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The Transformation of Russian Industrial Structure

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THE TRANSFORMATION OF THE RUSSIAN INDUSTRIAL STRUCTURE

Abstract

This analysis provides insight into the industrial structural transformation that Russia might experience between 2006 and 2020. The article determines that the trend of Russia's industrial structure change is from secondary to tertiary sectors by evaluating statistics on GDP and labour mobility. The study also reveals that significant occurrences including the 2008 financial crisis, the 2014 Ukrainian conflict, and Putin's reelection in 2020 all had a detrimental effect on Russia's industrial structure. By introducing a number of metrics, including GDP, labour force population, unemployment rate, and significant events, the article further concludes that these elements are the primary ones impacting the industrial structure. The Thiel index is introduced at the end of the paper to assess the rationality of Russia's industrial structure. This study analyses how Russia's industrial structure is changing through in-depth case studies and empirical research. It focuses in particular on the effects of economic events, policy, employment, and GDP on industrial structure, filling a vacuum in earlier research. Thirdly, this study also resolves the debate over the effects of policy, employment, and GDP on industrial structure, and it constructs a regression model for further empirical investigation.

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Chapter 1: Introduction

1.1 Research Background

During the past thirty years, Russia has undergone a significant shift in its industrial composition. The nation has initiated numerous industrial initiatives and, guided by President Putin, has implemented a command-oriented strategy for economic governance to assist the shift from a centrally planned to a market-based economy (Simachev and Kuzyk, 2018). Due to the aforementioned alterations, Russia had a notable increase in its gross domestic product (GDP), which rose from US\$516.81 billion to US\$148.35 billion in the year 2020. This expansion was accompanied by an average yearly growth rate of 1.14 percent. The GDP per capita likewise saw an upward trajectory, with a notable rise from US\$3,493 in 1990 to US\$10,127 in 2020. Russia has undergone substantial transformations in its industrial composition over time. Specifically, the agricultural sector accounted for 14% of the country's industrial structure in 1990, while manufacturing represented 40%, and services constituted 46% (World Bank, 2022a, 2022c, 2022b). However, by the present day, these proportions have changed significantly. Agriculture now comprises only 5.83% of the industrial structure, manufacturing accounts for 26.79%, and services have grown to represent 67.38% (World Bank, 2022a, 2022c, 2022b). Based on the provided statistical data, it can be seen that the implementation of an industrial strategy has proven to be successful in facilitating a shift

towards the tertiary sector, mostly composed of services. Projections indicate that by the year 2020, the tertiary sector is anticipated to include the majority of job opportunities, constituting over 60% of the entire economic framework. This adjustment aligns with recent scholarly study conducted by Greenwald and Stiglitz (2013) as well as Chen and Xie (2019). The findings of these studies indicate that facilitating an economy's shift towards the tertiary sector, which encompasses services, necessitates the optimisation of a country's industrial structure. As a consequence, Russia's industrial framework underwent a transformation, transitioning from the primary sector to the tertiary sector.

Moreover, it is important to acknowledge that Russia, renowned for its status as the largest country worldwide in terms of land size, owns a substantial quantity of natural resources and exhibits a diverse industrial infrastructure (Statista, 2021). The significant role of its geographical location, historical history, and economic system on the global economy has been highlighted by Crafts and Venables (2001). After the disintegration of the Soviet Union, Russia has undergone a series of economic transformations, transitioning from a centrally planned economy to a market-oriented economy. This transition has been accompanied by significant alterations in the industrial structure (Britannica, 2023). The aforementioned transformation is evident not alone in the varieties and magnitudes of industries, but also in their fundamental frameworks and operations. While heavy industry and resource extraction continue to dominate Russia's industrial structure, there is a growing

significance placed on the expansion of the service industry and high-tech businesses (WorldAtlas, 2017). The aforementioned shift in the industrial structure is not just a consequence of Russian economic progress, but also a necessary decision made by Russia to align with the prevailing trajectory of global economic growth.

1.2 Research Reasons

The examination of the transformation of Russia's industrial structure has significance not only as a valuable point of reference for Russia's economic progress, but also as a noteworthy case study for the broader global context of economic transformation and industrial advancement (Zhao & Tang, 2018).

There are several potential uses in this context:

The shift from a planned economy to a market economy in Russia, as the principal successor of the former Soviet Union, holds considerable significance as a point of reference for other transitioning nations. This process also entails dramatic changes in the industrial structure (Sahut and Teulon, 2021). Countries in Central and Eastern Europe, Central Asia, and other regions are currently undergoing a comparable process of industrial structural transformation. These nations have the opportunity to draw insights from Russia's experience in order to circumvent similar detours and effectively modernise their economies. By optimising and upgrading their industries, these countries can enhance their economic performance (Encyclopaedia, 2022).

Furthermore, it may be argued that Russia exhibits the characteristics of a resource-based economy, and its ongoing industrial structural change can be seen as a transition from a resource-based economy to a knowledge-based economy (Frayne, 2012). Hence, an examination of the process of Russia's industrial structural transformation can offer valuable insights for other economies reliant on natural resources, such as Australia, Canada, Saudi Arabia, and other nations. This analysis can assist them in identifying novel avenues for economic growth and attaining sustainable economic development amidst the challenges of resource depletion and escalating environmental pressures.

Moreover, in the context of globalisation, the rebuilding and relocation of industrial chains emerge as a significant phenomenon (Koehn, 2023). The examination of Russia's industrial structure transformation in research can offer theoretical and practical insights for the reconstruction of the global industrial chain. This analysis can assist countries in gaining a better understanding of the development trajectory of the global industrial chain, optimising their own industrial layout, and strengthening their position within the global industrial chain.

The investigation of a sustainable development model is inherent in the process of transforming Russia's industrial structure (Akindinova, Bessonov, & Yasin, 2022). Hence, an examination of the evolution of Russia's industrial framework

can offer valuable insights and benchmarks for worldwide sustainable development. This analysis can assist nations in attaining a harmonious development of their economy, society, and environment, concurrently with their pursuit of economic progress. Moreover, it can facilitate the advancement of global sustainable development endeavours.

1.3 Research Question

While numerous studies have been dedicated to examining the industrial structural transformation in Russia, the majority of these studies have primarily focused on providing descriptions and explanations of the transformation process. However, there has been a limited amount of comprehensive research conducted on the various modes of transformation, the factors that influence it, and the rationality of industrial organisation. The prevailing corpus of scholarly literature mostly focuses on conducting qualitative analyses of the phenomenon of industrial structure transformation. The objective of this study is to utilize nine regression models in order to examine the difficulties and limitations linked to the transformation of industrial structure. This will be accomplished via the implementation of an empirical research methodology. The objective is to identify the specific factors that influence the process of industrial structure transformation. Hence, this research endeavour aims to address the limitations observed in prior studies by examining the following four concerns:

(1) What approaches have been taken in the structural transformation of

Russia's industry? What obstacles have been encountered during the process of Russia's industrial structural transformation? This study aims to conduct a comprehensive analysis of the primary trajectories of Russia's industrial structural transformation, focusing on the aspects of industrial upgrading and industrial transfer. The research will also analyse the problems encountered in the structural transformation of Russian industry.

(2) What economic events have affected Russia's industrial transformation? How did these major economic events affect Russia's industrial transformation? The study will review and analyse the major economic events in Russia in recent years with a view to revealing the mechanism by which these events have affected the transformation of Russia's industrial structure.

(3) What are the important factors affecting industrial restructuring in Russia? The research will delve into the important factors affecting the transformation of Russia's industrial structure from various perspectives, including policy, employment, and output value.

(4) How to judge whether Russia's industrial organisation is reasonable? This research aims to construct a dynamic model for assessing the rationality of Russia's industrial structural transition, utilizing the economic calculation method and the Theil Index.

1.4 Research Outline

The literature review section will examine the methodology employed in industrial structural transformation and the challenges encountered during this process. Additionally, it will investigate the impact of policy, employment, and output value on the transformation of industrial structure. This study will also examine the assessment of the rationality of industrial structural transformation and identify the deficiencies in current research by synthesising existing theoretical and empirical evidence. Additionally, it will highlight the potential contributions of our study in enhancing the understanding and advancement of structural transformation. This request entails providing a concise overview of the current theoretical and empirical knowledge, as well as identifying the specific contributions that the proposed study aims to make in addressing the existing gaps in the literature.

This study will utilise the three-sector theory, the Thiel index theory, the industrial life cycle theory, and the institutional change theory within the theoretical framework section. These theories will be employed to elucidate the process by which Russia divides and transforms its industries using the three-sector theory, to examine the cyclical changes experienced by Russia's industries, and to analyse how Russia employs the theory of institutional change to optimise the transformation of its industrial structure through institutional mechanisms or policies. Ultimately, the study will use the framework of institutional transformation. This research will use the Thiel index theory to assess the rationality of industrial structural change.

The next portion of this study will explicate the technique used to quantify the industrial structure, using regression models. Additionally, it will elucidate the analytical approach employed to assess the influence of output, employment, economic events, and policies on the industrial structure, via empirical research. The methodology section provides a comprehensive account of the research methodology used in this study, including the data collecting and processing procedures, as well as the analytical techniques utilised to address the research inquiries.

The Results and Discussion section will use multiple linear regression to investigate the major aspects in the research of Russia's structural transformation of industries, as well as to provide a feasible approach to such transformation. To answer the four study issues pertaining to the structural change of Russian industry, a total of nine regression models will be used.

The conclusion section provides a concise overview of the study's contribution, addressing the deficiencies of prior literature and presenting the key results, research limitations, and potential avenues for future research.

Chapter 2: Literature Review

2.1 Introduction

The literature review will look at the issues with industry structural transformation, as well as the solutions proposed by other academics, and will

also look at the challenges with industrial structural transformation. Russia will be utilized as a case study. The focus of the study will be on the challenges and complexities related to industrial structural transformation in Russia, together with the evaluation of the rationality of this shift. The subsequent step involves doing research to identify potential solutions for addressing challenges pertaining to industrial structure, with the aim of facilitating the transformation of said structure.

2.2 The debate on industrial structural transformation

2.2.1 The Debate over the way of Industrial Structural Transformation

There are varying viewpoints about strategies for altering the industrial system. According to Xiao (2017), the market mechanism plays a crucial role in driving the transformation of the industrial structure. Through market competition, outdated industries can be phased out, while the growth of emerging industries can be fostered. This process facilitates the self-adjustment and optimisation of the industrial structure.

According to Li (2021), there exist divergent perspectives on the matter. Li asserts that education and training have significant importance, as they have the potential to enhance the calibre and expertise of the workforce. Moreover, Li underscores their capacity to facilitate the adaptation of individuals to emerging industries, hence catalysing transformations in the industrial

landscape. According to Li (2021), worker mobility was posited as the proposed remedy.

Furthermore, Zhong, Chen, and He (2021) propose an innovative paradigm that posits technical innovation as the primary catalyst for industrial structural transformation. The authors contend that the implementation of innovative developments and technologies holds the capacity to improve productivity efficiency and foster the development of new products and services, consequently promoting the progression of industrial structural transformation.

Different scholars have different views as time advances. Bonvillian (2021) argues that providing policy direction is a crucial tool for changing the industrial structure. They think that the government may direct the flow of money and resources into profitable and developing industries by developing appropriate policies, thereby fostering the optimisation and modernization of the industrial structure (Chen and Xie, 2019a).

Research gap for this dispute

The existing body of literature pertaining to methodologies used for facilitating structural change within industries is subject to certain constraints and shortcomings. Previous studies have indicated that education, technological

innovation, policy guidance, and market mechanisms play significant roles in industrial structural transformation. However, there remains uncertainty regarding the primary factors influencing professional structural transformation and the appropriate methodology for conducting empirical investigations to examine the impact of various factors on industrial structural transformation.

To address the existing research deficiencies, this thesis will undertake a comprehensive investigation into the following areas: The present study aims to examine the many stages of Russia's industrial structural transformation in order to identify the essential components that are crucial for the successful implementation of this transformation. Additionally, this research will explore the suitability of the industrial structural transformation for Russia. Furthermore, the present research aims to provide a theoretical framework in order to enhance comprehension of the tangible circumstances surrounding industrial structural change within the microeconomic context.

2.2.2 Issues related to structural transformation of industries

Diverse perspectives among researchers exist about matters pertaining to the structural restructuring of industries. According to Yang (2016), a significant challenge in the process of industrial structural change is the excessive dependence on low-tech sectors, which are characterised by labor-intensive operations. If a nation or geographical area's industrial composition is too reliant

on low-technology or labor-intensive sectors, it might face a competitive disadvantage in the global arena. This phenomenon may be attributed to the relatively lower profitability and susceptibility to competition from other nations or areas within certain sectors (Du, Cheng, & Yao, 2021). To effectively tackle this issue, it is essential for the nation or locality to provide resources towards enhancing education, research, and development endeavours. This would facilitate the advancement of technical proficiency and foster innovation, ultimately driving the transition of the industrial sector towards a knowledge-based tertiary industry (Jong, 2014).

The excessive dependence on businesses that are characterised by high levels of resource consumption or intensity may result in significant environmental challenges, including pollution and the depletion of resources (Lampert, 2019). The aforementioned phenomenon not only has adverse effects on human well-being and overall life satisfaction but also presents a significant challenge to the attainment of sustained economic progress (Cohen, 2020). To address this issue, it is essential for the nation or locality to pursue ecologically sustainable production techniques, including the use of renewable energy sources and the implementation of a circular economy model (UN Environment Programme, 2017).

If the structural transformation of industries does not go smoothly, it may lead

to a large number of unemployment problems (Schlogl, 2017). This may lead to social instability and even trigger social unrest. In order to solve this problem, the country or region needs to provide sufficient employment opportunities, for example, through the development of services and high-tech industries (Kenton, 2020).

According to Konovalova and Maksimov (2017), a nation or area may exhibit heightened vulnerability to economic changes if its industrial structure exhibits excessive reliance on a certain sector. For instance, the Russian economy may have significant repercussions when subjected to swings in oil prices due to its excessive reliance on oil exports (Depersio, 2019). In order to mitigate this issue, it is essential for the nation or locality to undertake measures aimed at enhancing economic diversification and diminishing reliance on a single sector.

Research gap

Previous research may have inadequately considered the interdependencies between industrial structural concerns and other socio-economic factors. One notable aspect is to the interconnection between industrial structure concerns and several other domains, such as employment, environment, and education. Furthermore, the examination of policy interventions aimed at resolving industrial structure difficulties remains lacking. One potential area of inquiry is the development and execution of efficacious strategies aimed at fostering the

enhancement and modernization of industrial frameworks.

The forthcoming paper aims to address the existing research gap by examining the specific challenges associated with industrial structure transformation in Russia. It will explore the interconnections between the problems of industrial structure transformation in Russia and other economic issues, such as employment concerns, using Russia as a case study. This section will examine the use of policies as a means to facilitate the advancement and enhancement of industrial structures.

