CHARLES UNIVERSITY IN PRAGUE

FACULTY OF SOCIAL SCIENCES

Institute of International Studies

Master thesis

2022 **Jinli Yao**

CHARLES UNIVERSITY IN PRAGUE

FACULTY OF SOCIAL SCIENCES

Institute of International Studies

Jinli Yao

Inward FDI and Industrial Structure Optimization and Upgrading: Empirical Evidence from Central and East European EU Countries

Master thesis

Prague 2022

Author: Bc. Jinli Yao

Supervisor: Mgr. Karel Svoboda, Ph.D.

Academic Year: 2021/2022

Bibliographic note

YAO, Jinli. *Inward FDI and Industrial Structure Optimization and Upgrading: Empirical Evidence from Central and East European EU Countries*. 76 p. Mater thesis. Charles University, Fakulty of Social Sciences, Institut of International Studies Supervisot prof. Mgr. Karel Svoboda, Ph.D.

Abstract

The main aim of this paper is to study whether the inward FDI will optimize and upgrade of industrial structure in Central and East European EU countries. If yes, which industry's inward FDI has a better effect on industrial structure optimization and upgrading? I established the influence mechanism as the analysis framework of the whole paper. Then I gathered a dataset of 11 CEE EU countries from 2000 to 2019 and established the industrial structure upgrading index and rationalization index. The empirical results showed that IFDI will optimize industrial structure in the short term and will upgrade industrial structure in the long term. IFDI from the secondary industry has the best effect on industrial structure optimization and upgrading. Therefore, this paper suggests that CEE EU countries introduce FDI, and emphasizes that they had better cooperate with foreign capital that helpful for the high-end development of the manufacturing industry in CEE EU countries. At the same time, they should promote the development of their own organization and management in order to absorb high technology and achieve technological catch-up.

Keywords

IFDI, Foreign Capital, Industrial Structure Optimization and Upgrading, Industrial Restructuring, Industrial Structure Rationalization, Industrial Structure Advancement

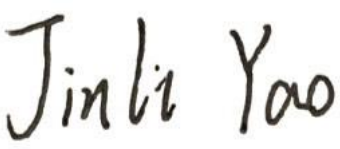
Range of thesis: 76 th. symbols

Declaration of Authorship

1. The author hereby declares that he compiled this thesis independently, using only the listed resources and literature.

2. The author hereby declares that all the sources and literature used have been properly cited.

3. The author hereby declares that the thesis has not been used to obtain a different or the same degree.

Prague **2nd August, 2022** **Jinli Yao** 

Institute of International Studies
Master thesis propsal

PROGRESS REPORT
(600 words minimum)

Name:
YAO Jinli

Programme:
International Masters in Economy, State and Society

E-mail:
18427619@fsv.cuni.cz

Term:
Winter

Academic year:
2021/2022

Dissertation title:
Inward FDI and Industrial Structure Optimization and Upgrading: Empirical Evidence from Central and East European EU Countries

Expected date of submitting:
2nd August

Head of the Seminar:
doc. PhDr. Jiří Vykoukal, CSc.

Supervisor:
Mgr. Karel Svoboda, Ph.D.

Topic changes (why):

New title (if):
Inward FDI and Industrial Structure Optimization and Upgrading: Empirical Evidence from Central and East European EU Countries

Research question changes (why):
The research question was defined according to the new title.

New research question/ (if):
Will IFDI optimize and upgrade the industrial structure in Central and East European EU Countries? If yes, which industry's inward FDI has a better effect on industrial structure optimization and upgrading?

New sources (comment, please, on the source base):
Panel Data from 2000-2019 (annual data), 11 CEE EU countries, Czech Republic, Poland, Estonia, Latvia, Lithuania, Hungary, Slovakia, Slovenia, Croatia, and Romania. They are all later members of the EU. Data is from the World Bank, Eurostat, UNCTAD, ILO, UIS and wiiw databases. Except for the wiiw database, all other databases are official, thus highly reliable. The wiiw database is commercial database, from which I selected IFDI by sectors.

State of art (incl. new sources):

Scholars' conclusions on the relationship between FDI and industrial structure optimization and upgrading are not completely consistent. According to different research conclusions, literature can be divided into promotion, hindrance, and uncertainty. Blomstrom.M (1989) empirically tested the impact of FDI on Mexico's economic development and industrial structure upgrading, and the research showed that FDI contributes to the upgrading of manufacturing industrial structure. The empirical conclusion of Eva Kippenberg (2005) shows that FDI can promote the upgrading of industrial structure. Radosevic et al. (2005) explored the positive effects of FDI on industrial restructuring in CEE automobile industry, by using descriptive analysis. However, Liu Yajuan (2006) used the data of China from 1988 to 2004 to conclude that FDI made China's secondary industry expand excessively and aggravated the unbalanced development of its industrial structure. This point of view is proved again in the empirical article of Deng Lina (2015). Besides, the research of Tam Bang VuandllanNoy (2009) shows that the promotion effect of FDI on industrial structure has spatial and industrial heterogeneity. Radosevic et al. (2005) explored the positive effects of FDI on industrial restructuring in CEE automobile industry, by using descriptive analysis. Some scholars have also constructed the index of industrial structure optimization and upgrading. For example, Liao et al. (2021) constructed an indurstrial structure rationalization index, but they wrongly use it with another index weighting.

There are some limitations of previous studies:

1. There is little literature on the CEE EU countries.
2. The index was used defectively.
3. Few studies focus on industry level.

Changes in theory & methodology (why):

Consider the motivation theory of FDI, the basic theory of FDI affecting industrial structure, and rough models.

New theory & methodology (if):

Theory:

1. Theories about the motivation of inward FDI, such as theory of monopolistic advantage, the internalization theory, eclectic theory of international production, the theory of product life cycle,
2. Theories about the evolution of industrial structure, such as Petty-Clark law, Kuznets law, binary structure theory, unbalanced growth theory.
3. Theories about the relationship between FDI and industrial restructuring, such as population and resource endowment theory, gap theories, theory of flying geese, marginal industry expansion theory, the theory of dynamic comparative advantage.

Methodology: Quantitative Method

Model1: $ISA = \alpha_0 + \alpha_1 lnifdi + \sum \alpha_k * CONTROL + \varepsilon$, where ISA (Industrial Structure Advancement Index) takes the output added value of each industry as a share of the total GDP, and give a weight of 1.2.3 to primary, secondary, and tertiary respectively.

Model2: $ISR = \beta_0 + \beta_1 lnifdi + \sum \beta_k * CONTROL + \varepsilon$, where ISR (Industrial Structure Rationalization Index) is

$$\sum_{k=1}^{3} \frac{Y_k}{Y} \left| \frac{Y_k/L_k}{Y/L} - 1 \right|$$

, Y_k/L_k is comparative labour productivity of each industry, and Y/L is the average labour productivity of the country.

Proposed structure of dissertation:

Introduction

Literature Review and Theoretical Framework

Descriptive Analysis of IFDI and Industrial Structure in CEE EU Countries

Empirical Analysis

Conclusion

Changes in expected outcomes (why):

Change according to the research questions. Hope the results will show:

1. Whether IFDI optimize and upgrade the industrial structure?
2. If yes, from which industry IFDI has a better effect on that?
3. Control variables are significant, and see whether these variables are related to the existing theories.

Cooperation with your supervisor (does it work?):

My supervisor is friendly, and It is my honor to work with him.

Troubles you face:

CONTENTS

INTRODUCTION

In the early 1990s, Central and Eastern European countries underwent upheavals. Politically, they abandoned the socialist political system and moved closer to the multi-party Western constitutional democracy system. Economically, they abandoned the planned economy system and chose to transition to the market economy. Simultaneously, in order to get rid of the former Soviet Union's sphere of influence and the competition between Eastern and Western countries, many countries in Central and Eastern Europe put forward the slogan of 'return to Europe', that is, the development direction of joining the European Union, in order to seek political and economic integration with Western countries. After more than ten years of political and economic transformation, eight countries (Czech Republic, Estonia, Hungary, Lithuania, Latvia, Slovakia, Slovenia, and Poland) finally became EU member states on May 1, 2004. Romania and Bulgaria joined the EU in 2007 and Croatia in 2013. This paper refers to the 11 countries as the Central and Eastern European EU countries. For Central and Eastern European EU countries, joining the EU not only means a rapid recovery of their economies after the transition but also can help promote their market-oriented transformation.

As an important part of the world economy, the CEE EU countries have undergone market economic reform and are constantly exploring effective economic policies and institutions to attract foreign direct investment (FDI). Since the 1990s, as one of the main driving forces of economic globalization, FDI has played a considerable role in CEE EU countries. These countries have increasingly become one of the major regions attracting FDI worldwide. The inward FDI stock of the CEE EU countries increased from 106.46 billion in 2000 to 826.49 billion in 2019.

In fact, since the 1960s, scholars have begun to pay attention to the impact of international investment on industrial restructuring. As emerging economies in the world economy, the FDI and industrial structure of CEE EU countries has substantial research value. However, the literature on FDI and industrial structure in CEE EU countries is minimal, and there is a lack of data and empirical analysis materials. Therefore, this thesis hopes to fill the gap in this field to a certain extent. In addition,

the existing literature has not established a unified research framework and indexes to analyse the impact of IFDI on optimizing and upgrading the industrial structure.

Based on the above background, this thesis will focus on two issues. One is to explore the influence mechanism of inward FDI on the optimization and upgrading of industrial structure. This thesis will construct an analysis framework from the supply side and demand side of industrial structure optimization and upgrading. The other is to explore whether the inward FDI will optimize and upgrade the optimization and upgrading of industrial structure in Central and Eastern European EU countries. If yes, which industry's inward FDI has a better effect on that? In this process, this thesis will construct indicators for the upgrading of industrial structure and the optimization of industrial structure.

Both qualitative analysis and quantitative analysis will be used in this thesis. Based on the theories of industrial economics, international investment, and international trade, this paper studies the mechanism and fundamental laws of IFDI in promoting industrial restructuring and economic growth in combination with the specific characteristics of CEE EU countries and constructs a theoretical framework. On the basis of theoretical research, this thesis collects data of CEE EU countries from 2000 to 2019 from multiple perspectives and channels. STATA will conduct the quantitative analysis, and the influence effect of IFDI on the optimization and upgrading of the industrial structure will be calculated, which will make the research results of this thesis more credible.

This thesis is structured in the following manners. First, in the introduction, this thesis introduces some background information and relevant academic background to raise the research question. The following introduction makes an overall plan for this study’s research methods and chapter structure.

The first chapter introduces the theoretical framework in detail. This part reviews the historical literature and puts forward the potential research direction. Moreover, this chapter summarizes the fundamental theories about FDI, industrial structure, and their relationship. Then, the analysis mechanism is established according to these theories.

The second chapter analyses the development level of FDI and industrial structure in central and east European EU countries. Among them, the analysis of industrial structure is carried out from four aspects: output value added, industrial employment structure, industrial structure deviation coefficient and hierarchy coefficient.

The third chapter is about the econometric analysis of the impact of IFDI on the industrial structure optimization and upgrading of CEE EU countries, which is the most critical chapter of this thesis. The entire process is displayed, from the selection and description of data and variables to the estimation of the model to the interpretation of the results. Finally, the last part presents conclusions, and puts forward some suggestions.

1. Literature Review and Theoretical Framework

This chapter will review the historical literature and present potential research directions. In addition, this chapter also summarizes and analyses the motivation theory of FDI, the evolution theory of industrial structure, the connotation and driving factors of industrial structure optimization and upgrading, and the theory of the relationship between FDI and industrial restructuring. Then the analysis mechanism is established according to these theories.

1.1 Literature Review

With the deepening of the development of openness among countries, the global foreign direct investment scale continues to expand. The inward FDI can bring resources, such as technology, capital, and workforce, thereby changing the host country's trade structure, industrial structure, and economic development status. Thus, FDI and its impact have been widely studied.

Previous studies on the impact of FDI mainly focused on capital formation, economic growth, import and export trade, and industrial structure. Therefore, this

paper mainly reviews relevant literature from the four aspects and proposes the potential research direction through the corresponding literature review.

1.1.1 FDI and Capital Formation of the Host Countries

The early research on the impact of FDI on host countries started with capital formation. Nurkse (1953) believed that "insufficient capital formation was the bottleneck restricting a country's capital development, and the inward FDI could increase the amount of capital in the host country, thus promoting its economic development". However, there was still a debate about whether FDI can promote or inhibit the investment level of the host country.

On the one hand, some scholars demonstrate that FDI would promote domestic capital formation. For example, Lubitz (1966) studied the effect of FDI on Canadian domestic capital formation by using the data from 1951 to 1962, and the research results showed that for every dollar of increase in FDI, the total domestic investment would increase by $3. Borensztein et al. (1998) studied 69 developing countries using the data from 1970 to 1979 and 1980 to 1989 and found that FDI was an essential channel of technology transfer and played a prominent driving role in long-term economic growth. The study also confirmed the existence of a multiplier effect, whereby an increase of one unit of FDI leads to more than one unit of total investment in the recipient country. Driffield et al. (2003) studied the influence of FDI on different regions of the United Kingdom and believed that FDI promoted the formation of investment in the host country, but there were significant regional differences, which were mainly reflected in the north of England, Scotland and some regions of Wales. The reason is that these regions have less labour force scale, leading to the weak absorption capacity of the FDI spillover effect. Agosin and Machado (2005) selected panel data from 1970 to 1996 to study the capital formation process of FDI in 39 countries, including Latin America, Africa, and Asia. The results showed that 19 countries showed a neutral FDI effect, 10 countries showed a multiplier effect, and 10 countries showed a crowding effect. Tan (2009) selected relevant data from 1985 to 2005 of 29 regions in Mainland China to study the role of FDI in capital formation in China as a whole and in eastern, central,

and western regions, respectively. The results showed that FDI positively influences capital formation in the above regions. Lean and Tan (2011) designed an empirical study on the relationship between FDI inflow into Malaysia and domestic investment from 1970 to 2009 and found that FDI could promote domestic investment, and there was a short-term causal relationship between the two.

On the other hand, some scholars argue that FDI inflow has a negative pulling effect on the capital level of the host country. Van Loo (1977) selected data from 1948 to 1966 to study the influence of FDI on investment, consumption, and net export in Canada and found that FDI positively affects total investment. However, if the indirect effects of FDI on domestic consumption levels and foreign trade were taken into account, FDI would have suppressed the growth and ultimately negatively impacted total investment. Bosworth et al. (1999) studied how capital inflow affects domestic investment and savings using panel data from 1979 to 1995 of 58 developing countries and found that different types of capital inflow have different impacts on domestic investment. Eregha (2012) used the Economic Community of West African States (ECOWAS) data from 1970 to 2008 to conduct an empirical study and concluded that FDI was crowding out domestic investment.

Specifically, Central and Eastern European EU countries are transitional countries. Capital formation in these countries is highly dependent on foreign capital, so attracting FDI has become the most important factor in ensuring economic growth and stability in investment policies. Using Hungarian data from 1995 to 2012 and the VEC model, Ramirez and Kömüves (2014) concluded that there is two-way causality between FDI inflows and gross fixed capital formation (GFCF). Also, Wang's (2005) statistical description method to proves that GFCF of Central and Eastern European countries showed an overall upward trend from 1990 to 2000, but the proportion of domestic investment decreased significantly during this period, while the status and role of foreign investment, especially FDI, increased significantly.

1.1.2 FDI and the Economic Growth of the Host Country

The standard neoclassical growth model held that, by promoting capital formation, FDI could increase the capital stock of the host country, thereby promoting the host country's economic growth. Section 1.1 explains the relationship between whether FDI can promote capital formation. Thus, scholars also have different views on whether FDI can promote economic growth in host countries.

Although many pieces of literature believe that FDI can promote economic growth, quite a several scholars have concluded that FDI is negatively correlated or not significantly correlated with economic growth. For example, Easterly (2002) argued that the use of preferential policies to attract FDI would discourage domestic investment. When the income gap between the invested country's enterprises and the multinational companies entering the country is quite large, FDI will hinder economic growth. Khaliq and Noy (2007) conducted an analysis using Indonesian data from 1998 to 2006 and found that FDI harmed the growth of the mining and quarrying sector. Ang (2009) selected relevant data from 1970 to 2004 in Thailand to conduct an empirical study and believed that FDI inflows negatively correlated with the development of Thailand's economy. Temiz and Gökmen (2014) used quarterly data from 1992 to 2007 to study the relationship between FDI and Turkey's economic growth, and concluded that neither the short-run nor the long-run impact of FDI on Turkey's economic growth is significant.

Besides, some studies have shown that certain conditions must be met for the positive effect of FDI. For example, Balasubramanyam et al. (1996) pointed out that the economic growth effect of FDI is negative in those import substitution countries and positive in those export-oriented countries. Borensztein et al. (1998) made an empirical analysis of the FDI utilization data of 69 less developed countries from 1970 to 1989 and divided all countries into 9 groups according to the level of the labour force. The research results showed that FDI could promote economic growth in countries with higher labour force levels. That is to say, although FDI is an important channel for technology introduction and innovation and plays a more significant role in economic development than domestic investment, the prerequisite is that the invested country needs to have the ability to digest, absorb and utilize advanced technologies quickly.

Balasubramanyam (1999) found that developed infrastructure conditions are more conducive to enhancing the effect of FDI on economic development. World Investment Report (2001) presented the effect of FDI and economic growth differs in different sectors. Taking the primary economic sector as an example, since this sector is mainly capital-intensive and has fewer linkages with other sectors, its linkage effect is negligible. On the other hand, FDI flowing into the manufacturing sector will significantly impact the economy, as the sub-sectors within the manufacturing sector are closely linked. Most of the FDI flowing into the service industry provides services for the host country market and directly contacts local customers, so the forward linkage effect is relatively significant. However, the backward linkage effect will differ between service industries. If FDI can improve the quality and efficiency of the service sector in the host country, other sectors of the economy will be positively affected. Alfaro et al. (2004) pointed out that in countries with relatively mature financial markets, FDI can promote economic growth.

There are also studies specifically aimed at Central and Eastern European countries, which conclude that FDI positively affects economic growth. For example, Eller et al. (2006) focused on financial sector FDI in 11 CEE countries from 1996 to 2003 and showed the nonlinear positive impact of financial sector FDI on economic growth. Eren and Zhuang (2015) examined 12 new EU member States over the period 1999-2010 and concluded that FDI would have an impact only if the target economies had some degree of absorptive capacity. Vojtovič et al. (2019) used data from 1997 to 2004 for the CEE EU countries and concluded that FDI positively impacts economic growth.

1.1.3 FDI and Trade of the Host Country

Generally, trade structure and industrial structure affect each other. However, in the early days, scholars studied the two separately. At first, scholars believed that the relationship between FDI and trade was substitution. Mundell (1957) proposed a study on the relationship between investment and trade. Based on the Heckscher–Ohlin model, deduced the theory of substitution relationship between trade and investment.

Nevertheless, the theory is based on a series of strict assumptions that have little practical applicability. Then Vernon (1966) used the product life cycle theory to analyse each stage from a dynamic point of view and concluded that the flow direction of product and capital is opposite. Buckley and Casson (1976) proposed internalization theory to illustrate the substitution relationship between investment and trade. Internalization theory holds that multinational corporations will invest in internalized economic activities when the cost of exporting goods exceeds the cost of internalizing them. In this case, the FDI will replace export trade. Dunning's eclectic theory of international production pointed out three ways for multinational companies to engage in international production: international technology transfer, product export, and foreign direct investment, which defaults to the substitution relationship between trade and FDI.

However, Dunning (2001) studied the development trajectory of FDI and trade between Taiwan and South Korea. He believed that the increase in import trade of a country or region would increase the inflow of foreign capital into the country, which would increase the export, which in turn would increase the country's foreign investment. This also shows that the relationship between trade and investment may no longer be a pure substitution relationship, thus the substitution theory faces great challenges. In fact, in 1978, Kiyoshi Kojima put forward the theory of the complementary relationship between trade and investment in his representative book *Foreign Direct Investment Theory*. Helpman (1984) established a simple general equilibrium model and reached a similar view to Kojima. He believed that the FDI of multinational corporations would change the endowment of domestic factors of production, and under the long-term influence, the FDI will also change the export commodity structure of that country.

Subsequently, some scholars believed that the relationship between FDI and trade is not monotonic. In 1985, Markusen and Lars further proposed the complementary model of FDI and trade. In this model, they pointed out that if the relationship between trade and non-trade factors is 'cooperative', then mobile factors of production will increase trade. It is concluded that FDI and trade are complementary.

Conversely, the relationship between FDI and trade is substitution, if the relationship between trade factors and non-trade factors is 'non-cooperative'. Jose Pontes (2007) argued that there is a non-monotonic relationship between trade costs and FDI. For low-value trade costs, trade and FDI are substitutable, while for higher-value trade costs, trade and FDI can be complementary. Bayoumi and Lipworth (1997) found that the impact of FDI flow on trade is short-term through the investment and trade data of Japan and 20 major trading partners during 1982-1995. In contrast, the stock of foreign direct investment has a long-term impact on trade.

However, only a handful of papers have investigated the CEE countries, mainly in relation to the old EU member states. For example, Sapienza (2009) studied the relationship between bilateral FDI and EU-15 exports to CEE countries using the extended gravity method and found a complementary situation. Vukšić and Kutan (2007) studied the data of twelve CEE countries from 1996 to 2004 and concluded that FDI would promote the export capacity of host countries. However, Albulescu et al. (2019) used the data of Czech Republic, Slovakia Hungary, and Poland from 2000 to 2013 to conclude that the inward FDI has no considerable influence on trade.

1.1.4 FDI and the Industrial Structure of the Host Countries

Scholars also held different views on the relationship between FDI and industrial structure. Most scholars advocated that FDI could promote the development of industrial structures. For example, Caves (1974) demonstrated that FDI has spillover effects and can significantly promote the development the host country's industrial structure. Bloomstrom et al. (1989) empirically tested the effect of IFDI on the economic development and industrial structure in Mexico, and the concluded that IFDI has upgraded the structure of the manufacturing industry. Due to the correlation effect, Markusen (1999) believed that transnational corporations' investment in developing countries could promote their industrial development and structural upgrading.

Since most scholars advocated the positive effect of FDI on the upgrading of the industrial structure, relevant scholars have systematically studied the mechanism of FDI affecting the upgrading of the industrial structure of the host country and formed a

relatively mature theoretical system. The 'two-gap' model was established by Chenery & Strout (1969), the 'three-gap' model was proposed by Hirschman (1970), and the 'four-gap' model was proposed by Harris & Todaro (1970). This theoretical point of view advocated that FDI has the function of 'supplementing the gap' and can provide necessary factor resources for the host country's economic development. Some scholars also summarized the influence of FDI on industrial structure from the perspective of industrial transfer gradient. For example, Akamatsu (1932), based on the summary of the laws of industrial development in East Asian countries, proposed the 'goose-flying industrial development model' and believed that introducing foreign capital could optimize and upgrade the industrial structure. On this basis, Ozawa (2001) put forward the 'Stages of Growth Paradigm'.

