Implications of Economic Resilience in Liaoning Province: A Comprehensive DPSIR Analysis

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Abstract: Regional economic development is as volatile as tides, often subject to the impacts of financial crises, economic recessions, and various external shocks. These disruptions can not only disrupt a region's economic progress in the short term but also profoundly alter its future development trajectory, either plunging it into a prolonged downturn or presenting opportunities for adjustment and recovery amidst adversity. This paper focuses on the concept of "regional fiscal resilience", taking Liaoning Province as a case study to illuminate how different regions in China respond to challenges such as financial crises and economic recessions. Employing the Driver-Pressure-State-Impact-Response (DPSIR) analytical framework, the paper delves into the current economic predicament of Liaoning and uncovers its structural issues. The research findings indicate that Liaoning's overreliance on traditional industries significantly limits its ability to withstand financial shocks. The path out of this dilemma lies in profound economic restructuring, seeking a more agile and resilient future development trajectory.

1. Introduction

Financial crises, recessions, and other shocks often have an impact on the constantly changing course of regional economic growth. It is often seen that while some areas are severely impacted by disruptions and go down the path of a protracted downturn, others possess the capacity to actively adapt to external shocks and achieve sustained economic growth [12]. This difference reveals the different responses of different regions to shocks, which in turn lead to significant differences in their stages of development. Economic geography and regional studies have received a lot of scholarly interest as a result of the investigation into how and why certain areas react to disturbances differentially. The word "resilience" has become important in examining the dynamics and mechanics of how an organization or a person reacts to and rebounds from stress. The capacity of organisms to recover to their equilibrium state in the face of disturbances was initially explained by the concept of resilience, which was first created in the ecology and science of engineering [9]. Within a developmental context, resilience refers to a region's ability to maintain sustained growth while undergoing change, adaptation, and conversion in order to recover from a shock. Regional economic resilience, another term for evolutionary resilience, is used in the regional economic research basin. According to Martin and Sunley (2015), regional fiscal resilience refers to an economy's ability to either adapt to new unsustainable paths or endure or recuperate from disturbances to its prior developmental trajectory caused by the market, competition, and environment. Numerous recessions have hit the world economy during the 1980s, and they have had a big impact on how regional economies have developed. This article will embark on the concept of economic resilience, utilizing the comprehensive DPSIR (Driver-Pressure-State-Impact-Response) analysis method to investigate the factors influencing economic resilience in Liaoning province. The aim is to reveal the existing problems within Liaoning's current economic predicament and to facilitate economic development.

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2. Literature Review

2.1 Theoretical Review

Resilience, initially rooted in environmental science. It has evolved into a multidimensional concept crucial for understanding the ability of cities and regions to adapt, recover, and thrive amidst various shocks and disruptions. It has described an ecosystem's ability to withstand and recover from external shocks. As research progressed, the application of this concept has continually expanded, and it has now become an essential analytical framework in various fields, including geographical economics[8]. Hassink highlights the reason for certain localized economies' ability to revive and endure, whereas other ones continue to sink. This adjustment is also known as fiscal resilience[7]. Usually, it relates to the capacity of cities or regions as economies to withstand shocks and bounce back. Natural catastrophes, threats to the environment, and economic downturns worldwide are a few examples of these disruptions. This may involve social and political unpredictability, resource depletion, and climate change. In addition, technology depreciation may be the cause (Huang et al., 2015). There has been a change in perspective recently toward viewing financial resilience via a naturalistic lens [2], as opposed to conventional viewpoints, which limit resilience to a system's ability to return to a stable equilibrium that already exists.

The Darwinian viewpoint highlights the constant need for adaptability and economic revitalization. According to this strategy, preventing economic stagnation and decline requires constant creativity and adaptation. That is even when there aren't any big surprises. According to this perspective, resiliency is the ability to return to a prior condition. Nonetheless, it entails the ability to expand over the long term and forge new avenues for expansion. This encompasses the introduction of new sectors or breakthroughs in technology. It also involves the capacity to withstand transient shocks and bounce back from them. Furthermore, there is a connection connecting these two resilience-related factors. Both immediate recuperation and long-term adaptability are essential. The way that shocks affect a region's capacity to forge new avenues for development emphasizes how interrelated resilience is. According to Boschma, the evolutionary method expands the definition of resistance beyond its conventional boundaries. According to Folke, resilience should not just be seen as a safeguard against loss[2][6]. Nonetheless, it may be seen as a dynamic process that encourages continuous growth and change. Resilience is seen in this larger context as a critical component of cities' and regions' capacity for adaptation and long-term prosperity.

2.2 Empirical Review

Numerous empirical investigations have found a range of elements that determine economic resilience, drawing on theoretical arguments. One of these elements is a varied industrial mix. Among them is a staff that is creative and proficient. Aside from that, it has a contemporary, effective structure and strong financial institutions. Liberal market circumstances and robust relationships of knowledge between institutions, local economies, and businesses are also among them. Aggressive government initiatives are also required [18]. Even though these elements are important, only a small number of research have created specific measures of economic robustness. It is essential for policymakers to establish such metrics. The reason is due to the fact that they supply instruments for monitoring resilience's advancement and establish guidelines for improving it [15][16]. It is important to note that there is no universally accepted framework for measuring financial resilience, especially considering the diverse indicator systems developed for different types of resilience.