2.2.3 Controversy over the role of policy in structural transformation of industries

The discourse around the function and aims of policy in industrial restructuring include divergent economic ideologies and social ideals. Chen and Xie (2019) propose that policy should serve as a "facilitator" in driving industrial structural change, asserting that the government need to use active policy intervention to lead and support this process. This perspective highlights the primary responsibility of the government in promoting technical innovation and industrial advancement. The government should actively support firms in these endeavours via the provision of fiscal subsidies, tax incentives, and other policy tools (Mazzucato, 2015). The objective of this perspective often revolves on prioritising assistance for high-technology sectors with the aim of fostering

industrial advancement and stimulating economic expansion. According to Song et al. (2022), there is a contention that high-tech sectors play a pivotal role in driving future economic development, and it is recommended that regulations be implemented to foster their growth.

On the other, some perspectives put out by researchers posit that policy ought to assume the function of a "watchdog". These scholars contend that policy should primarily provide a level playing field inside the market, allowing the market mechanism to independently facilitate the process of industrial structural change (Vrolijk, 2020). This perspective places significant importance on the independence of the market (Vrolijk, 2020) and posits that excessive governmental involvement has the potential to disrupt the functioning of the market mechanism and impact the effectiveness of industrial structural transformation (Pettinger, 2019). The primary objective of this perspective is often to prioritise social equality and environmental preservation, even at the potential expense of economic expansion (Pettinger, 2019). According to Menton et al. (2020), it is said that the process of industrial structural transformation encompasses not only economic considerations but also social and environmental dimensions. Consequently, policies addressing this phenomenon should adopt an integrated approach that takes into consideration all these variables.

The complexity of industrial structure transformation strategies arises from the confrontation and integration of these two perspectives. The determination of the responsibilities and aims of policies should be based on a careful consideration of the particular socio-economic environment and development requirements. It is essential to consider a mix of elements in order to optimise social welfare, as highlighted by the United Nations in 2015.

Research gap

First, quantifying the role of policy on industrial structure is a complex task. Changes in industrial structure may be influenced by a variety of factors, including policy factors but also non-policy factors such as technological progress, market demand, and the resource environment (Saboniene, 2010). How to accurately quantify the role of policy factors and exclude the influence of non-policy factors is a problem that needs to be solved.

Furthermore, evaluating the impact of policies on the industrial structure is a significant problem. Although prior studies have successfully measured the impact of the policy, it is crucial to determine the extent to which this impact aligns with the intended outcomes and goals of the policy. This assessment is a significant aspect that requires attention and resolution.

The proposed study aims to address the identified gap in the existing literature by using a regression model to examine the significance of particular policies

on the industrial structure. To quantify the influence of these policies on the industrial structure, dummy variables will be included into the analysis. The dummy variables are assigned a value of 0 in the presence of policy influence, and a value of 1 in the absence of policy. Subsequently, we will proceed to assess the impact of policy implementation on the transformation of industrial structure. To quantify this effect, we will use the Tel index to examine the industrial structure.

2.2.4 Controversy over the impact of employment on industrial transformation

There are divergent perspectives about the influence of employment on the process of industrial transformation within the labour force. According to Zhang et al. (2022), the authors suggest that the presence of employment has a positive impact on the process of industrial structural change. The migration of labour has a significant impact on the restructuring of the industrial sector. As an illustration, the shift of China's labour force from agriculture to industry results in a structural transformation of the country's primary sector into the secondary sector (Zhang et al., 2022). Simultaneously, the phenomenon of labour mobility plays a pivotal role in facilitating the structural restructuring of many sectors. According to the life-cycle hypothesis, when the labour force in an industry experiences growth and productivity improves, the sector is likely to attract expansion. This, in turn, leads to increased profitability and further

growth. An illustrative instance of this phenomenon may be seen in the oil and gas sector of the Russian Federation. The sector saw heightened productivity and a significant influx of labour due to the escalating global energy demand (IEA, 2022). According to the International Energy Agency (IEA, 2022), the industry has seen substantial development, resulting in a notable expansion of its presence within Russia's industrial framework. The influence of employment on the structural change of industry is evident.

According to Donovan and Schoellman (2021), labour is seen as having a negative impact on the process of structural change within the industrial sector. Benach et al. (2011) express worry on the potential detrimental effects on the industrial structure of the recipient nation if the predominant flow of migration consists of low-skilled workers. The primary cause for this apprehension is from the potential inadequacy of low-skilled workers to fulfil the requirements of high-tech companies in the host nation. For instance, when a city's primary economic sector revolves on high-technology industries and the majority of incoming workforce consists of individuals with limited skill sets, there may arise a situation where the labour force is unable to effectively carry out the tasks required in the high-tech sector. Consequently, this mismatch in skills might potentially result in a deterioration of the overall industrial composition (Wolcott, 2020).

Research gap

Previous research has commonly established a connection between labour mobility and the transformation of industrial structure. This connection typically involves the movement of labour from inefficient industries or regions to more efficient ones, thereby facilitating the optimisation and advancement of the industrial structure (Long and Ferrie, 2022). Nevertheless, the direct correlation between labour migration and industrial structural change fails to adequately explain the profound interconnection between these two phenomena.

To begin with, it is important to note that labour mobility encompasses not only the movement of individuals in terms of quantity, but also the transfer of skills and knowledge (Radcliffe, 2022). The phenomenon of labour mobility has the potential to facilitate the dissemination of skills and information, hence influencing the process of industrial structural change (Hayes, 2019). As an example, the migration of highly trained workforce has the potential to stimulate technical advancements and facilitate the evolution of industrial framework towards a more sophisticated trajectory (OECD, 2022). Nevertheless, there is a need for more study on the strategies to reach this goal via the optimisation of labour mobility, the facilitation of high-skilled labour mobility, and the implementation of effective policy measures (Sault, 2022).

Furthermore, it is important to consider that the correlation between labour

mobility and the change of industrial structure might be influenced by other variables, including local regulations and the prevailing market conditions (Carrera and Raurich, 2018). According to Abella (2013), several variables have the potential to influence the direction and velocity of labour mobility, thereby impacting the change of industrial structure. The examination of how to enhance the industrial structure via labour mobility in light of these characteristics is a topic of significant scholarly interest.

The potential interplay between labour mobility and the evolution of industrial structure may be bidirectional. Labour mobility has the potential to facilitate the alteration of industrial structure (Shi, 2021). Conversely, the transformation of industrial structure may also have an influence on labour mobility (Kwatiah, 2016). As shown by Qu and Lyu (2018), the process of enhancing industrial structures has the potential to provide a greater number of employment opportunities that need advanced skills, hence fostering the influx of highly trained personnel. A comprehensive examination of this reciprocal association may enhance our comprehension of the correlation between labour mobility and industrial structural change.

The influence of a specific worker force on the industrial structure is a subject of ongoing debate. To effectively examine the impact of a specific labour force on the evolution of the industrial structure, it remains essential to use Russia as

a case study. In subsequent analysis, this research will use the labour force's flow as variable X and the transformation of the industrial structure as variable Y. Regression models will be constructed to examine the influence of these two variables.

2.2.5 The impact of output value on the transformation of the industrial structure

In addition to the impact of employment, the change of industrial structure may also be influenced by the industry's production value. The significance of the output value lies in its role as a crucial metric for assessing the level of productivity within an industry or economy (Chen, Jefferson, & Zhang, 2011). According to Chen, Jefferson, and Zhang (2011), an increase in the output value of an industry signifies a rise in productive activity within that sector. This growth in output value has the potential to attract more resources and investment, hence facilitating the transformation of the industrial structure. In contrast, the authors Bu Jiuhe et al. (2023) claim that the process of structural transition within industries is also associated with a reduction in overall production. Despite an increase in workforce and a shift towards a more labor-intensive sector, there has been no corresponding improvement in production efficiency.

However, an alternative perspective posits that the increase in production does

not automatically result in the optimisation of the industrial structure (Li and Lin, 2017). The concentration of production growth in low-value-added sectors, rather than high-value-added businesses, may be a contributing factor (Kordalska & Olczyk, 2022). For instance, if a nation's economic expansion primarily stems from the extraction of raw materials or the production of low-technology goods, which offer limited value addition, the growth in output may not necessarily facilitate the optimisation and advancement of the country's industrial framework (Bjornlund, Bjornlund, and Rooyen, 2020). Alternatively, this might potentially result in an industrial framework that exhibits a greater reliance on sectors with lower value-added contributions, thereby impeding the process of optimising and upgrading the industrial structure (Wang, Han, & Zhang, 2021).

Both perspectives possess elements of veracity, however they are also subject to certain constraints. The potential for output growth to facilitate the optimisation and advancement of industrial structures is contingent upon several aspects, such as the origin of output growth, the technical proficiency of the industry, the market conditions, the legislative framework, and other relevant considerations. Hence, more empirical investigations may be necessary to thoroughly examine this matter.

Research gap

The academic discourse surrounding the correlation between the labour force and the transformation of industrial structure has evolved, prompting the need for empirical research. This research aims to analyse the specific changes in the relationship between the labour force and industrial structure. Subsequently, a regression analysis will be conducted to determine whether this relationship follows a linear or non-linear pattern. This study will use Gross Domestic Product (GDP) as a metric to assess economic production, then examining the correlation between GDP and the process of industrial structural change.

2.2.6 Controversy over the rationality of evaluating industrial structural transformation

Lee (2001) considers economic efficiency to be one of the important criteria for judging the rationality of industrial structures. A rational industrial structure should be able to use resources efficiently and produce maximum economic output (Juma, 2023). This means that the industrial structure should be able to allocate resources to the industries that create the most value (Asana, 2022). For example, if a country's or region's resources are better suited for manufacturing, then its industrial structure should be dominated by manufacturing (Schwertner and Moret, 2020).

Contrasting perspectives exist, positing that work prospects constitute a significant factor as well. According to Lahtinen, Sirniö, and Martikainen (2018),

it is essential for an industrial structure to possess the capacity to provide an ample number of work options, particularly for those with limited skills. This phenomenon may be attributed to the fact that work serves as the primary means through which individuals acquire money, hence playing a crucial role in fostering social stability and fairness (Piece, 2012). An instance of this may be seen when a nation or region's industrial composition heavily depends on high-tech sectors, potentially resulting in employment challenges for those with lower skill levels (Li, Ding, and Niu, 2019).

Snyder (2019) asserts that technical advancement is a significant determinant of economic development and hence a crucial metric for evaluating the rationality of industrial composition. According to Zou and Xiong (2022), an optimal industrial framework should foster technical advancements and enhance productivity efficiency. For instance, if the industrial framework of a nation or locality fosters firms to engage in research and development (R&D) and innovation, it might potentially facilitate technological advancement (Wu and Shao, 2022).

The rationality of industrial organisation is often evaluated based on the criteria of economic stability (Dressler and Burns, 2004). According to Duan et al. (2022), an optimal industrial structure should possess the capacity to endure economic volatility, including variations in market demand and price fluctuations.

For instance, the maintenance of a certain degree of variety in the industrial structure of a nation or area may enhance its resilience against economic swings (Tan et al., 2020).

Research gap

One significant study deficiency in the examination of the rationality of industrial organisation is to the absence of a comprehensive set of evaluation indicators.

At present, several studies may use distinct indicators to evaluate the rationality of industrial organisation, potentially resulting in divergent evaluation outcomes.

For instance, some research endeavours may centre their investigation on the relative distribution of industries, whilst others may prioritise the examination of industries' technical composition or environmental ramifications. These variations have the potential to result in significant disparities in the evaluation outcomes across various research investigations. Hence, the identification of a comprehensive and scientifically sound evaluation indicator system that effectively captures the rationality of industrial structure is a significant area of study that requires attention.

An further noteworthy research gap pertains to the selection of evaluation methodologies. At now, a standardised approach for evaluating the rationality of industrial organisation has yet to be established. Consequently, many studies use diverse methodologies, including qualitative research, quantitative analysis,

or a combination of both. Variations in methodologies might potentially impact the precision and dependability of the evaluation outcomes. Hence, the selection of the best suitable assessment methodology and the establishment of measures to guarantee the precision and dependability of the assessment outcomes need more investigation.

Industrial structure changes with time and environment, so how to conduct a dynamic assessment of industrial structure is an important research gap. Currently, most studies conduct assessments based on data at a particular point in time, ignoring the dynamic changes in industrial structure. This may result in the assessment results not accurately reflecting the actual situation of the industrial structure. Therefore, how to build a dynamic assessment model and predict future changes in industrial structure is an important research topic.

The present research will use the Theil Index as a means to evaluate the rationality of the industrial organisation. The Theil Index is designed to assess the degree of reasonableness in the proportional connection across industries. It evaluates if the proportions of various sectors, in terms of total output value, employment, and other relevant factors, are acceptable. A low value of the Theil Index indicates a high level of rationality in the industrial structure, whereas a high value of the Theil Index suggests a low level of rationality in the industrial structure. The study will conduct calculations of the Theil index at various time

intervals in order to analyse and evaluate the fluctuations in the index for dynamic assessment.

2.3 Structural transformation of Russian industry

Some of the factors influencing industrial structural transformation have already been mentioned, and it is necessary to further examine which of these factors is more important for industrial structural transformation. Russia could be the subject of a study to examine which factors are more important for the structural transformation of the industry, as Russia is an important global energy exporter and the transformation of its industrial structure has an important impact on global energy markets.

2.3.1 The importance of studying Russian industry structural transformation

Russia is a significant energy exporter to the globe, especially in the oil and gas industry, where it ranks among the top producers and exporters globally (Meredith, 2022). As a result, the changes to Russia's industrial structure, notably in the energy sector, will have a considerable influence on the world energy market (IEA, 2022b). The first is that Russia's energy policy and industrial restructuring will have a direct influence on the world's energy supply. Russia's ability to successfully transition from a resource-dependent economy to a more diversified one might have a big impact on how the world's energy

markets are supplied (BBC, 2022). Second, the reorganisation of Russia's industrial sector can have an impact on world energy costs (Tsafos, 2022). For instance, if Russia is successful in increasing the quantity of energy it produces and the effectiveness of its energy industry, this might put pressure on global energy prices (Boehm, 2022). Finally, studying the changes to Russia's industrial structure can help us comprehend the patterns and changes in the global energy markets (Cheremukhin et al., 2016). To provide insights into the prospective trajectory of the global energy market and provide guidance for formulating energy policies, researchers may use Russia's industrial structural change as a valuable analytical framework. To get a comprehensive understanding of the Russian economy and the global energy market, it is feasible to examine the progression of Russia's industrial composition.

In addition to having a substantial impact on the global energy market, Russia's changing industrial structure also has repercussions for the study of Russian socio-economic concerns, which encompass a wide range of socio-economic issues including employment, income distribution, and social welfare (Brown and Brown, 1999). The resolution of these problems is essential for the social and economic growth of Russia. First, the job market will be directly impacted by the alteration of the industrial structure (Medvedev, 2016). For instance, if Russia can successfully expand its high-tech and service sectors, it may add a significant number of new jobs, reducing the need for labour and enhancing

social stability (Soldatov, 2021). Second, income distribution may be impacted by industrial restructuring (Ross, 2019). Through industrial restructuring, Russia may be able to boost the added value of its economy, which might result in higher incomes, better income distribution, and higher living conditions for its citizens (Reuters, 2022a). Additionally, social welfare may be impacted by industrial restructuring. For instance, if Russia is successful in improving the effectiveness and competitiveness of its economy through industrial restructuring, it may boost the government's fiscal income, which might allow for more funding to be given to social welfare and enhance the welfare of the populace (Hays, 2016). As a result, the research may better grasp these socio-economic problems and provide solutions by analysing Russia's industrial revolution.