Besides, some scholars have focused on the impact of the technological spillover effect of FDI on the industrial development of the host country. The first scholar to put forward the theory of FDI technology spillover was Mac Dougall. Since then, a large number of scholars have begun to pay attention to this field and continue to expand the theoretical depth. Caves (1974) conducted a more comprehensive analysis of the externalities of FDI technology spillovers. He concluded that the realization process of FDI technology spillovers is achieved through the competition, demonstration, and imitation effect among enterprises. Chen (1997) divided the spillover effect of FDI into horizontal and vertical effects. The horizontal effect mainly depends on the competition mechanism, the demonstration mechanism, and the personnel flow mechanism. Javorcik (2004) divided the above mechanisms from the perspective of active spillover and passive spillover. He believed that the imitation and competition effects belong to the passive spillover form of FDI, and the correlation effect of upstream and downstream industries belongs to the active spillover form of FDI.

However, some scholars have come to the opposite or uncertain conclusions. For example, Kokko (1994) found through research that due to over-reliance on FDI, the local enterprises in the host country can easily make the host country fall into the trap of attracting investment and be trapped in the low value-added production links,

which is unfavourable for the long-term development of technology-intensive industries. Hunya's (2002) study on Romania's manufacturing industry shows that FDI has a noticeable driving effect on the development of traditional manufacturing industry, but has little effect on the promotion of high-tech. Zhou et al. (2002) pointed out that FDI reduces the competitiveness of other enterprises in the entered industry but is beneficial to the development of industries other than the entered industry. Griffith and Redding (2004) pointed out that FDI inhibits the technological progress of corporations in the host country, thus harming the upgrading of the domestic industrial structure. Liu (2006) used the data of China from 1988 to 2004 to demonstrate that FDI made China's secondary industry expand excessively and aggravated the unbalanced development of its industrial structure. This can also be proved in the empirical paper of Deng (2015). The research of Vu and Noy (2009) emphasized the spillover effect of FDI, especially advocated that the host country can strengthen cooperation with enterprises in developed countries through FDI and realize the upgrading of the industrial structure of the host country through technological catch-up. However, they also demonstrated that the positive effect of FDI has spatial and industrial heterogeneity. Hule and Stocker (2014) pointed out that the foreign capital attracted by developing countries brought backward industries that were eliminated by developed countries, which hindered the industrial development of these countries in the long run.

There is little literature on the impact of FDI and industrial structure optimization and upgrading in CEE countries. However, there is some literature on the relationship between FDI and sectoral structure. Kippenberg (2005) obtained IFDI can upgrade the industrial structures, by using the data of 18 sectors in Czech Republic from 1993 to 2003. Radosevic et al. (2005) demonstrated the positive effects of FDI on automobile industry’s restructuring, by using descriptive statistical analysis. Pavlínek (2009) studied the automobile industry in the Czech Republic, Slovakia, Poland, and Hungary from 1996 to 2006 and concluded that FDI was beneficial to industrial restructuring and production growth.

It is worth noting that some studies have begun to explore the indicators of industrial structure optimization and upgrading, such as Yu et al. (2020), Liang (2021),

and Liao et al. (2021). They all use different indexes. Moreover, Liao (2021) weighted the rationalization index of industrial structure with another index, which is likely to be wrongly used because the rationalization index of industrial structure should be a reverse index.

Through the review of the above literature, this thesis finds that scholars still have different opinions on the relationship between FDI and industrial structure. The existing research mainly has the following limitations:

1) Most of the studies focus on one country, and very few studies involve a region, and none even focus on CEE EU countries.

2) Previous studies on CEE countries lack unified indicators to measure the industrial structure optimization and upgrading and cannot effectively quantify the impact of inward FDI on industrial structure optimization and upgrading.

3) Previous studies are mainly limited to the national or sectoral level, and few involve the industry level.

Therefore, this paper chooses the Central and East European EU countries as the sample region rather than a specific country and uses the related data from primary, secondary, and tertiary industries to construct comprehensive dependent variables for quantitative analysis. This analysis can make the results more general and may provide a basis for upgrading the industrial structure of the Central and East European EU countries.

1.2 Theories

This thesis defines FDI, industrial structure, and industrial structure optimization and upgrading. Then, it summarizes the theories related to FDI, the theory of industrial structure evolution, the motivation of industrial structure optimization and upgrading, and the theories related to FDI and industrial structure reconstruction.

1.2.1 Foreign Direct Investment Theory

Foreign Direct Investment refers to the long-term investment behaviour of directly participating in overseas asset management and operation with economic profit as the main motive. Compared with international indirect investment, FDI is long-term and strategic. From the capital form, FDI can be physical capital, monetary capital, brand, technology, and other forms of expression. With the deepening of economic exchanges among countries, the significance of FDI for the economic development of countries is no longer limited to the acquisition of economic profits, but gradually developed into an important way for countries to participate in the global industrial division of labour. FDI can be further divided into IFDI (Inward Foreign Direct Investment) and OFDI (Outward Foreign Direct Investment) according to different capital flows. IFDI is capital inflow relative to the host country, and OFDI is capital outflow relative to the home country. The research object of this paper is IFDI.

According to the different motives, FDI can be divided into market seeking, cost seeking, factor seeking, and technology seeking. Market seeking refers to foreign investment activities conducted by enterprises in order to explore foreign markets, expand market share and realize a scale economy. Cost seeking refers to the foreign investment activities conducted by enterprises in order to reduce production costs by taking advantage of cheap factors of production in host countries. Factor seeking refers to enterprises' foreign investment activities to obtain scarce domestic factors of production and break through the resource bottleneck. The technology-seeking type refers to the foreign investment activities carried out by enterprises in order to learn foreign advanced technology.

The theory of FDI mainly came into being in the 1960s. After the end of World War II, with the rapid development and expansion of multinational companies, FDI has gradually become an important form of the global organization of economic activities. The motivation and determinants of FDI by multinational corporations are the core of FDI theoretical research. Many academic schools have formed in the decades since the birth of FDI theory.

1. Theory of Monopolistic Advantage

The Theory of Monopolistic Advantage refers to an international direct investment theory in which firms expand FDI by virtue of their specific monopoly advantages, also known as specific advantage theory. This was the first theory to explain the reasons for the foreign investment of multinational companies from the perspective of monopoly, proposed by MIT Professor Stephen H. Hymer in 1960. He believed that since the real market is not a perfect market with perfect competition, multinational enterprises can take advantage of their foreign investment to form a monopoly position in a larger market and obtain monopoly profits. On the one hand, due to the fierce competition in the domestic market, investing in other countries can reduce competition and increase profits. On the other hand, although they produce similar products, their management capabilities are very different. When some companies have advantages that others do not, this advantage can help them expand their market scope.

After that, in 1970, Kinderberg, who worked in the same school as Hymer, supplemented the advantages of enterprises based on Hymer's research, such as trademarks, management capabilities, and financing channels. Besides, he expounded on the benefits of foreign investment by multinational companies from two aspects. One is to achieve scale advantages in product and factor markets, and the other is to shape the monopoly of product and factor markets. From this point of view, FDI is an enterprise operation behaviour adopted by multinational corporations with particular advantages to construct monopoly advantages further.

This theory replaces perfect competition with imperfect market competition and emphasizes that the foreign investment behaviour of multinational companies is based on the profit maximization motivation choice of consolidating their advantages. Also, this theory separates the FDI theory from the traditional theory in an independent form for the first time. It creates a theoretical precedent for studying FDI from the perspective of corporate profit maximization motivation, which significantly impacts the theory's development. However, the theory is mainly based on analysis and description, with less empirical analysis. Two problems cannot be reasonably explained. First, the theory cannot explain why companies with technological advantages must invest directly

instead of making profits through licensing transactions. Second, the theory does not involve geographical distribution and location selection of multinational corporations operating in host countries. Besides, this theory originated in the United States. Thus, although it can better explain the phenomenon of direct mutual investment between enterprises in western developed countries, it cannot explain the phenomenon of FDI in developing countries without monopoly advantages.

2. The Theory of Internalization

The internalization theory proposed in the 1970s is a new theory to analyse the motivation of FDI, and it is also a development and supplement to the theory of monopoly advantage. This theory regards the external market transactions and internal market management of enterprises as two ways to allocate resources and believes that there are transaction costs in the external market, such as incomplete market and inter-state trade barriers. Enterprises can internalize the external market into transactions between different departments in different regions of the same enterprise through foreign investment to realize the allocation of resources on a global scale. This theory emphasizes that the essence of international direct investment of enterprises is not the international transfer of capital but the international expansion of enterprise ownership and management rights. Besides, this theory better explains why multinational corporations do not sell technology and knowledge as commodities in the international market but profit by establishing new enterprises. The reason is that there will be obstacles for knowledge products to realize the value of their exclusive rights in the external market, so internal marketization is a method to minimize transaction costs, which is also the basic motivation of this theory.

By applying the transaction cost economics pioneered by Coase et al. to the field of FDI, the internalization theory opens up new ideas and new ways to study the theory of FDI. Although the internalization theory is based on the analysis of the incomplete market, it is very different from the theory of monopoly advantage. The theory of monopoly advantage believes that the market’s incompleteness is a prerequisite for enterprises to carry out FDI. In contrast, the theory of internalization believes that the market's incompleteness is caused by the inherent defects of the market mechanism,

which has a deeper understanding and awareness of the incompleteness of the market. The internalization theory considers the behaviour of international direct investment by studying the internal decision-making process and internal operating motivation of multinational corporations, starting from the contradiction between internalization and the market. This breaks through the limitations of comparative advantage investment theory and product life cycle theory in many aspects, which can better explain multi-faceted relationships, such as direct investment and trade barriers, the international division of labour and international markets, the motives of investment transfer between developed countries and developing countries, and multinational corporations transfer pricing phenomenon. However, the internalization theory only explains the vertical integration of international direct investment by multinational companies, but the lack of explanation is the horizontal integration, unrelated diversification, and other investment behaviours.

3. Eclectic Theory of International Production

In 1977, Professor Dunning of the University of Reading put forward the famous international production compromise theory. He summarized the advantages that enterprises can obtain in foreign investment as ownership advantage (O), location advantage (L), and market internalization advantage (I), and believed that these three fundamental factors determine the foreign direct investment behaviour of multinational companies.

Specifically, the ownership advantage (O) of an enterprise refers to the advantages of an enterprise's FDI due to its ownership, such as the scale advantage, management experience, brand reputation, and technological advantage of the enterprise. The location advantage (L) refers to the locational environmental advantage obtained by the enterprise operating in the invested country. The variables that affect the location advantage mainly include natural resources, input prices, investment policies for international transportation costs, etc. This advantage determines the direct external investment in the international production layout. Internalization advantage (I) refers to the advantage that multinational companies have by internalizing the external

market through foreign investment, avoiding unfavourable factors in the external market where they are located, and reducing market transaction barriers.

He further discussed the options for enterprises with different advantages for international economic activities. That is, when an enterprise has ownership advantage but not internalization and location advantage, it should choose the transfer of franchise rights to integrate into the international market. When an enterprise has the advantage of ownership and internalization but not location advantage, it should participate in the international market through foreign trade. When the foreign investment of enterprises has the above three advantages simultaneously, the enterprise can participate in international resource allocation in the form of international direct investment.

The eclectic theory constructs a general theoretical framework of FDI and is the most influential and complete theory of international direct investment so far. It combines industrial organization and comparative advantage analysis at the micro and macro levels. However, since the international production trade-off theory cannot fully explain the diversity of FDI, it is called the 'general theory'. There are four main flaws in the theory. First, Dunning separates ownership advantages as elements, which is not strictly logical and scientific. Second, overemphasis on the existing advantages of FDI. Even if many developing country enterprises do not have the advantages mentioned by this theory at the same time, they have already carried out FDI, and some have expanded the direct investment area to developed countries. This phenomenon shows that the advantages of FDI for enterprises are relative and dynamic and that enterprises can continuously acquire and accumulate advantages in the process of FDI, rather than absolute and fixed advantages as mentioned above. Third, the fundamental analysis is limited in the micro field, and there is no certain height that ignores the close relationship between enterprises and investment countries. Fourth, the theory lacks a unified theoretical basis and research line.

4. The Theory of Product Life Cycle

In 1966, Vernon first proposed the theory of product life cycle in his paper, in which he used the change of product life cycle to explain the motivation, timing and location choice of American multinational corporations' FDI after the war.

The so-called product life cycle refers to the process of changing the position of a product in market competition, which can be divided into three stages: the new product, the maturing product, and the standardized products. Vernon believed that the investment decisions of multinational companies are also different at different stages of the product. When the product is in the initial stage, other developed countries have not mastered the technology of the new product and cannot carry out the corresponding production, so the innovative country sets a high price for the product and sells it in high-income countries and regions. When the product is in the second stage, the mature stage, due to the increasing number of competitors, the market competition becomes increasingly intense, and the price factor plays an increasingly important role in the competition. In order to reduce domestic production costs and better control the market, it is necessary to carry out large-scale production and further expand the market scope to find countries with purchasing power. When the products are in the standardization stage, the products and technologies have been highly standardized and popularized, and the entire international market structure has changed from a monopoly and oligopoly to a competitive market. Price becomes the only determinant in market competition, and production costs determine the market share of enterprises. The critical point is that at this time, enterprises will choose to produce in developing countries and other regions with cheap production factors and import this product to meet domestic demand.

Product life cycle theory integrates factor endowment theory and international trade theory and accurately expresses when developed countries are more favourable for foreign trade, technology transfer, and foreign investment. However, this theory also has two main limitations. One is that it cannot explain the behaviour of many multinational corporations that conduct R&D, production, and sales in the host country from the beginning. The other is that it cannot explain the phenomenon of mutual investment between developed and developing countries very well.

1.2.2 Theory of Industrial Structure Evolution

With the in-depth development of the social division of labour and the level of production specialization, a collection of enterprises engaged in similar production and operation activities constitutes an industry, which is a meso-economic category between the individual micro-level of enterprises and the national macro-level. The industrial structure includes three aspects. From the perspective of resource input, it refers to the allocation status of production factors among industries. From the point of view of quantity, it refers to the quantitative proportional relationship between the various industries. From the quality point of view, it refers to the difference in each industry's output capacity and technical level.

The evolution of industrial structure means that the structure and content of industry change constantly in economic development. Some theories hold that the evolution of industrial structure has regularity.

1. Petty-Clark Law

William Petty, a classical Chinese, and British economist, put forward in his representative work *Politics Counts* that among the three industries of commerce, manufacturing and agriculture, the income of commerce is the highest, followed by manufacturing and agriculture the least. The income difference among the three industries drives the labour force to flow from low-income to high-income sectors.

Based on the research, Clark revealed the internal relationship between the level of per capita national income and the evolution of industrial structure through statistical analysis. The Petty-Clark law took Fisher's three-industry classification method as the analytical framework, collected, and organized the time data of labour input and total output in more than 20 countries, and pointed out that with the economy's development raising the level of per capita income, the labour force will transfer from primary industry to secondary industry and then transfer to the third industry. There are two main reasons for this pattern of industrial development. The first is that the products produced by the primary industry are necessities of life. After the income reaches a certain level, the consumer demand for the products of the primary industry does not increase synchronously with the increase in income. The income elasticity of demand decreases, so more income and labour flow to the secondary or tertiary industries.

Secondly, due to the long production cycle of the primary industry, the slow progress of production technology, and the lower return on investment than the secondary industry, social capital prefers to invest in the secondary industry, which further promotes the development of the secondary industry.

Petty Clark's law research on the evolution of industrial structure has three main characteristics. First, take the three-industry classification method as the basic theory. Second, based on the research on time series data, study the changes in the industrial structure of some countries over time. The per capita national income level has been continuously improved during this process. Third, the distribution in each sub-industry measures changes in the industrial structure.

2. Kuznets Law

Based on inheriting the theoretical research of Petty Clark and others, the American economist Kuznets conducted further research on the law of labour transfer in the 1960s. He replaced the previous primary, secondary, and tertiary industries with agriculture, industry, and service industries based on the differences in the degree of dependence on resources and the types of demands of different industries in production. Using the modern economic statistics system, he further analysed the relationship between industrial structure change and economic development from labour industry distribution and national income. Then he concluded that as the economy grew, the share of income from the agricultural sector in national income and the share of people employed in agriculture in the labour force continued to decline. The industrial sector's share in national income continues to rise, while the share of service sector revenue in national income was unchanged or slightly increased.

3. Binary Structure Theory

Lewis (1954) elaborated on the ‘two-sector development model’ in his paper and proposed that both the traditional agricultural system and the modern industrial system exist in developing countries, namely the ‘dual economic structure’.

The agricultural sector has limited arable land, a large population, and many surplus labours with zero marginal output. However, the industrial sector is expanding faster than the population, so labour productivity and wages are lower in the agricultural

sector than in the industrial sector. Thus, the difference in wage level promotes the labour force to transfer from the agricultural sector to the industrial sector until the marginal productivity of labour and the wage level of the two sectors are equal, and the dual economic structure is gradually transformed into the unitary economic structure.

The transfer of rural labour to non-agricultural industries is divided into three stages. In the first stage, agricultural surplus labour with zero marginal output is transferred to the industrial sector. The transfer of this part of the agricultural labour force will not impact the total agricultural output. In the second phase, the labour force whose marginal output is not zero but cannot meet its own consumption needs starts shifting to the industrial sector. Since the marginal output of this part of labour is not zero, the labour transfer reduces the production of the agricultural sector, increases the price of agricultural products, and increases the cost of industrial production, which hinders the further expansion of the industrial sector and the absorption of surplus rural labour. At this stage, the total agricultural output must be increased by improving agricultural labour productivity. When the food shortage is passed, this part of labour continues to transfer to the industrial sector until the surplus labour is completely transferred. In the third stage, the movement of Labour between the two sectors depends on competitive wage rates. The two sectors can support each other and develop together. On the one hand, the agricultural sector raises raw materials for the development of the industrial sector. On the other hand, the industrial sector feeds on agriculture and provides machinery and technology for agricultural development, transforming traditional agriculture into modern agriculture.

4. Unbalanced Growth Theory

In 1958, American economist Albert Hirschman put forward unbalanced growth theory in his book *Economic Development Strategy*.

From the perspective of resource scarcity, this theory holds that the resources of developing countries are limited, and it is impossible to develop all industries simultaneously. Therefore, strategic industrial sectors with solid industrial correlation should be preferred for investment, and the leading sectors with priority development can drive the development of other industries through industrial correlation.

Unbalanced growth theory proposes the famous "chain effect, " including forward, backward, and side linkage.

1.2.3 The Connotation and Motivators of Industrial Structure Optimization and Upgrading

This part will first introduce the connotation of industrial structure optimization and upgrading, and then discuss its driving factors from the perspectives of supply, demand, international and institutional.

Industrial structure optimization and upgrading means improving the level and efficiency of industrial structure through industrial adjustment. The purpose is to optimize the national economic benefits and evolves in the direction of benefit promotion, technological progress, and coordinated development. It is a dynamic process in which the industrial structure gradually becomes more reasonable and continuously upgraded. Therefore, mainstream economists believe that industrial structure optimization and upgrading include the process of industrial structure upgrading and the process of industrial development rationalization.

The advancement of industrial structure refers to the trend and process that the overall quality and efficiency of industrial structure evolve from low level to high level on the basis of following the evolution law of industrial structure and constantly improving the technological innovation ability of industrial development. The advancement of industrial structure is primarily reflected in two aspects. From the perspective of resource allocation and utilization, industrial structure advancement is a process in which emerging industries replace sunset industries, and production factors constantly flow from inefficient to efficient sectors. From the perspective of demand, the improvement of the living standard increases people's demand for products of secondary and tertiary industries, and the industrial structure advancement in line with the demand is manifested in the increasing proportion of secondary and tertiary industries in the economy.

The rationalization of industrial structure refers to the adjustment of relevant elements of the initial industrial structure, so that the industrial structure tends to be

reasonable in a specific stage, and finally realize the effective utilization and reasonable allocation of resources among industries. Namely, it refers that different industries and departments within the industry should gradually coordinate and promote each other, so that the development of each industry is in step with the development of the whole national economy. Judging whether a country's industrial structure is reasonable must be based on the actual situation. There are three basic criteria. Are existing resources being used reasonably and effectively? Does it meet the needs of the market? Is there a coordinated ratio between industries? If the industrial structure does not meet rationalization requirements, it is necessary to further coordinate the industrial structure so that each economic variable changes in a particular direction. This coordination mainly includes the coordination in the rationalization process, the coordination of the relative position of each industry, and the coordination of the industrial quality.

The rationalization of industrial structure and the advancement of industrial structure are inseparable. The advancement of industrial structure is embedded in the rationalization of industrial structure, emphasising the adjustment process of the leading industry from low-efficiency to high-efficiency. However, without rationalization, the advancement can only be a ‘pseudo-advancement’. At this time, the industrial structure advancement can promote the industrial structure rationalization at a higher level. The industrial structure advancement focuses more on the long-term benefits of economic development, and the industrial structure rationalization focuses more on the current benefits. The relationship between rationalization and advancement should be that advancement drives rationalization, and rationalization promotes advancement.

Actually, in different historical development periods, the content of industrial structure optimization and upgrading is different. The basic goal of industrial structure optimization is always to optimize the resource allocation of a country or a region, maximize the macroeconomic benefits, coordinate the national economy's supply and demand structure and promote sustained and rapid economic growth. But strictly speaking, the industrial structure optimization does not require the national economy supply and demand structure to reach equilibrium ultimately, but the process of

approaching the "optimal goal" under particular historical background and national conditions.

After understanding the connotation of industrial structure optimization and upgrading, this section will continue to discuss the driving factors of it.

Firstly, this thesis considers the motivation of industrial structure optimization and upgrading from the perspective of supply factors. The fundamental production factors such as capital, technology, and labour force are regarded as the supply factors of industrial structure adjustment in this paper.

The labour force is an indispensable actor in participating in, organizing the production of factors, and promoting industry development. Countries with abundant labour can reduce labour costs, give full play to the advantage of "demographic dividend", replace other production factors with a cheap labour force, and promote the development of labour-intensive industries. Besides, the improvement of labour skill level, that is, the improvement of human capital level, can accelerate the conversion efficiency of various production factors into output, which provides the possibility for the high-level and high-efficiency development of the industry.

