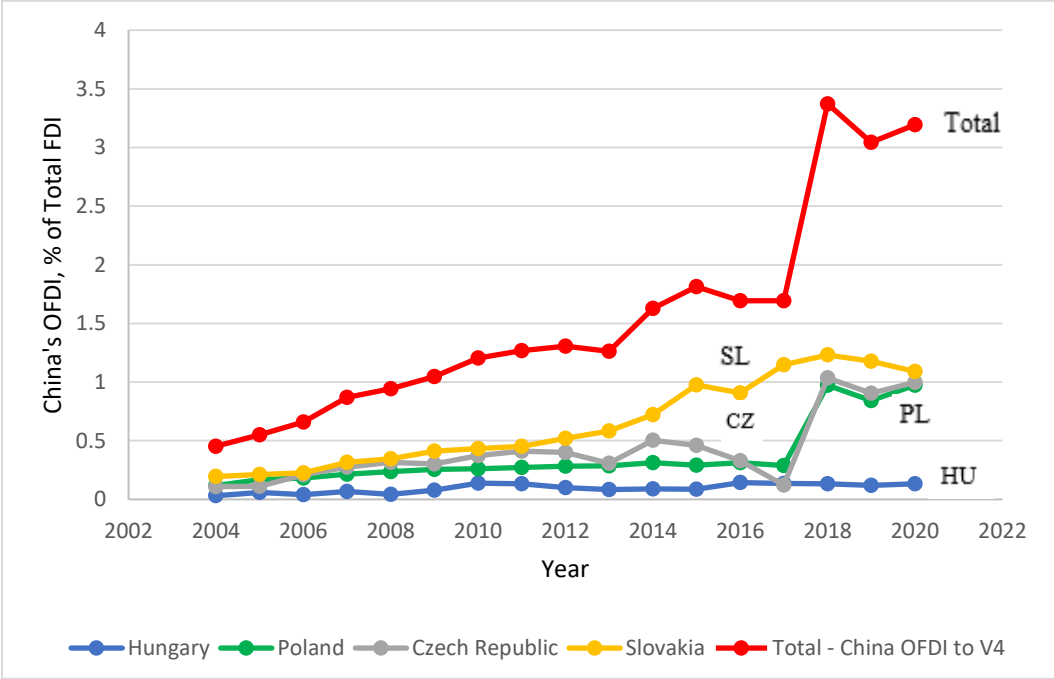
Source: Author's construction. Data from OECD

This empirical research seeks to build upon the existing body of knowledge by providing quantitative evidence of the effects of China's OFDI on the economic growth of the V4 countries. By employing robust econometric techniques and analysing extensive datasets, this study aims to quantify the relationships between China's OFDI and the real GDP growth of V4.

It is essential to acknowledge the potential heterogeneity in the effects of China's OFDI across the V4 countries, considering their differing economic structures, industrial compositions, and levels of integration with global markets. Moreover, exploring the mediating mechanisms through which China's OFDI influences economic growth, such as productive capacities, provides a nuanced understanding of the channels through which these effects manifest.

2. Problem statement

In the contemporary landscape of global economics, a pressing empirical research problem revolves around the quantifiable effect of China's OFDI on the economic growth of the V4 countries. This research seeks to empirically investigate the extent to which China's OFDI impacts the economic growth trajectories of these Central European nations, shedding light on the specific causal relationships, magnitudes, and dynamics that shape this intricate phenomenon. Amidst the evolving global economic order, understanding the empirical links between China's OFDI and economic growth in the V4 countries is of paramount importance. The research problems are defined by the following core questions:

• Causal relationship: To what degree does Chinese FDI causally contribute to the economic growth of the V4 countries? Is there empirical evidence of a direct positive association between increasing China's FDI inflows and higher rates of economic expansion?

• Quantifying growth effects: What is the quantifiable impact of Chinese FDI on key economic growth indicators, such as real GDP growth in the V4 countries? Can these effects be measured statistically and substantiated with empirical data?