An essential component of Russia's modernization is the alteration of its industrial structure. The transition from a conventional resource-based economy to a more diversified, knowledge-intensive, and technology-intensive one is a challenging and intricate process (Inozemtsev, 2016). First off, one of the key indicators of economic modernization is the alteration of the industrial structure. It is better for this thesis to grasp the implications and requirements of economic modernization, including industrial upgrading, technical innovation, and human resource optimisation, by analysing the evolution of Russia's industrial structure (Alpha History, 2019). Second, a significant driver of

economic modernisation is the process of structural transformation within the industrial sector. According to Islam and Iversen (2018), the enhancement and streamlining of the industrial structure have the potential to enhance the productivity and competitiveness of the economy, hence promoting sustainable economic development. It is good for this research to better grasp how to promote economic modernization through industrial structural transformation by analysing the transformation of Russia's industrial structure. Additionally, industrial restructuring is a crucial strategy for overcoming the different difficulties that develop throughout economic modernization (Chasnoff and Spogli, 2021). For instance, one of the key concerns in the process of economic modernization is how to address the job and environmental issues brought on by the change in the industrial structure (Chulu, 2016). By looking at Russia's industrial restructuring, it is also possible to see how these issues may be resolved through industrial restructuring. Studying Russia's industrial structural transformation may help one better comprehend the difficulties and complexity of economic modernization.

Whether the transformation of Russia's economic system will affect the structural transformation of industry is also a question worth examining. From an autocratic market economy, like China's, Russia will transition to an authoritarian command economy, like North Korea's (Hess, 2022). An economy that is self-sufficient relies less on foreign commerce and outside investment and more on its own resources and production potential. This indicates that

rather than importing products and services from other nations, the nation satisfies its own requirements as much as is practical (Hess, 2022). These institutional changes have had a significant and complicated influence on the industrial structure's transformation (Ickes and Ofer, 2006). Other developing nations making the switch from an authoritarian command economy to a self-sufficient economy can learn a lot from this experience. First, the Russian experience can help them better foresee and prepare for difficulties and obstacles that may occur throughout the transition process by helping these nations comprehend the extensive effects of institutional change on the structural transformation of their sectors. Second, these nations might use the Russian experience as a strategic guide to help them devise more successful plans for industrial restructuring as part of the institutional transformation process. Finally, these nations may theoretically benefit from the Russian experience by developing a stronger theoretical knowledge of the intricacy and complexity of industrial transformation (Czinkota, 1997). Overall, other emerging nations going through comparable revolutions may learn a lot from Russia's experience in changing its industrial structure.

There are some notable research gaps in the study of industrial structural transformation in Russia. Firstly, while some of the factors influencing industrial structural transformation, such as policy, technological progress, and market demand, have been examined, the specific roles and interactions of these

factors in Russia remain unclear. Second, while the impacts of industrial structural transformation on economic growth, employment, and the environment have been studied to some extent, the extent and mechanisms of these impacts in the specific context of Russia still require further research. As well as the manner in which structural transformation is carried out in Russia specifically and how the rationality of industrial structural transformation is evaluated, this has not yet been studied.

This article aims to address the existing research gap by conducting an empirical study that use quantitative approaches to assess the variables influencing the development of Russia's industrial structure and determine their relative significance. In order to comprehensively examine the socio-economic consequences of industrial structural transformation in Russia, it is imperative to employ case studies and comparative research methods. These approaches will facilitate an in-depth analysis of Russia's industrial policies, enabling an evaluation of their efficacy and efficiency. Additionally, the implementation of methodologies such as the Thiel index will allow for an assessment of the dynamics within Russia's industrial structure. This assessment will aid in understanding the patterns of change within the industrial sector and provide insights into its future trajectory.

2.3.2 Reasons for the transformation of Russia's industrial structure

The predominant factor contributing to the shift in Russia's industrial structure is the nation's disproportionate dependence on mining, oil, and gas sectors (Horton & Palumbo, 2021). The underlying cause for this interdependence is from Russia's substantial deposits of natural resources, particularly in the form of oil and gas. These reserves have facilitated Russia's ability to export these resources, so generating significant foreign currency and fostering economic growth during the last several decades (Ermolaev, 2017).

Nevertheless, this reliance has rendered Russia's economy very susceptible. The considerable fluctuation in oil and gas prices on the global market poses a substantial risk to Russia's export profits, since a decline in prices might have a profound impact on the Russian economy (Rogoff, 2022). Furthermore, it is worth noting that resources such as oil and gas are classified as non-renewable, and the issue of resource depletion becomes more pronounced as extraction continues (National Geographic, 2022). The potential consequences of this situation extend beyond the impact on resource exports and the Russian economy, including a range of social issues including unemployment and poverty (Habitat for Humanity, 2023).

Hence, the alteration of the industrial framework has emerged as an inexorable decision for the economic advancement of Russia. Russia has the potential to diminish its reliance on oil, gas, and other mineral resources by undertaking a

transformation of its industrial structure. This transformation would include diversifying its industries, including the development of manufacturing, services, and high-tech sectors. This measure will not only enhance the stability of Russia's economy but also provide further prospects for its economic development.

One of the primary factors contributing to the alteration of Russia's industrial framework is the issue pertaining to its economic efficacy (Cordell, 2019). The inefficiency is mostly shown in two key features. One perspective is that the absence of competitive forces in these sectors, resulting from longstanding protection and subsidies, has contributed to their limited ability to innovate and produce efficiently (Tarver, 2022). Conversely, the substantial utilisation of energy and resources during the manufacturing procedures of these sectors, sometimes accompanied by significant ecological contamination, significantly diminishes their economic efficacy (Organisation for Economic Co-Operation and Development, 2004).

Historically, the Russian government has provided protection and subsidies to traditional sectors within the country, including heavy industry and military industry. This approach has ensured a level of stability in the growth of these industries, but it has also resulted in a decline in their economic efficiency (Luzin, 2021). According to Luzin (2021), the growing debt burden of the Russian

defence sector, which gives rise to inflationary pressures and also foreshadows forthcoming escalations in military expenditures, stands as the foremost signal of the industry's economic inefficiencies. According to Luzin (2021), there has been a significant increase in the total debt of the military industry, which has surged from 3.31 trillion rubles over a span of two years to 41 trillion rubles between the years 2019 and 2020. This translates to a substantial monetary range of around \$600 million to \$100 million. The Russian economy is experiencing limited growth due to the increasing costs associated with the weapons business. Consequently, there is an urgent need to promptly restructure Russia's industrial framework in order to address its subpar economic efficiency.

Hence, it is imperative for Russia to enhance its industrial competitiveness and efficiency by undertaking industrial restructuring initiatives, particularly in the domains of services and high-tech sectors, with the aim of enhancing overall economic efficiency (Golovanova & Ryabkov, 2020). The expansion of many service sectors, notably contemporary domains like banking, information, education, and healthcare, will not only cater to the increasing demands of individuals but also enhance the economic value and efficiency (Buckley and Majumdar, 2018). The advancement of industries characterised by advanced technology, such as electronic information, biotechnology, and new materials, has the potential to stimulate technological advancement, enhance the

economy's capacity for innovation and competitiveness, and additionally contribute to the enhancement of economic efficiency (Organisation for Economic Cooperation and Development, 2007). Enhancing economic efficiency is a fundamental impetus behind Russia's industrial structural reform. Through the process of restructuring its industrial framework, Russia has the potential to cultivate industries that are more competitive and efficient, so enhancing its economic efficiency and fostering sustainable economic growth.

The alteration of Russia's industrial structure may be attributed to the significant influence of globalisation. With the increasing intensity of globalisation and the escalating rivalry in foreign markets, Russia is confronted with multifaceted issues (Larsen, 2022). According to Koehn (2023), Russia has the potential to enhance its standing in international competitiveness and effectively respond to shifts in the global market via the reformation of its industrial framework. The ongoing conflict in Ukraine serves as a pertinent illustration of the aforementioned perspective. In response to the emergence of the Ukraine crisis, Western nations implemented a sequence of economic sanctions on Russia. These sanctions had a notable influence on the Russian economy, notably on its economic framework, which heavily depended on the exportation of oil, gas, and other natural resources (Neuman and Hurt, 2023). Russia has gained a heightened awareness of the vulnerability of its economic model, which relies excessively on exporting resources, and recognises the pressing need to

overhaul its industrial structure.

Consequently, the Russian government has initiated measures aimed at enhancing the efficacy and competitiveness of its economy, so facilitating its capacity to effectively respond to fluctuations in the international market (Fedyunina and Averyanova, 2019). In light of the globalisation pressures and the situation in Ukraine, Russia has gained a heightened awareness of the significance and immediacy of restructuring its industrial framework, which has been influenced by the ongoing change of its industrial structure.

2.3.3 Major events affecting the structural transformation of Russian industry

A substantial body of work exists about the impact of the financial crisis on the Russian economy. As an example, Desai (2010) investigates the contraction of Russia's gross domestic product (GDP) and the upsurge in unemployment subsequent to the financial crisis of 2008. Nevertheless, there has been much scrutiny over the excessive reliance of the Russian economy on energy exports. Furthermore, there is a dearth of literature examining the potential impact of the economic crisis on Russia's industrial structural reform. The interrelationship between GDP, unemployment, and industrial structure may provide valuable insights into the potential for structural transformation within the Russian industry. Additional empirical research is required to be conducted at a later

time, since the subject matter remains unexplored.

In conjunction with the prevailing financial crisis, the 2014 Ukrainian war emerged as a potential factor influencing the structural transformations inside the Russian economy. The strained relations between Russia and the West due to the 2014 Ukrainian crisis led to the imposition of economic sanctions on Russia and exerted severe pressure on its economy. The imposition of sanctions resulted in the obstruction of Russia's exports, namely in the energy sector, so negatively impacting the nation's economic growth. According to Karpia (2015), the energy sector in Russia stands out as the most prominent industry, characterised by a distinctive set of circumstances. The sector was additionally impacted by various factors, including the substantial decrease in oil prices, the decline in gas exports in 2014, and the imposition of financial sanctions by Western nations. It is worth noting that despite these challenges, revenues from the export of energy resources experienced a notable increase after 2014, primarily due to fluctuations in exchange rates (Karpia, 2015).

Given the observed increase in the energy sector's export revenues alongside a decrease in export volume, the influence of the Ukrainian crisis on Russia's industrial structure remains uncertain. Consequently, it becomes imperative to undertake an empirical investigation in the future to determine whether this impact on the energy sector is detrimental or beneficial. Additionally, such a

study would shed light on whether it affects the transformation of the Russian industry's structure and the efficiency of the market. In addition to the ongoing developments in Ukraine, there exists a dearth of scholarly material that investigates the potential ramifications of the financial crisis and Putin's constitutional amendment in 2019 on the process of industrial structural transformation. Is it likely that Russia will undertake measures to optimise its industrial structure in the aftermath of these significant economic events? The research inquiries of the thesis will centre on economic occurrences, specifically the financial crisis of 2008, the events in Ukraine in 2014, and the potential influence of the alteration in Putin's constitution in 2019 on the structural transformation of Russian industry.

2.3.4 Challenges of structural transformation of Russian industry

One of the primary obstacles encountered in the process of transforming Russia's industrial structure is to the imperative task of diminishing its reliance on energy sources (Mitrova and Melnikov, 2019). The Russian economy exhibits a significant dependence on the exportation of energy resources, namely oil and gas. This heavy reliance on such resources has resulted in a certain degree of limitation in terms of economic diversification (The New York Times, 2022). When global energy prices see an upward trend, Russia has the potential to generate substantial export profits, so contributing to the relative

stability and prosperity of its economy. Nevertheless, it is worth noting that the Russian economy has significant repercussions and encounters slow or even negative economic development when oil prices decline (Reuters, 2022). Moreover, the excessive dependence on resource exports in Russia hampers the country's economic progress by limiting its internal growth potential and making it too reliant on external factors (Bradshaw and Connolly, 2016). Hence, the need of addressing the problem of reducing resource dependency and fostering economic diversification emerges as a crucial task in the process of transforming Russia's industrial framework.

In conjunction with Russia's excessive reliance on energy resources, the nation's technical progress has constrained the development of its high-tech sectors. While Russia has strengths in some areas of high-tech industries like aerospace technology, its total capacity for technical innovation is comparatively limited. This constraint, to some degree, hampers the country's ability to enhance its industrial structure (Jankowski, 2021). The deficiency in Russia's ability for technological innovation has had a detrimental impact on its competitiveness within the global economy, namely within the high-technology sector (Mittal, 2022). Furthermore, the dearth of technical innovation capabilities poses a significant challenge for Russia in its endeavour to transition from a resource-centric economy to a knowledge-driven economy. This predicament is further compounded by the obstacles encountered during

the restructuring of its industrial framework (Sanghi and Yusuf, 2018). Hence, it is essential to address the crucial issues of enhancing technical innovation capacities and fostering the growth of high-tech businesses over the course of Russia's industrial restructuring.

The composition and grade of human resources in Russia provide a substantial obstacle to the transformation of its industrial structure. The shortage of highly skilled personnel is seen as a key factor contributing to Russia's challenges in establishing high-tech firms (Metz and Satariano, 2022). The insufficiency of human resources is a hindrance to the capacity of the Russian economy to engage in innovation, thereby impacting the nation's prospects for sustained economic development (Lalljee, 2022). The insufficiency of human resources presents an obvious disadvantage for Russia in the context of global competition within the contemporary, highly competitive global economy. This is particularly significant since human resources play a vital role in determining a nation's competitiveness on the world stage (Eberstadt, 2022). Hence, a critical issue that necessitates attention during Russia's industrial restructuring pertains to the enhancement of the structure and refinement of human resources, with a specific focus on the education and integration of highly skilled professionals.

The market-oriented reform process in Russia is now in its early stages, and

the country's economic and legal environment, which is deemed undesirable, has posed difficulties in implementing changes to its industrial structure (Czinkota, 1997). The challenges associated with the institutional framework have implications for the level of openness and competitiveness in the Russian economy, as well as the decision-making processes and market conduct of businesses (Cabolis et al., 2022). Additionally, they impede the ingress of foreign investment and technological advancements. According to Yukhanaev et al. (2015), an inadequate legal framework and market environment may lead to an inefficient allocation of resources and impede the sustainable development of the economy. Hence, the primary considerations that need resolution over the course of transforming Russia's industrial framework include the modification of the market milieu and the augmentation of the legal framework.

2.4 Research Gap

There are several unsolved concerns in the present study. The first point of contention is in the varying perspectives among researchers on the process of industrial structure change. Consequently, this essay aims to go further into the exploration of the particular methods used in such transformation. There is a dearth of scholarly study on the change of industrial structure and its influencing elements, particularly in the context of the Russian Federation. Case studies and empirical research on this topic are notably scarce in academic literature. Thorough investigation. Hence, the following essay will examine the

transformation of Russia's industrial structure.

The second research gap pertains to the limited attention given by scholars in the previous article to the interplay between industrial structure transformation and social and economic issues. Specifically, the connection between industrial structure transformation and employment problems, as well as economic-related problems, was neglected. Consequently, the subsequent article aims to address this limitation by conducting a focused investigation into the impact of economic events, policies, employment, and GDP on the industrial structure.