Capital is the essential element of large-scale industrial development. Marx emphasized the critical role of capital in social reproduction in *Das Kapital*. The allocation of capital among industries determines the pace of industrial development and the level of the industrial structure of a country. The emergence of emerging industries and the expansion of mature industries need the necessary support of capital accumulation, and the exit of backward industries also needs the corresponding capital transfer. Therefore, the direction of capital allocation is essential in determining the optimization and upgrading of industrial structure.

The introduction of foreign capital not only provides capital for industrial development but also upgrades the industrial structure by promoting technological progress. On the one hand, the technological level is reflected in the input-output efficiency of production factors, which promotes the adjustment and flow of labour, capital, and other factors among different industrial sectors, thus changing the industrial structure. On the other hand, technology can also be manifested in initiating and

improving new forms of business and modes of production, which helps improve production efficiency and is a crucial driving force for optimizing and upgrading a country's industrial structure.

Although production factors are the basis of industrial development, the rise, maturity, and decline of the industry embody social needs. Therefore, demand factors guide the direction of industrial structure change, and adapting to and meeting social needs is the goal of industrial structure optimization and upgrading. Therefore, the next step is to consider the driving force from the perspective of demand.

According to the different consumption subjects, consumption demand can be divided into resident consumption demand, enterprise production consumption demand, and government consumption demand, namely government purchase demand. Improving the national income level and accumulating national wealth can stimulate the total increase in consumer demand. The change of consumption structure often comes from the impact of new consumption products and new consumption modes, which leads to the change of industrial development direction and industrial development mode.

The production demand of enterprises is the investment. By changing the allocation ratio of new production factors, the investment affects the direction of industrial development and promotes industrial restructuring. Regional differences in investment will also affect regional industrial layout.

Government purchase is the reflection of government consumption demand. Generally speaking, the government’s financial input in education, public health, and public infrastructure can be regarded as public goods provided by the government for citizens, which is an important aspect of government functions. Government purchase is an important source of funds for developing industries with public service attributes, such as the education industry and public health.

Then, this thesis considers the motivators of industrial structure optimization and upgrading from international factors. Under the tide of globalization, national economic development and industrial restructuring are no longer the result of the internal cycle of the national economy but also the external cycle of the international

economy. International trade and international investment provide the main way for countries to integrate into the global industrial chain and profoundly change each country's industrial development layout.

International trade includes import and export. Export can be regarded as the demand from the international market. The change of export quantity and the structure's adjustment directly impact the domestic industry's development layout. Import can increase domestic industrial competition, create industrial demand, and promote the improvement of domestic industrial technology.

Besides, the expansion of the international investment scale has become an essential factor affecting the adjustment of the industrial structure. Foreign capital often makes up for the shortage of capital and technology in the early stage of industrial development in the latecomer countries and is an important force in promoting the economic start of the latecomer countries. Thus, foreign investment is an important means for domestic industries to seek production materials and product market space from the external market, which can prolong the domestic industrial chain, realize the optimal allocation of factor resources from the global perspective, and realize the optimization and upgrading of industrial structure.

Similarly, institutions are also an essential factor affecting industrial development and reform and a significant driving force for industrial structure optimizing and upgrading. First, the institutional arrangement changes the incentive mechanism and then affects the resource allocation process in industrial development. Under the resource allocation mode dominated by the government, industrial development is more subordinate to the national interests, while under the resource allocation mode dominated by the market, industrial development is more diversified and efficient. Second, suitable institutional arrangements provide a stable, fair, and efficient operating environment for enterprise production, factor agglomeration, and technological progress and thus improve the efficiency of industrial structure optimization and upgrading.

1.2.4 Theory of the Relationship Between FDI and Industrial Restructuring

One reason investment plays a vital role in industrial restructuring is that it can form actual demand, and the other reason is that it can create new production capacity. The above two factors contribute to new demand and industries in the society, thus changing the original industrial structure. The invested industries will grow faster than uninvested industries, thus changing the existing industrial structure. Therefore, the most direct reason that affects the original industrial structure is the distribution of capital invested in the industrial part. Therefore, FDI, as the backbone of regional economic investment in fixed assets, its investment mode and direction significantly affect the process of industrial restructuring in the host country. Based on the above reasons, it is significant to systematically analyse the theory of foreign direct investment and industrial restructuring.

1. Population and Resource Endowment Theory

In the initial stage of industrialization, resource endowment directly affects the industrial structure of a country. A comparative analysis of the history of industrial structure development in various countries shows that resource endowment is the condition for industrialization and economic growth in most countries. Resource endowment greatly influences and functions in the early and middle stages. When the manufacturing industry replaces the production advantage of primary products, its role and influence will tend to shrink when the initial stage is transitioning to the middle stage. At this time, there is a positive correlation between labour quality and industrial structure. Under skilled labour and a high level of management ability, the marginal capital-output ratio is higher, and the same amount of capital will produce more output than before.

FDI can change the initial endowment conditions of the host country and accelerate the evolution of industrial structure by increasing the stock of capital factors in the host country. At the same time, it can bring advanced enterprise management and staff training to the host country, improve the quality of workers, and optimize and upgrade the industrial structure of the host country.

2. Gap Theory

Chenery and Strout (1966) proposed the ‘double gap model’ in the 1960s. This model is derived from Keynes's aggregate supply and aggregate demand theory, which has become a typical theory that developing countries should make rational use of foreign investment. According to Keynes’s equilibrium theory of aggregate supply and aggregate demand, $C + I + X = C + S + M, I - S = M - X$, in which ‘saving gap’ means that savings is less than investment, and ‘foreign exchange gap’ means that the amount of imports is smaller than the amount of savings. The research shows that due to the structural rigidity of the host country, its early economic development is restricted by the lack of domestic resources, and there is usually a ‘foreign exchange gap’ and ‘savings ap’. Therefore, FDI can remedy the ‘foreign exchange gap’ and ‘savings gap’, promote the development of emerging industries, and improve national economic income. The ‘double gap’ theory also emphasizes that enterprises’ overseas investment is an independent choice under the profit motive. It mainly studies how developing countries effectively utilize foreign capital in the face of insufficient resources and an imbalanced economic structure. The shortcoming of this model is that it does not give a reasonable explanation for the technology, management, and other aspects that affect investment

Based on the theory of the ‘double gap’, Hirschman discussed the importance of making up the ‘technology gap’ for developing countries to optimize industrial structure and sustain sustainable and rapid economic growth and put forward the theory of ‘three gaps’. Later, American scholar Todaro proposed that FDI could make up for the foreign exchange and savings gaps and the ‘government tax gap’ and ‘production factor gap’, thus drawing the ‘four gaps’ theory. These theories all believe that developing countries’ development cannot fill the above gap in a short period, but by attracting foreign capital, the gap of advanced technology and high-level management talents can be filled, thus promoting the development of domestic industries.

3．Theory of Flying Geese

This theory was put forward by Kaname Akamatsu, a Japanese scholar, in the 1930s. He summarized the process of foreign investment introduction and domestic

industry cultivation as a circular development model of 'foreign introduction - domestic development - product export'. Through the introduction of FDI, the domestic industry can learn from the industrial development experience of developed countries, take advantage of the industrial development advantages of foreign capital, accelerate the development level of domestic industry, and achieve export after forming comparative advantages, thus realizing the whole process of promoting industrial upgrading with the help of foreign capital.

The 'flying geese' pattern appears first in the consumer goods industry because of its low added value, then in the production industry, and finally in all manufacturing industries. The core of the 'flying geese model' is the theory of dynamic industrial transfer. With the investment of foreign capital and the improvement of the degree of industrialization, an industry will continue to develop and then decline, and the industry will be transferred to a lower tier of countries. This kind of industrial upgrading is achieved by giving play to complementary advantages. The main force driving the 'flying geese' change is the transfer of the industries to be invested in countries with resources and technology.

Akamatsu's ultimate goal is to reveal that the industrial development model of developing countries is a kind of 'catch-up', and explain how developing countries realize the process of the industrial structure upgrading by participating in the international division of labour. Nevertheless, the scope of the echelon is limited. In the long run, this pattern is inevitable to break. The major drawback of this model is that for developing countries, the flying geese model is not an innovation model but only a catch-up model, with great uncertainty. Besides, the flying geese mode is easy to cause the capital shortage of the invested countries.

4. Marginal Industry Expansion Theory

Kiyoshi Kojima proposed the theory of marginal industry expansion in the 1970s. This theory is based on the theory of resource endowment advantage, and the main content is that the comparative cost difference between the investor country and the host country widely exists in terms of resources, technology, market, and other aspects.

According to Kiyoshi Kojima, marginal industries are at a comparative disadvantage, and most are labour-intensive industries. The host country has a comparative advantage in labour-intensive industries. In this way, the investing country can transfer labour-intensive industries to the host country, thereby reducing marginal production industries and concentrating superior resources in superior industries. At the same time, the host country can transform its comparative advantages into reality by introducing advanced technology and management methods and providing more employment opportunities, which is conducive to the host country's social stability and economic development. In this process, the investor country not only developed the superior industries of the host country but also gave full play to its own comparative advantages. Both sides adjusted and optimized their industrial structure while realizing trade volume growth.

According to Kiyoshi Kojima, the hierarchy of the industrial structure transferred to developing countries is determined by the hierarchy of the industrial structure of the multinational companies themselves and the degree of comparative advantages and disadvantages, while comparative interests determine whether the multinational companies carry out foreign direct investment. Therefore, this theory can explain the reasons and industries for FDI in developing countries. However, it only takes the investor country as the object and does not consider the initiative of multinational corporations, which is inconsistent with the reality of negative investment from developing countries to developed countries and horizontal investment among developing countries.

5. The Theory of Dynamic Comparative Advantage

Based on Akamatsu's 'Flying Geese Theory', Japanese economist Ozawa (1992) proposed the theory of dynamic comparative advantage. The key to this theory is that different characteristics of global economic structure affect the economic operation, especially investment.

The characteristics of global economic structure include:

1) The bureaucratic structure of the economic development level is obvious;

2) The upgrading and development of the economic structure of all countries have corresponding steps and stages;

3) There are differences between the demand side and the supply side within each economic entity;

4) Enterprises are the creators and traders of intangible assets;

5) There is a tendency in the policies of various countries to turn inward to outward.

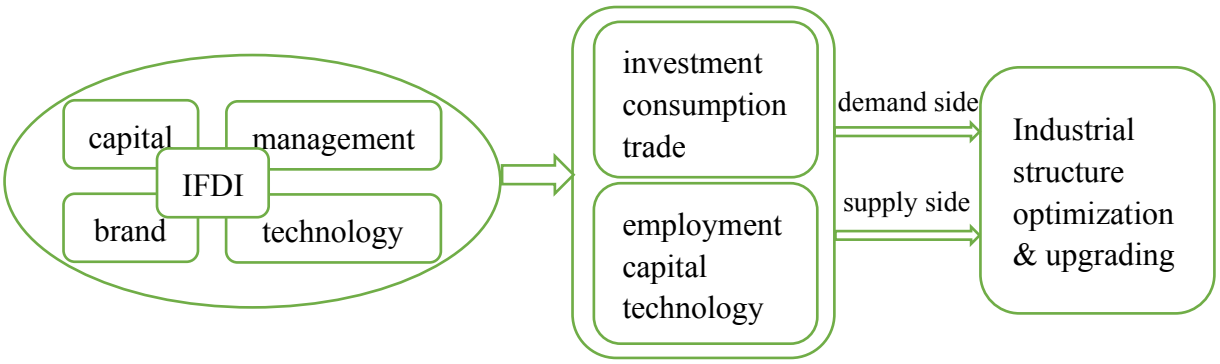
The first characteristic shows that the speed and form of utilizing foreign capital and investment depend on the difference in economic development level. The second characteristic indicates that accumulating foreign capital utilization and investment experience will gradually upgrade a country's industrial structure. The industrial upgrading of each stage is determined by its comparative advantages, and specific factor endowments and technical capabilities correspond to it. It attempts to explain how FDI can best upgrades industrial structure and economic growth in countries at different stages of economic development. Finally, it concludes that the choice of FDI must be compatible with the country's development stage, and the FDI mode should be an orderly flow of capital, corresponding to the change of economic structure. In the factor (resource and labour) driven stage, the FDI attracted by the country is mainly labour-oriented or voluntary-oriented. In the transition from labour to investment, FDI is mainly absorbed in capital goods and intermediate goods. “In countries that transition from investment-driven to innovation-driven, FDI is mainly absorbed in technology-intensive industries.”

Ozawa’s view is that the key for developing countries to catch up with developed countries and achieve economic success lies in exploiting and exploiting the externalities provided by the bureaucratic structure of economic development, which provides developing countries with the opportunity to inherit and learn from the technology and knowledge transfer by developed countries.

1.3 Mechanism Analysis of IFDI and Industrial Structure Optimization and Upgrading

Compared with international indirect investment, FDI has a strategic operation. Therefore, when investigating the influence of FDI on the optimization and upgrading of industrial structure, this thesis considers FDI as a 'basket' investment portfolio that integrates capital, technology, management, and brand from the perspective of FDI's multidimensional attributes. Multinational corporations are the main carriers of FDI. By inducing the correlation effect and competition effect through transnational corporations, the demand-side factors, such as investment, consumption, trade, and the supply-side factors, such as employment, technology, and capital, are changed to affect the optimization and upgrading of the industrial structure of the host country. Thus, this section will follow the logical route of 'FDI- supply and demand structure - industrial optimization and upgrading' (as shown in Fig.1), and discuss how FDI affects industrial structure optimization and upgrading through investment, consumption, trade, employment, capital, and technology channels.

Figure 1: Influence mechanism of a 'basket' of factors



1.3.1 IFDI Affects Industrial Structure Optimization and Upgrading Through the Demand Side

As shown in Figure 1, there are investment, consumption, and trade factors on the demand side. Therefore, this section looks at the influence of IFDI on industrial structure optimization and upgrading through these three factors in turn.

First, this section will explore how IFDI affects the optimization and upgrading of industrial structure by changing investment. The greenfield investment and the M&A (Mergers and Acquisitions) investment are the main investment methods of FDI. Greenfield investment can directly promote the increase of investment in specific industries of the host country and further indirectly drive the development of upstream and downstream industries and the increase of investment demand in the host country through the industry correlation effect. Although M & A investment cannot directly expand the production capacity of the host country and increase the new investment flow, the competition effect caused by M & A investment can improve the subsequent investment in related industries.

The influence of FDI on the optimization and upgrading of the industrial structure of the host country mainly depends on the direction of FDI. If FDI flows to the emerging industries of the host country, it can directly fill the investment gap in the development of the emerging industries of the host country. This can exert the industry correlation effect and competition effect, activate the investment inflow of the host country's emerging industries, and then promote the development of the host country's emerging industries from naive emerging industries to leading industries. If FDI flows to the leading industries with mature development and certain comparative advantages of the host country, it may lead to overinvestment within the industry. Suppose FDI obtains preferential policies to attract investment and has 'natural advantages' in competition. In that case, FDI inflow can 'crowd out' domestic industries, cause bankruptcy of enterprises in the host country, 'brand engulf', etc. Therefore, it will hinder the growth of emerging industries and brand cultivation in the host country, and is not conducive to industrial optimization and upgrading in the host country. Suppose FDI flows to industries that the host country does not encourage to develop, or industries that do not conform to the direction of optimization and upgrading of the host country's industrial structure. In that case, it will often lead to a 'low-end lock-in' of relevant supporting factor resources of the host country, which is not conducive to the optimization and upgrading of the host country's industrial structure. The legal system of developing countries is often not perfect in the early stage of development, and

developed countries usually choose to transfer highly polluting industries to developing countries to avoid environmental pollution regulation. As a result, developing countries have become pollution havens. In this case, FDI not only destroys the natural environment of developing countries, but also hinders the development of green industries.

Then, this thesis will discuss how IFDI affects the optimization and upgrading of industrial structure by changing consumption. FDI can change the scale and structure of household consumption and government purchase and affect the optimization and upgrading of industrial structure. Consumption is mainly affected by income, and the impact of FDI inflow on residents' income is complex. If FDI can create or maintain the employment level of the host country, it will improve the income of the host country's residents. However, the creation of new positions usually comes from replacing the original jobs, resulting in the loss of employment opportunities for low-skilled labour, thus leading to the decline of residents' income level and consumption ability. Low-end lock-in of product market demand is not conducive to optimizing and upgrading industrial structure. FDI inflow affects the host country's fiscal taxation, changes the public consumption power, and then impacts the product market demand capacity and demand structure, affecting the optimization and upgrading of the host country's industrial structure.

Besides, FDI brings new brands and products to the product market of the host country, which can directly affect the product demand of the host country, drive the rise of diversified and diversified product demand, change the consumption demand structure of the host country, and affect the optimization and upgrading of the industrial structure of the host country.

The next step is to discuss how IFDI affects the optimization and upgrading of industrial structure by changing consumption. From the perspective of international market demand, export and import are important aspects that affect the optimization and upgrading of domestic industrial structure. The inward FDI further promotes international trade and capital flow, strengthening the connection between the international market and the economic development of host countries.

Suppose FDI flows to the strategic emerging industries of the host country. on the one hand. In that case, FDI can promote international cooperation, improve the innovation level of the emerging industries, expand the international perspective, accelerate the agglomeration of factors and resources needed to promote the development of the emerging industries of the host country, and promote the development of the emerging industries of the host country. On the other hand, FDI connects the host country with the international market, expands the market space of the host country, and contributes to the growth of emerging industries in the host country. If FDI flows into the backward industries of the host country, it will expand the scale of the international market and attract more domestic resources to backward industries. The 'low-end lock-in' of factors will slow down the pace of industrial structure optimization and upgrading of the host country.

1.3.2 IFDI Affects Industrial Structure Optimization and Upgrading through the Supply Side

This paper regards employment, capital, and technology as supply-side factors, and will discuss how IFDI affects the optimization and upgrading of industrial structure through these three factors.

First, IFDI influences the optimization and upgrading of the industrial structure of the host country by changing the quantity and quality of employment. From the perspective of employment quantity, on the one hand, greenfield investment can not only directly create jobs for the host country but also indirectly expand the employment scale of upstream and downstream industries through the correlation effect and competition effect, realizing 'job creation'. On the other hand, FDI can affect 'employment transfer'. For example, FDI acquisition of enterprises on the verge of bankruptcy in the host country can save workers who are about to lose their jobs. Besides, FDI can harm the number of employments in the host country through the 'employment loss' effect and the 'employment crowding out' effect. The entry of FDI improves the industry's competitiveness and compresses enterprises' profit space. Enterprises in the host country have to reduce labour costs by downsizing, and even

some enterprises in the host country are forced to close down and exit the market. Therefore, FDI entering the host country causes ‘employment loss’ and ‘employment crowding out’ effects. From the perspective of employment quality, FDI can bring international management concepts, promote transnational talent exchange, improve the human capital level of the host country, and provide talent support for the advanced industrial structure of the host country.

IFDI can also affect the optimization and upgrading of industrial structure by changing capital accumulation. In the short term, FDI directly replenishes the foreign exchange reserves of host countries and helps alleviate the capital shortage in developing emerging industries in host countries. In the early stage of opening and development, most developing countries actively introduced foreign capital to compensate for the lack of capital accumulation in domestic industrial development. In addition to physical capital, FDI inflow is often accompanied by the inflow of other capital goods such as patented technology and production equipment, which provides essential basic elements such as physical capital and technological capital for cultivating emerging industries in host countries. Therefore, FDI influences the optimization and upgrading of the industrial structure by influencing the accumulation of physical and technological capital in the host country.

However, in the long run, the return of FDI to investment will negatively impact the host country’s capital accumulation. On the one hand, FDI divestment can directly reduce the capital accumulation of domestic industrial development. On the other hand, the repatriation of investment income has a direct negative impact on the capital account of the host country. Therefore, the return of FDI has a more significant impact on the development of foreign-led industries in the host country.

Also, IFDI can change the industrial production efficiency of the host country through technology spillover effect and become an important force to optimize and upgrade the industrial structure of the host country. Enterprises in the host country have two ways to use the technological advantages of FDI. One is the direct replication of FDI technology, which is helpful for the host country to improve the technological level quickly, but not conducive to the cultivation of independent technological

competitiveness of enterprises in the host country. The other is the 'digesting, absorbing and improving' of FDI technology. Although it requires a long period and a large amount of talent, capital, and R&D investment, it is conducive to the formation of competitive technological advantages of the host country. FDI technology spillovers can affect the industrial development of host countries due to the correlation effect and competition effect between industries and enterprises. On the one hand, new technologies in FDI change the utilization efficiency of various production factors resources in the host country, thus changing the allocation ratio of resources and causing changes in industrial structure. On the other hand, FDI technology spillover can reduce production costs and drive product prices down. At the same time, the improvement of technology level can effectively improve the quality and performance of products, promoting the increase of product demand and the rapid development of related industries.

Although IFDI has a technology spillover effect, some scholars believe that the technology transfer of IFDI does not play a prominent role in improving the technological competitiveness of the host country and even has a crowding out effect on the independent innovation ability of the host country to some extent. First, IFDI can absorb the employment of high-quality talents in the host country, which is equivalent to the loss of human capital for local enterprises and is not conducive to the technological progress of local enterprises. Second, IFDI has a first-mover advantage in technology and can form technological barriers through patent registration and other ways to hinder technology diffusion. Third, IFDI's technology export to the host country will cause local enterprises to rely on technology, which is not conducive to cultivating the host country's independent innovation ability. In addition, the technology spillover of FDI is subject to the conscious technology protection of multinational corporations and has strategic selectivity. In order to realize 'technology blockade' and 'technology monopoly', FDI involving core technologies often adopts the way of the sole proprietorship.

2. Descriptive Analysis of IFDI and Industry Structure in CEE EU Countries

This thesis uses NACE industry classification, which is the classification of economic activities in the EU, as industry classification standard. Appendix 1 shows the correspondence between the three industries and NACE.