• Mediating mechanisms: What are the mediating mechanisms through which China's OFDI exerts its effects on economic growth in the V4 countries? Are these effects primarily driven by technology transfer, increased exports, enhanced productivity, or other factors?

• Policy implications: What policy implications can be drawn from the empirical findings regarding the impact of China's OFDI on economic growth in the V4 countries? How can policymakers leverage these insights to optimize the benefits of Chinese investment while addressing potential challenges?

3. Research hypotheses

This research empirically investigates the effect of China's OFDI on the economic growth of the V4 countries. The study provides the hypotheses based on the research questions. Four hypotheses are included in the study and are discussed below.

Hypothesis 1

H_1: China's OFDI has a positive and significant effect on V4's economic growth in the short and long run.

According to Solow (1957), capital stock is a source of economic growth and is expected to impact aggregate output positively. FDIs increase the capital stock of a country and if utilized efficiently and effectively they have a propensity to increase aggregate output in the long run (Borensztein et al. 1998). The literature on FDI and economic growth nexus postulate variegated findings. Some scholars find the negative effects of FDI on economic growth (Hassan, 2022). Other scholars find positive effects of the FDI on economic growth (Trojette, 2016; Nketiah-Amponsah and Sarpong, 2019). An empirical study by Curwin and Mahutga (2014) finds that inward FDIs have a positive effect on V4's economic growth in both the short and long run. Therefore, this study expects a positive effect of China's OFDI on the economic growth of the V4 countries in both the short and long run.

Hypothesis 2

H_1: China's OFDI has a positive and significant effect on V4's economic growth through productive capacities.

The effect of China's OFDI on the economic growth of the V4 countries is not complete without moderating factors that drive this relationship. Novel studies utilize at least one or more moderating factors as influencing the FDI and economic growth relationship. Most scholars postulate a positive relationship between productive capacities in the FDI and economic growth nexus (De Mello, 1999; Durham, 2004; Nayyar, 2008; and Yu et. 2019). Moderating factors

influence the direction and magnitude of inward OFDIs. This research deploys productive capacities as a moderating factor. In the estimation, the productive capacities index is utilized which is a composite indicator that includes 46 indicators. Hence, this study expects a positive effect of the productive capacities index as a moderating factor.

Hypothesis 3

H_1: China's OFDI has a positive and significant effect on V4's economic growth at different economic growth states.

It is of paramount importance for policymakers and economic participants in both the host and investor countries to understand how inward FDI affects economic growth in different states of the economy. The study defines state 1 as a period of low economic growth, and state 2 as a period of high economic growth. In the literature, there are scholars who find that the effect of FDIs on economic growth is more positive and more significant in State 2 than in State 1 (Hayat et al., 2017). There is a lack of regime-switching studies on the FDI and economic growth nexus in the CEE region. However, this study expects a positive effect of China's OFDI on V4's economic growth at both low and high economic growth states.

Hypothesis 4

H_1: China's OFDI has a positive and significant effect at different quantile levels of V4's economic growth.

Different levels of economic growth are exposed to different levels of foreign capital. A country with higher levels of economic growth can possess higher levels of domestic and international investments. A study by Hsu et al. (2011) utilized Quantile Regressions and found that FDI affects economic growth more at higher percentiles and that developed countries with higher levels of absorptive capacities gain more from FDI than those with lower levels. This dissertation expects China's OFDI to have a positive effect with varying magnitudes at different percentiles of economic growth of the V4 countries.

4. Novelty of the research

The novelty of the dissertation includes 2 parts. Firstly, empirical estimations of the effect of China's OFDI on V4's economic growth is filling the gap of lacking empirical analysis on this topic. Literature in this field shows many research studied economic cooperation between China and V4, the motivations of China's OFDI in V4, and more broadly, Chinese investment in Central and Eastern Europe (Chen, 2012; Liu, 2013; Szunomár, 2014; Szunomár & Biedermann, 2014; Matura, 2014; Fan, 2014; Jacoby, 2014; Meunier, 2014; Deng, 2014; Kong, 2015; Chen, 2016; Góralczyk , 2017; Matura, 2017; McCaleb & Szunomár, 2017; Fürst, 2017; Liu, 2017; Jacimovic et al, 2018; Shi & Heiduk, 2019; Moldicz, 2020; Turcsányi, 2020; Ramasamy & Yeung, 2020; Matura, 2021; Karásková, 2021; Moldicz, 2021; Szunomár, 2022). However, it's barely found studies that apply quantitative methods to this topic.