Simultaneously, there exist ongoing debates regarding the impact of policy, employment, and GDP on industrial structure. Certain scholars assert a positive influence, while others argue for a negative influence. Consequently, this paper aims to conduct additional empirical research on the aforementioned influences by establishing regression models.

Furthermore, the existing body of literature concerning the rationality of Russia's industrial structure is limited, and there is a lack of empirical evaluations that offer a robust economic model for assessing its rationality. Consequently, this paper aims to address this gap by constructing an economic model that can effectively establish the rationality of Russia's industrial structure. Moreover, it is noteworthy that during significant economic occurrences such

as the 2008 financial crisis and the Ukrainian events, the attention of individuals was predominantly directed towards the repercussions of these events on the Russian economy, while disregarding the consequential alterations in Russia's industrial framework. Consequently, this study aims to delve deeper into the influence of these economic events on the industrial structure.

The later paper will look at the following four aspects to compensate for the limitations:

(1) What approaches have been taken in the structural transformation of Russia's industry? What obstacles have been encountered during the process of Russia's industrial structural transformation?

(2) What economic events have influenced Russia's industrial transformation? How did major economic events affect Russia's industrial transformation?

(3) What are the important factors affecting Russia's industrial restructuring?

(4) How to judge whether Russia's industrial organisation is rational?

Chapter 3: Theoretical framework

3.1 Introduction

This paper will discuss five significant theories that are often used to analyse the structural transformation of businesses. Specifically, it will focus on the three-sector theory, the industrial life cycle theory, and the institutional change theory. The three-sector theory places significant emphasis on the correlation

between the level of economic advancement and the composition of industries within a given economy. The industrial life cycle theory places significant focus on the temporal dimension and its influence on the configuration of industrial structure. The idea of institutional transformation places significant focus on the interplay between the external environment and the structure of industries. The selection of these three theories is based on their ability to provide a thorough understanding of the process of industrial structure change from many angles. Moreover, these theories have been extensively used and validated in empirical research.

3.2 Three-Sector Theory

In the 18th century, Adam Smith established the first industrial framework. Smith (1776) categorised economic activity into three broad sectors: the primary sector, which encompasses agriculture; the secondary sector, which pertains to manufacturing; and the tertiary sector, which encompasses services. Smith (1776) posited that the interdependence of these three sectors was crucial, since they together constituted the foundation of the economy.

Adam Smith's classification of the primary industry lacks precision, since it fails to include mineral extraction under this sector. The segmentation of industrial structure has been further developed by researchers. For example,

Christensen (2005) has further refined the industrial structure division and added quarrying and mineral extraction to the primary sector. Duignan (2023) proposed novel methodologies for categorising the primary sector. According to Duignan (2023), the primary sector can be categorised into two distinct groups. The first category is the genetic industry, which involves the production of raw materials that can be augmented through human intervention in the production process. The second category is the extractive industry, which encompasses the production of non-renewable raw materials that cannot be expanded through cultivation.

According to Jing et al. (2022), the progression of the economy was accompanied by a shift from the primary sector to the secondary sector. Due to technological advancements and heightened levels of productivity, individuals have shifted away from relying only on natural resources and have instead been involved in more intricate production and processing endeavours (Hammond, 2020). According to the Organisation for Economic Co-operation and Development (OECD, 2020), this transformation has the potential to enhance economic efficiency, provide employment opportunities, and foster economic expansion and prosperity. The secondary sector encompasses economic activities largely focused on the production and processing of tangible commodities. This includes various businesses such as manufacturing, construction, and energy, which include the extraction and utilisation of

resources such as electricity, coal, oil, and gas (Drew, 2022). According to Tejvan Pettinger (2015), the secondary sector is distinguished by the conversion of raw materials into finished goods or the processing and modification of already existing items. This industry usually requires significant human and material inputs, including workers, equipment, technology, and capital.

Significantly, there exists a state of perplexity about the differentiation between the primary and secondary sectors within the domain of energy. The extraction of energy is classified under the primary sector, since it involves the first exploitation and collection of resources (Energy Education, 2023). Subsequently, the second sector is responsible for the subsequent manufacturing and production of commodities (Rosenberg, 2023). The allocation of industries is intricately linked to the evolution of our industrial framework, therefore emphasising the significance of directing attention towards the division of industrial structure (Wang et al., 2020).

As the economy continues to advance, there is a growing recognition of the increasing significance of the tertiary sector in comparison to the secondary sector, primarily due to its role in facilitating the expansion of the country's Gross Domestic Product (GDP) (Hayes, 2022). The tertiary sector, sometimes referred to as the service sector, pertains to the segment of the economy that

offers intangible commodities or services. The sector encompasses a diverse range of professional services, including education, healthcare, finance, and information technology services. Additionally, it includes consumer-oriented services such as shopping, restaurants, tourism, and entertainment (WorldAtlas, 2016).

However, a contentious debate exists over the allocation of the industrial structure and its potential implications for the process of industrial transformation. According to Rosenberg (2023), the conventional categorization of the economy into three sectors no longer accurately represents the contemporary economic landscape due to advancements in technology and the increasing intricacy of economic systems. The diversification and complexity of the tertiary sector have been influenced by the emergence of contemporary service sectors, including information technology services and financial services (Cheng, 2013). Furthermore, some high-tech manufacturing sectors, such as the production of electronic information goods, may exhibit a greater propensity for innovation and value creation compared to certain conventional service industries. This phenomenon also leads to a blurring of the delineations within industrial categorization. Consequently, scholars have put forward more comprehensive methods of categorising sectors, including the subdivision of the tertiary sector into the quaternary sector (characterised by knowledge-intensive services) (Pettinger, 2021) and the fifth

sector (including cultural and creative industries) (Rosenberg, 2023).

It is crucial to comprehend the aforementioned disagreement, since the partition of the industrial framework has implications for the evolution of the industrial structure (Xue et al., 2022). For instance, when the industrial structure undergoes incremental refinement, there is potential for the inclusion of more high-technology businesses inside the tertiary sector. This transition enables the conventional service industry to undergo a shift towards becoming a technology-driven sector. The process of refining the industrial structure has the potential to facilitate economic diversification inside a nation. Consequently, the subsequent research will primarily concentrate on evaluating the rationality of the existing industrial structure and proposing strategies for its restructuring.

Application of theory to the research

The purpose of this thesis is to examine the application of the three-sector theory in analysing the evolving industrial structure of Russia. Specifically, this study aims to explore the manner in which the theory can be employed to assess the changing dynamics of Russia's industrial sectors, compare the various factors influencing its industrial structure, and propose a suitable model based on the theory for studying Russia's industrial landscape.

3.3 Criteria for structural transformation of industries

The assessment of industrial structure transformation relies significantly on the analysis of alterations in the percentage of industrial output value (Kendrick, 1961). The significance of an industry in the national economy may be gauged by examining the percentage of its production value in relation to the overall value of the economy (BEA, 2022). The assessment of industrial structural transformation may be made by examining the fluctuations in the ratio of production value between high-value-added industries and low-value-added industries (Kordalska & Olczyk, 2022). According to the BEA (2006), a shift in the industrial structure can be inferred when there is an increase in the proportion of output value from high value-added industries and a decrease in the proportion of output value from low value-added industries. This shift indicates a transition from a predominantly resource- and labor-intensive industrial structure to one that is primarily technology- and knowledge-intensive, thus signifying a transformation in the industrial landscape.

High-value-added industries include sectors that are characterised by advanced technology and services, often necessitating elevated levels of technological advancements and human capital inputs. Moreover, these businesses provide outputs with a relatively high value (Nicolaas, 2020). According to Roser (2013), an increase in the proportion of output value in these industries signifies an improvement in the country or region's level of economic development, enhanced technological innovation capacity, and more

efficient utilisation of human resources. This trend suggests a higher level of development in the industrial structure.

In contrast, sectors with low value-added, such as agriculture and heavy manufacturing, often depend on significant human and resource inputs, resulting in relatively modest output value (OECD, 2019). A potential indication of a country or region reducing its dependence on resources and labour and transitioning towards industries that rely more heavily on technology and knowledge is a decrease in the share of output value in these industries. This shift signifies a transformation in the industrial structure (Shawn, 2017).

Application of theory to the research

The objective of this study is to use a theoretical framework to analyse the extent of industrial structural change in Russia's industrial sector. Subsequently, an assessment will be conducted to ascertain the validity of this transformation. To evaluate the justification of the industrial structural transformation, the Theil Index will be employed.

3.4 The Theil Index

The Theil Index is a widely used economic statistic that is employed to assess the rationality of industrial structure (US Census Bureau, 2016). The measure is used to assess the level of dispersion within the industrial structure by the computation of the disparity between the output value proportion and the labour

force proportion in each industry (Yi, 2021). According to Liu, Xie, and Song (2017), a lower value of the Theil Index indicates a lesser degree of discreteness in the industrial structure, hence implying a more rational industrial structure.

Specifically, the formula for calculating the Theil Index is: $TL = \sum_{i=1}^3 \left(\frac{Y_i}{Y}\right) \ln\left(\frac{Y_i}{Y} / \frac{L_i}{L}\right)$ TL is the Theil index, Y is GDP, Yi is output value of various industries, L is total employment in Russia, Li is number of employments in various Industry (Neri, 2022). According to Lumen (2022), if the proportion of GDP attributed to a certain industry significantly exceeds its corresponding employment share, it suggests a potential overreliance on labour and raises questions about the rationality of its economic structure. Alternatively, when the proportion of an industry's GDP aligns closely with its proportion of employment, it suggests that the sector may exhibit higher levels of productivity and possess a more rational industrial structure (Shawn, 2017).

Theil Index is a commonly used tool in the field of economics research, with several economists using this metric to assess the rationality of industrial organisation (Wolcott, 2020). For instance, some scholarly investigations have used the Theil Index as a tool for examining variations in industrial composition across diverse nations or regions, and assessing the consequential impact of these disparities on economic progress. Previous research has used the Thiel

Index as a means of evaluating the impact of industrial policies, specifically in terms of their efficacy in facilitating the enhancement of industrial structure. Hence, the Thiel index has significant value as a tool for comprehending and examining the phenomenon of industrial structure.

Application of theory to the research

This article aims to use the Theil index as a metric for assessing the rationality of Russia's industrial structure. The concept pertains to the quantification of disparities in the composition of industrial sectors. A lower score is indicative of a less disparity in industrial structure, hence implying a more rational industrial structure. Hence, a Theil Index approaching 0 indicates a highly rational industrial structure, characterised by equitable distribution of output value and labour force across sectors, without any excessive concentration or fragmentation of businesses.

Conversely, a Theil Index value approaching 1 indicates a significant variation in the industrial structure, potentially resulting in either excessive concentration or dispersion among some sectors. Consequently, the overall industrial structure may be deemed suboptimal. This observation suggests that the growth of certain sectors may excessively depend on labour or resources, while disregarding the potential contributions of technical advancements and innovation. Alternatively, it may indicate that the development of some

industries has been overlooked or intentionally hindered.

3.5 Industry Life Cycle Theory

In conjunction with the three-sector theory, an alternative framework known as the industrial life cycle theory has been put forth by American economist Vernon. According to Vernon (1966), this theory posits that industries undergo a sequential progression characterised by phases of expansion, peak, contraction, and trough. It is argued that this theoretical framework can effectively facilitate the examination of industrial transformations. The theory has the potential to evaluate the process of industrial transformation.

According to Mullor-Sebastián (1983), an industry is considered to be in an expansion phase when it operates within a market that is both open and competitive, and experiences growth in terms of revenue and profits. In order to meet the increasing demand for goods or services within the sector, it is likely to attract extra competitors. Following an early period of rapid profit expansion within the sector, a state of stability follows, sometimes referred to as the peak phase (Rasiah & Yap, 2019). The contraction phase of the industrial life cycle occurs subsequent to the attainment of its peak. The current time is characterised by a decline in profitability, since sales have decreased compared to the previous era, which had an upward trend in demand. The contraction phase may potentially be followed by a recession, or alternatively, it may serve

as an indication that the industry's immediate demand has reached its zenith. According to Chen (2019), the industry makes adjustments to its capacity throughout the downturn phase. As marginal rivals are eliminated, stronger enterprises see a reduction in output. The profits of the industry see a decrease. In due course, it is anticipated that the sector would experience a period of decline characterised by reduced levels of demand and production capacity (CFI Team, 2022).

The use of the industrial life cycle theory enables the examination of the structural transition that occurs within various industries. An illustrative instance may be found in the work of Shirokova (2009), who formulated a life-cycle framework including three distinct phases: initiation, expansion, and institutionalisation. According to Shirokova's (2009) research, the progression of Russian start-ups exhibits a distinctive pattern of gradual centralization and formalisation during the transition from one stage to another. Notably, the study reveals that owner control of the company persists even after the implementation of professional management. This work presents a first attempt to address the examination of industrial life cycle analysis in emerging countries. However, the authors' application of the theory is limited, as they only focus on constructing a model to evaluate the significant structural change of industries and its potential impact on the development of the Russian economy. Sheresheva et al. (2020) briefly acknowledge the industrial transformation in

Russia, but provide limited analysis on the specific industrial transformation within the tourism sector. The authors fail to thoroughly examine the state of industrial transformation in Russia, including the challenges it encounters, and do not propose a sound methodology to assess the rationality of the current structure of industrial transformation in the country. In contrast, the study conducted by Sheresheva et al. (2020) primarily focuses on the Russian tourist industry, with less attention given to other significant sectors of the Russian economy, such as oil and gas. The study will centre its attention on the energy sector of Russia and undertake an analysis of the challenges faced by Russia in its process of structural change.

Application of theory to the research

Initially, it is important for the study to gather pertinent data pertaining to diverse sectors within the Russian economy, including metrics such as production value and employment figures. The economic magnitude and significance of an industry may be reflected by the value of output, but the influence of an industry on the labour market can be gauged by the number of people employed. The provided data may assist in determining the life cycle stage of each industry.

The dissertation may thereafter study the aforementioned data in order to ascertain the life cycle stage of each respective sector. For instance, when an industry has substantial increases in both production and employment, it might be indicative of the sector being in a phase of expansion. At this juncture,

industries often exhibit elevated market demand and a heightened possibility for expansion.

Subsequently, this research aims to examine the potential shift occurring inside Russia's industrial structure. For instance, in the event that the expansion and workforce engagement within high-tech sectors are seeing notable growth, while the production and employment within conventional industries are witnessing a decline, this might potentially suggest a transformative shift in Russia's industrial framework from traditional to high-tech industries. This transition often signifies a shift in the economy from being reliant on labor-intensive industries to becoming more technology-intensive, so reflecting a significant trend in economic growth.

3.6 Institutional Change Theory

The significance of institutional change theory on industrial structure is noteworthy, alongside the use of industrial life cycle theory for analysing the transformation of industrial structure. Institutional theory is a study tradition that investigates the recognition of institutions, including plans, norms, traditions, and routines, as authoritative standards for social activity (Gordon, 2022). The evolution of human civilizations has been influenced by institutional change (Samadi, 2021).

According to Peregrino and Oliveira (2020), it has been proposed that institutional reforms have the potential to not only influence corporate performance but also reshape the structure of the sector. In their study, Peregrino and Oliveira (2020) conducted a comparative analysis of the industry's performance over several periods of institutional change. Their findings indicate that policy measures have a significant influence on the process of industrial structural transformation. Nevertheless, the essay lacks a particular discussion on the quantification of policies in order to determine the relative influence of different factors on the industry's structural development. This research endeavour aims to address the existing knowledge gap by examining the effects of certain industrial policies on the evolution of industrial structure, as well as identifying the key determinants that exert the most significant influence on this process.