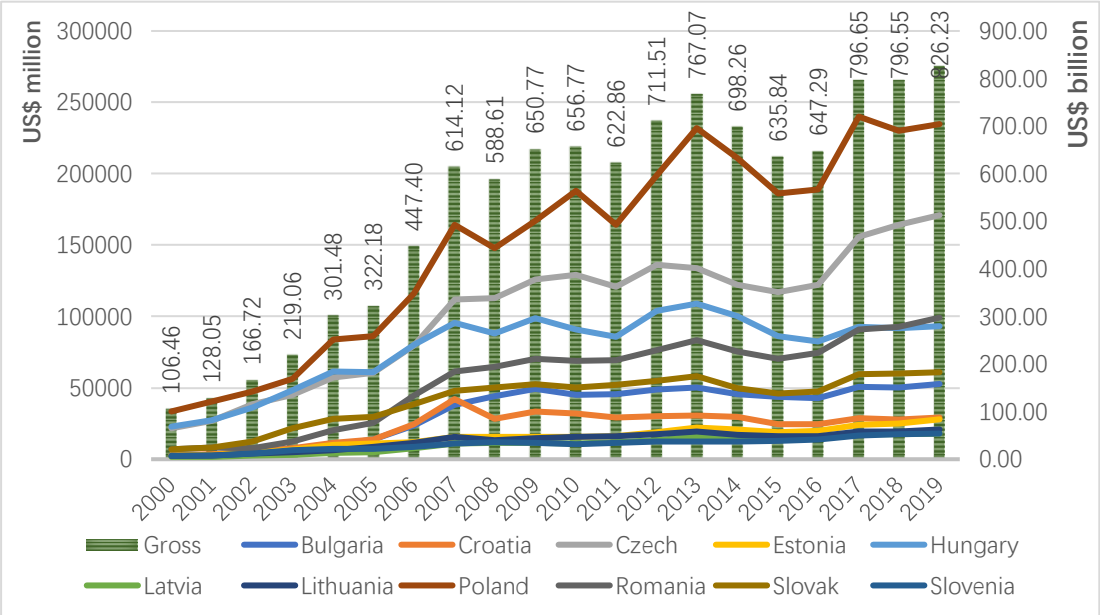
2.1 Analysis of IFDI in CEE EU Countries

This section analyses the overall size and source of IFDI inflows from CEE EU countries and the industrial distribution of IFDI.

2.1.1 An Overview of the Total IFDI

As shown in Figure 2, the inward FDI stock of the CEEEUs showed an overall increasing trend from 106.46 billion in 2000 to 826.49 billion in 2019, reaching the highest level in 2019. Although inward FDI stock in CEE EU countries fluctuated between 2000 and 2019, FDI has become the main driver of capital growth in these countries. Specifically, the country attracting the most FDI among the 11 countries is Poland, followed by the Czech Republic.

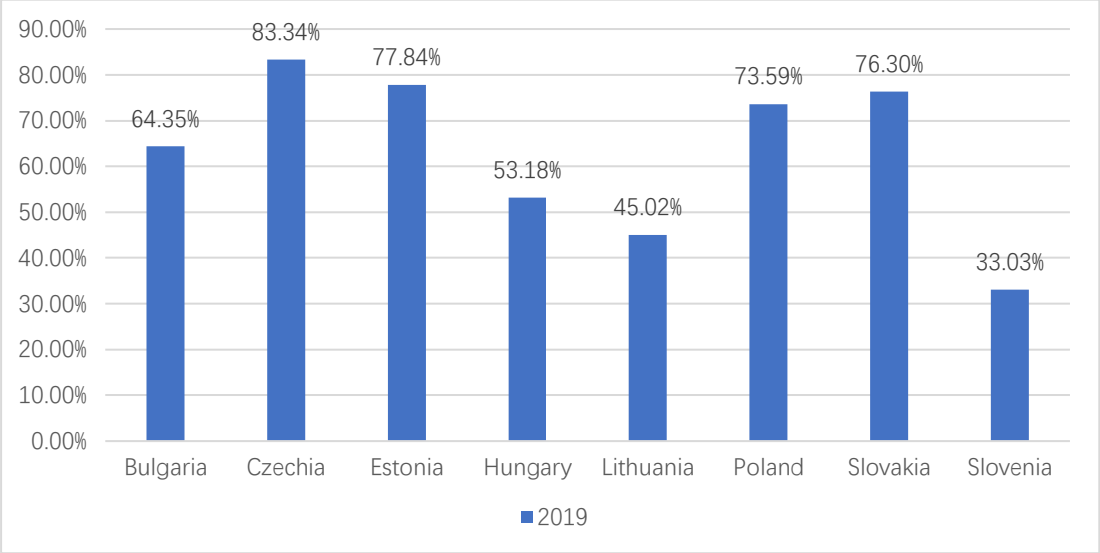
Figure 2: Inward FDI stock in CEEEUs as a whole and by country



Source: UNCTAD stat

Furthermore, most of inward FDI to the region come from the old EU member states (EU-15). As shown in Figure 3, more than 70% of FDI in the Czech Republic, Estonia, Poland, and Slovakia comes from the EU-15 in 2019. The old EU members are relatively developed, so the foreign capital introduced may contain relatively high technical content. If the CEE EU countries have sufficient capacity to absorb technology spillovers, then the direct investment from EU-15 countries is likely to optimize and upgrade the industrial structure in the CEE EU countries.

Figure 3: The ratio of inward FDI in CEEEUs coming from the EU 15 in 2019



Source: wiiw Databases

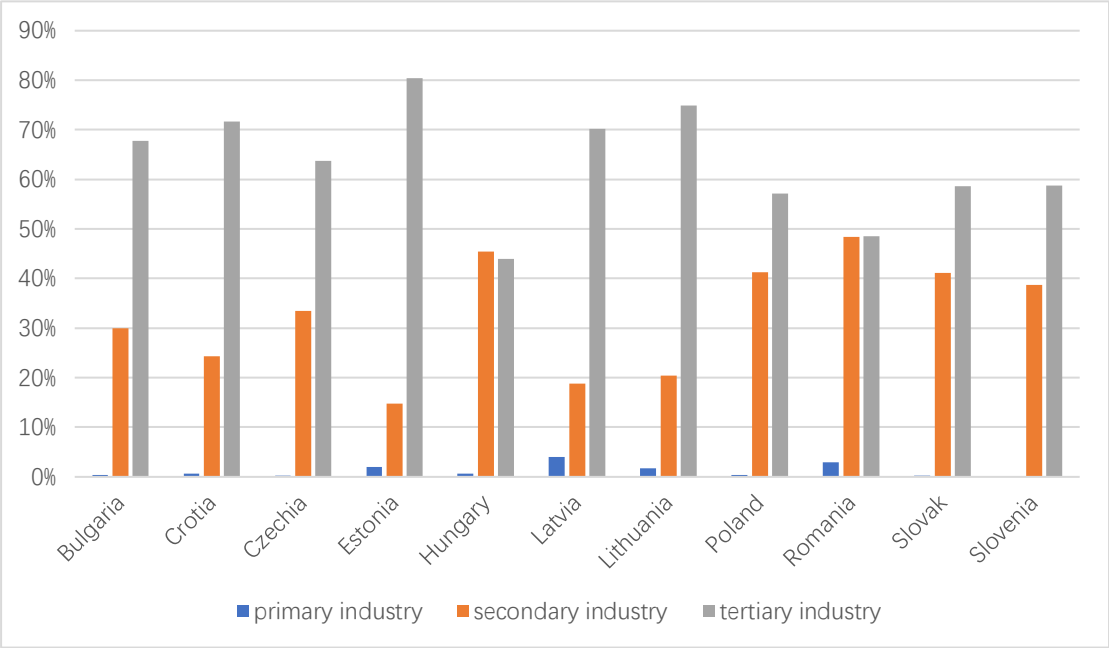
Note: Data for Croatia Latvia and Romania is missing.

2.1.2 Analysis of Industrial Distribution of IFDI in CEE EU Countries

As can be seen from Figure 4, in general, among the three major industries, CEEEU countries attract less FDI in the primary industry and the most FDI into the tertiary industry. But Hungary's inward FDI into the secondary industry slightly outnumber that into the tertiary industry, and Romania's inward FDI into the tertiary industry is only 0.062% more than that in the secondary industry.

Besides, among the 11 countries, Estonia attracts the least and Romania attracts the most FDI from the secondary industry, with 14.77% and 48.47% respectively. The FDI of the tertiary industry attracted by Hungary and Estonia accounted for the smallest and largest share, respectively, with 45.47% and 80.45%.

Figure 4: Inward FDI stock by industry in CEEEUs in 2019



Source：Calculated based on data from the wiiw Databases.

2.2 Analysis of Industrial Structure in CEE EU Countries

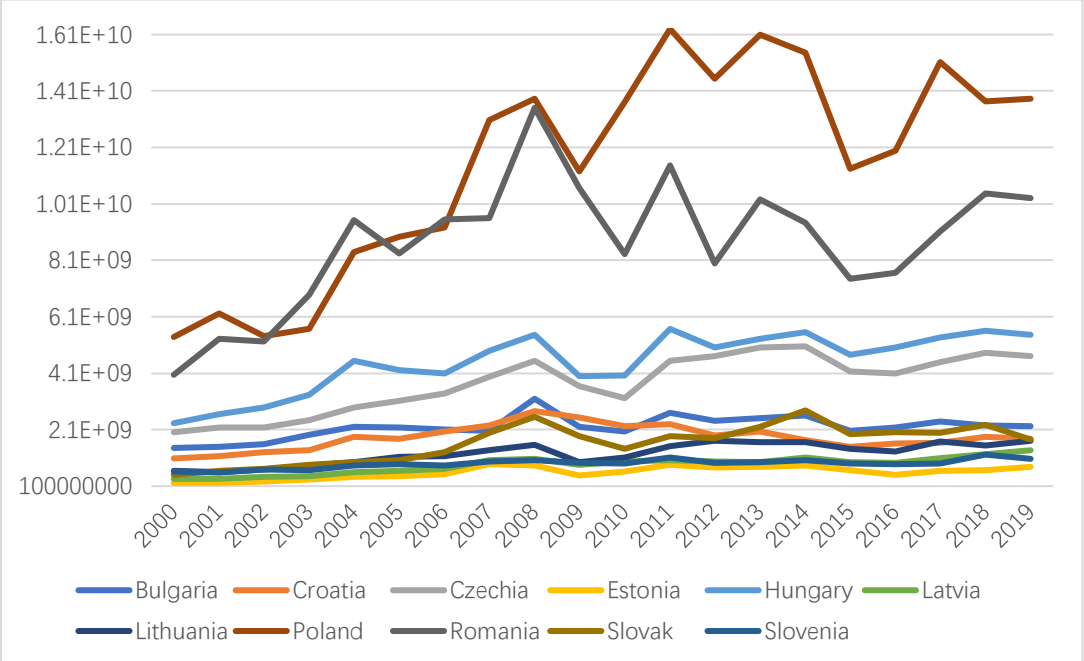
This part will be analysed from four aspects: output value added, industrial employment structure, industrial structure deviation degree and industrial structure hierarchy coefficient.

2.2.1 An Overview of Output Value Added

The primary industry is the basic industry on which human beings depend for survival and the foundation of national economic development. The economic development of all countries in the world through the ages shows that the development of social production begins with agriculture first, followed by the innovation and development of industry and service industry.

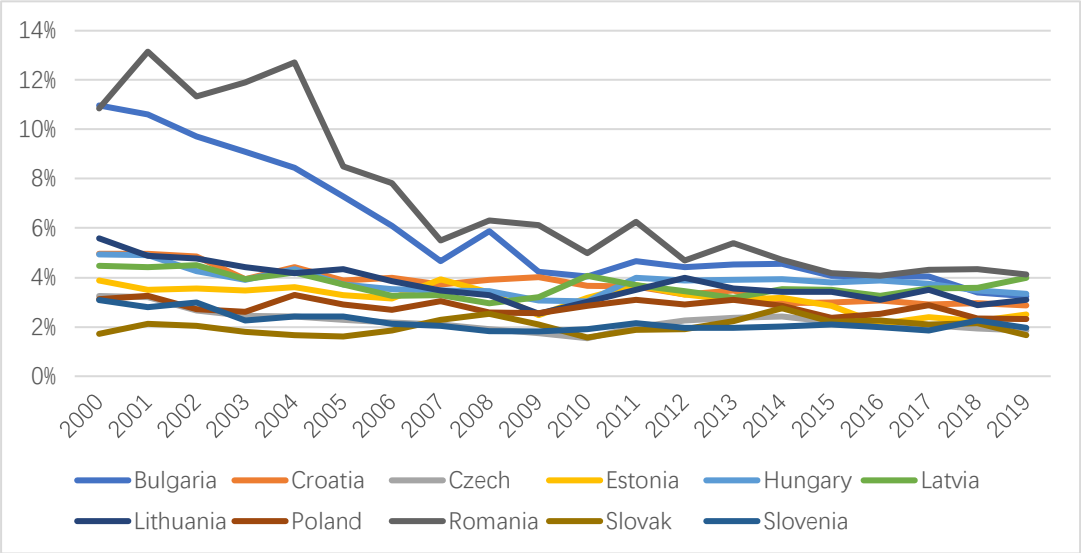
Figure 5 and Figure 6 show the change in the output value added of the primary industry and its share of GDP in CEE EU countries since 2000. In general, the output value added of the primary industry in CEE EU countries shows a spiral upward trend, but the ratio of agricultural value added to GDP is on a downward trend. Among these countries, Poland's value added from the primary industry grew the fastest, from 5.38 billion in 2000 to 13.84 billion in 2019, but its share in GDP dropped from 3.13% to 2.32%. Romania had the second fastest growth in value added of the primary industry, rising from 4.04 billion in 2000 to 10.30 billion in 2019, but its share of GDP fell from 10.85% in 2000 to 5.50% in 2007. It indicates that the added value of the secondary and tertiary industries in Poland and Romania has increased significantly, which can also be verified in Figure 7 and Figure 9. Moreover, by 2007 Bulgaria and Romania had the fastest decline in the value added of primary industries as a share of GDP. However, since joining the EU in 2007, the decline has slowed, perhaps because of the EU's common agricultural policy and transition fund for agricultural development in CEE EU countries.

Figure 5 : Output value added of the primary industry in CEEEUs, 2000-2019



Source: World Bank

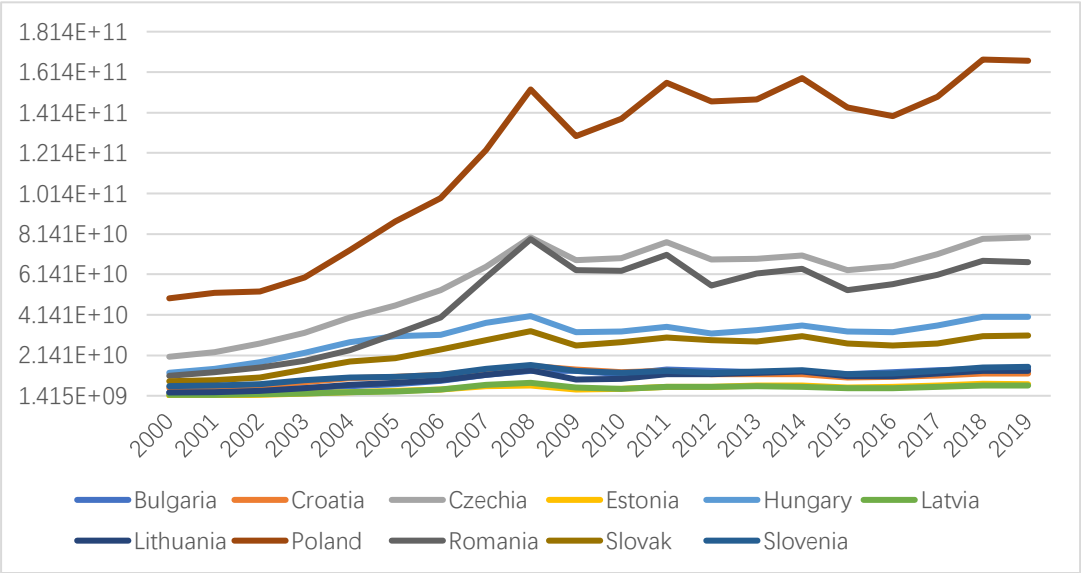
Figure 6: The proportion of added value of primary industry in GDP, 2000-2019



Source：World Bank

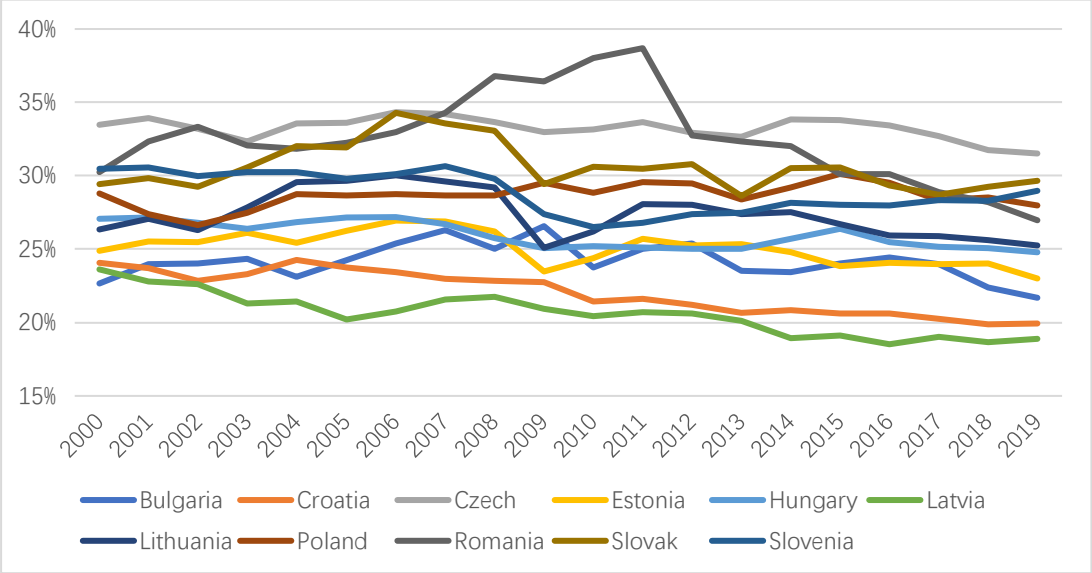
The secondary industry is the main industry of modernization, which determines the scale, speed, and level of a country's economic modernization to a large extent. At the same time, it provides raw materials, fuel, and power for other departments. It is the main body of national fiscal revenue generation and fundamentally ensures a country's economic independence and political independence.

Figure 7： Output value added of the secondary industry in CEEEUs, 2000-2019



Source: World Bank

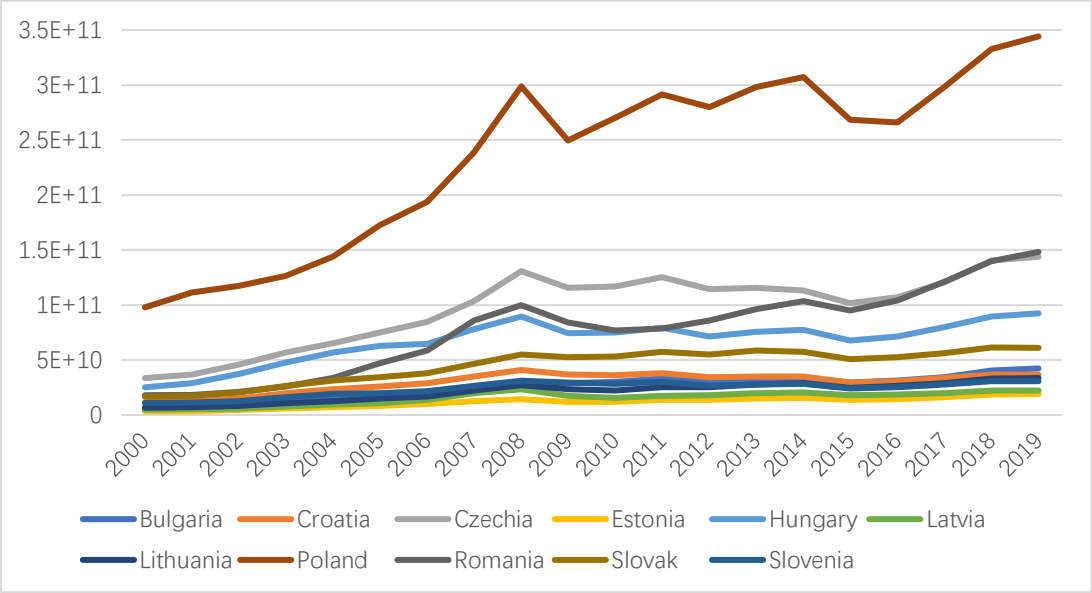
Figure 8: The proportion of added value of secondary industry in GDP, 2000-2019



Source：World Bank

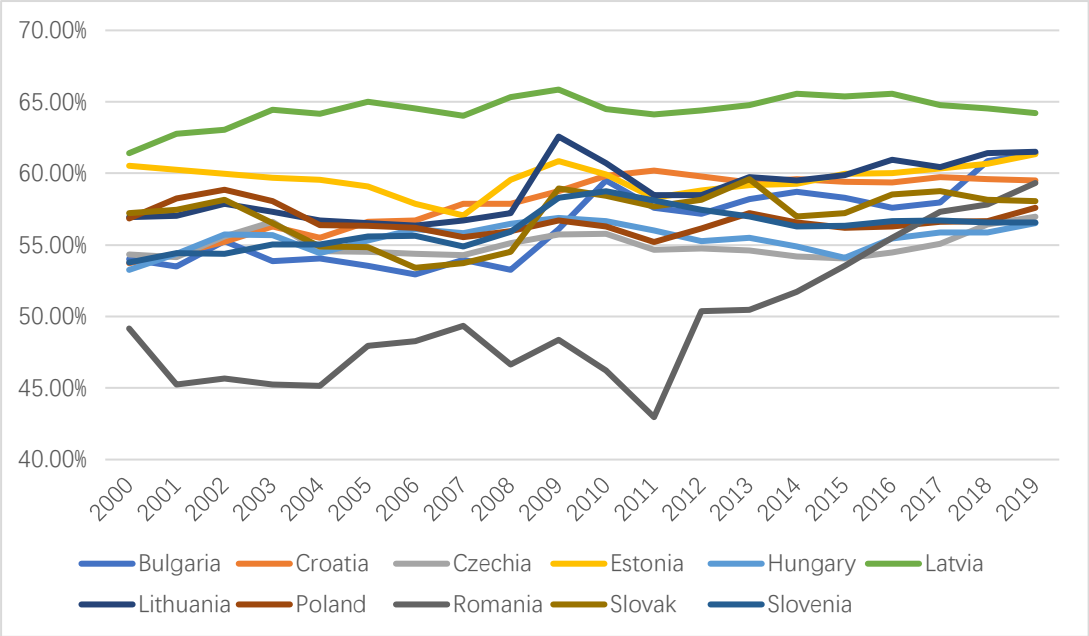
It can be seen from Figure 7 and Figure 8 that from 2000 to 2019, the added value of the secondary industry in CEEEUs showed a spiral upward trend, but its proportion in GDP showed a slight downward trend. From the perspective of the value added of the secondary industry, Poland, Czech Republic, and Bulgaria are the more developed countries among the 11 countries.