China's OFDI affects V4's economic growth and there are several moderating factors that enable this relationship. The international institutions and researchers stressed the importance of strengthening productive capacity and argued that developing productive capacity would contribute to economic performance (Andreoni, 2012; Freire, 2011; Gnangnon, 2021). I believe China's OFDI affects the V4's economic growth through productive capacities. Thus, the second novelty is that I create an interaction between China's OFDI and the Productive Capacities Index (PCI). The idea of this research is that an increase in productive capacities have positive effects on both foreign direct investment and gross domestic product. It follows the hypothesis that PCI positively and significantly moderates China's OFDI and V4's economic growth nexus and that PCI has a significant and positive effect on V4's economic growth. This hypothesis has not been tested empirically in the V4 countries by scholars. Hence, the dissertation makes a significant contribution to the study of China's OFDI and V4's economic growth nexus which is aligned with the literature on productive capacities, FDIs, and economic growth.

Foreign investors are more likely to invest in countries with higher productive capacity. When a country has ability to produce goods and services efficiently and effectively, it becomes an attractive destination for FDI. Investors seek opportunities where they can utilize existing infrastructure, skilled labour, advanced technology, and reliable supply chains to maximize their

returns on investment. Increased productive capacity signals a favourable business environment, leading to higher FDI inflows. For example, Hong and Kim (2003) find that Korea prefers to invest in European countries that have a large market. The V4 countries are countries connected to the European Union single market and this is attractive for foreign investors. Nayyar (2008) finds that the location advantages for Indian firms arise from market opportunities, cheaper inputs, and trade barriers in host countries. In addition, Yu et al. (2019) finds that Chinese firms, in the Belt and Road Initiative (BRI), that are responsive to invest in foreign countries consider productive capacity factors in the host countries. They also find that the BRI positively affects China's Outward FDI. When a country enhances its productive capacity, it can meet a higher level of domestic demand for goods and services. This expanded market potential can make the country more attractive to foreign investors. FDI inflows increase as investors seek to tap into the growing consumer base and take advantage of increased sales opportunities. A country with improved productive capacity can often offer cost advantages in terms of labour, infrastructure, or access to resources (Siddharthan and Narayanan, 2020). This cost efficiency appeals to foreign investors who seek to minimize production costs and maximize their profitability. By investing in countries with increased productive capacity, foreign investors can benefit from economies of scale, lower production costs, and improved competitiveness in global markets (Desai et al., 2005). Productive capacity expansion often involves investments in infrastructure, such as transportation networks, energy facilities, and communication systems. Improved infrastructure can significantly reduce logistical challenges and costs for businesses, making the country more appealing to foreign investors. Efficient infrastructure facilitates the smooth operation of businesses, enhances connectivity, and streamlines supply chains, all of which can attract FDI. Increasing productive capacity often involves investing in human capital development, including education and training programs (Moudatsou, 2003). By improving the skills of the local workforce, a country can offer a skilled labour pool to foreign investors. This can be a crucial factor for FDI inflows, as investors are more likely to establish operations in countries where they can find a skilled workforce to meet their production needs. Expanding productive capacity often involves adopting advanced technologies and promoting innovation. Countries that invest in research and development, technology transfer, and innovation ecosystems become attractive destinations for foreign investors (De Mello, 1999). These investors seek opportunities to access the latest technologies, collaborate with local research institutions, and leverage innovation-driven growth. By fostering a

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supportive environment for technology and innovation, a country can attract FDI from companies looking to benefit from these advancements. When productive capacity increases, it implies that the economy can produce more output, which has a positive impact on GDP. An expansion in productive capacity enables an economy to meet growing demand, both domestically and internationally, resulting in increased production, sales, and revenue. This leads to higher GDP as more goods and services are produced and sold, generating economic growth. Additionally, an increase in productive capacity can have multiplier effects on the economy. Cornia (2021) finds that productive capacity does not only stimulate economic growth but also reduces growth volatility. It creates employment opportunities, stimulates income growth, and enhances overall economic activity. These factors further contribute to GDP growth.