Diverse perspectives among researchers exist about the extent to which policies may have a substantial effect on the structural change of industries, as well as the specific mechanisms via which policies might shape industry structure. According to Chen and Xie (2019), the implementation of industrial policy has the potential to expedite the process of structural change inside industries, hence enhancing the pace of economic growth in China. According to Vrolijk (2021), there is a contention that industrial policy has a detrimental effect on the structural evolution of industries. The rationale for this discourse

stems from the fact that many governments have formulated distinct industrial systems. The structural composition of industries exhibits variations across different nations. However, it is indisputable that industrial policy has a significant impact on the configuration of the sector.

Besides industrial policy, fiscal policy also has a significant impact on the structure of industries. According to Chen and Xie (2019), it is believed that fiscal policy has the potential to facilitate the transformation of the industrial structure, hence enhancing economic growth. According to Wang et al. (2020a), the implementation of fiscal decentralisation has the potential to modify the industrial structure in a manner that influences energy efficiency. The enhancement of energy efficiency in China's eastern and central regions has been facilitated by the modernization of the industrial structure and the implementation of fiscal decentralisation. According to Wang et al. (2020a), the Chinese government has implemented stricter rules on industries that are both highly polluting and energy-intensive. This action has been prompted by the heightened environmental concerns expressed by residents residing in eastern China, in comparison to their counterparts in other regions of the country. Zhou et al. (2022) provide an alternative perspective, suggesting that the influence of fiscal policy on the structural change of the sector might potentially have adverse effects (Zhou et al., 2022). The impact of fiscal policy on the three industries varies due to potential temporal disparities, such as during epidemics,

which can result in delayed effects of policy implementation on industry transformation (Zhou et al., 2022) and potentially negative consequences for the industry (Zhou et al., 2022).

The problematic nature of the effect of policy on industrial transformation arises from the fact that policy decisions are often impacted by extraordinary occurrences. During the financial crisis, the effectiveness of fiscal policy in driving industrial change may have been constrained. Henceforth, the next study will concentrate on examining the influence of significant economic occurrences on the process of industrial transformation.

Application of theory to the research

The primary objective of using Institutional Change Theory is to get a comprehensive knowledge of the impacts of institutions, specifically highlighting its influence on socio-economic behaviours and results (Dacin, Goodstein, and Scott, 2002). When evaluating the consequences of institutional changes, researchers may examine how these reforms have influenced the structural transformation of industries. This may be achieved by comparing the industrial structure before to and after the implementation of policy reforms. For instance, in the event that the advancement of an industry gains momentum or a nascent sector begins to materialise subsequent to an institutional reform, it may be posited that the said reform has had a beneficial

influence on the structural metamorphosis of the industry. In contrast, if there is a lack of discernible alteration in the industrial framework subsequent to institutional reform or if the progress of certain industries has been impeded, it might be posited that the institutional reform has yielded an adverse effect on the evolution of the industrial structure. By using this approach, we may evaluate the impacts of the institutional reform and then modify and enhance the institutional framework as necessary.

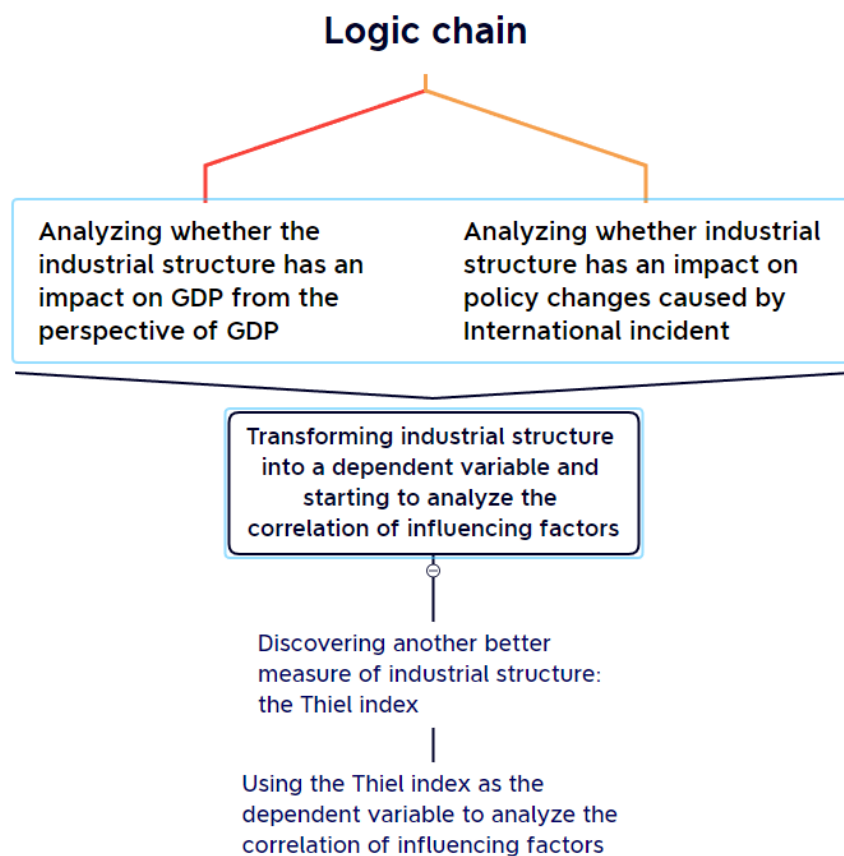
Chapter 4: Methodology

4.1 Method Overview

The research section of this article mainly adopts quantitative analysis methods, because the main object of this article is the factors that affect the industrial structure. These factors are mostly numerical variables, such as GDP, unemployment rate, and employed population. Traditional qualitative methods may find it difficult to thoroughly study these factors.

The primary method used in this article to show how the industrial structure and influencing factors correlate through time is regression analysis. The statistics were taken from the statistical reports of the BRICS nations and the Statistics Bureau's official website in Russia. Multiple linear regression and logistic regression are the two primary types of regression. While the latter is typically

employed when the dependent variable is a second categorical variable, the former is utilized when the dependent variable is a continuous variable. It should be mentioned that the study section of this article extensively use regression to demonstrate the association, which is not just restricted to the outcomes with industrial structure as the dependent variable. The reason is that starting directly with the industrial structure can lead to poor writing logic. Therefore, the following are the writing ideas for the regression section of this article, which serves as the logical chain for easy reading:



4.2 Regression analysis

Regression analysis is the most common method in quantitative methods, but

its importance does not diminish because it is common. On the contrary, regression analysis is one of the most important theoretical foundations in any academic paper. Braun and Oswald (2011) pointed out that linear regression analysis is one of the most important tools, especially when researchers create and test predictive models.

The reason why regression analysis is chosen for quantitative research in this article is based on the following reasons: The variables studied in this paper are all continuous variables except for major International incidents, and the expected relationship between the dependent variable and the independent variable is also assumed to be linear in this paper. b. Regression analysis provides regression coefficients that can explain the impact of independent variables on the target variable. These coefficients can explain the expected change in the target variable due to the unit change of the independent variable. This interpretability makes regression analysis widely used in research and helps to understand the relationships between variables. c. Because there are many variables involved in this article, regression analysis can help select and control other independent variables that may affect the target variable. By including relevant independent variables in the model, this article can explore their independent contributions to the target variable and control their impact to more accurately evaluate the relationship between the target variable and specific independent variables.

4.2.1 Variable Description

According to the logical chain of this article, the dependent variables involved are as follows:

GDP	GDP of Russia from 2006 to 2021
Big incident	Whether a major international incident has occurred (the occurrence is recorded as 1, not recorded as)
Y2_Y3	Proportion of output value of Secondary sector of the economy to output value of Tertiary sector of the economy
Y2_Y1andY3	The proportion of the output value of the Secondary sector of the economy in the total output value of the primary and Tertiary sector of the economy
TL	<p>The <u>Thiel</u> index is an index that measures whether the industrial structure is reasonable, and its specific formula is as follows:</p> $TL = \sum_{i=1}^3 \left(\frac{Y_i}{Y} \right) \ln \left(\frac{Y_i}{Y} / \frac{L_i}{L} \right)$ <p>TL is the <u>Theil</u> index, Y is GDP, Y_i is output value of various industries, L is total employment in Russia, L_i is number of employment in various Industry. Because we only measure three industries here, the range of values for i here is 1-3</p>

The independent variables involved are as follows:

It should be noted that, depending on the model, some of the dependent variables mentioned above will act as independent variables in other models.

Unemployment_rate	Unemployment rate
L2_L	Ratio of labor force in Secondary sector of the economy to total labor force
Big incident	Whether a major International incident has occurred (the occurrence is recorded as 1, not recorded as)
GDP	GDP of Russia from 2006 to 2021
Y2_Y3	Proportion of output value of Secondary sector of the economy to output value of Tertiary sector of the economy
Y2_Y1andY3	The proportion of the output value of the Secondary sector of the economy in the total output value of the primary and Tertiary sector of the economy

A control variable is an experimental design method used in scientific research that fixes the values or conditions of certain factors in the experiment to more accurately observe the impact of other factors on the results. The purpose of control variables is to eliminate Confounding and make the research results more reliable and repeatable. The principle of controlling variables is an important experimental design principle in scientific research. By controlling variables, the effectiveness of the studied factors can be better measured, and the reliability and accuracy of the experiment can be improved (Collins and Tabak, 2014). The control variables involved are as follows:

Primary. industry	Change in output value of Primary sector of the economy: output value of the next year minus that of the previous year
Second. Industry	Change in output value of Second sector of the economy: output value of the next year minus that of the previous year
Tertiary. industry	Change in output value of Tertiary sector of the economy: output value of the next year minus that of the previous year
Total_labor	The total number of Russian labor force from 2006 to 2021
Proportion_L2	Ratio of labor force in Secondary sector of the economy to total labor force
Proportion_L3	Ratio of labor force in Tertiary sector of the economy to total labor force

4.2.2 Variable selection

The variable selection used in this study is based on a theoretical basis. As mentioned earlier, there are many different opinions on the role and objectives of policies in industrial structure adjustment. However, this article tends to link major events with national policies. For example, Freeman (2004) claimed that the escalation of global trade tensions is due to trade disputes between

countries and the rise of trade protectionism, making the global trade environment more unstable and uncertain. This international trade tension has had a series of impacts on countries' fiscal and monetary policies. Chen and Xie (2019) proposed that policies should play the role of "facilitators", advocating that the government guide and promote industrial structure transformation through active policy intervention. This viewpoint emphasises the importance of the government playing a leading role. They believe that the government can encourage enterprises to engage in technological innovation and industrial upgrading through financial subsidies, tax incentives, and other policy tools (Mazzucato, 2015). Therefore, a very important variable in this article is whether a major event occurs.

It is also crucial to consider how labor affects industrial structure. There are several points of view about how employment will affect how the labor market changes. According to Zhang et al. (2022), employment has a beneficial role in the evolution of industrial structures. The shift in industrial structure will be impacted by the movement of labor. For instance, when workers in China move from the agricultural to the industrial sectors, the country's primary sector of the economy would transition structurally into the secondary sector (Zhang et al., 2022). At the same time, the flow of labour has also driven the transformation of industrial structures. According to Mullor Sebastián's (1983) life cycle theory, when the number of employees in an industry increases and productivity

increases, the industry will quickly attract expansion, and the improvement of profitability will bring more growth. And Russia is currently in such a period. So this article also uses the working population as an important measurement indicator. Take Russia's oil and natural gas industry as an example. With the increase in global energy demand, the productivity of the industry has increased, attracting a large number of employed people (International Energy Agency, 2022). This has led to rapid growth in the industry. It is worth mentioning that in addition to numerical values, this article also uses the proportion of the working population as a variable. This is because specific values may not necessarily reflect the situation well.

In addition to the impact of employment on changes in industrial structure, industrial output value is also a factor driving the transformation of industrial structure. This is because output value is an important indicator for measuring an industry or economic production activity (Chen, Jefferson, and Zhang, 2011). If the output value of an industry increases, it indicates an increase in production activities, which may attract more resources and investment, thereby driving changes in the industrial structure (Chen, Jefferson, and Zhang, 2011). Therefore, this article also considers GDP as a representative factor of industrial output value, as GDP can indeed reflect the situation of various industries.

In summary, this article adopts GDP, employed population, and major events as factors that affect industrial structure. It should be noted that these indicators have been treated to some extent in this article, such as measuring the industrial structure in proportion to the output value, using the unemployment rate to represent the employed population, and so on.

4.2.3 Hypothesis of regression

Based on the above logical chain, this article conducted a total of five regressions, with the first part having two regressions, each using GDP and Big incidence as dependent variables to analyse their correlation with industrial structure and other variables. The third and fourth regressions use the quantified industrial structure as the dependent variable. Here, only two methods are used to quantify They are the ratio of the measured output value of the Secondary sector of the economy (as shown in the dependent variable table). The last regression is the largest model in this article, with the Thiel index as the dependent variable. The following table presents the assumptions for these five regressions:

Model1: GDP as the dependent variable	
H0	GDP is not related to industrial structure
H1	Significant correlation between GDP and industrial structure
Model2: Big incident as the dependent variable	
H0	Big incident is not related to industrial structure

H1	Significant correlation between Big incident and industrial structure
Model3: Y2/Y3 as the dependent variable	
H0	The coefficients of all variables in this model are 0
H1	At least one variable in this model has a coefficient other than 0
Model4: Y2/(Y1 + Y3) as the dependent variable	
H0	The coefficients of all variables in this model are 0
H1	At least one variable in this model has a coefficient other than 0
Model5: The Thiel index as the dependent variable	
H0	The coefficients of all variables in this model are 0
H1	At least one variable in this model has a coefficient other than 0

4.3 Research Ethical Consideration

It is a delicate ethical question to employ secondary data alone. It maximizes the return on the public investment in data collecting, eases the burden on respondents, and ensures the reproducibility of study results, increased transparency of the research process, and the objectivity of the research project. The importance of secondary research comes from the full realization that the advantages exceed the dangers of re-identifying people and exposing private information. In this regard, data usage happens when key ethical requirements are met: de-identification of data before release, agreement of the subject is logically assumed, the analysis's findings do not re-identify the respondents, and using data does not result in harm or stress to anybody. Large research-

driven data sets and significant public non-profit data are used in the study to provide national statistics. In full compliance with the aforementioned guidelines, they have developed infrastructure and services for maintaining, storing, and distributing data that is appropriate for secondary analysis. These organizations' work is to guarantee that the secondary data acquired complies with all ethical requirements. The responsibility for ethical consideration is shifted from the researcher to the institutions by using these entities to acquire data. Recognizing these data sources during the research process is the only thing left to do to prevent plagiarism. The researcher used the Harvard reference method to identify all secondary sources, including previous publications, for all material obtained from others while avoiding plagiarism.

Chapter 5 Analyze and Results

5.1 How Russia undergoes industrial structure transformation

From 2006 to 2020, Russia's industrial structural transformation went through

three key stages.