Figure 9： Output value added of the tertiary industry in CEEEUs, 2000-2019



Source: World Bank

Figure 10: The proportion of added value of tertiary industry in GDP, 2000-2019



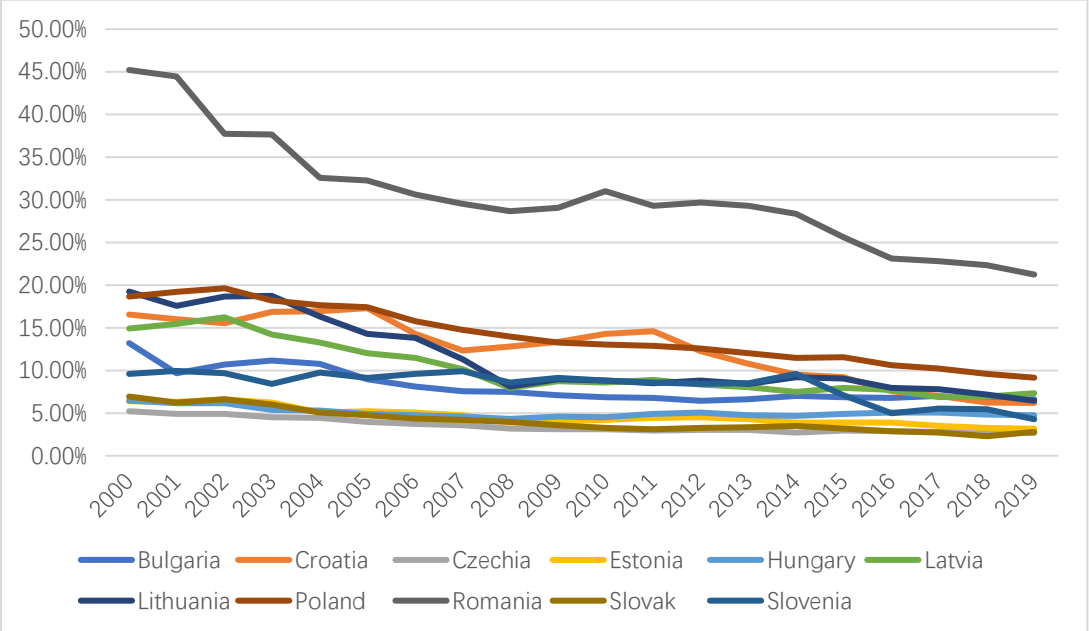
Source：World Bank

As a modern emerging industry, the tertiary industry's economic status is gradually prominent in the total national output. Figures 9 and 10 show that the value added of the tertiary industry in CEEEUs has a spiral upward trend, but the proportion of the value added of the tertiary industry in GDP is relatively stable. Besides, as shown in Figure 9, Poland's value added of the tertiary industry is much higher than that of the other 10 countries, while Estonia's is the lowest of the 11 countries. As shown in Figure 10, Latvia's tertiary industry accounted for the highest proportion of GDP, reaching 64.22% in 2019. Romania's tertiary industry accounted for the fastest proportion of GDP, increasing from 42.96% to 59.33% since 2011.

All in all, on the one hand, the changes in the output value added of industrial structure indicate that the productivity level of the primary industry in CEE EU countries has improved. On the other hand, it shows that CEE EU countries are gradually transforming from a traditional agricultural power to a manufacturing or service power.

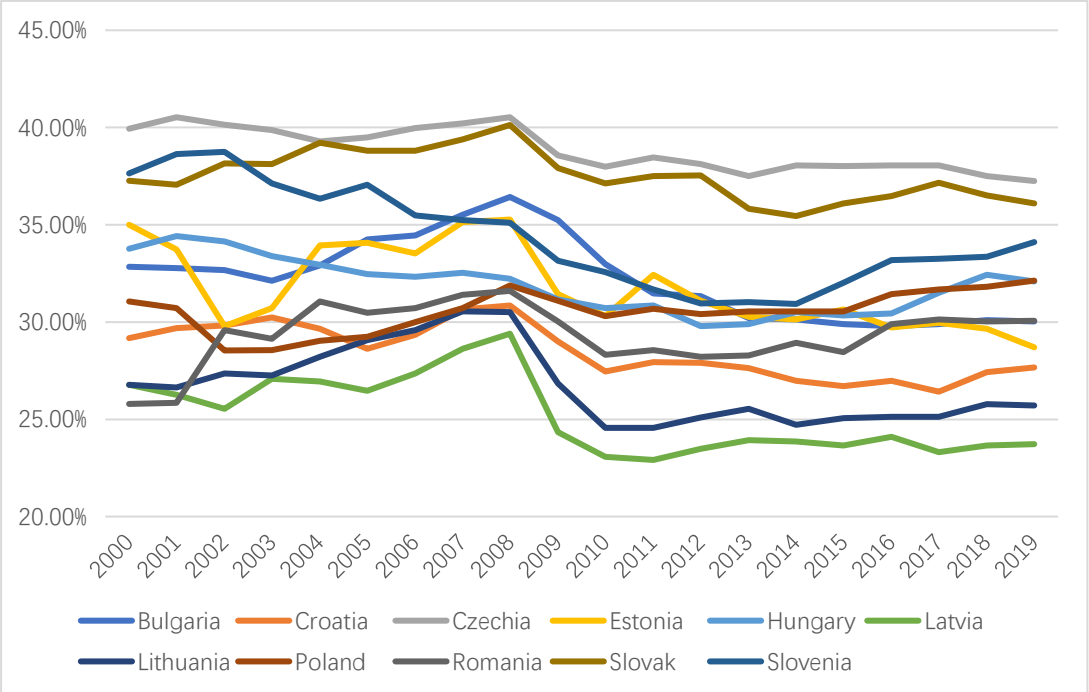
2.2.2 An Overview of Industrial Employment Structure

Figure 11: Share of primary industry employment in CEEEUs



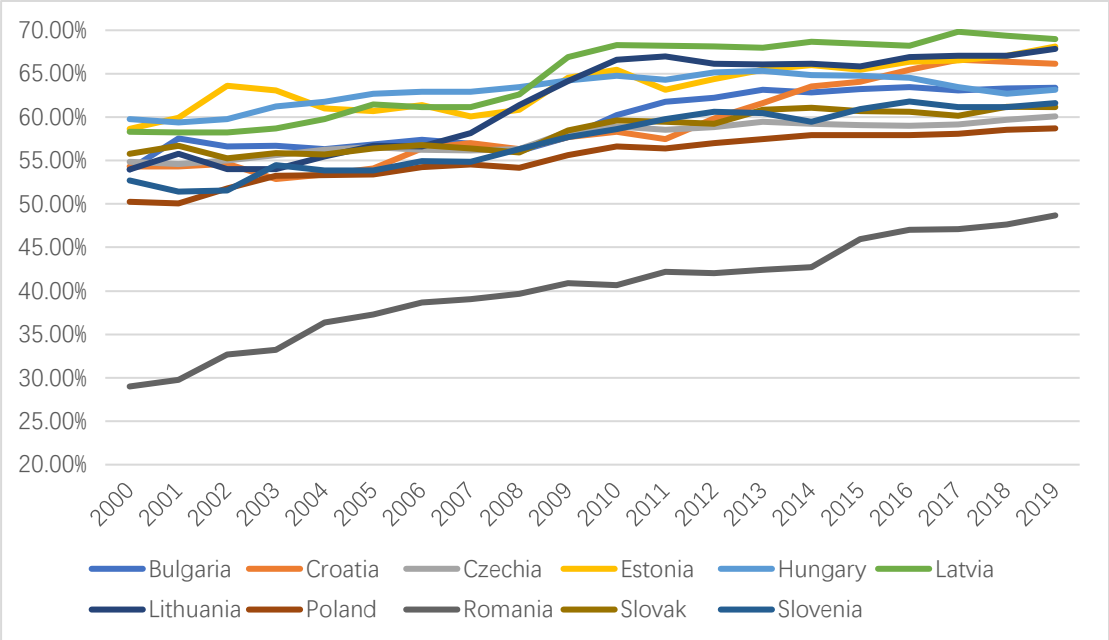
Source: International Labour organization

Figure 12: Share of Secondary industry employment in CEEEUs



Source: International Labour organization

Figure 13: Share of tertiary industry employment in CEEEUs



Source: International Labour organization

Figures 11 and 12 show that from 2000 to 2019, the proportion of employment in the primary and secondary industry in CEEEU countries generally has a downward trend. Furthermore, the share of employment in the secondary sector fell abruptly in 2008-2009, most likely due to the impact of the financial crisis. Figure 13 shows that the proportion of employment in the tertiary industry generally has an upward trend. It is worth noting that Romania has the fastest decline in the share of employment in the primary sector and the fastest growth in the share of employment in the tertiary sector.

All in all, labour force is the important factor input of industrial development. The above figures show that the allocation of labour among industries is gradually rationalizing in CEE EU countries. This may indicate a relatively high proportion of mechanized and large-scale agricultural operations in CEE EU countries, which fully releases the labour force of the primary industry and can further promote the advancement of human capital.

2.2.3 Industrial Structure Deviation Degree

The deviation degree of industrial structure is a comprehensive index to investigate the industrial structure rationalization from the perspective of whether the structure of industrial added value and the structure of employment is symmetric. It can be calculated by the following formula:

$$SD_i = \frac{Y_i/L_i}{Y/L} - 1 = \frac{Y_i/Y}{L_i/L} - 1$$

Where $\frac{Y_i/Y}{L_i/L}$ is the comparative labor productivity of industry 'i', which can reflect the rationality and effectiveness of labour factor allocation among industries.

If SD_i=0, it indicates that the industrial structure and employment structure are in equilibrium. If SD_i>0, it indicates that the labour force of industry 'i' is in a relative shortage state and can absorb more labour force employment, and the labour force of other industries should be transferred to industry 'i'. If SD_i<0, it indicates that the labour force in the industry 'i' is in a relative surplus, and there is a hidden unemployment problem. The larger the absolute value of SD_i is, the higher is the asymmetry and irrationality between employment structure and industrial structure.

Table 1: Average industrial deviation and comparative labour productivity in CEEEUs

year	Industrial Structure Deviation Degree			Comparative Labour productivity		
	Primary	Secondary	Tertiary	Primary	Secondary	Tertiary
2000	-0.5176	-0.1306	-0.0072	0.4824	0.8694	0.9928
2001	-0.5203	-0.1301	-0.0069	0.4797	0.8699	0.9931
2002	-0.5243	-0.1299	-0.0063	0.4757	0.8701	0.9937
2003	-0.5274	-0.1295	-0.0061	0.4726	0.8705	0.9939
2004	-0.5303	-0.1291	-0.0058	0.4697	0.8709	0.9942
2005	-0.5329	-0.1286	-0.0054	0.4671	0.8714	0.9946
2006	-0.5358	-0.1279	-0.0051	0.4642	0.8721	0.9949
2007	-0.5385	-0.1272	-0.0047	0.4615	0.8728	0.9953
2008	-0.5405	-0.1267	-0.0044	0.4595	0.8733	0.9956
2009	-0.5434	-0.126	-0.0041	0.4566	0.874	0.9959
2010	-0.5454	-0.1257	-0.004	0.4546	0.8743	0.996
2011	-0.5471	-0.1251	-0.0041	0.4529	0.8749	0.9959
2012	-0.5493	-0.1246	-0.004	0.4507	0.8754	0.996
2013	-0.5516	-0.1242	-0.0039	0.4484	0.8758	0.9961
2014	-0.5539	-0.1236	-0.0037	0.4461	0.8764	0.9963

2015	-0.5557	-0.1231	-0.0038	0.4443	0.8769	0.9962
2016	-0.5567	-0.1229	-0.0038	0.4433	0.8771	0.9962
2017	-0.558	-0.1228	-0.0037	0.442	0.8772	0.9963
2018	-0.5588	-0.1225	-0.0037	0.4412	0.8775	0.9963
2019	-0.5591	-0.122	-0.0039	0.4409	0.878	0.9961

Source: Calculated based on data from the World Bank

According to the results in Table 1, the structural deviation degree of the three industries in the CEEEUs is always negative, which indicates that the labour force in the three industries is in surplus, and there is hidden unemployment in the industries. However, the absolute value of the primary industry increases steadily, and the structural deviation degree of the secondary and tertiary industries tends to be 0, indicating that the primary industry's industrial structure and employment structure become more asymmetric and irrational. In contrast, the structure of the secondary and tertiary industries is more reasonable.

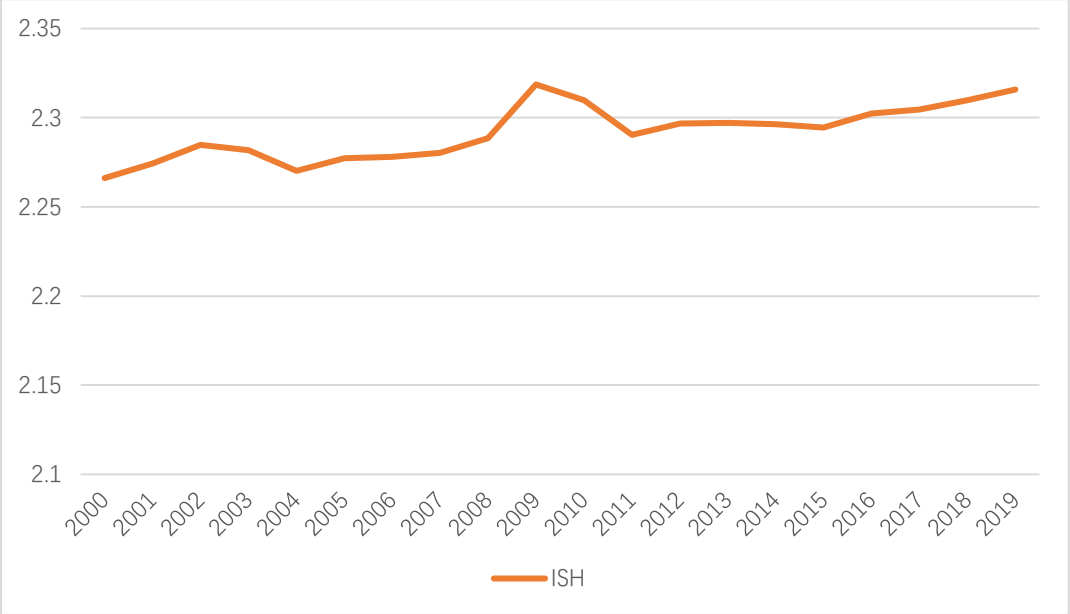
2.2.4 Industrial Structure Hierarchy Coefficient

According to Clark's law, as the level of economic development increases, the proportion of non-agricultural industrial output value in total economic output will increase. Therefore, increasing the proportion of non-agricultural output value is a very important law reflecting the advanced industrial structure. With the advent of the era of industrial informatization and service, it is not convincing to use the traditional non-agricultural industrial output value ratio to measure the advanced level of industrial structure. Referring to the economic servitisation, this paper uses the hierarchy coefficient of industrial structure (SH) to measure whether the level of 'servitisation' of industrial structure has been improved. If SH is on the rise, the economy is advancing in the direction of servitisation, indicating that the upgrading level of the industrial structure is constantly improving.

$$SH = \sum_{i=1}^{3} i \times \frac{Y_i}{Y}$$

Based on Jing's (2005) weighting method, this paper sets the weights of the primary, secondary and tertiary industries as 1, 2, and 3, respectively. If SH is closer to 1, the industrial structure level is lower, and the closer it is to 3, the industrial structure level is higher.

Figure 14: Average industrial structure hierarchy coefficient in CEEEUs



Source: Calculated based on data from the World Bank

It can be seen from Figure 14 that the average industrial structure hierarchy coefficient of CEEEUs is spiralling. Specifically, the average SH was 2.27 in 2000 and 2.32 in 2019. The industrial structure in 2003, 2004, 2010, 2011, 2014, and 2015 showed an inverse trend of upgrading, while the hierarchy coefficient of the industrial structure in other years gradually increased.

2.3 The Comparison of IFDI and Industrial Structure Change

In general, with the continuous expansion of the IFDI scale in the CEE EU countries, the hierarchy coefficient of the industrial structure increases simultaneously, and the deviation degree of industrial structure in the secondary and tertiary industries decreases continuously. This shows that the industrial structure of CEE countries is

constantly being optimized and upgraded while the IFDI is constantly improving. The results of this statistical description provide a fundamental empirical basis for this paper to study the impact of IFDI on the CEE EU countries and provide an empirical statistical basis for the further use of econometric methods to test the relationship between the two.

3. Empirical Analysis

3.1 Methodology

Panel data are generally divided into time series, cross-section, and panel data. Among them, both time series and cross-section data are one-dimensional data, time series data are data obtained by variables at different time points, and cross-section data are data composed of different statistical units at a fixed time. Panel data are recorded in both time and cross-section dimensions, so panel data can also be regarded as mixed data.

The advantages of using panel data to build the model are as follows:

(1) The sampling accuracy of the estimator is improved due to more observations;

(2) Having access to consistent and even effective parameter estimation;

(3) Compared with cross-section data modelling, panel data modelling can obtain more dynamic information.

Panel data models are typically defined as: $Y_{it} = \alpha_{it} + X_{it}\beta_{it} + \varepsilon_{it}$

Where Y_{it} is the explained variable, $X_{it} = \left(x_{it}^1, x_{it}^2, \dots, x_{it}^k\right)$ is a vector of variables of dimension $1 \times k$; $\beta_{it} = \left(\beta_{it}^1, \beta_{it}^2, \dots, \beta_{it}^k\right)$ is a parameter vector of $k \times 1$; i=(1,2,…,N) represents entity; t=(1,2,…,T) represents time; ε_{it} represents error term. It satisfies the basic assumption $\varepsilon_{it} \sim N(0, \sigma_\varepsilon^2)$ of classical econometric models.

According to different assumptions of coefficients, panel data models can be divided into:

(1) Pooled model. For different individuals, the intercept term is random and the regression coefficients are the same.

$$Y_{it} = \alpha_{it} + X_{it}\beta_{it} + \varepsilon_{it}$$

The assumption of the model is: $H_{01}: \alpha_i \neq \alpha_j;\ \beta_i = \beta_i;\ i \neq j;\ i, j = 1,2, \dots, N$

(2) Fixed coefficient model. The intercept term and regression coefficient are the same for different individuals.

$$Y_{it} = \alpha + X_{it}\beta_{it} + \varepsilon_{it}$$

The assumption of the model is: $H_{02}: \alpha_i = \alpha_j;\ \beta_i = \beta_i;\ i, j = 1,2, \dots, N$

(3) Random coefficient model. For different individuals, the intercept term and regression coefficient are random.

$$Y_{it} = \alpha_{it} + X_{it}\beta_{it} + \varepsilon_{it}$$

In order to test the effects of IFDI on industrial structure optimization and upgrading in CEE EU countries, the fixed effect model is proposed to adopt.

This thesis uses a fixed effects model for prediction, for the following reasons:

1. The dataset is panel data, if we use a pooled model, we ignore the structure of the dataset. Also, pooled model ignores the heterogeneity, resulting inconsistent estimates.

2. The random effects model cannot change the consistency of the model estimates.

3. The selected region contains 11 countries, which may have heterogeneity, and the fixed effects model is more suitable for the data with differences between the entity.

4. The effects of some variables on individuals vary over time, and fixed effects can add time effects to help get more robust results.

The static panel models are as follows:

$$Y_{it} = \alpha_0 + \alpha_1 X_{1it} + \alpha_2 X_{2it} + \alpha_3 X_{3it} + \cdots + \alpha_k X_{kit} + \mu_i + \tau_i + \varepsilon_{it}$$

Where 'i' represents entity; 't' represents time; 'ε' represents the error term; 'μ_i' represents entity effect and 'τ_t' represents time effect.

3.2 Variable Selection

Table 2: Variable Information

Variable	Meaning	Unit	Source
ISR	Industrial Structure Rationalization Index	/	Calculated from World Bank data
ISA	Industrial Structure Advancement Index	/	Calculated from World Bank data
lnifdi	Total Inward FDI Stock (logarithm)	US dollars at 2000 constant prices per capita	UNCTAD STAT
fdi1	The inward FDI stock in the primary industry (% of total inward FDI stock)	%	Calculated base on the wiiw Database
fdi2	The inward FDI stock in the secondary industry (% of total inward FDI stock)	%	Calculated base on the wiiw Database
fdi3	The inward FDI stock in the tertiary industry (% of total inward FDI stock)	%	Calculated base on the wiiw Database
lnincome	Per Capita National Income (logarithm)	US dollars at 2000 constant prices per capita	UNCTAD STAT
open	Trade openness: Trade (% of GDP)	%	World Bank
RD	Research & Development expenditure (% of GDP)	%	World Bank & Eurostat
GDPgrow	GDP growth rate	%	World Bank
HC	Human Capital: Enrolment by level of education tertiary / Total Population	/	Calculated from UIS and World Bank database.
lnemp	Number of persons employed (logarithm)	/	International Labour organization
gov_a	Government expenditure (% of GDP)	%	World Bank

The industrial structure optimization index and the industrial structure advancement index are the dependent variables, which are calculated from World Bank data. The data of inward FDI stock (ifdi) and per capita nation income are from the database of the United Nations Conference on Trade Development (UNCTAD). Since FDI and income are monetary units, they are processed with a GDP deflator, with 2000 as the base period, and logarithms are taken for them. The inward FDI stock of the three industries accounts for the proportion of all inward FDI stock respectively, which are respectively expressed as 'fdi1', 'fdi2' and 'fdi3', which are from wiiw database. Data on the trade openness, GDP growth rate, and government expenditure are all from the World Bank database. The data on R&D expenditure comes from two databases, the World Bank Database for 2000-2018 and Eurostat for 2019. The data of human capital are calculated from the World Bank and UIS databases, of which the tertiary education enrolment rate is from the UIS database and the total population data is from the World Bank. Data on the number of persons employed comes from the International Labour Organisation. The employment figures come from the International Labor Organization. Because the value is too large, in order to avoid heteroscedasticity, this paper also takes the logarithm of it.