This study finds that most scientific scholars utilize PCI variables partially. Therefore, I combine these variables and adopt the PCI mathematically constructed by UNCTAD (2021). The PCI is divided into 8 categories: Human capital, Natural capital, Energy, Transport, Information and Communication Technology, Institutions, Private sector, and Structural change.

5. Methodology

5.1 Data collection and description

This study utilized annual data with a sample period ranging from 2004 to 2020. *Table 1* provides abbreviations, definitions, and sources of the data. Listed in the tables are the dependent and independent variables. The dependent variable is Real GDP growth. The independent variables have been chosen astutely from the determinants of economic growth from the mainstream economics literature.

Table 1. Description of Variables

Variable	Definition	Source
Dependent Variable		
gdp	Real gross domestic product growth	Fitch Connect
Independent Variable		
fdi	China's OFDI, % of Total FDI	OECD
gfi	Germany's OFDI, % of Total FDI	OECD
ufi	USA's OFDI, % of Total FDI	OECD
wfdi	World's OFDI, % of GDP	World Bank
pci	Productive capacities index	UNCTADstat
tfp	Total factor productivity index	Penn World Table
fcap	Fixed capital formation, % of GDP	Fitch Connect
tro	Trade openness, % of GDP	Penn World Table
sav	Savings, % of GDP	Fitch Connect
popgr	Population, % chg y-o-y	Fitch Connect
ppi	Producer prices inflation, ave, % chg y-o-y	Fitch Connect
vol	Volatility, Standard deviation of GDP growth (%)	Own construct, Fitch Connect
y2008	2008 Global Financial Crisis, Dummy: 1=Crisis; 0=No Crisis	Own construct

Source: Author's construction.

5.2 Theoretical framework: Augmented Solow Growth Model

The point of departure is from the Solow growth model which is utilizing to understand the sources of economic growth in the long run. This is a vanilla framework that help economics scholars identify causes of growth and their process. The Solow model, also known as the neoclassical growth model, is one of the most widely used frameworks for understanding economic growth. It was developed by Robert Solow in the 1950s and 1960s and has been influential in shaping the field of macroeconomics. Economists continue to debate and refine growth frameworks, seeking

to improve understanding of economic growth and inform policy decisions. Therefore, this theoretical framework is to understand how FDI is incorporated into the model.

The framework that has been adopted is the augmented Solow growth model which is a Dynamic General Equilibrium (DGE) model. FDI is a foreign capital that is an addition to the domestic capital. There are no major differences in how foreign capital and domestic capital affect economic growth. Endogenous growth models postulate that FDI can exert a permanent effect on economic growth (Romer, 1990). In the Solow model, FDI increases domestic capital by affecting output. According to Hanson (2001), the complementary composition of foreign capital, FDI, and domestic capital creates a final impact of economic growth that is larger than deploying domestic capital alone. When foreign companies invest in the domestic market, they bring in funds to establish or expand their operations. This investment can lead to the creation of new factories, offices, and infrastructure, which increases the overall stock of physical capital in the host country (Felipe, 1999).