In the initial phase from 2006 to 2008, Russia began to realise the importance of economic diversification. The government began to promote the development of non-energy sectors, including manufacturing, agriculture and services, and worked to improve the business environment to attract more foreign investment. Among other things, the global financial crisis in 2008 led to a decline in Russia's GDP and an increase in unemployment (Desai, 2010). This accelerated the transformation of Russia's industrial structure.

The next phase of development was from 2009 to 2014. During this phase, the government increased investment in technology and innovation to promote scientific and technological progress and industrial upgrading. At the same time, the government also implemented a series of policies to encourage entrepreneurship and the development of small and medium-sized enterprises (SMEs) in order to promote employment and economic growth. The fall in oil prices in 2014 further highlighted the urgency of industrial structural transformation (Karpia, 2015).

Then comes the deepening phase from 2015 to 2020. During this phase, Russia continued to promote the non-energy sector and began to focus on high-tech industries, such as information technology and artificial intelligence. The

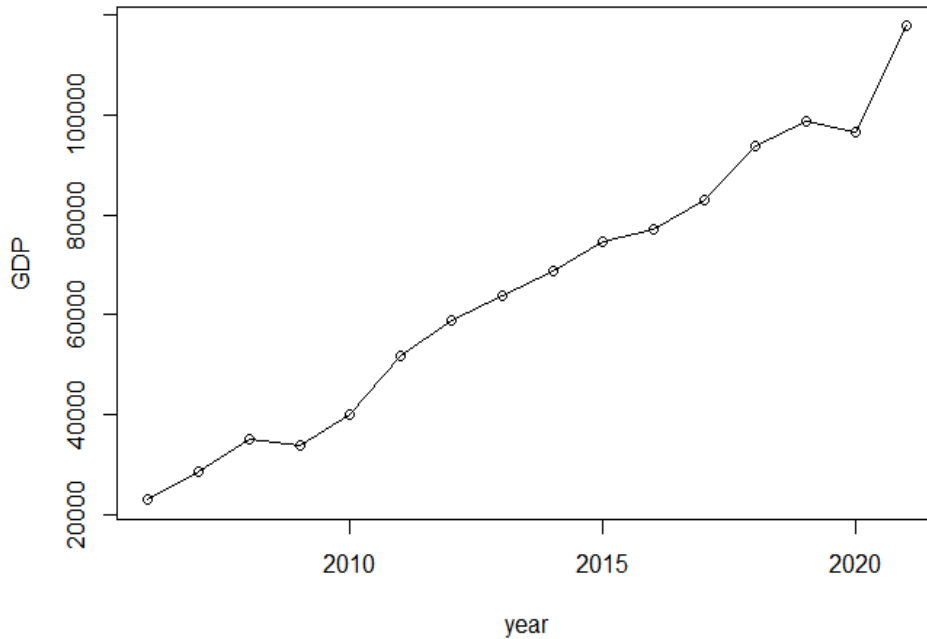
government has also increased its investment in education and scientific research in order to train more highly skilled personnel and promote the optimisation and upgrading of the industrial structure (Jong, 2014).

5.1.1 From the perspective of Gross Domestic Product

Beginning with Russia's overall GDP (in billions of rubles), we go on to the analytical section. Please be aware that the industrial structure is the focus of this article's research; therefore, the GDP utilized in this article is the GDP of the production technique. Russia is clearly on an increasing trend, as evidenced by the 16 years' worth of total GDP statistics, particularly in the most recent year of 2021, when it finally surpassed the 100,000 mark. The primary goal of this essay is to analyze the trend of GDP rather than concentrate on any particular numerical amount.

Figure 1: GDP trendline

Total GDP line plot



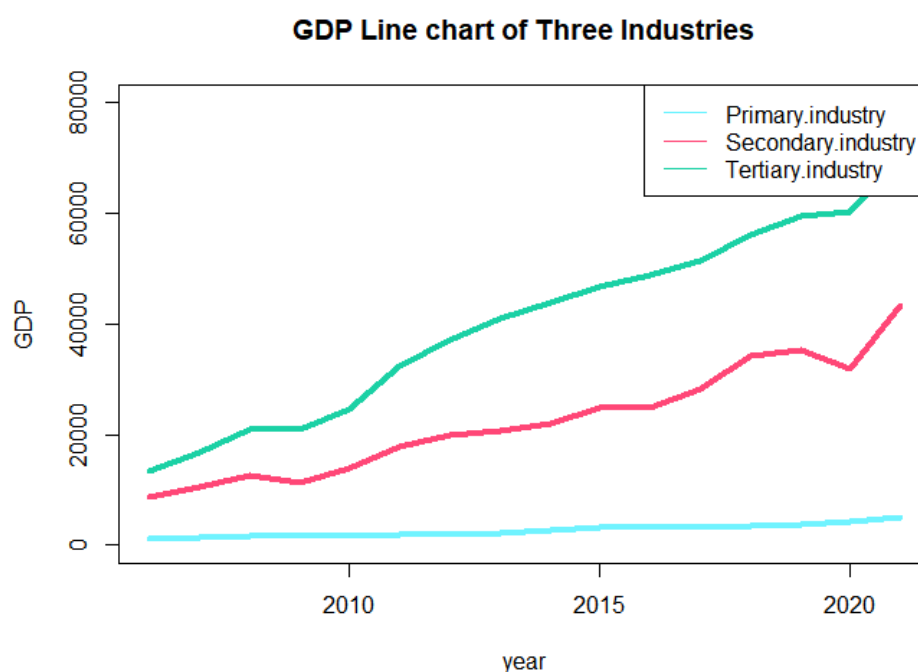
Source :Russian Official Statistics Service

With the line graph above it is easy to see that the overall trend is continuously rising. However, there are two notable declines in 2009 and 2020, which correlate with the two key events from the previous section: the financial crisis of 2008 and the change in Putin's constitution in 2019 and his re-election as President of Russia in July 2020. The implications of such a major event are far-reaching, and Hutcheson and McAllister (2017) also claim that this is such a far-reaching and important change, which he achieves by 'zeroing out' presidential terms that began before the constitutional change, potentially enabling President Putin to overcome term limits and remain in office beyond 2024. The first part of this paper has already confirmed that Russia's presidential term limits have been reduced. The previous part of this paper has already identified Russia's heavy dependence on the secondary sector, and in

particular on energy in the secondary sector. Therefore, this paper examines Russia's industrial structure in the context of declining GDP.

Because the core of this article is industrial structure, following the previous section, this article further studies the changes between various industrial structures and the problems of industrial structure.

Figure 2: Line graph of output value of the three industries



Source :Russian Official Statistics Service

Again, this part of the paper has never been concerned with specific values, the core is their trends. From this graph, the following aspects can be seen: a. the secondary and tertiary industries are significantly higher than the output value of the primary industry, which indicates that the primary industry accounts for a very small share in Russia; b. although this paper very much focuses on

describing the importance of energy for Russia, the secondary industry, in which energy is located, is actually not a dominant industry in Russia either; c. by using the line graphs mentioned above, this paper finds that the secondary industry and the tertiary industries are almost perfectly aligned with the overall GDP trend due to their huge share; d. However, it is worth noting that on the two major events highlighted in this paper, 2009 and 2020, it is clear to see that the secondary industry is much more closely aligned with the overall trend, which means that when experiencing a major event, the secondary industry is the main factor that changes the GDP. In other words, the secondary industry is more susceptible to shocks, and it is quite a bit less resilient than the tertiary industry.

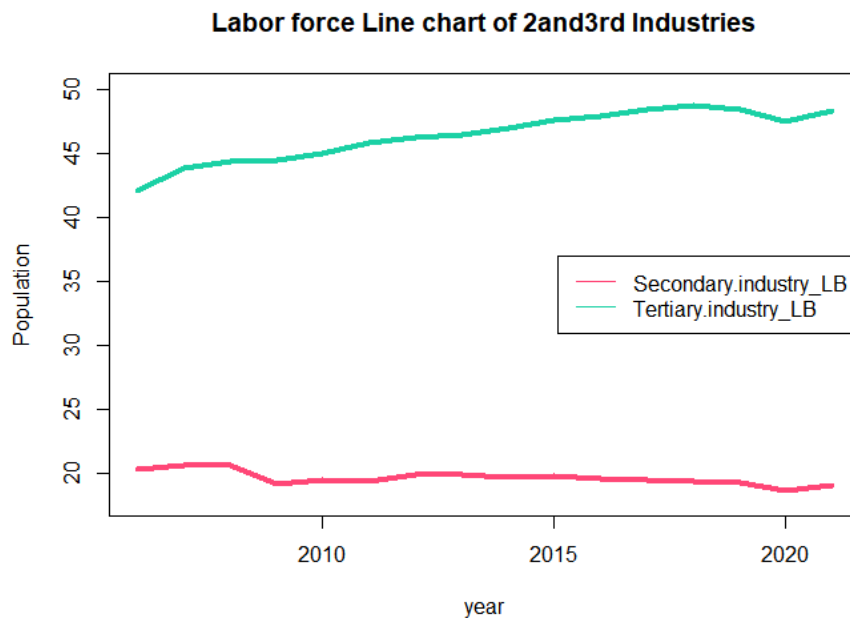
With these two very simple line graphs above, it is once again argued that Russia is too dependent on the secondary sector, which leads to a huge shock whenever there is an international or policy fluctuation.

5.1.2 Discussion from the perspective of labor force employment population

Another important measure of industrial structure is the employed population, and more specifically the number of people employed in each sector can measure the industrial structure of a country. Therefore, this paper looks at the second aspect to further check the direction of this paper as well as to further

analyse the industrial structure of Russia.

Figure 3: Line graph of labour force in secondary and tertiary industries



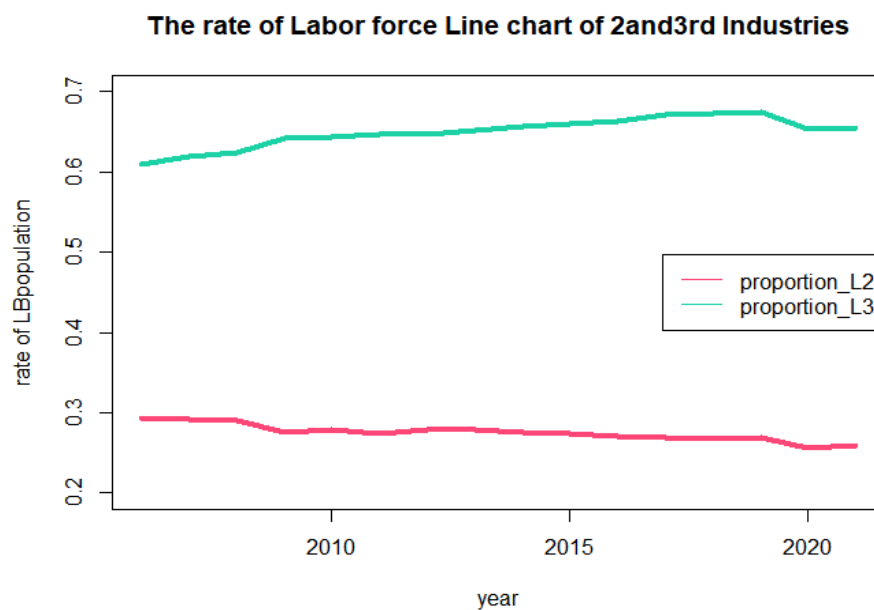
Source :Russian Official Statistics Service

The graph above shows a slight trend: employment in the secondary sector is decreasing, while employment in the tertiary sector is increasing accordingly. This gives the first possible result of the structural transformation of the industry in this paper: Russia is moving towards decreasing the secondary sector and increasing the tertiary sector. It is important to note that in terms of the employed population, the financial crisis of 2008 mainly affected the employed population in the secondary sector, while the policy reforms of 2019 have had an impact on both segments, however the greater decline has been in the tertiary sector. This implies that the structural transformation of Russia's industry is underway,

which can be seen in terms of the impact of major events, with the first crude financial crisis having targeted the secondary sector exclusively, but the second time around, the policy had a much smaller impact on the secondary sector.

This analysis is somewhat incomplete, as the above section looks at absolute employment in the secondary and tertiary sectors, and the following section analyses the changes in the share of employment.

Figure 4: Labour force in secondary and tertiary sectors as a percentage of total labour force



Source :Russian Official Statistics Service

After eliminating the possible effects of the rise or fall in the total population of Russia, the graph above shows the change in the share of secondary and tertiary industries in total employment. The underlying trends have not changed

much, confirming that Russia is indeed undergoing a structural transformation of its industrial structure.

5.1.3 Descriptive statistical analysis of key data

The above analysis is the result of the line graph of GDP and the employed population of each industry, and such a description lacks substantial numerical analysis. Therefore, the next step in this paper is to conduct a simple descriptive statistics on these two parts of the data to assist the logical chain of this paper and support the viewpoints of this paper. Please note that the descriptive statistics are intended to better present the data used in this paper as well as to demonstrate the complete logic of the analysis, and are not intended to increase the cognitive load on the reader.

Table 1: Descriptive statistics table for total GDP and output of the three industries

	Total GDP	Primary industry	Secondary industry	Tertiary industry
Min	22977	1039	8554	13384
1st Qu.	38826	1576	13596	23681
Median	66230	2420	21325	42485
3rd Qu.	85644	3348	29131	52602
Max	117737	4974	43443	69320
Mean	65327	2629	22510	40188

Stand deviation	28408	1172	10159	17229
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Source :Russian Official Statistics Service

The table above shows descriptive statistics on GDP (in billions of rubles), and we can see that in terms of intuitive values, it is true that the secondary sector is not the one that accounts for the core of the GDP, and there is no doubt that the primary sector is not important in Russia. Comparing the median and mean values for each category shows that the skewness of the data is not very large, and basically the difference between the median and the mean is not significant. The interesting point is that only the tertiary sector and overall GDP have the same skewness, i.e., the median is larger than the mean, which implies that the tertiary sector is actually more important to Russia from a GDP perspective, both in absolute terms and in the shape of the data. This has to lead this paper to ponder the question of why it is the secondary sector that tends to take the hit, if the tertiary sector dominates.

Table 2:Descriptive statistics for the total labour and the labour force of the three industries

	Total_employee	2 nd employee	3 rd employee	Rate of 2 nd	Rate of 3 rd
Min	69.20	18.70	42.14	25.65%	60.90%
1 st Qu.	70.88	19.38	44.89	56.94%	64.33%
Median	71.50	19.55	46.75	27.47%	65.21%
3 rd Qu.	72.33	19.90	48.10	27.88%	66.06%
Max	73.90	20.67	48.80	29.30%	67.45%
Mean	71.49	19.66	46.45	27.51%	64.95%

Source :Russian Official Statistics Service

The above table shows descriptive statistics on total employment and employment by industry. The conclusions of this table are the same as those of the GDP table above, and since we already know that the primary sector is not important, we will not repeat the section on the primary sector in this table. It is still not possible to see the centrality of the secondary sector from the numerical section alone.

However, combining all of the above, the first practical result of this paper is that, although the secondary sector is not numerically dominant in Russia, it tends to be the most reflective of the Russian economy as a whole in terms of line graphs and data trends - meaning that problems with the Russian economy are most likely to be exposed in the secondary sector. This means that problems in the Russian economy are most likely to be exposed in the secondary sector. Thus, Russia's industrial structure is problematic: over-

reliance on the secondary sector has led to an irrational industrial structure (Depersio, 2019). Although this paper has shown that Russia is apparently undergoing a deep structural transformation of its industrial structure - in fact, it has been doing so for a very long time - it is not clear whether this transformation is justified. However, whether such a transformation is justified, why it occurred around these time points and what are the important factors influencing the transformation of the industrial structure will be presented later in this part.