3.2.1 Explained Variables

ISA (Industrial Structure Advancement Index)

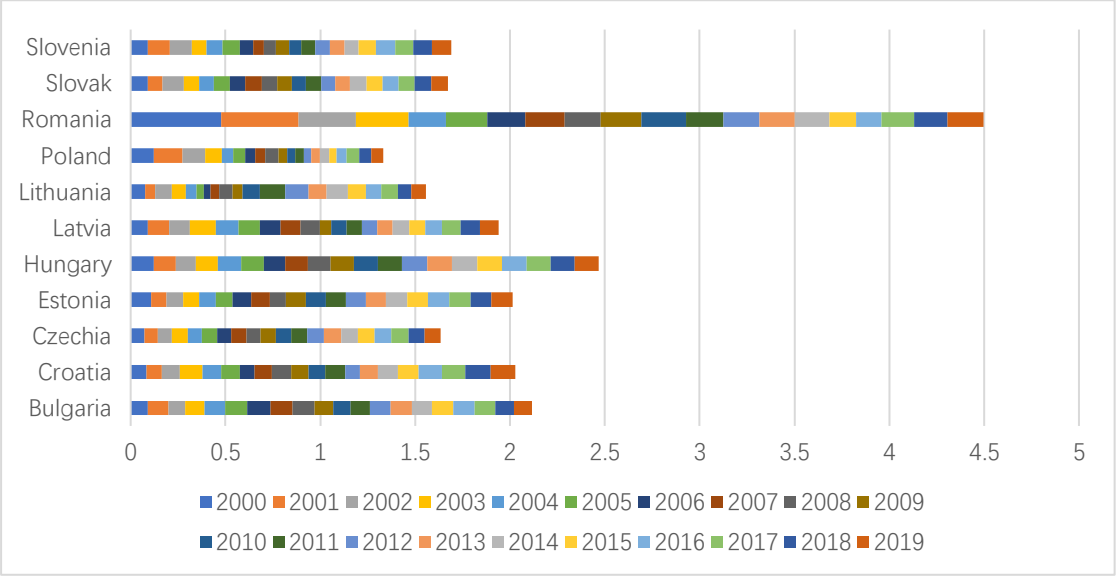
Based on the research of Jia (2014), this chapter establishes industrial structure rationalization index (ISR), with the specific formula as follows:

$$ISR = \sum_{k=1}^{3} \left(\frac{Y_k}{Y}\right) \left| \frac{Y_k/L_k}{Y/L} - 1 \right|$$

Y_k is the added value of industry 'k', Y is gross domestic product, L_k is the number of persons employed in industry 'k', L is total employment. Therefore, Y_k/L_k in the above equation is the comparative labour productivity of industry 'k', and Y/L is the average comparative labour productivity. When $Y_k/L_k = Y/L$, ISR=0, which

indicates that the industrial structure is in the most reasonable state. However, in most countries, the industrial structure is not in the most reasonable state, only in the process of development to the most reasonable state. Therefore, the ISR ranges from (0,1). It is worth noting that ISR is an inverse indicator, and a smaller ISR indicates a higher degree of rationalization of industrial structure. The data used to construct this indicator are from the World Bank. This paper calculates the ISR values of 11 countries from 2000 to 2019, as shown in the Figure 15 below:

Figure 15: Measurement results of ISR indicators for CEEEUs from 2000 to 2019



Source: Calculated based on the World Bank data.

ISA (Industrial Structure Advancement Index)

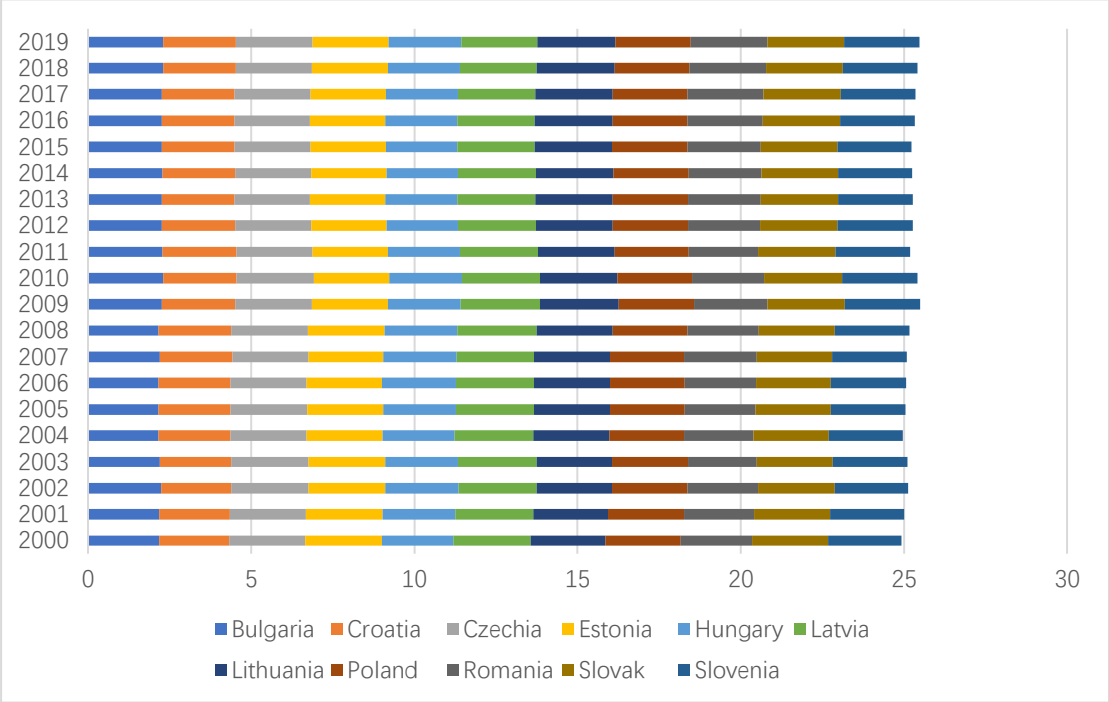
In this model, the proportion of added value of three industrial sectors in GDP of each country is used to calculate the advanced level of industrial structure. The index formula is as follows:

$$ISA = \sum_{k=1}^{3} n \times \frac{Y_k}{Y}$$

Where, 'n' is the weight coefficient of each industry, Y_k is the added value of industry 'k', Y is gross domestic product. According to the definition formula, the range of ISA is [1,3]. ISA is a positive indicator, and the larger the value, the higher the level of industrial structure advancement. The data used to construct this indicator are

from the World Bank. This paper calculates the ISA values of 11 countries from 2000 to 2019, as shown in the Figure 16 below:

Figure 16: Measurement results of ISA indicators for CEEEUs from 2000 to 2019



Source: Calculated based on the World Bank data.

3.2.2 Core Explanatory Variables

The variable 'lnifdi' in the model represents the logarithm of Inward Foreign Direct Invest Stock. The data have been processed according to the GDP deflator. Stocks were chosen over flows because Bayoumi and Lipworth (1997) pointed out that FDI stocks have a longer-term impact than flows. Furthermore, the reason for taking log transformation is to avoid heteroscedasticity. 'lnifdi' is measured in $US at 2000 constant prices. In this paper, the short-term effect and long-term effect of FDI on the optimization and upgrading of industrial structure are represented by lnifdi and the lagging one period of lnifdi (L.lnifdi) respectively.

In order to further test the inward FDI of the three industries on the optimization and upgrading of industrial structure, there will be additional core explanatory variables, the proportion of the inward FDI stock in the primary industry to the total (fdi1) and

the one lag period of ‘fdi1’ , the proportion of the inward FDI stock in the secondary industry to the total (fdi2) the one lag period of ‘fdi2’, and the proportion of the inward FDI stock in the tertiary industry to the total (fdi3) the one lag period of ‘fdi3’.

3.2.3 Control Variables

Section 1.3 of this paper introduces the analysis mechanism of IFDI optimizing and upgrading the industrial structure, that is, FDI generally affects the optimization and upgrading of industrial structure through two channels: supply side and demand side. The supply side includes employment, capital, and technology, while the demand side includes investment, consumption, and trade. Therefore, this paper includes such control variables as national income per capita (lnincome), GDP growth rate (GDPgrow), R&D expenditure as a percentage of GDP (RD), human capital (HC), the number of persons employed (lnemp), trade openness index (open), and government expenditure as a percentage of GDP (gov_a). This can contribute to the robustness of the results.

First, the logarithm of national income per capita (lnincome) is selected as one of the control explanatory variables. The data have been processed according to the GDP deflator. The reason for taking the logarithm is to avoid heteroscedasticity. And it is expected that ‘lnincome’ is negatively correlated with ISR, and positively correlated with ISA.

Second, GDP growth rate (GDPgrow) is chosen to represent the economic development of a country. The more developed a country's economy is, the more science and technology it has, the more advanced its industrial structure will be. Thus, it is expected that ‘GDPgrow’ is negatively correlated with ISR, and positively correlated with ISA.

Third, this paper takes the proportion of R&D expenditure in GDP (RD) as the indicator of technological progress. Although FDI can bring advanced technologies, only when the invested country has sufficient ability to absorb and utilize these technologies can the host country improve its competitiveness. Therefore, the host country usually increases R&D expenditure and improves its technological level. It is

expected that ‘RD’ is negatively correlated with ISR, and positively correlated with ISA.

Fourth, the logarithm of number of persons employed (lnemp) is used to describe the employment situation in a country. The reason for taking the logarithm is to avoid heteroscedasticity. As the new jobs brought by FDI often come from the replacement of the original jobs, it may lead to the loss of employment opportunities for low-skilled labour, which leads to the decline of residents' income level and consumption ability. Therefore, this paper expects that ‘lnemp’ is positively correlated with ISR and negatively correlated with ISA.

Fifth, enrolment by level of education tertiary (HC) is regarded as human capital. The enhancement of human capital can effectively improve the innovation ability of one country, so as to improve the added value of our products and promote the development of our industrial structure. Thus, it is expected that ‘HC’ is negatively correlated with ISR, and positively correlated with ISA.

Sixth, the trade openness index (open) is the ratio of the trade volume of goods and services to GDP. Trade openness reflects the degree to which a country participates in international trade. It is expected that ‘open’ to be negatively correlated with ISR and positively correlated with ISA.

Seventh, ‘gov_a’ indicates the level of government intervention. Since the government often provides policy and economic support for industrial development, this paper selects the ratio of expenditure in the general budget of local finance to GDP to represent the degree of government intervention. This paper also expects ‘gov_a’ to be negatively correlated with ISR and positively correlated with ISA.

3.3 Data Preparation and Analysis

To ensure the authenticity of the data, 11 countries with significant missing data were removed from the sample of 22 CEE countries. The final selection of 11 CEE countries happens to be the CEE EU countries. Thus, this thesis will use a balanced long panel dataset with 20 years of annual data for 11 countries. However, there are

still flaws in the selected data. For example, government expenditure data for some countries are missing, and there are outliers in the 'lnincome' and 'GDPgrow' data.

Thus, this paper carries out data cleaning before data analysis. The box plots show that 'lnincome' and 'GDPgrow' have outliers, so 'lnincome' and 'GDPgrow' are processed with a tail reduction of 2.5%. The variable 'gov' has missing values, so this paper uses regression method to fill in the missing values.

Table 3 shows that the dataset has a sufficient sample size. Specifically, there are 220 observations, far exceeds the rule of thumb of '104+K' observations. the standard deviation of the variables is not 0, indicating that the variation of the variables is large enough.

Table 3: Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
ISR	220	0.1043242	0.0506105	0.0349601	0.4772214
ISA	220	2.291895	0.0670781	2.11784	2.426929
lnifdi	220	23.83495	1.104012	21.2487	25.9052
fdi1	220	0.860056	0.8953919	0.0160782	4.382205
fdi2	220	36.31144	10.91913	14.76875	59.41047
fdi3	220	60.85332	9.633142	40.37302	80.44549
lnincome	220	9.066713	0.508463	7.620349	9.804694
open	220	117.3246	33.25655	48.52133	190.6986
RD	220	0.9510594	0.4837331	0.36053	2.56487
GDPgrow	220	3.665793	2.949193	-2.69445	10.21497
emply	220	4084532	4451198	569965	1.77E+07
lnemp	220	14.73967	0.9642946	13.25333	16.68813
gov_a	220	37.44573	4.918719	29.23	55.28

3.3.1 Correlation Test

The covariance matrix will be used to test the correlation among variables, and if the significance level is within 5%, the star symbol is displayed.

It can be seen from the covariance matrix (Table 4) that among all explanatory variables, 'lnincome' and ISR have the highest correlation, with an absolute value of

0.4221, and ‘HC’ and ISR have the second highest correlation, with an absolute value of 0.3302. For the explained variable ISA, ‘HC’ has the highest correlation with it, with an absolute value of 0.4161, and ‘lnincome’ has the second highest correlation with it, with an absolute value of 0.3901.

In addition to the high correlation coefficient between the variables and their lagged one period variables, the correlation coefficient between ‘fdi2’ and ‘fdi3’ and ‘L.fdi3’ are both very high, showing a positive relationship between inward FDI in secondary industry and tertiary industry. Furthermore, ‘lnifdi’ and ‘lnemp’ reached 0.7454, showing a positive relationship of FDI and employment. The correlation coefficient between ‘lnincome’ and ‘RD’ reached 0.6491, showing a positive relationship of per capita income and R&D expenditure. However, the coefficient between those core explanatory variables, the inward FDI of total and three industries, and explained variable ‘ISR’ and ‘ISA’ are weak.

Table 4: Covariance Matrix

	ISR	ISA	lnifdi	L.lnifdi	fdi1	L.fdi1	fdi2	L.fdi2
ISR	1							
ISA	-0.4818*	1						
lnifdi	-0.0398	-0.0713	1					
L.lnifdi	-0.0310	-0.0798	0.9891*	1				
fdi1	0.2020*	0.2119*	-0.1599*	-0.1577*	1			
L.fdi1	0.2185*	0.2070*	-0.1882*	-0.1614*	0.9594*	1		
fdi2	0.0682	-0.2164*	0.2953*	0.2836*	-0.4006*	-0.3854*	1	
L.fdi2	0.0560	-0.1890*	0.3333*	0.2917*	-0.3987*	-0.3997*	0.9244*	1
fdi3	-0.0855	0.1769*	-0.3218*	-0.3078*	0.2364*	0.2338*	-0.9391*	-0.8712*
L.fdi3	-0.0677	0.1451*	-0.3510*	-0.3188*	0.2414*	0.2344*	-0.8807*	-0.9384*
lnincome	-0.4221*	0.3901*	0.3126*	0.2880*	0.0102	-0.0202	-0.1637*	-0.1251
open	-0.3147*	0.3207*	0.1417*	0.1333	-0.0934	-0.1086	-0.1583*	-0.1343
GDPgrow	0.0200	-0.0175	-0.2164*	-0.2682*	-0.0012	0.0180	0.0914	0.0985
RD	-0.2569*	0.0655	0.0729	0.0776	-0.2650*	-0.2842*	-0.1129	-0.1138
HC	-0.3302*	0.4161*	-0.1332*	-0.1906*	0.0850	0.0439	-0.2232*	-0.1851*
lnemp	0.2477*	-0.3142*	0.7454*	0.7426*	-0.2130*	-0.2135*	0.5356*	0.5285*
gov_a	-0.1579*	0.0749	-0.1734*	-0.1342	0.0930	0.0995	-0.0906	-0.1234

Table 4 (continued): Covariance Matrix

	fdi3	L.fdi3	lnincome	open	GDPgrow	RD	HC	lnemp	gov_a
fdi3	1								
L.fdi3	0.9271*	1							
lnincome	0.1361*	0.1000	1						
open	0.1100	0.0900	0.5824*	1					
GDPgrow	-0.0600	-0.1000	-0.2791*	-0.0500	1				
RD	0.1200	0.1200	0.6491*	0.5218*	-0.2247*	1			
HC	0.2185*	0.1908*	0.3318*	0.0100	-0.0100	0.0800	1		
lnemp	-0.5414*	-0.5360*	-0.2652*	-0.3712*	-0.0300	-0.2621*	-0.2538*	1	
gov_a	-0.0600	-0.0176	0.1838*	0.1440*	-0.3934*	0.1511*	0.0700	-0.2496*	1

3.3.2 Stationarity Test

The stationarity of data is the premise of regression analysis. If the data is not stationary, putting the data into the model for analysis will lead to spurious regression. Therefore, once it is found that the data is not stationary, it is necessary to find a way to transform the non-stationary data into stationary, which can usually be accomplished by the difference method. Therefore, this paper uses the graphical method and the unit root tests to test whether the variables are stationary in the original sequence. If the variables are stationary, they can be directly put into the model for regression analysis. Otherwise, the difference method should be used to transform the non-stationary data into stationary data.

Stationarity requires that the time series of the variable visually look like a 'random walk', which is the value of tomorrow is the value of y today plus an unpredictable disturbance. Appendix 2 shows that except for the data of variable 'fdi1', which seems to have a trend, all the others are random walks, also stationary. However, visual methods are subjective and may lead to errors. Therefore, for the sake of insurance, this paper will also use the numerical method to verify the results.

The numerical test for the stationarity of test data is the unit root test. Given the long panel dataset, the thesis adopts the LLC test, which is also for balanced panels. Based on the LLC test and the BIC information criterion, the null hypothesis of having unit root is strongly rejected for all variables at the 1% significance level, which is

shown in Table 5. Given that the data for all variables are stationary, the thesis will run the regression analysis on this next.

Table 5: Unit Root Test Results

Variable	LLC (Levin, Lin & Chu) test	
	Adjusted t-statistics	P-value
ISR	-3.1865	0.0007
ISA	-3.2337	0.0006
lnifdi	-2.6028	0.0046
L.lnifdi	-2.5535	0.0053
fdi1	-3.3389	0.0004
L.fdi1	-3.3559	0.0004
fdi2	-5.3931	0.0000
L.fdi2	-3.7347	0.0001
fdi3	-3.1014	0.0010
L.fdi3	-4.1557	0.0000
lnincome	-3.2852	0.0005
open	-2.7714	0.0028
RD	-1.9294	0.0268
GDPgrow	-6.4282	0.0000
HC	-3.8038	0.0001
lnemp	-3.7330	0.0001
gov_a	-5.1063	0.0000

3.4 Model Specification and Estimation

Since this thesis will not only discuss the impact of overall FDI, but also study the impact of FDI in three industries on the optimization and upgrading of industrial

structure, this section will establish four sets of models. However, the four sets of models remain the same except that the core explanatory variables changed. Therefore, to avoid complexity, all the estimation shown are only for the first set of models, that is, models with overall inward FDI as the core explanatory variable.

3.4.1 Model Specification

This paper uses a static panel data model for analysis and assumes that the models include two-way fixed effects. Table 6 and Table 7 report the estimation results of two-way fixed effects for the two models with ISR and ISA as dependent variables, respectively. Model (1) in both tables contains only the core explanatory variables, and the subsequent models add one control variable in turn. Model (8) contains all regressors.

Table 6: Variables for Preliminary Estimation for ISR model

regressor	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
lnifdi	-.0464*	-.0412 **	-.0449*	-.0426**	-.0426**	-.0369*	-.0346*	-.0337*
L.lnifdi	.0203	0.0264	0.0338***	0.0308	0.0400*	0.0284	0.0264	0.0270
lnincome		-.0307*	-.0312*	-0.0345**	-0.0347**	-0.0362**	-.0340**	-.0355**
open			.0006***	.0007***	.0006***	.0007***	.0007***	.0007***
GDPgrow				-.0019*	-0.0019*	-0.0019**	-.0026***	-.0024**
RD					0.0091	0.0089	-0.0003	-0.0014
HC						0.0069*	.0088**	.0090**
lnemp							.1273***	.1376***
gov_a								0.0005
Constant	.7415***	.7544***	.5869**	.6327***	.5525**	.5361**	-1.3722**	-1.5657**
entity effects	yes	yes	yes	yes	yes	yes	yes	yes
time effects	yes	yes	yes	yes	yes	yes	yes	yes
dependent Variable	ISR							
R^2_{adj}	0.1565**	0.1714**	0.2021***	0.2191***	0.2225***	0.2362***	0.2835***	0.2847***

Note: * if p<0.1; ** if p<0.05; *** if p<0.01

Table 7: Variables for Preliminary Estimation for ISA model

regressor	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
lnifdi	-.0180	-.0281	-.0244	-.0237	-.0236	-.0153	-.0173	-.0207
L.lnifdi	.0900***	.0785***	.0710***	.0700***	.0647***	.0566**	.0584**	.0562**
lnincome		.0586***	.0591***	-.0581***	.0584***	.0562***	.0543***	.0600***
open			-.0004**	-.0006**	-.0005*	-.0005*	-.0005*	-.0006**
GDPgrow				-.0006	-.0006	-.0006	-.0001	-.0007
RD					-.015	-.0152	-.0075	-.0012
HC						.0099**	.0082*	.0074
lnemp							.1134**	-.1519***
gov_a								-.0017
Constant	.5677**	.5431**	.7113**	.7250**	.8580***	.8344***	2.5352***	3.2541***
entity effects	yes	yes	yes	yes	yes	yes	yes	yes
time effects	yes	yes	yes	yes	yes	yes	yes	yes
dependent variable	ISA							
R^2_{adj}	0.3480***	0.3761***	0.3922***	0.3930***	0.3977***	0.4125***	0.4321***	0.4405***

Note: * if p<0.1; ** if p<0.05; *** if p<0.01

As shown in Table 6 and Table 7, the adjusted R^2_{adj} increases with each additional variable in the model. Thus, the model (8), which includes all variables, is the most appropriate. Finally, the four sets of models the paper expected are as follows. The first set of models is to test the impact of total inward FDI on the optimization and upgrading of industrial structure.

$$ISR_{it} = \alpha_0 + \alpha_1 lnifdi_{it} + \alpha_2 lnifdi_{it-1} + \alpha_3 lnincome_{it} + \alpha_4 open_{it} + \alpha_5 RD_{it} + \alpha_6 GDPgrow_{it} + \alpha_7 HC_{it} + \alpha_8 lnemp_{it} + \alpha_9 gov\_a_{it} + \mu_{it} + \tau_{it} + \varepsilon_{it}$$

$$ISA_{it} = \beta_0 + \beta_1 lnifdi_{it} + \beta_2 lnifdi_{it-1} + \beta_3 lnincome_{it} + \beta_4 open_{it} + \beta_5 RD_{it} + \beta_6 GDPgrow_{it} + \beta_7 HC_{it} + \beta_8 lnemp_{it} + \beta_9 gov\_a_{it} + \mu_{it} + \tau_{it} + \varepsilon_{it}$$

The second set of models is to test the impact of inward FDI in the primary industry on the optimization and upgrading of industrial structure.

$$ISR_{it} = \alpha_0 + \alpha_1 fdi1_{it} + \alpha_2 fdi1_{it-1} + \alpha_3 lnincome_{it} + \alpha_4 open_{it} + \alpha_5 RD_{it} + \alpha_6 GDPgrow_{it} + \alpha_7 HC_{it} + \alpha_8 lnemp_{it} + \alpha_9 gov\_a_{it} + \mu_{it} + \tau_{it} + \varepsilon_{it}$$

$$ISA_{it} = \alpha_0 + \alpha_1 fdi1_{it} + \alpha_2 fdi1_{it-1} + \alpha_3 lnincome_{it} + \alpha_4 open_{it} + \alpha_5 RD_{it} + \alpha_6 GDPgrow_{it} + \alpha_7 HC_{it} + \alpha_8 lnemp_{it} + \alpha_9 gov\_a_{it} + \mu_{it} + \tau_{it} + \varepsilon_{it}$$

The third set of models is to test the impact of inward FDI in the secondary industry on the optimization and upgrading of industrial structure.

$$ISR_{it} = \alpha_0 + \alpha_1 fdi2_{it} + \alpha_2 fdi2_{it-1} + \alpha_3 lnincome_{it} + \alpha_4 open_{it} + \alpha_5 RD_{it} + \alpha_6 GDPgrow_{it} + \alpha_7 HC_{it} + \alpha_8 lnemp_{it} + \alpha_9 gov\_a_{it} + \mu_{it} + \tau_{it} + \varepsilon_{it}$$

$$ISA_{it} = \alpha_0 + \alpha_1 fdi2_{it} + \alpha_2 fdi2_{it-1} + \alpha_3 lnincome_{it} + \alpha_4 open_{it} + \alpha_5 RD_{it} + \alpha_6 GDPgrow_{it} + \alpha_7 HC_{it} + \alpha_8 lnemp_{it} + \alpha_9 gov\_a_{it} + \mu_{it} + \tau_{it} + \varepsilon_{it}$$

The last set of models is to test the impact of inward FDI in the tertiary industry on the optimization and upgrading of industrial structure.

$$ISR_{it} = \alpha_0 + \alpha_1 fdi3_{it} + \alpha_2 fdi3_{it-1} + \alpha_3 lnincome_{it} + \alpha_4 open_{it} + \alpha_5 RD_{it} + \alpha_6 GDPgrow_{it} + \alpha_7 HC_{it} + \alpha_8 lnemp_{it} + \alpha_9 gov\_a_{it} + \mu_{it} + \tau_{it} + \varepsilon_{it}$$

$$ISA_{it} = \alpha_0 + \alpha_1 fdi3_{it} + \alpha_2 fdi3_{it-1} + \alpha_3 lnincome_{it} + \alpha_4 open_{it} + \alpha_5 RD_{it} + \alpha_6 GDPgrow_{it} + \alpha_7 HC_{it} + \alpha_8 lnemp_{it} + \alpha_9 gov\_a_{it} + \mu_{it} + \tau_{it} + \varepsilon_{it}$$

Where 'i' means nation ($i = 1,2 \ldots 11$); 't' means time ($t = 2000, 2001 \ldots 2009$); '$\varepsilon$' means the error term; 'μ_i' means entity effect and 'τ_t' means time effect.