Empirical study built upon the theories put forth by academics such as Martin. It has attempted to gauge the various areas' economic resiliency. For example, Italy's financial crisis between 1970 and 2011 was analyzed with a focus on employment levels and their regional variations [11][8]. Similarly, the resilience of Spanish communities to economic downturns has also been evaluated [1] . Three primary concepts of resilience are being used by them. They are environmentally friendly, engineering, and adaptable. An initial assessment of Italy's provincial economic resilience was given by Faggian[5]. Struggle and recuperation are emphasized. The connection between resilience and recuperation has been a controversial topic in this study. Resistance and restoration did not significantly correlate, according to Faggian. In all UK areas, Martin, R found a positive correlation

between these variables[14]. On the other hand, Tan, Y found that in Northeast China, resistance and recovery were strongly negatively correlated. In Europe and other Western nations, there has been a lot of discussion about financial resilience[19].

Studies on resource-based communities (RBCs) in China that are resilient economically, however, are still scarce. Numerous intricate aspects impact how regional economies react to recessions. Labor, company structure, relatedness, and technical coherence are all included in this. In addition, legislative frameworks and the standard of governance are important factors [17]. These elements establish how susceptible an area's economy is to shocks from a recession. In addition, it assesses the entity's resilience to those shocks, flexibility, as well as capacity to bounce back [14]. Why certain variables have a greater influence on resilience than others is a crucial research subject in community resilience studies. Martin and Sunley (2015) put out a paradigm that incorporates commercial and industrial systems in order to solve this. It covered the situation of the job market as well as the role of decision-making and authority. Examined the characteristics that set apart various resilience groups in more detail. Vulnerability[4], assets, adaptive capability, and support strategies are the main points of emphasis. According to [14], financial trends affect a region's capacity to withstand shocks and recover. The studies further showed that, areas in Italy that have a larger proportion of public employees and service industry workers tend to be more resilient to economic recessions [11]. It is said that areas with a greater industrial sector, however, exhibited greater resilience to shocks[3].

The age distribution of local enterprises, governmental frameworks, and geographic location are further drivers. In addition, academic interest has been drawn to wage expenses and culture at work [10]. Overall, the determinants of economic resilience vary based on the region and the stage of economic development. But a large portion of the study has mostly looked at Western nations. This begs the issue of whether and how the Chinese context may be tailored to the processes of economic resilience. It is turning it into a subject worthy of further research.

3. Research Methodology

3.1 Selection of Indicators

- Driving Forces (D): The study selects indicators representing the key drivers of economic activity in Liaoning. This includes industrial output, foreign direct investment (FDI), technological innovation, and demographic factors (e.g., population growth, labor force participation).
- Pressures (P): It chooses indicators that reflect the economic pressures. It includes trade dependency, environmental degradation (e.g., pollution levels), energy consumption, and external economic shocks (e.g., global financial crises, trade wars).
- State (S): The study identifies indicators that represent the current state of economic resilience. This includes GDP growth rate, unemployment rate, income inequality (Gini coefficient), industrial diversity index, and infrastructure development.
- Impact (I): The study uses indicators to assess the impact of pressures on the economic state. It includes changes in employment rates, poverty levels, regional disparities, and shifts in industrial structure.
- Response (R): The study selects indicators to evaluate the effectiveness of responses, including government expenditure on social services, investment in innovation and technology, policy initiatives for industrial upgrading, and environmental protection measures.

3.2 Data Sources

- Qualitative data: The study gathers data from peer-reviewed journals, government policy reports, and internet sources. The study incorporates a critical literature review and document analysis**.**
- Quantitative data: The data are primarily sourced from the "China Statistical Yearbook" and "Liaoning Statistical Yearbook" of various years.

4. DPSIR Model Application

4.1 Driving Forces and Pressure Analysis

- The study explores the relationship between driving forces and pressures. Here the qualitative model describes how industrial output (a driving force) contributes to environmental pressures like pollution.
- The study examines how driving forces and pressures evolve. It shows their impact on economic resilience (GDP).
- It is to determine the impact of specific pressures (e.g., trade shocks) on the economic state of Liaoning.
- It is to evaluate the effectiveness of specific policy responses in enhancing economic resilience. Here the study compares regions that implemented industrial upgrading policies with those that did not.

The study uses the qualitative model to explore the relationships between policy responses and their effects on economic resilience (GDP). This approach can simultaneously evaluate the direct and indirect effects of policy intervention.