The framework utilizes the Cobb-Douglas production function which states that total production is a function of labour inputs, capital inputs, and total factor productivity (Cobb and Douglas, 1928). The contribution by Solow (1957) was able to decompose the determinants of economic growth and make use of growth accounting which can explain to us how much of a country's economic growth can be explained by its determinants. The aggregate production function used by the Solow model is a very parsimonious framework that should be expanded to include other sources of growth. In response to this limitation, Mankiw, Romer, and Weil (1992) added human capital in the framework to account for the aggregate contributions of education, skills, and work experience of the employed people. Output growth per effective labour depends on physical capital and human capital. In the long run, Solow assumes the output per effective labour can reach a steady state. The relative contribution of physical and human capital on output depends on the shares of the two capitals. Slow model enables scholars to predict the speed of convergence to the steady-state level of output. According to Mankiw, Romer, and Weil (1992), convergence to a higher level of output growth per effective labour can be achieved if a country utilizes its capital efficiently. Therefore, developing appropriate FDI policies can accelerate economic growth. The augmented Solow model enriches economic growth studies by implicitly incorporating FDI into

the traditional Solow model framework. By doing so, it allows us to analyse the role of FDI in shaping economic growth and understand the mechanisms through which financial factors interact with other determinants of growth.

According to Romer (1990), FDI has a high propensity to increase physical and human capital, as well as research and development which increases innovations. An increase in innovation and competitiveness can accelerate technology and productivity and affect economic growth positively (Grossman and Helpman, 1991). In their empirical study, Li and Tanna (2018) found that FDIs can affect economic growth by affecting total factor productivity (TFP) which depends on technology and its efficiency in the host country. They also find that the gains from FDIs are more explained by institutions than TFP growth. According to Rakshit (2022) trade openness of the host country can create an enabling environment for greater FDIs if there is a strong export-orientation. If this condition does not hold, trade openness can have a negative impact in the long run.

The augmented Solow model provides insights into the role of capital accumulation and resource allocation. The model also provides a framework to analyse the impact of FDI, which is part of physical capital, and its policies on economic growth. It allows us to explore how improvements in attracting foreign capital can affect long-term growth. This framework can be used to inform policymakers about the potential benefits of promoting FDI and implementing appropriate policies to support economic growth. Besides, the augmented Solow model enables to study of how financial crises and disruptions can impact long-term growth. It captures the negative effects of financial crises which can have lasting consequences for economic performance. The augmented Solow model provides a more comprehensive framework to analyse the interplay between FDI and economic growth.

5.3 Empirical framework

5.3.1 Panel Data Modelling

Building upon the theoretical framework of the augmented Solow growth model, this research is applying empirical models to examine the relationship between China's OFDI and V4's economic growth. Panel data econometrics are utilized to analyse how much economic growth can be

explained by China's OFDI. All the variables in the model have data availability making the panel balanced. Panel data analysis is conducted based on necessary steps as scientifically demonstrated by Angrist and Pischke (2009). The panel data method provides advantages in which several countries can be regarded as a group, and it can generate representative estimates.

The linear panel data models applied in this dissertation include Feasible Generalized Least Squares (FGLS), Pooled Ordinary Least Squares (POLS), Fixed Effects (FE), and Random Effects (RE).

5.3.2 Markov-Switching Dynamic Regression Modelling

Markov Switching Dynamic Regression (MSDR) is a statistical modelling technique used to analyse time series data where the underlying data-generating process can switch between different regimes or states (Hamilton, 1989). It combines elements of Markov models and regression analysis to capture the dynamic behaviour of the data over time. The purpose of MSDR is to provide a flexible framework for modelling complex time series data that exhibit regime switches. In many economic, financial, and social phenomena, the data-generating process can change over time due to various factors such as economic cycles, policy changes, market conditions, or shifts in investor sentiment. MSDR allows for the identification and estimation of these different regimes and provides insights into the characteristics and dynamics of each regime. The key idea behind MSDR is that the observed time series data are assumed to be governed by an unobservable Markov chain, where each state represents a different regime (Goldfeld and Quandt, 1973). The transitions between states are governed by probabilities, and within each state, a regression model is used to describe the relationship between the variables of interest. The model parameters and the probabilities of switching between states are estimated using statistical techniques such as maximum likelihood estimation. By explicitly accounting for regime switches, MSDR allows for a more accurate representation of the underlying dynamics of the data. It can help identify periods of stability versus volatility, different patterns of behaviour, and relationships that vary across regimes. This model helps understand and predict changes in regimes that can be useful in decision-making and policy formulation (Hamilton, 1990). It is of paramount importance to know the effect of China's OFDI on the V4's economic growth path at different economic growth states.