To avoid complexity, all the estimation shown are only for the first set of models, that is, models with overall inward FDI as the core explanatory variable.

3.4.2 Pre-estimation

In order to make the results more robust, this section presents the results (as shown in Table 8 and 9) of the four estimation methods, pooled, random effect, entity fixed effect and two-way fixed effect, respectively.

Table 8: Regression results of the four effects of the ISR model in the first set

regressor	Pooled Effect	Random Effect	Fixed Effect	Fixed Effect
lnifdi	-0.0503** (0.0202)	-0.0374** (0.0165)	-0.024* (0.0128)	-0.0337* (0.0199)
L.lnifdi	0.0378* (0.0194)	0.0256 (0.0157)	0.0065 (0.0121)	0.0270 (0.0196)
lnincome	-0.0187 (0.0125)	-0.0211* (0.0123)	-0.0291** (0.0142)	-0.0355** (0.0167)
open	-0.0001 (0.0001)	0.00003 (0.0001)	0.0006*** (0.0002)	0.0007*** (0.0002)
GDPgrow	-0.0010 (0.0012)	-0.0014 (0.0010)	-0.0018** (0.0008)	-0.0024** (0.0010)
RD	-0.0005 (0.0081)	0.0018 (0.0082)	-0.0041 (0.0095)	-0.0014 (0.0109)
HC	-0.1231*** (0.0032)	-0.0063** (0.0030)	0.0051* (0.0027)	-0.0090** (0.0039)
lnemp	0.0123 (0.0090)	0.0156* (0.0094)	0.1285*** (0.0375)	0.1376*** 0.0426
gov_a	-0.0009*** (0.0007)	0.0010 (0.0007)	0.0002 (0.0008)	0.0005 (0.0009)
Constant	0.5000*** (0.0965)	0.4143*** (0.1000)	-1.1992** (0.5755)	-1.5657** (0.7164)
entity effects	no	no	yes	yes
time effects	no	no	no	yes
dependent variable	*ISR*			
R^2	0.2786***	0.2616***	0.2388 ***	0.2847***

Note: * if p<0.1; ** if p<0.05; *** if p<0.01, and the values in parentheses are standard deviations.

Table 9: Regression results of the four effects of the ISA model in the first set

regressor	Pooled Effect	Random Effect	Fixed Effect	Fixed Effect
lnifdi	-0.0239 (0.0276)	-0.0135 (0.0171)	-0.0174 (0.0171)	-0.0207 (0.0244)
L.lnifdi	-0.0002 (0.0266)	0.0372** (0.0162)	0.0356** (0.0161)	0.0562** (0.0241)
lnincome	0.0764*** (0.0171)	0.0183 (0.0174)	0.0315* (0.0190)	0.0600*** (0.0204)

open	0.0007*** (0.0002)	-0.0006** (0.0002)	-0.0007*** (0.0002)	-0.0006** (0.0003)
GDPgrow	-0.0015 (0.0016)	-0.0016 (0.0010)	-0.0017* (0.001)	-0.0007 (0.0012)
RD	-0.0575*** (0.0111)	-0.0126 (0.0119)	-0.0023 (0.0126)	-0.0012 (0.0134)
HC	0.0183*** 0.0043	-0.0069* (0.0036)	-0.0088** (0.0037)	0.0074 (0.0048)
lnemp	0.0137 (0.0123)	-0.0696*** 0.0222	-0.1732*** (0.0501)	-0.1519*** (0.0522)
gov_a	-0.0014 (0.0009)	-0.0009 (0.0009)	-0.0021* (0.0011)	-0.0017* (0.0011)
Constant	0.5000*** (0.0965)	2.7402*** (0.3123)	4.3295*** (0.7675)	3.2541*** (0.8793)
entity effects	no	no	yes	yes
time effects	no	no	no	yes
dependent variable	*ISA*			
R^2	0.3861***	0.2811***	0.2972 ***	0.4405***

Note: * if p<0.1; ** if p<0.05; *** if p<0.01, and the values in parentheses are standard deviations.

The results in Table 8 show that the variable ‘lnifdi’ is negatively correlated with ‘ISR’, meaning the inflow of FDI will promote the rationalization of industrial structure in the short term. Furthermore, Table 9 shows that the variable ‘L.lnifdi' is positively correlated with ‘ISA’, showing that the inflow of FDI will promote the advancement of industrial structure in the long run.

From the perspective of control variables in the model, the per capita income (lnincome) is negatively correlated with ISR, but positively correlated with ISA, meaning per capita income will optimize and upgrade the industrial structure. Besides, ‘GDPgrow’ is negatively correlated with ISR, that is, the rise of GDP growth rate will lead to the rationalization of industrial structure, but the relationship between ‘GDPgrow’ and ISA is not significant, which is also inconsistent with expectations. Then, the number of persons employed (lnemp) is positively correlated with ISR, and

negatively correlated with ISA, which is in line with expectations. However, the trade openness (open) is positively correlated with ISR, but negatively correlated with ISA, meaning an open trading environment may hinder the optimization and upgrading of industrial structure, which is contrary to expectation.

Other things that are not in line with expectations are

1) 'RD' has mostly insignificant relationship with ISR and ISA under all models;

2) 'gov_a' has mostly insignificant relationship with ISR;

3) there is a potential negative correlation between government intervention and industrial structure upgrading;

4) the direction of 'HC' is not the same under different effects. For example, there is a negative correlation between HC and ISR in pooled model, random model, and two-way fixed model, but a positive correlation between HC and ISR in entity fixed model. HC is positively correlated with ISA under pooled model, but negatively correlated with ISA under random model and entity fixed model.

Considering the differences in model results, this paper needs to find the optimal estimation technique. The specific methods and steps are as follows.

First, the thesis estimates the fixed effects models with ISR and ISA as dependent variables. We use F-test to determine if the fixed-effect is more appropriate than the pooled model. The null hypothesis of F-test is the intercept terms are all equal to zero. The P-value of the F-test in both models are zero, which reject the null hypothesis at significance level of 1%. Therefore, this paper concludes that fixed effects outperform pooled effects in fitting the two models. Then, we need to compare whether the two models are better under random effects or better under mixed effects, by using LM test. The null hypothesis of LM test is that there are no individual random effects. And the P-value of LM test in both models are zero, which also rejects the pooled model at 1% significance level. Simultaneously, it shows our model should include random terms that reflect individual characteristics. Finally, Hausman test is used to study if the two models fit the fixed effect or the random effect better. We find that in the model with ISR as the dependent variable, the p-value was zero, and in the model with ISA as

the dependent variable, the p-value was 0.0633. This means that the null hypothesis is rejected at 1% and 10% significance levels, respectively, also meaning the fixed effect outperformed the random effect in both models.

Table 10 Results were tested by fixed, random and mixed effects models

Purpose of Examination	Method	Model with ISR		Model with ISA	
		Result	Conclusion	Result	Conclusion
Fixed or Pooled	F-test	F=42.71 P=0.00	Fixed	F=45.83 P=0.00	Fixed
Random or Pooled	(Breusch-Pagan's) LM test	Chi2=597.1 P=0.00	Random	Chi2=472.51 P=0.00	Random
Fixed or Random	Hausman test	Chi2=2164.54 P=0.00	Fixed	Chi2=16.17 P=0.0633	Fixed

After determining the use of the fixed effects models, the paper needs to determine further whether to add time dummy variables. Since the two-way fixed effects models are expected in this paper, we can run the two-way fixed effects models first and then use the t-test to decide whether time dummy variables should be included. In the model with the dependent variable ISR, the P-value of the t-test is 0.8892. Thus the null hypothesis cannot be rejected. Thus, the model with the dependent variable ISR does not need to add the time effects. In the model with the dependent variable ISA, the P-value of the t-test is 0.0016, rejecting the null hypothesis at the significance level of 1%. Thus, the model with the dependent variable ISR should use a two-way fixed effect.

Having determined the model effects, the paper should also examine cross-sectional dependence. The Pesaran CD test is used to detect CSD. The P-values of models with deepened variable ISR and ISA are 0.363 and 0.319, respectively, indicating the CS is independent.

Finally, endogeneity is a problem that should be considered in every regression analysis. This problem usually arises in two situations. One is that the independent variable and the dependent variable are reciprocal causation. The other one is that there is a correlation between independent variables and the random error term. When

encountering the endogeneity problem, we usually deal with it by adopting the instrumental variable method or adding the lagged variables of the explanatory variables. In this paper, because the impact of FDI on industrial structure optimization and upgrading may have a time lag, the one lag period of inward FDI stock is added to represent the long-term impact of FDI on industrial structure optimization and upgrading. After processing, this paper uses the Ramsey RESET test to detect whether omitted variable bias still exists. The results show that the P-value in the model with the dependent variable ISR and ISA are 0 and 0.0288, respectively, rejecting the null hypothesis of no OVBs. So, OVBs still exist. This result means that other political or economic factors that have not been observed are determinants of industrial structure optimization and upgrading and are related to the existing regressors. Besides, if the stock of IFDI increases after the optimization and upgrading of the industrial structure, it will also lead to endogeneity.

3.4.3 Post-regression Modification

In this section we will test for heteroscedasticity and autoregression. If the panel residuals have heteroscedasticity single and no autocorrelation, the standard errors can be corrected using heteroscedasticity robust estimation. If heteroscedasticity and autocorrelation are present, the HAC robust estimation should be used.

Appendix 3 shows the visualization results of heteroscedasticity, in which both cross-sectional and time series data are heteroscedasticity. In order to ensure the accuracy of the results, this paper also uses the numerical test, the Wald test. The P-values in both models are zero, rejecting the null hypothesis that the variance is constant. Both the visual and Wald tests show heteroscedasticity.

Then, the Wooldridge test are utilized to detect the autocorrelation. The results in both models show a zero P-value, rejecting the null hypothesis of no first-order autocorrelation. Thus, autocorrelation also exists. In this case, the HAC robust should be utilized. The results are shown in Table 11 (modification_ISR and modification_ISA).

Table 11 Model Comparison of Fixed effect and modification to the estimator

Variable	fixed_ISR	modification_ISR	fixed_ISA	modification_ISA
lnifdi	-0.0240*	-0.0240*	-0.0207	-0.0207
L.lnifdi	0.0065	0.0065	0.0562**	0.0562*
lnincome	-0.0291**	-0.0291	0.0600***	0.0600
open	0.0006***	0.0006	-0.0006**	-0.0006
GDPgrow	-0.0018**	-0.0018	-0.0007	-0.0007
RD	-0.0041	-0.0041	-0.0012	-0.0012
HC	0.0051*	0.0051	0.0074	0.0074
lnemp	0.1285***	0.1285	-0.1519***	-0.1519
gov_a	0.0002	0.0002	-0.0017	-0.0017*
_cons	-1.1992***	-1.1992	3.2541***	3.2541*
N	209	209	209	209
r2	0.2388	0.2388	0.4405	0.4405
r2_a	0.1623	0.2044	0.3195	0.3571

Note: *, * * and * * * represent significance levels of 10%, 5% and 1%, respectively.

3.5 Interpretation of Results

Table 12: Final Results

Variable	ISR	ISR	ISR	ISR	ISA	ISA	ISA	ISA
lnifdi	-0.0240*				-0.0207			
L.lnifdi	0.0065				0.0562*			
fdi1		0.0051				-0.0133**		
L.fdi1		-0.0068				-0.0111		
fdi2			-0.0005				0.0001	
L.fdi2			-0.0011*				-0.0002	
fdi3				0.0003				0.0000
L.fdi3				0.0012*				0.0003
lnincome	-0.0291	-0.0505	-0.0463*	-0.0441*	0.0600	0.1235**	0.0887*	0.0906*
open	0.0006	0.0006	0.0003	0.0003	-0.0006	-0.0007	-0.0007	-0.0007
GDPgrow	-0.0018	-0.0016	-0.0006	-0.0006	-0.0007	-0.0009	-0.0012	-0.0010
RD	-0.0041	-0.0042	-0.0022	-0.0014	-0.0012	-0.0095	-0.0100	-0.0099

HC	0.0051	0.0039	0.0066	0.0054	0.0074	0.0008	0.0085	0.0087
lnemp	0.1285	0.1297	0.0853	0.0861	-0.1519	-0.2599***	-0.1683	-0.1724
gov_a	0.0002	0.0006	0.0002	0.0004	-0.0017*	-0.0022*	-0.0023*	-0.0023*
_cons	-1.1992	-1.4465	-0.7372	-0.9317	3.2541*	5.2121***	4.1334**	4.1614**
Entity Effects	yes	yes	yes	yes	yes	yes	yes	yes
Time Effects	no	no	no	no	yes	yes	yes	yes
N	209	209	209	209	209	209	209	209
r2	0.2388	0.222	0.3133	0.3025	0.4405	0.4627	0.4114	0.4126
r2_a	0.2044	0.1868	0.2822	0.271	0.3571	0.3825	0.3236	0.3249

Based on the above estimates and Table 12, the first set of models is:

$$ISR_{it} = -1.1992 - 0.024lnifdi_{it} + 0.0065lnifdi_{it-1} - 0.0291lnincome_{it} + 0.0006open_{it} - 0.0041RD_{it} - 0.0018GDPgrow_{it} + 0.0051HC_{it} + 0.1285lnemp_{it} + 0.0002gov\_a_{it} + \mu_{it} + \varepsilon_{it}$$

$$ISA_{it} = 3.2541 - 0.0207lnifdi_{it} + 0.0562lnifdi_{it-1} + 0.06lnincome_{it} - 0.0006open_{it} - 0.0012RD_{it} - 0.0007GDPgrow_{it} + 0.0074HC_{it} - 0.1519lnemp_{it} - 0.0017gov\_a_{it} + \mu_{it} + \tau_{it} + \varepsilon_{it}$$

The second set of models is:

$$ISR_{it} = -1.4465 + 0.0051fdi1_{it} - 0.0068fdi1_{it-1} - 0.0505lnincome_{it} + 0.0006open_{it} - 0.0042RD_{it} - 0.0016GDPgrow_{it} + 0.0039HC_{it} + 0.1297lnemp_{it} + 0.0006gov\_a_{it} + \mu_{it} + \varepsilon_{it}$$

$$ISA_{it} = 5.2121 - 0.0133fdi1_{it} - 0.0111fdi1_{it-1} + 0.1235lnincome_{it} - 0.0007open_{it} - 0.0095RD_{it} - 0.0009GDPgrow_{it} + 0.0008HC_{it} - 0.2599lnemp_{it} - 0.0022gov\_a_{it} + \mu_{it} + \tau_{it} + \varepsilon_{it}$$

The third set of models is:

$$ISR_{it} = -0.7372 - 0.0005fdi2_{it} - 0.0011fdi2_{it-1} - 0.0463lnincome_{it} + 0.0003open_{it} - 0.0022RD_{it} - 0.0006GDPgrow_{it} + 0.0066HC_{it} + 0.0853lnemp_{it} + 0.0002gov\_a_{it} + \mu_{it} + \varepsilon_{it}$$

$$ISA_{it} = 4.1334 + 0.0001fdi2_{it} - 0.0002fdi2_{it-1} + 0.0887lnincome_{it} - 0.0007open_{it} - 0.01RD_{it} - 0.0012GDPgrow_{it} + 0.0085HC_{it} - 0.1683lnemp_{it} - 0.0023gov\_a_{it} + \mu_{it} + \tau_{it} + \varepsilon_{it}$$

The fourth set of models is:

$$ISR_{it} = -0.9317 + 0.0003fdi3_{it} + 0.0012fdi3_{it-1} - 0.0441lnincome_{it} + 0.0003open_{it} - 0.0014RD_{it} - 0.0006GDPgrow_{it} + 0.0054HC_{it} + 0.0861lnemp_{it} + 0.0004gov\_a_{it} + \mu_{it} + \varepsilon_{it}$$

$$ISA_{it} = 4.1614 + 0.0003fdi3_{it-1} + 0.0906lnincome_{it} - 0.0007open_{it} - 0.0099RD_{it} - 0.0010GDPgrow_{it} + 0.0087HC_{it} - 0.1724lnemp_{it} - 0.0023gov\_a_{it} + \mu_{it} + \tau_{it} + \varepsilon_{it}$$

According to the empirical results in the first set of models, the core explanatory variable, 'lnifdi', significantly negatively correlates with 'ISR', which means that the inward FDI will optimize the industrial structure in the short run. To be specific, if we change inward FDI by 1%, we would expect 'ISR' to decline by 0.0002 units, ceteris paribus. However, the relationship between 'lnifdi' and 'ISA' is insignificant. Furthermore, 'L.lnifdi' significantly positively correlates with 'ISA', which means the inward FDI will upgrade of industrial structure in the long run. That is, if we change the inward FDI of the last year by 1%, we would expect 'ISA' this year to increase by 0.0006 units, ceteris paribus. This shows that the inflow of FDI has a time lag. In addition, the inward FDI will optimize the industrial structure in the short term and upgrade industrial structure in the long term. Therefore, inward FDI generally will optimize and upgrade industrial structure.

The results of the second, third and fourth sets of models show that the three industries have different impacts on the optimization and upgrading of industrial structure. Inward FDI in the primary industry will hinder the upgrading of industrial structure in the short term. If we change inward FDI of the primary industry by 1%, we expect ISA to decline by 0.0133 units, ceteris paribus. Then, the inward FDI in the secondary industry will improve the rationalization of the industrial structure in the

long run. Specifically, if we change the inward FDI of the secondary industry by 1%, we expect 'ISR' to decrease by 0.0011 units next period, ceteris paribus. Finally, inward FDI of the tertiary industry will hinder the rationalization of the industrial structure in the long run. If we change the inward FDI of the tertiary industry by 1%, we expect ISR to increase by 0.0012 units next period, ceteris paribus. This indicates that if CEE EU countries want to introduce FDI, the optimal principle is to introduce investment in the secondary industry.

In addition, in the latter three sets of models, it can be found that the increase of per capita income can upgrade the industrial structure, no matter which industry FDI flows into. However, the increase of per capita income can optimize the industrial structure only when the FDI flows into the secondary and tertiary industries.

Furthermore, in each set of models, government intervention (gov_a) has no significant effect on the rationalization of industrial structure (ISR) but has a significant negative correlation with the advancement of industrial structure (ISA). The latter may be because the government allocates its budget mainly to agriculture and manufacturing. Agriculture is the basis for ensuring national food security, and industry fundamentally guarantees a country's economic independence and political independence. Therefore, the government will promote the development of these two industries by increasing their budget, thus making the industrial structure unable to be advanced.

However, many control variables are not significantly associated with ISR and ISA, which is contrary to the expectations of this thesis. However, an empirical analysis model cannot make all the variables significant. This paper believes that the control variables in this paper impact the industrial structure, but because of heterogeneity, their impact on the dependent variable in the total sample is smoothed out. So maybe a grouped sample test will find that they are significant in a subset of samples.

Conclusion and Policy Recommendation

In the theoretical framework part, this paper systematically discusses the influence mechanism of IFDI on the optimization and upgrading of industrial structure.

Then in chapter 2, the statistical description method is used to analyse the development level of FDI and industrial structure in CEE EU countries. On this basis, the correlation between the two changes is captured. In the empirical econometric analysis, this paper uses the panel model to test the impact of the overall IFDI on the optimization and upgrading of industrial structure in CEE EU countries and separately analyses the impact of the IFDI of three industries on the optimization and upgrading of industrial structure, the main research conclusions of this paper are as follows:

1. IFDI influences the optimization and upgrading of industrial structure through two channels: the supply side and demand side. The supply side includes employment, capital, and technology, while the demand side includes investment, consumption, and trade.

2. The optimization and upgrading of industrial structure is measured from two aspects: industrial structure rationalization and industrial structure advancement. Only when these two conditions are met at the same time can the industrial structure be optimized and upgraded.