5.2 Finding the causes of inflection points: GDP and major events

This paper, as a result of the research described above, has identified two important time inflection points: the declines in 2009 and 2020. Due to the fact that economic policies such as fiscal policy and monetary policy have a lag (Jovanovski and Muric, 2011). Moving forward in time slightly by one year reveals that this coincides with very important dates in time: the financial crisis of 2008 and Putin's change of the constitution in 2019 and his continuation as president for a second term in July 2020.

Another big event for Russia was the Ukrainian crisis in 2014 and the fall in crude oil prices in the same year. The impact of this on the secondary sector was significant. However, as the graphic in the first part shows, there is no such trend. One possible reason for this is exchange gains and losses. So in total,

this paper will explain the impact of the above three major policies on Russia's GDP in that part. It should be noted that this paper will quantify these three events using the dummy variable, which takes 1 when the event occurs and, due to the lag, does the same in the second year of the event, and 0 in the year when no event occurs.

In addition, it should be noted that the core research of this paper is still industrial structure, so in this section, this paper further explores the way to quantify industrial structure, and starts with GDP, and then sequentially explores GDP and international events as the main dependent variables in this section, and explores their correlation with industrial structure and other factors.

5.2.1 Quantifying industrial structure

The challenge in this research is how to quantify the industrial structure because it is challenging to express the industrial structure with a single ratio. In order to quantify it, this study will use the ratio of ratios, which may be calculated by dividing the secondary industry ratio by the tertiary industry ratio or by multiplying the secondary industry ratio by the sum of the primary and secondary industries. Both approaches use the ratio of the secondary industry as the numerator, with the intention of indicating that the focus of the study in this paper is on the secondary industry.

In addition to the quantification of the ratio, the second idea of quantification

proposed in this paper is to carry out the subtraction of the two years before and after. By comparing the difference between the secondary and tertiary industries in the two years before and after, the transformation of industrial structure can also be measured: subtracting the output value of the subsequent year from the output value of the preceding year. The advantage of this approach is that it can make the research object of this paper transformed from static to dynamic model.

5.2.2 Finding the cause of inflection point by the perspective of GDP

After we have quantified the industrial structure, this paper intends to use the two quantification methods mentioned above as independent variables to judge whether GDP is related to the industrial structure quantified in this paper, in addition, as mentioned at the beginning of this paragraph, this paper will analyse whether the policy changes brought by the international events will affect the GDP as well, in addition, the employed population is a topic that has to be talked about, and the indicators related to the employment involved in this paragraph include The unemployment rate and the ratio of employment in the secondary sector (in fact, at the beginning of the study, the ratio of employment in the primary and tertiary sectors was also included, but the correlation between these two factors is weak and difficult to interpret because of the secondary sector that is the subject of the study).

The following are the four models with GDP as the dependent variable:

Table 3: Four regression models with GDP as the dependent variable

y = GDP	Model1	Model2	Model3	Model4
(Intercept)	795689 *** (1.4e-07)	778763 *** (6.5e-09)	732647 *** (1.78e-08)	736093 *** (1.21e-08)
Y2/(Y1+Y3)	-1501066 . (0.0670)	-1258763 * (0.0354)	101413 * (0.0434)	
Y2/Y3	1427062 . (0.0508)	1217735 * (0.0248)		96375 * (0.0294)
Unemployment rate	-12758 *** (2.27e-05)	-12540 *** (8.16e-06)	-10720 *** (5.29e-05)	-10814 *** (3.50e-05)
L2_L	-2409102 *** (3.02e-07)	-2392128 *** (7.74e-08)	-2381421 *** (2.82e-07)	-2394524 *** (1.95e-07)
Big_incident	-2041 (0.6303)			
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1				
R ²	0.9736	0.9729	0.9563	0.9588
Adjusted R ²	0.9604	0.9631	0.9454	0.9485

Source :Russian Official Statistics Service

From this first model it can be seen that the unemployment rate as well as the employed population in the secondary sector are significantly correlated as the p-value of both of them is less than our usual significance indicator of 5 per cent.

This means that we need to reject the original hypothesis that the coefficients of these two independent variables are zero. Unfortunately, however, big events do not seem to have any correlation here, and industry structure has some correlation (if we use the condition of 10% as the significance level).

The paper therefore makes another attempt to remove the event variables and regress them again to obtain the second model in the table: by interpreting the p-values it can be seen that all the variables up to this point are significantly correlated with GDP. It can also be seen through the adjusted R square that the second model is more interpretable than the first model, i.e. the adjusted R square of the first model is 0.9604, while the adjusted R square of the second model is 0.9631, which is an improvement of 0.27 per cent in interpretability. In summary, this paper finds that GDP and industrial structure do have a significant correlation.

However, a very confusing point is that the effect of industrial structure on GDP cannot be reasonably explained by the coefficients of Model I and Model II alone: the ratio coefficients of Y2 to Y3 are positive, and the ratio of Y2 to Y1+Y3 is negative. There is no uniformity in the positive and negative coefficients of the industrial structure in question. In addition, the fact of putting these two variables together may cause problems of multicollinearity. Although this paper calculates the correlation coefficients for these two variables, r is not equal to 1

(which is reasonable, since what is perfectly covariant with Y_2/Y_3 must be $(Y_3 - Y_2)/Y_3$) but on the one hand, in order to exclude the problem of possible multicollinearity, and on the other hand, this paper, in order to facilitate the interpretation, makes models III and IV respectively, which contain only one measure of industrial structure.

Both of the above models show that the models are still relevant even if the other industrial structure variable is removed, although the interpretability of these two models becomes weaker in terms of adjusted R^2 . From both models it can be seen that industry structure is positively correlated with GDP, meaning that the need to either increase the share of Y_2 or decrease the share of Y_3 will cause GDP to rise. This further illustrates that despite the numerical dominance of the tertiary sector, it is the secondary sector that can really influence, or be positively correlated with, GDP.

The paper has examined two core results up to this point, the first being that GDP is indeed correlated with industrial structure, and the other being that it is again argued that the core industry in Russia is the secondary sector. It should be noted that the regression analysis here does not specify the causal effect, so the result is only that GDP is significantly correlated with industrial structure, which paves the way for the study of the correlates of industrial structure later in the paper.

5.2.3 Finding the cause of inflection point with the perspective of the big incidents

After the regression analyses in the previous section, this paper finds that GDP does not seem to be very much related to international events, but the decline in GDP caused by time points must not be a chance event. Because it is true that there are abnormal movements of GDP around these years. Therefore, in this section, the paper uses international events as the dependent variable and performs a logistic regression with the aim of analysing what international events are specifically associated with causing the abnormal movements in GDP. Since GDP has been analysed to be really uncorrelated with the big events, the only independent variables left here are employed population and industrial structure. Therefore, this paper concludes Model 1 as shown in the table below. According to the logistic regression results of Model 1, this paper can clearly point out that the big event will affect the industrial structure but has nothing to do with the proportion of the number of employed people, so this paper fits the logistic regression again and excludes the other two irrelevant variables so as to conclude Model 2:

Table 4: Two regression models with big incidents as dependent variable

y=big_incident	Model1	Model2
----------------	--------	--------

(Intercept)	8.2924 * (0.0486)	5.051 ** (0.00728)
Y2/(Y1+Y3)	-118.7088 * (0.0126)	-94.682 * (0.01676)
Y2/Y3	102.5530 * (0.0150)	80.583 * (0.02144)
Unemployment rate	-0.107 (0.3990)	
L2_L	-8.3155 (0.5794)	
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1		
AIC	23.247	21.725

Source :Russian Official Statistics Service

It can be seen that significance still holds and that the AIC for model 2 is lower than that of model 1. In logistic regression, the AIC is a model selection criterion used to assess the quality of a model fitted to a given dataset. It is based on maximum likelihood estimation, which takes into account the complexity of the model and how well it fits the data. This implies that Model 2 is superior. Although the same problem remains: the coefficients of the two measures of industry structure have different plus and minus signs. But the coefficients of the logistic regression do not have significance in themselves, so there is no difficulty in interpretation. To confirm the association between the two measures

and the major events, this paper still uses the Pearson correlation test in order to avoid the issue of multicollinearity:

Table 5: Pearson correlation test between industries structure and big incidents

Pearson correlation test	
$Y2/(Y1+Y3)$	-0.777082319
$Y2/Y3$	-0.742001866

The results are clear, which means that the share of occurrence of secondary industries and the occurrence of big events show a negative correlation. This is also in line with the findings earlier in the paper.

5.3 Important factors affecting structural transformation of industries

At this point, the paper has completed the previous part of the focus on laying the groundwork. Starting with GDP, it was found that Russia's industrial structure does have an overdependence on the secondary sector; then the industrial structure was quantified and analysed to correlate GDP with the industrial structure, and further analysed to correlate international events with it as well. In this way it seems that the core research subject comes to the middle of the industrial structure, which is an important factor connecting GDP and international events, and also serves as the core subject of this paper. In fact there has already been a great deal of evidence of their connection in the

previous literature review. For example, Chen, Jefferson and Zhang (2011) pointed out that in addition to employment can influence the transformation of industrial structure, industrial output can also influence the transformation.

5.3.1 Regression analysis with industrial structure as dependent variable

A lot of regression analyses have been done in the previous paragraph, in this paragraph, the quantified industrial structure will be used as the dependent variable to specifically analyse what are the important factors affecting the transformation of industrial structure.

Firstly, the eight variables of $Y_2/(y_1+y_3)$ as the dependent variable, GDP, unemployment rate, whether there is a major international event, primary industry, secondary industry, tertiary industry as well as the change of the total employment population and the proportion of the secondary employment population to the total employment population are used as the independent variables. They are looking at the relationship between GDP as an economic indicator and industrial structure, the unemployment rate as a variable to measure the rationality of employment in the nation, global events as a time-phase variable, the shift in the labor force among various industries as a variable based on the change in the industrial structure, and finally the ratio of the secondary industry as a direct measure of the rationality of the labor force. This selection of variables considers the impact of absolute values on the one

hand and the dynamic indicator of changes in the industrial structure on the other. The particular model looks like this:

Table 6: Regression modelling of industrial structure

$y = Y2/(Y1+Y3)$	Model1	Model2	Model3	Model4 ($y = Y2/Y3$)
(Intercept)	-2.08E+00	-2.116 *	-9.993E-01	-2.565E+00 *
GDP	3.087E-06 .	3.081E-06 *	1.311E-06 .	3.643E-06 *
Unemployment rate	2.75E-02	2.98E-02		3.676E-02 .
Big_incident	-2.81E-02	-2.78E-02		-0.0275
change_1	1.04E-02			
change_2	-1.17E-02			
change_3	1.26E-02			
total_change	NA			
L2_L	8.14E+00	8.256 *	5.221E+00 *	9.724E+00 *
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1				
R^2	0.5273	0.5107	0.2915	0.5198
Adjusted R^2	0.1137	0.3327	0.1825	0.3452

Source :Russian Official Statistics Service

This produced the first multiple linear regression model. Model 1 is a fairly poor model, but it is a starting point for the research in this paper. Although there is not a single significant variable at the 5% significance level, based on the fact that this is a model that puts in all the variables that can be studied, this result

is acceptable. However, if the significance level is scaled up to 10%, GDP and the labour share of the secondary sector are barely correlated.

Of course, this is only the first barely result, and now we use stepwise variable censoring. The intermediate process will not be repeated, this paper found that the best model for the model two in fact, this model still have the above two variables are significantly correlated: GDP and the labour force share of the secondary industry. the correlation of GDP is naturally not need to describe more, but the industrial structure and the labour force share of the correlation between the presentation of this paper's first discovery. This is a point worth explaining, we did find that GDP and the share of employed people are significantly correlated in the previous study, and here we did a regression analysis between industrial structure and the labour force share in the secondary industry, and the correlation is still significant. This may imply that the labour force share is also a significant factor in measuring industrial structure.

Here the paper explains another misunderstanding, the reader may wonder whether the model would be more significant and useful if there were only GDP and labour force share here, the answer is no. Model 3 is a regression analysis with only these two variables. It can be seen here that GDP is not relevant at the 5% significance level. This means that the unemployment rate and the occurrence of major international events act as instrumental variables, which

make the model more interpretable and mainly strengthen the explanation of industrial structure by GDP. In particular, the dummy variable, which acts as an instrumental variable, once again argues that even though a major international event is not significant in the model, it cannot be ignored. In other words, it is a very important control variable.

In order to rule out the possibility that the difference in the results is due to the different ways of quantifying the industrial structure in this paper, the dependent variable is further replaced by another, more concise Y_2/Y_3 , which is a more direct indication of the industrial structure of Russia: since the core of the Russian economy has nothing to do with the primary sector, it is only necessary to compare the secondary and tertiary sectors, and in order to avoid repeating the same thing over and over again, we use the optimal model - Model 4 - from the regression directly. Similarly, model 4 does not differ much at the 5% significance level, but if this is scaled up to 10%, the model does outperform the former. Regardless of the significance level, here is further confirmation of the relationship between industrial structure and labour force share, and as an inseparable instrumental variable - major international events. As for the explanation of the unemployment rate, one possible reason is that the unemployment rate is able to complement what is not explained by the labour force share, since the variable L_2/L in this paragraph of the study is the labour force in the secondary industry compared to the employed population, and for

the country as a whole the unemployed population is not taken into account, which is complemented by the unemployment rate.

So far, the core part has been addressed in this paragraph. That is, the important factors affecting the industrial structure are the country's GDP, the labour force share, the occurrence of major events and the unemployment rate. These four components are closely related to industrial structure. The explanatory variables are GDP and labour force share.

5.3.2 Measuring Transformation-Dynamic Modelling

However, the research up to this point, the defect of this paper is that only a static industrial structure is studied, regardless of the dependent variable, the core of this paper only studied the industrial structure share of a certain point in time, which is not a reasonable measure of the transformation of industrial structure. Because the transformation is a dynamic process, he must compare the earlier and later to achieve the transformation, so another reasonable dependent variable is the numerical change in the secondary industry's labor force population. Because this paper has established the close relationship between the labor force population and the industrial structure, this paper changes the dependent variable once more to the numerical change in the secondary industry's labor force population and the regression results are as follows:.

Table 7: Regression modelling of changes in secondary sector output

y = change_2	Model
(Intercept)	-4.70359 .
unemployment.rate	-0.28144 **
big_incident	-0.40466 *
L2_L	23.44261 *
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1	
R ²	0.7104
Adjusted R ²	0.638

Source :Russian Official Statistics Service

Surprisingly, the interpretability of this model is stronger than all the previous models, and unemployment and the occurrence of major events are still significantly correlated here based on the 5 per cent significance level. This implies that the unemployment rate and the occurrence of major events have a greater impact on the transition process than the static measure of "ratio". These two variables are more explanatory than the static condition of "ratio". This makes sense because, as mentioned earlier, the changes in fiscal and monetary policy due to the occurrence of major events have a lag, which brings about a change of at least two years before and after the event, which is better captured by the change in the dependent variable: the labour force in the secondary sector. A better way to put it is actually the movement of the labour

force, since the primary sector is not important in Russia, so the main movement is between the secondary and tertiary sectors. So the coefficients of the model here are interpreted to mean that when a major international event occurs, the secondary sector reduces the population by 0.4 billion to the tertiary sector. This basically coincides with the line graph we made earlier.