This study investigates this effect in periods during which the GDP of each country exhibits high and low. MSDR can model V4's economic growth, as measured by GDP growth, as a switching process to capture the heterogeneous behaviour that can be observed through expansions and recessions. V4's GDP growth is modelled depending on China's OFDI and a set of control variables. MSDR model divides the data by two states/regimes – high and low economic growth periods. The model provides estimates separated into state 1, which is a period of low economic growth, and state 2, which is a period of high economic growth. The model identifies the regime possibilities for each observation. In each regime, the parameter estimates reveal the relationship between the dependent variable and independent variables. MSDR also estimates the transition probabilities of each state to the other and calculates the expected duration of each state.

5.3.3 Principal Component Analysis modelling

Principal Component Analysis (PCA) is used to reduce the dimensionality of a dataset while retaining the most important information. It identifies patterns and relationships in the data by transforming the original variables into a new set of uncorrelated variables called principal components. The purpose of PCA is to simplify complex datasets, improve interpretability, and extract the most relevant information. By reducing the number of variables, PCA alleviates the computational burden in subsequent analyses and mitigates issues related to multicollinearity. By transforming the variables into orthogonal components, PCA reduces the intercorrelations among the variables. This can be particularly useful in regression analysis, where multicollinearity can lead to unstable parameter estimates and difficulties in interpretation.

According to Abdi and Williams (2010), the goals of Principal Component Analysis (PCA) are to extract the most important information from the data table; compress the size of the data set by keeping only this important information; simplify the description of the data set; and analyse the structure of the observations and the variables. This means that the model can reduce the number of variables into components that help explain the dependent variables with only important information from the data.

5.3.4 Cross-Sectional Autoregressive Distributed Lag Modelling

Cross-Sectional Autoregressive Distributed Lag (CS-ARDL) modelling is used to analyse relationships between variables in cross-sectional data. It extends the traditional autoregressive distributed lag (ARDL) model, which is typically applied to time series data, to handle cross-sectional data settings. The purpose of CS-ARDL modelling is to investigate the long-run and short-run relationships between variables in a cross-sectional setting, considering the potential presence of endogeneity and dynamic interactions among the variables. It allows researchers to examine how changes in independent variables impact the dependent variable over time, while also considering the potential lagged effects and interdependencies among the variables (Pesaran and Smith, 1995). The CS-ARDL model combines elements of autoregressive (AR) models, distributed lag (DL) models, and panel data analysis. It includes lagged values of the dependent and independent variables, as well as the average values of the independent variables over time, to capture both the dynamic and long-run relationships. The CS-ARDL approach helps to uncover the short-run and long-run dynamics in cross-sectional data, offering insights into causal relationships and policy implications. The model can handle both stationary and non-stationary variables, making it suitable for analysing data with different characteristics (Pesaran, 2006).

One of the hypotheses in this research is to estimate the short-run and long-run effects between the independent and dependent variables. The study estimates it with the model specification that considers any cross-sectional dependence between variables. Cross-sectional dependence can be found when the panel data from countries under the study are correlated, which can make the coefficient estimation inconsistent (Pesaran, 2006; Chudik and Pesaran, 2015). This statistical problem can also be caused by unknown common factors that are not included in the model. If these common factors are omitted from the model, they become omitted variables, ultimately leading to omitted variable bias. To fully ensure that the study obtains consistent estimates and considers any model inefficiencies, they study applies the Cross-Sectional Autoregressive Distributed Lag (CS-ARDL) model (Pesaran and Smith, 1995). To achieve the estimation purpose, the study applies the most possible parsimonious model of the convergence model, transforming it into the CS-ARDL. The main idea of the CS-ARDL is to first estimate the short-run coefficients, and secondly estimate the long-run coefficients.