3. The impact of IFDI on the optimization and upgrading of industrial structure is divided into long-term and short-term effects. The IFDI optimizes CEE EU countries' industrial structure in the short run and upgrades those countries' industrial structure in the long run. Hence, this thesis believes that IFDI will optimize and upgrade the industrial structure in CEE EU countries.

4. In CEE EU countries, IFDI of the primary industry will hinder the upgrading of industrial structure in the short term. The IFDI in the secondary industry will improve the rationalization of the industrial structure in the long run, and the IFDI of the tertiary industry will reduce the rationalization of the industrial structure in the long run.

5. Only when FDI flows to the CEE EU countries' secondary and tertiary industries can the increase of per capita income promote the rationalization of industrial structure.

6. Government intervention may hinder the upgrading of industrial structure.

This paper proposes the following and suggestions based on the above research and conclusions.

First, CEE EU countries should actively introduce FDI, but they should introduce FDI in the secondary industry as much as possible. Currently, in CEE EU countries, the tertiary industry is the leading industry attracting IFDI. However, the high-end development of the manufacturing industry is an important area of industrial structure optimization and upgrading. Therefore, the development of the manufacturing industry in CEE EU countries still needs to expand the cooperation with foreign capital, especially the foreign capital, which can help the high-end development of the manufacturing industry in CEE EU countries.

Furthermore, the CEE EU countries can diversify the ways for FDI to enter the region. Whether IFDI can optimize and upgrade industrial structure mainly depends on the technological spillover effect of IFDI. However, if foreign enterprises enter as sole proprietorships, they may strengthen the protection of their core technologies, so it is not easy to release the spillover effect of technology to promote industrial development. Therefore, in terms of attracting FDI, CEE EU countries should not only continue to expand joint ventures and cooperation, but also explore new ways of attracting foreign investment. At the same time, enterprises in CEE EU countries should also actively promote the reform of their organization and management, and align their management, operation, and design with international standards and modern enterprise management systems, so as to enhance their ability to absorb technology spillovers even achieve technological catch-up.

Besides, the CEE EU countries attract FDI mainly from the old EU member states. Although the old EU member states are also relatively developed, the CEE EU countries should attach importance to the technological content of FDI and take it as the standard for the introduction to give full play to the technological spillover effect, instead of taking the country as the standard. Moreover, one of the important means for CEE countries to attract FDI from the old EU member states is tax competition. However, this is easy to cause the domestic industry development of unequal competition. The unequal competition will lead to foreign enterprises not only

squeezing the market share of local enterprises but also crowding out labor, capital, and other factor resources, thus hindering the construction of independent brands and the improvement of enterprise competitiveness in CEE EU countries, finally hindering the upgrading of industrial structure.

In this regard, CEE EU countries should reduce the policy preference of granting supranational treatment to foreign-funded enterprises when introducing FDI. Instead, they should focus on improving and building a sound international business environment and stimulating the market's vitality for their enterprises, thus increasing the expected return of FDI and its attractiveness to FDI. At the same time, it is necessary to improve the development environment of enterprises in their own country and provide an equal development platform for cultivating their competitiveness and developing independent brands.

Bibliography

AGOSIN, Manuel R., and Roberto Machado. "Foreign investment in developing countries: does it crowd in domestic investment?." *Oxford Development Studies* 33.2 (2005): 149-162.

AKAMATSU, Kaname. "The synthetic principles of the economic development of our country." *Theory of Commerce and Economics* 6 (1932): 179-220.

ALBULESCU, Claudiu Tiberiu, and GOYEAU, Daniel. "The interaction between trade and FDI: The CEECs experience." *International Economics and Economic Policy* 16.3 (2019): 489-509.

ALFARO, Laura, et al. "FDI and economic growth: the role of local financial markets." *Journal of international economics* 64.1 (2004): 89-112.

ANG, James B. "Foreign direct investment and its impact on the Thai economy: the role of financial development." *Journal of Economics and Finance* 33.3 (2009): 316-323.

BALASUBRAMANYAM, Venkataraman N., SALISU, Mohammed and SAPSFORD, David. "Foreign direct investment and growth in EP and IS countries." *The economic journal* 106.434 (1996): 92-105.

BALASUBRAMANYAM, Vudayagiri N., SALISU, Mohammed, and SAPSFORD, David. "Foreign direct investment as an engine of growth." *Journal of International Trade & Economic Development* 8.1 (1999): 27-40.

BAYOUMI, Tamim, and LIPWORTH, Gabrielle. “Japanese Foreign Direct Investment and Regional Trade.” Journal of Asian Economics, vol. 9, no. 4, Elsevier Inc, 1998, pp. 581–607, doi:10.1016/S1049-0078(98)90064-1.

BLOMSTROM, Magnus, Ari Kokko, and Mario Zejan. "Multinational corporations and productivity convergence in Mexico." *Foreign Direct Investment*. Palgrave Macmillan, London, (2000). 134-159.

BORENSZTEIN, Eduardo, GREGORIO, Jose De and LEE, Jong-Wha. "How does foreign direct investment affect economic growth?." *Journal of international Economics* 45.1 (1998): 115-135.

BOSWORTH, Barry P., COLINS, Susan M. and REINHART, Carmen M. "Capital flows to developing economies: implications for saving and investment." *Brookings papers on economic activity* 1999.1 (1999): 143-180.

BUCKLEY, Peter CASSON, J., and Mark. "A long-run theory of the multinational enterprise." *The future of the multinational enterprise*. Palgrave Macmillan, London, (1976). 32-65.

CAVES, Richard E. "Multinational firms, competition, and productivity in host-country markets." *Economica* 41.162 (1974): 176-193.

CHEN, Edward KY. "The total factor productivity debate: determinants of economic growth in East Asia." *Asian-Pacific Economic Literature* 11.1 (1997): 18-38.

CHENERY, Hollis B., and STROUT, Alan M.. "Foreign assistance and economic development: Reply." *The American Economic Review* 58.4 (1968): 912-916.

DENG, Lina. FDI, International Technology Spillover and The Upgrading of China's Manufacturing Industry (Doctoral Dissertation, Shandong University). 2015.

DRIFFIELD, Nigel, and Dylan Hughes. "Foreign and domestic investment: regional development or crowding out?." *Regional studies* 37.3 (2003): 277-288.

DUNNING, John H. "The eclectic (OLI) paradigm of international production: past, present and future." *International journal of the economics of business* 8.2 (2001): 173-190.

EASTERLY, Wiiliam. R. *The elusive quest for growth: economists' adventures and misadventures in the tropics*. MIT press. (2002).

ELLER Markus, HAISS, Peter, and STEINER, Katharina. "Foreign direct investment in the financial sector and economic growth in Central and Eastern Europe: The crucial role of the efficiency channel." *emerging Markets review* 7.4 (2006): 300-319.

EREGHA, Perekunah Bright. "The dynamic linkages between foreign direct investment and domestic investment in ECOWAS countries: A panel cointegration analysis." *African Development Review* 24.3 (2012): 208-220.

EREN, Mesut, and ZHUANG, Hong. "Mergers and acquisitions versus greenfield investment, absorptive capacity, and economic growth: Evidence from 12 new

member states of the European Union." *Eastern European Economics* 53.2 (2015): 99-123.

GRIFFITH, Rachel, REDDING,Stephen and SIMPSON, Helen. "Foreign ownership and productivity: new evidence from the service sector and the R&D lab." *Oxford Review of Economic Policy* 20.3 (2004): 440-456.

HARRIS, John R., and TODARO, Michael P. "Migration, unemployment and development: a two-sector analysis." *The American economic review* 60.1 (1970): 126-142.

HELPMAN, Elhanan. "A simple theory of international trade with multinational corporations." *Journal of political economy* 92.3 (1984): 451-471.

HULE, R., & STOCKER, H. Economic Consequences of Hysteresis Effects in FDI. Institute of Economic Theory, Economic Policy and Economic History. (2014).

HUNYA, Gabor. "Restructuring through FDI in Romanian manufacturing." *Economic Systems* 26.4 (2002): 387-394.

IVARSSON, Inge, and Claes Göran Alvstam. "Upstream control and downstream liberty of action? Interdependence patterns in global value chains, with examples from producer-driven and buyer-driven industries." *Review of Market Integration* 2.1 (2010): 43-60.

JAVORCIK, Beata Smarzynska. “Does Foreign Direct Investment Increase the Productivity of Domestic Firms? In Search of Spillovers Through Backward Linkages.” The American Economic Review, vol. 94, no. 3, American Economic Association, (2004), pp. 605–27, doi:10.1257/0002828041464605.

JIA, Nisha, HAN, Yonghui, ZOU, Jianhua. Effects of Two-way FDI on Industrial Restructuring in China: Influence Mechanism and Empirical Test. *Journal of International Trade* .11(2014):109-120. doi:10.13510/j.cnki.jit.2014.11.011.

JING, Xueqing. Industrial Structure Upgrades and Economy Growth – The analysis of Yangtze Delta Area. Journal of Nantong University(Social Sciences Edition). 03 (2005).

KHALIQ, Abdul, and NOY, Ilan. "Foreign direct investment and economic growth: Empirical evidence from sectoral data in Indonesia." *Journal of Economic Literature* 45.1 (2007): 313-325.

KIPPENBERG, Eva. "Sectoral linkages of foreign direct investment firms to the Czech economy." *Research in International Business and Finance* 19.2 (2005): 251-265.

KOJIMA, Kyoshi. *Direct Foreign Investment: A Japanese Model of Multi-National Business Operations*. Vol. 10. Routledge, (2010).

KOKKO, Ari. "Technology, market characteristics, and spillovers." *Journal of development economics* 43.2 (1994): 279-293.

KUTAN, Ali M., and VUKŠIĆ Goran. "Foreign direct investment and export performance: empirical evidence." *Comparative Economic Studies* 49.3 (2007): 430-445.

LEAN, Hooi Hooi, and TAN, Bee Wah. "Linkages between Foreign Direct Investment, Domestic Investment and Economic Growth in Malaysia." *Journal of Economic Cooperation & Development* 32.4 (2011).

LEWIS, William Arthur. "Economic development with unlimited supplies of labour." (1954): 139-91.

LIANG, Fengyan. *Research on the Influence of Two-way FDI on the Optimization and Upgradingof Chine's industrial structure.*辽宁大学 Niaoling University, Doctoral dissertation. 2021.

LIAO, Hongwei, YANG, Liangping, DAI, Shuanping, Assche Ari Van. "Outward FDI, industrial structure upgrading and domestic employment: empirical evidence from the Chinese economy and the belt and road initiative." *Journal of Asian Economics* 74 (2021): 101303.

LIU, Yajuan. Foreign direct investment and the evolution of China's industrial structure. *Finance and Trade Economics*, (5), 2006: 50-56.

LUBITZ, Raymond, 1966. "The United States Direct Investment in Canada and Canadian Capital Formation, 1950-1962," unpublished Ph.D. dissertation, Harvard University.

MARKUSEN James R., and LARS E. O. Svensson. “Trade in Goods and Factors with International Differences in Technology.” *International Economic Review*, vol. 26, no. 1, (1985), pp. 175–92. *JSTOR*, https://doi.org/10.2307/2526533. Accessed 31 Jul. 2022.

MARKUSEN, James R., and VENABLES, Anthony J.. "Foreign direct investment as a catalyst for industrial development." *European economic review* 43.2 (1999): 335-356.

MUNDELL, Robert A. "International trade and factor mobility." *the american economic review* 47.3 (1957): 321-335.

NURKSE, Ragnar. "Notas sobre o Trabalho do Sr. Furtado Relativo a" Formação de Capitais e Desenvolvimento Econômico"." *Revista brasileira de economia* 7.1 (1953): 67-87.

OZAWA, Terutomo. "Foreign direct investment and economic development." *Transnational corporations* 1.1 (1992): 27-54.

OZAWA, Terutomo. “The ‘hidden’ Side of the ‘flying-Geese’ Catch-up Model: Japan’s Dirigiste Institutional Setup and a Deepening Financial Morass.” Journal of Asian Economics, vol. 12, no. 4, Elsevier Inc, (2001), pp. 471–91, doi:10.1016/S1049-0078(01)00098-7.

PAVLÍNEK, Petr., DOMAŃSKI, Bolesław, and GUZIK, Robert. "Industrial upgrading through foreign direct investment in Central European automotive manufacturing." *European Urban and Regional Studies* 16.1 (2009): 43-63. doi: 10.1177/0969776408098932.

PONTES, José Pedro. "A non-monotonic relationship between FDI and trade." *Economics Letters* 95.3 (2007): 369-373.

RADOSEVIC, Slavo, and ROZEIK, Andrew. "Foreign direct investment and restructuring in the automotive industry in Central and East Europe." (2005).

RAMIREZ, Miguel D., and KÖMÜVES, Zsófia. "Economic infrastructure, private capital formation, and FDI inflows to Hungary: a unit root and cointegration analysis with structural breaks." *Atlantic Economic Journal* 42.4 (2014): 367-382.

SAPIENZA, Elvira. "The interaction between export and FDI: Central-Eastern Europe and EU15." *Università degli Studi di Foggia Quaderni DSEMS* 13 (2009).

TEIMIZ, Dilek, and GOKEMN, Aytaç. "FDI inflow as an international business operation by MNCs and economic growth: An empirical study on Turkey." *International Business Review* 23.1 (2014): 145-154.

United Nations Conference on Trade and Development. *World investment report 2001: promoting linkages*. UN, (2001).

VAN LOO, Frances. "The effect of foreign direct investment on investment in Canada." *The Review of Economics and Statistics* (1977): 474-481.

VERNON, Raymond. "International investment and international trade in the product cycle." *International economic policies and their theoretical foundations*. Academic Press, (1992). 415-435.

VOJTOVIČ, S., KLIMAVIČIENE, A. and PILINKIENE, V. The Linkages between Economic Growth and FDI in CEE Countries. *Ekonomicky Casopis,* 67(3), (2019): pp. 264-279.

VU, Tam Bang, and Ilan Noy. "Sectoral analysis of foreign direct investment and growth in the developed countries." *Journal of International Financial Markets, Institutions and Money* 19.2 (2009): 402-413.

WANG, Jian. Research on Economic growth in transition countries. Fudan University. (2005).

YI, Jianxia, WEI, Xue, and XUE, Qing. "The Effects of Two-Way FDI on Industrial Structure Development-Evidence From Shandong in China." *Fifth International Conference on Economic and Business Management (FEBM 2020)*. Atlantis Press, 2020.

ZHOU, Dongsheng, LI, Shaomin and DAVID, K. Tse. "The impact of FDI on the productivity of domestic firms: the case of China." *International Business Review* 11.4 (2002): 465-484.

List of appendices

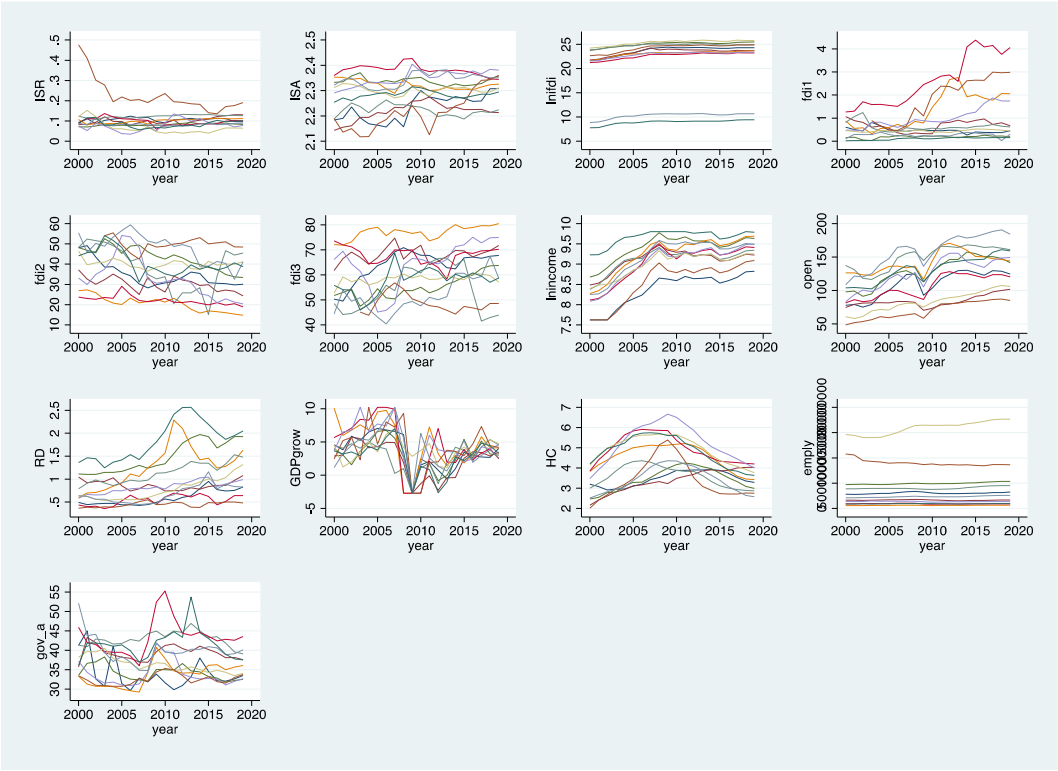
Appendices

Appendix 1: Correspondence between NACE and three major industries (Table)

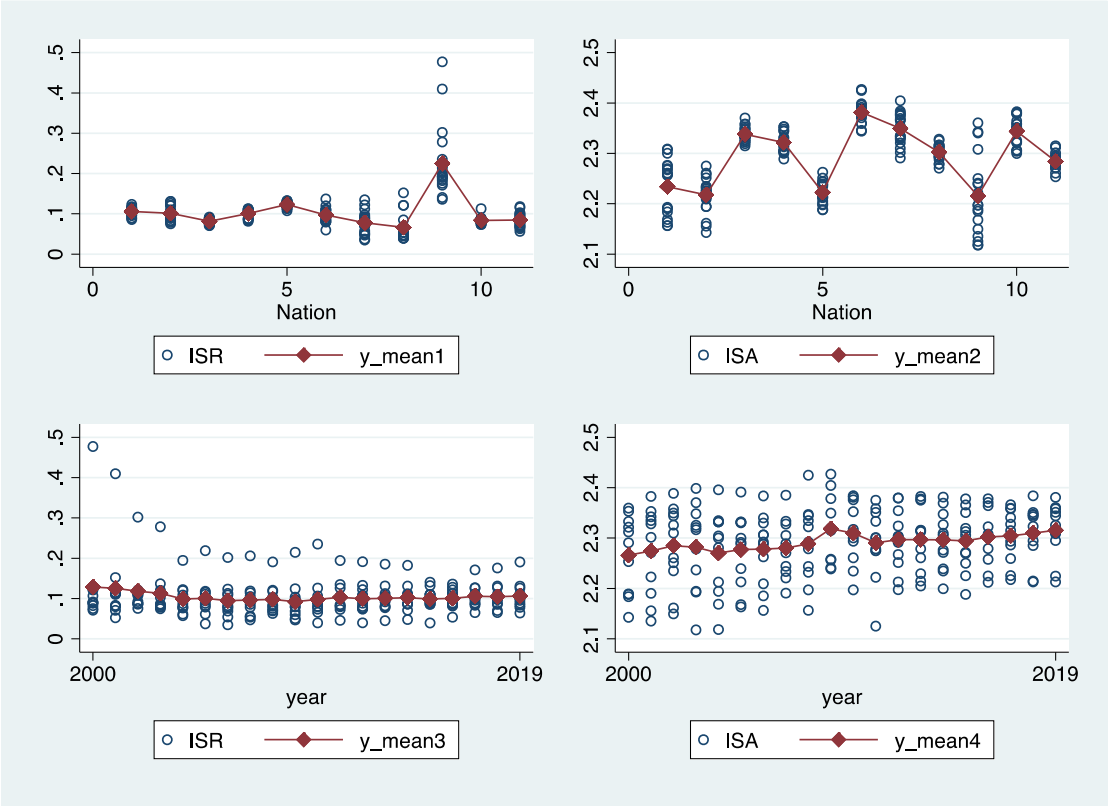
	NACE Rev.2	NACE Rev.1
Primary industry	(A) Agriculture, forestry, and fishing	Agriculture, hunting and forestry (A); Fishing (B)
Secondary industry	(B) Mining and quarrying (C)Manufacturing (D)Electricity, gas, steam, air conditioning supply (E)Water supply, sewerage, waste manag., remediation (F)Construction	(C)Mining and quarrying (D)Manufacturing (E)Electricity, gas and water supply (F)Construction
Tertiary industry	(G)Wholesale, retail trade, repair of motor vehicles etc. (H)Transportation and storage (I)Accommodation and food service activities (J)Information and communication (K)Financial and insurance activities (L)Real estate activities (M)Professional, scientific and technical activities (N)Administrative and support service activities (O)Public administration, defence, compuls. soc. Security (P)Education	(G)Wholesale, retail trade, repair of motor vehicles etc. (H)Hotels and restaurants (I)Transport, storage and communication (J)Financial intermediation (K)Real estate, renting and business activities (L)Public administration, defence, compuls. soc. Security (M)Education (N)Health and social work

	(Q)Human health and social work activities (R)Arts, entertainment and recreation (S)Other service activities (T)Activities of househ. as employers and for own use (U)Activities of extra-territorial organisations & bodies	(O)Other community, social and personal services (P)Private households with employed persons (Q)Extra-territorial organizations & bodies

Appendix 2: Visual Analysis of Stationarity (Figure)



Appendix 3: Visual Analysis of Heteroscedasticity (Figure)



DISSERTATION PROJECT

Name:
YAO Jinli

Programme:
International Masters in Economy, State and Society

E-mail:
18427619@fsv.cuni.cz

Academic year:
2021/2022

Dissertation title:
Inward FDI and Industrial Structure Optimization and Upgrading: Empirical Evidence from Central and East European EU Countries

Expected date of submitting:
2nd August

Head of the Seminar:
doc. PhDr. Jiří Vykoukal, CSc

Supervisor:
Mgr. Karel Svoboda, Ph.D.

Title:
Inward FDI and Industrial Structure Optimization and Upgrading: Empirical Evidence from Central and East European EU Countries

Short description of the topic:
Study whether IFDI will optimize or upgrade the industrial structure in CEE EU countries.

Proposed structure:
Introduction
Literature Review and Theoretical Framework
Descriptive Analysis of IFDI and Industrial Structure in CEE EU Countries
Empirical Analysis
Conclusion

Sources (basic selection):
Annual data (2000-2019) of the CEE EU Countries (Bulgaria, Czech Republic, Croatia, Estonia, Hungary, Poland, Lithuania, Latvia, Slovakia, Slovenia).