4.2 Data Analysis and Discussion

Following the founding of the People's Republic of China, Liaoning Province's economic growth has had considerable ups and downs. Chinese industrialization was greatly aided by Liaoning during the First Five-Year Plan (1953–1957). It makes for around one-sixth among the state's contemporary industrial initiatives [12]. By 1957, it had the nation's greatest production of heavy industries. But Liaoning's economy began to deteriorate in the early 1990s (Li et al., 2020). Other parts of China saw tremendous expansion. 2003 saw the implementation of the "Revitalization of Old Industrial Bases in Northeast China" policy as a reaction. It has momentarily revitalized Liaoning's heavy industry. The global financial crisis of 2008 nonetheless resulted in a substantial decline [12]. By 2015, Liaoning's GDP growth rate had dropped to barely, the lowest of all Chinese provinces.

Conventional industries, especially mining and heavy equipment manufacturing, play a major role in Liaoning's economy. It now controls much of its industrial organization. The province's secondary sector has historically made about 46–50% of the total GDP. Heavy industry is the main force behind it. [12] This dependence on one industry is exacerbated by the large percentage of state-owned businesses. The area is now more susceptible to market swings and outside shocks. This vulnerability has been further compounded by the industrial rigidity and dependency on the resources of nature. Low economic resilience is the result[13].

To understand Liaoning's economic resilience, a DPSIR (Driving Forces, Pressures, State, Impact, Response) framework is applied.

5. Driving Forces (D)

Industrial Output

- Indicator: The industrial output value of Liaoning Province.
- Value: In 2015, the secondary industry (mainly heavy industry) accounted for approximately 46% of the provincial GDP.
- Explanation: Industrial output is a major driver of Liaoning’s economy, especially in heavy industries. It includes steel, machinery and petrochemicals. High industrial output signifies the region’s capacity to generate economic activity. However, it also reflects its dependence on a few sectors.

Foreign Direct Investment (FDI)

- Indicator: FDI as a percentage of GDP.
- Value: FDI inflows to Liaoning were around 5% of GDP in 2015.
- Explanation: FDI is crucial for technological transfer, innovation, and the diversification of the industrial base. A relatively low FDI indicates limited

international investment. It may hinder economic resilience and the introduction of advanced technologies.

Pressures (P)

Trade Dependency

- Indicator: Export-to-GDP ratio.
- Value: In 2015, Liaoning's export-to-GDP ratio was about 20%.
- Explanation: High trade dependency makes the region vulnerable to global market fluctuations and external economic shocks. It includes trade wars or changes in global demand.

Environmental Degradation

- Indicator: Air pollution levels (PM2.5 concentration).
- Value: The average PM2.5 concentration in Liaoning was around 60 μg/m³ in 2015.
- Explanation: High levels of pollution reflect the environmental costs of heavy industry. It indicates potential long-term economic and health challenges, which can undermine economic resilience.

State (S)

GDP Growth Rate

- Indicator: Annual GDP growth rate.
- Value: In 2015, Liaoning's GDP growth rate was 3%.
- Explanation: A low GDP growth rate indicates economic stagnation and a lack of resilience. It especially when compared to national averages.

Unemployment Rate

- Indicator: Official unemployment rate.
- Value: The unemployment rate in Liaoning was around 6.3% in 2015.
- Explanation: A relatively high unemployment rate suggests labor market weakness. It can exacerbate economic vulnerabilities during downturns.

Impact (I)

Employment Rates

- Indicator: Employment growth rate.
- Value: Employment growth in Liaoning was stagnant, around 0.5% in 2015.
- Explanation: Low employment growth indicates limited job creation. It reflects economic stagnation and reduces the region's ability to recover from shocks.

Poverty Levels

- Indicator: Poverty rate.
- Value: The poverty rate in Liaoning was approximately 7% in 2015.
- Explanation: Higher poverty rates highlight economic disparities and social challenges that can hinder economic resilience.

Response (R)

Government Expenditure on Social Services

- Indicator: Government social spending as a percentage of GDP.
- Value: Social spending in Liaoning was around 10% of GDP in 2015.
- Explanation: High social spending can cushion the impact of economic shocks by supporting vulnerable populations. However, it needs to be effectively targeted.

Investment in Innovation and Technology

- Indicator: Government R&D investment as a percentage of GDP.
- Value: Government R&D investment was approximately 0.5% of GDP in 2015.
- Explanation: Investment in innovation is critical for long-term economic resilience. Despite this, Liaoning invests little in comparison to its demands.

A thorough grasp of the variables influencing Liaoning's financial durability is provided by this study, which makes use of the DPSIR methodology. It draws attention to both its advantages and disadvantages.

6. Conclusion

Through the DPSIR analysis of Liaoning Province's economic strength, it reveals various complex factors that affect its economic resilience. It not only reveals the advantages of Liaoning's economy but also points out its potential shortcomings. Although Liaoning has historically relied on a surge in heavy industry to achieve significant economic growth, this mechanism-based model once fueled rapid regional expansion. However, this over-reliance on heavy industry has become a double-edged sword, bringing many hidden dangers. Insufficient foreign investment and a lack of innovation investment further exacerbate the problem, limiting technological progress and industrial diversification. Such an economic structure not only suppresses Liaoning's economic vitality but also poses challenges to its long-term resilience and sustainable development.

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