6. FINDINGS

6.1 Main findings

The study concludes that the China's OFDI has a positive and significant effect on the V4's economic growth. The novelty of this research is the acknowledgement of productive capacities as a moderating factor between China's OFDI and economic growth of the V4 countries. Considering the productive capacities, China's OFDI affect economic growth positively. Productive capacities are significant in all sections of the findings. These suggest that productive capacities in the V4 countries are significantly important factors that explains the relationship between FDIs and GDP growth in the V4 countries.

Firstly, the paned data modelling was applied which includes FGLS, POLS, FE, and RE. The study reveals that all the four panel data models utilized postulate similar effects. The RE model has been chosen as the anchor model after diagnostic checks. The RE model finds that the net effect of China's OFDI on V4's economic growth is an estimated 0.20%. This is after accounting for the interaction between China's OFDI and real GDP growth of the V4. Since the statistical results are strongly significant, the conclude can be drawn that China's OFDI has a causal effect on the V4's economic growth. China OFDI contributes to the V4's economic growth by providing capital for new projects and businesses. China's OFDI also focuses on building infrastructure through its Belt and Road Initiative program. These developments enhance connectivity, facilitate trade, and improve the overall business environment. The investment in the V4 countries bring new technologies, management practices, and production methods. This contributes to innovation and the development of local industries. China's OFDI helps diversify the sources of investment and trade for the V4 countries, reducing their dependence on a limited number of partners. The study deployed an ad hoc analysis by estimating the effect of Germany, USA, and World OFDI to the V4. These OFDIs have a positive and significant effect. The net effect of Germany's OFDI on V4's real GDP growth is 0.15%, the net effect of USA's OFDI on V4's GDP growth is 0.13%, and the net effect of the World OFDI on V4's GDP growth is 0.10%. Panel data modelling have treated the four countries as group and hence provided a group mean estimate. In contrast, the MSDR model provides partial estimates of each country.

Secondly, the MSDR model finds that China's OFDI has a positive and significant effect in each country of the V4. The study postulates that China's OFDI has a positive and significant effect on the V4's economic growth, even after controlling for productive capacities. During periods of economic slowdown or recession, the V4 countries face challenges in achieving robust economic growth due to various factors such as global economic conditions, financial crises, and internal economic issues. Lower global demand for goods and services may negatively affect the export-oriented economies of the V4 countries. In low growth periods, foreign investors might be more cautious, leading to a decline in FDIs inflows. Economic slowdowns can put pressure on government finances, limiting their ability to invest in infrastructure and development projects. Economic downturns can lead to higher unemployment rates and exacerbate income inequality, impacting overall economic stability. The V4 countries experienced economic challenges during the 2008 global financial crisis and the Eurozone crisis. Their ability to navigate and recover from these crises provides valuable lessons in crisis management and policy resilience. During times of economic expansion and favourable conditions, the V4 countries can experience strong economic growth. Strong global demand for V4 countries' exports can boost economic growth, especially if they specialize in high-demand industries. In times of economic optimism, foreign investors might see opportunities in the V4 countries, leading to increased FDI inflows. Investment in infrastructure projects can stimulate economic activity and productivity. Implementation of pro-business and market-friendly reforms can enhance competitiveness and attract investments. Access to European Union funds can support various development projects and regional initiatives, fostering economic growth. Embracing technological advancements and fostering innovation can boost productivity and economic performance.

Thirdly, the study utilizes PCA model which groups three components into "the dimension of China's OFDI" [*pc1*], "the dimension of Volatility of real GDP" [*pc2*], and "the dimension of the 2008 Global Financial Crisis" [*pc3*]. *Pc1* is the main variable of interest and it consists of China's OFDI, total factor productivity, fixed capital formation, trade openness, population growth, and producer price inflation. PCA model has attributed productive capacities to *pc2*. After creation of components, Quantile Regression model has been utilized to estimate effects of the components at the 25th, 50th, and 75th quantile of real GDP growth. The study concludes that *pc1* has a positive and highly significant effect when real GDP growth is at its .50 and .75 percentile, and moderately

significant at its .25 percentile. PCA postulates that effect of China's OFDI is large at lower real GDP growth level than in higher growth levels. This reflects an opportunity for China's investments to exerts its share in the marketplace and increase its efficacy on V4's economic growth. *Pc1* also concludes that its factors mentioned above are all significant in the promotion of economic growth. *Pc2* has a negative and significant effect when real GDP growth is at its .50 and .75 percentile. Volatility reduces real GDP growth by a large percentage at lower levels of growth than in high levels of growth. *Pc2* is not significant when real GDP growth is at the .25 percentile. *Pc3* is not statistically significant at all levels of real GDP growth. However, PCA postulates that the global financial crisis reduces real GDP growth at higher levels of economic growth.