5.3.3 A new index to measure industrial structure - the Thiel index

This paper has answered all the questions in this paragraph up to this point, but it still wants to provide a plausible explanation of industrial structure. When we know that industrial structure is closely related to GDP and labour force, a model can be fitted to explain industrial structure specifically. That is to say, using mathematical methods to merge the ratio of GDP and labour force so that it can better explain the industrial structure. Therefore, under the continuous exploration of this paper, a theoretical index that can provide support with the results of this paper is found: the Thiel index.

5.4 Judging whether the industrial structure is reasonable - Thiel index.

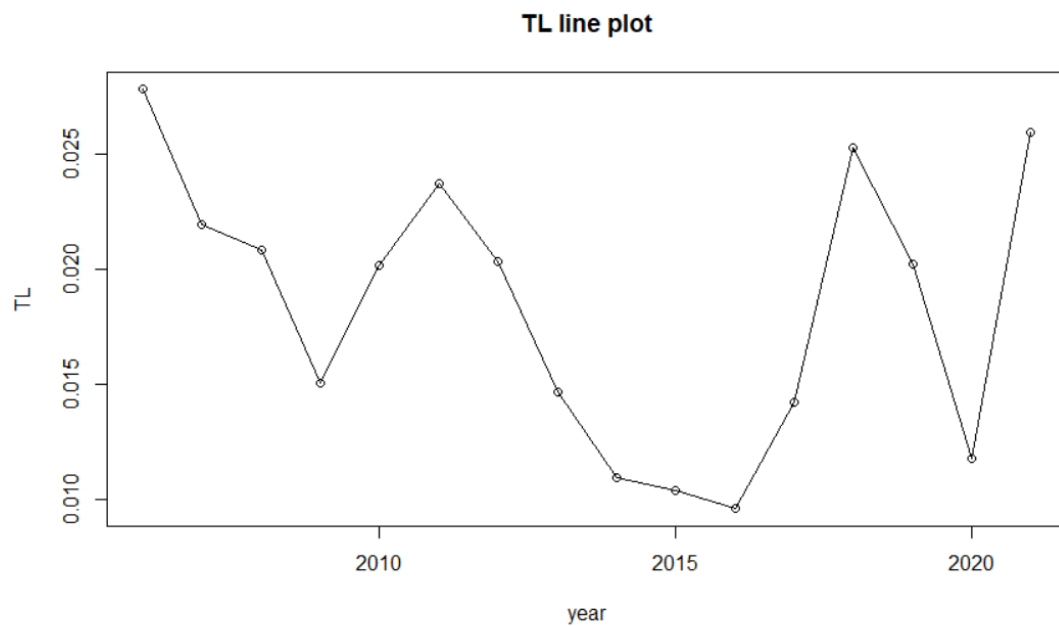
In order to determine the degree of income inequality, Taylor employed the Taylor Index in 1967, which was derived from the information theory notion of entropy. Utilizing this metric to gauge the structure's rationalization is also scientific. The Thiel index, whose formula is described in the preceding approach, will be used in the following studies in this work. TL is equal to 0, the

industrial structure is rational, TL is not equal to 0, the economy deviates from equilibrium, and the industrial structure is irrational. It is vital to note that all of these statements are true. The more rational the structure of the indicator is, the closer its value is to 0 (Liu, Xie and Song, 2017).

It is evident that the GDP and the production value of each sector are the economic indicators used in this index, and that the total number of employed individuals and the number of employed individuals in each industry serve to indicate the industrial structure. The Thiel index logarithmically processes the entire industrial structure and takes into account the ratio of all industries as a whole. The analysis is more thorough and rigorous. As a result, the Tel index will be used in the next analysis of this research to evaluate the rationality of the industrial structure.

5.4.1 Russia's Thiel index in recent years

Figure 5: Russia's Thiel index from 2006 to 2021



Source :Russian Official Statistics Servic

Table 8:Russia's Thiel index from 2006 to 2021

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
TL%	2.78	2.19	2.08	1.50	2.02	2.37	2.03	1.47	1.10	1.04	0.96	1.42	2.52	2.02	1.18	2.59

Source :Russian Official Statistics Service

The above graphs and tables show that there are fluctuating changes in Russia's industrial structure as seen in Russia's Thiel Index, with little regularity. However, in combination with the major events indicator of this paper, it can be observed that the troughs in the volatility of the Taylor index are present in the periods when major events occur, such as the impact of the financial crisis in 2009, the Ukrainian crisis and the fall in crude oil prices in 2014-2016 and the constitutional reform in 2019.

However, the surprise is that this paper uses the Taylor index, which the closer this index is to 0, the more rational the industrial structure is. This is a very interesting point because along with these crises, it has instead led to a rationalisation of Russia's industrial structure in the direction of rationality, a scenario not pre-conceived in this paper. In turn, this means that Russia's overdependence on the secondary sector has caused it to fall each time it has experienced international fluctuations, and the decline in the share of the secondary sector's output has forced the country's industrial structure to shift to other (mainly tertiary) sectors, which proves once again that Russia must move away from its overdependence on the secondary sector if it wants to rationalise its industrial structure.

5.4.2 Regression analyses using Thiel index as the dependent variable

Table 9: Regression model of Thiel index

y = TL	Model
(Intercept)	0.2726 **
Total	0.000002703 ***
Primary. industry	-0.00001612 **
Tertiary. industry	-0.000003812 ***
Primary. industry_LB	0.0047750
Secondary. industry_LB	-0.0772500

Tertiary. industry_LB	0.0332200
proportion_L2	4.7320000
proportion_L3	-2.4130000
unemployment.rate	-0.003187 *
big_incident	0.0005449
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1	
R^2	0.9909
Adjusted R^2	0.9727

Above is the final regression model of the paper: the Thiel index is used as the dependent variable and measured in relation to GDP, primary sector output, tertiary sector output, and unemployment. The R square here shows the superb explanatory power of this model: 99.09%. The lack of significance of the significant events variable here is puzzling because this should be a very explanatory variable from what the line graphs show, so the paper again does a correlation test between TL and it:

```

Pearson's product-moment correlation

data:  zxtdata$big_incident and zxtdata$TL
t = -3.1088, df = 14, p-value = 0.007696
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 -0.8617726 -0.2098359
sample estimates:
      cor
-0.6390675

```

The p-value here is less than 5% indicating that their correlation is significant. It

also means that after continuous attempts in this paper, it is found that the Thiel index not only quantifies the industrial structure well, but also explains more significantly that international events cause changes in national policies and thus affect the industrial structure.

5.5 Results

5.5.1 Results of Hypothesis Validation

This paper involves five regression hypotheses in the methodology section, and here this paper shows the results of the unified hypothesis test. Based on the five regressions in this paragraph, from Table 3 to Table 9, the results of hypothesis testing in this paper are as follows:

Model1: GDP as the dependent variable	
H1	Significant correlation between GDP and industrial structure
Model2 : Big incident as the dependent variable	
H1	Significant correlation between Big incident and industrial structure
Model3 : $Y2/Y3$ as the dependent variable	
H1	At least one variable in this model has a coefficient other than 0
Model4 : $Y2/(Y1 + Y3)$ as the dependent variable	
H1	At least one variable in this model has a coefficient other than 0
Model5 : The Thiel index as the dependent variable	
H1	At least one variable in this model has a coefficient other than 0

The table shows that all the models in this paper are significant, which means that this paper consistently adopts the alternative hypothesis and rejects the Null hypothesis.

5.5.2 Accomplishment of the objectives of this paper

The first question to be addressed in this paper is what are the paths of Russia's industrial structural transformation. This has already been answered in the beginning of this paragraph: from 2006 to 2020, Russia's industrial structural transformation went through three key stages. The 2 inflection points can be seen on the charts of GDP and labour force, and the analysis in this paper argues for the plausibility of the second node. In terms of labour mobility, it is also true that Russia is increasing inputs in the tertiary sector. A rise in inputs results in a rise in output. Due to the very small proportion of the primary sector, the tertiary sector essentially reflects the secondary sector's decreased output. This illustrates that, as was previously said, the transition of Russia's industrial structure is moving from secondary to tertiary industries.

The financial crisis in 2008, the Ukraine crisis in 2014, and Putin's reelection in 2020 are the three big events that have had a significant impact on Russia's industrial structure over the previous 20 years, according to the second conclusion. This study examines how these events have affected society and

discovers that they are in fact connected to changes in the industrial structure, particularly in the secondary sector. These mega-events typically have a negative effect on the secondary sector. Tables 4 and 5 above can be used to support this conclusion.

So what are the important factors affecting industrial restructuring in Russia? Starting with GDP (including the output of each industry) and the occurrence of a big event or not at the beginning, this paper introduces a series of indicators that can reflect these factors, such as the labour force population and the unemployment rate. In the end, the factors affecting industrial structure are found exactly: GDP, the proportion of labour force in the secondary industry, the unemployment rate and the big event. Here the models are slightly different because of the different indicators used to measure the industrial structure. In particular, the static and dynamic models are significantly different as to whether big events directly affect industrial structure. However, regardless of the choice of dependent variable, we can arrive at consistent results.

Finally, in order to assess the logic of Russia's industrial structure, this research introduces the Thiel index. This study's analysis of such a model reveals that Russia's industrial structure has been preserved somewhat acceptable. The Thiel index for Russia is very low in years when major events occur, which is an unexpected conclusion. In other words, the adverse effects of major events on

the secondary sector have led to a more logical industrial structure in Russia. Therefore, in order to make a change in its industrial structure, Russia does need to lower the output and labor force of the secondary sector.

Chapter 6: Conclusion

6.1 Contribution:

This study aims to fill a research vacuum by investigating the impact of economic events, policy, employment, and GDP on industrial structure. This article also addresses the ongoing debate around the influence of policy, employment, and GDP on industrial structure. There exists a divergence of scholarly opinions about the impact, with proponents arguing for its favourable effects and detractors positing its detrimental consequences. This work aims to do more empirical research on the aforementioned implications by constructing a regression model. Moreover, the existing body of work about the rationality of Russia's industrial structure is notably limited and lacks a comprehensive economic model that can effectively assess its rationality. This study presents an economic framework aimed at demonstrating the rationale behind the formation of the industrial structure. This work aims to provide a comprehensive analysis of the effects of significant economic occurrences, such as the 2008 financial crisis and the events in Ukraine, on the industrial structure. Previous research has overlooked this aspect, making it an important area of investigation.

This study examines the transformation of Russia's industrial structure. Between the years 2006 and 2020, Russia had three significant phases in its industrial structure, which are discernible via the examination of GDP and labour force graphs. These stages are marked by two distinct turning points. Russia is now seeing growth in its tertiary sector, leading to a rise in production in terms of labour mobility. The decline in production within the secondary sector mostly impacts the tertiary sector, while the primary sector's contribution is rather little. This observation provides more evidence for the ongoing transition of the Russian industry from the secondary sector to the tertiary sector.

According to the second conclusion posited in this article, Russia's industrial structure has been impacted by three notable events over the last two decades: the financial crisis of 2008, the Ukrainian war of 2014, and Vladimir Putin's re-election in 2020. These incidents had a detrimental influence on the share of the secondary sector.

The present study examines the key factors that influence the process of industrial restructuring in Russia. The study reveals that the primary determinants impacting the industrial structure encompass GDP, the proportion of the workforce engaged in the secondary sector, the rate of unemployment, and significant occurrences. This analysis incorporates multiple indicators such

as GDP (including industry-specific output), the size of the labour force, the unemployment rate, and the occurrence of major events.

The article introduces the Thiel index as a means to assess the rationality of Russia's industrial structure. The results suggest that the industrial structure of Russia has a certain degree of rationality. The Thiel index pertaining to Russia is noteworthy because to its very low values during years marked by big events. This demonstrates that rather than exerting a negative impact on the secondary sector as a result of catastrophic occurrences, the industrial structure of Russia has become more rational. Furthermore, it is indicated that in order to achieve the transformation of the industrial structure, Russia should consider reducing the output and labour force within the secondary sector. This article addresses many gaps in research pertaining to the evolving industrial structure of Russia. Currently, there is a scarcity of research about the specific mechanisms of industrial structural transformation in Russia, despite the existence of varying viewpoints among scholars on this matter. This article undertakes a comprehensive analysis of Russia's industrial system, using a rigorous methodology that includes detailed case studies and empirical research. The objective is to explore potential avenues for transformation within this system. Furthermore, previous studies have often overlooked the correlation between alterations in the industrial framework and socio-economic challenges, neglecting to acknowledge the connection between shifts in the industrial

structure and issues pertaining to employment and the economy.

6.2 Limitation

The primary focus of this dissertation is on the secondary sector, since it is a crucial component of Russia's economic dependence. According to the introductory section of the regression analysis segment in this research, the primary industry's contribution to the overall Russian industry is deemed insignificant, hence indicating its comparatively diminished significance for the country. The use of this particular paper for examining the effects of the primary industry is hardly seen. The essay will focus on the secondary industry, particularly in the context of Russia's excessive reliance on this sector, highlighting its inherent challenges as compared to the tertiary industry. Based on the existing literature, it is observed that the secondary industry has a consequential impact on the tertiary industry. Consequently, an increase in the secondary industry is likely to result in a decrease in the proportion of the tertiary industry. Therefore, to comprehensively analyse the relationship within the industrial structure, it is sufficient to concentrate on examining the proportion of the secondary industry.

6.3 Future research directions

In the course of synthesising the results of this study, it is shown that the change

of Russia's industrial structure is a multifaceted and protracted undertaking, which is subject to the effect of several elements such as GDP, labour force size, unemployment rate, and significant events. The unusually low Thiel index seen in Russia during years of significant events might be interpreted as an indication of the country's industrial structure becoming more rational. This shift can be attributed to the negative effect experienced by Russia as a result of these large occurrences. Furthermore, it may be inferred that in order to facilitate the transition of Russia's industrial structure, there is a need to decrease the production output and labour force within the secondary sectors. Nevertheless, it is important to acknowledge in this study that the change of industrial structure is not a rapid or immediate undertaking, but rather a gradual and continuous process that demands both time and persistent dedication. In the forthcoming period, it is essential for Russia to persist in devoting attention and doing thorough analysis of the diverse aspects that influence the alteration of industrial structure. This will enable the country to develop more effective strategies and execute appropriate policies aimed at fostering the enhancement and refinement of its industrial framework.

In general, the study presented in this article offers significant insights and methodologies for comprehending and evaluating the evolution of Russia's industrial framework. However, there are some unresolved issues that need more investigation and scholarly inquiry. In order to enhance the current state,

it may be advantageous to incorporate additional specific recommendations or anticipated outcomes. For instance, conducting research on particular policies or measures that can foster the advancement of the tertiary sector, thereby mitigating the excessive reliance on the secondary sector, could be considered. Simultaneously, this study also aspires for future research endeavours to examine the metamorphosis of Russia's industrial structure via other lenses, including social, cultural, and educational dimensions, or using diverse methodologies, such as qualitative inquiry and case analyses.

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