Fourthly, the research describes the short and long run effects of China's OFDI on V4's economic growth by deploying the CS-ARDL model. The conclusion is that China's OFDI has a positive and significant effect in both the short and long-run, even after controlling for the effect of productive capacities. All the covariates in the model have positive effect on economic growth except for producer price inflation, volatility of real GDP growth, and the global financial crisis of 2008. The novel contribution of the study postulates that productive capacities have a positive and causal effect on economic growth in the short and long run. Another conclusion can be drawn that productive capacities take longer to sufficiently increase economic growth in the V4 countries. China's FDI contribute to sustained economic growth by providing new capital to the domestic economies. This leads to increased real GDP growth and improved living standards over the long term. Long-term Chinese investments can lead to stronger economic ties and potentially influence diplomatic relations between China and the V4 countries. As members of the European Union, the V4 countries need to align their policies on FDI with EU regulations and policies. Long-term Chinese investments can have implications for EU-level discussions on trade and investment. Over the long term, China's investments in infrastructure projects can enhance connectivity within the V4 countries and beyond. This can contribute to regional integration and economic development. Therefore, this study can postulate that improved infrastructure resulting from China's OFDI can facilitate trade, reduce transportation costs, and boost economic activities in the long run.

China's OFDI into the V4 countries can bring about various opportunities that can benefit both China and the V4 countries. These opportunities can span economic, technological, and diplomatic

dimensions. The expertise of China in infrastructure development, showcased through initiatives like the Belt and Road Initiative, could lead to significant investment in the V4 countries. This could result in improved transportation networks, energy projects, and connectivity that facilitate trade and economic growth. China's advanced manufacturing capabilities can provide opportunities for joint ventures or investments in manufacturing facilities. This could enhance the V4 countries' production capacities and promote trade ties between China and the V4.

6.2 Contribution to the existing literature

This research contributes to the empirical literature of FDI and economic growth. There is a gap that exist which lies in how China's OFDI affect economic growth of the V4 countries. The study re-investigates the FDI-growth nexus in the post-socialist period of the V4. The use of Panel Data, MSDR, PCA, and CS-ARDL modelling provides rich empirical findings from these heterogenous countries. In all the models, the study finds a positive and significant effect of China's OFDI on V4's economic growth from a sample period 2004 to 2020. China's OFDI to the V4 may not be large as the investment by countries such as Germany and USA, but significantly contributes to economic growth. The study supports the findings by scholars who have found a positive effect while utilizing various research methods. A novel contribution to the FDI-growth nexus is the empirical application of productive capacities as a moderating factor. Various studies found productive capacities to be leading factors in attracting FDIs and promoting economic growth in CEE countries. However, empirical evidence has not been provided for the V4 countries, especially where productive capacities are measured as a composite index. Hence, the study contributes by adding an interaction term of China's OFDI and Productive Capacities Index (PCI) in the effect of China's OFDI and V4's economic growth nexus. The FDI-growth literature partially postulates a positive effect of productive capacities on economic growth without utilizing the PCI. These studies neglect that multiple productive factors moderate the FDI-growth nexus. This research also holds similar findings for the case of China's OFDI and V4's economic growth which is a phenomenon previously not researched comprehensively. And all productive capacities contained in the PCI significantly promote economic growth positively. The positive effect of China's OFDI on economic growth is also supported by the theoretical contribution of the Solow model, which describes that any form of capital, domestic and foreign, promotes economic growth.

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